

Hybrid tugboats: tomorrow's answer to air quality concerns

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Responding to changing marine emissions standards

Two of the United States' largest ports, Los Angeles (POLA) and Long Beach (POLB) will soon have a new way to combat poor air quality – a hybrid tugboat. Together, these ports handle over 40 per cent of all containerised cargo coming into or leaving the United States. Located in the South Coast Air Basin, the ports are under pressure to meet the goals of the San Pedro Bay Ports Clean Air Action Plan. The much-touted plan touches every facet of port operations, from reducing emissions on delivery trucks to ensuring that all cargo-handling equipment is retrofitted or built to be as environmentally friendly as possible.

This sweeping proposal aims to significantly reduce health risks posed by air pollution from port-related ships, trains, trucks, terminal equipment and harbour craft of all types. Part of the plan calls for all harbour craft based at San Pedro Bay Ports (including POLA and POLB) to meet Environmental Protection Agency (EPA) Tier 2 emissions requirements in the next two years.

The EPA Tier 2 requirements are part of a series of major initiatives that will reduce emissions from passenger vehicles, highway trucks and busses and non-road diesel equipment, including harbour craft. Expectations for improving air quality run high – which is where Foss' planned hybrid tug comes in. With the ports of Los Angeles and Long Beach contributing \$1.39 million to make delivery in mid 2008 a reality, the Foss hybrid tug, which will use less fuel and lower emissions, is the focus of many environmental hopes in the maritime industry. In exchange for funding, Foss has agreed to homeport the new hybrid tug in Southern California for five years.

A solution that uses proven technologies

Foss Maritime has long included environmental stewardship as one of their core values. 115 year-old Seattle-based Foss Maritime has long included environmental stewardship as one of their core values, and recently announced that it has joined the SmartWay Transport® Partnership as its first marine operations carrier. The partnership is a voluntary collaboration between the US Environmental Protection Agency (EPA) and the freight industry designed to increase energy efficiency while significantly reducing greenhouse gases and air pollution. Developing the hybrid tug is part of Foss' commitment to be part of the on-going global movement toward cleaner power. Foss Maritime is working with Aspin, Kemp and Associates (AKA) to design the world's first true hybrid tug, incorporating in its system some technologies that have been in use for many years, and putting the pieces together in a new way.

Tugboats are a good fit for the hybrid technologies because they have extremely high power requirements, but only for short durations. The Quanta DES system, an existing hybrid technology that will be modified for use in the tug, has a flexible design that allows it to be adapted to a variety of power and duty requirements.



The hybrid tug will look and perform like its Dolphin class sisters (shown here) but with a different power set-up.

Matching power to need

The hybrid technology that will be incorporated into the propulsion system of the new tug minimises fuel consumption by using a specialised power management system to match required power to the most efficient combination of batteries, generators and main engines at whatever power level is needed. For example, if a tug is simply idling or docked, a lower amount of power will be provided. For escorting or moving a ship, the full horsepower of a Dolphin class tug will be available immediately.

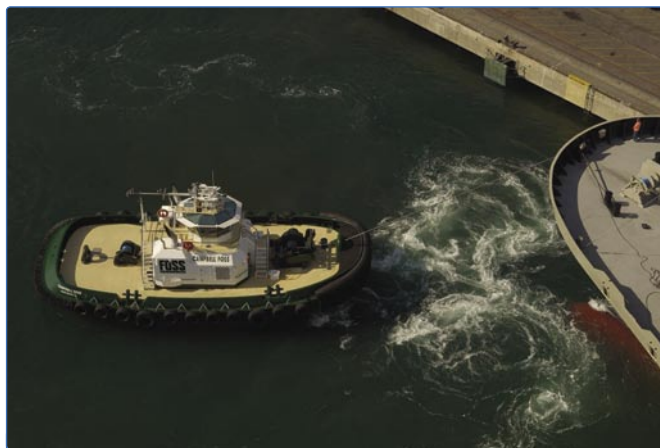
The hybrid tug uses a sophisticated power management system that delivers power seamlessly from batteries, generators and the main engines when necessary. There are several different modes of operation for the tugs:

- Minimal emissions (with a 0-5 per cent load when idling or stopped)
- Eco-cruise (with a 6-19 per cent load during slow transit pf 6 kts)
- Mid-range (carrying a 20 to 65 per cent load at faster speeds or while assisting ships)
- Full-power (carrying a 66 per cent to full load at full power ship-assist speeds)

Based on the performance of the standard Dolphin tugs operating in San Pedro Harbor, it is estimated that the hybrid will spend at least 75 per cent of its operating hours in the lowest two modes of operation. In both these modes there will be no main engine operating, only batteries and generators. Because hybrids deliver power efficiently and are cycle-dependant, the tug will create fewer emissions during slower or idle times but will be able to access full strength and maintain required propulsion when necessary.



