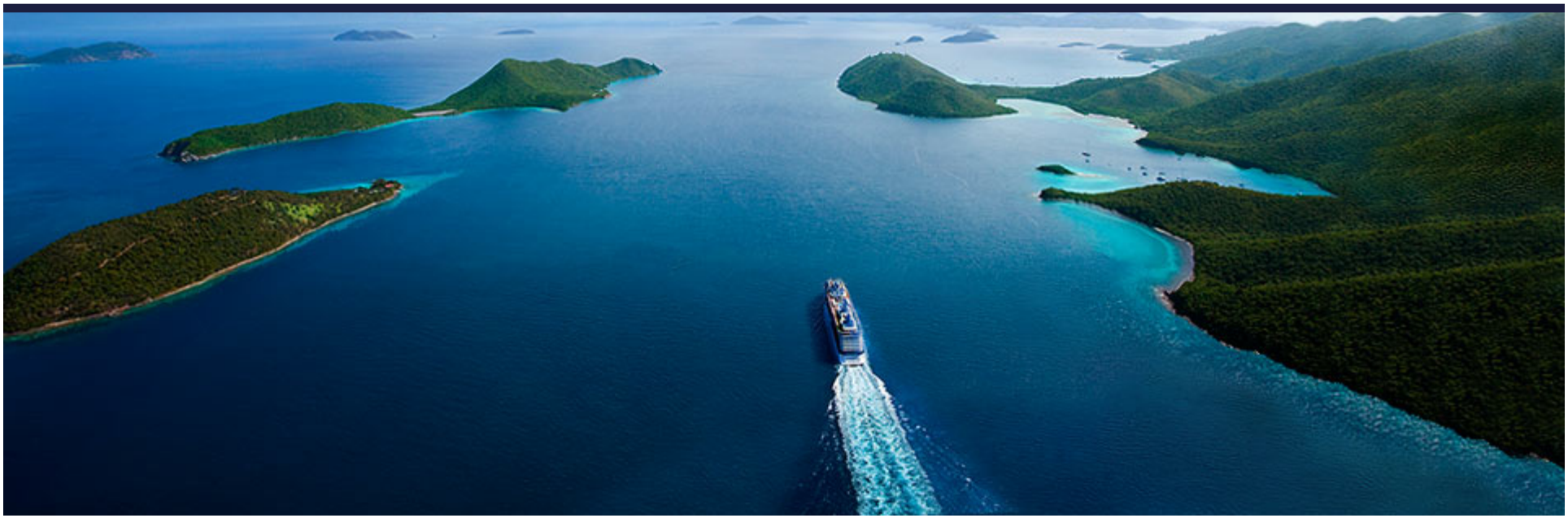
LESSONS LEARNED FROM GREENING CRUISE VESSELS

Jamie Sweeting
Vice President, Environmental Stewardship
and Global Chief Environmental Officer
Royal Caribbean Cruises Ltd.



Royal Caribbean's approach to minimizing environmental impacts

- Energy and Air Emissions
- Water and Wastewater
- Waste and Chemical Management
- Conservation, Destinations and Education

Energy and Air Emissions

- In 2010, our ships reduced fuel consumption by 4.7% per available passenger cruise day (APCD) over 2009 levels
- This corresponds to just over 25,000 fewer metric tons of fuel than planned
- Since 2005, we have reduced our fuel consumption by 13.6% per APCD

