



**HOLLAND-AMERICA
LINE**

Holland America Line

Environmental
Management And the
Signature of Excellence

FFCA Conference
May 16, 2007

Holland America Line: 133 Yrs Young



- ◆ Incorporated Rotterdam 1873
- ◆ WWI: 6 ships lost
- ◆ WWII: 25 ships to 6
- ◆ 1970's Transatlantic air service grows
- ◆ 1989 Carnival Corporation Purchase
- ◆ 1990's to 2006 – growth from 3 vessels to 16
- ◆ 2007 – Divestiture of Wind Star



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The Holland America Line Fleet 13 Fantastic Ships



- 750 – 2,000 guests
- 45,000 to 85,00 tons
- Caribbean, Alaskan, European and World Itineraries

Emission Reduction Efforts: A multi-pronged approach

- ◆ Technology
 - ◆ Shore Power
 - ◆ Sea Water Scrubber
- ◆ Conservation



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Conservation Through Collaboration & Innovation



Environment
Canada

Environnement
Canada



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Plugging into Shore Power

Reducing dockside emissions and conserving fuel



In collaboration with:

- ◆ U.S. Environmental Protection Agency
- ◆ Puget Sound Clean Air Agency
- ◆ Port of Seattle
- ◆ Seattle City Light
- ◆ ABB Marine
- ◆ Cochran Electric
- ◆ Earl's Marine Closures & Services



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Plugging into Shore Power

Shore-side Installations



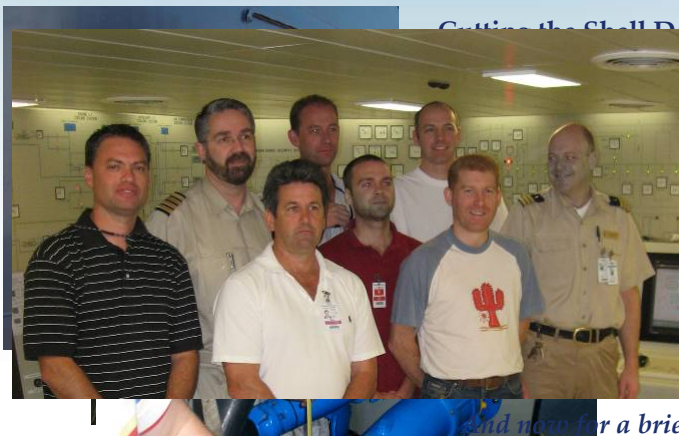
Preparing the Site...
Installing the Transformer...
Spinning the Cable...
Installing the Jib-Crane.



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Plugging into Shore Power

Shipboard Modifications



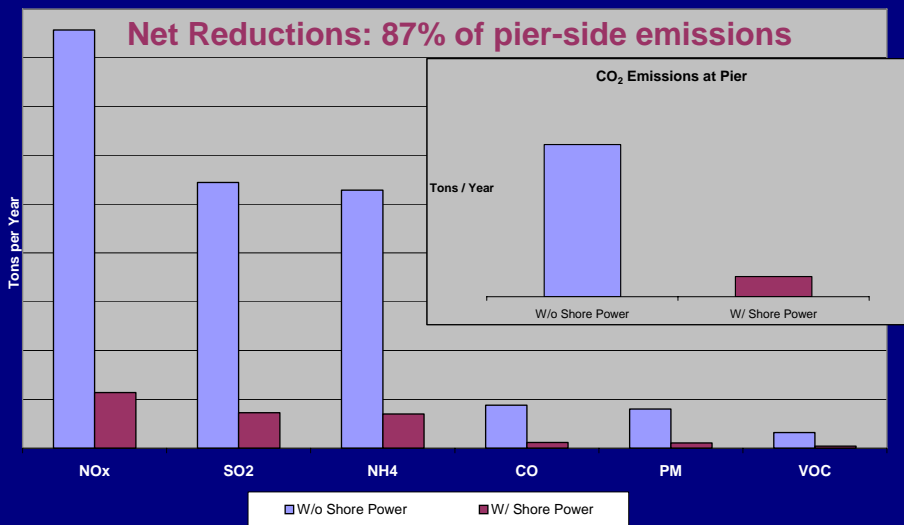
Cutting the Shell Door...
The Switching
AS Dedicated
Team Makes it
Happen...
board...

And now for a brief demonstration.



