Planning for Future Transportation Realities
412 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
Vessel Cargo Handling Circa 1955
US Navy Fast Frigate Circa 2045
What We Know Today... Will Surely Be Different Tomorrow!
I skate to where the puck is going to be, not where it has been.

- Wayne Gretzky
Three Dramatic Mega Trade Trends will Increase Global Trade Demand
Current Market Conditions Appear to be Improving for Marine Carriers

Expect the Global Maritime Trade Volume to Double by 2030...

Source: JOC.COM January 2018
I. INCREASE IN GLOBAL POPULATION:
Global population is likely to be 8.5 billion by 2030, with 96% of growth coming from developing countries.

India will overtake China with the largest population.

Source: Global Marine Trends 2030 – QinetiQ – Lloyd’s Register
World’s Largest Countries by Population in 2100

- India: 1.5 billion
- China: 1 billion
- Nigeria: 794 million
- United States: 447 million
- DR Congo: 379 million
- Pakistan: 352 million
- Indonesia: 306 million
- Tanzania: 304 million
- Ethiopia: 250 million
- Uganda: 214 million

World’s 10 Largest Economies

Projected Real GDP (trillions of 2010 dollars)

- United States: 23.9
- China: 18.8
- India: 7.3
- Japan: 6.5
- Germany: 4.3
- United Kingdom: 3.8
- France: 3.5
- Brazil: 3.2
- Canada: 2.5
- Italy: 2.3

Source: UN Population Data
II. GLOBAL GDP COULD GROW THREE TIMES WITHIN THE NEXT 20 YEARS

The countries with the largest growth in per capita GDP will be China, Vietnam, India and Indonesia.

Purchasing power in developing Asia will rise 8 times between 2010 and 2030.

Source: Global Marine Trends 2030 – QinetiQ – Lloyd’s Register
III. 40% HIGHER ENERGY DEMAND IN 2030

China oil consumption could triple, overtaking the USA to become the largest oil consumer.

The USA will remain the biggest natural gas consumer, while China will see the largest growth in natural gas consumption.

Source: Global Marine Trends 2030 – QinetiQ – Lloyd’s Register
Emerging North American Port Privatization Efforts
Comprehensive Update to the Current POLB Port Master Plan
Long Beach Container Terminal (LBCT)
STS Cranes & Automated Guided Vehicles (AGVs)
Long Beach Container Terminal (LBCT)
Automated High Productivity Intermodal Cranes
Macquarie Infrastructure Partners (Australian Banking and Investment Group) has expanded its US footprint beyond the East Coast to the West Coast through the $1.78 billion purchase of Long Beach Container Terminal (LBCT) from Hong Kong's Orient Overseas (International) Limited (OOIL).

Macquarie has stakes in New Jersey's Maher Terminals at Port Elizabeth and Penn Terminals. Buying LBCT gives it major port assets on the US West and East coasts.

Source: JOC April 30, 2019
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
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?

KEY

WORLD’S LARGEST PORTS [BY CARGO VOLUME PER YEAR]

- 10 MILLION TONS
  - 100
  - 500

PANAMA CANAL

Roughly a million containers will travel through the canal each week (twice the current rate) once new lanes for bigger vessels are finished in 2016. The construction authority recently announced it is at least six months behind schedule.
The World's Largest Ports Are Connected Inside The Marine Silk Road The Circle

Key

World's Largest Ports (by Cargo Volume Per Year)

- 10 Million Tons
  - 100
  - 500
A standard dot density map of population (each dot represents 50,000 people).
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.
Expect the Global Maritime Trade Volume to Double by 2030

“In the next 10-15 years world trade is projected to grow significantly. It is estimated that this growth will result in a doubling of seaborne trade volumes from 10 billion tons of cargo annually today to 20 billion tons of cargo around 2030”.

