NYSERDA Agreement #25543

Eriemax:

Assessment of Green Ship Technologies and Plan for Deployment on the Erie Canal / NYS Barge Canal System

Final Report

(Progress Report 7 per Agreement)

Prepared for

New York State Energy Research
& Development Authority

Prepared by

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INTRODUCTION

TransTech Marine Co. (TTMC) responded to NYSERDA PON 2271 with the following proposal and was subsequently awarded Agreement 25543:

"*Eriemax*"

Proposal to Conduct Technical Assessment of Green Ship Technologies and Develop a Pro-Active Plan for Their Deployment to Create a Modern Freight-way via The Erie / New York State Barge Canal System

After three years of in - depth research and design, including some false-starts that delayed the project and for which we wish to express our appreciation to our sponsors for their forbearance, TransTech is pleased to submit this Final Report.

EXECUTIVE SUMMARY

As the title of this report indicates, there were two separate related components of the investigation. "Assessment of Green Ship Technologies" comprised technical review of off-the-shelf technologies to determine if an appropriate vessel design for the intended purpose existed, that purpose being to determine if modern "green" marine transport technology can contribute to reinvigoration of commercial use of the Erie / NYS Barge Canal. Some off-the shelf technologies were found to be appropriate to the intended purpose, however a design of correct size was not discovered, hence, preliminary design of a suitable vessel to help launch a "proof-of-concept" project was undertaken.

The second part of this investigation, "… and Plan for Deployment on the Erie / NYS Barge Canal System" encompassed two tasks: 1) Creation of a business plan to provide a model for pro-active re-developers of the Erie / NYS Barge Canal freight corridor, and 2) Identification of an appropriate mechanism to capitalize new *Eriemax* initiatives that can be easily replicated by any *community* [1].

This Final Report is intended to provide an actionable plan for any community that appreciates the benefits to be realized from greater utilization of the Erie / NYS Barge Canal. They are multitudinous and accrue at every level of society, including local and regional economic stimulation, reduction in air pollution achieved by freight switching to the cleaner marine transport mode, skilled jobs creation in ship building and ship operations, employment in marine terminal and freight distribution activities and production of financial rewards for transport entrepreneurs.

[1] As described in Community / Co-op Shipping Model, please see page 34, instant.

AVAILABLE MARINE TRANSPORT MARKETS

The objective of the investigation is to increase commercial utilization of the Erie / NYS Barge Canal so obviously communities, farms and factories along and proximate to the waterway are primary beneficiaries of increased use of the waterway. These communities were never the sole beneficiaries of the Erie / NYS Barge Canal, of course. The waterway enables deep penetration into the Midwest via the Great Lakes and connects to the Atlantic Ocean via the Hudson River. Hence, the Canal actually serves three markets which in turn define the types of marine equipment that can be used to serve shippers in those markets:

:

1) **"*Contained Canal*"** - comprises communities and hinterlands along the Canal itself. Cargoes from central New York State bound for New York City move via the Canal and Hudson River as they always have, as far as Erie Basin on the Brooklyn waterfront, the true southern terminus of the Erie Canal, and other points in the harbor. These waters are sheltered and all marine transport technologies considered (next section) are suitable on them.

2) **"*Conduit Canal*"** - provides access / egress to / from the entire Great Lakes region. This greatly expands the potential cargo base. However, marine equipment needed for navigating the Great Lakes is more robust than what is needed for canal and riverine work, though not as robust as what is needed to navigate near-coastal waters of the Atlantic Ocean.

   Two routes to / from the Great Lakes are available through the Erie / NYS Barge Canal. The original east - west canal enters Lake Erie at Buffalo. Just west of Syracuse the north - south Oswego Canal enters Lake Ontario near Oswego. From Lake Ontario, the upper lakes (Erie, Huron, Michigan and Superior) are reached via the Welland Canal in Ontario, Canada.

3) **"*Connected Canal*"** - considers the Erie / NYS Barge Canal as an integral component of the US Inland and Intracoastal Waterway System as defined by the US Army Corps of Engineers (Figure 1). The necessity to sail in Atlantic Ocean waters in some places necessitates the most seaworthy marine equipment. However, the tradeoff is maximum vessel employment flexibility and access to the greatest number of shippers. This could be particularly valuable in winter time when the Erie / NYS Barge Canal is closed; an ocean-capable vessel could operate in coastal ocean service, rather than lay-up for the winter.

Figure 1

Connected Canal was selected as the geographic target market. This naturally had ramifications on the design effort and vessel cost, however, greater flexibility and market size are of paramount value. TransTech also took note of the following:

> "The Ford Motor Company developed a very successful "motorship" in the early 1920s that could navigate the Great Lakes, the New York State Canal System and the Intercoastal Waterway all the way into the Caribbean. The vessels were swift through locks and safe beneath the low bridges of the Western Canal."[2]

The Ford ships obviously were designed to take advantage of the second round of expansion and other improvements made to the Erie / NYS Barge Canal which were completed in 1919. Since over a hundred near sister ships followed the prototype into service on the Lakes and Canal and the last of these ships operated into the 1990s, the case for building in maximum range and flexibility is very strong.

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2 **NEWYORK STATE CANAL SYSTEM -MODERN FREIGHT-WAY,** Final Report, Prepared for **NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY** And **NEW YORK STATE DEPARTMENT OF TRANSPORTATION GOODBAN BELT, LLC** Buffalo, NY, NYSERDA Contract Number 11104, NYSDOT Task Assignment C-08-27, May 2010.

.RIVER – SEA SHIP 80' LOA
(RSS – 80)

Four off-the-shelf technologies that were investigated in detail are presented pictorially in Figures 2. Each technology is evaluated against "*Connected Canal"* service requirements in Figure 3.

Figure 2

***Eriemax* Technology Vs. Service Requirement**

	Contained Canal	*Conduit Canal*	*Connected Canal*
Tug & Barge	Yes	Limited	Limited
Tug-Barge Unit	Yes	Yes	Yes
Motorized Barge	Yes	No	No
River-sea Ship	Yes	Yes	Yes

TTMC April 2013

Figure 3

To assist technology selection, NYSERDA provided TransTech a copy of *NEW YORK STATE CANAL SYSTEM - MODERN FREIGHT-WAY*[3], prepared by Goodban Belt, LLC in 2010. The arguments this study makes and the method proposed for "jump-starting" expanded commercial use of the Erie / NYS Barge Canal are compelling. However, TransTech chose not to proceed in this investigation's direction for three reasons:

[3] IBID

1) Goodban Belt selected a large motorized barge for its proposed inaugural service. As indicated in Figure 3, motorized barges are not suitable for operation on the Great Lakes or Atlantic Ocean, thus limiting operations to canal, riverine and other sheltered waters. While Goodban Belt's proposed initial service would indeed be large, growth prospects would be limited by equipment limitations.

2) The enormous shipper identified by Goodban Belt, namely, the NYC Department of Sanitation, unquestionably has the cargo volume to support a new barge service, and should in fact be moving more garbage out of the city by water to reduce road congestion and air pollution. NYC DOS is not a replicable customer, however. "Top down" stimulus by a single, government, mega-shipper is less likely to create a large, diverse fleet of ships utilizing the Erie / NYS Barge Canal than would a "bottom up" widely replicable, pro-active business model.

3) Like Goodban Belt, TransTech did consider using larger vessels initially. *Eriemax* PD-1 (Figure 4, bottom) bears resemblance in size, capacity, speed and cost to Goodban Belt's motor barge (Figure 4, top). The capital cost of either design is far beyond the means of a trade corridor that is rich in history but short on recent memory of profits to justify large capital investment. Hence, TransTech's development of *Eriemax* PD-1 and consideration of similar approaches by others was abandoned to pursue a smaller, lower cost, (re)-entry-level design solution.

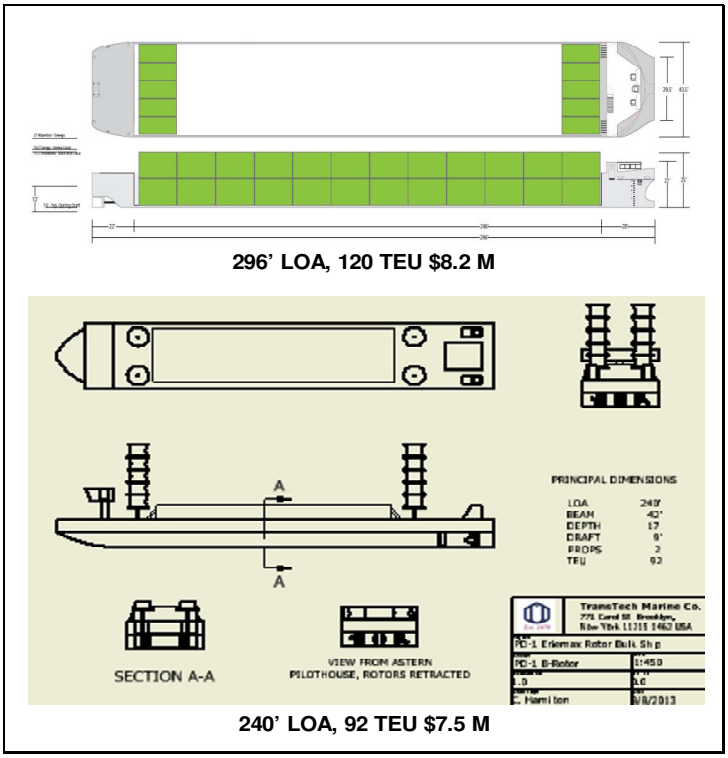

Figure 4

Notably, a tug-barge unit is also able to meet "*connected canal"* service requirements. Ability to separate cargo and propulsive units is supposed to improve economies (by increasing utilization of the power unit), however, in practice most TBU's operate in the permanently-joined mode; that is, rarely do they actually operate in the drop-and-swap mode because of scheduling and other difficulties. TBUs in the smaller size range are not less costly to build than a ship of equal capacity, nor are they automatically less costly to operate. But TBUs do incur speed and sea-keeping penalties compared to self-propelled ships, as well as potentially higher maintenance costs and greater crew fatigue. Hence, the decision was made to proceed with a small river - sea ship design.

RSS – 80 Design Evolution

River-Sea Ship 80' LOA is designed against TransTech's Green Marine Technology Chart (Figure 5), using "greenest" technologies presently available, with new-builds becoming progressively "greener" as improved technologies come into the market.