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2007 Shore Power Emissions Reduction
42 Port Calls - Vista Class Ships



Emissions Scrubber Feasibility Study

Exploring Technology for Cleaner Air

In collaboration with:

- ◆ Environmental Protection Agency
- ◆ Environment Canada
- ◆ Puget Sound Clean Air Agency
- ◆ Port of Seattle
- ◆ Port of Vancouver
- ◆ Caterpillar



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Emissions Scrubber Feasibility Study

Exploring Technology for Cleaner Air



Phase I: Scope & Feasibility Study

- Research & Design
- Report November 2006

Phase II: Fabrication & Installation

- Installation – Spring 2007
- Operational Testing
- Final Report June 2008

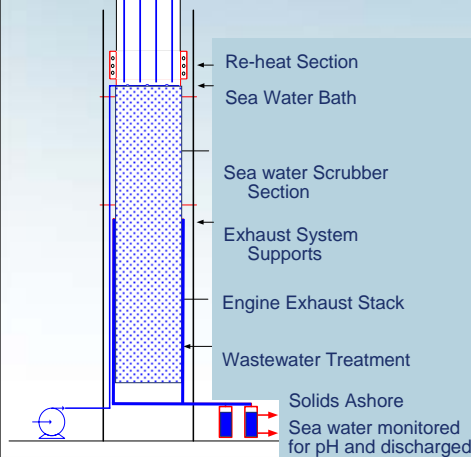


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Scrubbed air exhaust

Seawater Scrubber

Applying Shore Technologies at Sea



- Exhaust routed through seawater bath.

“Scrubbing” benefits:

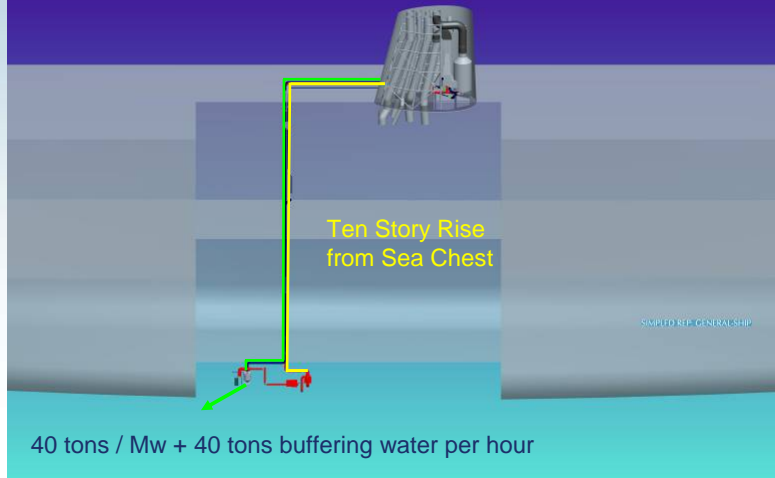
- Almost complete elimination of SO_x emissions
- Substantially reduces particulate matter
- Decreases in NO_x emissions

- Benefits at sea and in port.



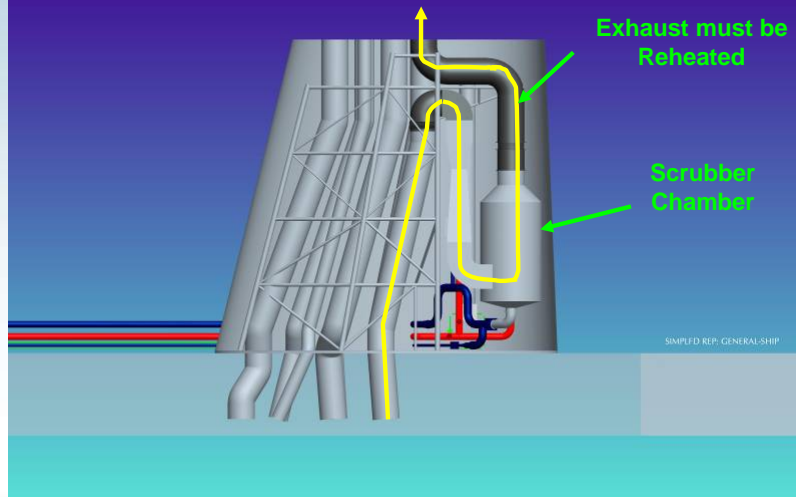
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Sea Water Through the Scrubber



