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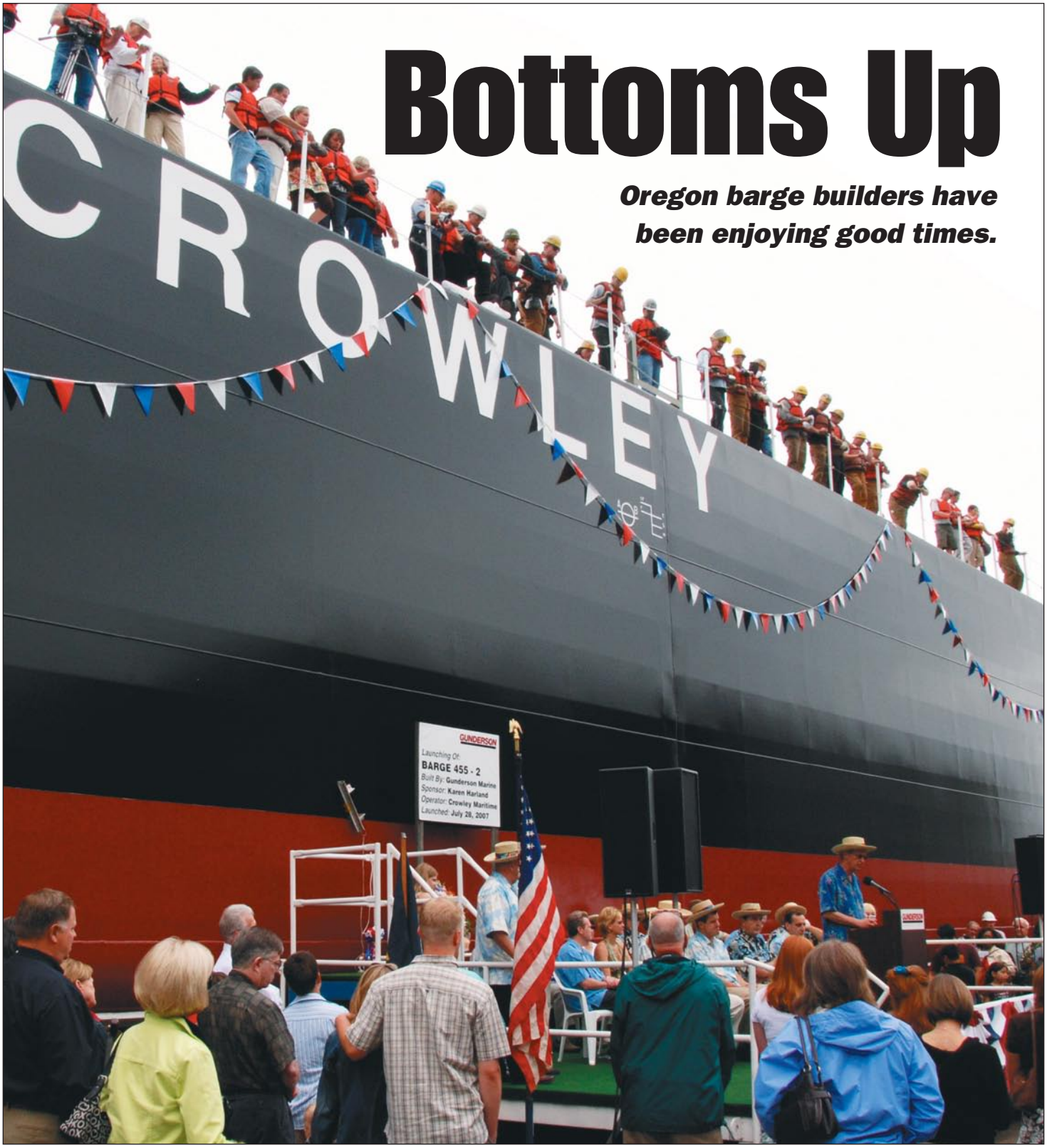
Bottoms Up

Oregon barge builders have been enjoying good times.



Bender fenders

Soft fendering is designed to prevent tugs from damaging ships.

By Michael Crowley, Correspondent

Every day in every major port, there are scores of "controlled collisions."

However, unlike crashes on roads and highways, these water collisions rarely result in major damages.

When a pilot tells a tug to push on a tanker or ship, it's the tug that will likely emerge unscathed if the "collision" exceeds the deflection ability of either the tug's fendering or the ship's hull plating. That's why tug companies are willing to pay $100,000 or more to outfit their vessels with protection — tug fendering.

Fendering has not always been this pricey because the risk of damage wasn't as great. The first material used for fendering, wood, was downright cheap. Eventually tugboat crews wove old towing lines into rope fenders that replaced the wood.

Two things killed rope fendering: synthetic lines and increased horsepower. Synthetic lines didn't wear out nearly as fast as natural rope, so when regular rope fendering or bow mats wore out, there wasn't material to replace them.