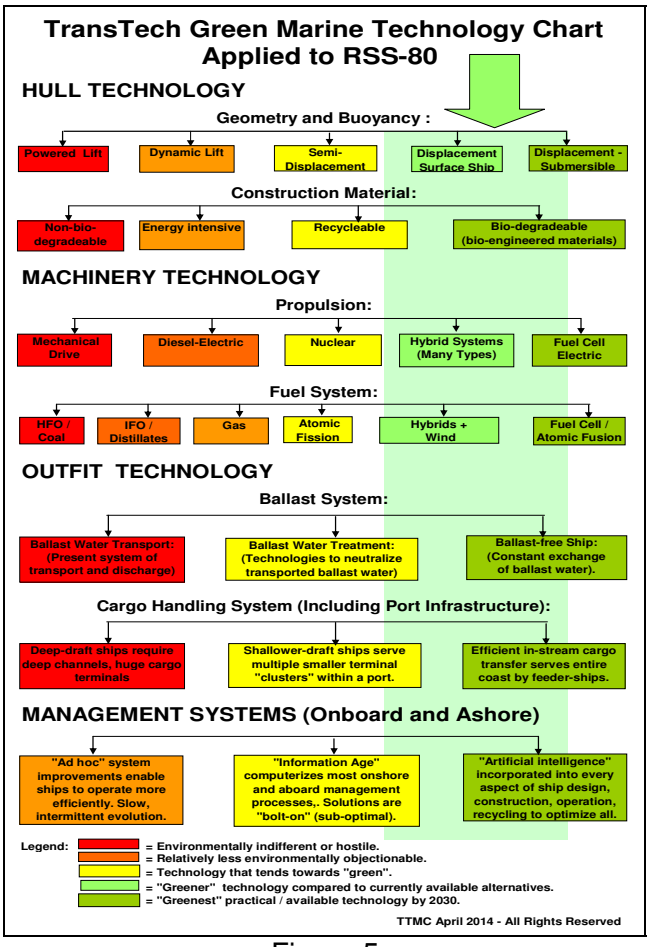

Figure 5

The mantra for designing RSS - 80 was: "*Build like a barge, operate like a tugboat*". Summary information follows:

Design Requirements / Constraints:

Hull	Steel, simple curvature with chines. Broad skeg.
Mach' / Props / Speed	Hybrid sail diesel electric / sail / 2 rotatable, retractable motor-driven rudder propellers / 7.0 - 8.0 knots
Outfit	Sail booms double as cargo derrick jib booms for working cargo. Roller type hatch covers.
Capacity	10,000 cu. ft. (250 MTs) 100 deadweight tons 18 TEU equivalents
Compliment	4 crew for 16 hrs. / day, 9 crew for 24 / 7.
Endurance	Two weeks / 2,000 miles
Flag / Class	USA / ABS
Constraints	LOA 80.0 ft. (minimum to qualify for ABS load line) Draft 9.0 ft. (working limit in Erie / NYS Canal) Air T 14.5 ft. (lowest bridge 15.5 ft. clearance)

Principal Dimensions, Form Coefficients & Preliminary Hydrostatics:

Principal dimensions, form coefficients and preliminary hydrostatics are presented in Figure 6.

Hull Shape:

All hull surfaces use flat or two-plane (simple) curvature steel plate, no three-plane (complex) curvature and no castings for ease of construction (Figure 7).

Construction Sequence:

RSS – 80 is designed for "kit" construction; all major structural parts are pre-cut and numbered in a factory then shipped to the construction site for assembly (Figures 8 and 9). Simplified construction process enables fabrication of the hull in rudimentary building facility, including brown-field. Machinery and outfit systems are likewise pre-packaged for remote site installation.

RSS-80

Principal Dimensions, Form Coefficients & Hydrostatics

			Notes & Formulas
Principal Dimensions:			
LOA	80.00	Ft.	
LBP	80.00	Ft.	Plumb bow and transom
Beam	20.00	Ft.	
Depth	10.00	Ft.	
Draft	5.25	Ft.	
Draft scantling	7.5	Ft.	
Form Coefficients:			
Block Coefficient	0.695		
Prismatic Coefficient	0.818		
Midship Coefficient	0.850		
Waterplane Area Coefficient	0.825		
Hydrostatics (at DWL full load, no trim or heel)			
Displacement - Salt Water	140.00	LTsw	LWL x BWL x T full load x Cb
Design Displacement	313,600.00	Pounds	
Volume of Displacement	4900.00	Cu. Ft.	
Displacement / Length Ratio	273.44		Displ in LT / ((LWL / 100)^3) This is medium DL ratio. Heavy vessel has D L ratio > 320.
Sail Area	1500	Sq. Ft.	Preliminary … SA/D indicates SA can increase
Sail Area to Displacement Ratio	5.20		SA / (Displ in cu ft)^.6667 Range for heavy displacement vessels is 10 to 15
Waterplane Area (approx.)	1320.00	Sq. Ft.	Cwp x LWL x B
Tons per Inch Immersion	3.81	LT	(LWL x B x 0.08333) / 35 cu ft. per ton SW
Moment to Trim 1 inch (MTi)	30492.00	Foot / Pounds	Approx.: (0.35 x (waterplane area)^2)/B
Wetted Surface (Taylor)	1652	Sq. Ft.	
Wetted Surface (Denny)	1674	Sq. Ft.	

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Figure 6

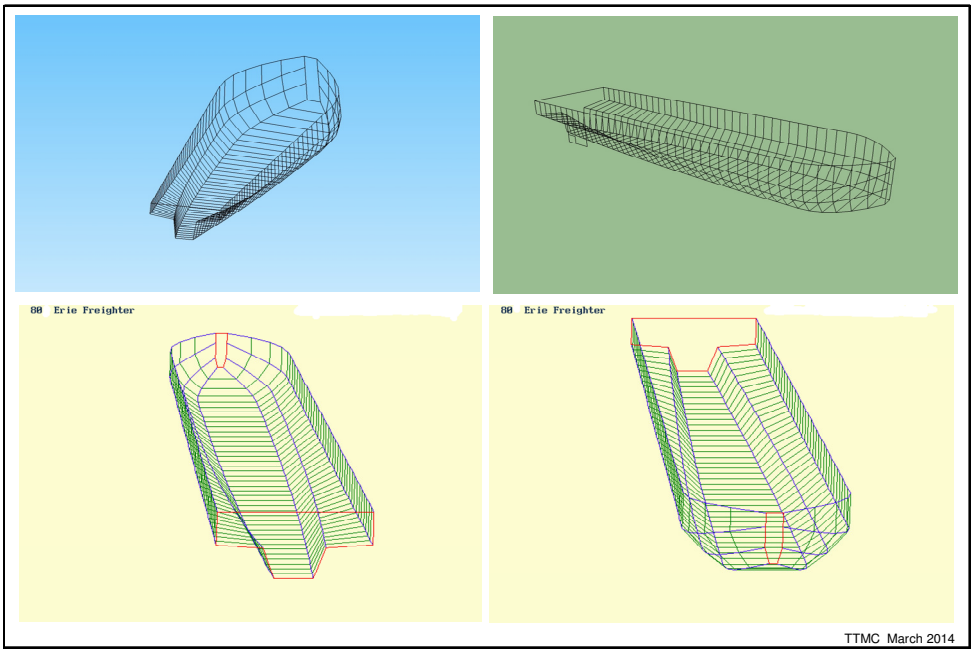

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Figure 7

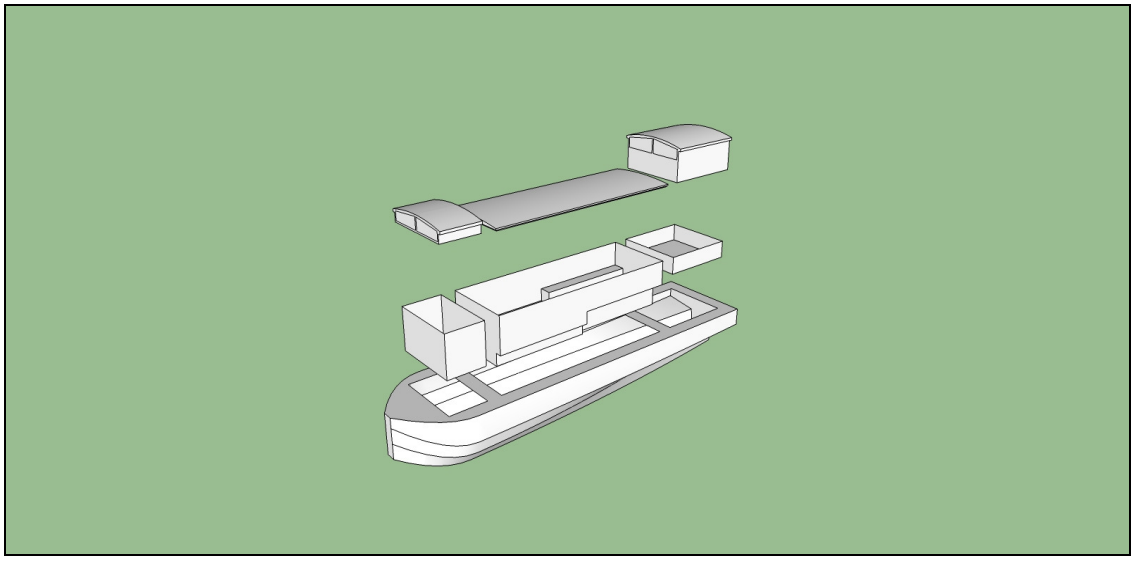


Figure 8

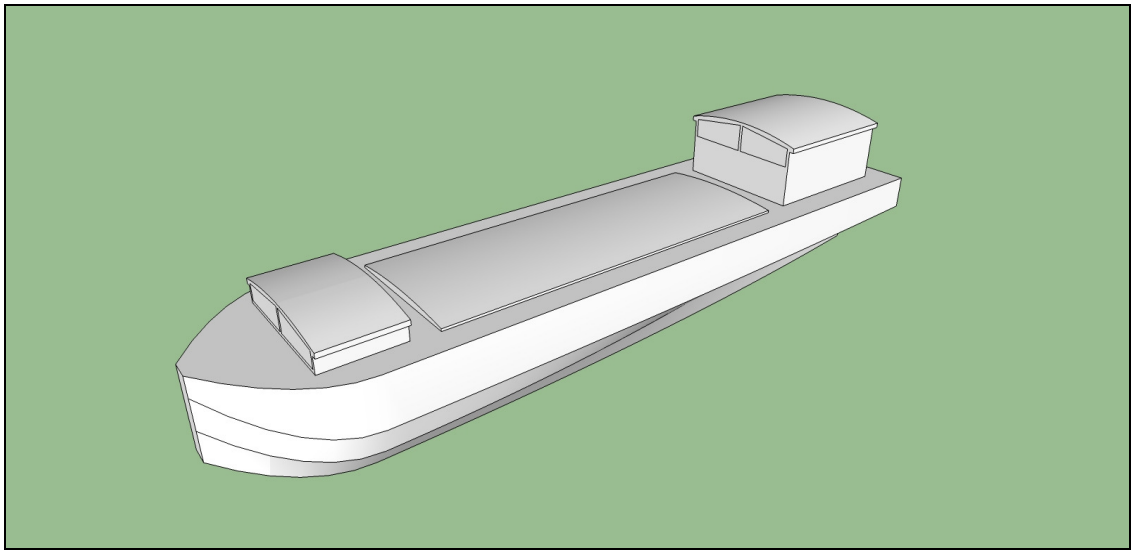


Figure 9

Propulsion System:

RSS - 80 will use a hybrid diesel-electric / sail propulsion system (Figure 10). When transiting the Erie / NYS Barge Canal, propulsion is by twin electric motors powered by batteries and diesel generators. A wide skeg is fitted to enable placement of the main battery compartment to be as low as possible where the weight will make the greatest contribute to stability and sail-carrying ability (Figures 11 and 12).