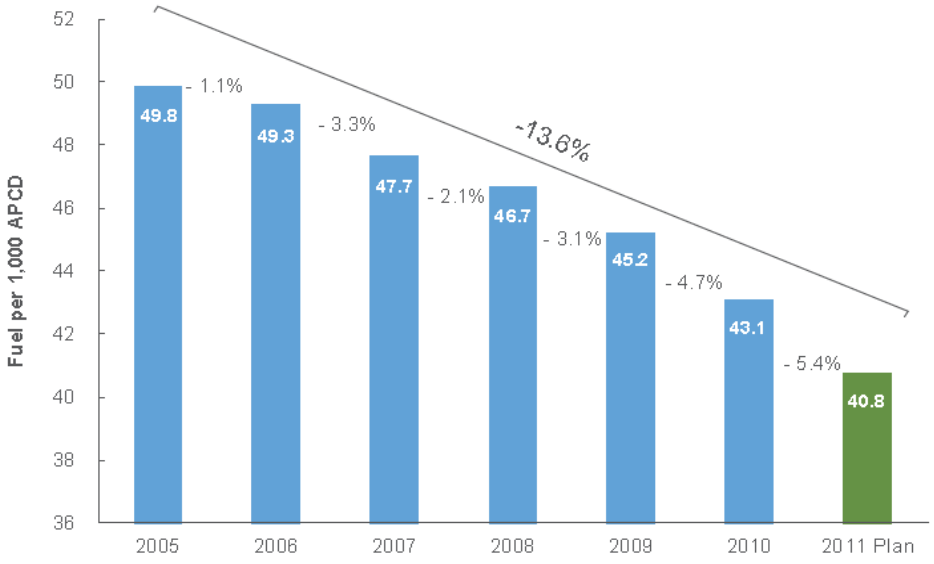


Figure 1 – Fuel Consumption per 1,000 APCD

Generate cleaner and more efficient power

Exhaust Scrubber

Optimize Engine Overhaul Schedule

Waste Heat Recovery

Measures to improve energy efficiencies

- Improved hydrodynamics
- Propeller, propulsion and hull design
- Adjusting ship speed to increase fuel efficiency

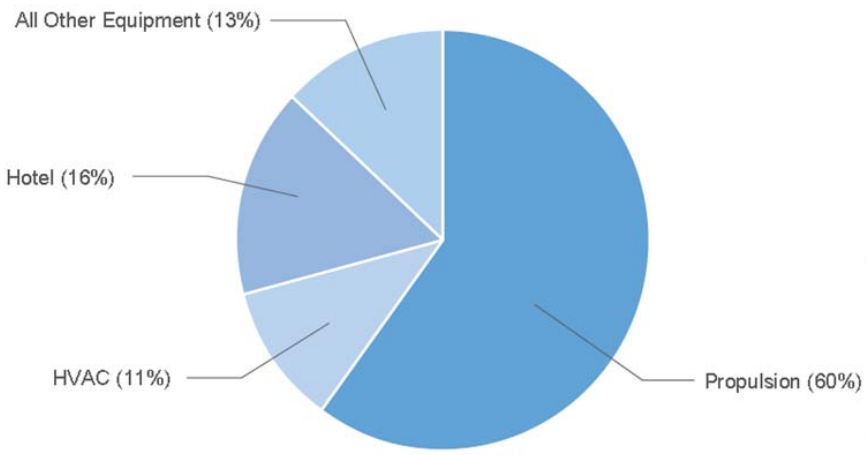


Figure 2 – 2010 Fuel Consumption Drivers

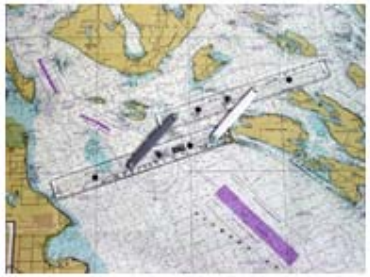
- Itinerary planning to optimize timing route, speed, and distance traveled
- Utilizing waste heat produced by our engines (e.g. heating water for showers, galleys, and preheating fuel burned in engines)
- When operating in cold climates, utilizing cold seawater to chill water, rather than running air-conditioning compressors, saving 4-5 MT fuel/day
- Application of solar films/window tinting, solar panels, advanced energy efficient glass
- Replacing halogen and incandescent bulbs with LED and compact fluorescent lights

