Planning for Future Transportation Realities

M. John Vickerman

Williamsburg, Virginia
410 Years Ago: 1607
A Voyage of Three Vessels
Created the First Permanent English Port in Jamestown, VA

13 Years Before the Pilgrims Landed at Plymouth,
Three Brigantine - Barque Vessels
(Forerunners of the Deep Water Cargo Vessel)
of the Virginia Company
of London Landed in Jamestown, Virginia
Godspeed Brigantine/Barque, Circa 1607
Deadweight Tonnage: 40 tons
LOA: 88 feet;  Crew: 13,  Passengers: 39
M/S EMMA MÆRSK  Circa 2013

Godspeed Brigantine/Barque, Circa 1607
Cargo Handling Circa 2010
What We Know Today... Will Surely Be Different Tomorrow!
To Be Competitive Today...

Marine/Intermodal Terminals Must Reduce Throughput Cost & Increase Cargo Velocity Securely and as Stewards of the Environment
The Evolution of Today’s Global Shipping Lanes
The Maritime Silk Road Replaced the Overland Silk Road as the Primary Trading Route Across Eurasia After the Tang Dynasties (618 to 907)
The Marine Silk Road was a Precursor to:

Today’s modern supply chain logistics, distribution and shipping transportation networks
90% of Global Trade is Carried Out by Shipping

The Majority of Today’s Ocean Trade is Conducted on the Marine Silk Road
The World’s Primary Shipping Route:
The Marine Silk Road
Maersk’s Global Trading Routes Today

[Map showing global trading routes]

MAERSK GROUP

APM TERMINALS

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Indian Ocean Electric Blue Shipping Lane Trails
From the Marine Silk Road
The World’s Largest Ports Are Connected Via The Marine Silk Road

Where are the Biggest Ports?
The World’s Largest Ports Are Connected Inside This Circle Via The Marine Silks Road the Circle

KEY

WORLD’S LARGEST PORTS (BY CARGO VOLUME PER YEAR)

- 10 MILLION TONS
  - 100
  - 500
Global Shipping Routes Plotted by AIS GPS

Today’s Busiest Shipping Routes:
(1) Panama Canal, (2) Suez Canal, (3) Offshore China

Shorter – Faster Arctic Ocean Route
2+ Months A Year Using Convoys

Half the Time & Distance
International External Industry Pressures Driving Today’s Logistics
More than 98% of everything we consume, wear, eat, drive and construct is brought to us via ships through the North American port system.
Growth in GDP and World Trade

World trade will grow by 73% in the next 15 years. With merchandise trade volumes in 2025 hitting $43.6 trillion compared to today’s $27.2 trillion. CAGR = 4.5%
World Trade’s Share of the Economy Grows Again

Globalization trend is shifting, not reversing, long-term.

(World imports, percent of GDP)

% INCR = 37%

Source: IHS Global Insight – World Trade Service
Long Term GDP Annual Growth Rates

Source: OECD Economic Forecast May 2014
What/Who Determines Today's Logistics Trade Flows?
Who Owns & Controls Today’s Cargo?

• The “Shipper” or “Beneficial Cargo Owner” (BCO)

• BCO = Importer of record, the entity that physically takes possession of cargo at destination and does not act as a third party in the movement of such goods

• The person or company who is usually the supplier or owner of commodities shipped.
Key Success Factor: Cargo Will Flow “Downhill” to the “Lowest Cost - Best Service Levels” (Total Logistics Costs From Origin to Destination)

Above All Be MARKET DRIVEN
Poll of the Top 1000 “Blue Chip” Multinational Shipper Priorities

- Competitive Freight Rate: 38%
- Schedule Reliability & Consistency: 43%
- Transit Time & Speed: 12%
Today’s Logistics Truth:

“The customer wants more and is willing to pay less for it.”
Functional Classification of Global Maritime Cargoes

- All Maritime Cargo
  - General Cargo
    - Break Bulk: Sacks, Cartons, Crates, Drums, Pallets, Bags
    - Neo-Bulk
    - Containerized: Containers, Lift On/Lift Off (Lo/Lo), Roll On/Roll Off (Ro/Ro)
  - Bulk Cargo
    - Liquid Bulk: LNG, Petroleum, Molasses, Chemicals, Vegetable Oil
    - Dry Bulk: Grain, Sand & Gravel, Scrap Metal, Coal/Coke, Clinker, Fertilizer
The TEU (Twenty Foot Equivalent Unit)

“The Port & Container Shipping Unit of Measure”