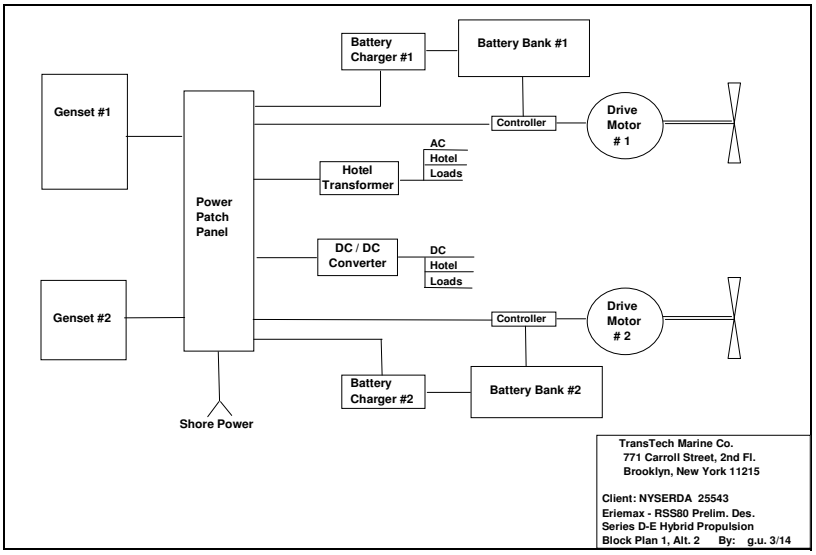


Figure 10

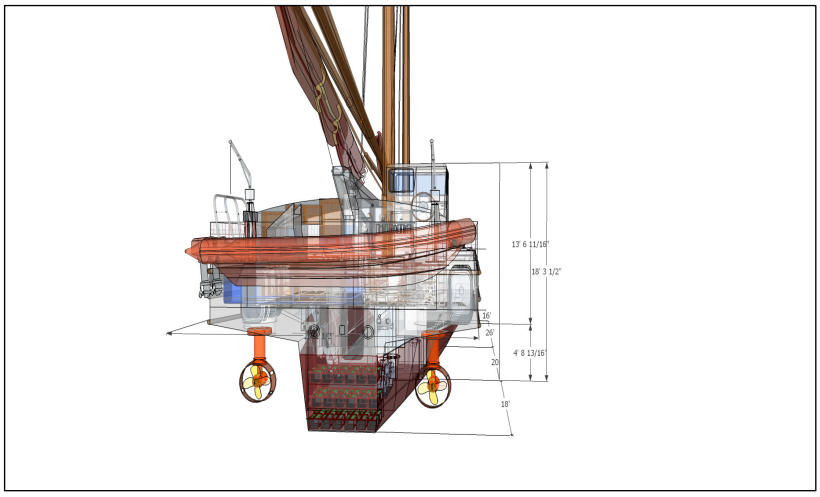


Figure 11

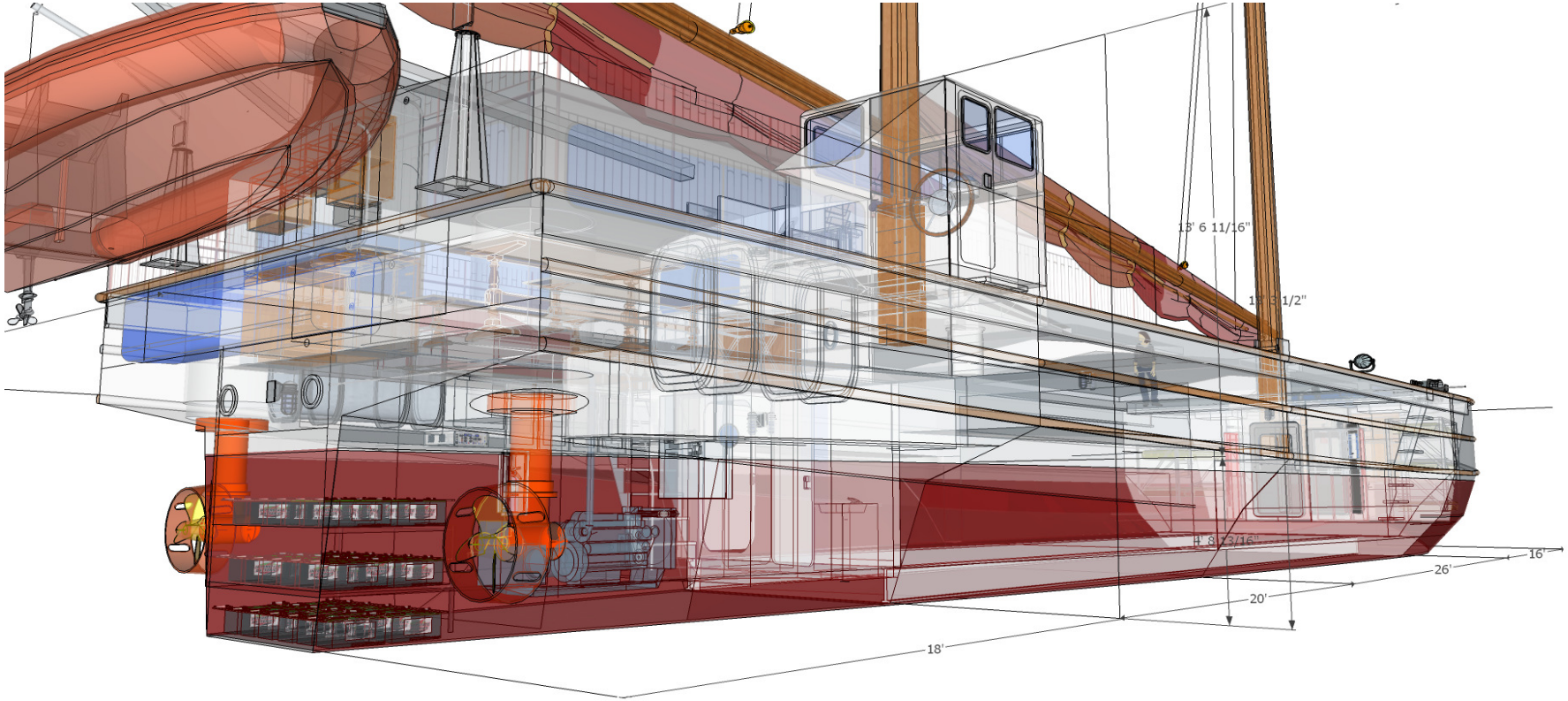


Figure 12

At full propulsive power of 70 kW (about 95 BHP), RSS-80 will be capable of about 7.5 knots (Figure 13). Economy in power and fuel consumption is gained by operating at speed-to-length ratio of 0.85. Steaming at a more conventional SLR of about 1.0 would increase RSS-80's speed by only a knot while increasing power consumption by fifty percent. Slower speed is acceptable because RSS - 80 is purposefully designed for what TransTech calls the WIT transport model (Warehouse in Transit), rather than the JIT model (Just in Time). For many commodities, WIT is believed to be more in tune with current societal needs, economic realities and environmental priorities than the outdated, over-used JIT model that often speeds goods along highways in hours merely to spend days in a warehouse awaiting final local delivery. Numerous surveys have established that cargo shippers and consignees favor economical transport over higher priced express transport in most cases, the exception being perishable commodities.

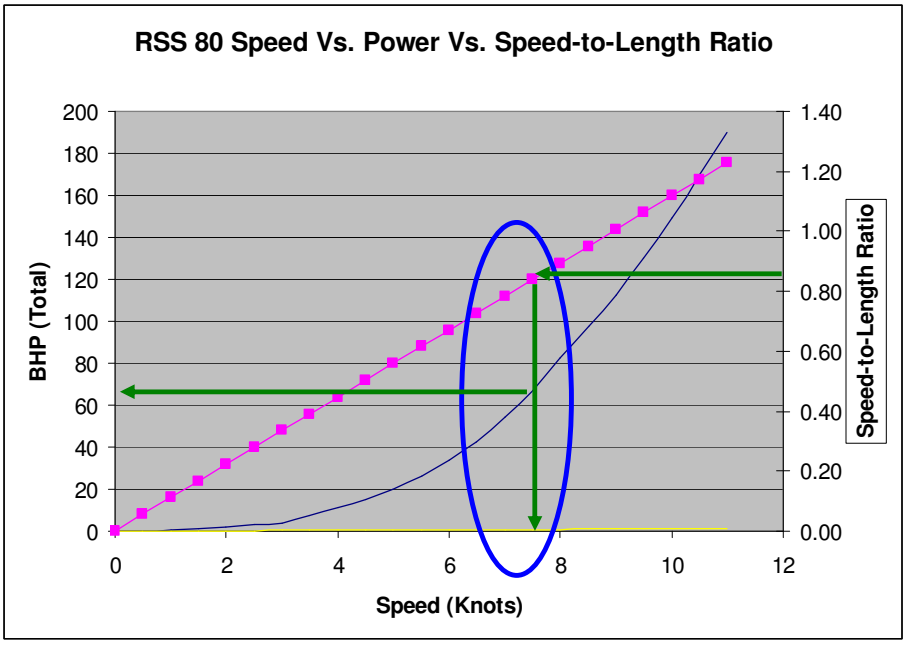


Figure 13

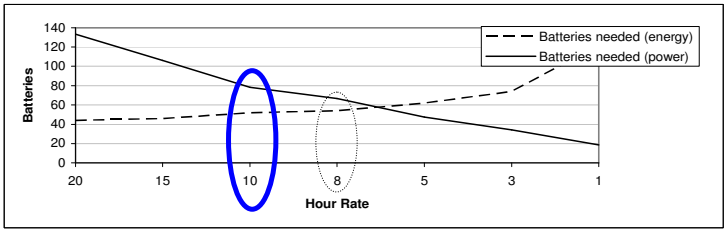
Energy Storage:

Navigation in the Erie / NYS Barge Canal is restricted to daylight hours. RSS - 80's propulsion and house load power needs will be met by a battery bank comprised of 72 deep-cycle lead-acid batteries (Figure 14) and two 35 Kw generators. Both generators can be shut down at night, using only battery power for house loads. One or two generators can be run during the day time to optimally meet power requirements and re-charge batteries (Figure 15).