Optimize propulsion

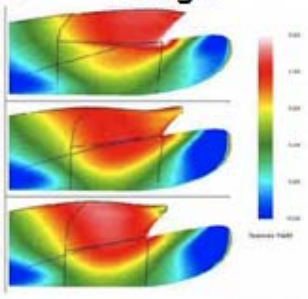
Pod & Rudder / Propeller Design

Hull Coating & Maintenance

Speed, Route, & Trim Optimization



Advanced Bulbous Bow Design



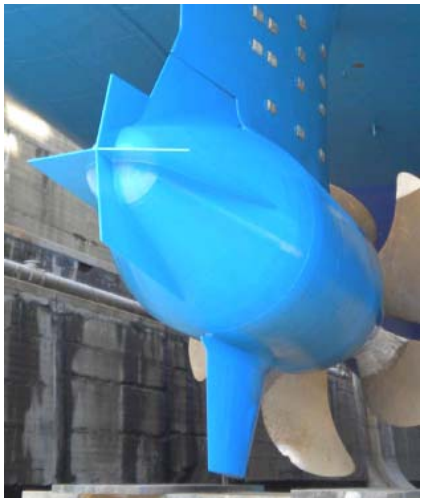
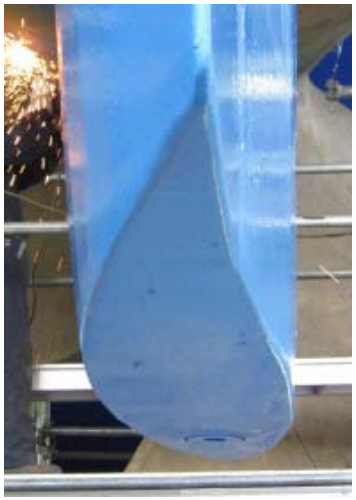
Hull cleaning and maintenance

- Biofouling degrades underwater hull conditions
- Results in more power needed for propulsion to maintain service speeds
- Biofouling varies from region, ship speed and type of under water coat used

Optimize propulsion - initiatives

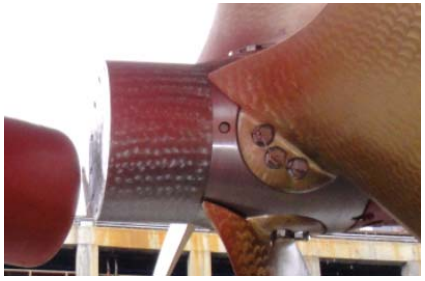
- Hull Cleaning & Maintenance
  - Approx.10% improvement in propulsion efficiency immediately after dry dock
- Radiance Azipod Modification
  - Hydrodynamic efficiency increased via aft cone and fin shape
  - Approx. 3.5% improvement in propulsion efficiency
- Vision Prop & Rudder Re-design
  - Improved hydrodynamic flow between propeller and rudder
  - New blades optimized for 18 knots rather than 24
  - Early test results show a 5% improvement in propulsion efficiency

