



Foss Hybrid Harbor Tug

Faster Freight-Cleaner Air
February 26, 2008



Hybrid Technology

- Environmental stewardship and innovation
- Deliver power efficiently
- Lower Fuel consumption



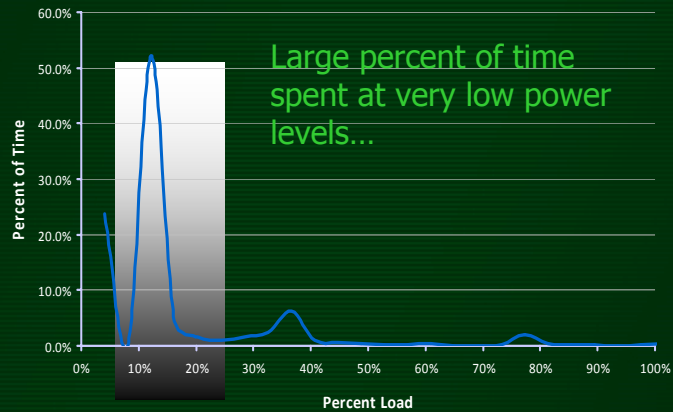
Why Hybrid Makes Sense

- Harbor tugs have engines sized for maximum thrust
- Hybrid optimizes power sources (engines, batteries, generators) to run only when needed
 - Power sources run at or near their design point for maximum efficiency

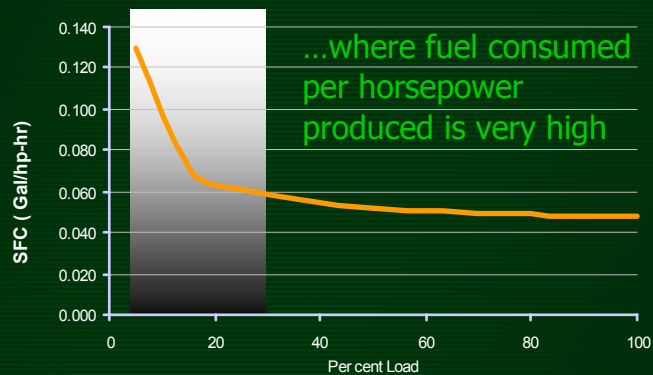
Dolphin Tugs



The Harbor Tug Dilemma



The Harbor Tug Dilemma



The Harbor Tug Dilemma



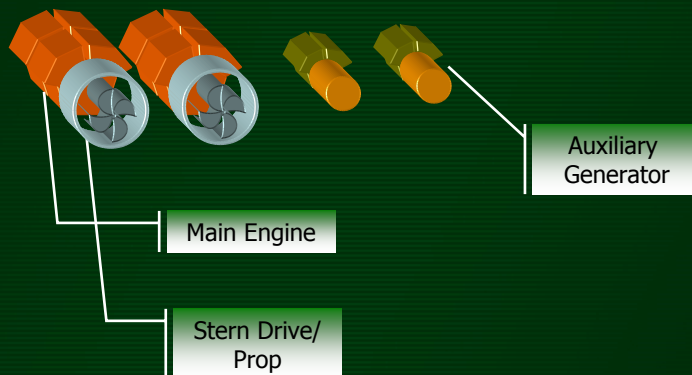
AKA/XeroPoint

- Technology partner/systems integrator
- Extensive experience in the design and delivery of marine power systems, energy management, automation and control systems
- International company with worldwide operations

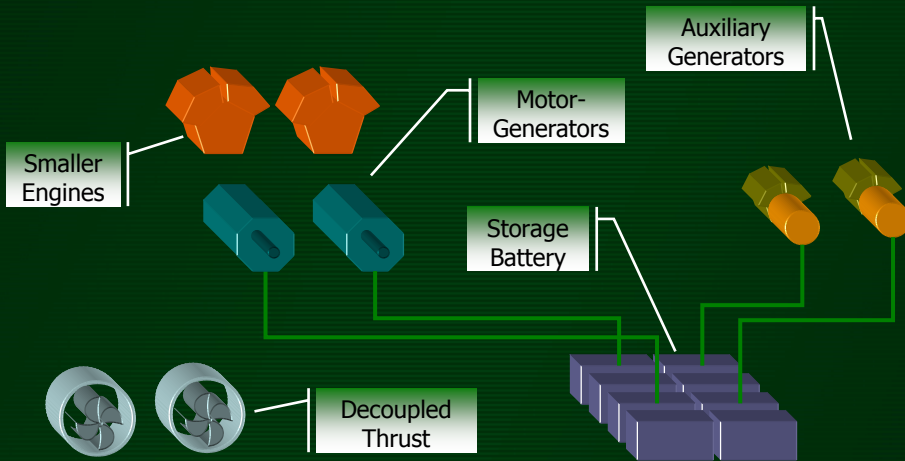
Engineering Parameters

- Compact platform-no change in hull design
- Fit within the confines of engine room
- Retain redundancy
- Deliver horsepower and bollard pull

Conventional Tug Propulsion



Hybrid Tug



A New Dolphin

	Dolphin	Hybrid
Main Engines	(2) CAT 3512D HD (2540 hp)	(2) Cummins QSK50 (1800 hp)
Generators	(2) 125 kw (168 hp)	(2) 300 kw (402 hp)
Propulsion	Rolls Royce US 205 FP ASD	Rolls Royce US 205 FP ASD (2) 1,200 hp MG set 600 hp battery bank

Four Modes of Operation

Mode	Power Range	% of Operating Hours
Minimal Emissions	0-5%	65%
Eco-Cruise	6-22%	13%
Mid-Range	23-46%	15%
Full Mode	47-100%	7%

Minimal Emissions Mode

- Idle periods, “no-wake” maneuvering
- Main engines are off line
- Uses battery storage for hotel load and station keeping maneuvering
- One genset comes on as needed to recharge batteries
- Hotel load alone can be provided from batteries alone for extended periods



Emissions Reductions

- Energy storage to ride through load fluctuations
- Increased efficiency
- Smaller Tier 2 mains
- Batteries can be recharged using shore power



Additional Benefits

- Fuel and lube savings of 20-30%
- Reduced life cycle costs
- Can act as a mobile power generating station
- Reduced noise
- Flexible design to take advantage of technology developments
- Easily adaptable for retrofits as well as new builds

Conclusion

- Additional capital costs
- Emissions benefit dependant on the operation
- Increased engineering