And by the 1960s, instead of tugs pushing against the side of a ship with a few hundred horsepower, tugs had "2,000 horsepower and 30 tons of bollard pull," said Eric Blumhagen, **Jensen Maritime Consultants**, Seattle. Since the fine shape of the bow wasn't that much different from the less powerful tugs of a few years earlier, tugs were pushing harder over the same square footage.

Even in the 1970s, which was "the last big tug-building spurt before the current one," said Bruce Washburn of **Washburn & Doughty**, East Boothbay, Maine, tugs had narrow bows and small contact areas. Looking back in some of his old design books, Washburn said he found statements "that tugs with 3,000 to 4,000 horsepower had reached their limit because that was as hard as you could push on the side of a ship." Square or D-shaped rubber was used as fendering around the bows, with maybe laminated rubber sections below it. "It was rubber as opposed to steel, but it didn't have a hell of a lot of difference in its give," Washburn said.

Today, tugs with nearly 7,000 hp and up to 90 tons of bollard pull are docking ships. That's why the "give" Washburn refers to is the major consideration for bow fendering on a tug. When a tug pushes up against a

Bruce Buls

Soft cylindrical fendering and loop fendering can both protect against damages to the ship.

ship there are three ways the energy is absorbed: damage to the tug, damage to the ship or deflection of the energy by the fendering.

Softer fendering deflects the energy much better than hard fendering. For bow fendering, "hard or extruded rubber once it's in contact doesn't give," said Dennis Kerber of **Schuyler Rubber** Co., Woodinville, Wash., noting that extruded rubber is fine for a side-fender application where you want a hard slippery surface.

"Because the tug is typically built like a tank, the energy [of a push] is transferred to the hull of the ship. That's where you have the damage. You want to dissipate as much energy as possible. You do that with as soft a fender as possible," said Kerber.

Besides using softer fenders, the bows of modern ship-assist tugs are built with a large radius, instead of the narrow bow sections of earlier tugboats. Now when a tug comes up against the side of a ship the energy is dissipated over a much wider area and there's less chance of damaging the side of a ship.

Kerber said rubber cylindrical fendering (Schuyler Rubber markets **Shibata**'s cylindrical fendering) and loop fendering made from recycled rubber works best in this case, with loop fendering's soft outer layer having the same deflection characteristics as airplane tires, and that's backed up by 11" of hard rubber.

STILL ROOM FOR TIRES

That doesn't mean there's not a place for the traditional tire. "Some like the looks of the traditional tire fender, and they are relatively cheap and work pretty well," said Blumhagen. When used with more expensive fenders, tires prolong the life of the expensive fendering while providing an extra cushion.

Sometimes that cushioning is needed, even when used with modern materials. Take the case of the tug *Valor* that was launched at **Nichols Brothers Boat Builders** in Freeland, Wash., early in the summer for **BayDelta Maritime**. The 100' tug with 6,770 hp, over 90 tons of bollard pull and a 14-knot speed, has more than $100,000 in fendering, including Shibata cylindrical fendering and D- and M-shaped fendering blocks.

Bruce Buls

Tires combined with newer high-tech fenders form a good combination.

When **Crowley Maritime** chartered the tug, it added tires at the bow and along the sides. Anticipating tanker work in the often heavy seas of north Puget Sound, the company wanted another layer of protection.

Schuyler Rubber designed the *Valor*'s original fendering, which reflected BayDelta's desire for "a European looking tug," according to Kerber. That meant using a lot of hard fendering, which isn't as much of a problem in Europe because "they do longline assists where they very seldom contact the fenders. Here we bang. Bang hard. The fenders had to be covered with something," said Kerber.

When Kerber talks about the hard fendering, he's referring to the M-formed rubber below the cylindrical fendering.

"The Shibata is fine. It compresses easily. When it compresses to the point where the M fendering is contacted, that's where you get the jolt that you want to avoid," Kerber said. Thus the tires.

One alternative is to use loop fendering below the cylindrical tube.

LNG ISSUES

Sometimes ship designers don't fully appreciate all the issues of tug power and ship-assist practices.

Washburn said that one of his customers was considering a project "that was limited to two tons per-square-foot of loading in the side of the hull. And then they said 'we want an 80-bollard-ton tug.' " He said he was thinking, "Do the arithmetic. You can't have it."

Washburn didn't say if that was an LNG project, but it may have been because new LNG ships are stipulating very low hull pressures to avoid damage to the plating. New fendering will have to be developed because "there have been a few projects that nobody has been able to satisfy the load deflection requirements for," said Kerber. In some cases, the designers have backed off from their demands.

Washburn pointed out another area of weakness for ship designers: bollards. Some attachment points meet the high-load forces a tug can exert, but not all bitts on a ship meet that standard. Put a line over the wrong bitt and you can have problems.

"There are two ways to use a tug, and the weak link in both cases is the ship," said Washburn. WB