September 10, 2024 MIR-24-26

Contact of Tugboat *Olympic Scout* with Hylebos Bridge Fender

On October 12, 2023, at 2341 local time, the tugboat *Olympic Scout* was assisting the articulated tug and barge *Montlake* (tugboat) and *Sodo* (barge) as it headed outbound on the Hylebos Waterway in Tacoma, Washington (see figure 1 and figure 2).[1] As the vessels attempted to transit through the Hylebos Bridge, the starboard quarter of the *Olympic Scout* struck the bridge's protective fender system. There were no injuries, and no pollution was reported. The *Olympic Scout* sustained superficial damage; the south side of the bridge's fender system was damaged beyond repair and was replaced at a cost of $2.43 million.

Figure 1. *Olympic Scout* underway at unknown date. (Source: Olympic Tug & Barge, Inc.)

[1] (a) In this report, all times are Pacific daylight time, and all miles are nautical miles (1.15 statute miles). (b) Visit ntsb.gov to find additional information in the public docket for this NTSB investigation (case no. DCA24FM003). Use the CAROL Query to search investigations.

Casualty Summary

Casualty type	Contact
Location	Hylebos Waterway, Tacoma, Washington 47°16.64′ N, 122°23.68′ W
Date	October 12, 2023
Time	2341 Pacific daylight time (coordinated universal time –7 hrs)
Persons on board	4 (*Olympic Scout),* 5 (*Montlake/Sodo*)
Injuries	None
Property damage	$2.43 million (replacement cost for fender)
Environmental damage	None
Weather	Visibility 10 nm, clear, winds east 3.3 kts, water calm, air temperature 52°F, water temperature 56°F, evening nautical twilight 1933
Waterway information	Channel, width 150 ft (between bridge fenders), depth 25 ft, current negligible (flood tide, 35 minutes past slack water [low tide])

Figure 2. Area where the *Olympic Scout* contacted the Hylebos Bridge fender, as indicated by a circled *X*. (Background sources: Google Maps [maps], Google Earth [bridge image])

1 Factual Information

1.1 Background

The 92-foot-long, 26-foot-wide towing vessel *Olympic Scout* was constructed of welded steel. The vessel was built in 1976 by the Pacific Towboat and Salvage Company in Long Beach, California, as the *Avenger*. In 2007, Harley Marine Special Leasing LLC acquired the vessel; Harley Marine Services Inc. became the operator and renamed the vessel the *Olympic Scout*. In 2020, Olympic Tug & Barge Inc. (OTB) became the operator. The *Olympic Scout* had two 1,125-hp main-propulsion diesel engines (2,250 hp combined), each driving a fixed-pitch propeller, with two plate-type rudders behind each propeller.

The 112-foot-long, 34-foot-wide tugboat *Montlake* was constructed of welded steel. The vessel was built in 1990 by the Bollinger Machine Shop and Shipyard Inc. in Lockport, Louisiana, as the *Doc Candies*. In 2022, EEF SPV 3 LLC acquired the vessel; OTB became the operator and renamed the vessel the *Montlake*. The *Montlake* had two 2,100-hp main-propulsion diesel engines (4,200 hp combined), each driving a fixed-pitch propeller, with two shaped-foil rudders behind each propeller. The *Montlake* was coupled to the barge *Sodo*, and they operated together as an articulated tug and barge (ATB) (see figure 3).

Figure 3. *Montlake/Sodo* underway in July 2023. (Source: OTB)

The 289-foot-long, 78-foot-wide *Sodo* was a double-hull tank barge constructed of welded steel. The barge was built in 2011 by the Zidell Marine Corporation in Portland, Oregon, as the *DBL-55*. In 2022, EEF SPV 3 LLC acquired the

vessel; OTB became the operator and renamed the vessel the *Sodo*. At the time of the casualty, the barge was carrying 15,083 barrels of ethanol, which was 27% of the total cargo carrying capacity of the barge.

