



# U.S.-Mexico Demonstration of Fuel Switching on an Ocean Going Vessel in the Gulf of Mexico

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Veracruz, Mexico  
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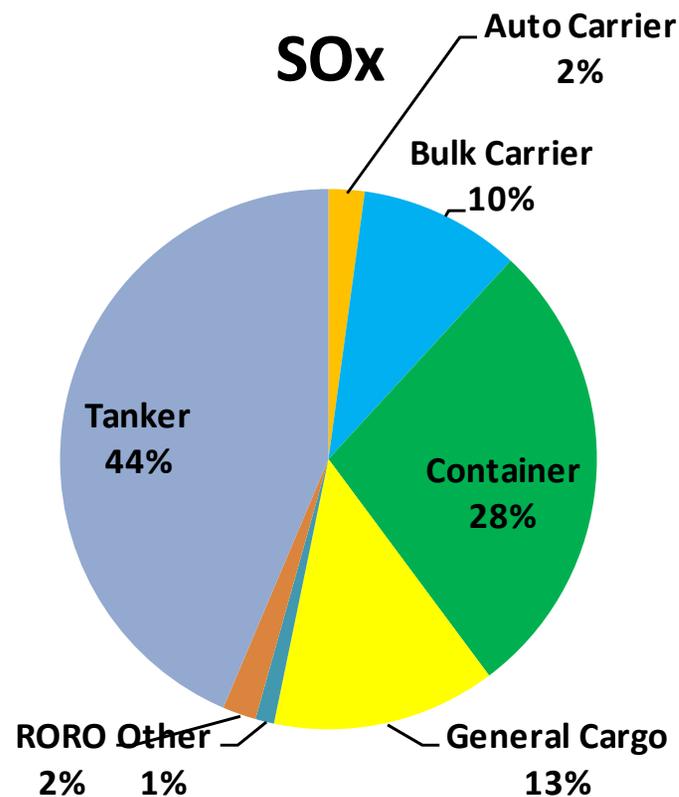
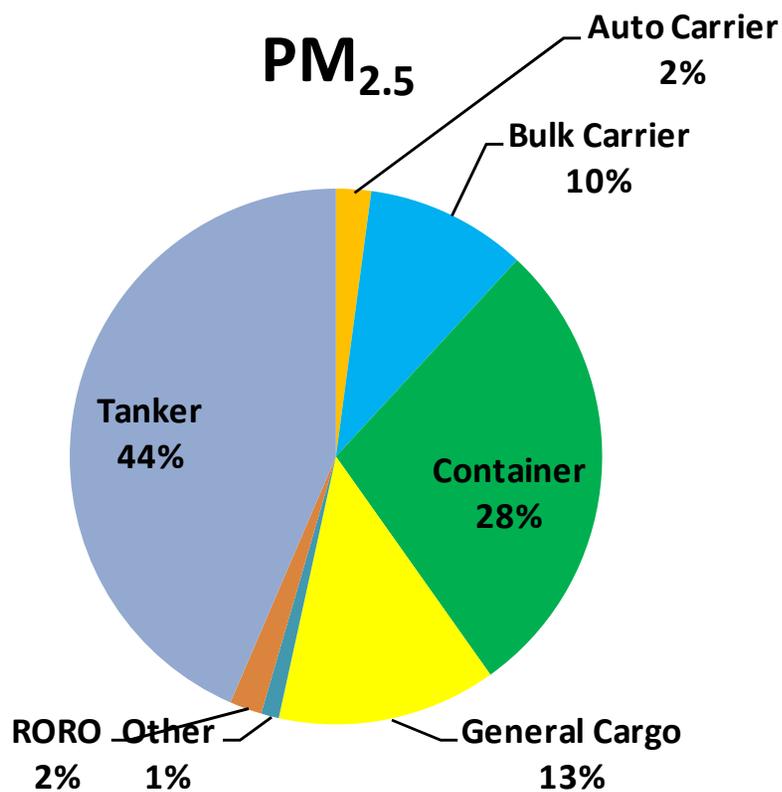
# Project Details

- ▶ **Demonstrate Switching to Low Sulfur Distillate Fuels on an Ocean Going Vessel sailing between Houston and Mexico**
- ▶ **Measure Emission Reductions**
- ▶ **Start Dialog with Mexico about Benefits of Fuel Switching at Mexican Ports**
- ▶ **Discuss with Mexican Government US commitments to establish an Emission Control Area under the International Maritime Organization Treaty for the Prevention of Pollution from Ships**