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A Closer Look



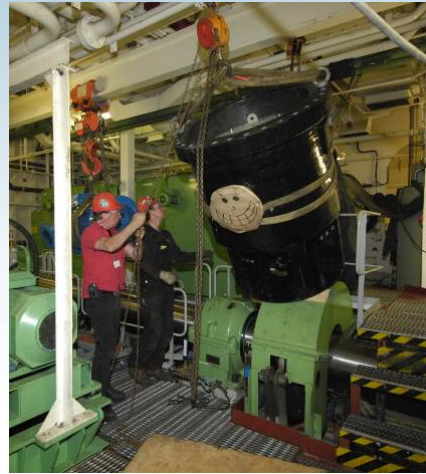
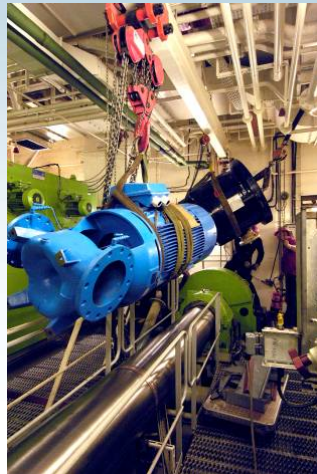
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Installing the Sea Chest...



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Pumps, Pipes & Fittings...



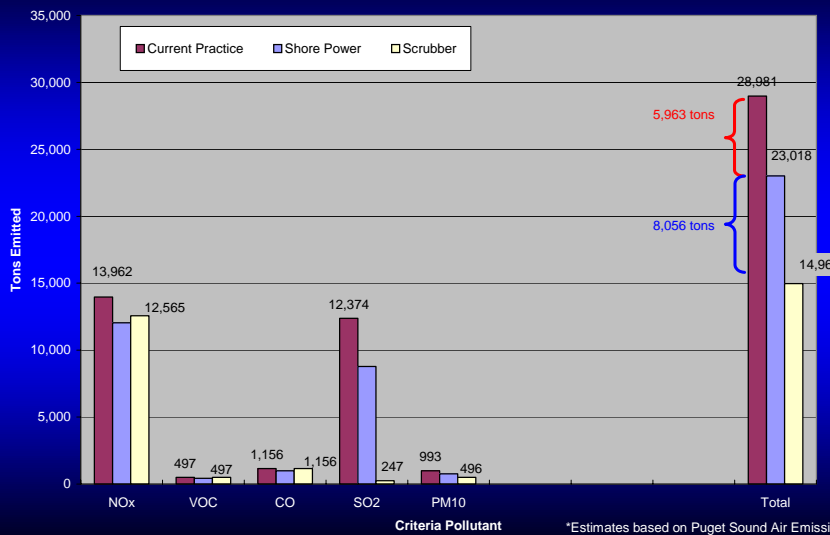
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A Tight Fit in the Funnel...



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Scrubber vs. Shore Power



*Estimates based on Puget Sound Air Emissions Inventory, Capture Efficiencies applied to OGV's fleet wide



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Challenges Ahead:

- ◆ Complete installation and commissioning
- ◆ Capture and interpret the data
- ◆ Navigate the regulatory framework
- ◆ Adapt lessons to future installations