The Hylebos Bridge was a double-bascule road bridge that crossed the Hylebos Waterway about 0.9 miles east of the waterway's entrance at Commencement Bay in Puget Sound (see figure 4).[2] The bridge was originally constructed in 1939 and was rebuilt in 2012. The bridge piers on the north and south sides of the waterway were protected from vessel strikes by a fendering system constructed of wood piles and timber facing boards. The center section of each fender ran roughly parallel to the channel under the bridge spans, while the sections on the east and west sides were angled outward forming broad funnels. Each of the fenders was equipped with red navigation lights marking the ends of the angled sections, the ends of the center section, and the centerline of the bridge span (five lights per fender). The navigational channel between the center sections was 150 feet wide, according to the National Oceanic and Atmospheric Administration electronic navigation chart for the area (US5WA22M).

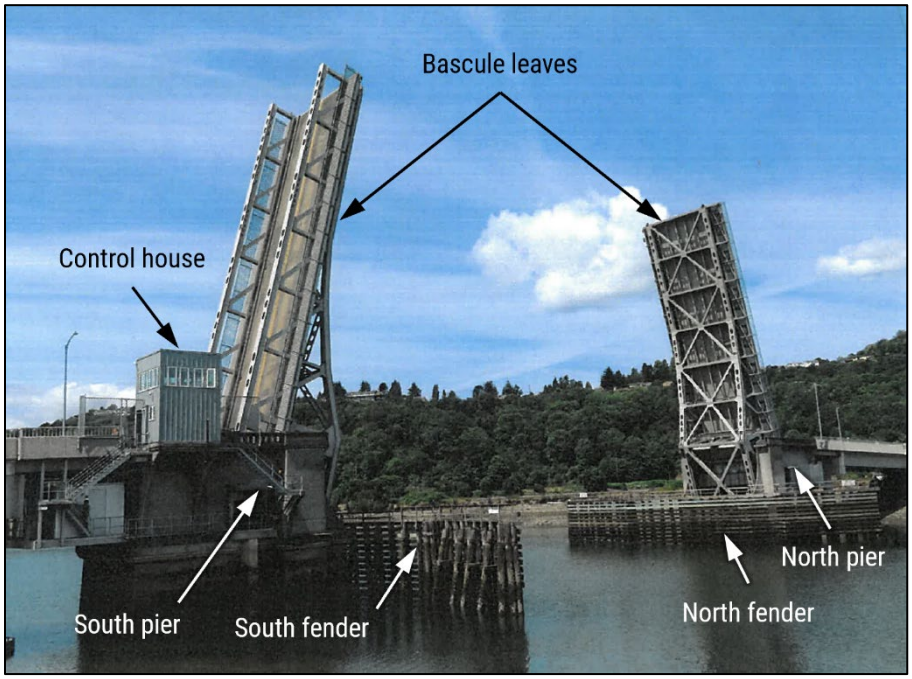

Figure 4. Hylebos Bridge in the open position in 2020. (Background Source: Hardesty & Hanover, LLC)

[2] A bascule bridge is a moveable bridge with a leaf, or span, that pivots upward with the assistance of a counterweight. A double (or double-leaf) bascule bridge has two leaves, one on each side of a waterway, that meet when the bridge is closed.

1.2 Event Sequence

On the night of October 12, 2023, the ATB *Montlake/Sodo*, with a crew of five, was scheduled to depart from the SeaPort Sound Terminal, located on the north side of the Hylebos Waterway, bound for Seattle, Washington. The ATB was moored starboard side to the terminal wharf, with the bow oriented in the westerly (outbound) direction. While at the wharf, the bow of the *Sodo* was 1,276 feet from the center of the Hylebos Bridge.

The *Olympic Scout*, with a crew of four, was dispatched to assist the *Montlake/Sodo* while getting underway and navigating out of the narrow waterway. Upon arrival at the terminal at 2302, the *Olympic Scout* made up to the *Montlake/Sodo* on the barge's port side, near the bow, using three lines. The tugboat's stern was facing forward on the bow of the barge, commonly called a "heads and tails" makeup. The *Olympic Scout* captain said that this makeup was common for barge and ATB assist jobs, providing the most maneuverability.

Before getting underway, the *Montlake/Sodo* crew conducted a pre-departure brief/navigation assessment; then, the *Montlake* captain notified Vessel Traffic Service Puget Sound and the Hylebos Bridge operator of the ATB's pending departure.[3]

At 2333, the *Montlake/Sodo* got underway in darkness, with the assistance of the *Olympic Scout*. After pulling away from the pier, they paused in the channel because the Hylebos Bridge had not been opened. The *Montlake* captain called the bridge operator again, and the bridge began to open. According to the City of Tacoma website, the amount of time it took for the bridge to open was about 2 minutes. While awaiting the bridge opening, the bow of the *Montlake/Sodo*, along with the *Olympic Scout*, drifted to port toward the south side of the channel (see figure 5).