Source: Danish Maritime Forum, 24-28 October 2016
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%

Source: Oxford Economics 2013
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
Global Container Trade Growth Forecast
(Accelerating in 2019 and Beyond)

Total world container volume with year over year change
*(f) = forecast

Source: 2019 HIS Markit – Trends in the World Economy and Trade report - JOC
NAFTA FTA Trade Volumes
(2016 Imports and Exports, in Billions of US Dollars)

Source: United Nations Comtrade Database – Data Visualization

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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

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

“The customer wants more and is willing to pay less for it.”
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)

- 1,890 Cases @ $25.50/Case = $48,195
- 315 20” TVs @ $299/TV = $94,185
- 10,000 Pairs @ $30/pair = $300,000
- 432,000 Packs @ $4.00/Pack = $1,728,000
International Maritime Cargo Demand & Logistics Trends
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

Source: Drewry Shipping Consultants
Southeast Asian Manufacturing Centroid Shift

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
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 International Shipping Center
Yangshan Deep Port & Logistics Park

Shanghai Port Set a 2011 Record by Handling over 30 million TEUs
Emerging New Economic Global Trade Drivers

(BRIC → ASEAN 2020) + India
Indonesian factory workers will still be making approximately 58 times less than their American counterparts in 2019.
The combined population of ASEAN creates the world’s third largest market with more than 600M people

Source: 2012 World Bank Data
Rising ASEAN Emerging Markets
(GDP in Billions of USD)

Source: HIS Global Insight
47 New Seaports Will Be Built Across ASEAN
ASEAN Has a Population of more than 600 million People and a GDP of over US $2.1 Trillion

Population, 2011 (Est.) (Million)

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

<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>

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 (80% of all ASEAN Cargo)

Source: ASEAN.org, Frost & Sullivan

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

Source: ASEAN.org, Frost & Sullivan
The Arrival of Mega Container Ships in North America
(The Advent of Ultra Large Container Vessels (ULCV) – Megamax MGX 24 Vessel)
Evolution of the Modern Container Vessel

- Early container ship (1956-): 500 – 800 TEU, 137x17x9m
- Fully Cellular (1970-): 1,000 – 2,500 TEU, 215x20x10m
- Panamax (1980-): 3,000 – 3,400 TEU, 250x32x12.5m
- Panamax Max (1985-): 3,400 – 4,500 TEU, 290x32x12.5m
- Post Panamax (1988-): 4,000 – 5,000 TEU, 285x40x13m
- Post Panamax Plus (2000-): 6,000 – 8,000 TEU, 300x43x14.5m
- New Panamax (2014-): 12,500 TEU, 366x49x15.2m
- Triple E (2013-): 18,000 TEU, 400x59x15.5m

Source: FORWARD Florida Media, March 2014 – Adapted with permission from the Geography of Transport Systems, Jean-Paul Rodrigue
US East Coast Port vessel sizes from Asia have been increasing since the opening of the expanded Panama Canal in June 2016.

The maximum vessel size has increased from 10,700 TEU to 14,400 TEU, and the share of the Asia-East Coast carried by 12,000- to 15,000-TEU vessels has increased from 9.6% to 14.8% in the third quarter of 2018.
Average Container Ship Size Climbs

As expected, the average size of ships in the global fleet continued to grow substantially.

Source: 2019 HIS Markit – Trends in the World Economy and Trade report - JOC
US East and Gulf Coast Ports Make Significant Asian Import Market Share Gains

Source: 2019 HIS Markit – Trends in the World Economy and Trade report - JOC
Size of container ships has been growing at a faster pace than all other ship types.

Source: Clarkson Services – OECD/ITF 2015 Project: Impact of Mega Ships
OECD Historical Development of Container Vessel Size (1970 to 2017)

Development of container ship size

- 1970: 4,500 TEUs
- 1977: 3,126 TEUs
- 1990: 4,814 TEUs
- 1997: 8,160 TEUs
- 2006: 15,550 TEUs
- 2017: 21,100 TEUs

Average TEU size:
- Newbuilds: 7,500 TEUs
- Average TEU capacity: 4,500 TEUs

Source: Clarkson Services – OECD/ITF 2015 Project: Impact of Mega Ships
Future Development “Extrapolated” OECD Container Vessel Size (2015 to 2035)

Source: Clarkson Services – OECD/ITF 2015 Project: Impact of Mega Ships
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
Largest NEO-PANAMAX Containership to Transit the New Panama Canal – August 2017
(OCEAN Alliance’s weekly South Atlantic Express (SAX) service)

