SESSION VI: Continuing Evolution of Marine Terminal Design and Cargo Handling Systems

Presented By
M. John Vickerman

Williamsburg, Virginia
13 Years Before the Pilgrims Landed at Plymouth, Three Brigantine Vessels of the Virginia Company of London Landed in Jamestown, Virginia
Godspeed Brigantine, Circa 1607
Deadweight Tonnage: 40 tons
LOA: 88 feet; Crew: 13
Vessel Cargo Handling Circa 1955
US Navy Fast Frigate Circa 2045
What We Know Today... Will Be Surely Be Different Tomorrow!
International Port External Industry Pressures Driving Today’s Logistics
The Sea State of Trade Is Dramatically Changing...
The More It Changes...
The More It stays The Same
Global Trade: Current Course & Direction?

Financial Global Meltdown, Cargo Demands, System Capacity, Funding, Port Productivity & Environmental Concerns

North American Port Gateways
To Be Competitive Today...
Marine/Intermodal Terminals Must **Reduce** Throughput **Cost** & **Increase** Cargo Velocity
**Securely** and as **Stewards of the Environment**
The “Port”
One of the Many Diverse Constituencies in the Cargo Transportation Logistics Chain

Objective:
A multimodal “Seamless” integrated world wide cargo conveyance system.
At Current Productivity and Growth Levels by 2020
North American Ports & Their Associated Intermodal Systems Will Be Severely Congested.
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.”
International Maritime Cargo Demand Trends
Relationship Between US Trade and US Prosperity
(US Trade & Gross Domestic Product - $ Billions)

Source: USDOT Based on USDOC Data
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
Advancing vs. Developing Countries
Global Growth Rates

The “Great Recession” Appears to Have Ended at the End of 2009. Initial Indicators Point to a World Economy Expected to Expand by 3.8% in 2010/2011

Source: IMF - Forecast by TD Economics, December 2009
World Bank’s 2010 “Global Economic Prospects”

World Output will Increase 33% in 10 years

- 2000: $30 Trillion
- 2010: $40 Trillion
World Container Forecast to 2024 in TEUs
(186% Increase in Next 20 Years)

2007: 96 Million
2024: 243 Million

Forecast

Growth Rate (CAGR)
1994 to 2004: 8.3%

Source: Global Insight
Primary Containerized Ocean Freight Flows
(Billions of Laden FEU-Kilometers, 497 Flows)

One FEU-Kilometer = a 40 foot container transported one Kilometer

Source: American Shipper July 2009 – MergeGlobal SeaFlow Model
Shorter – Faster Arctic Ocean Route

2+ Months A Year Using Convoys

½ the Time & Distance
Global Financial & Trade Growth Recovery: A 2011 Reversal?
The World Economy Has Suffered the Worst Recession of the Postwar Era

(Percent Change)

Source: IHS Global Insight
Economic Performance Varies by Region

(Real GDP, Percent Change)

Source: IHS Global Insight
IMF World Economic Outlook – July 2010
(%; quarter-over quarter, annualized)

Source: IMF Staff Estimates
World Container Growth Forecast
(Including full & Empty Containers, Port to Port, and Transshipment Volume in Millions of TEUs)

Drewry estimates worldwide container volume will surpass the 2008 level in 2012.

Source: Drewry Shipping Consultants
San Pedro Bay (POLA + POLB) Container Volume Forecast

344% Increase by 2035 From 2009 Levels

Source: HIS Global Insight 2010 Forecast
San Pedro Bay (POLA + POLB)
TEU Container Traffic 2003 to 2010

“Approaching Record Volumes”

7th Consecutive Month of Year-Over-Year Increases

Source: Ports of Long Beach and Los Angeles
Congressional Budget Office (CBO) Forecast
Percent Change in Real GDP – June 2009

Source: Rand Corp. Fast Forward –
Key Issues in Modernizing the US Freight Transportation Systems

Panama Canal Opening

2011

2014
2009 - 2010 Container Rate Benchmark
(Average FEU Spot Rate in US Dollars)

$986 per FEU
May 2009

$2,189 per FEU
May 2010

Source: Drewry Shipping Consultants [Journal of Commerce May 24, 2010]
New Market Shift For North American Ports

After Years of Dominating North American Maritime Trades, US West Ports are Threatened…

Converging Economic Forces Now Favor Growth of the Gulf and East Coast Ports for Asian Trade via the Midwest!
North American Emerging Mega-Regions

Future US Growth Areas

Midwest Converging Mega Consumption Zones

Source: America 2050 Prospects - Regional Plan Association
Recently Moody’s Revised Its Outlook for the US Port Industry From Stable to NEGATIVE!