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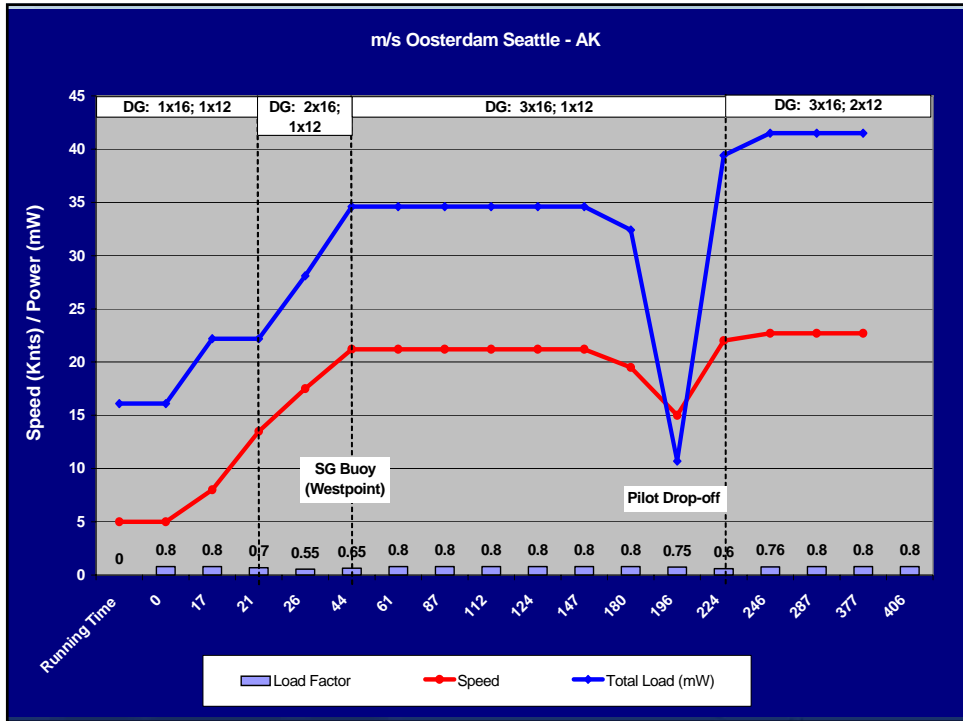
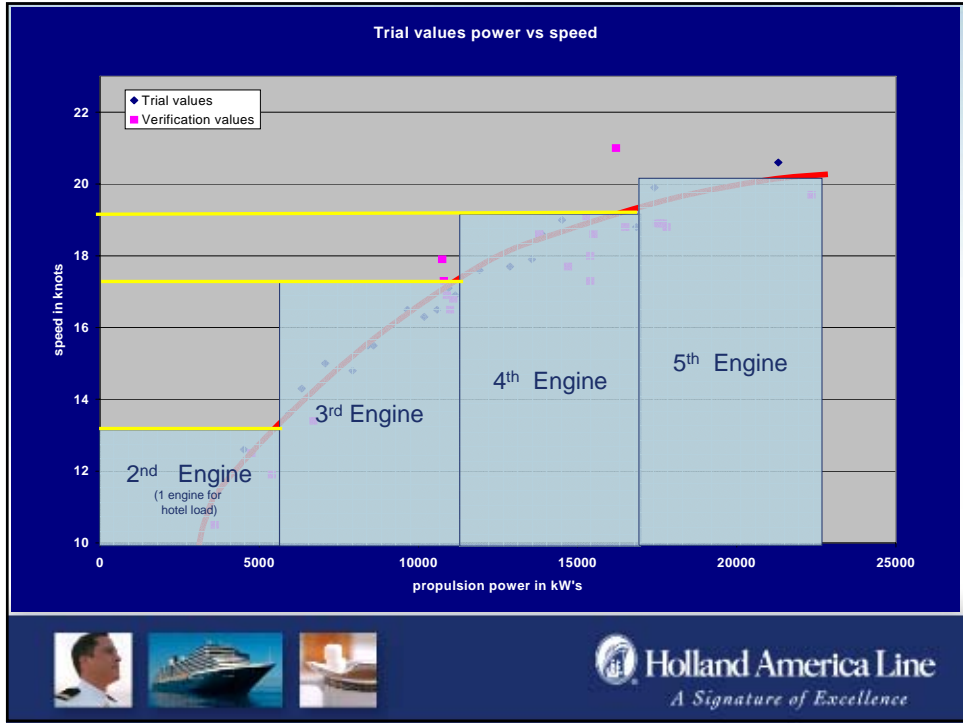
Conservation: The Challenge – Reduce Fuel Consumption by 2%

