Future Trends and Challenges of the MTS

John Vickerman
Norfolk, Virginia
Today’s Agenda

• External Industry Pressures
• International Cargo Demand Trends
• The Asian Import Trade Challenge
• North America Forecasted Cargo Volumes
• North American Port & Intermodal Capacity
• International Port Productivity Comparisons
• Vessel Technology Trends
• Environmental Concerns for Vessel Emissions
Port & Intermodal External Industry Pressures
Global Trade: Current Course & Direction?

Cargo Demands, Capacity, Funding, Port Productivity & Environmental Challenges

North American Port Gateways
Vessel Cargo Handling Circa 1950
What We Know
Today... Will Be
Surely Be Different
Tomorrow!

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To Be Competitive Today...

Marine/Intermodal Terminals Must Reduce Throughput Cost & Increase Cargo Velocity Securely and as Stewards of the Environment
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 “Port”
One of the Many Diverse Constituencies in the Cargo Transportation Logistics Chain

Objective: A multimodal “Seamless” integrated world wide cargo conveyance system.
The Global Container Industry Continues to Consolidate...

- Total number of slots
- Slots controlled by top 20 carriers
- Slots controlled by 4 global alliances

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Number of Slots</th>
<th>Slots Controlled by Top 20 carriers</th>
<th>Slots Controlled by 4 Global Alliances</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>5,053</td>
<td>2,244</td>
<td>1,479</td>
</tr>
<tr>
<td>2000</td>
<td>8,180</td>
<td>4,850</td>
<td>2,674</td>
</tr>
<tr>
<td>2005</td>
<td>9,763</td>
<td>6,881</td>
<td>2,827</td>
</tr>
</tbody>
</table>

- 44.4% of slots controlled by top 20 carriers
- 59.3% of slots controlled by 4 global alliances
- 70.5% of slots controlled by 4 global alliances
The North American Freight Paradox: The Nation’s Ports and Their Intermodal Linkages are Experiencing the “Best of Times and the Worst of Times” in Terms of Growth and Demands on Capacity
At Current Productivity and Growth Levels by 2020
North American Ports & Their Associated
Intermodal Systems Will Be Severely Congested.

In Today’s Supply Chain
Congestion Can’t be an Excuse...
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.”
Today: Global Trade is an Intermodal System

Typical Transit Days: Hong Kong to New York

43 Days Transit Time Reduction (-72%) in 35 years

Source: Kansas City Southern Railroad
We do not have an “intermodal system” as such. Rather we have an aggregation of multiple, private and public modes, each of which are “stove-piped” within their own individual areas of interest with little or no true cross communication and collaboration.
Ports are Experiencing Dramatic Surges in Seaport Security Costs

Port of Miami’s Security Costs Today are 600% Higher Than that of 2001
US Port Security Breach: Supply Chain Disruption

$50 Billion Loss

Cargo Backlog Cleared in 60 Days

PORT SECURITY WAR GAME—ECONOMIC IMPACT

Exhibit 4

Day 1: Ports of Los Angeles and Savannah shut down

Day 4: Customs closes all ports and border crossings

Day 12: U.S. ports reopen

Day 20: Railcar explodes in Chicago; 24 hour stand-down

Day 26: Ports return to normal schedule, inspection rate

Source: Booz Allen Hamilton
Equipment and Technologies
Security Container Inspection

100% Radiological Inspection Regime

Gamma-Ray Scan

Source: TranSystems
A radiation portal monitor is a detection device that provides Customs and Border Protection (CBP) with a passive, non-intrusive means to screen containers and trucks as well as other conveyances for the presence of nuclear and radiological materials.
First generation Radiation Portal Monitors (RPM), have been referred to as… Kitty Litter Detectors because they couldn’t differentiate between dangerous and non-dangerous sources, spectral devices referred to as Spectroscopic (SPM), can identify isotopes.
Fig. 2. Detected spectra for coherent addition of eleven 75mm NaI DSN detectors with a 0.01Ci source, a typical portal monitor detection of the same source, and detection of a 0.1Ci source using only one DSN detector, as well as an average single DSN detector sensing a 0.01 Ci source.
Safe Port Act of 2006 (HR 4954 - The Security and Accountability For Every Port Act)

• 100% scanning using visual imaging and radiation detection

• Deployment radiation detection equipment in the 22 largest US seaports by the end of 2007 with screening of all ports handling inbound containers by end of 2008.