Part of the Clean Air Action plan calls for all harbour craft based at San Pedro Bay Ports to meet EPA Tier 2 emissions requirements in the next two years, which is where Foss' planned hybrid tug comes in to play.



Aside from the benefits of using less fuel and having fewer emissions, the hybrid tug will also be quieter overall and could act as a mobile power generating station.

The payoff: reduced emissions

The biggest benefit of the hybrid tug will be cleaner air in the ports they work in. Tugboats often spend time idling in a harbour or doing tasks less strenuous than full powered ship-assist, resulting in unused power. When that power is supplied only by diesel engines, resources are spent and unnecessary emissions are created. The hybrid tug will rely on battery power, supplemented by diesel generators and main engines. The payoff comes in reduced PM, NO_x, SO_x and CO₂ emissions.

Particulate matter and nitrogen oxides are expected to be reduced by 44 per cent when compared with the Dolphin tugs currently operating in San Pedro harbor. Carbon and sulfur emissions – major contributors to greenhouse gases – will also be reduced as the hybrid tug will burn less diesel fuel. This adds up to Foss' hybrid tug reducing all engine emissions and exceeding the EPA's Tier 2 emissions requirements for marine engines.

A practical, replicable solution

The hybrid tug will look and perform like its Dolphin class sisters but with a different power set-up. The hybrid-tug will be built at Foss' Rainier, Oregon shipyard using an existing 78' foot Dolphin-class design, and will appear exactly like its sister Dolphin tugs on the outside. The tug will retain the Rolls-Royce Azimuthing Stern Drives (ASD's) for propulsion.

The engine room of the hybrid tug, however, will look quite different from its sisters. Two Cummins QSK50 Tier 2 main engines rated at 1,800 hp will be used instead of the two 2,540 hp engines carried by most of the Dolphin fleet. Supplementing the Cummins engine, the hybrid design will feature one 600 hp battery pack and two 1,200 hp motor generator sets. The two auxiliary generators will increase in horsepower from 168 hp to 402 hp. Together, this supplemental power will give the hybrid the full horsepower and bollard pull of its Dolphin class sisters, capable of all manner of ship assist and escort.

If the tug lives up to expectations, it is expected that this first hybrid tug will lead to others. The technology used in the hybrid design has already been proven and is well-understood in other applications, and the tug's flexible design will allow it to take advantage of emerging technologies such as improved battery and fuel advances. Though the first hybrid tug is a new build, other Dolphins could be retro-fitted with the new hybrid technology, and the hybrid technology could be incorporated into other new or existing harbour tugs.

The hybrid tug has the capability to recharge batteries from shoreside power in addition to utilising the auxiliary generators. Since it is expected that all major container, selected liquid bulk and cruise ship terminals at POLA will have shore-side electricity within five years and all container terminals and one crude oil terminal at POLB within five to ten years, this will allow tugs to shut down diesel-powered auxiliary engines. Shoreside power is something the port is moving towards for all vessels.

Benefits beyond reduced emissions

At one time, developing an environmentally-conscious tug would have seemed infeasible. Thanks to the adaptation of existing technologies and a number of companies and organisations committed to working more cleanly, that vision is becoming a reality. The expectation is that the hybrid tug will demonstrate benefits beyond using less fuel and having fewer emissions, such as fuel and lube savings, reduced life cycle costs and the possibility of the hybrid tug acting as a mobile power generating station at sea. By using battery power in standby mode and only bringing generators and main engines online when higher power is required, the hybrid tug will be quieter overall than traditional tugs. This reduction in exposure to noise will benefit crews living and working on the tug.

ABOUT THE AUTHOR



Susan Hayman, a graduate of the Merchant Marine Academy, holds an MBA from Harvard Business School. Responsible for driving the strategic and tactical work that ensures Foss' safety culture, Ms Hayman oversees

all company programmes requiring that equipment and operating practices meet all applicable government and regulatory requirements.

ABOUT THE COMPANY

Foss Maritime Company, headquartered in Seattle, Washington, offers a complete range of maritime services and project management to customers across the Pacific Rim, Europe, South America and around the globe.

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