Moody’s noted that for "ports serving significant levels of discretionary cargo to Midwest Markets, competition has few geographic barriers as intermodal flexibility, rail rates, and volatile bunker fuel prices play into the relative cost structure."

Moody’s Investors Service
Essence of World Economic Crisis

Empty Idle Ships in Singapore Harbor

January 9, 2009 AIS Ship Position Plot

Source: January 9, 2009 Spore AIS Ship Position
Essence of World Economic Crisis
Empty Idle Ships in Singapore Harbor
10% of the World Fleet

A 10.4 Million TEU Container Fleet
...At Anchor!

Source: February 20, 2009 Aerial Photo
Idle Containerships by Size Range
(Rapid Reduction Currently Stands at 1.7% of Total Capacity)

Source: Alphaliner Newsletter August 30, 2010
The Growing Asian Import Trade Challenge
Dramatic Market Shifts are Underway that will Affect the Very Core of US Trade and Transportation
China-US: Twin Engines of the World

Population:
US: 298 million
China: 1,307 million
(1/5 World)

The number of Chinese children in elementary school is equivalent to the total US population.
Mainland China Container Port Growth
(Compound Annual Growth Rates)

5 Yr Average = 27.2%
Increased Volume
China Breaks Container Traffic Record

Chinese Ports hit an All-Time Monthly High of 12.44 Million TEUs in May 2010 - Foreign Trade Surged by nearly 50% from a year ago. Six of the Top 10 Chinese Ports Booked Record Volumes.

Source: European Liner Affairs Association - ELAA 2009 Price Index – JOC June 2010
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
Southeast Asian Manufacturing Centroid Shift

Current Inbound U.S. Cargo Flow

Expanded Asian Panama Canal 2014 Flows

Eastbound: All Water Flow
Eastbound: US Intermodal Rail Flow

U.S. Intermodal Rail Flow
Western Centroid Shift

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Southeast Asian Manufacturing Centroid Shifts

Current Inbound U.S. Cargo Flow
U.S. Intermodal Rail Flow
Western Centroid Shift
Westbound All Water/Suez Flow
Westbound Intermodal U.S. Flow

With Manufacturing Centroid Shifts Into Vietnam and/or India, The North American East Coast will See Dramatically More Westbound Suez Traffic
2010 Westbound Suez Canal Container Vessel Traffic
Potential Huge Volumes: South East Asian origin cargo currently moves westbound to LA/LB and land-bridged to US Midwest… can be diverted Eastbound at lower cost and faster transit to US Midwest
Ho Chi Minh City Regional New Container Terminals *(12 Terminals in 14 years)*

Fastest Growing Container Hub Outside of China

**Cai Mep-Thi Vai Container Hub**

Source: Alphaliner Newsletter August 30, 2010
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><strong>152,985,229</strong></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>
India Plans to Triple Port Capacity by 2020 US-India Containerized Trade

Source: PIERS Global Intelligence Solutions
Canada’s Intermodal Land Bridge
Canada’s Strategic Global Location

(Shortest Trade Routes to Asia and Europe)

- Trans-Pacific Route
- Trans-Atlantic (EU-NAFTA)
- North South (NAFTA)

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Canada’s Intermodal Rail Network
New Terminals Are Being Built on All Three Coasts to Support Asian & South American Trade Linkages

Port of Prince Rupert

Port of Startup

LIGTT

Map showing ports and rail connections.
Maher Melford Automated Container Port & Intermodal Logistics Park
Melford International Terminal Project Components

- CN Intermodal Rail Terminal
- Logistics Park
- Container Port
First Phase:

- 315 Acre Terminal
- Intermodal Rail Terminal
- 1500 Acre Logistic Park

First Phase:

- 2 Berths
- 1.5 M TEU Capacity
- 250 Acre Logistic Park
- $420 million USD
Closest East Coast Port To Europe and the Suez:

• **29 Hour Sailing Advantage** on New York
• **36 Hour Sailing Advantage** on Norfolk
Inland Ports: Europe’s Current Strategy Applications
The Inland Port
“The Concept of an Inland Port System as a Regional Competitive Advantage”
Inland Ports Defined
A Convergence of Logistics Trends

Short Sea Shipping Technology
Intermodal Rail
Logistics
Automation
Distribution Center
Rotterdam World Gateway - EUROGATE Builds an Inland Container Port Network

ECT Main Terminal

Maasvlakte 2 Plan

European Shortsea Network

Short Sea Container Inland Port
The Dutch Transport Ministry and Port of Rotterdam Authority (PoRA) signed a Founding Agreement on June 29, 2009

The Town of Alblasserdam, East of Rotterdam will get a Container Transferium (CT), a Inland Port Container Transfer Facility to be operated by Binnenlandse Container Terminals Nederland (BCTN).

“This is the first time the Port Authority has promoted such a partnership. PoRA to promote transport by rail and water and to shift containers from road to the other modes of transport in order to reduce the number of trucks in the road.”
Dutch Transport Ministry Inland Port Container Transferium (CT) Strategy
(Noord River, Town of Alblasserdam, €38 million, open by end-2012)
Dutch Transport Ministry Inland Port Container Transferium (CT) Strategy

(Noord River, Town of Alblasserdam €38 million, open by end-2012)
North American Inland Ports: Connected to Emerging Trade Corridors
Emerging New Trade Corridors

Source: NASCO
Current Largest US Distribution Markets

Source: HIS Global Insight
Emerging Major Inland Port Logistics Centers
Throughput Capacities in Millions of TEUs
BNSF Logistics Park, Joliet, IL
A New Model For Freight Logistics Centers

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 Lázaro Cárdenas First Phase Opportunity

- **600,000 TEU Throughput**
- Robust US intermodal access
- Potential Expense Reduction Opportunities

Access channel 59 feet deep

Internal ship channels already 45-54 feet deep

Source: Kansas City Southern (KCS) Railroad, February 2007

Lazaro Cardenas
Phase I - 700K TEU
Fut. Phase - 2.0 mil TEU
CenterPoint – KCS Intermodal Center Inland Port Solution

- 1,348 Acre Logistics Park
- 970 Acre Industrial Park
- 7.4 M SF Building Area
The Inland Port: “With Integrated JIT Delivery: The Inland Port Can Greatly Increase the Freight System Capacity”
The Inland Port: “The Concept of an Inland Port System as a Regional Competitive Advantage” Leveraging Supply Chains
Louisiana International Deep Water Gulf Transfer Terminal: Deep Water Port Commission
Louisiana International Deep Water Gulf Transfer Terminal: “Gateway to the Americas”
The Vision for the LIGTT Concept:
Integrated Hub & Spoke Distribution System
The Vision for the LIGTT Concept:
An Integrated Hub & Spoke Distribution System

Using the Mississippi River as a Strategic Highway:
Change US Midwest Supply Chain Distribution Logistics Networks...

Achieving Better Reliability, Lower Cost, and Greater Market Share
International Port Productivity Comparisons
Global Port Terminal Productivity

North American Ports Are Not As Productive As The Most Productive International Ports By a Factor Of More Than 4 To 1
**Global Marine Terminal Productivity**

*(Circa 1999 to 2004)*

*(Throughput measured in TEUs/Acre/Year)*

<table>
<thead>
<tr>
<th>Region</th>
<th>1999</th>
<th>2004</th>
<th>5YR CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asian Ports</strong></td>
<td>9,272</td>
<td>16,595</td>
<td>15.3%</td>
</tr>
<tr>
<td><strong>European Ports</strong></td>
<td>4,284</td>
<td>6,396</td>
<td>15.4%</td>
</tr>
<tr>
<td><strong>United States Ports</strong></td>
<td>2,894</td>
<td>4,028</td>
<td>7.7%</td>
</tr>
<tr>
<td><strong>US West Coast Ports</strong></td>
<td>3,543</td>
<td>4,944</td>
<td>7.5%</td>
</tr>
<tr>
<td><strong>US Gulf Coast Ports</strong></td>
<td>3,149</td>
<td>4,635</td>
<td>9.4%</td>
</tr>
<tr>
<td><strong>US East Coast Ports</strong></td>
<td>2,021</td>
<td>2,661</td>
<td>6.8%</td>
</tr>
</tbody>
</table>