Radiance Azipod Modification

Vision Prop & Rudder Re-design





Reducing emissions - exhaust gas scrubbers

How scrubbing works

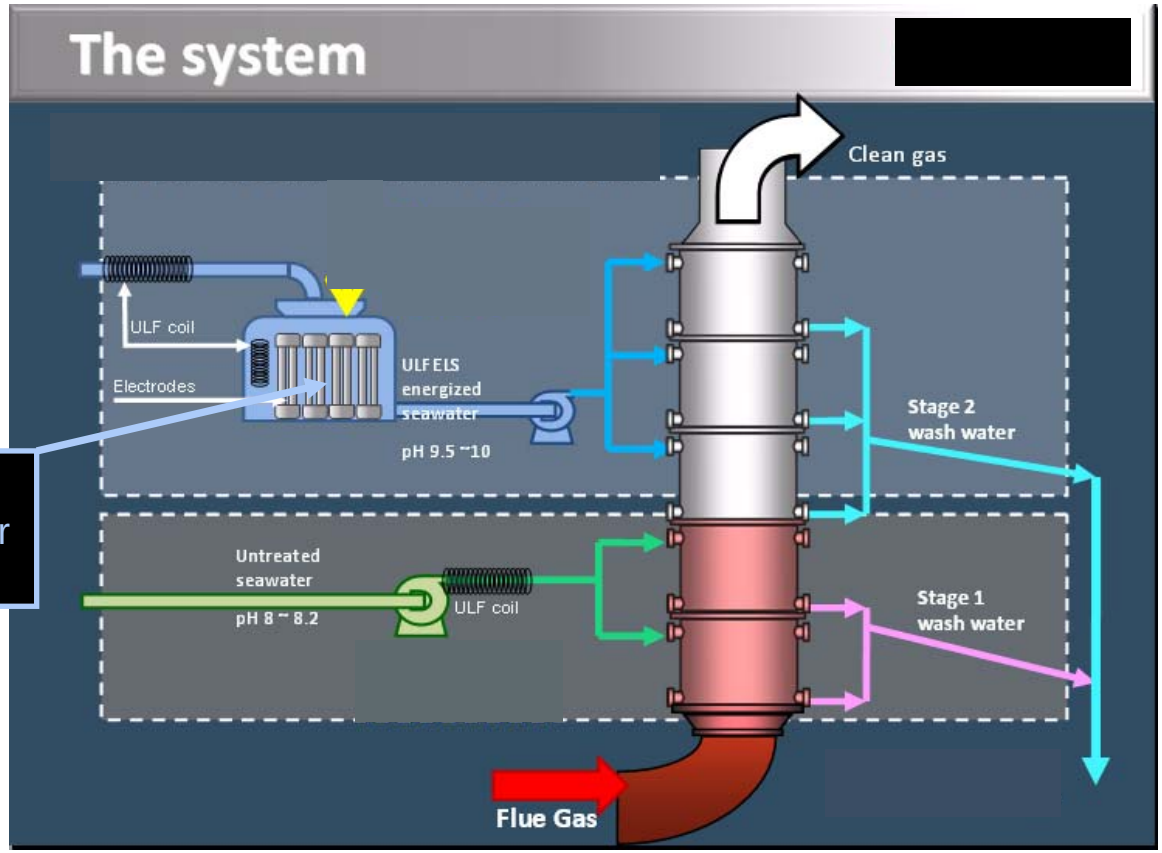
Uses a method of charging sea water droplets, changing pH, capturing particles, breaking hydrogen bonding and turning gases such as SOx into non-air polluting substances.

SOx → Sulfates or Sulfur + Oxygen

Reducing emissions - exhaust gas scrubbers

The Ecospec System

- Installation on *Independence of the Seas*
- First “test run” was Sept 23, 2011