RSS 80 Battery Bank Size Calculation

Model: **Surrette Series 4000 T12 250M - HD Marine Deep Cycle.** **Weight =** 130 lb_t

Hour rate =	20	15	10	8	5	3	1	hr
AmpHours =	275	259	234	220	193	162	99	Amp-hr
Voltage =	12	12	12	12	12	12	12	Volts
Amperage =	13.75	17.27	23.40	27.50	38.60	54.00	99.00	Amps
Max. D. O. D. =	0.50	0.50	0.50	0.50	0.50	0.50	0.50	Percent
Energy per battery =	3.30	3.11	2.81	2.64	2.32	1.94	1.188	kW-hr
Specific Energy =	25.38	23.91	21.60	20.31	17.82	14.95	9.138	W-hr / Lb.
Power per battery =	0.17	0.21	0.28	0.33	0.46	0.65	1.188	kW
Specific Power =	1.27	1.59	2.16	2.54	3.56	4.98	9.138	W / Lb.
Batteries needed (energy) at D.O.D. = 50%	44	46	52	54	62	74	122	
Batteries needed (power) at D.O.D. = 50%	133	106	78	67	47	34	19	



Recommended Number of Batteries to Satisfy Both Energy and Power Requirements at 10 Hour Rate = **72** **batteries**

Total Weight of Battery Bank = **9360** **lb_t**

4.2 **LT**

TTMC April 2014

Figure 14

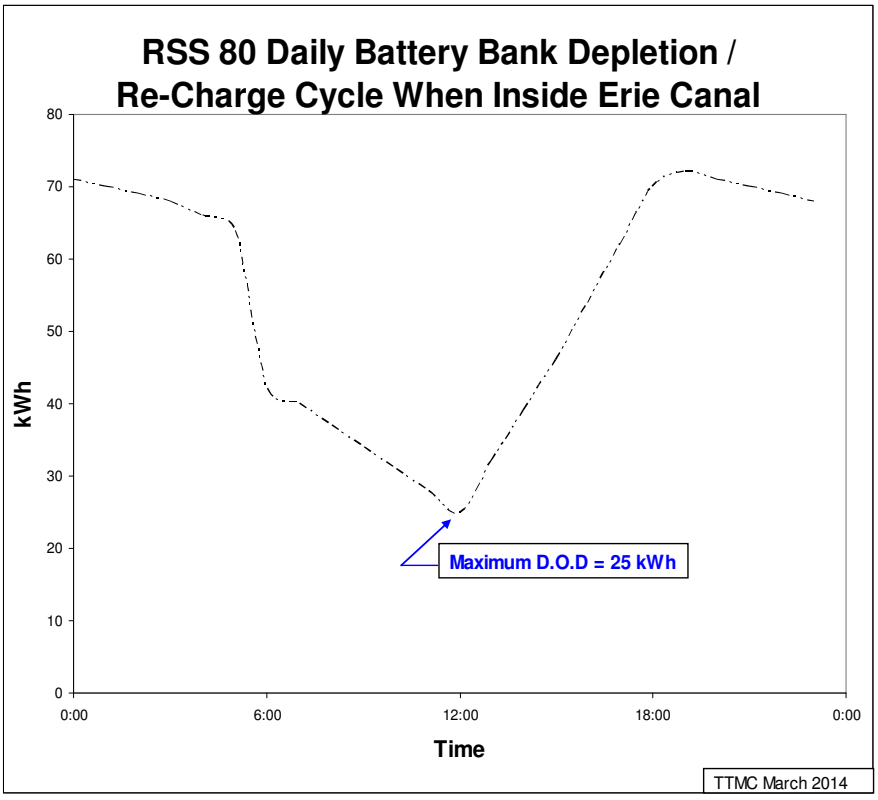


Figure 15

Sail Propulsion:

RSS - 80 will use Chines junk style lug sails on two masts to simplify handling by a small crew (Figure 16). The masts are fitted in tabernacles to enable them to fold down. The main boom on each mast serves as jib of a derrick to work cargo in port. Under sail in favorable conditions, RSS - 80 will be capable of about 6.5 knots.

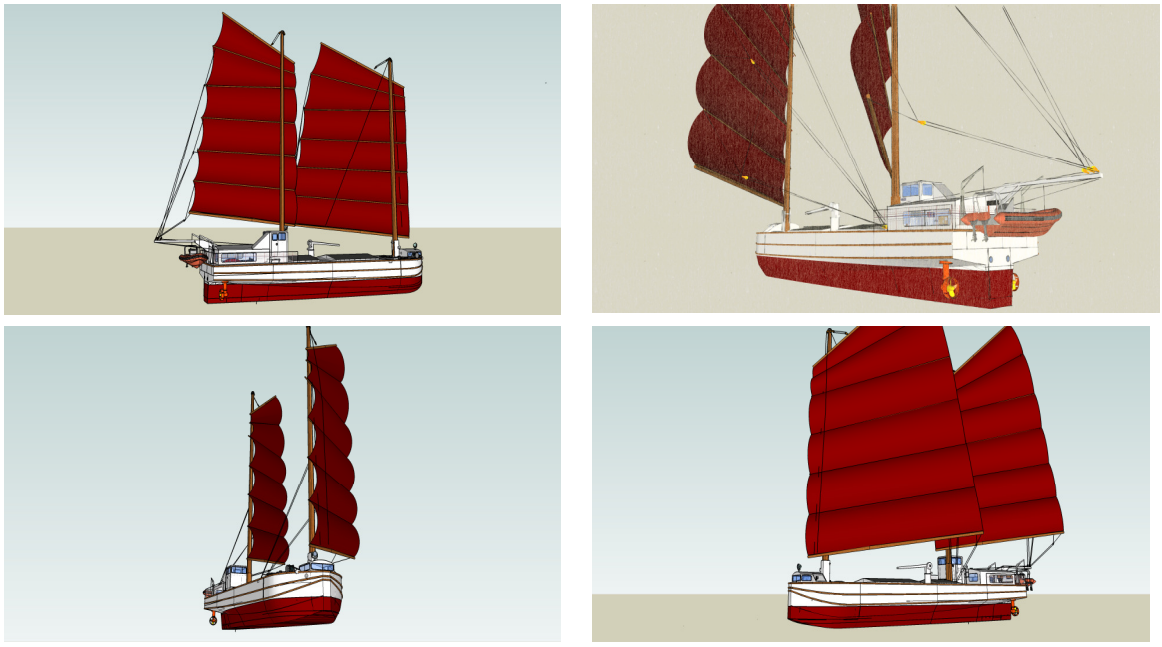


Figure 16

Cargo Stowage and Access:

RSS - 80 is first a foremost a commercial cargo carrier. Cargo holds are large and unencumbered (Figure 17) and decks are kept clear for working cargo (Figure 18).