At 2337, the *Montlake/Sodo* began heading toward the bridge. A *Montlake/Sodo* crewmember was stationed at the starboard bow of the barge in order to report the distance to the bridge as the ATB approached. The crewmember stated that the *Olympic Scout* crew was responsible for reporting distances on the port side.

[3] In accordance with Title 46 *Code of Federal Regulations* 140.635, a *navigation assessment* is required to be completed by operators of inspected towing vessels before getting underway. The assessment must consider, among other requirements, water depth, visibility and weather conditions, horizontal clearance during bridge transits, navigational hazards, and the configuration of the tow.

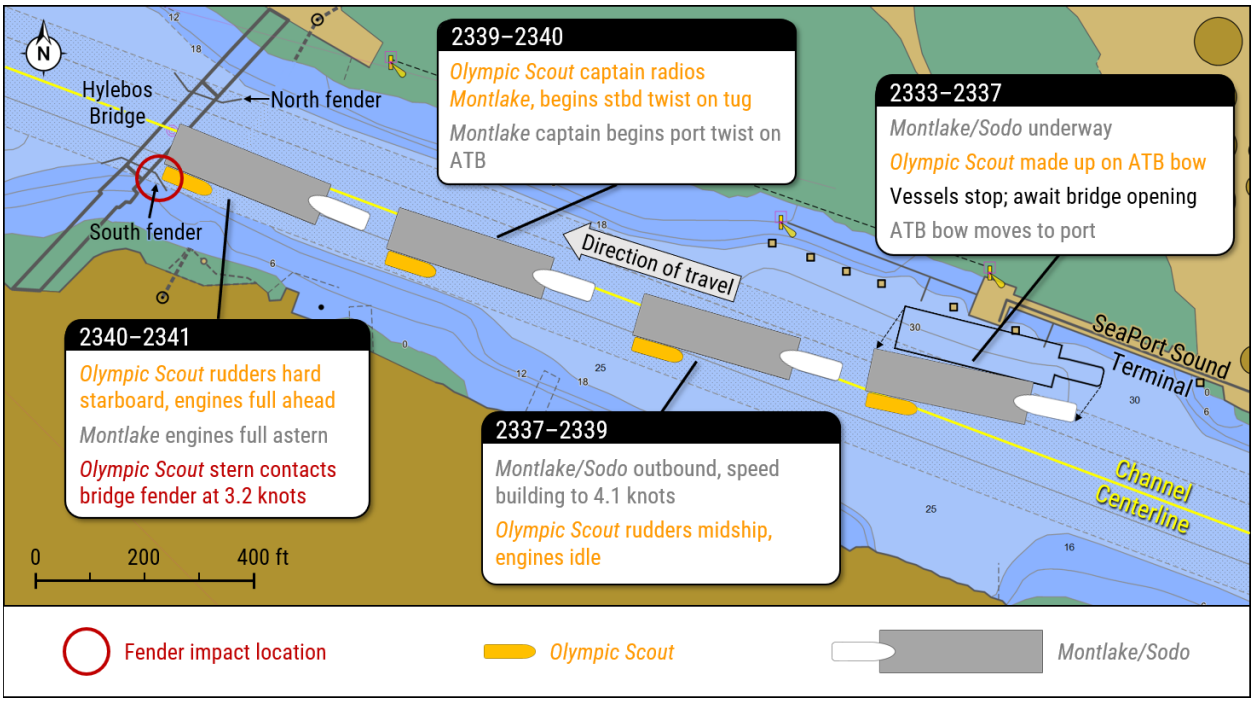

Figure 5. Casualty sequence of events. Times of engine speeds and rudder movements are approximate based on crew interviews. (Background Source: National Oceanic and Atmospheric Administration electronic navigation chart US5W22M – Tacoma Harbor, as displayed on Rose Point Electronic Charting System)

According to the *Olympic Scout* captain, his vessel's engines were at idle and the rudders were midship while he awaited instructions from the *Montlake* captain for any required maneuvering. The *Olympic Scout* captain stated that he had no difficulty seeing the bridge, and all the bridge fenders' navigation lighting was on.