1 TEU = One 20 ft. ISO Container
1 FEU = 2 TEUs = One 40 ft. Container
## How Much Can a Single Container Hold?

### Example 40 ft. Container

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
<th>Unit Price</th>
<th>Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heineken Cases</td>
<td>1,890</td>
<td>$25.50/Case</td>
<td>$48,195</td>
</tr>
<tr>
<td>20” TVs</td>
<td>315</td>
<td>$299/TV</td>
<td>$94,185</td>
</tr>
<tr>
<td>Pairs</td>
<td>10,000</td>
<td>$30/pair</td>
<td>$300,000</td>
</tr>
<tr>
<td>Marlboro Packs</td>
<td>432,000</td>
<td>$4.00/Pack</td>
<td>$1,728,000</td>
</tr>
</tbody>
</table>
International Maritime Cargo Demand & Logistics Trends
Historical Global Container Market Demand
(Millions of TEUs)

North American Growth Lags Other Global Regions

Source: Drewry Shipping Consultants

2009 Recession

Asia
Europe
N. America
A Turning Point in Global Economic History

The Advanced Economies Will Decline From 2/3 share of the Global Economy to a 1/3 Global Share. The Global Economy Will See Higher Average Pace of Growth in the Future…

Source: IMF - Forecast by TD Economics, December 2009
2025 World Container Port Market Demand
(Millions of TEUs)

10% CAGR from 1990 - 2008
(9.1% ) global volume loss for 2009
Recovery in 2010 with 14.8% growth
50% projected rise 2009-2015

260% Increase

Source: Drewry Shipping Consultants October 2011
Southeast Asian Manufacturing Centroid Shift

Current Inbound US Cargo Flow

Expanded Asian Panama Canal Post 2016 Flows

Eastbound: All Water Flow
Eastbound: US Intermodal Rail Flow

U.S. Intermodal Rail Flow
With Manufacturing Centroid Shifts Into Vietnam and/or India, The North American East Coast will See Dramatically More Westbound Suez Traffic
Suez Canal’s $8.5 Billion Expansion Plan
(A New $4 Billion 45-mile-long parallel channel and Global Logistics Park)

3 Daily Convoys:
- 2 Northern Convoys
- 1 Southern Convoy

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The Suez Canal’s $8.5 Billion Expansion of the Canal

Completed September 2015

New 45-mile-long parallel channel cutting waiting times to transit by 3 hrs. from 11 hrs.
Dredging 180 Million Cubic Meters (35-kilometers-long and 24-meters-deep) Shipping Route in Less than One Year
Egyptian Jet Fighter Escort Selfie
(Taken with the New Expanded Suez Canal in the Background)

Source: Photo Courtesy of MIRASCO, August 2015
The Number of Ships Able to Navigate the Suez Canal Simultaneously Has Increased from 23 to 97, Thus **Doubling the Suez Canal Capacity by 2023**
The Continuing Asian Import Trade Challenge
Of the 10 busiest ports in the world, Nine are in Asia, of the top 10, Six are on the Chinese mainland.

The Port of Shanghai is No. 1, and The Port of Singapore is No. 2.

These Two Ports are Larger Than All North American Ports Combined.
China-US: Twin Engines of the World

2015 Population:
US: 325 million
China: 1,400 million
(1/5 World – 19%)

The number of Chinese children in elementary school is equivalent to the total US population.
Shanghai International Shipping Center
Yangshan Deep Port & Logistics Park

New Port City

New Logistics Park

20 Mile New Port Access Bridge Constructed in 3 yrs

54 New Berths
Shanghai International Shipping Center
Yangshan Deep Port - 20 Mile Bridge Access

“Second Longest Ocean Bridge in the World”
Shanghai Yangshan Deep-Water Harbour
Yangshan Deep Port – 54 Berths East China Sea
Shanghai Port Set a 2011 Record by Handling over 30 million TEUs
Emerging New Economic Global Drivers

(BRIC) ASEAN 2017) + India
Huge Population Growth Over Next Decade
Top 10 countries to add 422 million people by 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>2010</th>
<th>2020</th>
<th>Nominal Change</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>1,173,108,018</td>
<td>1,326,093,247</td>
<td>152,985,229</td>
<td>13.0%</td>
</tr>
<tr>
<td>China</td>
<td>1,330,141,295</td>
<td>1,384,545,220</td>
<td>54,403,925</td>
<td>4.1%</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>88,013,491</td>
<td>120,420,018</td>
<td>32,406,527</td>
<td>36.8%</td>
</tr>
<tr>
<td>USA</td>
<td>310,232,863</td>
<td>341,386,665</td>
<td>31,153,802</td>
<td>10.0%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>152,217,341</td>
<td>182,344,492</td>
<td>30,127,151</td>
<td>19.8%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>177,276,594</td>
<td>204,274,257</td>
<td>26,997,663</td>
<td>15.2%</td>
</tr>
<tr>
<td>Congo</td>
<td>70,916,439</td>
<td>95,605,489</td>
<td>24,689,050</td>
<td>34.8%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>242,968,342</td>
<td>267,532,450</td>
<td>24,564,108</td>
<td>10.1%</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>158,065,841</td>
<td>180,753,264</td>
<td>22,687,423</td>
<td>14.4%</td>
</tr>
<tr>
<td>Brazil</td>
<td>201,103,330</td>
<td>222,607,506</td>
<td>21,504,176</td>
<td>10.7%</td>
</tr>
</tbody>
</table>
## Asian Hourly Wage Rates in US Dollars