Source: 1999 - 2004 CI Database, Seaports of the Americas, Port Data
Maritime Vessel Technology Trends
The Future of Container Ship Carriers?

Shoals of Red Ink: $19 Billion in Losses in 2009
April 26, 1956

In 1955 Malcolm McLean, sold McLean Trucking, and secured a bank loan of US$42 million to build the world's first container ship.

58 Modified 35-foot Truck Containers

April 2006:
50 Year Anniversary of the Container
World Container Ship Evolution

- **Ideal X**
  - 1st Generation
  - (Pre-1960 - 1970)
- **Full Cellular**
  - 2nd Generation
- **Panamax**
  - 3rd Generation
  - (1985)
- **Post Panamax**
  - 4th Generation
  - (1986 - 2000)
- **Super Post Panamax**
  - 5th Generation
  - (2000 - 2006)
- **Ultra Post Panamax**
  - 6th Generation
  - (2006-2012)

<table>
<thead>
<tr>
<th>Generation</th>
<th>Year Range</th>
<th>TEU Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Generation</td>
<td>Pre-1960 - 1970</td>
<td>1,700 TEU</td>
</tr>
<tr>
<td>2nd Generation</td>
<td>1970 - 1980</td>
<td>2,305 TEU</td>
</tr>
<tr>
<td>3rd Generation</td>
<td>1985</td>
<td>3,220 TEU</td>
</tr>
<tr>
<td>4th Generation</td>
<td>1986 - 2000</td>
<td>4,848 TEU</td>
</tr>
<tr>
<td>5th Generation</td>
<td>2000 - 2006</td>
<td>8,600 TEU</td>
</tr>
<tr>
<td>6th Generation</td>
<td>2006-2012</td>
<td>12,000+ TEU</td>
</tr>
</tbody>
</table>
Madison Maersk (3,928 TEUs) in the Panama Canal
(Current Max Panamax Vessel = 4,500 to 5,000 TEUs)
The new-build known as “M/S Emma Maersk”, was christened at the Odense-Lindo Shipyard in Denmark in August 2006. The nominal capacity of the new vessel could be as high as 14,000 TEUs based on its reported LOA of 397 m, Beam of 56 m, Draft of 15.5 m, Gross Tonnage 170,974 gt, Speed 25.5 knots.

Source: Journal of Commerce August 2006, Marine Log December 2006
A.P. Moller-Maersk L Class M/S Emma Maersk
(14,000 TEU Vessel - 22 Containers Wide)

Maersk Line's E-class Container Vessel: *Ebba Maersk*, set a world record for the number of slots when it carried 15,100 TEU.

Length: 1,302 ft, Width: 207 ft, Net Cargo: 123,200 tons

**Quay Cranes:** 10, **Engine:** 14 in-line cylinders diesel engine (110,000 BHP)

Cruise Speed: 31 mi/h, Full Crew: 13, Construction cost - US $145 M+

Today’s Mega Ships - Measuring Up

Eiffel Tower – 990 feet

Regina Maersk – 1043 Ft, 140 Ft wide, 6000+ TEUs
Today’s Mega Ships - Measuring Up
How Wide, How Deep?