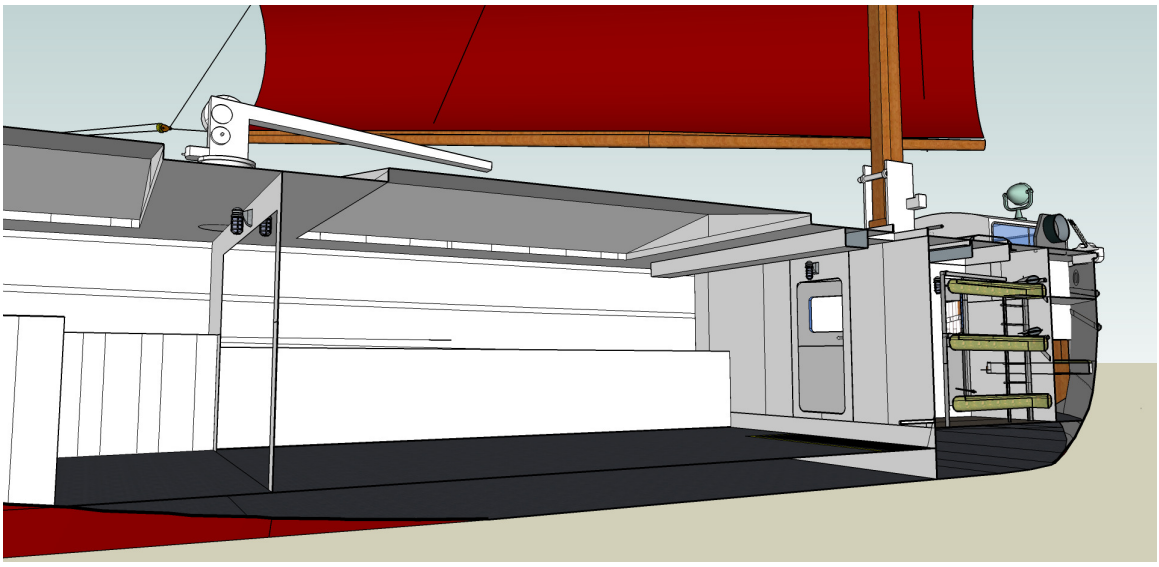


Figure 17

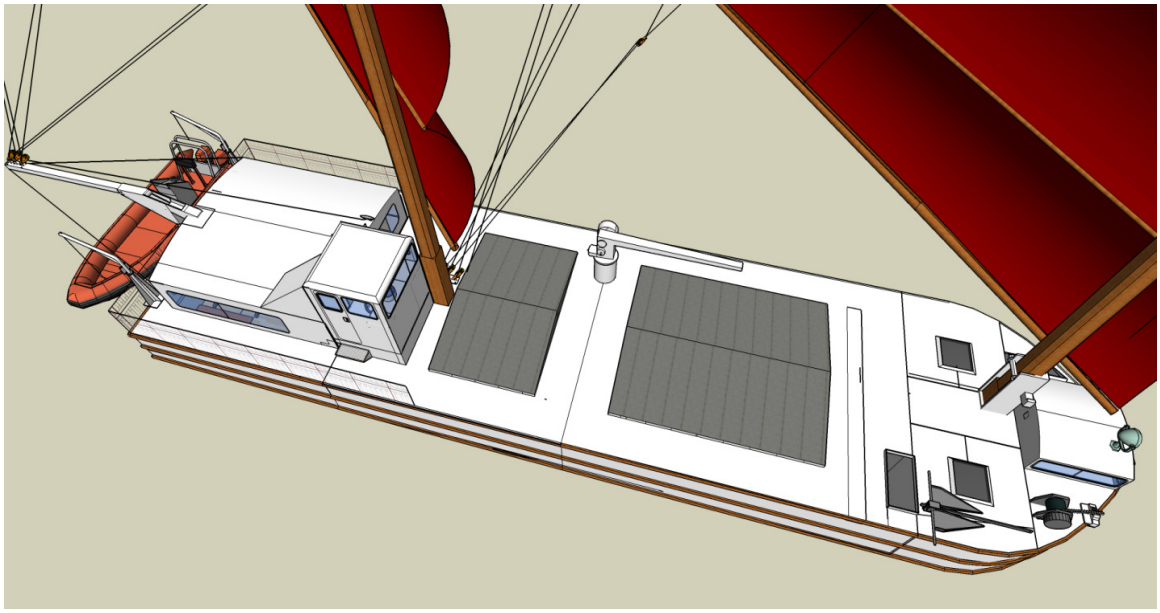


Figure 18

Accommodation Space:

Last but not least, RSS – 80 is a comfortable live-aboard vessel of comparable standard to European River Rhine barges that are often operated by a live-aboard family, or North American tuna seiners which can spend many months at sea and therefore are outfitted to a high standard. RSS - 80's aft cabin combines owner's stateroom, navigation bridge and small office (Figures 19 and 20). The forecastle is fitted with bunkbeds for crew members. Comfortable outfit is not a luxury since small cargo ships often operate on tight schedules and thin margins and it is an established fact that rested crews make fewer errors.

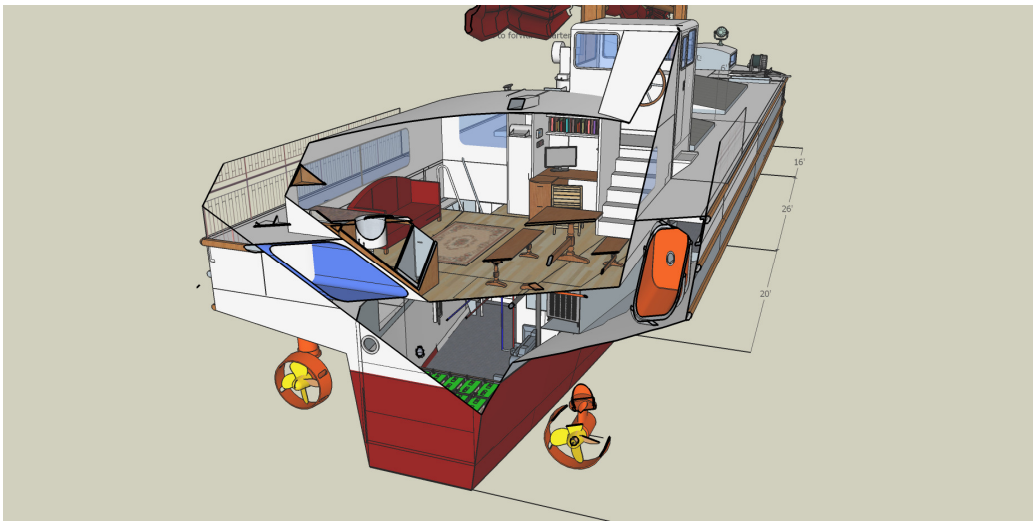


Figure 19

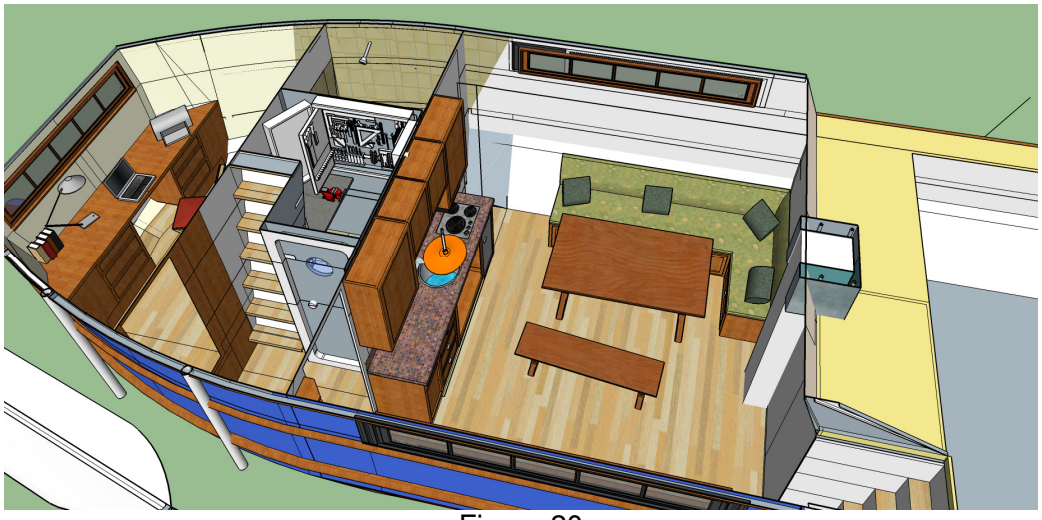


Figure 20

Cost Estimate:

The original minimum acquisition cost of RSS - 80 was put at $660,000 (Figure 21). This is the “volunteer labor / donated build site” price and even with those allowances, the initial estimate is now thought to be too low in light of the fact the propulsion and energy storage systems have been upgraded. A more realistic “community build ” price of RSS - 80 is now put at about $800,000. Doubling this figure is not unrealistic were a professional ship builder to take charge. Nevertheless, even at $1.5 million, RSS - 80 is but one fifth the cost of TransTech’s PD-1 or Goldman Belt’s motor barge, albeit cargo capacity is also significantly lower. RSS - 80 is offered as the more plausible design around which to begin efforts to reinvigorate commercial use of the Erie / NYS Barge Canal. In the case of using public markets to finance projects (see Capitalization Plan, p. 32, instant) a “sweet spot” appears to exist for initiatives able to be capitalized at not more than $1 million, since this is the cap for a number of funding instruments.

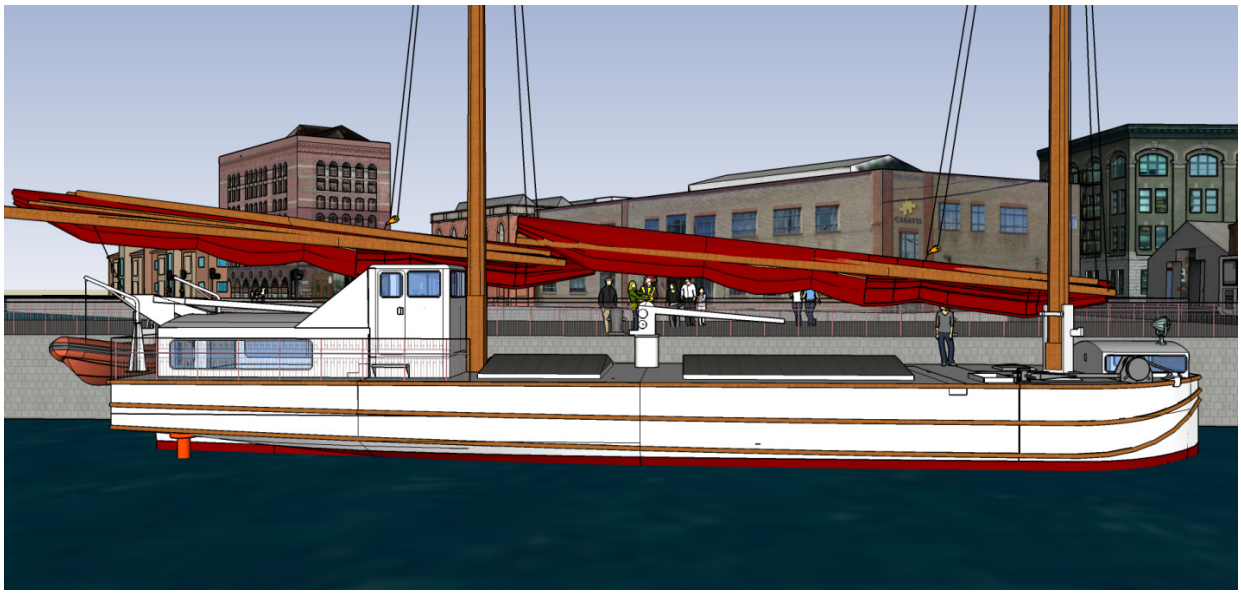
TransTech Preliminary Cost Estimator
Eriemax RSS - 80
Summary Sheet

Owner:	Hudson - Erie	LOA)Ft.)	80.00	Speed / Props:	7.5 / 2	Date:	April 2014
	Freight Transport Co.	LBP (Ft.)	80.00	Mach'y Type:	Hybrid Electirc		
Type:	Eriemax	Beam (Ft.)	20.00	kW (total)	80	Project No:	NYSERDA 25543
	Sea River Ship	Depth (Ft.)	10.00	Range (n.m.):	2500		Eriemax RSS-80
Trade:	U.S. Coastal,	Draft (scantling)	7.50	Crew:	9	Prepared by:	G. F. Uttmark
	Great Lakes.	Light Ship (LT)	40.00	Passengers:	0		TTMC
	Bays, Sounds	Deadweight (LT)	100.00	Loaded Disp. (LT)	140.00		Alt. 0 / Rev. 0