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHINA</strong></td>
<td>1.56</td>
<td>1.63</td>
<td>1.83</td>
<td>2.16</td>
<td>2.51</td>
<td>2.90</td>
<td>3.29</td>
<td>3.66</td>
</tr>
<tr>
<td><strong>HONG KONG</strong></td>
<td>7.24</td>
<td>7.27</td>
<td>7.42</td>
<td>7.64</td>
<td>7.95</td>
<td>8.27</td>
<td>8.68</td>
<td>9.11</td>
</tr>
<tr>
<td><strong>INDIA</strong></td>
<td>0.50</td>
<td>0.49</td>
<td>0.53</td>
<td>0.57</td>
<td>0.61</td>
<td>0.66</td>
<td>0.71</td>
<td>0.78</td>
</tr>
<tr>
<td><strong>INDONESIA</strong></td>
<td>0.51</td>
<td>0.51</td>
<td>0.59</td>
<td>0.67</td>
<td>0.77</td>
<td>0.88</td>
<td>0.98</td>
<td>1.08</td>
</tr>
<tr>
<td><strong>JAPAN</strong></td>
<td>24.30</td>
<td>26.23</td>
<td>22.59</td>
<td>21.70</td>
<td>20.41</td>
<td>19.81</td>
<td>19.51</td>
<td>18.73</td>
</tr>
<tr>
<td><strong>SOUTH KOREA</strong></td>
<td>13.21</td>
<td>11.27</td>
<td>13.31</td>
<td>14.54</td>
<td>16.49</td>
<td>18.70</td>
<td>20.91</td>
<td>23.38</td>
</tr>
<tr>
<td><strong>MALAYSIA</strong></td>
<td>2.99</td>
<td>2.80</td>
<td>2.97</td>
<td>3.18</td>
<td>3.38</td>
<td>3.58</td>
<td>3.80</td>
<td>4.03</td>
</tr>
<tr>
<td><strong>PHILIPPINES</strong></td>
<td>1.65</td>
<td>1.59</td>
<td>1.67</td>
<td>1.77</td>
<td>1.87</td>
<td>1.99</td>
<td>2.11</td>
<td>2.24</td>
</tr>
<tr>
<td><strong>SINGAPORE</strong></td>
<td>13.18</td>
<td>12.86</td>
<td>13.18</td>
<td>13.85</td>
<td>14.69</td>
<td>15.59</td>
<td>16.53</td>
<td>17.54</td>
</tr>
<tr>
<td><strong>TAIWAN</strong></td>
<td>7.24</td>
<td>6.56</td>
<td>6.95</td>
<td>7.19</td>
<td>7.50</td>
<td>7.85</td>
<td>8.19</td>
<td>8.52</td>
</tr>
<tr>
<td><strong>THAILAND</strong></td>
<td>1.08</td>
<td>1.06</td>
<td>1.04</td>
<td>1.08</td>
<td>1.19</td>
<td>1.27</td>
<td>1.35</td>
<td>1.42</td>
</tr>
<tr>
<td><strong>VIETNAM</strong></td>
<td>0.81</td>
<td>0.86</td>
<td>0.87</td>
<td>0.89</td>
<td>0.97</td>
<td>1.03</td>
<td>1.07</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Source: JOC, IMA Asia – Asia Forecasts 2010
47 New Seaports Will Be Built Across ASEAN
ASEAN Has a Population of 600 million People and a GDP of over US $2.1 Trillion

Population, 2011 (Est.) (Million)

<table>
<thead>
<tr>
<th>Countries</th>
<th>Nominal GDP, 2011 (est.) (US$, Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>822.63</td>
</tr>
<tr>
<td>Thailand</td>
<td>332.47</td>
</tr>
<tr>
<td>Singapore</td>
<td>253.74</td>
</tr>
</tbody>
</table>

