Aspin Kemp & Associates

A Canadian based company specializing in the design and development of power, propulsion and control systems primarily in the marine and offshore oil and gas industries.

- Designed and manufactured the world’s first hybrid tug.
- Developers of the Advanced Generator Protection (AGP) system.
- Operate a manufacturing and R&D facility in PEI with complete test lab and training facilities.

AKA - PRINCE EDWARD ISLAND

AKA - ONTARIO
Foss Maritime Company

- Founded in 1889
- West Coast and Global
- Two Shipyards
- 50 tugs; 70 barges
- 3,000-8,000 hp tugs
- Headquartered in Seattle
The Foss Harbor Fleet

- **Dolphin Class**
  - 5,080 HP

- **Enhanced Tractor**
  - VSP 8,000 HP

- **ASD Class**
  - 6,610 HP

- **VSP – 4,000 HP**

- **E-ASD Class**
  - 6,250 HP

- **VSP 3,000HP**
Foss Maritime – Going Green!

- Certified 14001 Environmental Management System for all vessels and offices
- ISO 9001, ISM, Responsible Carrier Program (RCP).
- Voluntarily switched their entire fleet to ULSD in 2007
- Full vapor recovery on all petroleum barges, double hulled, LED lighting
- First company accepted into EPA’s SmartWay Transport program for their Marine Operations
- Upgrade program for engine purchase using Best Available Control Technologies (Tier 2 and 3 currently)
- Energy audits on 20 vessels
- Shorepower at all docks

Testing a Diesel Oxidation Catalyst on tug Brynn Foss
Recent Environmental Awards & Recognitions

2011  **Chamber of Shipping Environmental Achievement Award** (also 2010, 2009, 2008 and 2007)

2010  **Green Washington 2010 Runner Up** (Seattle Business)

2010  **Association of Washington Business Environmental Excellence Award**

2009  **WORKBOAT** Comprehensive Environmental Management Plan (First Place Winner)

2009  **WORKBOAT** Environmental Initiative Award (Second Place Winner)

2009  **WORKBOAT** Carolyn Dorothy Significant Boats of 2009 winner (more than one winner)

2009  **Significant Small Ships award winner** - Carolyn Dorothy from The Royal Institution of Naval Architects

2009  **Port of Seattle and Propeller Club’s** Marine Environmental Business of the Year

2009  **Port of Long Beach’s Green Flag Environmental Achievement Award**

2008  **San Pedro Bay Ports Clean Air Action Plan Clean Air Excellence Award**

2009  **Marine Environmental Business of the Year Honorable Mention** – Port of Seattle

2008  **Port of Long Beach and Los Angeles Clean Air Action Plan Award**

2008  **Environmental Protection Agency’s Clean Air Excellence Award** – Development of the World’s First Low Emissions Hybrid Tug

2008  **U.S. Coast Guard William M. Benkert Award** for Marine Environmental Protection – Gold Level

2008  **British Petroleum Shipping CEO’s HSE Award** for Outstanding Environmental Achievement

2007  **Environmental Protection Agency’s Clean Air Excellence Award** - Clean Air Technology category
A Green Dolphin!

Foss Maritime’s Carolyn Dorothy – The World’s First Hybrid Tug
Duty Cycle Considerations
The Tug Problem?

As with other vessel types, tugs need lots of power....but not very often.

They are designed for full out...but typically run there less than 3% of the time....otherwise... they are near idle.

In fact...they usually operate in the least efficient part of their range.

Specific fuel consumption “rears its ugly head”.
The Hybrid Tug Rationale

Typical harbour tug duty profile*

*data from actual operations, Foss Maritime SoCal
The Hybrid Tug Rationale

% of time
percent
conventional power plant design point
percent of full load

The Hybrid Tug Rationale

% of time
percent
conventional power plant design point
percent of full load
The Hybrid Tug Rationale

specific fuel consumption *

percent of full load
The Hybrid Tug Rationale

% of time

hybrid power plant design points

percent of full load
Definition & Schematic Diagrams
Defining Hybrid

Typically includes:
– transmission of mechanical, mechanical-electrical and electrical power for propulsion;
– electrical, chemical and/or mechanical energy storage to absorb excess power developed and to allow it to be re-used later in the operational duty cycle; and
– a power transmission configuration and control system capable of maximizing the vessel’s efficiency at multiple points on its duty cycle.

A propulsion system which incorporates a combination of drive line configurations, an energy management system, and/or energy storage to reduce or eliminate the low efficiency operation of diesel engines.
Conventional Mode

(Emergency)
Stop Mode

Shore Power

Aux Gen

AC (Vessel Service) Bus

Batteries/Storage

AFE

DC/DC

AFE

AFE

AFE

AFE

VFD

DC Bus

Port Main Engine

Stbd Main Engine

M/G

Clutch

Clutch

Clutch

Clutch
Idle Mode

- **Aux Gen**
- **Batteries/Storage**
- **AC (Vessel Service) Bus**
- **DC Bus**
- **Port Main Engine**
- **Stbd Main Engine**
- **M/G**
- **Clutch**
- **VFD**

Shore Power is connected to the AC bus, and the batteries/storage are connected to the DC bus. The main engines are controlled by the M/G and Clutch, and the VFD provides variable frequency drive to the AC bus.
Transit Mode 1

- Aux Gen
- DC/DC AFE
- Batteries/Storage
- DC Bus
- AC (Vessel Service) Bus
- Port Main Engine
- Stbd Main Engine
- M/G
- VFD
- Clutch
- Shore Power
Transit Mode 2

- Aux Gen
- Port Main Engine
- Stbd Main Engine
- AC (Vessel Service) Bus
- Batteries/Storage
- DC/DC AFE
- DC Bus
- Shore Power
- VFD
- M/G
- Clutch
Assist Mode
Alternative (Single Main Engine) Configuration
Construction
Engine Room
Engine Room
New Hybrid Projects
Hybrid Cabinets
Build Photos
Human Machine Interface
Human Machine Interface

BATTERY SYSTEM

Motor/Gens & VFDs

Propulsion

24 VDC Power

Battery System

Communications

AUX Gens & AFEs

[Diagram showing the battery system with details on each battery cell including temperature and voltage]
Hybrid Cabinets
Questions?