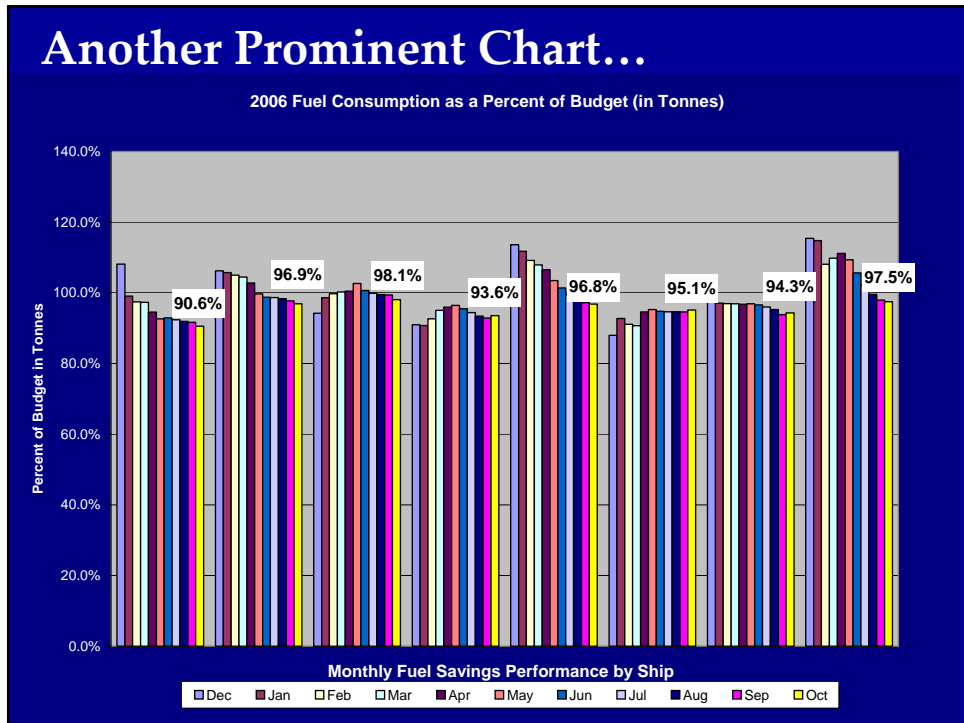
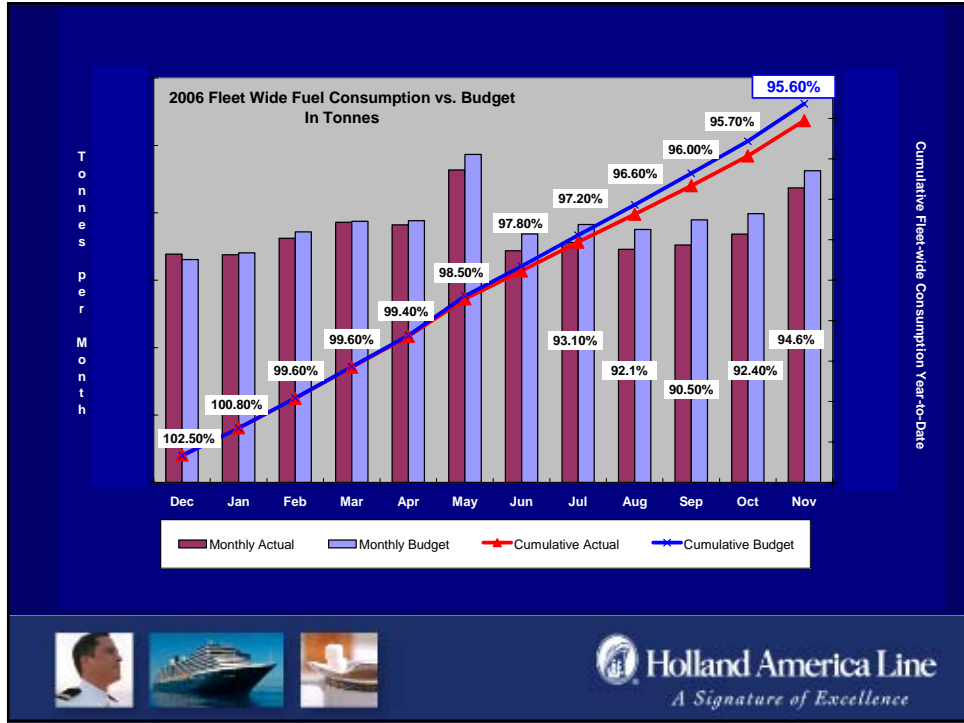
Some Key Factors:

- ◆ Diesel Generators are at maximum efficiency at $\approx 80-85\%$ of load
- ◆ Propulsion follows the *Schroef Wet*:
 - ◆ The Propeller Law: $2 \times S$ requires 2^3 fuel
- ◆ Schedule and itinerary must be met



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Key Lessons Learned...

- ◆ Optimize power plant choices
- ◆ Exercise arrival / departure discipline
- ◆ Behaviors matter
- ◆ Measuring the right thing, even imperfectly, yields results
- ◆ Don't underestimate where creative minds will take you



2007 and Beyond...



- ◆ Reinforce Continuous Improvement culture
- ◆ Adopt technology solutions where appropriate
- ◆ Engage with stakeholders to find meaningful solutions

