National Transportation Safety Board

Marine Accident Brief

Grounding and Sinking of Towing Vessel *Stephen L. Colby*

Accident no.	DCA14LM002
Vessel	*Stephen L. Colby*
Accident type	Grounding and sinking
Location	Upper Mississippi River, near mile 497, LeClaire, IA 41°35.8' N, 90°20.6' W
Date	November 25, 2013
Time	1555 central standard time (coordinated universal time – 6 hours)
Injuries	None
Damage	$3.9 million
Environmental damage	US Coast Guard estimated 2,096 barrels of petroleum product recovered from vessel and river Vessel carried est. 2,156 barrels of petroleum product when it sank—2,128 barrels of diesel and 28 barrels of lube oil
Weather	Mostly cloudy, winds southwest 12 mph and gusting to 29 mph, visibility 10 miles, air temperature 35°F
Waterway information	The Upper Mississippi River is upstream of Cairo, IL. Pool 14, location of the accident, is a body of water between US Army Corps of Engineers Lock & Dam 13 and Lock & Dam 14. The Coast Guard noted shallowest water depth was 9.88 ft, water temperature 37°F at time of accident

The uninspected towing vessel *Stephen L. Colby* struck hard bottom in the Upper Mississippi River (UMR) and partially sank off the right descending riverbank in LeClaire, Iowa, on November 25, 2013, at 1555 central standard time. Six of the nine crewmembers on board made it to the riverbank on their own. The nearby towing vessel *Aaron F. Barrett* recovered the remaining three crewmembers from the partially sunken vessel. No one was injured.

The superstructure of the *Stephen L. Colby* remained above the waterline when the vessel came to rest on the Mississippi River bottom near LeClaire, Iowa. (Photo from Quad Cities Times)

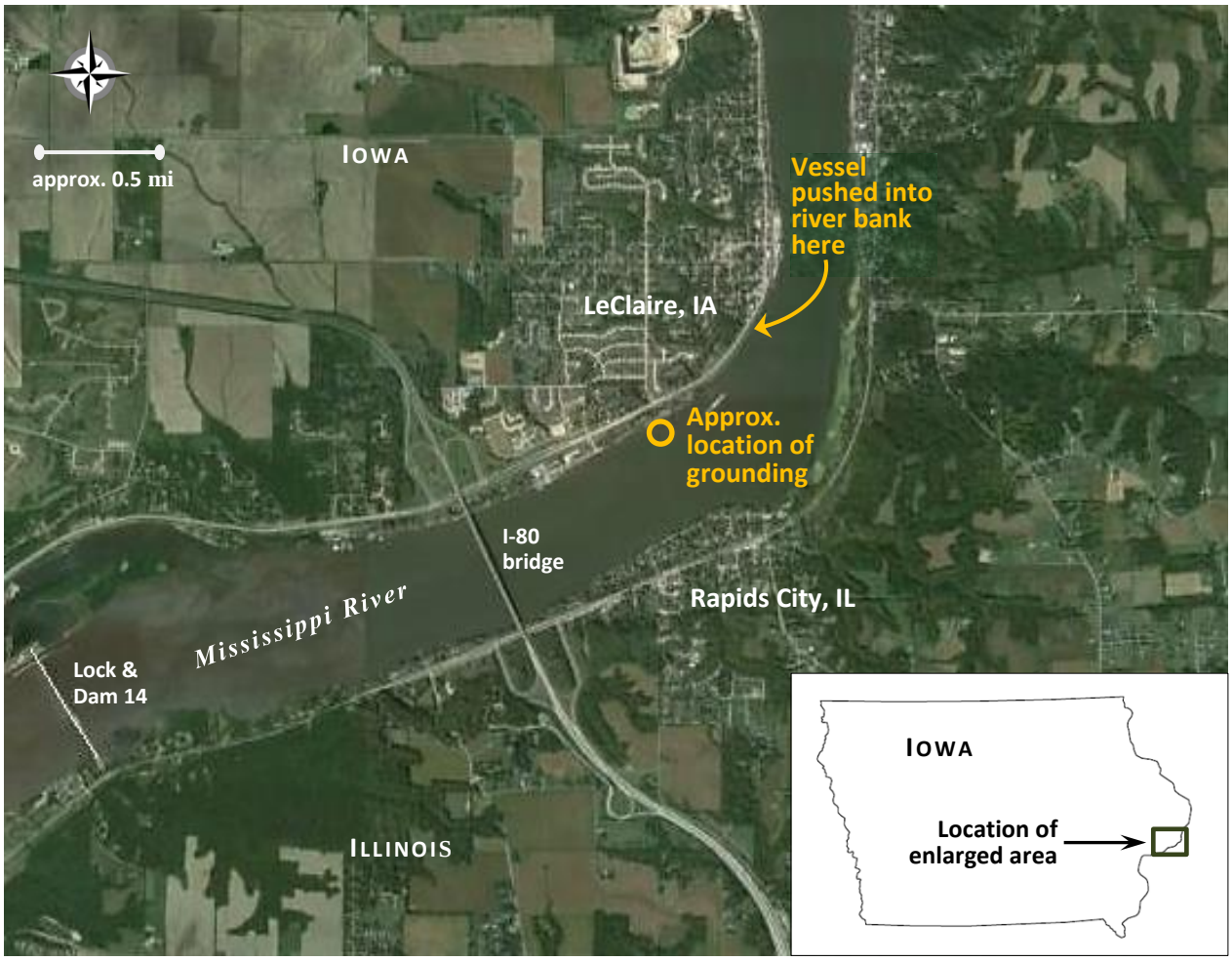
The *Stephen L. Colby* was operated as a line haul boat by Marquette Transportation Co. The term "line haul boat" is commonly used in the inland towing industry to refer to a vessel that is in continuous operation as it picks up and drops off barges at multiple locations along the waterway. At the time of the accident, the *Stephen L.*

