Ocean-going Vessel Standards – The Carrier’s Perspective
The A.P. Moller–Maersk Group

A.P. Moller-Maersk Group
HQ: Copenhagen, Denmark

- 2009 Revenue: USD $48.5 b in Shipping, Energy, Retail and Banking.
- 115,000 employees, 130 countries.
A.P. Moller-Maersk transportation businesses in North America

- Maersk Line Limited – US-flagged vessels
- Maersk Line North America – Sales, operations & inland transportation contracting (rail & trucking)
- APM Terminals Americas – Marine terminals
- Maersk Equipment Services – Equipment and maintenance
- Direct ChassisLink – NEW Neutral chassis leasing business
- Bridge Terminal Transport – Trucking & drayage
- Maersk Distribution Services Inc. –
- Gilbert – Warehousing & logistics
- Damco – Third-party logistics
Maersk Line – the container shipping arm

- Operations
  - Operates more than 470 vessels
  - Moves approx 1.8 million containers
- 90% of all goods transported globally is done by ship
- Maersk Line represents approx. 4% of worldwide shipping activities
- 16% of the container segment
- Consumes over 10 M tonnes of heavy fuel oil annually
Multiple vessels are scheduled on each route to provide regular (weekly) service.

Transpacific 6 (TP6) - Eastbound

<table>
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<tr>
<th>PORT</th>
<th>ARRIVES</th>
<th>DEPARTS</th>
<th>TRANSIT</th>
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<tr>
<td>Tanjung Pelepas, Malaysia</td>
<td>MON 1900</td>
<td>WED 0300</td>
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<td>FRI 2100</td>
<td>SAT 2200</td>
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<td>SUN 0400</td>
<td>MON 0400</td>
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<td>Los Angeles, CA, USA</td>
<td>FRI 1800</td>
<td>TUE 0200</td>
<td>16</td>
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Note: Weekly Service

Transpacific 6 (TP6) - Westbound

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<th>TRANSIT</th>
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<td>Los Angeles, CA, USA</td>
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<td>Yokohama, Japan</td>
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<td>THU 1600</td>
<td>17</td>
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<td>Nagoya, Japan</td>
<td>FRI 0800</td>
<td>FRI 1800</td>
<td>18</td>
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<td>Shanghai (YS), Mainland China</td>
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<td>Ningbo, Mainland China</td>
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<td>THU 0001</td>
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<td>Tanjung Pelepas, Malaysia</td>
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<td>WED 0400</td>
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</table>
Vessel schedule: Georg Maersk on TP-6

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<thead>
<tr>
<th>Port Name</th>
<th>Arrival Date</th>
<th>Departure Date</th>
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<tr>
<td>Hong Kong</td>
<td>18 Apr 2010</td>
<td>19 Apr 2010</td>
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<td>Nagoya</td>
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<td>Shanghai</td>
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<td>Xiamen</td>
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<td>Hong Kong</td>
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<td>Tanjung Pelepas</td>
<td>01 Jun 2010</td>
<td>02 Jun 2010</td>
</tr>
<tr>
<td>Jeddah</td>
<td>11 Jun 2010</td>
<td>12 Jun 2010</td>
</tr>
<tr>
<td>Suez Canal</td>
<td>15 Jun 2010</td>
<td>15 Jun 2010</td>
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<tr>
<td>Barcelona</td>
<td>19 Jun 2010</td>
<td>20 Jun 2010</td>
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<td>Valencia</td>
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<td>Algeciras</td>
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<td>Port Tangier Mediterranee</td>
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<td>25 Jul 2010</td>
<td>26 Jul 2010</td>
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<tr>
<td>Los Angeles</td>
<td>08 Aug 2010</td>
<td>12 Aug 2010</td>
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</table>
Maersk Alabama
• US flagged ship
• Operates near Africa delivering US food aid.
Burning hydrocarbon fuel creates air emissions
Transportation does have a significant impact on the environment, but...

We are actually doing something about it.
Fuel switching provides immediate air quality improvement.

**Vessels change fuels:**
From Bunker avg. 2.7% sulfur  
To Distillate avg. 0.12% sulfur

**Emissions reduction:**
SOx: 95%  
PM: 86%  
NOx: 6 to 12%

**Locations:**
California – from 24nm  
(1.5/0.5% required since 7/2009)  
WA & BC – at dock  
Houston – demo 11/09, DERA grant

Mærsk Mc-Kinney Møller stands on the dock at Pier 400 in Los Angeles with the Sine Maersk at berth behind him. The vessel was the first to perform a fuel switch as part of a Maersk Line pilot environmental initiative in California.