# Fuel Switching

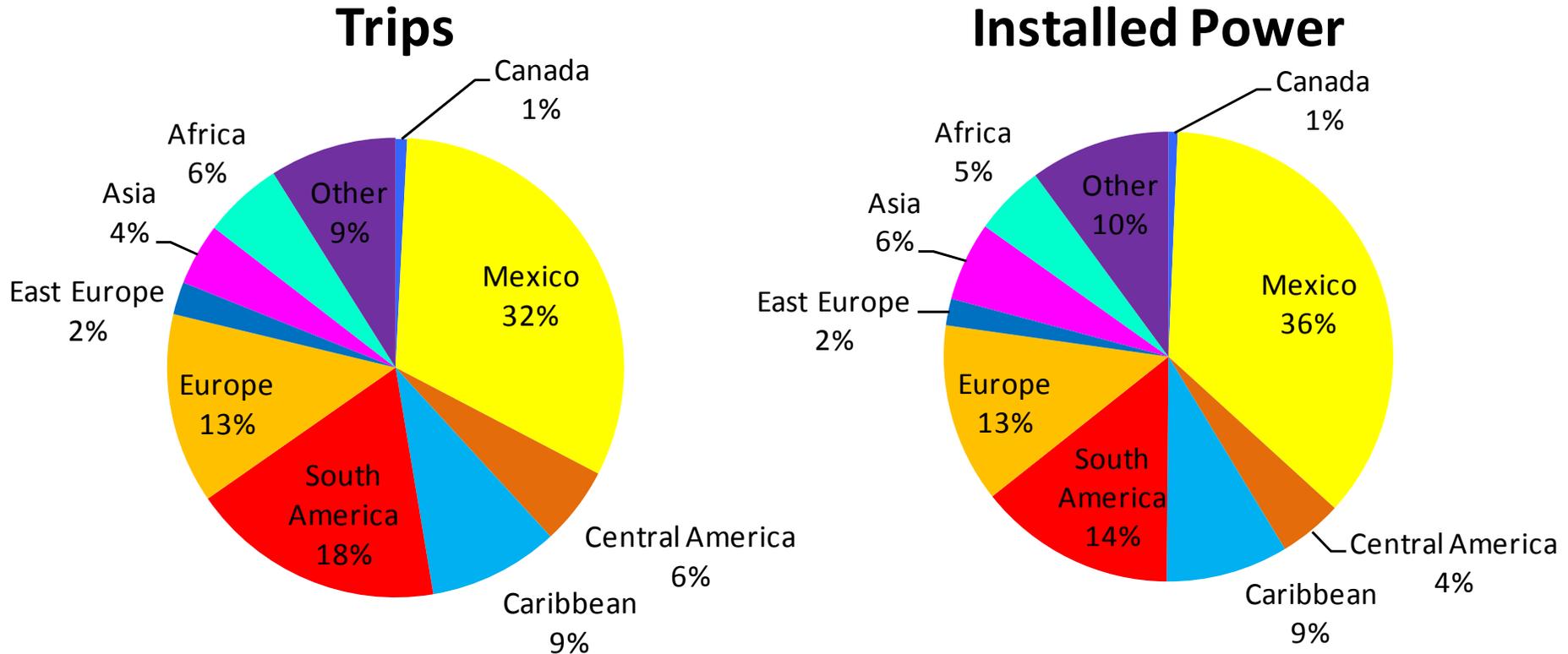
- ▶ **EPA is partnering with Port of Houston Authority to demonstrate fuel switching on two ocean going vessels of Maersk and Hamburg Süd**
- ▶ **Ocean going vessels normally operate on bunker fuel with a sulfur content between 2.5% and 4.5% (e.g., 25,000 and 45,000 ppm sulfur)**
- ▶ **Switching to low sulfur (0.1% or 1,000 ppm) distillate fuel will reduce PM emissions by 88% and SOx emissions by 96%**
- ▶ **Most ships already have additional Marine Distillate Oil/Marine Gas Oil (MDO/MGO) tanks**

# 2007 Port of Houston Emissions Estimates



Based upon 2007 Foreign Cargo Movements (USACE)