The *Montlake* captain stated that, when setting up for the bridge transit, he usually tried to center the ATB in the channel, allowing enough room for the assist tugboat to pass between the bridge fenders. As the ATB's speed slowly increased, the ATB was set to the port to the south side of the channel. Consequently, the *Montlake* captain attempted to steer back toward the middle of the channel.

The ATB's speed built to 4.1 knots. As the distance between the ATB and the bridge decreased, the *Olympic Scout* captain radioed the *Montlake* captain, telling him that the ATB needed to come more to starboard in order for the assist tugboat to make it through the bridge opening. The *Montlake* captain told the *Olympic Scout* captain to "do what he needed to do" to bring the tugboat and ATB back toward the center of the channel. The *Olympic Scout* captain stated that he then put a "right [starboard] twist" on the tugboat's rudders and engines (port engine ahead, starboard engine astern, rudders to starboard).

The *Montlake* captain was concerned that, with the *Olympic Scout* moving the ATB's bow to starboard, the stern of the ATB would move to port, toward the south bank of the waterway. Consequently, he put a port twist on his tugboat: port engine astern, starboard engine "punch[ed] ahead," rudders to port. The *Montlake* captain stated, "If he's going to be pushing my bow, I got to work against him."

The *Olympic Scout* mate, who had stepped out onto the main deck, radioed the captain, informing him that the tugboat needed another 15 feet of lateral movement to starboard (north) to make it through the bridge opening. The captain stated that the "right [starboard] twist wasn't giving us anything," so he put both engines ahead, with the rudders hard to starboard.

The *Olympic Scout* captain radioed the *Montlake* captain, informing him that the situation was not improving. The *Montlake* captain responded that the *Olympic Scout* captain should take whatever action he needed to, so the assist tugboat captain increased both engines to full ahead. The *Montlake* captain put his vessel's engines to full astern in an attempt to slow and stop the ATB.

At 2341, the *Olympic Scout*'s starboard quarter contacted the fender protecting the south pier of the Hylebos Bridge. The ATB's speed over ground at the time was 3.2 knots. When the *Olympic Scout* made contact, one of its three lines to the ATB parted.

The fender redirected the *Olympic Scout* and *Montlake/Sodo* toward the center of the channel, and momentum carried the vessels through the bridge opening. Once through the opening, the *Olympic Scout* crew took in the assist tugboat's remaining lines from the ATB. The *Olympic Scout* then turned around and transited parallel to the ATB until the vessels had exited the waterway into Commencement Bay.

After the vessel operators reported the incident to the US Coast Guard and operating company representatives, the *Olympic Scout* returned to its berth in Tacoma's Sitcum Waterway, while the *Montlake/Sodo* proceeded to its destination in Seattle.

1.3 Additional Information

1.3.1 Damage

Damage to the *Olympic Scout* was superficial, consisting of scraped paint along the top of the bulwarks on the starboard quarter.

There was no damage to the Hylebos Bridge piers, mechanical structure, or roadway. However, the center section of the south fender was displaced about 50 feet to the west, with the supporting piles pushed over at angles up to 40°. Timber facing boards were broken or missing along the full length of the fender. Dolphins, which were constructed of timber piles and located at the east end and the junctions of the center and west end section of the fender, were also pushed over (see figure 6). Navigation lights mounted on the fender were damaged or destroyed. The damaged south fender was replaced with a steel fender at an estimated cost of $2.43 million.

Figure 6. Damage to Hylebos Bridge fender system. *Left to right*: displaced center section and damaged dolphin; broken and missing timber facing boards on eastern and center sections. (Source: Coast Guard)

1.3.2 Vessel Crew

The captain of the *Olympic Scout* held valid Coast Guard-issued merchant marine credentials as master of towing vessels upon Great Lakes, inland waters, and Western Rivers and master of self-propelled vessels of less than 100 gross register tons on near coastal waters. He had worked for the operating company (including its precursor companies) for 30 years and had been employed as a vessel master since

2015. The captain stated that he had captained the *Olympic Scout* "off and on" for 5 years. He stated that he had not worked with the *Montlake/Sodo* before the harbor assist assignment on the night of the casualty.