• Transportation Worker Identification Credential (TWIC) card required in top 40 US ports in specified security zones by January 1, 2008

• Codification of ATS, CSI and C-TPAT "Greenlane".
NNSA Second Line of Defense
Radiological Portal Monitor (RPM) Systems Deployment

I Global Threat Reduction Initiative - Prevent terrorists from acquiring the nuclear and radiological materials needed for WMD - $100 M over 5 years

II Design, Integration, Construction, Communication, and Engineering (DICCE) – Design and install sustainable sensors and communication systems throughout the world with the capability to detect and deter illicit trafficking of nuclear materials across international borders - $700 M over 7 years

Seamless Shared Information Between Our First and Second Line of Defense Would Serve the Intermodal Industry Well. Port Security and Port Productivity are Two Sides of the Same Coin!
Once We Find a “Dirty Nuclear Threat”…
What Do We Do With It?, How Do We Contain It?
Port of Los Angeles/Port of Long Beach
Joint Container Inspection Facility (JCIF)

$65 M High Tech Model Facility to be Replicated at all US Container Gateway Ports Under a TSA/DHS Grant
International Maritime Cargo Demand Trends
World Bank’s 2010 “Global Economic Prospects”

World Output will Increase 33% in 10 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Output (Trillions $)</th>
</tr>
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<tbody>
<tr>
<td>2000</td>
<td>$30 Trillion</td>
</tr>
<tr>
<td>2010</td>
<td>$40 Trillion</td>
</tr>
</tbody>
</table>
Ocean Container Trade Volume Will Continue to Grow Faster than the World Economy

Global container growth has outpaced GDP growth by more than 300% in the past 5 years

Source: Global Insight World Service and World Trade Service
World Container Forecast to 2024 in TEUs
(186% Increase in Next 20 Years)

Growth Rate (CAGR)
1994 to 2004: 8.3%

Growth Rate (CAGR)
2004 to 2014: 6.1%
2014 to 2024: 5.0%

2005: 85 M
2024: 243 M

Source: Global Insight, 2004
In 2011 Hong Kong Alone will Equal the Top 15 US Container Ports

Source: Port Engineering Management, Vol. 22- Issue 6 - December 2004
<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
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<td>USA</td>
<td>USA</td>
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<td>USA</td>
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<tr>
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<td>UK</td>
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<td>Germany</td>
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<tr>
<td>INDIA</td>
<td>Russia</td>
<td>Italy</td>
<td>Brazil</td>
<td>France</td>
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<tr>
<td>Russia</td>
<td>Brazil</td>
<td>Brazil</td>
<td>Italy</td>
<td>Italy</td>
<td>Italy</td>
<td>Italy</td>
</tr>
</tbody>
</table>

Source: Global Insight, 2005
The Growing Asian Import Trade Challenge
Global Interdependent Economics Have Resulted in a Major Product Sourcing Shift to Asia

Source: Clarkson Research Studies
Today, more than 60% of all North American container trade is with Asia. European container flows have held steady (19% market share).

2005 North American Trade Regions

Total: 24.1 Million Units

Source: PIERS; Port Reported Throughput; Norbridge Analysis
Last 5 Years Asia-US Container Trade Increased 12% CAGR and China Accounted for 95% of the Increase

Source: PIERS, Port Reported Throughput, Norbridge
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)

Mainland China Container Port Throughput

<table>
<thead>
<tr>
<th>Year</th>
<th>Port Throughput (000TEU)</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>16099</td>
<td>30.1%</td>
</tr>
<tr>
<td>2000</td>
<td>23480</td>
<td>17.1%</td>
</tr>
<tr>
<td>2001</td>
<td>27480</td>
<td>35.4%</td>
</tr>
<tr>
<td>2002</td>
<td>37210</td>
<td>27.3%</td>
</tr>
<tr>
<td>2003</td>
<td>47360</td>
<td>25.9%</td>
</tr>
<tr>
<td>2004*</td>
<td>59673</td>
<td></td>
</tr>
</tbody>
</table>

5 Yr Average = 27.2%
Increased Volume
China’s Ministry of Railways Signed a 5 year Cooperation Agreement with the US BNSF Railroad for Intermodal Rail Development

- Develop China’s high volume efficient intermodal network
- $242 billion program to 2020
- On-dock & near-dock intermodal transfer yards at ports
- Ministry to build 18 mega-terminals with 7 at seaports, 40 smaller Intermodal terminals
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
Emerging New Mexican Intermodal Gateways & Corridors – Nearly 4 Million TEUs

