

CASE STUDY

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Press Information

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MTU Series 4000 engines power new Boston Towing and Transportation tugboats used at major LNG terminals

New high-speed diesel engines are ideally suited for ship-assist tugboats used to guide liquefied natural gas (LNG) tankers to both an onshore docking terminal in Boston Harbor and an offshore terminal near Gloucester, Massachusetts.

BOSTON, Massachusetts — Boston Harbor has been an important shipping center for more than 300 years, from its influx of European immigrants to the wide variety of cargo it handles today. Since the early 1970s, the area has become a major center for unloading the liquefied natural gas (LNG) tankers that supply natural gas to much of the Northeast. Getting those tankers safely to their terminals is the job of ship-assist tugboats such as those operated by Boston Towing and Transportation (BT&T). When BT&T commissioned two new tugs for assisting LNG tankers belonging to global giant Suez Energy North America, it specified them with twin [MTU](#) 16V Series 4000 marine diesel engines. The new ultra-reliable, high-speed diesel engines are proving to be ideally suited to this challenging application.

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The two new [BT&T](#) tugboats are the 39-meter Independence and the 30-meter Justice. Both boats were designed by the renowned naval architectural firm Robert Allan Ltd. specifically to provide support for LNG ships in harbor and at sea in heavy weather conditions. The Justice was built by Martinac Shipyards in Seattle, Washington; the Independence was built by Derektor Shipyards in Bridgeport, Connecticut. Boston-area MTU distributor, New England Detroit Diesel-Allison in Wakefield, Massachusetts, supplied the engines. The two new boats, the first in the fleet to be equipped with MTU marine engines, join a fleet of eight other tugs owned by BT&T.

According to Bill Skinner, marine superintendent for BT&T, “Suez Energy North America is BT&T’s largest customer, and they have contracted with us to handle LNG ships for the next 20 years. Based on that contract, Boston Towing was able to finance and build the new tugboats and take delivery of them in late 2009.”

BT&T handles approximately 60 LNG tankers coming into the Port of Boston at Everett, Massachusetts, and also tends supplemental LNG shipments that arrive at the Neptune deep-water terminal in international waters about 12 miles off the coast of Gloucester, Massachusetts. The 30-meter Justice was primarily designed to help ships coming into the Port of Boston, while the 39-meter Independence was designed for use at the deep-water terminal offshore. Because of the harsher environment that the Independence works in, the larger tug is specially designed with deck and bulwark deicing for cold weather, and for high winds and steep seas.

“Our primary mission at the LNG terminals is emergency towing,” says Skinner. “Our second mission is firefighting, and our third is personnel rescue using our crane-launched Ribcraft inflatable.”

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Power for propulsion and firefighting



Both new BT&T tugs are equipped with twin MTU 16V 4000 M61 engines, which deliver a combined 5,400 horsepower to twin controllable-pitch Rolls-Royce Z-drives. The Z-drives are in azimuth pods that rotate 360 degrees, giving the vessels virtually full power in any direction. Each tug has enough power to tow a 100,000-ton ship at a speed of three knots in a Beaufort scale force-five wind (18–24 miles per hour) in up to six-foot seas. The boats are also equipped for firefighting and can pump a minimum of 10,500 gallons per minute from two nozzles to a minimum distance of 425 feet.

“Whenever we set out on a boat-building venture like this,” says Skinner, “we ask ourselves a series of questions: What are the weather conditions likely to be? What is the load profile of the boat going to be? What endurance is going to be required? What’s the load factor during that endurance? What’s the size of the hull, and how much engine-room space do we have? So far, the MTU engines have matched our mission profile perfectly.”

Powerful and compact engines

The MTU Series 4000 engines are high-speed diesels with a top end of 1,800 RPM. Many other tugboat engines of the same horsepower rating are medium-speed engines that top out at 750 to 900 RPM. Because they run slower, the medium-speed diesels have to be much larger and heavier — an issue that affects the design of the boat and working space in the engine room. “In our smaller new tug, Justice, engine-room space was at a premium, so the more compact MTU engines with their better power-to-weight ratio made a significant difference in creating a workable engine room,” says Skinner.

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While BT&T had not used MTU engines in its tugboat fleet in the past, it became aware of MTU through its parent company, Reinauer Transportation, which has had good experiences with MTU engines. During the design stage of the new tugs, Skinner was convinced to consider the MTU line of high-speed marine diesel engines after learning about their high power-to-weight ratio, quiet operation, durability and excellent performance characteristics — including good fuel economy.