The captain of the *Montlake* held valid Coast-Guard-issued merchant marine credentials as master of towing vessels upon oceans and master of self-propelled vessels of less than 1,600 tons upon oceans. He had worked in the towing industry for 28 years, including 6 years with the *Montlake/Sodo*'s operating company. He had been employed as a vessel master since 2012.

The captains of the *Olympic Scout* and *Montlake/Sodo* had at least 9 hours of sleep each 24-hour period in the 4 days before the casualty, with the exception of one period in which the *Olympic Scout* captain had 6 hours of sleep. The *Olympic Scout* captain stated that he "felt well rested" at the time of the casualty, and the *Montlake/Sodo* captain stated that he had adequate rest before getting underway. Both captains were tested for drugs after the casualty, and the results were negative. Postcasualty alcohol testing was conducted too late after the casualty to be valid.

1.3.3 Bridge Fender Condition

In October 2022, about a year before the casualty, a civil/marine engineering consulting firm conducted an underwater inspection of the Hylebos Bridge, including the fendering system. Inspectors found that the fenders were in "overall fair to good condition." The report further stated:

> Inspection of the piling noted localized areas of minor to heavy marine borer damage identified in the intertidal and submerged zones of several piling, as well as heavy fungal decay noted above water in a number of piling. The majority of the significant damage, both above and below water, was found in the piling located within the timber dolphins

An underwater inspection conducted 5 years prior to the 2022 inspection had found similar results with the fender system.

After the *Olympic Scout* casualty, another marine consulting and surveying firm conducted an above-water survey of the Hylebos Bridge fender system, observed an inspection of the underwater portion of the fenders, and examined the condition of the old piles as they were removed during repair of the fender. They concluded:

> Although the fendering above the waterline can be considered as being in a generally fair condition, where sighted, the supporting structure below the waterline displays significant areas of wastage, rot, and marine worm and borer tracks....As such it is our considered opinion, based on our above comments and observations, that the timber fendering structures…are subject to an inherent loss of structural strength, and that the damage caused by the allision [*Olympic Scout* contact] resulted in significantly more damage being sustained as would have been, had the fendering structure been of sufficient structural strength.

2 Analysis

While made up to and assisting the ATB *Montlake/Sodo* as it transited outbound on the Hylebos Waterway, the tugboat *Olympic Scout* contacted the south fender of the Hylebos Bridge, significantly damaging the fender.

Before getting underway from the SeaPort Sound Terminal, the captain of the *Montlake/Sodo* radioed the Hylebos Bridge operator requesting that the bridge be opened. Shortly after, the *Montlake/Sodo* got underway, but the bridge had not yet opened, prompting the captain to again request it be opened. While awaiting the bridge opening, the ATB had to pause, and the bow of the ATB drifted to port, toward the south side of the channel. Once the bridge was opened a few minutes later and the *Montlake/Sodo* began to move forward, the ATB was set further to port. The *Olympic Scout* was made up on the port bow of the *Sodo* with its stern facing in the direction of the ATB's travel. Initially, the *Olympic Scout*'s engines were at idle and its rudders midship. In its position on the bow of the *Sodo*, the *Olympic Scout* caused drag on the forward port side of the ATB. The captain steered to starboard attempting to line up for the bridge, but likely due to the drag from the *Olympic Scout* on the port bow, he was unable to move the ATB appreciably to starboard. Consequently, the ATB was on the port side of the channel as it approached the bridge, with the *Olympic Scout* in danger of hitting the fender.

In an attempt to avoid hitting the Hylebos Bridge fender, the *Olympic Scout* captain used a starboard twist on his vessel's rudders and engines. Soon after, the *Montlake* captain initiated a port counter twist out of concern that the stern of the *Montlake* would approach the southern bank of the waterway. According to the *Olympic Scout* captain, the starboard twist on his tugboat "wasn't giving us anything."

When a vessel is underway and steering and propulsion are applied, a turning moment is created, and the vessel will pivot around a point, generally located centerline aft of the bow. The actual location of the point varies depending on the shape of the hull, speed, and other factors, but a common tenet is that, for a vessel moving forward under its own power, the location is about one-third of the length of the vessel aft of the bow.[4] When a vessel moves astern, the pivot point will move aft.