Weight Group	Quantity Tons	Material Cost Per Ton	Labor Productivity (hours per ton assembled)	Material Cost per Weight Group	Labor Hours per Weight Group	Labor Rate	Labor Cost per Weight Group	**Total Cost**
Hull	28.8	800	100	23036	2879	35.00	100781	**123817**
Outfit	4.5	2500	300	11161	1339	65.00	87054	**98214**
Mach'y/Bat'y	6.7	8000	250	53571	1674	45.00	75335	**128906**
Misc	1	1000	200	1000	200	35.00	7000	**8000**
Material & Labor SUB -TOTAL	**41.0**			**88768**	**6093**		**270170**	**358938**
Build Site Costs (Pct. of Materials Cost and Pct. of Labor Cost)			0.100			0.050		
				8877			13508	
Engineering Costs (Pct. of Materials Cost and Pct. of Labor Cost)			0.050			0.050		
				4438			13508	
DIRECT CONSTRUCTION COST				**$102,083**			**$297,187**	**$399,270**
Shipyard Overhead Rate (Pct. of Total Direct Labor Cost)			0.650					
Shipyard Overhead Expense								**193171**
Shipyard Profit & Escalations Rate (Pct. of Direct Build Cost + Overhead)			0.100					
Shipyard Profit + Escalations								**59244**
SHIPYARD DELIVERED PRICE (Ex-Spares)								**$651,685**
Spare Parts Package (Pct. of Direct Materials Cost)			0.100					
Spare Parts Package per Vessel								**8877**
SHIPYARD DELIVERED PRICE (Inc. Spares)								**660562**
Discount for Series Production (Neg. Pct. of Delivered Price, Ex-Spares)			0.000					
Discountfor for Series Production								**0**
TOTAL DELIVERED PRICE PER VESSEL								**$660,562**

Figure 21

BUSINESS PLAN



The Vision:

The vision is to start a movement, literally and figuratively. The “movement” is to create a fleet of community-owned (next chapter, instant), environmentally benign ships to profitably trade and transport by inland and coastal waterways cargoes that are inherently amenable to the marine mode.

Green ships that are economical to build and operate can deliver cargo at competitive freight rates and with lower carbon footprint than can be achieved by other transport modes or older marine equipment. Success of a pilot project will show the way to many others. When a fleet of RSS-80s (or larger) is operating, there will be many winners:

- All of society will enjoy cleaner air as lower emissions marine transport reduces congestion on highways.
- Producers of goods that are amenable to water transport will be able to get their goods to consumers more cleanly and economically.
- Consumers of the goods will benefit from lower transport costs, and in some cases, from the cachet that attaches to delivery of the goods by water.

- Communities that build and operate an RSS - 80 (or larger) will have greater control of their transport value chain while improving brand recognition and environmental awareness wherever the ship travels.

- Since US law requires ships in domestic commerce to be built in the US and crewed by American citizens, many new employment opportunities in “green” transport technology and operations will be created.

Strategy:

A pilot project can begin anywhere but before any kind of marine equipment is needed, first is needed a cargo that requires transport, and second is needed suitable docks at which to load and unload the vessel.

Cargo: Wine is offered as a plausible cargo on which to base an RSS - 80 pilot project. Three factor endowments combine with three comparative advantages, and good timing, to improve the chances of success. (Factor endowments are inherent whereas comparative advantages are created, either by individual effort or government incentive).

Factor Endowment 1 - Colossal (Base) Cargo Market:

New York State is the third largest producer of wine in the US, behind California and Washington. Over 1,600 vineyards and 400 wineries across the state produce almost 200,000,000 bottles of wine annually.

Wine production in New York State is centered in five main regions: Lake Erie Region, Niagara Escarpment, Finger Lakes, Hudson Valley, eastern Long Island, especially the North Fork. Smaller regions abut Lake Champlain and the shore of Lake Ontario. All of the wine producing regions in New York State are connected to each other and to the greater New York City metropolitan region by water (Figure 22).

source: www.newyorkwines.org

Figure 22

Factor Endowment 2 - NYS Unsurpassed Waterways System:

The Erie / NYS Barge Canal is comprised of four waterways (Erie Canal, Champlain Canal, Oswego Canal, Cayuga -Seneca Canal) that place the state among the most navigable in the nation. The four canals traverse 524 miles in total. The waterway remains the only all-water link between the Atlantic Ocean and the Great Lakes that is wholly within the continental United States, providing direct waterborne access amongst and between eight American states and Ontario, Canada.

In a "JIT" economy the Erie / NYS Barge Canal has notable challenges that include seasonality, low bridges and lack of night-time navigation. Notwithstanding these handicaps, cargo that *can* move via the Erie / NYS Barge Canal will reach east coast ports south of Boston in less time and at lower cost than freight moved to Atlantic coast ports via the Welland Canal / Saint Lawrence Seaway system. This is illustrated in Figure 23 for a Canal - capable ship traveling, for example, from Duluth, MN to the port of New York and New Jersey.

Of particular note in Figure 23 is that while transit time from Duluth to the Port of New York and New Jersey via the Erie / NYS Barge Canal is a day and half shorter than via the Welland Canal / Saint Lawrence Seaway system, the total mileage is but half. This has a major impact on fuel consumption and carbon footprint. The message is quite clear: Seaway size ships (about 30,000 dwt) carrying, for example, US Midwest or Canadian grain to Europe or Asia will not be replaced by Eriemax size ships (about 2,500 dwt) using the Erie / NYS Barge Canal. However coastal river-sea vessels trading between the Great Lakes and ports on the US Atlantic seaboard south of Boston and as far south as the Caribbean and Central America would be advantaged by using the Erie / NYS Barge Canal route. Not only is the Erie / NYS Barge Canal route faster and cleaner, it is also more economical because its halves the fuel bill and avoids the tolls on the Welland Canal / Saint Lawrence Seaway system, which are not inconsequential (Figure 24).

Duluth, MN to Erie Basin, Brooklyn
via Saint. Lawrence Seaway and Atlantic Ocean

	NM	Locks	Hours	Days
Duluth to Sault Saint Marie	342		24.4	
Soo Locks + St. Marys River	70	1	12.0	
Sault Ste. Marie to Port Huron, MI	269		19.2	
Lake St. Clair + Detroit River	77		7.3	
Detroit to Port Colborne, Ont.	244		17.4	
Welland Ship Canal	24	8	16.6	
Port Weller, Ont. - Kingston, NY	202		14.4	
Kingston, NY to Montreal (St. Law. S'way)	168		24.0	
Saint Lawrence Seaway		7	7.0	
Subtotal: Great Lakes + Seaway	**1396**	**16**	**142.4**	**5.9**
Montreal to Port NY via Atlantic Ocean	1534		109.6	4.6
Dwell Time + Misc.	0		24.0	1.0
TOTAL:	**3098**	**16**	**276.0**	**11.5**

Resource: www.nauticalcharts.noaa.gov/nsd/distances-ports/distances.pdf

Duluth, MN to Erie Basin, Brooklyn
via Erie / NYS Barge Canal

	NM	Locks	Hours	Days
Duluth to Sault Saint Marie	342		24.4	
Soo Locks + St. Marys River	70	1	12	
Sault Ste. Marie to Port Huron, MI	269		19.2	
Lake St. Clair + Detroit River	77		7.3	
Detroit to Buffalo, NY	261		18.6	
Subtotal: Great Lakes	**1019**	**1**	**81.6**	**3.4**
Erie / NYS Barge Canal	353	35	118.4	4.9
Troy, NY to Erie Basin, Brooklyn	134		19.1	0.8
Dwell Time + Misc.	0		24.0	1.0
TOTAL:	**1506**	**36**	**243.1**	**10.1**

Resource: www.nauticalcharts.noaa.gov/nsd/distances-ports/distances.pdf

TransTech Marine Co.

Figure 23

Pro Forma Saint Lawrence Seaway Toll - 2013

Typical 1500 DWT River-Sea Ship
(Tolls are in Canadian Dollars)

	Loaded - General Cargo	Loaded - Bulk Cargo	Ballast Condition
Cargo Toll (CDWT = 1500)	3,727.20	1,546.80	0.00
GRT Charge (GRT = 1200)	119.40	119.40	119.40
Lockage Charge (7 Seaway locks)	180.25	180.25	180.25
	$4,026.85	$1,846.45	$299.65
Toll in US Dollars ($1 CDN = $.9842 US)	**$3,954.37**	**$1,813.21**	**$294.26**

TTMC 4/2013

Pro Forma Welland Canal Toll - 2013

Typical 1500 DWT River-Sea Ship
(Tolls are in Canadian Dollars)

	Loaded - General Cargo	Loaded - Bulk Cargo	Ballast Condition
Cargo Toll (CDWT = 1500)	1,689.00	1,055.85	0.00
GRT Charge (GRT = 1200)	191.04	191.04	191.04
Lockage Charge (per GRT)	324.00	324.00	324.00
	$2,204.04	$1,570.89	$515.04
Toll in US Dollars ($1 CDN = $.9842 US)	**$2,164.37**	**$1,542.61**	**$505.77**

TTMC 4/2013

Figure 24

Factor Endowment 3 - Giant / Sophisticated Consumer Market:

Wine, as well as spirits, beer and many other products, is not a time-sensitive cargo. In fact, it is reputed to benefit from the motions of ocean transport in the same way that bourbon whiskey does. The advertisement in Figure 25 from *Wired* Magazine (April, 2014, p. 32) says in part, "On the ocean, endless rocking agitates the bourbon … (and) … sea air tops it off with a bit of brine." More to the subject of wine aficionados, a French company shipping wine to Montreal by barkentine reported the reduced air pollution from using a sailing ship and slow agitation of ocean passage added value to their wine in the eyes of their customers.

For cargoes like wine where perception and opinion impart value, it is not necessary to prove that waterborne transport improves taste, if it indeed does. Sophisticated consumers appear to appreciate that a product that is aged slowly and is supposed to be consumed slowly is in no way harmed, possibly improved - and certainly benefits the environment, if it travels a slower, cleaner more leisurely route to market.

Figure 25

	National Rank	Consumption (lpc / annum)
New Hampshire	1	19.6
Vermont	2	17.5
Massachusetts	3	16.9
New Jersey	4	14.6
Connecticut	6	14.4
Rhode Island	8	14
Delaware	9	13.5

New York State is the fourteenth largest consumer of wine in the US at 11.9 liters per capita per annum, behind Oregon (12.2) and ahead of Alaska (10.9). Wine consumption in New York State is greatest in the Greater New York City metropolitan region, the nucleus of the proposed pilot project. Also encouraging is the fact that seven of the top ten win consuming states in the US are within the operating range of the pilot project RSS – 80 vessel.

