

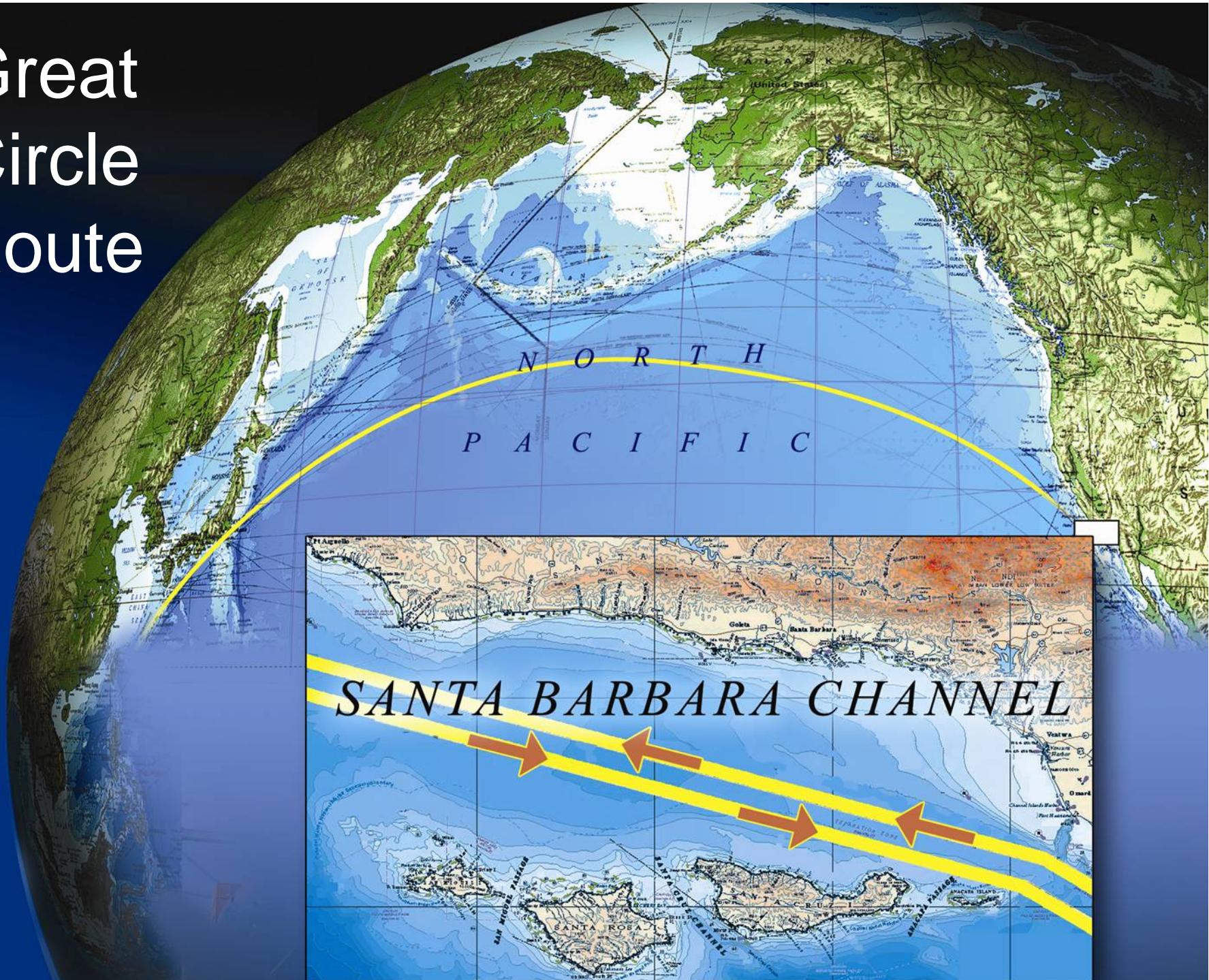
Marine Shipping Emissions

Maritime Working Group Meeting

**Tom Murphy, Manager
Technology & Environmental Assessment
SBCAPCD
September 12, 2006**

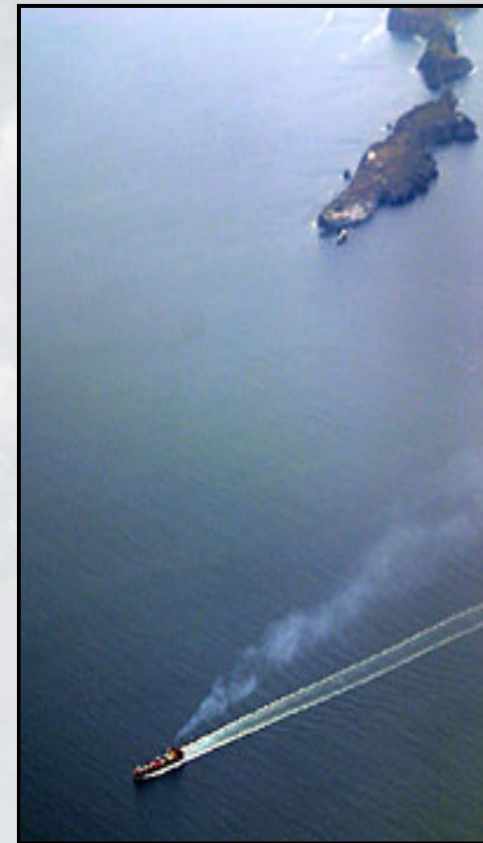


Great Circle Route

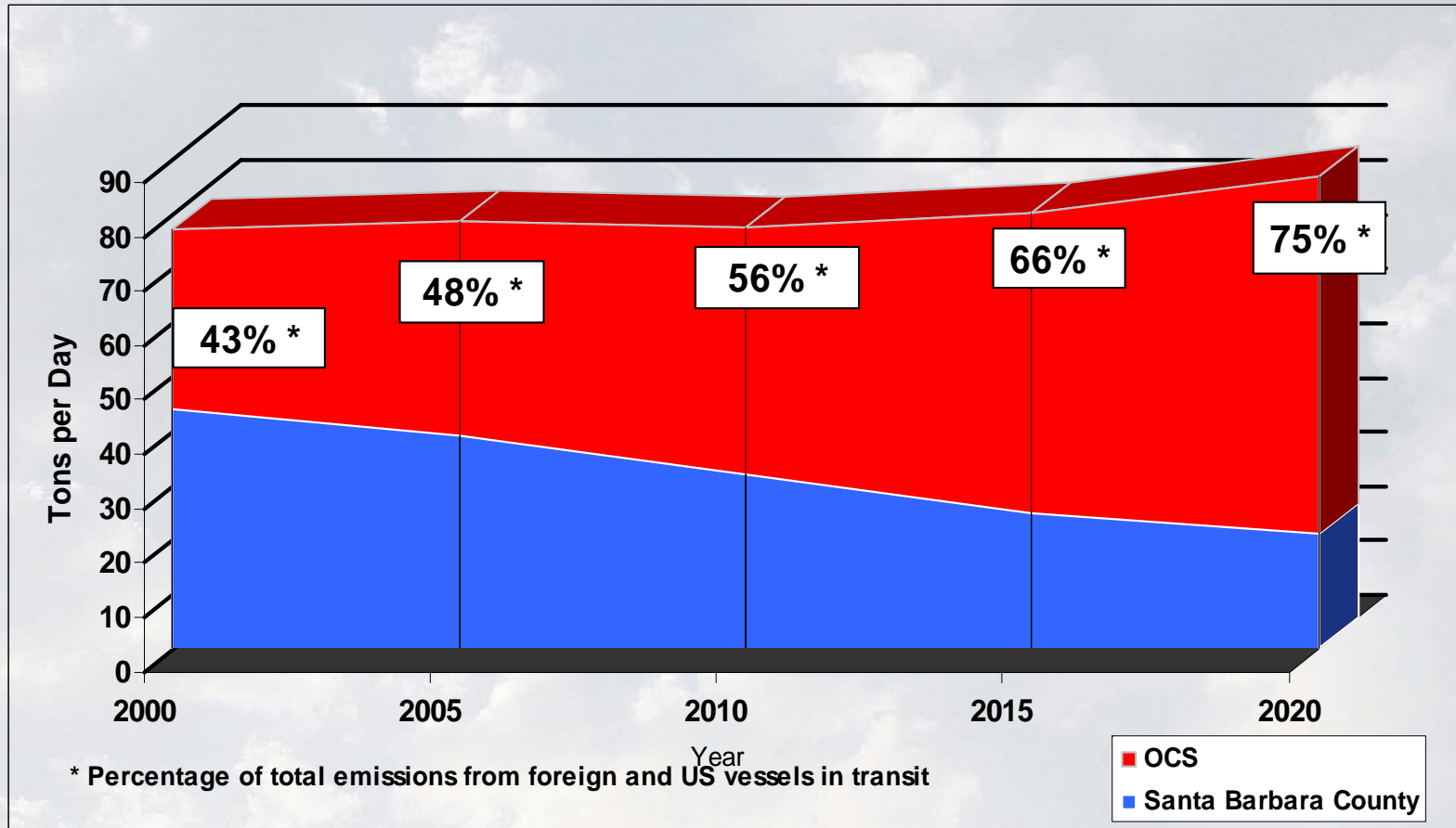


Santa Barbara Case Study

- 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



Santa Barbara Marine Emissions Inventory

2005 SB Marine Inventory

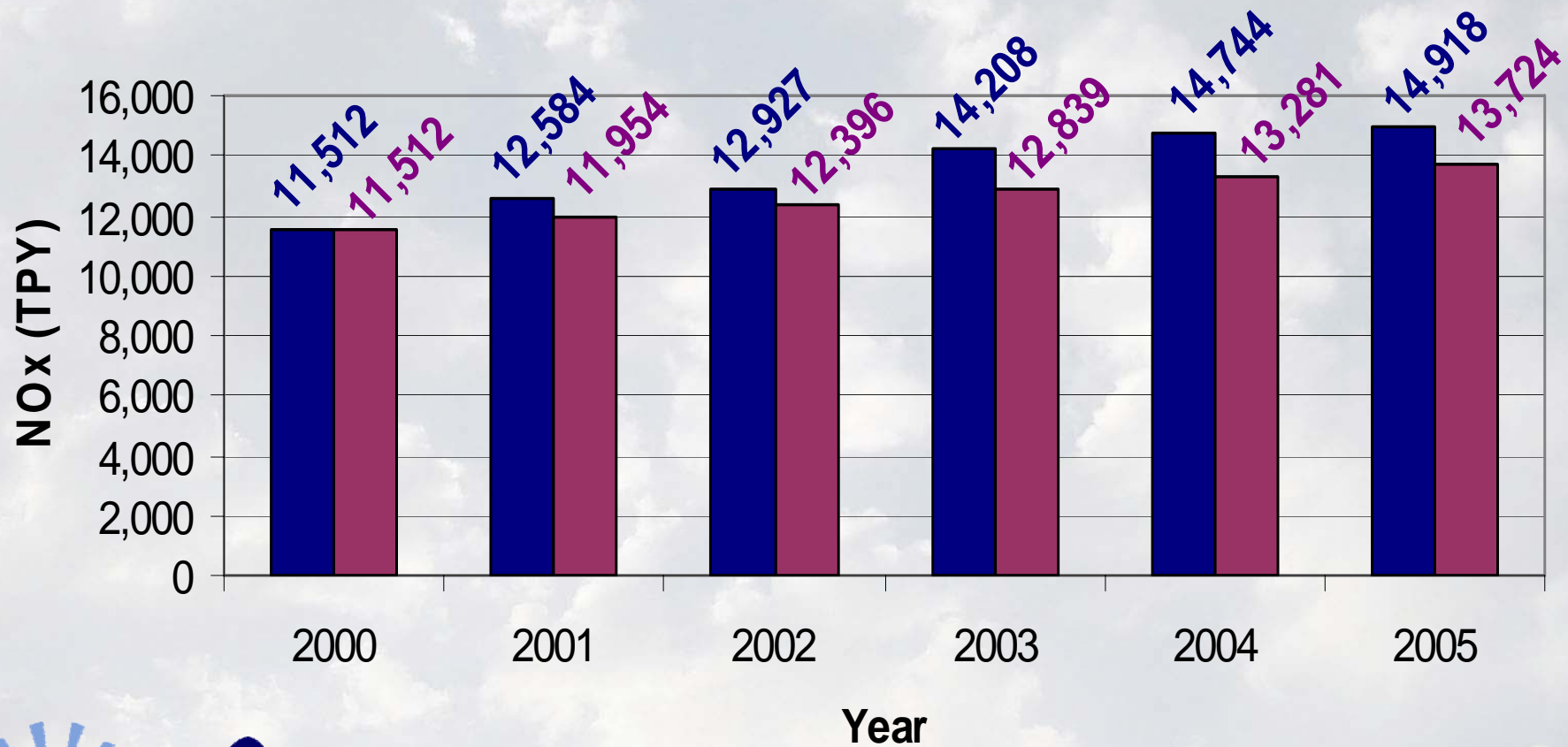
- 7,086 Transits
- 14,918 Tons of NOx
- 10% of the vessels were responsible for about 56% of the total NOx emissions
- 83% of all of the NOx emissions from container ships
- 92% of the NOx emissions from foreign-flagged vessels

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



■ Inventory NOx ■ Forecasted NOx

Demonstration Project

APL Singapore



Vessel Information

Vessel	APL Singapore
Ship type	Containership
TEU Capacity	5,108
Flag	United States
Built	1995

Engine Information

Engine	MAN B&W
Model	11K90MC-C
Type	2-Stroke
Engine power	66,398 hp

2005 Santa Barbara Impact (Source: SB Inventory)

Transits	19
NO_x rank	43 (out of 1,468 vessels)
NO_x emissions	67 Tons
PM emissions	5 Tons
SO_x 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:**
 - $\text{NO}_x = 65 \text{ TPY}$, $\text{PM} = 4 \text{ TPY}$
 - 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:*** NO_x, PM, SO_x, 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 ?