- Lazaro Cardenas
  - Phase I - 700K TEU
  - Fut. Phase - 2.0 mil TEU

- Guaymus
  - 1.0 mil TEU

- Punta Colonet
  - 1 mil TEU Throughput

- Lazaro Cardenas
  - Phase I - 700K TEU
  - Fut. Phase - 2.0 mil TEU
New North American Container Gateway

Prince Rupert Port Authority
the new world port
opening a new world of opportunity
The Emerging CN Transcontinental Land Bridge

- **Pacific Gateway**
- **Northeast Gateway**

**Prince Rupert Transit Times**
- Chicago: 107 hours
- Toronto: 108 hours
- Montreal: 115 hours
- Memphis: 135 hours

22 hours shorter by rail to Chicago than Vancouver (CP)
Melford International Terminal
Strait of Canso – Northeast Gateway

A Project Developed By Trident Holdings Inc.
Southeast Asian Manufacturing Centroid Shift

Current Inbound U.S. Cargo Flow

U.S. Intermodal Rail Flow

Western Centroid Shift

Eastbound: All Water Flow

Eastbound: US Intermodal Rail Flow

TranSystems
Southeast Asian Manufacturing Centroid Shift

Current Inbound U.S. Cargo Flow

Western Centroid Shift

U.S. Intermodal Rail Flow

Westbound All Water/Suez Flow

Westbound Intermodal U.S. Flow

TranSystems
Can North American Marine Terminals Handle the Forecasted Freight Volumes ?...
By 2020 Most US Container Port Gateways Will Double or Triple in Volume
By 2020 demand will exceed current capacity of many U.S. ports by as much as 200%.
North American Port & Intermodal Capacity Trends
2010 Projected Public Port Capacity Shortfall

75% of the 16 Ports Studied will have Significant Capacity Problems by 2010
Explosive Southern California Port Container Growth Forecasted

35 million TEUs

2030

44.7 Million TEUs

Capacity vs. Demand Bottom Line:
Balancing Capacity and Demand is Both a Public and Private Issue

North America’s future economic and environmental health is at risk as a result of declining transportation efficiency and reliability.

We Must Change Our Course

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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>Asian Ports</td>
<td>9,272</td>
<td>16,595</td>
<td>15.3%</td>
</tr>
<tr>
<td>European Ports</td>
<td>4,284</td>
<td>6,396</td>
<td>15.4%</td>
</tr>
<tr>
<td>United States Ports</td>
<td>2,894</td>
<td>4,028</td>
<td>7.7%</td>
</tr>
<tr>
<td>US West Coast Ports</td>
<td>3,543</td>
<td>4,944</td>
<td>7.5%</td>
</tr>
<tr>
<td>US Gulf Coast Ports</td>
<td>3,149</td>
<td>4,635</td>
<td>9.4%</td>
</tr>
<tr>
<td>US East Coast Ports</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
In 1955 Malcolm McLean, sold McLean Trucking, and secured a bank loan of US$42 million to build the world's first container ship.

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

1st Generation (Pre-1960 - 1970)
- 1,700 TEU

- 2,305 TEU

3rd Generation (1985)
- 3,220 TEU

- 4,848 TEU

5th Generation (2000 - 2005)
- 8,600 TEU

6th Generation ???
Madison Maersk (3,928 TEUs) in the Panama Canal

(Current Max Panamax = 5000 TEUs)
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

The diagram illustrates the growth in ship size and the increase in the number of containers they can carry, highlighting the evolution from smaller vessels to today’s mega ships.
### SUMMARY OF WORLD CONTAINERSHIP FLEET IN SERVICE AND ON ORDER
(OCTOBER 2005)

<table>
<thead>
<tr>
<th>Ship Type</th>
<th>5000-5999</th>
<th>6000-6999</th>
<th>7000+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Slots on Order</strong></td>
<td>371,509</td>
<td>435,032</td>
<td>1,561,394</td>
<td>4,323,417</td>
</tr>
<tr>
<td><strong>Ships on Order</strong></td>
<td>68</td>
<td>67</td>
<td>183</td>
<td>1,113</td>
</tr>
</tbody>
</table>

Current Vessel Capacity = 2,304,286 Slots
Order Book Vessel Capacity = 2,367,935 Slots

A 103% Increase in Fleet Slot Capacity on Order

Source: Containerisation International Yearbook 2005
Zim orders four 10,000 TEU container ships from Hyundai Shipyards in Korea; will double its carriage capacity
Zim will take delivery of the ships, second half of 2009

Cosco orders four 10,000 TEU containerships from Hyundai Heavy Industries to be delivered in 2008
$505 M Deal

Source: North Sea Terminal Bremerhaven GmbH & Co
## 2005 COSCO Orders Four 10,000 TEU Vessels

