2014 AAPA Marine Terminal Management Training
Hyatt Regency Philadelphia at Penn's Landing     October 7, 2014

Continuing Evolution of Marine Terminal Design & Cargo Handling

M. John Vickerman

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Williamsburg, Virginia
Vessel Cargo Handling Circa 1955
Cargo Handling Circa 2010
US Navy Fast Frigate Circa 2045
What We Know Today... Will Surely Be Different Tomorrow!
The World’s Largest Ports Are Connected Via The Marine Silk Road

Where are the Biggest Ports?
90% of Global Trade is Carried Out by Shipping

The Majority of Today’s Ocean Trade is Conducted on 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

To Be Competitive Today...

Marine/Intermodal Terminals Must Reduce Throughput Cost & Increase Cargo Velocity Securely and as Stewards of the Environment
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.
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.
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?
“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

Source: American Shipper, page 42, July 2012
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:

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

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

Current Inbound U.S. Cargo Flow

U.S. Intermodal Rail Flow

Western Centroid Shift

Expanded Asian Panama Canal 2014 Flows

Eastbound: All Water Flow

Eastbound: US Intermodal Rail Flow
With Manufacturing Centroid Shifts Into Vietnam and/or India, The North American East Coast will See Dramatically More Westbound Suez Traffic
2015 Suez Canal Pricing Strategy:
The Suez Canal has an opportunity to competitively alter global shipping patterns by undercutting 2015 Panama Canal new pricing strategy.
August 5, 2014
The Suez Canal Announces a $4 Billion Expansion of the Canal

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.
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

Population:
US: 314 million
China: 1,344 million
(1/5 World)

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
North American Cargo Demand Trends
(Déjà vu Experience)
NAFTA Trade Partners Are Growing

Mexico grows faster with near-shoring and broad trade growth

(Real GDP, percent change)

Source: IHS Global Insight – World Trade Service
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
Transatlantic Container Trade Recovery

(Millions of TEUs)

Source: IHS – Global Insight - The Global Outlook – October 14, 2010

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San Pedro Bay (POLA +POLB) Container Volume Forecast

344% Increase by 2035 From 2009 Levels

Source: IHS Global Insight 2010 Forecast
Maritime Vessel Technology Trends
April 26, 1956

58 Modified 35-foot Truck Containers

The deck of the Ideal X at Port Newark preparing for the historical sailing of the world’s first containership.

April 2006:
50 Year Anniversary of the Container

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

3rd Generation  (1985)
- Panamax

- Post Panamax

5th Generation  (2000 - 2006)
- Super Post Panamax

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
World Container Ship Evolution

24% increase in the average container ship size from 2008 to 2012
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 Mærsk Class
15,500 TEU

1997
Sovereign Mærsk class
8,100 TEU

1996
Regina Mærsk class
7,100 TEU

23 Containers Wide – 9 Tiers Above the Hatch
21,000 TEU Ultra Large Twin Engine Container Ship

Source: Alphaliner Newsletter Volume 2011 Issue 4
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>

92%

Source: Alphaliner Newsletter Volume 2011 Issue 21
New Era of LNG Vessels is on the Horizon:
Will LNG be the Fuel of the Future for Shipping?
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).
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...*
Panama Canal Expansion: New Capacity
Panama Canal Expansion

More than **14,000 ships** a year pass through the **50 mile long** 1914 manmade Link between the Pacific Ocean & Caribbean Sea carrying **275 million tons of Cargo and $100 billion in container shipping**

*Source: ACP Data*
Panama Canal Historical Tonnage Traffic

Source: ACP Data
The Panama Canal Circa 1914
Expansion of the Panama Canal: Circa 2016

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.

Depth needed for ships: 39.5 feet

110 feet

Greater than 181 feet

Depth needed for larger ships: 50.49 feet
Post 2016 Panama Canal
Panama Canal Third Lane Expansion
Circa Late 2015 / Early 2016

The Autoridad Del Canal de Panama
A $5.25 Billion Investment in a 3\textsuperscript{rd} 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
Today Only The Port of Virginia Can Handle The New 2015 Panamax Vessels Fully Loaded

<table>
<thead>
<tr>
<th>Location</th>
<th>Depth (ft)</th>
<th>TEU Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAX</td>
<td>38</td>
<td>4,500</td>
</tr>
<tr>
<td>NY/NJ</td>
<td>42-45</td>
<td>8,500</td>
</tr>
<tr>
<td>Savannah</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miami</td>
<td>44-47</td>
<td></td>
</tr>
<tr>
<td>Charleston</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norfolk</td>
<td>50</td>
<td>10,000 to 12,500+</td>
</tr>
<tr>
<td>Norfolk (authorized)</td>
<td>55</td>
<td></td>
</tr>
</tbody>
</table>

By 2015:
- NY/NJ: Miami, Baltimore
- Norfolk: 50 ft

By 2016:
- Savannah: 44-47 ft

Source: Virginia Port Authority (VPA) October 2011
Emerging New Caribbean Transshipment Center
Panama Ports Annual Transshipment 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
Non-Transit Panama Canal “Feeder Services” May Be the Real Boom from the Canal Expansion

Source: ACP and Compare, 2008 Data
New Panama Canal Pacific Entrance Ports

The Autoridad Del Canal de Panama

More Capacity than all of the Port of Los Angeles
PSA Panama International Terminal (PPIT) Western Entrance Conceptual Site Plan, Phase I + II

2 Million TEUs Roughly Equivalent to the Entire Port of Virginia
Corozal Oeste Container New Transhipment Terminal
Panama Canal Western Entrance - Phase I & II

The Autoridad del Canal de Panama

5.5 Million TEUs Roughly Equivalent to the Entire Port of New York & New Jersey

Source: ACP Expansion Project – Rodolfo Sabonge AAPA January 24, 2013
Corozal Oeste Container
New Transhipment Terminal
Panama Canal Pacific Entrance - Phase I & II

Terminal: 116 hectares (286.6 acres)

Source: ACP Expansion Project – Rodolfo Sabonge AAPA January 24, 2013
New Panama Canal Atlantic Entrance Port

More Capacity than all of the Port of Houston

The Autoridad Del Canal de Panama
The terminal, with an initial capacity of two million TEU, will be constructed by a consortium of Asian developers under the name Panama Colon Container Port LLC (PCCP).
Panama Canal Large Vessel Market Penetration into the US Midwest
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.)
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
Dramatic US Market Penetration after 2015

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

Reachable Market:
46% of US Population

Reachable Market:
63% of US Population

4,000 TEU ship, all-water.

8,000 TEU ship, all-water.

West Coast Cost Advantage

East Coast Cost Advantage

Source: PB Consultants - CSX Transportation May 12, 2011 - Director of Strategic Analysis
US and Canadian Rail Land Bridges

Panama Canal Market Penetration Break Even Cost Control Zone

Source: USDOT PB Panama Canal Expansion Study, June 2012
Dramatic US Market Penetration after 2015

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

The State of Texas & Texas Ports Could be the Real Beneficiaries!

Source: ACP Expansion Project – Rodolfo Sabonge AAPA January 24, 2013
Dramatic US Market Penetration after 2016

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 also most of Texas and the Midwest by 2016.

Source: Potential Effects of the Panama Canal Expansion on the Texas Transportation System, Texas DOT, Cambridge Systematics October 2011
Is This Trade Trend Long Lasting?

Planned Port Container Capacity Expansion in Asia Compared to US West Coast Ports

Source: Potential Effects of the Panama Canal Expansion on the Texas Transportation System, Texas DOT, Cambridge Systematics October 2011
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