Colby was transiting upriver from St. Louis, Missouri, to Clinton, Iowa, to pick up 15 loaded dry cargo barges.

On board were a licensed master, a licensed mate (on western rivers, a mate is also referred to as a "pilot"), an engineer, and six other crewmembers serving as leadman, deckhand, deckhand trainee, or cook. The master of the *Stephen L. Colby* had worked on board the vessel in the role of master or mate for 2.5 years before the accident. The mate received his credential as mate for towing vessels 10 months before the accident, and the company considered him experienced on that section of the UMR.

At 1100 on the day of the accident, the mate relieved the master on navigation watch when the *Stephen L. Colby* was just south of United States Army Corps of Engineers (USACE) Lock & Dam 15 at UMR mile 483, near Rock Island, Illinois. The vessel continued northbound on the river to USACE Lock & Dam 14 at UMR mile 493.3, near Pleasant Valley, Iowa, where it passed through the lock at 1530. The *Aaron F. Barrett*, also heading north, passed through the lock with the *Stephen L. Colby*.

The *Stephen L. Colby* was ahead of the *Aaron F. Barrett* as it passed under the Interstate 80 bridge at UMR mile 494.5 about 1545 and proceeded upriver at 6.3–6.6 mph. At 1555, as the *Stephen L. Colby* approached mile 497, the mate, who was on watch in the wheelhouse, heard and felt the hull strike something near the bow area. He pulled back the throttles to slow the vessel and directed the engineer to check the engine room for damage. The engineer reported a significant amount of water spraying up through the deck plating. The mate sounded the general alarm signal and maneuvered toward the right descending riverbank to ground the vessel in shallow water. Using VHF marine radio, the mate also requested support from the *Aaron F. Barrett*, which was about 1 mile downriver at the time.



Location of the grounding and sinking of the towing vessel *Stephen L. Colby*. (Background by Google Earth)

Uninspected towing vessel *Stephen L. Colby* on the Ohio River before the accident. (Photo from www.towboatgallery.com)

Once the vessel was grounded on the riverbank at about UMR mile 497, six of the crew disembarked safely ashore, and the mate, master, and engineer remained on board. The tug lost power as the water level quickly rose in the engine room, and it slid about 50 feet off the riverbank before the *Aaron F. Barrett* came alongside and held the *Stephen L. Colby* in position until the hull came to rest on the river bottom. The mate, master, and engineer then abandoned the partially submerged *Stephen L. Colby* and boarded the *Aaron F. Barrett* for safety.

Shortly after the *Stephen L. Colby* sank, the crew of the *Aaron F. Barrett* used a small aluminum workboat to deploy oil containment boom around the vessel. At first light on the morning after the accident, local responders, oil recovery personnel, and the Coast Guard continued the response effort.