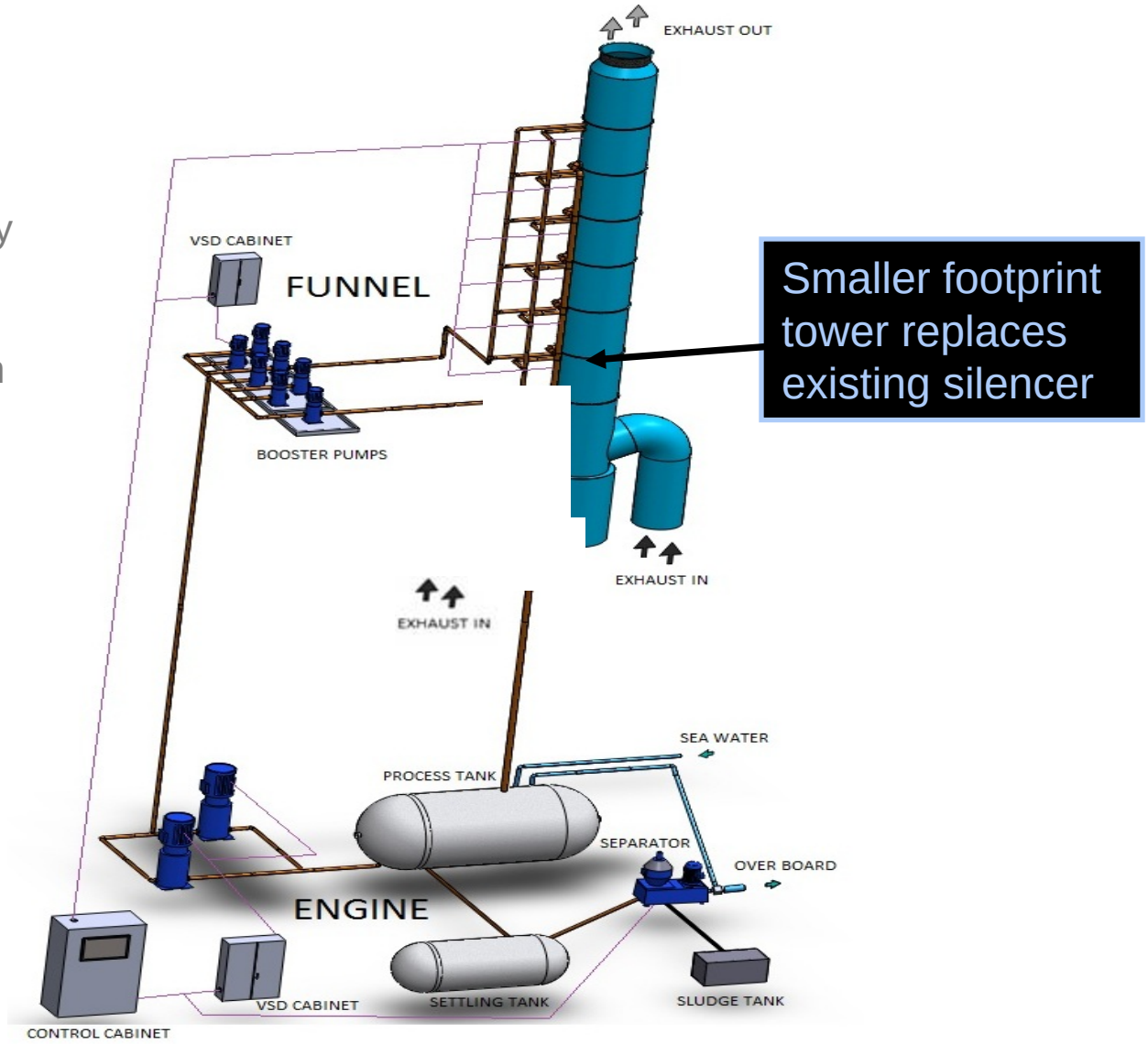


Electrodes change water pH

Reducing emissions - exhaust gas scrubbers

The Greentech System

- Installation began on Liberty on Oct 19, 2011
- First test run is expected on March 3, 2012