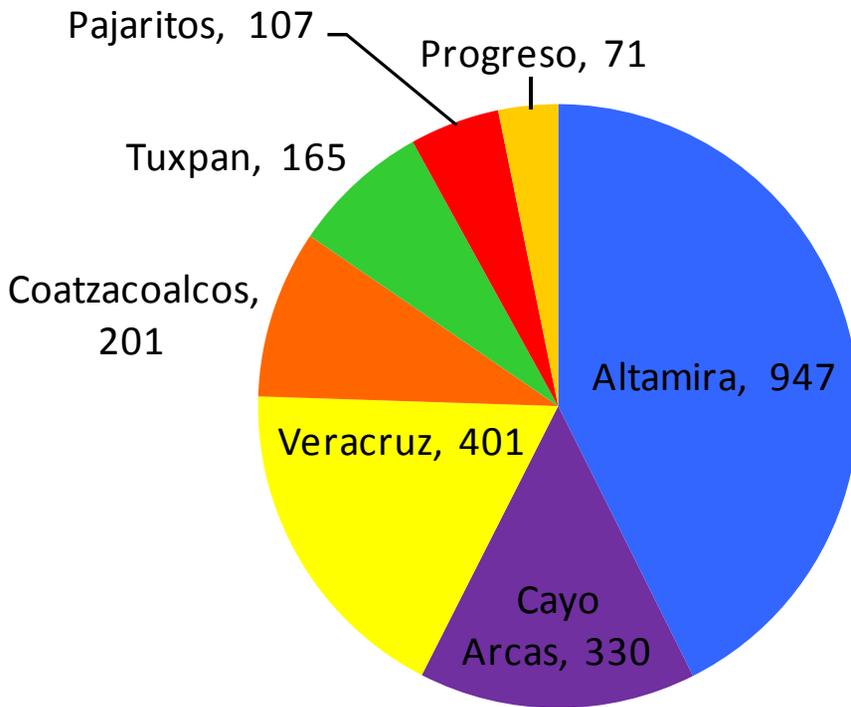
# 2007 Port of Houston Foreign Cargo Movements



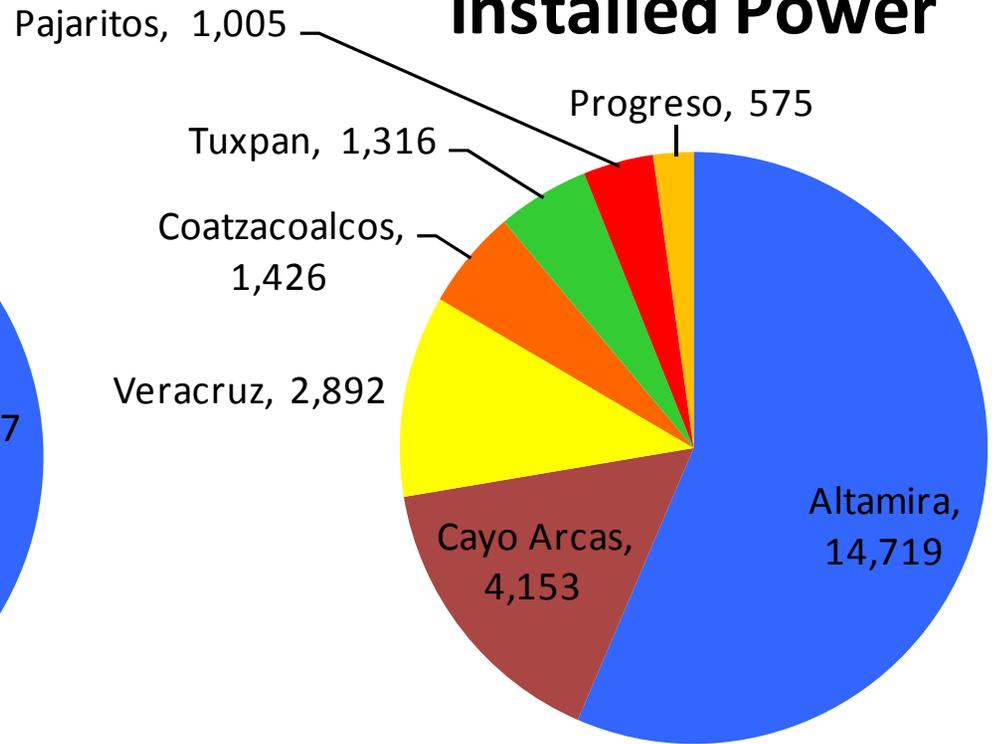
Based upon 2007 USACE Entrances and Clearances data  
Vessels that called upon the Port of Houston in 2007  
Installed Power = Total Ship Power x number of calls