Almost all wine-consuming states are also wine producers, though not as large as New York State. Dynamic trade can develop between different wine producing states because of the abundance of varieties. This is akin to Americans consuming European beers while Europeans consume American beers … because they like to. Trade in like commodities is "ceremonial trade", which has been shown to expand with consumer wealth and sophistication.

Since any wine transported by modern *green* ships would benefit from the cachet attached thereto, backhaul, ceremonial trade wine and spirits cargoes would multiply revenues, while increasing costs only marginally.

Comparative Advantage 1 – NYS "Farm Wineries" Laws:

In 1976 New York State passed the Farm Winery Act which allowed small grower-producers to sell directly to consumers, as well as reducing certain fees and providing tax and marketing advantages. Originally, the law required farm wineries to sell only estate-grown wines, but it was amended in 1978 to allow the use of any New York-grown grapes in wine sold at a farm winery.

A brilliant aspect of the Farm Winery Act was inclusion of a special permit for wineries to open up to five satellite stores in tourist areas within the state, rather than restricting sales to the farm (winery) proper. The 1976 law was so successful in encouraging creation / expansion of wineries in New York State that many other wine-producing states have since passed similar laws.

In 2011 the New York Fine Winery Bill was signed into law by Governor Andrew Cuomo. The new law further reduces regulatory burdens for New York farm wineries and simplifies the opening of branch stores as extensions of the farm winery.

Farm wineries are a form of value-added marketing that represent a huge component of New York State's 5 million visitors annually agritourism industry. Assuming the RSS - 80 pilot project can succeed in locating a docking location in New York City that will permit retail wine sales, TransTech believes one and perhaps several New York State wineries could be interested in opening a waterfront farm winery store. The ability to sample great New York State wines transported by perhaps the greenest freight transportation system in the country would stand excellent chance of becoming a tourist attraction in its own right, as well as a local economic stimulus and source of additional cash flow for the pilot project.

Comparative Advantage 2 – RSS - 80 Itself :

TransTech believes RSS - 80 itself will create a comparative advantage because it will rank among the greenest transport systems in the country and transporting wine by water as a first step in reinvigorating commercial use of the Erie / NYS Barge Canal will simply be interesting to people. (In the course of doing this R&D investigation, TransTech discovered that few people are aware the Erie / NYS Barge Canal is still operational as a commercial waterway … in fact, it is in excellent condition with modern size fully operational locks).

Comparative Advantage 3 - Proactive Community / Co-Op Finance:

Ocean shipping is one of the first industries where finance of the major asset became a comparative advantage in its own right. The practice of dividing ownership of a ship into sixty-four shares originated in medieval Italy. From Italy the practice spread across Europe where share offerings launched some of the most successful maritime ventures in history, including the Dutch East India Company and the Hudson Bay Company. The practice also came to the US where it was used to capitalize construction of schooners in Maine for transport of coal along east coast US and Canada.

TransTech believes that "community" ownership of a vessel that is transporting a consumer good must be beneficial. The subject of how this is to be achieved to launch the proposed pilot project is discussed in the next chapter of this report, Capitalization Plan.

Timing:

Arguments for increasing use of the waterborne transport mode are many and strong, and have been recited in many fora. They include …

- Global warming
- Peak oil
- Congested highways / Difficulty of building more
- Railroads operating at +100 percent load factor
- Vehicle emissions / Air quality issues
- "Third mode" national security advantages

TransTech could add to the above list that quality jobs would be created by building and operating a large fleet of RSS - 80s (or larger subsequent vessels) and that such initiatives would produce substantial beneficial ripple effects in the form of lower transport costs, cleaner transport footprint, regional economic revitalization and green ecotourism development.

Docking Locations: A pendulum service is proposed for the pilot project that operates as follows: Finger Lakes – NYC – North Fork, LI – NYC – Finger Lakes. A complete circuit of the pendulum would require about ten days with two days slack time built into the voyage. A large number of wineries are on or near navigable waterways (Figure 26).

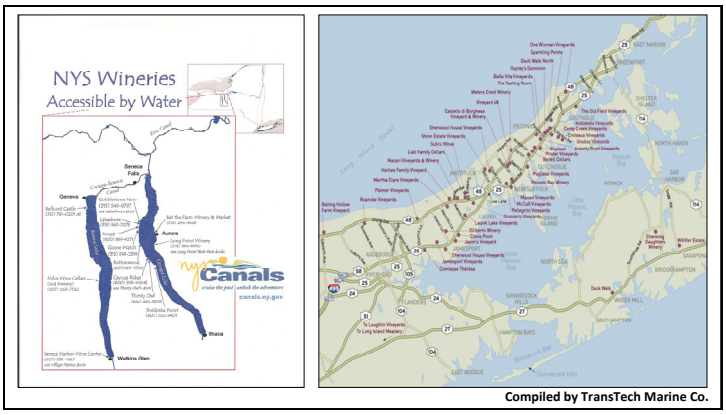


Figure 26

Many locations are available along the Erie / NYS Barge Canal for loading / discharging vessels the size of RSS - 80 (Figure 27). In addition to public terminals, some wineries have private docks at which small vessels can load and unload cargoes.

New York State Canal System - Terminal Locations

		Loading/Unloading			Mooring			
Terminal Location	Section	Available	Length (Ft.)	Not Available	Available	Length (Ft.)	Not Available	Comments
Fort Edward - Hudson River	1		640	X	X	320		Village holds permit for park on site
Fort Edward - Lock C-7	1	X	300		X	300		Access through Section yard. Loading limited. Mooring limited. CC uses wall.
Mechanicville	1	X	330		X	330		City & Chamber hold permits to use site and 100 ft dock.
Plattsburgh, Pier	1	X	200 x 400		X	400		City holds permit to use site, has requested lease. DEC holds MOU to use site.
Port Henry, Pier	1	X	320		X	390		Village holds permit to use site, including for docks along landside of terminal.
Thomson	1	X	230		X	230		Limited area to offload; land access must be obtained from others; currently under permit
Troy	1	X	575		X	575		Abandoned portion. 50 ft width to offload; land access must be obtained from others; currently under permit
Whitehall	1		470	X	X	470		Town holds permit to use site
Crescent	2	X	150		X			
Waterford	2	X	600		X	600		Limited offloading area. Town holds permit to use site.
Canajoharie	3	X	410		X	410		Limited offloading area. Town holds permit to use site.
Fonda	3	X	300		X	300		Section office. Use can not impact Canal operations.
St. Johnsville	3		150	X	X	150		Town holds permit to use site as marina.
Frankfort	4		300	X			X	Needs dredging, dock obstructions
Herkimer	4		500		X	500		Floating dock not available
Ilion	4		600	X			X	Leased by Ilion
Little Falls	4		600	X			X	Leased by Little Falls
Rome	4		910		X	900	X	Westerly portion has floating docks
Sylvan Beach	4		1910	X		500		Permitted to the Village
Verona Beach	4				X	500		Available but used by recreational vessels
Utica	4		1160	X			X	condition of harbor walls is questionable
*Three Rivers	5		350	X			X	Wall is unsound and closed.
Baldwinsville	5	X	690 & 570		X			Grant for recreational use
Brewerton (North)	5	X		X				Only the floating section is left.
Brewerton (South)	5	X	570		X			60' in center permitted to cruise operator. Coast Guard and Town have requested permit for the rest
Cleveland	5	X	240		X			DEC Fishing access permit
Fulton	5	X	800		X			
Oswego	5	X	594		X			Frequent municipal activities
Syracuse - North Dock	5		365	X			X	No docks left in Syracuse.
Syracuse - North Pier, North	5	X	335		X			
Syracuse - North Pier, South	5	X	365		X			
Syracuse - South Dock	5		735	X			X	No docks left in Syracuse.
Syracuse - South Pier, North	5	X	335		X			
Syracuse - South Pier, South	5	X	365		X			
*Waterloo	6	X	100		X			Large area from old DOT Residency
Lyons	6	X	360		X			Will be for recreational use via grant
Newark	6	X	650		X			Above lock only. Wall in village is for recreational use.
Palmyra	6	X	570		X			Village has to develop west end of wall for boat launch. Overhead issue with Route 21 bridge and UDS in area.
Seneca Falls	6	X	340		X			South wall only. Permitted to village for recreational use
Macedon	6		200		X	200		Upper end of Lock E-30. Heavy equipment can enter the area.
Weedsport	6	X	150		X			
*Adams Basin	7	X	530		X			Roadway construction needed for loading / Used often by Corporation Floating Plant
*Gasport	7	X	300		X			Roadway construction needed for loading / Municipal park is adjacent
*Knowlesville	7	X	250		X			Roadway construction needed for loading / Municipal park is adjacent

Source: NYS Canal Authority

Figure 27

The preferred docking location in New York City is along the Brooklyn waterfront, ideally near Erie Basin (Figure 28) since this will reinforce the connection to the waterway's colorful past (Brooklyn's Erie Basin is the southern terminus of the Erie Canal). Wine will be distributed throughout the city from the terminal via low-emissions hybrid powered vans that run on natural gas or electricity. The terminal will feature a Farm Winery store and sampling room. TransTech believes a waterfront Farm Winery store would become an important ecotourism destination since the waterfront provides a pleasant ambiance to sample wine and the very low carbon footprint RSS - 80 vessel would itself be an attraction to visitors, thereby contributing to local and regional economic redevelopment.