Wastewater treatment
Advanced wastewater purification systems

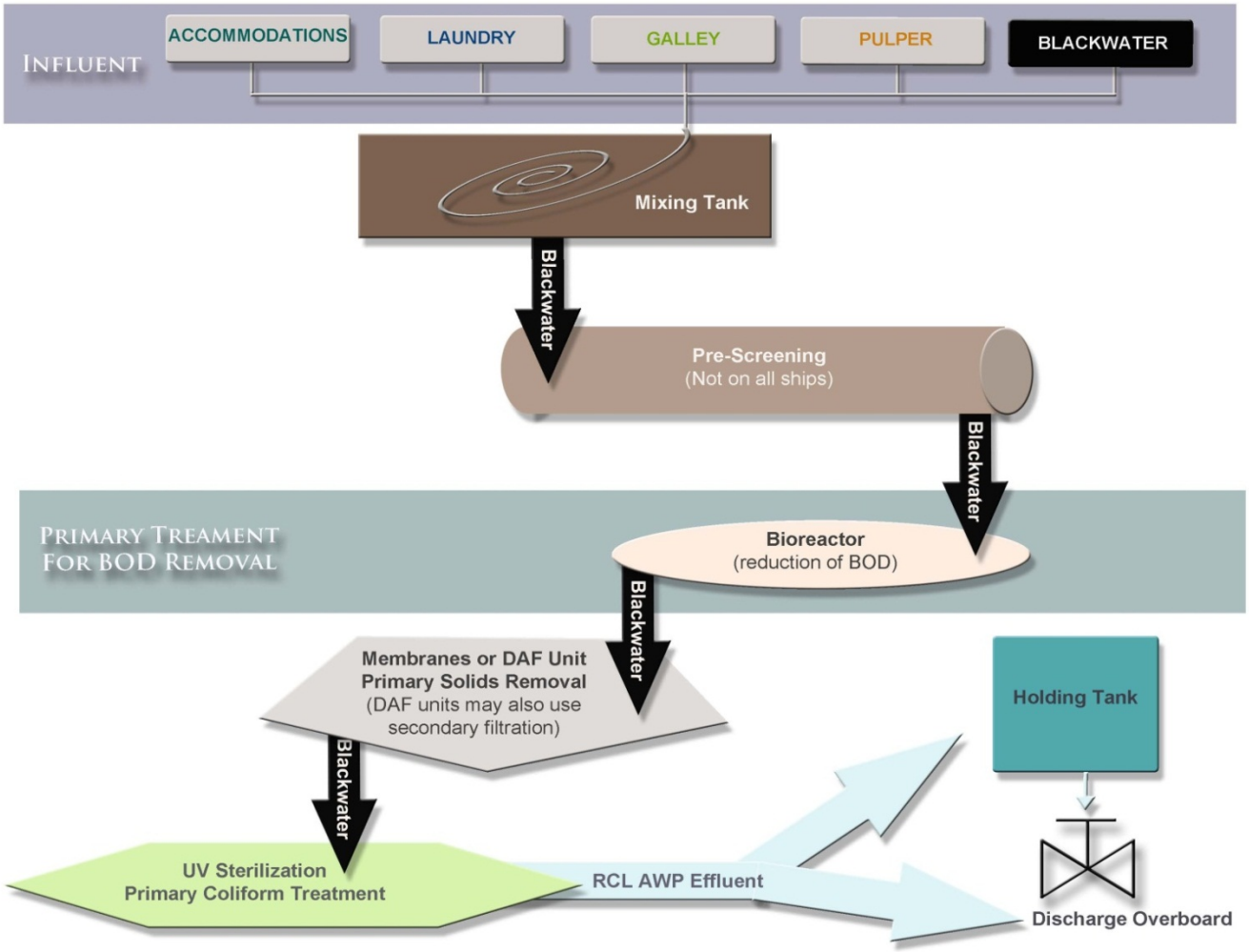
- Installing Advanced Wastewater Purification (AWPs) systems and treating gray and blackwater prior to discharge into the Ocean

- These systems produce an effluent that is cleaner than what is required by international sewage regulations and what is discharged from most leading municipal wastewater treatment facilities

- We currently have 25 of 32 installations completed and within the year will have 31 out of 33 ships completed

- Evidence of effluent quality is confirmed by routine onboard sampling and third party testing

Overview of AWP system



Waste Management

- One of the key principles of our environmental program, Save the Waves, is *Reduce, Reuse, Recycle*
  - We contract with suppliers to reduce packaging sources and use more sustainable materials
    - For example, we utilize larger containers with concentrated products to minimize waste, reduce packaging and transportation impacts (environmental & economic)
  - We recycle and reuse approximately 40% of all waste landed globally – upwards of 90% in S. Florida homeports.
  - All garbage is hand sorted and segregated onboard allowing the recycling of:
    - glass, paper, cardboard, aluminum and steel cans, scrap metal, incinerator ash, plastics, toner cartridges, wooden pallets, batteries, fluorescent lamps, electronics, plastic wrap and kitchen oil

Waste Management

- Various equipment are used to enable the most recycling with limited storage space
  - Depressurizers for releasing residual liquids from aerosol cans
  - Compactors for processing plastic, cardboard and metal
  - Glass crushers
  - Fluorescent lamp crushers to separate mercury from recyclable items such as aluminum and glass

- Each ship is also equipped with climate controlled storage facilities that allow them to hold recyclables until appropriate and approved recycling hubs are reached

Questions? Comments?

Email: JSweeting@rccl.com