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Baydelta Maritime: It's all about the kips
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The San Francisco Bay Area has a long history of intense competition amongst tug and ship-docking companies. Years ago, when rates were set by a tug's horsepower, one well-known firm is reported to have had engine plates made up with inflated horsepower. In the days of single-screw tugs, another company was noted for buying older tugs and repowering them with the biggest engine that would fit in the hull.

But that was all before the *Exxon Valdez* spill and the advent of the Oil Pollution Act of 1990 (OPA '90) and escort requirements and regulations. As regulations have become more stringent and liabilities more challenging, the nation's ports continue to refine definitions of "best available technology" as required in the OPA '90 regulations.

The idea of simple horsepower defining a tug's capabilities was challenged by the increased use of propeller nozzles that meant two tugs with the same horsepower might have significantly different bollard pulls. The introduction to America of advanced European z-drives and cycloidal drives further confused the power ratings. This confusion was compounded by the effect that enlarged skegs provide when used in the indirect mode.

In California the Oil Spill Prevention and Recovery (OSPR) section of the Department of Fish and Game is responsible for tanker escort regulations. In the Bay Area these are affirmed by the Marine Exchange of the San Francisco Bay Region. The OSPR has divided the Bay Area into six zones, each with specified escort tug requirements for tankers with capacities over 5,000 tons.

The defining criterion for tugs was horsepower. Then, more recently, static bollard pull, which is measured by a scale mounted in a line towed against a bollard on a solid pier. This can be a useful number in ascertaining a tug's ability to tow a barge or a ship. But it does not adequately measure a tug's ability to stop or direct a tanker that has lost steerage or power.

In an environment where competition has been the rule, the OSPR has required all tugs seeking certification for escort duties to undergo a formulaic assessment that will express their braking power in kips. Each kip (the word comes from kilo and pound)



With a bollard pull of 94 tons, Baydelta Maritime's new tug Delta Cathryn and its sister Delta Billie (left) are highly regarded for their ability to exert braking power when escorting ships in San Francisco Bay. (Alan Haig-Brown photo)

represents 1,000 pounds of braking power. This is the force that can be transferred to a ship's hull through a chock and bollard normally mounted along the centerline on the escorted vessel's stern.

A matrix issued by the OSPR specifies how many kips are required for escort tugs in each of the six regions under a variety of tidal currents. These range from 20 kips for a ship displacing 20,000 tons in Area 1, outside the Golden Gate, to a maximum of 970 kips for a ship displacing 160,000 to 180,000 tons in Area 6 at 4 knots of tide. This final number would require several tugs and is not likely to be required, as large ships can alter their schedules to avoid such dramatic tidal currents.

Each tug that is registered with the OSPR for escort work has its official kips rating published on the Marine Exchange website (www.sfm.org). It is up to the ship's agent to determine and hire the appropriate tug or combination of tugs to meet the required rating.

One day in early August, the 600-foot U.S.-flagged Panamax tanker *Overseas Boston* was ready to sail from the San Francisco anchorages, just south of the Bay Bridge, to sea. Baydelta Maritime's new tug *Delta Cathryn*, sister to *Delta Billie*, was assigned the job. The move of the tanker required only 70 kips according to the matrix prepared by the OSPR, so *Delta Cathryn* would handle the job alone.

Cathryn and *Billie* have the highest kips rating on the Bay. Even where a ship may require significantly higher kips than this job, it is attractive to agents to meet those requirements with one powerful tug rather than two tugs with lower kips ratings.

This derives from a combination of factors. The main engines each deliver 3,386 horsepower to Rolls-Royce z-drives. These upgraded Cat 3516C engines are the same block as Baydelta's *Delta Linda* and *Delta Deanna* (which were delivered in 1999), but those Cat 3516B engines delivered only 2,200 hp each. As a result, where *Linda* and *Deanna* had husky 70-ton static bollard pulls, the new boats exert a remarkable 94 tons of bollard pull.

While increased horsepower will explain the increased bollard pull, the increase in kips from 188 for *Linda* and *Deanna* to 266 for *Billie* and *Cathryn* is a result of significant differences in hull design combined with the increase in horsepower. Designed by Jensen Maritime's naval architect Eric Blumhagen, the new boats are similar to the earlier pair, but with some significant differences. At 100 feet in length, they are five feet shorter than the earlier boats but their 40-foot beams make them four feet wider than *Linda* and *Deanna*. In addition they have a long and deep skeg that extends several feet below the keel from the forefoot to a point



The Baydelta logo from the stack of Delta Cathryn, a 100-foot ASD tug built by Nichols Brothers Boat Builders in Washington state. (Alan Haig-Brown photo)



Mate Trevor Bozina operates the joy sticks on Delta Cathryn while accompanying the tanker Overseas Boston, as deck hand Shawn Mann looks on. (Alan Haig-Brown photo)

just ahead of the stern drives.