Population in ASEAN expected to grow at an average of 1.6 percent annually

ASEAN’s Economic Engine is Almost Twice that of the Middle East + North Africa

Source: ASEAN.org, International Monetary Fund, World Bank, Frost & Sullivan
Nine ASEAN Ports Handled More Than 66.3 million TEUS in 2011 (80% of all ASEAN Cargo)

ASEAN’s Container Volume is 1.65 Times the Total for All North America Container Ports Combined

Source: ASEAN.org, Frost & Sullivan
Top Global Container Port Productivity

Ocean Carriers & International Terminal Operators Do Not Consider North America as a “Best Case Practice”
Maritime Vessel Technology Trends: Emergence of the Neo-Panamax Vessel
50 Years of Container Vessel Evolutionary Growth

### 50 years of Container Ship Growth

<table>
<thead>
<tr>
<th>Year</th>
<th>Ship Name</th>
<th>Container-Carrying Capacity (TEUs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>Encounter Bay</td>
<td>1,530</td>
</tr>
<tr>
<td>1972</td>
<td>Hamburg Express</td>
<td>2,950</td>
</tr>
<tr>
<td>1980</td>
<td>Neptune Garnet</td>
<td>4,100</td>
</tr>
<tr>
<td>1984</td>
<td>American New York</td>
<td>4,600</td>
</tr>
<tr>
<td>1996</td>
<td>Regina Maersk</td>
<td>6,400</td>
</tr>
<tr>
<td>1997</td>
<td>Susan Maersk</td>
<td>8,000+</td>
</tr>
<tr>
<td>2002</td>
<td>Charlotte Maersk</td>
<td>8,890</td>
</tr>
<tr>
<td>2003</td>
<td>Anna Maersk</td>
<td>9,000+</td>
</tr>
<tr>
<td>2005</td>
<td>Gjertrud Maersk</td>
<td>10,000+</td>
</tr>
<tr>
<td>2006</td>
<td>Emma Maersk</td>
<td>11,000+</td>
</tr>
<tr>
<td>2012</td>
<td>Marco Polo (CMA CGM)</td>
<td>16,000+</td>
</tr>
<tr>
<td>2013</td>
<td>Maersk Mc Kinney Moller</td>
<td>18,270+</td>
</tr>
<tr>
<td>2014/15</td>
<td>CSCL Globe/MSC Oscar</td>
<td>19,000+</td>
</tr>
<tr>
<td>2018</td>
<td>Near Term Mega Vessel</td>
<td>22,000+</td>
</tr>
</tbody>
</table>

**Old Panamax:** 4,800 TEUs  
**Neo-Panamax:** 12,600 TEUs  
**Near Term Mega Vessel:** 22,000 TEUs

Container-carrying capacity has increased by approximately 1,200% since 1968.

Source: Allianz Global Corporate & Specialty - Data: Container-Transportation.com
24% increase in the average container ship size from 2008 to 2012

The Stage is set to Jump again to 25,000 TEU Mega Container Vessels

9,000 TEUs  12,000 TEUs
15,000 TEUs  18,000 TEUs
Largest Container Vessel to Call in North America: 
(December 26, 2015 APMT POLA - CMA CGM Benjamin Franklin
1,300 ft. LOA and 177 ft. beam, 18,000 TEUs)

The massive Benjamin Franklin was turned in 56 hours of operations, averaging 29.1 lifts per crane, per hour, averaging total 200 container moves against the vessel each hour, for a total of 11,200 lifts. The APM Terminal in Los Angeles worked as many as nine ship-to-shore cranes simultaneously against the Benjamin Franklin during its three and one-half day call.

1.5 times the Size of the Expanded Panama Canal
China Shipping Container Lines has invested $700m (£463m) in building the five Globes.

Source: BBC News Magazine, January 2015
CSCL Globe: The two-stroke engine, built in South Korea, operates at 56.8 megawatts.

It's estimated that the Globe's engine, which automatically adjusts fuel consumption based on the ship's speed and sea conditions, uses one fifth less per container than a vessel carrying 10,000 containers.

Globe's crew is only 23 people work on board during voyages.
### What are CURRENT DRAFTS AND BEAMS of New Container Vessels – Why are US Ports Dredging to 50 feet?