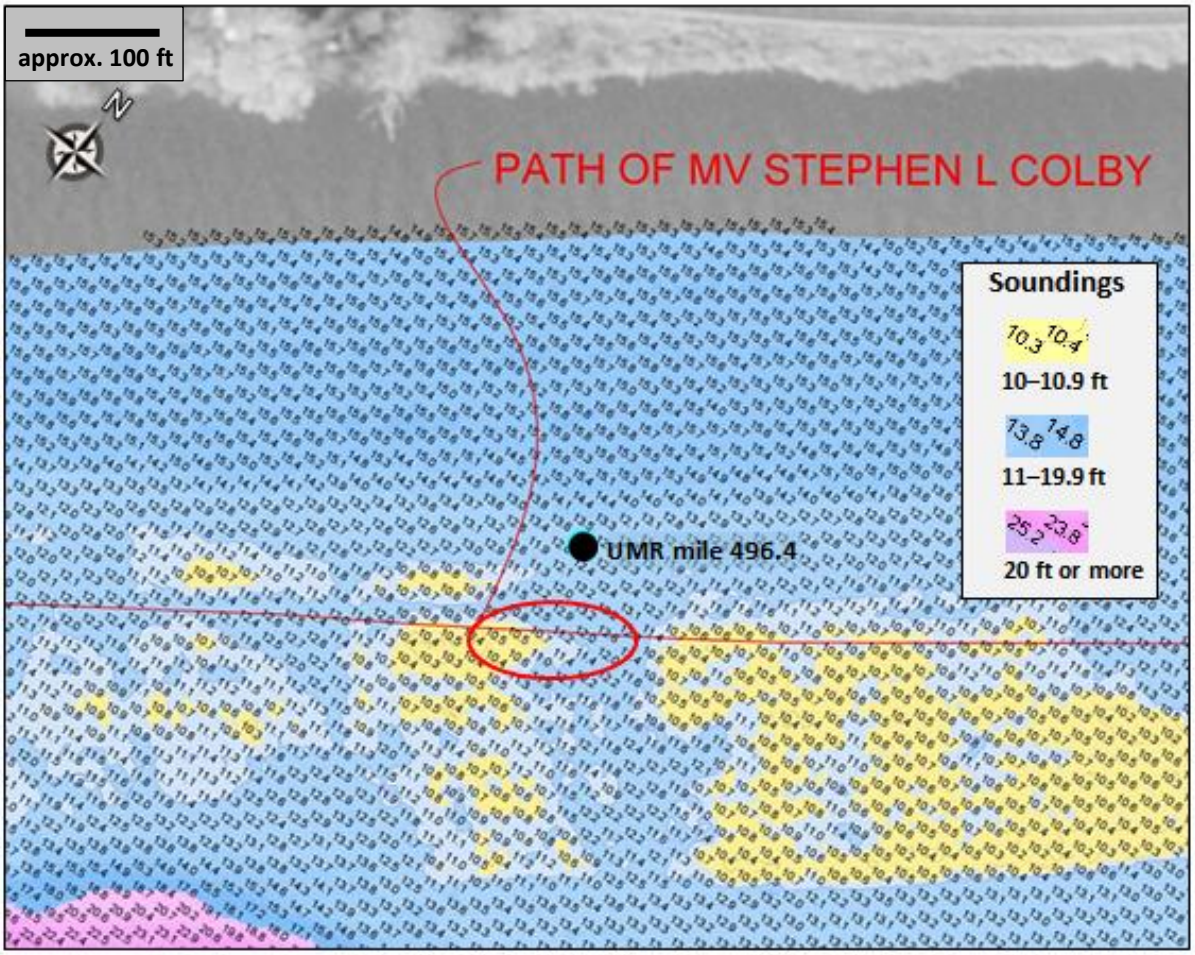
The USACE conducted soundings and a side-scanning sonar survey of the waterway near the accident site but did not locate any unknown hazards or obstructions on the river bottom. Using automatic identification system (AIS) data obtained from the *Stephen L. Colby*, the USACE overlaid the vessel's trackline on the sounding results. The results indicated the vessel had remained within the navigable channel before the accident (see below).

The *Stephen L. Colby* in the days after the sinking, with oil boom deployed to capture petroleum product released from the vessel. (Photo from US Fish and Wildlife Service)

The vessel's course passed over an area where a water diversion dike existed from the 1800s until the mid-1930s, when the channel was modified to accommodate construction of the present Lock & Dam 14.

The shallowest water depth recorded along the vessel's path at the time of the survey was 10.4 feet. Correction to reflect the water level at the time of the accident resulted in a calculated depth of 9.9 feet. According to Coast Guard information, Marquette Transportation reported the draft of the *Stephen L. Colby* at the time of the accident to be 9 feet both forward and aft, leaving an underkeel clearance of 8 to 11 inches when the *Stephen L. Colby* was at idle speed. Although the squat effect was not calculated in this situation, this hydrodynamic phenomenon—caused when a vessel passes through shallow water at speed—very likely reduced the vessel's underkeel clearance even further. (See box on squat, next page.)

> ***There are rock shelves in those areas and there have been several incidents over the years of boats . . . hitting those rocks and puncturing the hulls.***
>
> **— Company caution to operators**



Investigators used AIS data from the *Stephen L. Colby* to determine the vessel's course through the channel. The northeast path of the towing vessel (red line running left to right) is overlaid on a chart of depth soundings taken the day after the accident. The red oval indicates the approximate site of the accident. (Data plot by Coast Guard)

Squat effect and hydrodynamics

A ship moving through shallow water experiences pronounced effects from the proximity of the bottom. Similarly, a ship in a channel is affected by the proximity of the sides of the channel. These hydrodynamic effects—squat, bank cushion, and bank suction—can easily cause errors in piloting that lead to grounding.