# 2007 Houston to Mexico Foreign Cargo Movements

## Trips



## Installed Power



Based upon 2007 USACE Entrances and Clearances data  
Ships traveling between Port of Houston and Mexico

# Maersk Demonstration



## ■ Maersk Roubaix

- Container Ship – 1118 TEUs
- 9.7 MW Propulsion Engine
- Medium Speed Engine

## ■ Switched from Bunker Fuel (3.3% Sulfur) to Distillate Fuel (0.14% Sulfur) 24 nm from shore at Port of Houston and Port of Progreso, Mexico

## ■ Calculated Emission Reductions per call at Progreso

- 45 kg NO<sub>x</sub> (6%)
- 100 kg PM<sub>2.5</sub> (84%)
- 745 kg SO<sub>x</sub> (90%)
- Differential Fuel Cost \$1,248
- Fuel Costs Progreso to Houston \$28,318
- Represents only 4.4% of voyage fuel costs

# Hamburg Süd Demonstration

## Cap San Lorenzo

- Container Ship – 3,739 TEUs
- 28.8 MW Propulsion Engine
- Slow Speed Engine

## Emissions to be measured in port and at sea

## Estimated Emissions Reductions / Fuel Costs

### Veracruz (per call)

- 90 kg NO<sub>x</sub> (6%)
- 130 kg PM<sub>2.5</sub> (88%)
- 1,192 kg SO<sub>x</sub> (97%)
- Differential Fuel Cost \$3,273

### Altamira (per call)

- 93 kg NO<sub>x</sub> (6%)
- 137 kg PM<sub>2.5</sub> (88%)
- 1,259 kg SO<sub>x</sub> (97%)
- Differential Fuel Cost \$3,465

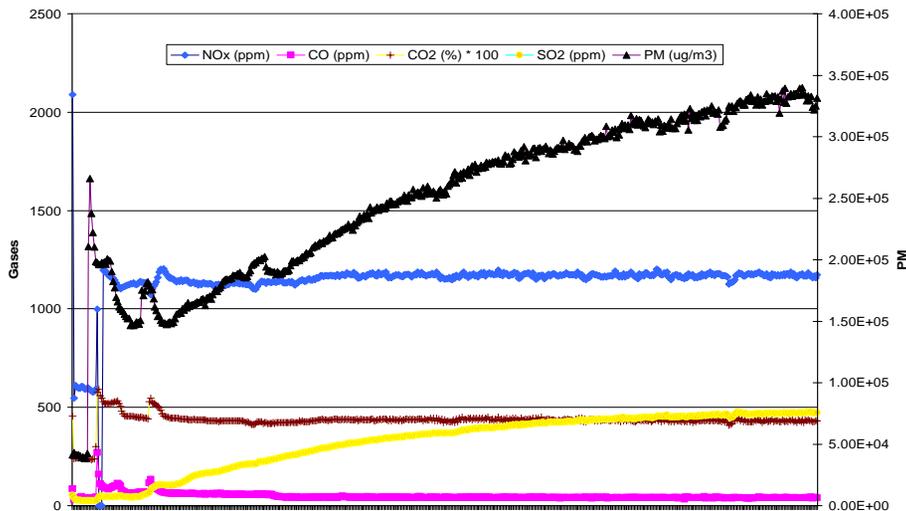
Fuel Costs for Veracruz -> Altamira -> Houston \$75,617 – Differential only 9%



# Emission Sampling

## UC Riverside will conduct measurements of in-use emissions and their reduction from fuel switching

- In compliance with the MARPOL NO<sub>x</sub> Technical Code (NTC) and other protocols
- Measure emissions on both high- and low-sulfur fuels at both specific engine loads and transient operations, main and auxiliary engines

