Port & Maritime Industry Trends and Developments

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Cargo Handling Circa 2010
US Navy Fast Frigate Circa 2045
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
The World’s Primary Shipping Routes

The Marine Silk Road
90% of Global Trade is Carried Out by Shipping

The Majority of Today’s Ocean Trade is Conducted on the Marine Silk Road
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?
On Earth, there are more people living inside this circle than outside the circle.

The world's largest ports are connected inside this circle via the marine Silk Road.
Global Shipping Routes Plotted by AIS GPS

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

Source: National Geospatial Intelligence Agency, American Association of Port Authorities (AAPA).
International
External Industry
Pressures Driving
Today’s Logistics
For North America, More than 98% of everything consume, worn, eaten, driven and constructed is brought via ships through the North American port system.
Relationship Between US Trade and US Prosperity – 1930 to 2005

(US Trade & Gross Domestic Product - $ Billions)

Source: USDOT Based on USDOC Data
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.

Source: Oxford Economics 2013

4.5% CAGR
Continuing Economic Global Growth

International trade is set to significantly grow despite current economic uncertainty in the U.S. and elsewhere around the world.

Source: TD Economics Forecast as of March 2013
Who Decides Where the Cargo Goes & Why?
“Cargo will go according to where it will flow most readily. That decision is made by the shippers and consignees and not by the terminal operator”

Eric Sisco
President of APM Terminals Americas Region
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

- 38% Competitive Freight Rate
- 43% Schedule Reliability & Consistency
- 12% Transit Time & Speed
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: Lumber, Paper, Steel, Autos
- 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)

- 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
Top Global Container Port Productivity
(TEUs/Hectare in Thousands)

Global Ocean Carriers & Terminal Operators Do Not Consider North American Ports as “Best Case Practice”
International Maritime Cargo Demand Trends
Historical Global Container Market Demand
(Millions of TEUs)

North American Growth Lags Other Global Regions

Source: Drewry Shipping Consultants

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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

2009 Recession

260% Increase

Source: Drewry Shipping Consultants October 2011
2015 Predicted Increases in World Seaborne Trade & Global Population

- World seaborne trade carried in tonnes (billions)
- World economy GDP in US $ (trillions)
- World population (billions)

Source: IHS Global Insight – World Seaborne Trade, OECD Statistics, UN Population
Southeast Asian Manufacturing Centroid Shift

Current Inbound U.S. Cargo Flow

U.S. Intermodal Rail Flow

Expanded Asian Panama Canal 2014 Flows

Eastbound: All Water Flow
Eastbound: US Intermodal Rail Flow

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Southeast Asian 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
Asia-North America Weekly Throughput: *Panama Canal vs. Suez Canal*

**2013 Q4 Suez Canal Volume Exceeds Panama Canal**

Source: American Shipper May 2015
The Suez Canal Announces a $4 Billion Expansion of the Canal

To Be Completed by September 2015

New 45-mile-long parallel channel cutting waiting times to transit by 3 hrs. from 11 hrs.

Half of a $8.5 billion project that includes a free trade zone, an industrial park and a regional logistics hub for the Middle East, North Africa and the Mediterranean.
Egyptian Jet Fighter Escort Selfie
(Taken with the New Expanded Suez Canal in the Background)

Source: Photo Courtesy of MIRASCO, August 2015
The Growing 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
Maritime Vessel Technology Trends
In 1955 Malcolm McLean, sold McLean Trucking, and secured a bank loan of US$42 million to build the world's first container ship.
World Container Ship Evolution

1st Generation (Pre-1960 - 1970)
- Ideal X

- Full Cellular
- Panamax

3rd Generation (1985)
- Post Panamax

- Super Post Panamax

5th Generation (2000 - 2006)

6th Generation (2006 - 2012)
- Ultra Post Panamax

TEU Capacity
- 101 TEU – (58 - 35 ft Containers)
- 2,305 TEU
- 3,220 TEU
- 4,848 TEU
- 8,600 TEU
- 15,000+ TEU
24% increase in the average container ship size from 2008 to 2012

The Stage is set to Jump again to 22,000 TEU Mega Container Vessels
Madison Maersk (3,928 TEUs) in the Panama Canal
(Current Max Panamax Vessel Approx. 4,800 TEUs)
Maersk’s New 30 Vessels (ordered) are 4 Times the Current Size of the Panama Canal & 1.5 times the Size of the Expanded Panama Canal