<table>
<thead>
<tr>
<th>Hull Number</th>
<th>Company</th>
<th>Year</th>
<th>Length (m)</th>
<th>Breadth (m)</th>
<th>Load Draft (m)</th>
<th>TEU Capacity</th>
<th>File Containers</th>
</tr>
</thead>
<tbody>
<tr>
<td>H6002</td>
<td>CMA CGM TBN</td>
<td>2015 Sep</td>
<td>400.0</td>
<td>59.0</td>
<td>16.0</td>
<td>17,859</td>
<td>21</td>
</tr>
<tr>
<td>S746</td>
<td>UASC TBN</td>
<td>2015 Apr</td>
<td>399.0</td>
<td>54.0</td>
<td>16.0</td>
<td>18,800</td>
<td>23</td>
</tr>
<tr>
<td>4277</td>
<td>MSC TBN</td>
<td>2015 Jan</td>
<td>395.4</td>
<td>59.0</td>
<td>16.0</td>
<td>18,400</td>
<td>23</td>
</tr>
<tr>
<td>2696</td>
<td>CSCL GLOBE</td>
<td>2014 Nov</td>
<td>400.0</td>
<td>58.6</td>
<td>16.0</td>
<td>19,000</td>
<td>23</td>
</tr>
<tr>
<td>4250</td>
<td>MAERSK MCKINNEY MOLLER</td>
<td>2013 Jun</td>
<td>399.0</td>
<td>59.0</td>
<td>16.0</td>
<td>18,270</td>
<td>23</td>
</tr>
<tr>
<td>4161</td>
<td>CMA CGM MARCO POLO</td>
<td>2012 Nov</td>
<td>396.0</td>
<td>53.6</td>
<td>16.0</td>
<td>16,020</td>
<td>21</td>
</tr>
<tr>
<td>203</td>
<td>EMMA MAERSK</td>
<td>2006 Aug</td>
<td>397.7</td>
<td>56.4</td>
<td>16.0</td>
<td>15,550</td>
<td>22</td>
</tr>
</tbody>
</table>

#### Answer:
- **Length:** up to 400.0 m (1312.34 ft)
- **Breadth:** up to 59.0 m (193.57 ft)
- **Load Draft:** up to 16.0 m (52.49 ft)
- **TEU Capacity:** up to 19,000 TEUs and 23 container wide
2018: Ultra-Large 20,000 TEUs Container Ships

2015: Maersk Planning Orders up to 10 New 20,000 TEU Ships ($1.5 Billion Order), Evergreen, Seaspan and United Arab Shipping Company (UASC) are also looking at 20,000 TEUs
A 20,000 TEU Mega-Container Vessel Can Produce High Intermodal Rail Volumes For One Weekly Vessel Call)

Vessel Capacity
20,000 TEU
(11,784 Units)

Assuming a 75% Intermodal Rail Split

26.8 Double Stacked Trains

26.8 Double Stacked Trains
Containership Orders – Country of Build
(Orders Since January 2010)

<table>
<thead>
<tr>
<th>Country</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Korea</td>
<td>139</td>
</tr>
<tr>
<td>China</td>
<td>64</td>
</tr>
<tr>
<td>Taiwan</td>
<td>16</td>
</tr>
<tr>
<td>Philippines</td>
<td>12</td>
</tr>
<tr>
<td>Romania</td>
<td>4</td>
</tr>
<tr>
<td>Japan</td>
<td>2</td>
</tr>
<tr>
<td>Germany</td>
<td>1</td>
</tr>
</tbody>
</table>

Size Range:
- Below 1,000
- 1,000-1,499
- 1,500-1,999
- 2,000-2,999
- 3,000-3,999
- 4,000-5,099
- 5,100-7,499
- 7,500-9,999
- Above 10,000

92%

Source: Alphaliner Newsletter Volume 2011 Issue 21
Vessel Size Expansion - Terminal Impacts
(Port Terminal Infrastructure & Equipment Geometry Impacts)

Source: Georgia Ports Authority and Vickerman & Associates
Future Container Vessel: NYK Super Eco Ship
Future Container Vessel: NYK Super Eco Ship

NYK Super Eco Ship 2030

Green Ship Design for the Future

TOTAL CO₂ reduction 70%

Nominated for the Clean Innovation award at Nor-Shipping 2009
“Deck” Barge Loaded with Containers

“Hopper” Barge Loaded with Containers

Source: USDOT Maritime Administration MARAD
Proposed Domestic AMH/Short Sea Container Services

Proposed New England Marine Highway Project's articulated tug barge short sea container service connecting New York City and Portland, Maine - 900 TEUs

Proposed MARAD ATB Ro/Con – HEC Design - 886 TEUs, Design Draft 14.1 ft. – 14 Knots
A “State of the Art” Hull Design to Ensure Optimal Speed in All River Conditions Utilizing LNG as Main Propulsion Fuel
American Patriot Container Transport, LLC. (APCT) Vessel Fleet Characteristics