CMA CGM’s THEODORE ROOSEVELT:
TEU Allowance: **14,855 TEUs**
Vessel LOA: 365.9 meters (**1,200.66 ft.**)  
Vessel Beam: 48.2 meters (**158.31 ft.**)  
Vessel Max. Draft: 16 meters (**52.49 ft.**)
50 Years of Container Vessel Evolutionary Growth

50 years of Container Ship Growth

<table>
<thead>
<tr>
<th>Year</th>
<th>Ship</th>
<th>Capacity (TEU)</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></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>Maersk Mc Kinney Moller</td>
<td>18,270</td>
</tr>
<tr>
<td>2014/2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>Near Term Mega Vessel: 24,000 TEUs</td>
<td>22,000</td>
</tr>
</tbody>
</table>

Old Panamax: 4,800 TEUs
Neo-Panamax: 14,800 TEUs

Near Term Mega Vessel: 24,000 TEUs

Source: Allianz Global Corporate & Specialty - Data: Container-Transportation.com

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The Recent Mega Container Vessels are Too Large for the New Panama Canal Third Lane Expansion

**Existing Locks**
- 33.5 m wide / 12.8 m deep / 304.8 m long

**New Locks**
- 55 m wide / 18.3 m deep / 427 m long

**Early Container Ship**
- 17 meters wide
- 137 m long
- 9 m draft
- 800 containers

**Maximum Ship Size, Existing Locks**
- 32.3 m wide
- 294.1 m long
- 12 m draft
- 4,500 containers

**Maximum Ship Size, New Locks**
- 49 m wide
- 366 m long
- 15.2 m draft
- 12,500 containers

**The Largest Container Ship, Maersk’s Triple E**
- 59 m wide
- 400 m long
- 14.5 m draft
- 18,000 containers

Source: A.P. Moeller-Maersk, Panama Canal Authority
May 8, 2017 Largest Container Vessel to Call at the Port of Virginia

COSCO Development Container Ship – 13,092 TEUs

Containership COSCO DEVELOPMENT at 1,200 feet long and 158 feet wide, it is 100-plus feet longer than the U.S. Navy’s newest aircraft carrier the Gerald R. Ford.
The Biggest Ship Ever in San Francisco Bay
CMA CGM Benjamin Franklin
1,300 ft. LOA, 177 ft. beam, 18,000 TEUs

Source: CMA CGM, The SF Chronicle
The Biggest Ship Ever in San Francisco Bay
CMA CGM Benjamin Franklin
1,300 ft. LOA, 177 ft. beam, 18,000 TEUs

Source: CMA CGM, The SF Chronicle
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..
South Korea’s Samsung Heavy Industries: 
*OOCL Mega Ships 21,100 TEU* to be delivered November 2017

Six ordered at 21,100 TEU, total cost of US $950 million. The contract also includes options for six additional units.
CMA CGM Group’s US$1.5 billion order for nine LNG Powered 22,000-TEUs container ships for delivery from the end of 2019. Asia-Europe trade may be set for 24,000 TEU ships from 2019.

Source: American Shipper - Lloyd’s List
Hyundai Heavy Industries (HHI) Confirms Orders of “Megamax” Boxships to Daewoo Shipbuilding & Samsung Heavy Industries For TWELVE 23,000 TEU Container Ships (Delivery in the second quarter of 2020)

• The twelve 23,000 TEU vessels will be deployed in the Asia-North Europe trade.

• All the “ECO FRIENDLY” new vessels will be sequentially delivered in the right time to prepare for the 2020 environmental regulations.

Source: Maritime Executive September 2018
Next Generation: *Suezmax 26,000 TEUs*

26 Bays, 25 Rows - Ultra Large Container Ships (ULCS)

With a Beam of 25 rows & Length of 26 bays

(LOA: 430 meters – 1,411 feet)

the ULCS capacity could reach **26,300 TEU**.