- 2013: Triple-E Maersk Class
  - 18,000 TEU

- 2006: Emma Maersk Class
  - 15,500 TEU

- 1997: Sovereign Maersk Class
  - 8,100 TEU

- 1996: Regina Maersk Class
  - 7,100 TEU

23 Containers Wide – 9 Tiers Above the Hatch
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
Vessel Size Expansion - Terminal Impacts
(Port Terminal Infrastructure & Equipment Geometry Impacts)

New Panamax (2014/15)
12,600 TEU

Current Panamax
4,800 TEU

Super Post Panamax
18,000 to 22,000 TEU

Depths 48 to 54 ft

Increased Terminal Throughput

Storage Area Impacts

Height Above Deck

Boom Outreach

Source: Georgia Ports Authority and Vickerman & Associates
Future Container Vessel: NYK Super Eco Ship
Future Container Vessel: NYK Super Eco Ship
The ocean shipping industry is the only industrial sector which is already compliant by a legally-binding IMO global agreement to reduce CO2 emissions.

Panama Canal Expansion: New Capacity
Panama Canal Historical Tonnage Traffic

Source: ACP Data
The Panama Canal Circa 1914
The canal, 35 yards above sea level, uses a series of parallel locks to lift ships to Gatun Lake for the 50-mile cruise across.
A $5.25 Billion Investment in a 3rd Set of Locks
Equating to 16% of Panama’s National GDP
Canal TEU Forecast by Vessel Beam
(FY2013 to FY 2030 – Millions of TEUs)

Increase of 7.7 Million TEUs (17 years) a 63% Increase

Beyond Current Panamax Width

Source: Container Market Segment and Transhipment Study – Oct 2012 ACP/M&N
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 Third Lane Expansion Capabilities

2011: 4,800 TEU

2014-2015: 12,600 TEU

Source: ACP Expansion Project
Nicaragua’s $40 Billion Contract with Chinese HKND to Dig a Rival to the Panama Canal
Alternative “Dry Canal” Proposals to Counteract Anticipated Canal Fees/Costs

APM Terminals announced $1 billion Container Port in Costa Rica

China’s proposal: 136-mile “dry canal” (Pacific Port of Buenaventura & Atlantic Coast Port of Cartagena in Colombia.)
## 2025 Summary of Canal’s Financial Results

(To 2025 In Millions of Dollars – Annual Fees)

<table>
<thead>
<tr>
<th>Financial Results</th>
<th>Year 2005</th>
<th>Year 2025</th>
<th>Annual average growth rate</th>
</tr>
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<tbody>
<tr>
<td>PCUMS Tons</td>
<td>279</td>
<td>508</td>
<td>3.0%</td>
</tr>
<tr>
<td>Transit Revenue</td>
<td></td>
<td>6,101</td>
<td>8.9%</td>
</tr>
<tr>
<td>Other Revenues</td>
<td>92</td>
<td>125</td>
<td>1.5%</td>
</tr>
<tr>
<td>Total Revenues</td>
<td>1,209</td>
<td>6,227</td>
<td>8.5%</td>
</tr>
<tr>
<td>Operating Costs</td>
<td>444</td>
<td>1,016</td>
<td>4.2%</td>
</tr>
<tr>
<td>Fee per Net Ton</td>
<td>218</td>
<td>668</td>
<td>6.5%</td>
</tr>
<tr>
<td>Public Services Fees</td>
<td>2</td>
<td>2</td>
<td>0.0%</td>
</tr>
<tr>
<td>Depreciation</td>
<td>61</td>
<td>231</td>
<td>6.8%</td>
</tr>
<tr>
<td>Net Income</td>
<td></td>
<td>4,310</td>
<td>11.6%</td>
</tr>
</tbody>
</table>

### Source: ACP Financial Data

- **546% Increase**
- **890% Increase**
Emerging New Caribbean Transshipment Center
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

The Autoridad Del Canal de Panama
Panama Canal Large Vessel Market Penetration into the US Midwest
Panama Canal Vessel Deployments Will Determine New US Logistics Patterns

The Distance to New Orleans and Savannah Via the Panama Canal

A Competitive & Robust Landside Access to the Gateway Port’s Inland Market will be a Key Success Factor!
The Primary North American Competitor to the Panama Canal is the Class I Rail Intermodal System

(Potential Increased Service Offerings and System Capacity)

Source: USDOT Maritime Administration (MARAD) 2009
Today’s 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 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 2016