<table>
<thead>
<tr>
<th>LOA Feet</th>
<th>Beam Feet</th>
<th>TEU Capacity</th>
<th>Vessel Drafts</th>
</tr>
</thead>
<tbody>
<tr>
<td>592</td>
<td>100</td>
<td>1824</td>
<td>9.0 ft. 9.6 ft., &amp; 10.0 ft.</td>
</tr>
<tr>
<td>772</td>
<td>100</td>
<td>2392</td>
<td>9.0 ft. 9.6 ft., &amp; 10.0 ft.</td>
</tr>
<tr>
<td>952</td>
<td>100</td>
<td>2960</td>
<td>9.0 ft. 9.6 ft., &amp; 10.0 ft.</td>
</tr>
<tr>
<td>1042</td>
<td>100</td>
<td>3244</td>
<td>9.0 ft. 9.6 ft., &amp; 10.0 ft.</td>
</tr>
</tbody>
</table>
Inland Waterway Vessel Transfer to Ocean Container Transport

Are the Cargo & Quantity Viable?

200 - 900 TEUs

1824 TEUs to 3244 TEUs

Commercially Viable
New Era of LNG Vessels is on the Horizon: Will LNG be the Fuel of the Future for Shipping?
TODAY: Viking Energy, an LNG-powered offshore supply boat – Courtesy of Eidesvik
TOTE Orders Two New LNG Powered Container Ships & Two RO/RO Conversions: Largest LNG Powered Ships in the World

These ships will be the largest ships in the world powered primarily by Liquefied Natural Gas (LNG).
TOTE Orders Two New LNG Powered Container Ships & Two RO/RO Conversions: Largest LNG Powered Ships in the World

Two 839-foot Orca-class vessels to liquefied natural gas-diesel dual fuel operation for Seattle-Alaska service and two 764-foot new-builds for the Florida-Puerto Rico trade.
Kawasaki Heavy Industries
9,000 TEU container ship
Fuelled by LNG

A new type of LNG tank that provides more space for container cargo.
Germanischer Lloyd (GL) & IHI Marine United Inc. (IHIMU) Concept Study 13,000 TEU Container Vessel Fuelled by LNG

The eFuture 13000C design (©IHIMU)
LNG Vessel Bunkering: North American Ports Are Not Prepared...
The first ceremony began on the Atlantic side at the new Agura Clara Locks, followed by the new Cocoli Locks on the Pacific side.
Panama Canal Historical Tonnage Traffic

Source: ACP Data
The United States Took Over the Original Canal Construction Project from the French in 1904 and completed it in 1914.
The Panama Canal Circa 1914
Panama Canal Pre-June 2016 (Old Panamax)
The New Third Lane Locks will **Add More than 6,000 Vessel Transits** Through the Panama Canal and will Double the Cargo Volume Transported

Source: ACP Expansion Project, Circle of Blue January 27, 2015
The Panama Canal Currently Accounts for 3% of the Volume of Global Trade, this Share Will Increase to 6 - 7 % over the next decade

Source: ACP Expansion Project, Circle of Blue January 27, 2015
Panama Canal Third Lane Expansion

New Lane

Existing Lanes

Panama Canal Authority
Panama Canal Third Lane Expansion
Water-Saving Basin Reservoir System

WATER-SAVING BASIN SYSTEM

1. The locks will have more efficient, easier to service rolling gates.
2. The water-saving basins will enable using 7% less water than the existing lock system and reusing 60% of the water required for each transit.
3. Valves
A $5.25 Billion Investment in a 3rd Set of Locks
Equating to 16% of Panama’s National GDP

Source: ACP Expansion Project, Circle of Blue January 27, 2015
Panama Canal Third Lane Expansion Capabilities

Source: ACP Expansion Project
Panama Canal Third Lane Expansion Capabilities

Neo-Panamax: 12,600 TEUs

Old Panamax: 4,800 TEUs

Length of Post-Panamax Vessel: 366m

Length of Panamax Vessel: 294m

Source: ACP Expansion Project, Circle of Blue January 27, 2015
A Larger Share of Other Vessels Will be Able to Transit the Canal - Fully Loaded

Crude Oil - 0% to 42%

LNG - 10% to 90%

Dry Bulk - 55% to 80%
Panama Canal Vessel Deployments Will Determine New US Logistics Patterns

The Distance to New Orleans and Savannah Via the Panama Canal is Identical. But Each Port Has Very Different Access to the US Heartland.

