AUTOMATED MOORING SYSTEMS
IS IT THE FUTURE?

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Problem Definition

• Pier Reconstruction in Stages
• Accommodate 2 Ships During Construction
• Remaining Berth Length Inadequate
• Mooring Within Construction Area
Staging Plan With Dolphins
STAGE 1

Construction Zone
STAGE 2

Construction Zone
STAGE 3

Construction Zone
Impacts of Standard Mooring to Construction & Operations

• Dolphins in Areas to be Dredged
• Dolphins Complicate Pile Installation
• Line Handling Safety
• Capstan??
Possible Solution

• Retrofit Existing Berths with VMS
• Build VMS into New Berths
• Eliminate Need for Dolphins
• Minimize Ship to Ship Clearance
STAGE 2

Construction Zone
STAGE 3

Construction Zone
How VMS Works

- Vacuum Pads Provide Mooring Forces
  - Typically 20 Tons/Pad

- VMS Adjusts to Ship Movement
  - Stepping Function

- VMS Limits Ship Movement
  - Prevents Kinetic Energy Build-Up
MoorMaster® – Automatic Mooring System

Technical Description

MM400 unit

- Outreach movement: 1 mt
- Vertical movement: 2 mt
- Fore/aft movement: 1 mt
- Pad hinges: + - 5°
MoorMaster® – Automatic Mooring System

• **Proven Safety**
  – The technology is safe and reliable and has been in daily commercial use since 1999.

• **Over 25,000 automatic moorings to date without failure**

• **Vacuum power system backed up by generators**
MoorMaster® – Automatic Mooring System

- Port of Sallah – APM Terminals
  - MoorMaster® 600
  - Shore based automatic mooring system
  - Capacity: 4x600 kN (4x60 tons)
  - Installation August 2006
Potential Benefits & Savings - TERMINALS

- Increases infrastructure capacity
- Elimination of non productive berth areas
  - In-between ships
  - At end of quay
Potential Benefits & Savings - LABOR

• One man operation – no line handlers
• Less time for tug assist at berthing

Potential Benefits & Savings – SHIPS GEAR

• Less wear and tear on lines
• Less wear and tear on wenches, equipment
Design Considerations

- Deck “Furniture”
- Crane Clearance
- Equipment Housing
- Wharf Loading
MoorMaster® – Automatic Mooring System

• MoorMaster® – A New Solution
Evaluation

- Retrofit – New Build – Relocation
- Labor Implications
- Tug Time Savings
- Ship Line Damage Savings
- Costs
Vacuum System - Ship Layout

LEGEND

- **SHIP ENVELOPE DURING CONSTRUCTION**
- **SHIP ENVELOPE: PHASE 1 COMPLETION – 2 BERTHS**
- **SHIP ENVELOPE: PHASE 1 COMPLETION – 3 BERTHS**
- **SHIP ENVELOPE: ULTIMATE BUILD OUT – 3 BERTHS**
- **EM** = EMMA MAERSK (“NEW PANAMAX”)
- **N** = HYUNDAI N CLASS 8,900 TEU
- **M** = HYUNDAI M CLASS 8,900 TEU
- **H** = HYUNDAI H CLASS 5,900 TEU
- **F** = HYUNDAI F CLASS 4,400 TEU
- **R** = HYUNDAI R CLASS 3,600 TEU
- **BOW**
- **STERN**
- **VESSEL FLAT SIDE LENGTH**

- **PURCHASE / INSTALL VAC UNIT**
- **PURCHASE / RETROFIT VAC UNIT**
- **CONSTRUCT SPACE FOR FUTURE VAC UNIT**
- **REMOVE / REINSTALL EXISTING VAC UNIT**
- **PREVIOUSLY INSTALLED UNIT OR SPARE**
- **PREVIOUSLY INSTALLED SPACE**

VAC. SYSTEM - SHIP LAYOUT FIG. 11
Vessel Flat Side vs Unit Locations
Approximate Holding Capacity of MM400 System on Various Container Vessels

( Beam wind condition, only MM400's holding vessel )

- 330m Vessel
- 300m Vessel
- 250m Vessel

Force vs. Wind Speed Chart

Wind Speed (km/hr)

(1 km/hr = 0.54 knots)
## Cost Tables (2008 Present Value)

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<tr>
<th>Lines</th>
<th>VMS</th>
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Over 20 years based on 2 ships/berth/week
Summary

• Can Provide Options in Tight Mooring
• Can Reduce Ship Movement
• Cost Effective if Labor Savings Can Be Realized
• It’s the Future??