-- March 21, 2006
Typical Fuel Switch Map

Fuel Switch Locations:
1. Auxiliary Engine Entry
2. Main Engine Entry
3. Port of Los Angeles
4. Main Engine Exit
5. Auxiliary Engine Exit

Data by ENVIRON
Fuel switch costs and implementation

• Little or no capital investment required – vessel or port
• Mobile solution – travels with the vessel
• Rapid implementation (weeks vs. years)
• Does not shift emissions to other power sources or locations
• Minimal personnel safety or training issues

BUT:

• Fuel cost differential is substantial
• Cost of Program to Maersk to date is over USD 20 million
• Some care needed in switching
Vessels are becoming more energy efficient, so are reducing emissions

Due to

- Technologies
- Operations
- Speeds
- Vessel size

- Reduced over two million tonnes CO$_2$ plus other emissions
- Reduction target for 2017 is 20% below 2007 levels
Maersk-owned container vessels – CO₂ emissions

- 15% decrease in fuel consumption and CO₂ emissions (per TEU x km)
- Reduced over two million tonnes CO₂
- Reduction target for 2007 – 2017 is 20%
Maersk Container Vessels -- NOx Emissions

- Decrease in NOx largely due to reduced fuel consumption
- Large and increasing number of vessels built after 2000, so NOx certified
Technical innovation is essential for sustainability

- Antifouling paint and maintenance of hull and propeller (1.5%*)
- Waste Heat Recovery System (10%*)
- Electronically controlled engine (0.5%*)
- Adjusting main engines (1%*)
- Voyage Efficient System (VES) (1%*)
- QUEST: Low energy reefer containers (0.5%*)
- Ballast water optimisation (1%*)
- Trim tests for all classes of vessels (1%*)

*CO₂ emission saving potential

Source: Maersk Line Sustainability Department
MSTRS 5/4/2010 Slide no. 16
Fuel use and costs increase exponentially at higher speeds

- The speed/fuel use curve is exponential.
- Speeding up will cost more fuel than what we save by slowing down.
- Lowest constant speed is best.
Designing schedules to reduce consumption

8 x 6,000 TEU vessel  
Weekly capacity: 6000 TEU

- To create a weekly schedule:
- 8 vessels means a full rotation time of 56 days

9 x 6,000 TEU vessels  
Weekly capacity: 6000 TEU

- To create a weekly schedule:
- 9 vessels means a full rotation time of 63 days

Asia-Europe example

- 35 days for ocean crossings and 21 days for Asia and Europe port loops

- 42 days for ocean crossings and 21 days for Asia and Europe port loops

MAERSK LINE
Minor change – great impact

- Before sailing at economical speed:
- 12 vessels
- Fuel consumption: 12,000 MT

37,000 MT
CO₂
20.5 Knots

12 ×

Barcelona ↔ Hong Kong ↔ Long Beach (CA)

- 16% Savings on fuel reduces costs, criteria pollutant emissions and CO₂

- With economical speed
- 13 vessels
- Fuel consumption: 10,000 MT

31,000 MT
CO₂
19 Knots

13 ×

Barcelona ↔ Hong Kong ↔ Long Beach (CA)
Super Slow Speed Steaming

Optimal Speed

Optimal Load

Figure 1; Cost per Nautical mile
Vessel: 3030TEU, ME: 7RTA96C, 200 Reefers; FO Cost 300$/mt
Adjusting main engines to economical speed

- Traditionally, vessels are optimized for high speed
- Lower economical speed allows for de-rating of the main engine
- Maximum engine power is restricted
- Significantly lower fuel consumption at medium power
Super Slow Steaming Initiative

- Study started in 2007, covered 110 vessels
  - Maersk collaborated with engine manufacturers
- Results:
  - OK to operate as low as 10% engine load
  - Traditional range is 40 – 60%
  - Manufacturers have changed recommendations
- Over 100 vessels used since 2007, resulting in
  - More flexible voyage & schedule planning
  - 10 – 30% fuel savings and reduced CO$_2$
  - Significant savings:
    - Post panamax: 3500 MT fuel, 10,000 MT CO2
    - $1 million
- Sustainable Shipping Operator of The Year - 2009
Cold ironing (shore power)