Squat is caused by the interaction of the hull of the ship, the bottom, and the water between. As a ship moves through shallow water, some of the water it displaces rushes under the vessel to rise again at the stern. This causes a venturi effect, decreasing upward pressure on the hull. Squat makes the ship sink deeper in the water than normal and slows the vessel.

The faster the ship moves through shallow water, the greater this effect. Groundings on both charted and uncharted shoals and rocks have occurred because of this phenomenon, when at reduced speed the ship could have safely cleared the dangers.

When navigating in shallow water, the navigator must reduce speed to avoid squat. If bow and stern waves appear nearly perpendicular to the direction of travel, and the vessel slows with no change in shaft speed, squat is occurring. Immediately slow the ship to counter it. Squatting also occurs in deep water, but the effect is more pronounced and dangerous in shoal water. The large waves generated by a squatting ship also endanger shore facilities and other craft.

Skilled pilots may use hydrodynamic effects to advantage in particular situations, but the average mariner's best choice is slow speed and careful attention to piloting.

— *Based on* The American Practical Navigator: An Epitome of Navigation, *originally by Nathanial Bowditch, first published in Newburyport, Massachusetts, 1802*

Oil response and salvage operations continued for about 2 weeks after the accident. Salvage divers performed temporary repairs to the hull in the engine room, where an opening about 34 x 30 inches was found just port of the centerline. Divers also completed temporary repairs to a smaller fracture in the hull plate in the pump room and sealed a preexisting fracture in a forward ballast tank. On December 11, 2013, the vessel was towed to dry dock in St. Louis, Missouri, where it arrived December 17 for further repairs.

Low water concerns along the UMR have persisted since 2012, mainly due to drought conditions in areas comprising the river's drainage basin. From late 2012 to early 2013, the USACE undertook several rock and sediment removal projects to maintain the navigational channel's required minimum depth of 9 feet. The USACE maintains the water level of pool 14 between 13.9 feet and 15.0 feet. At the time of the accident, the water level in pool 14 was 14.37 feet and rising.

The *Stephen L. Colby* was outfitted with electronic navigational tools including a global positioning system (GPS), radar, an echo depth sounder, and an electronic chart display and information system (ECDIS), all of which were operational and available to the mate at the time of the accident.

In addition to these electronic navigational tools, Marquette Transportation maintained a safety management system (SMS) including procedures for mitigating navigational risk. These SMS procedures did not specify a minimum underkeel clearance for each vessel in the fleet to maintain as a safety margin, but the sections on navigation procedures and voyage planning both required the master and wheelhouse person on watch to maintain appropriate draft and trim to ensure the vessel's operational dimensions were suitable for the waterway being transited.

The area of the UMR where the *Stephen L. Colby* grounded is known to require particular caution during periods of low water because the bottom is hard rock with a stepped or shelf formation. On November 16, 2013, the port captain for Marquette Transportation sent an e-mail reminder to all company vessel operators to use caution while transiting two specific areas of the waterway: the area just below Lock & Dam 14 and the vicinity of UMR mile 497, just upstream of the accident site. The e-mail warned, in part, "There are rock shelves in those areas and there have been several incidents over the years of a

boat . . . hitting those rocks and puncturing the hulls." The mate stated that he was not aware of this e-mail, but he knew those areas of the UMR presented special risks.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the grounding and sinking of the *Stephen L. Colby* was the failure of the master and mate to ensure sufficient underkeel clearance for the intended transit through the accident area.

Vessel Particulars

Vessel	*Stephen L. Colby*
Owner/operator	Marquette Transportation Co.
Type	Uninspected towing vessel
Hailing port	Paducah, KY
Builder, date	St. Louis Shipbuilding St. Louis, MO 1967
Official number (US)	506770
Construction	Steel
Length	144 ft (43.9 m)
Breadth	40 ft (12.2 m)
Draft	9 ft (2.7 m)
Gross tonnage (GRT)	597
Net tonnage	406
Engine power, manufacturer	2 EMD 16-645 E5 series diesels with Kort Nozzles, 5,000 hp (3,728 kW) each
Steering	2 steel rudders
Persons on board	9 crewmembers

For more details about this accident, visit http://www.ntsb.gov/investigations/dms.html and search for NTSB accident ID no. DCA14LM002.

Adopted: July 15, 2014

The NTSB has authority to investigate and establish the probable cause of any major marine casualty or any marine casualty involving both public and nonpublic vessels under 49 *United States Code* 1131. This report is based on factual information provided by the Coast Guard from its informal investigation of the accident and NTSB onsite investigation and analysis.