A Competitive & Robust Landside Access to the Gateway Port’s Inland Market will be a Key Success Factor!
Today Only The Port of Virginia Can Handle The New 2016 NeoPanamax Vessels Fully Loaded

Source: Virginia Port Authority (VPA) October 2011

<table>
<thead>
<tr>
<th>Location</th>
<th>Length Range</th>
<th>TEU Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAX (Jacksonville)</td>
<td>38 ft</td>
<td>4,500 TEU</td>
</tr>
<tr>
<td>NY/NJ (New York/New Jersey)</td>
<td>42 - 45 ft</td>
<td>8,500 TEU</td>
</tr>
<tr>
<td>Savannah</td>
<td>44 - 47 ft</td>
<td>10,000 to 12,500+ TEU</td>
</tr>
<tr>
<td>Miami</td>
<td>44 - 47 ft</td>
<td>10,000 to 12,500+ TEU</td>
</tr>
<tr>
<td>Charleston</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norfolk</td>
<td>50 ft</td>
<td></td>
</tr>
<tr>
<td>Norfolk</td>
<td>55 ft (authorized)</td>
<td></td>
</tr>
</tbody>
</table>
Port Authority of New York & New Jersey
Entrance Channel & Harbor Dredging Program
($1.6 Billion Program, Completion December 2014)
Raising of the Bayonne Bridge
(Estimated at $1 billion)

**Future** Clearance: 214 ft

**Current** Clearance: 155.3 ft

Maximum Vessel: 7,000 TEUs

Existing Level: 64 feet
Emerging New Caribbean Transshipment Center
(Large Ship to Feeder Vessel Transfer)
Panama Ports Annual Transhipment Growth “The Singapore of Latin America”

Proposed New Port Projects Would Double the Total in 5 Years
Panama Ports Container Transhipment Growth

6.8 Million TEUs – 18.5 % Growth Rate
The Panama Canal Expansion Will Move the Caribbean Transhipment Center Point to Panama
New Panama Canal Pacific Entrance Ports

More Capacity than all of the Port of Los Angeles

The Autoridad Del Canal de Panama
New Panama Canal Atlantic Entrance Port

More Capacity than all of the Port of Houston

ACP
The Autoridad Del Canal de Panama
North American Vessel Transshipment:
(Globally Transshipment accounts between 25 and 50% of all container volumes – In the US it’s < 15%)

Induced Transshipment/Feeder Ship Operations
2017 AAPA Executive Management Conference

Transforming Global Trade Logistics with New Ocean Carrier Alliances
The New **Ocean Alliance** would bring the World’s 3rd, 4th, 5th and 9th biggest Container Lines **Together in a Vessel-Sharing Agreement**…

Forcing the hands of the remaining players to quickly choose their strongest partners from the remnants of the CKYHE, G6 and O3 alliances
The New Ocean Alliance would bring the World’s 3rd, 4th, 5th and 9th biggest Container Lines Together in a Vessel-Sharing Agreement...

“The OCEAN ALLIANCE in April 2017 plans to deploy the most expansive all-water trans-Pacific service network to U.S. East and Gulf Coast ports that has been seen in years, according to a U.S. maritime regulator.”

JOC July 15, 2017

Source: JOC July 15, 2016
Restructuring of the Vessel Sharing Alliances Takes Effect Late April 2017
(Ocean Alliance to Dominate the Overall Trans-Pacific Trade)

US ports will face unprecedented operational challenges when ocean carriers restructure April, 2017

Three alliances will control 91% of the US trade volume

Source: Alphaliner – JOC - IHS Maritime & Trade
In 2015 US East Coast ports handled 7.9 million TEU of loaded containers, up 12.6% year-on-year.

US West Coast ports still handle 56% of the inbound loaded containers arriving in the US in 2015.
North American Cargo Demand Trends

(Déjà vu Experience)
Total U.S. Freight Tonnage Will Grow 23.5% by 2025.

Source: ATA US Freight Transportation 2025 Forecast
Transpacific Container Trade Recovery

(Millions of TEUs)

“Note the 2 to 1 Asian Import Imbalance”

Source: IHS – Global Insight - The Global Outlook – October 14, 2010
Large Container Vessel Market Penetration into the US Midwest
New State of US Marine & Intermodal Competition

Source: NW Seaport Alliance Strategic Business Plan, May 6, 2015
Prior to June 2016 - US Market Penetration

Panama Canal Economies of Scale with permit
deeper market penetration into the US

Reachable Market: 46% of US Population

4,000 TEU ship, all-water.

Source: PB Consultants - CSX Transportation May 12, 2011 - Director of Strategic Analysis
Dramatic US Market Penetration after June 2016

Panama Canal **Economies of Scale** with permit
deeper market penetration into the US

Reachable Market:
63% of US Population

8,000 TEU ship, all-water.