- Emissions reductions can be achieved when:
  - Both vessel and berth are equipped and hooked-up
  - Clean power is available - otherwise transfer emissions to shore generation
  - Benefits are reduced during connect and disconnect/engine restart
- High capital requirements
  - Vessel installation cost all inclusive – Est. today approx. $1.2M / vessel
  - Marne Terminal -- all inclusive (vault, trenching, equipment, transformer, conduit and cables, switchgear) for one berth (1000 ft of wharf length) to dock one ship is approximately $4-5 M. per berth
  - Off terminal infrastructure may also require upgrades
- Impact must consider hook-up/disconnect and engine restart
- Other implementation concerns for cargo vessels include very small crew, required skills, weather, location variations, high dock activity (safety)
- In contrast, fuel switch and slow steaming are quickly implemented, low capital investment, and mobile.
- Mobile solutions travel with the vessel → benefits everywhere the vessel travels.
How do we meet environmental goals while maximizing operational flexibility?

• Our vessels travel the world
  • International standards are essential for a level playing field
  • US state fragmentation is detrimental to progress
• Carriers and shippers are working to measure and reduce impacts
  • Harmonized tools are needed
• New sources of fuels: oil sands, assorted bio-based, blends
  • What must be measured or controlled to control environmental performance?
  • What new pollutants result??
  • Are CEMs necessary in a more diverse fuel future?
• Reduced sulfur – implementation considerations
  • Sulfur content may be more variable
Working with the industry and customers to reduce impacts

- Clean Cargo Working Group is a business-to-business forum with the goal “to promote more sustainable product transportation”

- Members are shippers and ocean liner companies including:
  - APL, CMA CGM, COSCON, Hamburg Sud, Hanjin, Hapag Lloyd, Hyundai, K Line, Li & Fung, Maersk Line, NYK Line, OOCL, Safmarine, Shell Marine, UPS, Yang Ming

http://www.bsr.org/consulting/working-groups/clean-cargo.cfm
### TABLE 1 - OVERALL PERFORMANCE

<table>
<thead>
<tr>
<th>Environmental Aspect</th>
<th>% of Fleet Reported On</th>
<th>Max Score Possible</th>
<th>Carrier Score</th>
<th>Carrier Score as % of Max</th>
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<tbody>
<tr>
<td>Owned</td>
<td>Time-Chartered</td>
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<tr>
<td>CO₂ Emissions (across all trade lanes)</td>
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<td>SOₓ Emissions</td>
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<td>NOₓ Emissions</td>
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<td>Environmental management systems</td>
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<td>Transparency</td>
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<td>Overall Performance</td>
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<td>100</td>
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*Score not available until "CCWG Average" is calculated for each trade lane.

### TABLE 2 - DETAILED CO₂ PERFORMANCE

<table>
<thead>
<tr>
<th>CO₂ Emissions - by trade Lane</th>
<th>% of Fleet Reported On</th>
<th>TEU-km</th>
<th>DRY CONTAINERS</th>
<th>REEFERS</th>
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<tr>
<td></td>
<td></td>
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<td>grams CO₂/ TEU-km</td>
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Reducing air emissions by routing

- Istanbul to Belgium
- Compare CO₂ emitted per container
  - all truck
  - sea and truck transportation

- Istanbul to Belgium
- Compare CO₂ emitted per container
  - all truck
  - sea and truck transportation

- Istanbul to Belgium
- Compare CO₂ emitted per container
  - all truck
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- Istanbul to Belgium
- Compare CO₂ emitted per container
  - all truck
  - sea and truck transportation
Case study: Nike

Visibility on supply chain carbon emissions to help accomplish 30% reduction target for 2020
Greener can also be cheaper

Case studies at www.damco.com

CarbonCheck projects with Boots, a leading international chain of pharmacy and health and beauty stores.

Since 2004, focus on these analyses have enabled Boots to

- reduce CO2 emissions by 29% and
- reduce logistics costs by 21%

in their inbound supply chain from Asia to their distribution centre in England.

”It goes to show that if you review and optimize your supply chain end-to-end from a green perspective, great savings can be made.”

-- Erling Johns Nielsen
Supply Chain Development Team
Maersk
Thank you

Contact Information:
Lee Kindberg
Director, Environment
704-571-2693
NAMENVIRO@maersk.com