Panama Canal *Economies of Scale* with permit
deeper 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
Emerging Trade Opportunities for the US Midwest
“Emerging Big Ideas”
changing course

navigating the future of the Lower Mississippi River Delta
“Changing Course”: A COMPETITION for a Project of National Significance

A 50-100 year, $15 billion plan that lays out a bold, ambitious, and essential vision for Mid-America’s future.
“Changing Course” has brought together teams of the world’s best engineers, scientists, planners and designers to show the “art of the possible” in creating a self-sustaining delta ecosystem.
“Changing Course”
Lower Mississippi River Basin Eco System

The Mississippi River Delta Region is:
40 % of the US Marshland
30% of the US Seafood Consumption
Over the last century, nearly 1,900 square miles of Louisiana’s coastal wetlands have vanished.

“Every hour, a football field-sized swath of land drowns in the Gulf’s advancing tides”… If nothing is done the Delta will continue to lose 19.3 square miles a year.
2115 Land Losses
(Sea Level Rise + Land Subsidence = 1.5 meters)

Note: the water area on this figure is based on inundation only after the 2060 MP estimate (i.e., does not include sediment input or organic growth after 2060). Also, influence of levees is not considered.

EsrI, HERE, DeLorme, MapmyIndia. © OpenStreetMap contributors, and the GIS user community
Without action, by 2100 Louisiana will have lost virtually all of its coastal wetlands.
New Orleans is at River Mile 100
(from Mile Zero at Head of Passes)
Navigational Solution:
Managed Distributaries – “Controlled New Deltas”

- New Delta - Initial
- New Delta - Mature
- Controlled Gate
New Orleans Bypass Channel
Reducing Distance to Baton Rouge by 30 Miles &
Eliminates Congestion in the Port of New Orleans

New Bypass Channel Around New Orleans

Distributary and vessel channel
With the Solutions Identified: New Orleans Flood Occurrence would be reduced from 1 in 100 years to 1 in 1,000 years.

New Orleans River Flood Elevations Would be Reduced 10 feet.

The Result: A Viable Self-Sustaining Economic River Delta Eco System
Recommended Navigational Improvements On the Lower Mississippi will “Shorten the Distance to Open Ocean” for All River Ports by More Than 75 Miles
America’s New Energy Self Sufficiency
FUELING GROWTH IN CHINA

Falling oil prices increase demand for Chinese exports and boost container carriers' profit prospects.

For every $10 fall in the oil price per barrel, there will be an additional $1.1 billion of consumer spending on Chinese exports.
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 2015.

Source: US Energy Information Administration, US Department of Energy
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.
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
  - Cove Point, MD
- Marcellus Shale
  - India: Reliance Industries, $1.7 B
  - Netherlands: Royal Dutch Shell, $4.5 B
  - Norway: Statoil, $3.37 B

- Shale plays
- Marcellus shale
- U.S. ports where liquefied natural gas exports are planned
- Natural gas and oil
- Gas product
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)
Impacts of the World’s Largest Gas Carriers VLGCs
LNG Tanker Vessel Size Evolution

- Methane Pioneer: 339 feet
- Original Nikiski tankers: 797 feet
- Typical modern tanker: 951 feet
- Q-Max: 1,132 feet
- Prelude floating LNG plant: 1,601 feet
Maximum Draft for Any LNG Ship is 12 Meters for LNG Loading and Regasification Terminals

The first Q-Max LNG carrier, Mozah, was built in November 2007.

### Panamax LNG Vessel Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Measurement</th>
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<tbody>
<tr>
<td>Length</td>
<td>345 m (1,132 ft.)</td>
</tr>
<tr>
<td>Beam</td>
<td>53.8 m (177 ft.)</td>
</tr>
<tr>
<td>Height</td>
<td>34.7 m (114 ft.)</td>
</tr>
<tr>
<td>Draft</td>
<td>12 m (39 ft.)</td>
</tr>
<tr>
<td>Capacity</td>
<td>266,000 cubic meters 9,400,000 cu ft.</td>
</tr>
</tbody>
</table>
Largest Gas Ocean Carrier: Q-Max LNG

Q-Max (Qatar Max)

Gross Tonnage: 164,000 t
Summer DWT: 129,000 t
Applications to Export LNG to Non-FTA Countries

Source: Office of Fossil Energy, Application Received by DOE to Export Domestically Produced LNG from the Lower US
Thank You
2011 International Gross Fixed Capital Formation as a Percent of GDP
(US is 32nd in the World - Below OECD Nations)