*Port of Antwerp*: New Terminals in Europe are using 26,000 TEU design vessels

Source: DNV GL in-house methodology - “Concept Design Assessment”
## Ultra Large Container Vessels (ULCV): Megamax-24 Era
(Post Neo-Panamax Comparative Vessel Characteristics)

### Alphaliner: Megamax - 24
MGX-24 Vessel

- **Length:** 24 Container Bay
- **Breath:** 24 Deck Rows
- **Height:** 24 Container Tiers
- **In Hold:** 12 container Tiers

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<tbody>
<tr>
<td>ACP “Neo-Panamax”</td>
<td>-</td>
<td>12,600</td>
<td>1,200</td>
<td>160.7</td>
<td>49.90</td>
<td>ACP Neo-Panamax Data</td>
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<tr>
<td>MAX Neo-Panamax</td>
<td>-</td>
<td>14,500</td>
<td>1,201</td>
<td>158.31</td>
<td>52.49</td>
<td>CMA CGM’s T. Roosevelt</td>
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<tr>
<td>Post Neo-Panamax</td>
<td>MGX-20</td>
<td>20,000</td>
<td>1,312</td>
<td>192.49</td>
<td>52.49</td>
<td>Design Vessel LNG</td>
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<td>Post Neo-Panamax</td>
<td>MGX-22</td>
<td>22,000</td>
<td>1,315*</td>
<td>193.57</td>
<td>52.49</td>
<td>CMA CGM 22,000 Option to go to 24 Rows</td>
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<td>Post Neo-Panamax</td>
<td>MGX-24</td>
<td>24,000</td>
<td>1,319</td>
<td>201.44</td>
<td>52.49</td>
<td>ULCV Suezmax 26,000 TEUs</td>
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<tr>
<td>Post Neo-Panamax</td>
<td>MGX-26</td>
<td>26,000</td>
<td>1,411</td>
<td>209.31*</td>
<td>52.49</td>
<td></td>
</tr>
</tbody>
</table>

* Calculated Value/Derived Value
Vessel Sharing Alliances Were Restructured Late April 2017
(Ocean Alliance to Dominate the Overall Trans-Pacific Trade)

*US ports will face unprecedented operational challenges.*

Three alliances will control 91% of the US trade volume

*Source: Alphaliner – JOC - IHS Maritime & Trade*
Largest Shipbuilding Nations in 2016
(Gross Tonnage, in 1,000s)

South Korea: 25,035 (91.4%)
China: 22,355
Japan: 13,309
Europe: 1,537
Others: 4,187

Source: IHS, Shipbuilders’ Association of Japan, Statista 2018
A 20,000 TEU Mega-Container Vessel Can Produce High Intermodal Rail Volumes For One Weekly Vessel Call)

Assuming a 75% Intermodal Rail Split

26.8 Double Stacked Trains

Vessel Capacity
20,000 TEU
(11,784 Units)
Breakthrough in Terminal Automation & Remote Control of STS Cranes
Moving Crane Operations Away from the Terminal: DP World Terminal 4 Jebel Ali Dubai (UAE)

(13 ship to shore (STS) cranes and 35 automatic stacking cranes (ASC) – By Late 2018 Port Volume will be 22.1 million TEUs > Top 3 US Ports Combined

All STS and Stacking Cranes at Terminal 4 Jebel Ali will be operated from a control room located away from the terminal.
Port of Rotterdam – Maasvlakte II
Remote Ship to Shore (STS) Crane Operators
Port of Rotterdam – Maasvlakte II
Remote Ship to Shore (STS) Crane Operators
Jumping from the Current STS 100 ft. Crane Gage to a New 150 ft. STS Gantry Cranes
Today’s STS Wharf Gantry Crane Evolution

APM Terminals released the following graphic today showing how container cranes have evolved in size over the years.
150 ft. Gage Semi-Automated STS Gantry Cranes

Four STS Gantry Cranes

RTG Container Yard

22 to 24 outreach

150 ft. gage
Encoder Systems for modern automated STS container cranes reduce costs and increases safety
Moving Crane Operations Away from the Terminal: DP World Terminal 4 Jebel Ali Dubai (UAE)

(13 ship to shore (STS) cranes and 35 automatic stacking cranes (ASC) – By Late 2018 Port Volume will be 22.1 million TEUs > Top 3 US Ports Combined

All STS and Stacking Cranes at Terminal 4 Jebel Ali will be operated from a control room located away from the of the terminal.
Semi-Automated STS Gantry Cranes Operations

Spreader capability to lift tandem, triple, quad & 6 pack loads
The US Midwest & The Mississippi River Are the New Intermodal Freight Battle Ground
New State of Marine & Intermodal Competition