Another factor that favored using MTU diesel engines in this application was the operating profile of the tugs. Skinner says that the boats spend “less than one-tenth of one percent at full rack speed” and usually have an annual load factor of only 30 to 35 percent due to the high percentage of idling time. However, when full power is needed, Skinner says, “the MTU engines have excellent throttle response combined with a very clean stack.”

Quiet operation is a safety factor

Engines with low noise and vibration play a big role in making a boat comfortable and safe for crews that work around the clock, says Skinner. Today’s working boats have only half the number of crew aboard as in the past, so there has to be a lot of technology to support them. By keeping engine noise and vibration low, there is much less fatigue experienced by the crew.

“The living quarters inside both of these vessels are extraordinarily quiet,” says Skinner. “Most of the time, we cannot tell the MTU engines are even running. In fact, the captains often don’t know the engines have been started until they look at their gauges.”

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Another reason BT&T decided on the MTU Series 4000 engines was that they could provide power for propulsion as well as for running the firefighting pumps. Each engine can deliver 1,000 horsepower off the front of the crankshaft to drive a firefighting pump, leaving a combined 3,400 horsepower to power the propellers for towing or maneuvering. This capability eliminated the need for two separate auxiliary pump engines that would have taken up a lot of space and required long-term maintenance.



“This is also where the controllable-pitch Z-drives come in,” adds Skinner. “These Z-drives allow us to use the same engines for pumping and propulsion and not worry about overloading them. They also save fuel, produce a cleaner stack and result in gentler handling in close quarters because of reduced prop wash.”

Scheduling maintenance on the go

Maintenance on BT&T’s new tugs consists primarily of regular oil and filter changes performed by the MTU distributor while the boats come to the dock for six hours during a crew change. While the engines are under warranty, Skinner says they are changing the oil every 1,000 hours as recommended by the manufacturer. Eventually, they will alter that schedule as they’ve done with the rest of their fleet based on what Skinner called “a common-sense factor” that involves analyzing oil samples and slowly increasing the oil-change intervals in 250-hour increments until an ideal interval is determined for the application.

The MTU Series 4000 engine boasts a long interval between overhauls, but while it would normally be considered ready after 30,000 hours of operation, Skinner thinks the engines in the Justice and Independence are likely to go much longer than that. “With this application’s low duty cycle, I don’t think we’ll be measuring our overhaul interval in chronological hours but rather in the total amount of fuel consumed. In fact, I’m 54, and I’ll be retired before these engines have to be overhauled. That’s a nice thought.”

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MTU Series 4000 engines are being used to power new Boston Towing and Transportation tugboats used at major LNG terminals along the East Coast.



The MTU 16V4000 M61 diesel delivers 2,700 horsepower with unexcelled fuel economy. Its high power-to-weight ratio and quiet operation help create workable engine rooms.



About MTU

MTU Detroit Diesel, Inc. is the North American regional headquarters of MTU Friedrichshafen GmbH, one of the world's most important providers of diesel engines and drive and propulsion systems for ships, heavy-duty land and rail vehicles, and distributed energy. It offers a complete line of power solutions from 30 to 12,200 bhp (20 to 9,100 kW) for applications in the marine, rail, power generation, oil and gas, agriculture, mining, construction and industrial, and defense markets. MTU Detroit Diesel, Inc. is the sales and after-sales organization of the Tognum Group in North America. www.mtu-online.com

Tognum

With its two business units, Engines and Onsite Energy & Components, the Tognum Group is one of the world's leading suppliers of engines and propulsion systems for off-highway applications and of distributed energy systems. These products are based on diesel engines with up to 9,100 kilowatts (kW) power output, gas engines up to 2,150 kW and gas turbines up to 45,000 kW.

The product portfolio of the Engines business unit comprises MTU engines and propulsion systems for ships, for heavy land, rail and defense vehicles and for the oil and gas industry. The portfolio of the Onsite Energy & Components business unit includes distributed energy systems of the brand MTU Onsite Energy and fuel-injection systems from L'Orange. The energy systems comprise diesel engines for emergency standby power, prime power and continuous power, as well as cogeneration power plants based on gas engines and gas turbines that generate both power and heat.

In 2010, Tognum generated revenue of around €2.56 billion and employs more than 9,000 people. Tognum has a global manufacturing, distribution and service structure with 25 fully consolidated companies, more than 140 sales partners and over 500 authorized dealerships at approximately 1,200 locations. The shares of Tognum AG (ISIN: DE000A0N4P43) have been stock-exchange listed since 2007 and are included in the MDAX.

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