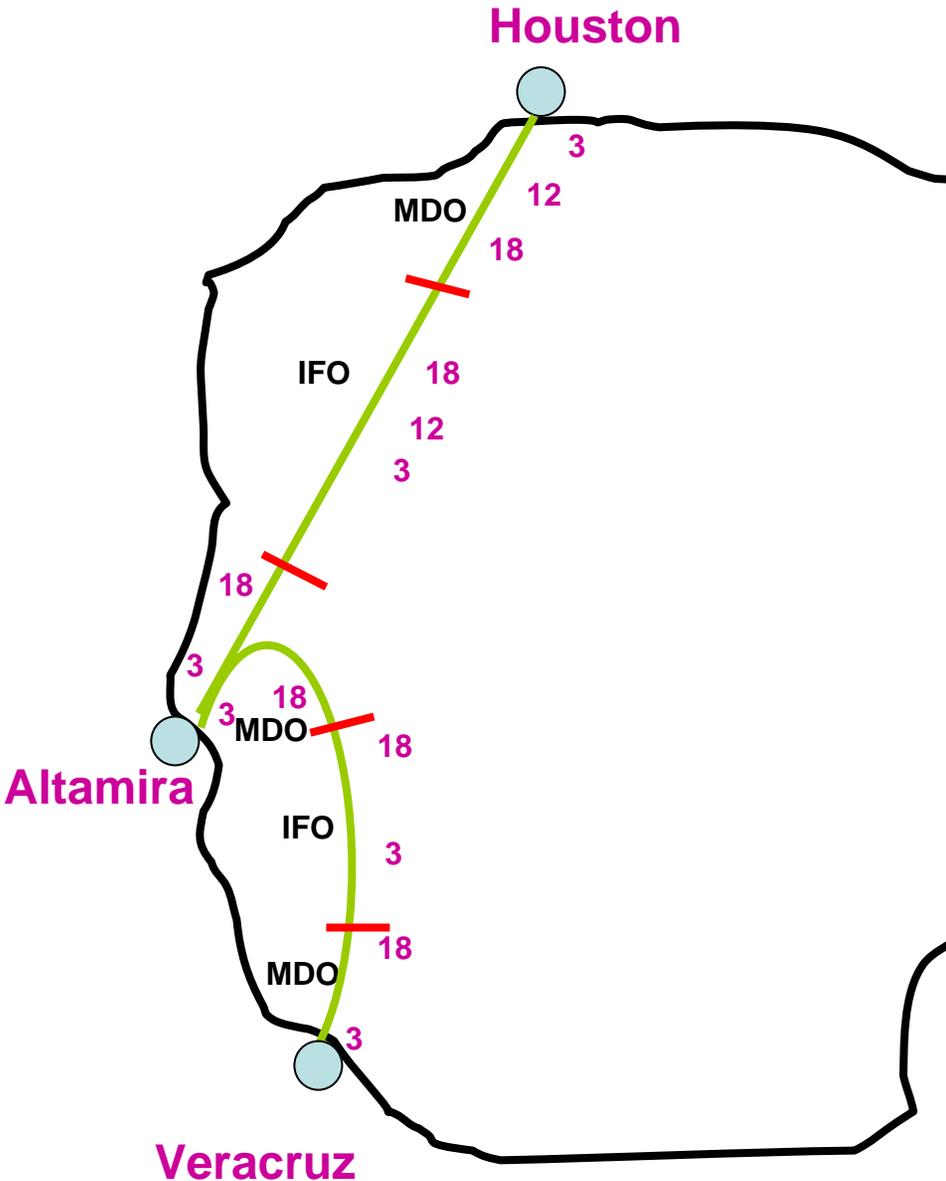


Example of measured gas, PM emissions during a fuel switch

- Measure all pollutants of interest:
  - NO<sub>x</sub>, CO, CO<sub>2</sub> continuously
  - PM continuously and speciated PM (EC, OC) with discrete filter samples
  - Measure SO<sub>2</sub> and calculate SO<sub>x</sub> from fuel measurements
- Report on engine performance, emission reductions, and implications for Gulf ports

# Fuel Switching Project Draft Vessel Stack Monitoring Plan

Docking/leaving Veracruz,  
Approaching/docking  
and leaving Altamira and  
Approaching/docking Houston



Fuel	Speed (knots)		
IFO	18	12	3
MDO	18	12	3

Fuel Switch Point — (24 nm from shore)

# Fuel Switching Issues

## ▶ Fuel Cost

- Currently MGO costs ~\$210/MT more than HFO

## ▶ Tank Size

- MDO/MGO tank size may be an issue – may require larger MDO/MGO tanks or converting some HFO tanks for MDO/MGO

## ▶ Fuel Switching Procedure

- Boilers must be slowly turned down to prevent fuel system problems when switching fuels
- Typical fuel switching takes from ½ to 1 hour

## ▶ Low Sulfur MGO Availability (0.1% Sulfur)

- Currently available in Houston
- Not currently available anywhere else along the test vessel routes

## ▶ Port Programs

- Port of Houston to pilot a fuel switching program with Maersk