Source: NW Seaport Alliance Strategic Business Plan, May 6, 2015
**US Market Penetration Via Panama Canal Expansion**

*(Economies of Scale)*

46% Penetration, Before 2016
Via All Water, 4,500 TEU Vessels

63% Penetration, After 2016
Via All Water, 8,000 TEU Vessels

75% Penetration, 2018 & Beyond
Via All Water & Pendulum Service
14,500 TEU Vessels

Source: Potential Effects of the Panama Canal Expansion on the Texas Transportation System

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New Container Port Battleground Region
(Representing 15% of the US GDP)

Source: USDC Bureau of Economic Analysis – Boston Consulting Group Analysis
North American Cropland Intensity
(Acres of Cropland as a percent of Land Area)

Battleground Region

Percent
- Less than 5
- 5 - 14
- 15 - 29
- 30 - 49
- 50 - 74
- 75 or more

United States
18.0 Percent

07-MC85
U.S. Department of Agriculture, National Agricultural Statistics Service
Dramatic US Market Penetration after 2017

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

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

Source: ACP Expansion Project – Rodolfo Sabonge AAPA January 24, 2013
Dramatic US Market Penetration Is Coming

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

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 2020

Source: Potential Effects of the Panama Canal Expansion on the Texas Transportation System, Texas DOT, Cambridge Systematics
2017 - 2020 Regional Competitive Inland Port & Distribution Center MS River Region

Distribution Center for Imports & Exports
US Soy Exports – Top 5 Destinations
(Millions of Tons)

Source: Karen Braun@kannbwx - Global Agriculture Columnist at Thomson Reuters

<table>
<thead>
<tr>
<th>EXPORT MARKETS</th>
<th>2017 RANK</th>
<th>VALUE</th>
<th>QUANTITY (METRIC TONS)</th>
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<td>China</td>
<td>1</td>
<td>$12,355,952</td>
<td>31,996,679</td>
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<tr>
<td>Mexico</td>
<td>2</td>
<td>$1,586,418</td>
<td>3,914,594</td>
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<td>Netherlands</td>
<td>3</td>
<td>$1,102,659</td>
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<tr>
<td>Japan</td>
<td>4</td>
<td>$975,733</td>
<td>2,299,341</td>
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<td>Indonesia</td>
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<td>$922,138</td>
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<td>Bangladesh</td>
<td>9</td>
<td>$385,050</td>
<td>1,046,891</td>
</tr>
<tr>
<td>Egypt</td>
<td>10</td>
<td>$364,491</td>
<td>1,010,074</td>
</tr>
<tr>
<td>TOTAL EXPORT TOP TEN</td>
<td></td>
<td>$19,175,643</td>
<td>49,336,129</td>
</tr>
<tr>
<td>TOTAL EXPORT (ALL COUNTRIES)</td>
<td></td>
<td>$21,582,206</td>
<td>55,542,883</td>
</tr>
</tbody>
</table>

Source: USDA – Foreign Agricultural Service 3-10-2015
US Soybean Destinations (2016)
(Primary International Export Percentages)

Source: IIASA-IFPRI, USDA AMS, Gro Intelligence

- Pacific Northwest - 25%
- Great Lakes - 2%
- Interior - 8%
- Atlantic - 4%
- Texas Gulf - 2%
- Mississippi Gulf - 60%
China will be hard-pressed to find another country that can produce as large a volume of soybeans as American farmers. Brazil and Mexico are two other sources for soybeans, but they can't match the U.S. in capacity.
What Are The Future Mega Ship Possibilities for the Lower Mississippi River?
Historical Rules Are Changing on the Lower Mississippi River
## Mississippi River Deepening: Southwest Pass to Baton Rouge
(50 to 55 foot depths are possible in the Future)

Mississippi River Ship Channel
Gulf to Baton Rouge, LA - General Reevaluation Report
Table D-32 Project Results

<table>
<thead>
<tr>
<th></th>
<th>48 Foot River Depth</th>
<th>50 Foot River Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Annual Benefits</td>
<td>$105,900,000</td>
<td>$147,810,000</td>
</tr>
<tr>
<td>Average Annual Costs</td>
<td>$103,520,000</td>
<td>$138,700,000</td>
</tr>
<tr>
<td>Net Benefits</td>
<td>$2,380,000</td>
<td>$9,110,000</td>
</tr>
<tr>
<td>BCR</td>
<td>1.02</td>
<td>1.07</td>
</tr>
</tbody>
</table>

*Project authorized to 55 feet - full channel. Smaller but positive BCR at 55 feet depth.*
The USACE in August 2018 signed the final economic justification report needed for the project.