[4] In the last 15 years, researchers have begun to challenge the tenet that the pivot point is one-third of the ship's length from the bow for a vessel moving forward through the water. However, in practical use, the rule has proven effective in most maneuvering situations (see T. Cummins, "A review of the ship's pivot point: Science, Maths and Observation' Where is the centre of a ship's rotation?", Marine-Pilots.com, July 17, 2020, https://www.nsc.org/getmedia/4b5503b3-5e0b-474d-af19-c419cedb4c17/fatigue-in-safety-critical-industries.pdf).

Figure 7 (below) shows the *Montlake/Sodo* with the *Olympic Scout* made up as it was during the Hylebos Bridge casualty. In this simplified illustration, the pivot point is assumed to be one-third of the total length of the *Montlake/Sodo* aft of the bow of the barge, and both the *Montlake* and *Olympic Scout* are applying a turning moment through the centerline of the ATB via their respective rudder and engine orders. Note that the moment arm for the *Montlake* is longer than the moment arm for the *Olympic Scout*, and thus the *Montlake* would require less effort to impart a turning moment on the ATB.[5] In addition to requiring less effort to turn the ATB, the *Montlake* had almost twice the engine power of the *Olympic Scout* (4,200 hp compared to 2,250 hp). Given the advantages in moment arm and power (turning moment), the *Montlake*'s port counter twist effectively negated the efforts of the *Olympic Scout* to move the ATB's bow back toward the center of the channel. The *Olympic Scout* captain applied progressively more rudder angle and engine speed, and the *Montlake* captain began backing down on his vessel's engines, but, by the time these actions were taken, the fender was too close for the *Olympic Scout* to avoid contact.

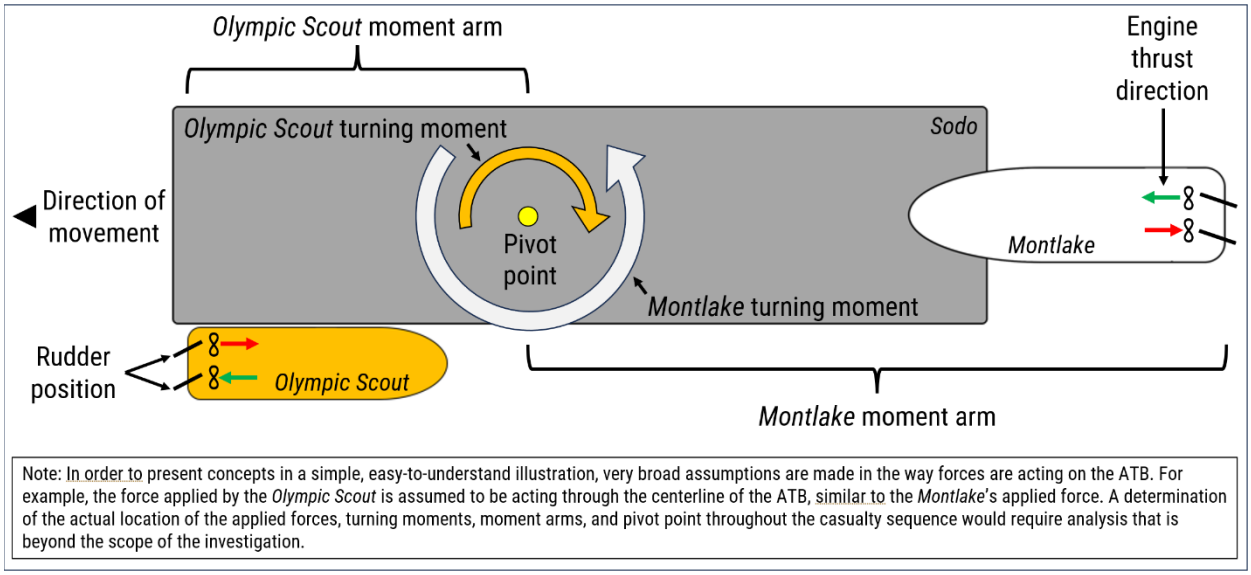

Figure 7. Simplified illustration of turning moments applied by *Olympic Scout* and *Montlake* as the ATB moved toward the Hylebos Bridge. The magnitudes of turning moments and moment arms are representative of relative strengths but are not to scale.