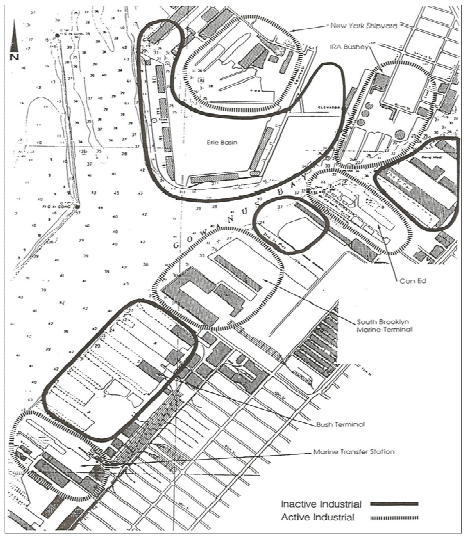


Figure 28

Expansion Opportunities:

The foregoing business plan summary described one RSS - 80 opportunity centered on wine transport. After a success pilot project demonstrates the enormous benefits to be derived from intensive use of the Erie / NYS Barge Canal by modern marine equipment, there are probably hundreds of expansion opportunities. The following illustrates how the frame created by a successful pilot project might be filled in:

1. Build out wine trading and transport business:

   Wine trade and transport in New York State provide large expansion opportunities beyond the initial route. As can be seen in Figure 29, the Niagara Escarpment and Lake Erie wine producing regions extend around all of Lake Erie (including Ontario, Canada, though not shown). In fact, except for Minnesota, all of the Great Lakes states have wine producing regions bordering the Lakes, two of the most famous being Michigan's Grand Traverse Bay (Figure 30) and Wisconsin's Door County Peninsula (Figure 31). Both regions are served by excellent ports.

Figure 29

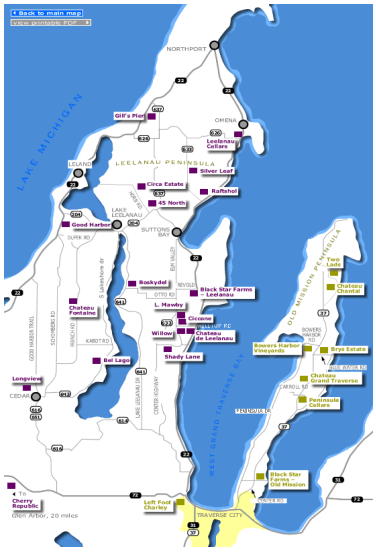


Figure 30

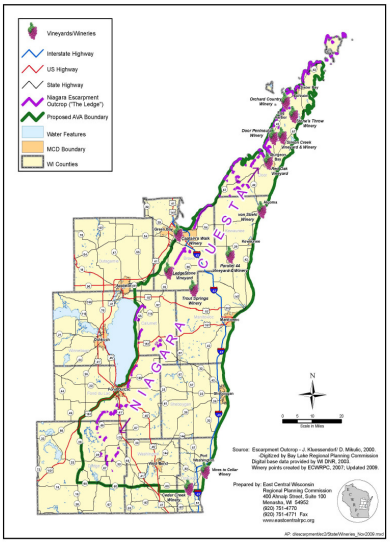


Figure 31

2. Expand into craft spirits and beers:

   New York is the ninth largest beer consuming state in the US and hosts many craft distillers and breweries, as do many neighboring states. Like wines, beers and spirits are non-perishable and benefit from the cachet attached to *green* marine transport.

3. Expand into condiments and long-lived edibles:

   Maple syrup, honey, preserved jams and jellies, dried fruits, cheeses, boutique grains and flour are a sample of long-lived foodstuffs that would probably gain value from *green* marine transport in the eyes of environmentally conscious consumers.

4. Expand into lower value / higher volume commodities:

   As the number and size of Eriemax vessels increases, unit throughput costs will decrease, making it profitable to transport larger volumes of lower value goods. Size progression of Erie / NYS Barge Canal-capable river-sea-ships should follow similar size progressions as the marine equipment that made the original Erie Canal part of American legend. Success begat success, small barges pulled by mules grew to large barges pulled by tugs, then to self-propelled barges, finally to lakes and coastal river-sea-ships. That is the goal of RSS - 80. Every large fleet starts with a lead ship.

CAPITALIZATION PLAN

Three business models were investigated to identify the most promising means to capitalize an RSS - 80 pilot project.

Industrial Shipping Model:

The industrial shipping model uses economy of scale to minimize unit cost. Scale economies are gained by building the largest practicable ship for a given trade. Established shipping companies have longstanding relationships in every sector of the ship capitalization markets. Transactions in the hundreds of millions of dollars are not uncommon for fleet renewal, expansion, strategic acquisitions, etc. Only rarely do the traditional shipping capital markets take on unknown risks or unknown entities. It does occur when a financially strong shipper, such as NYC Department of Sanitation, can put the full faith and credit of New York City into its shipping application. However, as noted earlier in this report, such financial clout would emphatically not be available to other projects.

In deciding against its own *Eriemax* PD-1 design and Goodban Belt's motor barge, TransTech concluded initiatives of this scale are beyond the ability of start-up enterprises to capitalize in a (presently) undeveloped trade. Attention then turned to smaller size vessels and other capitalization possibilities.

Owner - Master Model:

Attractions of a small, live-aboard cargo-carrying vessel are many, including affordable construction, low operating cost and docking flexibility. However, in many instances transport of cargo under normal commercial terms requires a "classed" vessel, the minimum length of which in the US is 80 feet LOA. This requirement points to a significantly larger vessel than many less formally operated owner / master cargo carriers. TransTech counts any cargo vessel up to about 65 feet in length that can be operated by a crew of two as being in the owner-master class.

Eventually the owner-master model was rejected because a cargo vessel must be large enough to transport sufficient freight to cover all its expenses, including cost of capital. It must be commodious enough for comfortable living aboard, and it should qualify for ABS classification. The inability of the owner / master model to provide sufficient scale and formality in order to have any kind of meaningful transport impact in the freight markets turned the search for capital toward a model that falls between the industrial shipping and owner / master models.

Community / Co-op Shipping Model:

Community / Co-op shipping is any group that joins together for the purpose of creating a commercial marine transport service. The group can be for or non-profit, independent or part of another group. A *community* might be a port …

> "Between 1817 and 1820, the number of small vessels of 18 to 65 tons burden increased rapidly, until each of the ports along Lake Erie's southern shore had one of its own[4]."

A *community* can be a group of shippers seeking more competitive access to markets such as was the case in the 1970s when French farmers created Brittany Ferries provide direct access to markets in Britain (Figure 32). Today, Brittany Ferries is one of the largest ferry companies in the world.

Farmers turn shipowners to create new demand

'Cornouailles' joins the cauliflower run

IT IS JUST over four years ago that a group of Breton farmers got together to find a way of transporting their produce to the UK faster and cheaper. This was the beginning of Brittany Ferries. Previously Breton produce had been transported several hundred miles by land to the traditional cross-Channel ports of France and then across to the UK, the produce (mainly cauliflowers and other vegetables) often arriving in poor condition. It was then that the farmers decided to do something themselves; they built their own port at Roscoff and sent out tenders for a year-round shipping service. But nobody took up the offer so the French farmers decided to set up their own service and launched Brittany Ferries. The major shareholder in Brittany Ferries parent company, BAI, is the Comité Economique de Fruits et Legumes de Bretagne.

PRINCIPAL PARTICULARS
'Cornouailles'
Passenger/car ferry
Yard No. 735
Trondhjems Mek Verksted, Norway
Brittany Ferries, France

Length oa	109.70m
length b.p.	98.00m
Breadth mld	16.50m
Depth to upperdeck	10.65m
Depth to main deck	5.25m
Draught max. scantlings	5.20m
Draught as a passenger ship	4.30m
Main propulsion system	Twin Deutz-Pielstick 16PA6V diesels, each rated 5 6000bhp
Service speed	19 knots
Capacity	500 passengers and 200 cars

Figure 32

[4] History of Great Lakes Navigation, Larson, John W., National Waterways Study, U.S. Army Engineers Water Resources Support Center, Institute for Water Resources, January, 1983.

A *community* can be a shipyard in search of new markets or it could be a group of entrepreneurs desiring to enter the transport business or many other parties. All are communities who might benefit from building and operating an *Eriemax* RSS - 80. The Community / Co-op shipping model was ultimately selected as offering the most pro-active mechanism to catalyze a pilot project and to replicate its success across many communities and shipping constituencies.

The Community / Co-op shipping model is consistent with the intent of the JOBS Act (Jumpstart Our Business Startups Act) which was signed into law by President Obama on April 5, 2012. This law provides a mechanism to capitalize construction and operation of *Eriemax* RSS - 80 vessels. Titles I (Reopening American Capital Markets to Emerging Growth Companies), V (Private Company Flexibility and Growth), and VI (Capital Expansion) of the law became effective upon enactment. Title II (Access to Capital for Jobs Creators) became effective on July 10, 2013 and Titles III (Crowdfunding) and Title IV (Small Company Capital Formation) are scheduled to come into force by October 2015. These will then be published in the Federal Register and become law 60 days later. Hence, by early 2016 all titles of the JOBS Act will be available for projects like *Eriemax* RSS - 80.

ShipShares LLC has been created and web site www.shipshares.com is under construction to present the prospectus for HEFTTCo. (Hudson-Erie Freight Trade & Transport Co.) to the internet community. This is a pilot project (Figure 33). The web site and prospectus will be complete as all titles of the JOBS Act come into full force. Parties interested in learning more about this opportunity are invited to contact the project primary researcher and designer, Geoff Uttmark:

geoff-nyc@shipshares.com

TransTech would like to end this final report by again thanking NYSERDA for its sponsorship, encouragement and patience in this undertaking. *Eriemax* RSS - 80 was a worthy challenge. After much effort we are confident of the way forward and of the tremendous benefit this initiative can produce for enormous numbers of people at the regional, state, local and community levels.

Business Plan
&
Solicitation of Indication of Investor Interest

Hudson-Erie Freight Trading & Transport Company
(Hereafter, HEFTTCo.)

Proposed Offering of
900,000 Common Shares
Par Value $ 0.01 at a price of $1.10 per share

Manager Placing Agent

HEFTTCo. is A Development Stage New York State Enterprise

HEFTTCo. is soliciting indication of investor interest in acquiring 900,000 shares of the Company's common stock (the "shares") at a per share offering price of $1.10 (the proposed "offering"). The minimum subscription would be 1000 shares ($1,100). Both the indicated offering price and number of shares offered have been arbitrarily determined and could change materially in a formal (or legally permitted unregistered) offering. This business plan is strictly a solicitation of investor interest in acquiring shares in HEFTTCo. as one possibility to capitalize the company. It is neither an offer to sell shares, nor is it an invitation to buy shares which can only be done legally through properly executed investment documents, including exemption from registration of the offering, if applicable. The level of interest indicated in acquiring shares in HEFTTCo. will assist in determining if the expense of making a formal (or legally permitted unregistered) offering is warranted. Affirmation of interest in possible acquisition of shares shall in no way at any time under any circumstances oblige a respondent to acquire shares in HEFTTCo.

Figure 33