The combination of additional power, wider beam and the large surface of the skeg creates the significant increase in kips or in the tug's ability to stop or change the direction of a disabled tanker. This is accomplished by working the tug in an indirect mode so that the hull acts as a huge sea anchor that combines with the thrust of the propellers to provide great stopping power up the tether line.

As the tug headed from its home pier on San Francisco's Embarcadero, it passed under the Bay Bridge at 2325, pushed along by 2 knots of flood tide and making 11.5 knots at 1,200 rpm. A few minutes later the rpm was increased to 1,400 and the boat was making 13.4 knots as Capt. Tim Westman called the Marine Exchange to check in for the *Overseas Boston* escort. There followed a pre-escort conference call with the ship's pilot, Capt. Reuben Rocci, in which he explained that the ship had a 200-ton super chock on the stern.



Mann sends the tug's tether line up the tanker's stern. (Alan Haig-Brown photo)

By the time the *Overseas Boston* crew had worked with *Cathryn's* young deck hand Shawn Mann to secure the tether line and had hauled its anchor, it was after midnight. Mate Trevor Bozina had taken the helm, while Westman and Engineer Ferdinand Perales went off to their bunks.

"We work with about 150 feet of line up for slow speeds," explained Bozina, "but we increase this to 400 feet for higher speeds."

He went on to explain that over the expanse of the Bay, they vary the length of the tether to meet differing needs. For example, in some areas of the northern part of the Bay, the shallow water can cause a squat effect for ships at high speeds so they have to slow and "we shorten up to 150 or 200 feet to help handle the ship. So we become an assist tug from an escort tug."



Delta Cathryn's yacht-white engine room holds two Cat 3516C main engines delivering almost 6,800 hp to the tug's Rolls-Royce z-drives. The boat's 40-foot beam and deep skeg add to its braking power. (Alan Haig-Brown photo)

Bozina also pointed out that not all of the big tug's work is tanker escort. "A big 1,100-foot box ship can't go slower than 10 knots and if they reverse their main they will walk to the side, so we have to provide braking power on the stern to get them under 4 knots so that they can be maneuvered into the piers at Oakland."

In this mode the most common method of providing braking power is to turn the nozzles outwards so that they generate a huge vortex and drag.

At 0040 *Cathryn* and *Overseas Boston* were under the Bay Bridge. Bozina had about 250 feet of line out and was following a course a little to starboard of the ship's wake.

"It is just a little easier to track like this, because it keeps the tug's big skeg out of the ship's propeller wash," he explained.

A tanker escort tug is a bit like a firetruck. It is an expensive piece of equipment deployed to be ready at a moment's notice should an emergency arise. At the same time, every precaution is taken by the San Francisco Bar Pilots, the shipping companies and the OSPR to make sure that an emergency does not occur. In that sense, this escort of *Overseas Boston* was typical as the two vessels approached the Golden Gate Bridge at 0110 making 8.7 knots. They passed under the bridge and the pilot radioed that *Cathryn* could take her line back as the ship had now entered Area 1.

But the tug's work was not over yet. As the ship's stern receded into the darkness, Bozina idled *Delta Cathryn* against the ocean swell and into the shelter of Bonita Cove just outside the north end of the Gate. The ship would travel another 11 miles to the sea buoy, where the pilot would release the tug as he left the ship for the pilot boat. But until then *Cathryn* was standing by, just in case.

It was a time for deck hand Mann and Mate Bozina to relax and talk about new diesels in train engines and, like most mariners on San Francisco Bay, about how much they like their jobs.

Bozina, who is 26, got his start on his parents' sailboat on the Bay and then, after attending Cal Maritime, spent two years in Valdez, Alaska, before coming back to the Bay.

"I like mornings the best," he said. "I get to see the city waking up with the cars and ferries carrying people to work."

One wonders how many of them are aware of the people like Bozina and boats like *Delta Cathryn* who work night and day to keep their Bay the beautiful place that it is.