American Association of Port Authorities
Cruise Seminar, February 5-7, 2008
San Francisco, CA

Tom Dow
Vice President, Public Affairs
Carnival Corporation & plc
Criteria for a Successful Shore Power Project

- Availability of an adequate supply of electricity at a reasonable cost.
- Frequency of calls by cruise vessels equipped to connect to Shore Power.
- Availability of the same dock and pier facility for these vessels for every call.
- Adequate dock and uplands space for equipment.
- Willing partners including – utility, port and government agencies.
Power is transmitted from an onshore substation equipped with a dual voltage transformer that will supply power to 11kV or 6.6kV class ships.

Internal shore side monitoring and protection is achieved with protection relays to insure safety and protection of both ship and shore electrical systems.

Flexibility to connect either 11kV or 6.6kV ships is achieved by two independent secondary breakers with Kirk-Key interlocks.

Power is carried to the ship through five flexible "Ship Cables" routed through a grounding switch.

This grounding switch works in conjunction with the ships automation system to ensures safety and reliability during the cable handling from shore to ship.
Cruise Ship Shore Power Project
Juneau, Alaska
2001
First High Voltage Shore Power Connection for Cruise Ships
Cruise Ship Shore Power Project

Power Cables
AmeriCable 350 KCMIL 15kV SHD-GC CPE

15kV 350 MCM Cu Conductor
Grounding Conductor
EPR Insulation
CPE Jacket
Cruise Ship Shore Power Project
Juneau, Alaska
Cruise Ship Shore Power Project
Juneau, Alaska

Electrical Energy Sales In Juneau, Alaska

- Ship Hotel Electrical Loads 7 to 11 MW @ 6.6 KV or 11 KV and .83 to .86 PF
- Total Annual Shore Power Consumption is 11 - 12 GWH Annually
Cruise Ship Shore Power Project
Juneau, Alaska

Design & Construction Timing

- Notice to Proceed Given by Princess
  December 1, 2000

- On Line Early June 2001
Cruise Ship Shore Power Project
Seattle, Washington
Cruise Ship Shore Power Project
Seattle, Washington

Electrical Energy Sales In Seattle, Washington

Transformer Capacity:
- 32.50 Megawatts.
- Total annual consumption 7.0 – 8 GWH.

Dual Service Delivery (Secondary) Voltage:
- 6.6kv and 11kv depending on class of ship.
- Both voltages are not used at the same time.

In Seattle the Primary Voltage is 27kv.
Cruise Ship Shore Power Project
Seattle, Washington

T-30
Transformer, Main & Secondary Metering Equipment
Cruise Ship Shore Power Project
Shoreside Installation

Power Cable Winch
Cruise Ship Shore Power Project
Shipboard Installation

Shipboard Control Panel
Cruise Ship Shore Power Project
Shipboard Installation

Shipboard Cables Connections

- 4 Power Connectors (Callenberg)
- 1 Neutral Connection (Callenberg)
- 2 Control (Cannon Plug)
- 1 SCADA (Cannon Plug)
- Standardization of Cable Connections
Cruise Ship Shore Power Project
Holland America Line - Seattle

Design & Construction Timing

- Preliminary Design Completed
  December 27, 2005

- Construction Began February 21, 2006

- Completed June 27, 2006
Cruise Ship Shore Power Project
Seattle, Washington

Festooning System
- Juneau, AK
- Seattle, WA
- San Francisco, CA
- Los Angeles, CA
- Long Beach, CA
- San Diego, CA
- Brooklyn, NY Red Hook
SEAWATER SCRUBBER SYSTEM
Holland America Line ms Zaandam
BP - Krystallon Seawater Scrubber System

The BP - Krystallon technology aboard the ms Zaandam is being supported by the U. S. Environmental Protection Agency; Environment Canada; the Puget Sound Clean Air Agency; B. C. Ministry of the Environment and the B. C. Clean Air Research Fund; the Ports of Seattle, Washington, and Vancouver, British Columbia; and BP. Along with Carnival Cruise Lines, Princess Cruises and Costa Cruises.
Scrubber Installation and Early Operation

In dry dock and on the run......

- Scrubber unit installed at Victoria Shipyard – April 8-21, 2007
- Piping and instrumentation installed during ship operations – April 21 through August 11, 2007
- Early scrubber operations in mid-August to mid-October were constrained to the times when the ship was “at sea.”
- Final commissioning is expected in first quarter 2008.
Sea Water Scrubbing on the ms Zaandam
A Schematic Drawing

Sea chest for water intake

Sea level

Wash water discharge

Reaction water

Scrubber wash water
Wash Waste Discharge Monitoring

Two main elements

- **Continuous monitoring.** pH, turbidity, PAHs, temperature, and dissolved oxygen.
- **Periodic monitoring.** Includes the constituents listed above plus total and dissolved metals.
Engine Emission Monitoring

Two main elements

- **Continuous monitoring.** Cascade Technologies CT 1000
- **Periodic monitoring.** A “stack test” by Environment Canada
HYDE BALLAST WATER TREATMENT
2000 Hyde Marine’s first fully developed BWT system installed aboard the “Regal Princess”.

2001 two additional Hyde Marine BWT systems installed aboard “Sea Princess” and “Star Princess”.

Testing conducted 2001-2003
2003 The first Hyde GUARDIAN system installed aboard the cruise ship “Coral Princess”.

2004 The “Coral” Hyde Guardian system is successfully tested to meet the USCG STEP and IMO standards.

IMO Type Approval and STEP shipboard testing will begin aboard Coral Princess March 2008.

Lloyds Register & MCA (UK) will approve tests to IMO G-8 guidelines.


Spring 2008 – Coral Princess to be first ship accepted by USCG into STEP program.

Fall 2008 – Type approval per IMO issued by Lloyd’s Register on behalf of MCA.
Hyde GUARDIAN™ System

CORAL PRINCESS

Disk Filter

Medium Pressure UV
Hyde GUARDIAN™

- Straightforward and fully automatic design using disk filtration and UV.
- Ballast water treated with filtration and UV during ballasting and with UV again during deballasting.
- Does not require chemicals and does not produce active substances.
Hyde GUARDIAN™ System

Hyde Guardian Ballast Water Treatment System
Hyde GUARDIAN™ System

BALLAST MODE

SEA CHEST ➔ BALLAST PUMP ➔ DISC FILTRATION ➔ UV DISINFECTION ➔ FILTER BACKWASH ➔ OVERBOARD

BALLAST TANKS
Hyde GUARDIAN™ System

DE-BALLAST MODE

SEA CHEST

BALLAST PUMP

DISC FILTRATION

BYPASS

FILTER BACKWASH

UV DISINFECTION

OVERBOARD

BALLAST TANKS