<table>
<thead>
<tr>
<th>Description</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH OVERALL</td>
<td>349 M (1145 FT.)</td>
</tr>
<tr>
<td>BREADTH</td>
<td>45.6 M (149.6 FT.)</td>
</tr>
<tr>
<td>MAX. DRAFT</td>
<td>14.5 M (47.6 FT.)</td>
</tr>
<tr>
<td>OPERATING SPEED</td>
<td>25.8 KNOTS (29.7 miles/hr)</td>
</tr>
</tbody>
</table>

*Source: Lloyd’s Register, February 2005*
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)

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

Key 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+

A.P. Moller-Maersk L Class M/S Emma Maersk
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The Hatch-Less Container Vessel

Per P&O Nedlloyd:
• 15% Faster Port Productivity
• 84% Less Re-Stows
• Less Damaged Boxes
Containerships & Recent Cruise Vessel Technological Advances...What’s Next?

SSP Propulsion
Schottel / Siemens

Azipod

Eagle Class Cruise Vessel
The 15,000 TEU Containership

“...the ship is a flight of fancy... but such a ship is within the current state of the shipbuilder’s art...”

R. G. McLellan, P&O Containers
The 15,000 TEU Containership

LOA. = 400 m (1,312 ft.)
Draft = 14 m (46 ft.)
BEAM = 69 m (226 ft.)

Panamax Dimensions

28 Wide
13 Wide

6-7 above deck
10-11 below deck
28 Across
Container Ship-in-a-Slip Concept
The 18,000 TEU Malaccamax
Reported Predictions/Benefits

• By 2010 on Asia-Europe Trade Route
• 30% Cheaper than 4800 TEU Panamax Vessel, primarily due to “Economies of Scale”
• US$40/TEU Savings

Source: Dynamar Consultancy, Rotterdam
Emergence of North American Fast Feeder Short-Sea Coastal Vessels

10,000 to 15,000 TEU Mega Ship

2,000 - 3,000 TEU Feeder Ship

The New Frontier: Transshipment and Short Sea
Short Sea Shipping
Coastwise Maritime Trade

Taking Freight off of Congested Roads
Emerging Viable Container On Barge Coastal Shipping Concepts & Inland Intermodal Port Potential
High-Speed, Low Wake, Intermodal Float Technology
Growing Environmental Concerns for Marine Vessel Emissions
Global Freight Energy Use is on the Rise

Source: 2005 Haagen Smit Worldwide Emissions Overview & NRDC “Harboring Pollution”
Global Diesel PM & NOx Baseline Projections

Land Based Pollutants Have Declined with Regulation, but the Unregulated Marine Based Pollutants are Increasing.

Absent New Standards and Regulations the Pollutant Baselines Are Forecast to Rise.

Source: 2005 Haagen Smit Worldwide Emissions Overview
Pollution Sources
US Ports vs Other Industries…
We Need To Do Better

Source: 2005 Haagen Smit Worldwide Emissions Overview & NRDC “Harboring Pollution”
Transportation Diesel Pollutants are Putting Our Health in Jeopardy

Progress has stalled and diesel emissions from ships, locomotives and port complex are projected to increase.

Source: SCAQMD, Multiple Air Toxics Exposure Study II, March 2000
South California Environmental Challenges

The “Diesel PM Death Zone”

- Environmental Constraints are Growing
- POLA/POLB Have had 40 major Projects Held up for Years
- State Looking Into User Fees

I-710 Typical Day from POLA/POLB
Cost-Effective Air Quality Emission Reduction Improvement Measures

- **Modernize truck fleet:**
  - Scrap dirty old trucks
  - Retrofit all other pre-2007 trucks

- **Upgrade all cargo handling equipment with electric equipment or clean fuels**

- **Use clean marine fuels**
  - Provide onshore electric power for ships at berth (Cold Iron)

- **Replace locomotives with cleaner technologies, fuels, and explore rail electrification**

Source: Southern California Association of Governments
MAGLEV Cargo Conveyor Demonstration Project

Victorville

Transrapid Freight Vehicle Concept

GENERAL ATOMICS

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Port & Intermodal Terminal Competitive Mandates

Ports & intermodal linkages must change the current cost versus value relationship in the logistics chain. Become Value Added Multipliers...

Successful ports & intermodal terminals in the next decade must invest in and leverage technology to improve terminal productivity, cost, effectiveness and reliability for all modes of transportation...securely as environmental stewards.
Thank You

John Vickerman
Norfolk, Virginia