“Two Phases in which 64 miles of the 254-mile portion from Baton Rouge to the Gulf of Mexico will need to be dredged.

**Phase 1:** Deepening the first 30 miles from Plaquemines to Venice – Two years to complete.

**Phase 2:** Deepening the 36-mile portion from Belmont Crossing to Baton Rouge – Two years to complete.

*The other portions of the river don’t need to be dredged because they are already at least 50 feet deep*

Source: Sean Duffy, Big River Coalition, told BlueWater Reporting in December 2018
Can Mega Container Vessels Physically Call in the Lower Mississippi River Region?
Historically the Largest Container Vessel to Call in the Lower Mississippi River was 8,000 TEUs with a Controlling Vessel Draft at 45 ft. (Eff. 47 ft)

Containership Size by Vessel Generation

<table>
<thead>
<tr>
<th>Vessel Class</th>
<th>Capacity (TEU)</th>
<th>Containers Across</th>
<th>Draft (feet)</th>
<th>Beam (feet)</th>
<th>Length Overall (feet)</th>
<th>Air Draft (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panamax</td>
<td>4,000</td>
<td>15</td>
<td>40</td>
<td>106</td>
<td>965</td>
<td>117</td>
</tr>
<tr>
<td>Post-Panamax</td>
<td>7,000</td>
<td>17</td>
<td>49</td>
<td>144</td>
<td>1,100</td>
<td>138</td>
</tr>
<tr>
<td>Super Post-Panamax</td>
<td>9,000</td>
<td>19</td>
<td>50</td>
<td>158</td>
<td>1,200</td>
<td>159</td>
</tr>
<tr>
<td>Neo Panamax</td>
<td>13,000</td>
<td>20</td>
<td>50</td>
<td>160</td>
<td>1,200</td>
<td>164</td>
</tr>
<tr>
<td>Megaship</td>
<td>18,000</td>
<td>23</td>
<td>52</td>
<td>193</td>
<td>1,300</td>
<td>187</td>
</tr>
</tbody>
</table>

With Controlling Depths at 50 ft. - 53 ft. The Largest Current Container Vessels Could Reach 18,000 to 20,000 TEUs in the Lower Mississippi River
Maersk’s Triple E Container Ship

1.5 times the Size of the NEW Panama Canal Wide Body Shallow Draft 18,000 TEU Vessel
(Same Design Draft of the 8,000 TEU Susan Maersk)

(Design Draft of 14.5 Meters = 47.57 feet)
The World’s Largest Container Ships On the Mississippi River

Source: OECD/ITF

<table>
<thead>
<tr>
<th>Year</th>
<th>10,000 TEUs</th>
<th>13,000 TEUs</th>
<th>14,500 TEUs</th>
<th>20,000 TEUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>3,126</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>4,814</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td>8,160</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
<td>10,100</td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
<td>19,100</td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td>20,000</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td>21,100</td>
</tr>
</tbody>
</table>

Mississippi River Container Vessel Size

Source: OECD/ITF
It Is Not Inconceivable that by 2025 the Lower Mississippi Design Vessel May Well be a 14,500 to 20,000 TEU Container Ship
Emerging New Inland Waterway Vessel Technology & Up River Terminals
“Deck” Barge Loaded with Containers

“Hopper” Barge Loaded with Containers

Source: USDOT Maritime Administration MARAD
Customary Container on Barge (COB)

- **Length OA**: 150'-0"
- **Breadth Mld**: 35'-0"
- **Depth Mld**: 12'-6"
- **Draft**: 9'-0"
- **Type of Vessel**: Double Skin Hold-Container Barge
- **No. of Containers**: 36 TEU
- **Max. Stack Weight**: 40T
- **Deadweight**: 2450 kip

**Features**
- Container stowage on-deck
- Highly fuel efficient transportation
- Ballast tanks optimized for Even keel loading/unloading

