



CHARLESTON BRANCH PILOTS' ASSOCIATION

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October 12, 2023

National Transportation Safety Board
Senior Marine Investigator
490 L'Enfant Plaza, SW
Washington, DC 20594

Dear Captain Karr,

**Re: Incident Involving the M/T BOW TRIUMPH in the Cooper River, South Carolina
September 4, 2022**

Thank you for your notice of our opportunity to provide comment to the analysis and probable cause portions of your investigation report into the referenced incident. We are grateful for your careful attention to this incident, and we look forward to receiving your report.

These comments have been drafted collaboratively with the owners of the BOW TRIUMPH, and are submitted on behalf of the Parties in Interest Charleston Branch Pilots Association, and Pilot John Thomas. It is certainly our intent that these comments are in keeping with the spirit of the designations of Parties in Interest as assets to the investigative process and are also fully in adherence with the guidance of 49 CFR Part 831 and all other applicable doctrines. These comments augment our technical review comments forwarded to you on September 22, 2023.

Analysis

We fully agree with the facts as presented in the draft report, and our proposed comments on the analysis of the incident focus on the facts presented under sections 1.3.2, Waterway Information, 1.3.3, Transits of the Bow Triumph and Other Vessels, and 1.3.4, Shallow Water Effect of the draft.

As the facts indicate, the water depth in Charleston Harbor, the Wando River, and in the Cooper River below Joint Base Charleston is maintained by the U.S. Army Corps of Engineers. For the channel adjacent to Joint Base Charleston, the U.S. Air Force (USAF) and/or the U.S. Navy (USN) is charged with maintaining the published channel depth in the Cooper River, including the waters at Wharf Alpha and Pier Bravo, which are marked Range Delta and Range Charlie. This channel also serves the commercial marine terminals at Ineos, Nucor, and Nexans upriver of the Base.

The published water depth at Range Delta and Range Charlie is 35 feet at mean lower-low water (MLLW), which is defined as the average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch. This means that at all tidal stages, the water should be deeper than the published project depth, which was 35 feet.¹

All personnel aboard the BOW TRIUMPH were properly trained, licensed, and credentialed. Following the allision, all tested negative for the presence of drugs and alcohol. Lastly, there was no mechanical failure aboard the vessel. That is, the ship's engines and rudder responded to all commands. Yet the vessel failed to turn.

The hydrodynamic effect of "bank suction" is well known to mariners, and therefore the location and depth of banks and shoals along a waterway are critical information to be shared by those agencies with domain over such channels. In the lower harbor below the Joint Base, the Army Corps of Engineers conducts and publishes depth surveys three to four times annually and disseminates them in both graphic and data-based formats for use by mariners, pilots, and navigators.

While based in physics and expressed by Bernoulli's principle, the "bank suction" phenomenon may be commonly understood as a nozzle. When a non-compressible fluid such as water flows through a restriction (nozzle), the mass flow rate of the fluid is not diminished, and thus the velocity of the fluid must increase. That is, the same amount of water passes, but now at a higher speed because the area through which it must pass has been narrowed. Velocity and pressure are inversely proportional. Therefore, when velocity increases, pressure drops. A drop in pressure creates suction.

When a ship passes close to banks or shoaling under the surface, which are imperceptible to the eye, the area through which water displaced by the movement of the ship must pass, between the ship and the riverbank, is constricted. Therefore, the water passing between the ship and the bank increases in velocity relative to water passing on the other side of the ship where there is no such constriction. This causes a marked drop in pressure between the ship and the bank, causing the ship to be pulled towards the bank, a phenomenon known as bank suction. The presence of shoals creates the same phenomenon because a shoal constricts the flow of water in the same manner as a riverbank.

In this case, the waters on the ship's port side as she approached the left turn before Pier Bravo were, despite the published channel depth, heavily shoaled. Those uncharted shoals caused a suction effect on the ship, drawing the ship's port quarter closer to shore and pulling the ship's entire track farther left in the channel. Suction on the port quarter countered the force of the rudder and prevented the bow from turning to port more than 9.6 degrees, despite the rudder being initially

¹ It is further noted that, as stated in Section 1.3.2 of the NTSB Report, the USACE provides hydrographic surveys, dredging and dredge material management service to Joint Base Charleston. Contracts call for the portion of the channel where the *Bow Triumph* approached the bend, known as Shoal 4, to be dredged to a depth of 40 feet (40' required + 2' allowable over depth).

placed 20 degrees to port and then 45 degrees to port. This caused the ship to proceed straight ahead as if on rails. All of this happened within the space of a few minutes.

Investigation has established that soundings obtained from the U.S. Army Corps of Engineers (USACE) in the days following the allision showed the actual water depth relative to MLLW was only 27 to 28 feet in the navigation channel at the point where the vessel began its turn to port, far shallower than the published project depth of the channel charged to the USAF and USN to maintain. These soundings indicate water depths as shallow as 29 feet halfway across the channel and as shallow as 24 feet on the charted edge of the channel. Following the incident, the Charleston Pilots requested the placement of Buoy 72A at this location.

According to the USACE survey of the water depth on 9 September 2022, four days after the incident occurred, the channel was heavily shoaled, with seven to eight feet *less* water available than represented on NOAA Chart 11524. The effect of this unreported shoaling is that the riverbank was effectively well west of the charted location, substantially narrowing the usable channel.

The ship's GPS track overlaid on soundings data shows that at 1558 hours, the water depth was 30'-2", at 1559 hours, the depth was 27'-2"; at 1600 hours, the water depth was 28'-4"; and at 1601 hours, the water depth was 28'-1". At no point was the water depth close to the published project depth of 35 feet.

Conclusions

The unreported water depths along Range D were substantive to the cause of this incident. Pilots and navigators typically apply the best available information for the safe transit of their vessels. When setting up turns, the available approach is critical to successfully navigating the turn. When turning to port into unfavorable current, lacking other vessel traffic, and noting the presence of a pier or other obstruction to starboard, it is reasonable for a mariner to use all available means to successfully navigate the turn, including positioning the vessel to the best advantage anticipating the set of the flood current around the bend. The experience and proficiency of the mariners onboard was applied to best use all available means for safe navigation of the turn, given that the published parameters of the waterway failed to indicate the presence of shoaling, and therefore the encroachment of the riverbank well into the waterway. This proved to be a critical factor to the outcome.

Probable Cause

The USAF and/or USN is responsible for maintaining the channel depth at Range Delta and Range Charlie. The published project depth of the channel is 35 feet at mean low-low water. The actual water depth was 27 to 28 feet. The unpublished shoaling caused bank suction on the ship. The bank suction prevented the ship from turning, despite no mechanical failure.

Recommendations

Channels serving commercial navigation should be consistently surveyed and those depth surveys should be disseminated similarly regardless of the federal agency responsible for dredging to maintain the project depth of that channel or waterway. Further, channels should be dredged more frequently to maintain the published project depth. Lastly, Buoy 72A should be made a permanent aid to navigation.

Thank you, again, for the opportunity to provide these comments. Please do continue to advise of any way we can be supportive of the remaining process to complete this investigation.

Sincerely,



John E. Cameron
Captain, U.S. Coast Guard (Retired)
Executive Director