HI

"Overview of the Terminal Design"

Prevention First 2006
September, 2006
Long Beach, CA

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Topics to be Covered

- The Need for the Terminal
- Full Project Flyover
- Design Criteria
- State-of-the-Art Systems and Features
- State-of-the-Art Analyses Performed
- Challenges and Hurdles to Overcome
The Need for the Terminal

Los Angeles Regional Demand

From Baker & O'Brien Study

- ANS
- California
- Imports

[Bar chart showing trends from 1994 to 2014]
The Need for the Terminal

**Foreign Imports Drive Demand**

- Significant increase in marine imports over next ten years—460,000 bbls/day or 100% increase
- Crude oil demand and decline of California crude oil productions drives the need for Pier 400 project
- Addresses petroleum import needs for the Los Angeles area
- Imports will be important to the continued economic development of the Los Angeles area economy

*From Baker & O’Brien Study*
Design Criteria – Big Picture

- **Import Capacity = 250,000 bbl/day**
- **Pier 400, Berth 408 Site Chosen**
  - Deep Draft (-81 ft) Requires No Additional Dredging
  - Original Driver Behind Pier 400 Landfill
  - Relatively Isolated From San Pedro Community
- **Accommodate Panamax up to VLCC**
- **Four 16-inch Unloading Arms**
- **One 8-inch Fueling Arm for Distillate Loading/Unloading**
- **State-of-the-Art Safety Features**
Design Criteria – Terminal Layout

- **Panamax** (LOA = 761 ft; Beam = 105 ft)
- **Suezmax** (LOA = 899 ft; Beam = 151 ft)
- **VLCC** (LOA = 1115 ft; Beam = 184 ft)
- **AFRAMAX** (LOA = 780 ft; Beam = 125 ft)
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VLCC</th>
<th>SUEZMAX</th>
<th>AFRAMAX</th>
<th>PANAMAX</th>
<th>FUEL BARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWT (tonnes)</td>
<td>325,000</td>
<td>149,000</td>
<td>105,000</td>
<td>70,000</td>
<td>1,400</td>
</tr>
<tr>
<td>Displacement (tonnes)</td>
<td>370,000</td>
<td>172,400</td>
<td>125,000</td>
<td>85,000</td>
<td>~1,800</td>
</tr>
<tr>
<td>LOA / Beam (ft)</td>
<td>1,115 / 184</td>
<td>899 / 151</td>
<td>780 / 125</td>
<td>761 / 105</td>
<td>170 / 44</td>
</tr>
<tr>
<td>Loaded Draft (ft)</td>
<td>74</td>
<td>56</td>
<td>48.5</td>
<td>44.6</td>
<td>~7</td>
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</tbody>
</table>
Design Criteria – Allowing for the Future
Design Criteria – Fueling System

- 8-inch loading arm
- 10,000 bbl distillate barge
Design Criteria

*MOTEMS Structural Criteria*

- Seismic Criteria
- Mooring Loads
- Berthing Loads
- Wave Loads
- Passing Vessel Loads
- Seiche
- Tsunamis
- Wind Loads
- Current Loads
- Load Combinations
- Safety Factors
Design Criteria

- MOTEMS Fire Prevention, Detection and Suppression Criteria
- MOTEMS Piping, Mechanical and Electrical Systems Criteria
- Seismic Sensors
- Environmental Monitoring
- Security
State-of-the-Art Systems and Features

Laser-Assisted Docking Aid System
State-of-the-Art Systems and Features

Quick Release Mooring Hooks with Integral load Monitoring and Staged Alarm
State-of-the-Art Systems and Features

- **Unloading Arms with Quick Connect/Disconnect Couplers**
State-of-the-Art Systems and Features

Real-time Environmental and Seismic Sensor Monitoring
State-of-the-Art Systems and Features

Gangway Tower with Integral Position Monitoring and Staged Alarm
State-of-the-Art Systems and Features

- Fire Protection System with Redundancies – Based on Hazard Analysis and Fire Plan
State-of-the-Art Systems and Features

- **Integrated Control System for Effective Operator Control**
State-of-the-Art Analyses Performed

Berth Operational Downtime Analysis

![Berth Operational Downtime Analysis Diagram]

- **Hs (m)**
  - Above 4.5
  - 4 - 4.5
  - 3.5 - 4
  - 3 - 3.5
  - 2.5 - 3
  - 2 - 2.5
  - 1.5 - 2
  - 1 - 1.5
  - 0.5 - 1
  - 0.4 - 0.5
  - 0.2 - 0.4
  - 0.1 - 0.2
  - 0.001 - 0.1
  - 0 - 0.001
  - Below -10
  - Undefined Value

1/1/1990 12:33:50 PM, Time step: 11, Layer: 0

(Grid spacing 13 meter)
State-of-the-Art Analyses Performed

Passing Vessel Motion Analysis

[Diagram showing vessel motion with axes X/L and V, and graph of dimensionless applied force & moment with Fx, Fy, and Mz (ft-kips) plotted against X/L.]
State-of-the-Art Analyses Performed

- Tsunami Hazard Analysis
State-of-the-Art Analyses Performed

**Seismic Structural Analysis Per MOTEMS**

- **Level 1 Seismic Performance**
  - Minor or no structural damage
  - Temporary or no interruption in operations

- **Level 2 Seismic Performance**
  - Controlled inelastic structural behavior with repairable damage
  - Prevention of collapse
  - Temporary loss of operations, restorable within months
  - Prevention of major spill (≥1200 bbls)
State-of-the-Art Analyses Performed

- **Structural and Piping Stress Analysis**
  - Fixity at Unloading Platform
  - Piping Along Shoreline
  - North Trestle
Challenges and Hurdles Overcome

- **Regulatory and Permitting Hurdles**
  - Over 25 agency approvals
  - Over 80 individual permits required

- **Political Challenges**
  - Effective Outreach
  - Citizens and Community Organizations
  - Interest Groups
  - Neighborhood Groups
  - Politicians

- **Alternative Marine Power Requirement**
  - Shore side infrastructure Challenges
  - Ship Conversion Challenges
Conclusions

- Next Generation Marine Oil Terminal
- First New CA MOT in 25+ Years
- First CA MOT to be Designed to New MOTEMS Requirements
- Precedent-Setting Solutions to Technical, Environmental and Political Challenges

PIER 400, BERTH 408 MARINE OIL TERMINAL
CONCEPTUAL DESIGN
PHOTO-SIMULATION
Overview of the Terminal Design

Thank You!

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