The width of the channel between the Hylebos Bridge fenders was 150 feet. The combined breadth of the 78-foot-wide *Montlake/Sodo* and the 26-foot-wide *Olympic Scout* was 104 feet, leaving a maximum clearance of 23 feet on either side of the combined unit, if it was perfectly centered in the channel. The *Montlake* captain stated that his normal practice was to center the ATB in the channel (not the ATB and

[5] The *moment arm* is the distance between the turning axis, or pivot point, and the applied force.

assist tugboat combined), which would have left only 10 feet of clearance between the *Olympic Scout* and the bridge's south fender, if the bridge transit was executed as intended. With such a tight clearance, the margin for error was slim.

The distance between the bow of the *Montlake/Sodo* at its berth and the bridge was 1,276 feet, providing a short distance for the ATB and its assist tugboat to line up to pass through the narrow opening between the protective fendering for the bridge. After getting underway, while the ATB waited for the bridge to open, the bow of the ATB moved to port. As the ATB began moving forward and accelerating to 4.1 knots, it was set further to port and, consequently, was not lined up properly with the bridge. Because of the short distance to the bridge and the speed of the ATB, there was insufficient time to correct the lineup before the *Olympic Scout* struck the fender. Given the slim margin of error for making the bridge transit and the short distance to make the approach, slowing or fully stopping the ATB's forward motion earlier would have provided the operators more time to correct the lineup and successfully transit through the opening between the bridge's protective fendering.

Protective fender systems are installed to prevent damage to abutments, piers, and other critical bridge structures by redirecting errant vessels back toward the navigable channel. After striking the south bridge fender, the *Olympic Scout* and *Montlake/Sodo* moved back toward the center of the channel, and the combined unit continued through the bridge opening. The Hylebos Bridge was undamaged, but the fender was catastrophically damaged. Precasualty inspections of the bridge's fenders in 2017 and 2022 noted significant deterioration of the fender piles from marine borer damage and fungal decay. A postcasualty inspection found similar damage, and a marine surveying and consulting firm stated, "the damage caused by the [*Olympic Scout* contact] resulted in significantly more damage being sustained as would have been, had the fendering structure been of sufficient structural strength." It is notable that the entire fender sustained catastrophic damage when the *Olympic Scout* struck it at one end (at an angle—not directly), yet the tugboat sustained almost no damage. The Hylebos Bridge fender system prevented damage to the bridge structure by the *Olympic Scout*; however, the system's degraded condition contributed to its extensive damage.

3 Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the contact of the assist tugboat *Olympic Scout* with the Hylebos Bridge fender was the captain of the articulated tug and barge (ATB) *Montlake/Sodo* not stopping or slowing the ATB's forward motion to correct the ATB's lineup before attempting the bridge transit. Contributing to the severity of damage to the bridge's fender system was the system's deteriorated condition.

Vessel Particulars

Vessel	*Olympic Scout*	*Montlake/Sodo*
Type	Towing/Barge (Tugboat)	Towing/Barge (ATB)
Owner/Operator	Harley Marine Special Leasing LLC / Olympic Tug & Barge Inc. (Commercial)	EEF SPV 3 LLC/Olympic Tug & Barge Inc. (both vessels) (Commercial)
Flag	United States	United States (both vessels)
Port of registry	Portland, Oregon	New Orleans, Louisiana/Portland, Oregon
Year built	1976	1990/2011
Official number (US)	571211	968591/1229343
IMO number	N/A	9032783 / N/A
Classification society	American Bureau of Shipping (Third-party organization)	American Bureau of Shipping (Third-party organization)/American Bureau of Shipping (Classification society)
Length (overall)	91.8 ft (28.0 m)	112.2 ft (34.2 m)/287.5 ft (87.6 m)
Breadth (max.)	26.2 ft (8.0 m)	34.0 ft (10.4 m)/77.7 ft (23.7 m)
Draft (casualty)	11.4 ft (3.5 m)	16.5 ft (5.0 m)/9.3 ft (2.8 m)
Tonnage	94 GRT	83 GRT/4,276 GT ITC
Engine power; manufacturer	2 x 1,125 hp (839 kW); Caterpillar D399 diesel engines	2 x 2,100 hp (1,566 kW); EMD 16-645E2 diesel engines / N/A

NTSB investigators worked closely with our counterparts from **Coast Guard Sector Puget Sound** throughout this investigation.