Source: PB Consultants - CSX Transportation May 12, 2011 - Director of Strategic Analysis
Dramatic US Market Penetration after June 2016

Panama Canal **Economies of Scale** with permit
deeper market penetration into the US Midwest

The Midwest & the Mississippi River Valley Could be the Real Beneficiaries!

Source: ACP Expansion Project – Rodolfo Sabonge AAPA January 24, 2013
The Panama Canal will prove to be a strong contender for Asian trade serving not only the US East Coast, but ALL of the Gulf and the Most of the Midwest by late 2017.
2017 AAPA Executive Management Conference

America’s New Energy Self Sufficiency
US oil production recently hit a 20-year high and could surpass Saudi Arabia’s output by 2019.

The US has a 100-year supply of natural gas, & will be the world’s largest natural gas producer by end of 2017.

Source: US Energy Information Administration, US Department of Energy
July 25, 2016 First Ever LNG Vessel Through the New Panama Canal Locks

The Expanded Canal can accommodate 90 percent of the world’s LNG tankers, which will have a major impact on global LNG flows and offer numerous benefits to shippers.
Global energy market trends are set to transform the maritime industry, with major investments to be ploughed into new LNG terminals and huge projected growth in exports expected in the coming years.

Consider: The United States is poised to become one of the world’s top LNG exporters in the next five years, the Canal will allow vessels departing the U.S. East and Gulf Coast for Asia to enjoy significant reductions in voyage times (up to 22.8 days roundtrip), making U.S. gas deliveries to major Asian importers very competitive. Vessels departing the U.S. Gulf Coast for the West Coast of South America will similarly experience generous time savings.
By 2020, U.S. is Projected to Be a Net Exporter of Natural Gas

Source: Derived from US Energy Information Administration: EIA AE 02014
US Natural Gas Production by Source
(Trillion Cubic Feet)

Source: Derived from US Energy Information Administration: EIA AE 02014
There is Enough Recoverable Domestic Natural Gas to Meet America’s Needs for at Least 100 years at Current Consumption Rates.

Source: Derived from US Energy Information Administration: EIA AE 02014
Foreign Investment in US Gas and Oil

- Bakken Shale
  - Norway: Statoil, $4.4 B
  - Jordan Cove, OR

- Niobrara Shale
  - China: CNOOC, $1.3 B

- Woodford Shale
  - United Kingdom: BP Plc, $1.75 B

- Barnett Shale
  - France: $2.25 B

- Eagle Ford Shale
  - China: CNOOC, $2.2 B
  - Netherlands: Royal Dutch Shell acquired 250,000 acres, price uncertain
  - Australia: BHP, $15.1 B Eagle Ford & Haynesville Plays

- Haynesville Shale
  - Netherlands: Royal Dutch Shell acquired 400,000 acres, price uncertain

- Utica Shale
  - Undisclosed Major Foreign Energy Corp., $2.14 B

- Marcellus Shale
  - India: Reliance Industries, $1.7 B
  - Netherlands: Royal Dutch Shell, $4.5 B
  - Norway: Statoil, $3.37 B
Marcellus/Utica/Appalachian Shale Basins

Marcellus Shale: 1,925 billion cubic feet

Utica Shale: 38.2 trillion cubic feet – 20 Times Larger than Marcellus
US LNG Exporters Target Marcellus Shale as Feed Gas
(Liquefaction Participants are Now in the Market for Dedicated Pipeline Supply to Match Their Exporting Needs)

US LNG Exporters Target Marcellus Shale as Feed Gas
(Liquefaction Participants are Now in the Market for Dedicated Pipeline Supply to Match Their Exporting Needs)
Inland Ports Defined: A Convergence of Logistic Trends
Inland Ports Defined
A Convergence of Logistics Trends

Short Sea Shipping Technology
Intermodal Rail
Logistics
Automation
Distribution Center
Emerging Major Inland Port Logistics Centers

Throughput Capacities in Millions of TEUs
Wal-Mart’s New 3.4 million SF (78 acres under roof) Import Distribution Center

The Cost of This Import Distribution Center was Paid for by the Savings in Truck Drayage Between the Warehouse & the Intermodal Rail Terminal
The Inland Port: “With Integrated JIT Delivery: The Inland Port Can Greatly Increase a Regions Freight System Capacity”
ASCE 2017 Report Card for America’s Infrastructure

Ports: C+
Inland Waterways: D
Roads: D

Failure to Act: It Costs Each US Family $3,400 per year

Cost to Improve: $4.6 Trillion
International Gross Fixed Capital Formation as a Percent of GDP
(US is 32nd in the World - Behind OECD Nations)
2017 AAPA Executive Management Conference

Thank You