Pre-1970
1,700 TEU
<10 Containers Wide

1970-1980
2,305 TEU
10-11 Containers Wide

1985
3,220 TEU
11-13 Containers Wide

1986-2000
4,848 TEU
13-17 Containers Wide

2000-2005
8,600+ TEU
17-24 Containers Wide
A Container Ship Capable of Fitting 22,000 Containers - Designed by South Korea’s STX Shipbuilding Co

Both one and two-propeller types with the ability to reach 24 to 26 knots. 460m in length, 60m wide and 30m high. They are capable of saving more than 40% on the unit transportation cost.
Total Containership Order Book by TEU Range
(% of TEU Capacity)

Source: Drewry 2010 Container Forecaster

8,000 – 10,000+ TEU
= 56% of the Order Book

8,000 – 9,000 TEU

10,000+ TEU
Evergreen to Order 100 New Containerships for delivery 2010-2011

Source: JOC April, 9 2010

32 vessels of a new type with a capacity of 8,000 TEUs each
20 additional S-type (7,024-TEU) ships
20 additional U-type (5,364-TEU) ships
20+ 2,000-TEU feeder ships of a new type
Panama Canal Expansion: New Capacity
Post 2015 Panama Canal Environment

What Does the Competitive Environment Look Like FIVE Years From Now?
Current Panama Canal Constraints

Madison Maersk (3,928 TEUs)
(Current Max Panamax Vessel = 4,800 TEUs)
Panama Canal Transit Reservation Demand

Third Lane Canal Expansion

2007: 4,800 TEU

2014-2015: 12,600 TEU

$5.25 Billion

Source: ACP Expansion Proposal
The Post Panamax Boom Favors All-Water Service Routes

US Southeast & US Gulf Coast Ports can directly benefit from the Panama Canal’s new Lane Opening 2014/15
Benefits of the New Panama Canal
New Lane Opening December 2014/15

• A Doubling of Capacity & Change in Shipping Patterns for Asian Cargo to North America
• By 2020, 64 % of the PCA will be containerships
• An Immediate Savings to Exporters of 30 %
• Movement of discretionary cargoes from west coast ports including Los Angeles and Seattle, and the Class I railways
• It costs as much as $1,000 more per cargo container to use trains than ships – all water
The New Post Panamax Boom Favors All - Water Service Routes with the Following Vessel Characteristics:

- Vessel Capacity: **9,000 to 10,000 TEUs**
- Vessel Draft: 46 to 50 feet (tropical fresh water)
- Required Port Channel Depths: **50 to 54 feet**
- LOA: 1,000 to 1,200 feet
- Beam: 140 to 160 feet
The Container Ship Colombo Express (8750 TEU)
Southeast Louisiana Asian Routing Comparison – Shanghai to New Orleans

It costs as much as $1,000 more per cargo container to use trains than ships for Land Bridge Traffic.

Source: Parsons Brinkerhoff - Napoleon Avenue Container terminal Development
Norfolk Southern vs CSXT/CSXI
(Quarterly intermodal volume, 1000s of carloads)

Norfolk Southern is set to capture a majority of Southern PRC Midwest Bound Cargoes

Source: NS and CSX Railroad Annual Reports
Norfolk Southern Heartland DST Corridor

(Carrier Opinions on the corridor are undecided)
$842 Million CSX National Gateway

National Gateway was awarded 2009 Competitiveness Project of the Year (North American Strategic Infrastructure Leadership Forum)
Emerging US Green Inland Port Technologies

CSX High Density Intermodal Crane Configuration

NS High Density Nested Crane Configuration
CSX Rail Mounted Gantry (RMG) Cranes
Small Footprint/High Volume Intermodal Terminal
CSX Rail Mounted Gantry (RMG) Cranes
North Baltimore Ohio Rail Hub
Automated Intermodal Rail Terminal Concepts - Europe

Automatic Stacking Cranes (ASC)

Automatic Guided Vehicles (AGV)
A 14,000 TEU Mega-Container Vessel Can Produce High Intermodal Rail Volumes (One Weekly Vessel Call)

- Double Stacked Trains
- 75% Intermodal Split
- Vessel Capacity 10,000 TEU (8,235 Units)
Container Dwell:
The Average Length of Time an Average Container Remains on the Terminal

U.S. Marine Container Terminal Dwell:
6 to 8 Days (Average)
North American Intermodal Rail Terminal Dwell:

1 1/2 - 2 Day (Average)

When You Reduce Terminal Dwell by One Half

You Double the Terminal Throughput...without Building!
SESSION VI: Continuing Evolution of Marine Terminal Design and Cargo Handling Systems

Thank You