[Diagram of Customary Container on Barge (COB)]
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
ECSA
European Community Shipowners’ Associations
Short Sea Shipping
The full potential yet to be unleashed
Short Sea Shipping Expertise Today: European Common Market

Short Sea LNG Bunker Vessel
AMSbarge Containerkraanschip
(Port of Rotterdam)
Port of Hamburg Port Feeder Barge Concept
(168 TEU Capacity)

Port Feeder Barge Gmbh Port of Hamburg
PORT FEEDER BARGE GmbH
Managing Director:
Dr.-Ing. Ulrich Malchow
The all-electric container vessel Yara Birkeland (the joint project of Yara and technology company Kongsberg)

The Yara Birkeland will be the world’s first fully electric and autonomous container ship. At 70m with a 100-150 TEU capacity, it will travel with remote pilotage by 2019 and fully autonomous by 2020.
Yara Birkeland Autonomous
Zero Emission – No Ballast Vessel
Yara Birkeland Autonomous
Zero Emission – No Ballast Vessel

Zero Emission Cargo Handling
North Sea Container Line (NCL), the Norwegian Feeder and Short Sea Carrier, has introduced a new concept for coastwise and inland waterway shipping...

Similar to the LASH System of Two Decades Ago
American Patriot Holdings (APH) Prototype Inland Container Vessel

A “State of the Art” Hull Design to Ensure Optimal Speed in All River Conditions Utilizing LNG as Main Propulsion Fuel
American Patriot Holdings (APH) Prototype Inland Container Vessel

A “State of the Art” Hull Design to Ensure Optimal Speed in All River Conditions Utilizing LNG as Main Propulsion Fuel coupled with the Patented Z-Wake Bow Design.
American Patriot Container Transport, LLC (APCT) General Vessel Fleet Characteristics

<table>
<thead>
<tr>
<th>LOA Feet</th>
<th>Beam Feet</th>
<th>TEU Capacity</th>
<th>Scantling Vessel Drafts</th>
</tr>
</thead>
<tbody>
<tr>
<td>595</td>
<td>100</td>
<td>1696</td>
<td>10.0 ft.</td>
</tr>
<tr>
<td>772</td>
<td>100</td>
<td>2392</td>
<td>10.0 ft.</td>
</tr>
<tr>
<td>952</td>
<td>100</td>
<td>2960</td>
<td>10.0 ft.</td>
</tr>
<tr>
<td>1042</td>
<td>100</td>
<td>3244</td>
<td>10.0 ft.</td>
</tr>
</tbody>
</table>
American Patriot Container Transport, LLC.
Hybrid 600 ft Lock Vessel Characteristics

<table>
<thead>
<tr>
<th>LOA Feet</th>
<th>Beam Feet</th>
<th>TEU Capacity</th>
<th>Scantling Vessel Drafts</th>
</tr>
</thead>
<tbody>
<tr>
<td>595</td>
<td>100</td>
<td>937 - 4 Tier</td>
<td>10.0 ft.</td>
</tr>
<tr>
<td>595</td>
<td>100</td>
<td>1,190 - 5 Tier</td>
<td>10.0 ft.</td>
</tr>
<tr>
<td>595</td>
<td>100</td>
<td>1,443 - 6 Tier</td>
<td>10.0 ft.</td>
</tr>
<tr>
<td>595</td>
<td>100</td>
<td>1,696 - 7 Tier</td>
<td>10.0 ft.</td>
</tr>
</tbody>
</table>

Speed: 18 mph, Fuel: LNG
Vessel Range: 2000 miles
Inland Waterway Vessel Transfer to Ocean Container Transport

1824 TEUs to 3244 TEUs

200 - 900 TEUs

Commercially Viable?

Cargo Quantity Viability?
ASCE 2017 Report Card for America’s Infrastructure

Ports: C+
Inland Waterways: D
Roads: D

Cost to Improve: $4.6 trillion

Failure to Act: It Costs Each US Family $3,400 per year
International Gross Fixed Capital Formation as a Percent of GDP

(US is 32nd in the World - Below OECD Nations)
Required EEOIs
units of gCO₂/tnm

- Containership
- Bulk carrier
- Tanker

Source: Lloyd’s Register Group Limited and UMAS 2017