Great Circle Route
Santa Barbara Case Study

- Over 7,000 annual transits
- 130 miles of coastline
- Large 2-stroke engines
- Vessels burning heavy bunker fuels
- Majority of the vessels are foreign flagged
- Trade volumes expected to continue increasing

Santa Barbara County NOx * Emission Forecast

* NOx = Onshore + OCS
Santa Barbara Marine Emissions Inventory

2005 SB Marine Inventory
- 7,086 Transits
- 14,918 Tons of NOx
- 10% of the vessels were responsible for about 56% of the total NOx emissions
- 83% of all of the NOx emissions from container ships
- 92% of the NOx emissions from foreign-flagged vessels

Comparing the SB inventories for 2000 and 2005
- 8% increase in the annual number of vessels
- 10% increase in annual transits
- 35% increase in annual installed power
- 30% increase in annual NOx emissions

Santa Barbara Marine Emissions Inventory vs. Forecast
Demonstration Project
APL Singapore

<table>
<thead>
<tr>
<th>Vessel Information</th>
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<tbody>
<tr>
<td>Vessel</td>
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<tr>
<td>Ship type</td>
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<tr>
<td>TEU Capacity</td>
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<tr>
<td>Flag</td>
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<td>Built</td>
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<table>
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<tr>
<th>Engine Information</th>
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<tr>
<td>Engine</td>
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<tr>
<td>Model</td>
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<td>Type</td>
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<tr>
<td>Engine power</td>
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</tbody>
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2005 Santa Barbara Impact (Source: SB Inventory)

| Transits | 19 |
| NOx rank | 43 (out of 1,468 vessels) |
| NOx emissions | 67 Tons |
| PM emissions | 5 Tons |
| SOx emissions | 46 Tons |

Demonstration Project
Emission Control Technologies

- **Technologies:**
  - Fuel-water emulsification system
  - Slide valves

- **Project Cost:**
  - About $780,000 for hardware + Installation
  - CARB Carl Moyer multi-district funding award (2005)
  - Contract between APL and BAAQMD

- **Annual Emissions Reductions in CA Coastal Waters:**
  - NOx = 65 TPY, PM = 4 TPY
  - CA weighted Moyer cost-effectiveness = $1,370/ Ton

- **Participants:** APL, BAAQMD, SLOAPCD, VCAPCD, SBCAPCD, EPA, CARB, MARAD, PoLA, PoLB, MAN B&W
Demonstration Project
Emissions Testing

• **Cost:** About $100,000
• **Emissions Testing:**
  – **Pollutants:** NOx, PM, SOx, HC, CO, CO2
  – Various vessel operating modes
  – Fuel oil and lube oil analysis
  – In-use, ocean-going vessel emissions testing protocol
• **Funding Partners:**
  – PoLA and PoLB
  – VCAPCD, SLOAPCD and SBCAPCD
• **Testing Contractors:**
  – UC Riverside and MAN B&W

Questions ?