AVIATION HIGHWAY MARINE RAILROAD PIPELINE

April 10, 2025 MIR-25-15

Engine Room Fire aboard Towing Vessel *Johnny M*

On January 30, 2024, about 0330 local time, an engine room fire broke out aboard the towing vessel *Johnny M*, which was pushing four barges on the Tennessee River near Grand Rivers, Kentucky (see figure 1 and figure 2).[1] The six crewmembers aboard were unable to extinguish the fire and abandoned ship to a Good Samaritan vessel. Local fire departments extinguished the fire. There were no injuries, and no pollution was reported. Damage to the vessel totaled $3 million.[2]

Figure 1. *Johnny M* underway before the fire. (Source: marinetraffic.com, Roger Green)

[1] In this report, all times are central standard time, and all miles are statute miles.

[2] Visit ntsb.gov to find additional information in the public docket for this NTSB investigation (case no. DCA24FM020). Use the CAROL Query to search investigations.

Casualty Summary

Casualty type	Fire/Explosion
Location	Tennessee River, mile 22.4, Grand Rivers, Kentucky 37°00.83′ N, 088°15.72′ W
Date	January 30, 2024
Time	0330 central standard time (coordinated universal time –6 hrs)
Persons on board	6
Injuries	None
Property damage	$3 million
Environmental damage	None
Weather	Visibility 7 mi, scattered clouds, winds south-southeast 14 mph, air temperature 34°F, water temperature 34°F, morning twilight 0635, sunrise 0703
Waterway information	Lake; width at casualty location about 1.3 mi

Figure 2. Area where the fire aboard the *Johnny M* occurred, as indicated by a circled *X*. (Background source: Google Maps)

1 Factual Information

1.1 Background

The 88-foot-long *Johnny M* was an inspected towing vessel constructed of welded steel and built by NewSouth Marine Construction in Greenville, Mississippi, in 2009. Terral RiverService owned and operated the *Johnny M* on the Western Rivers transporting river barges. The *Johnny M* operated under the company's towing safety management system and had a valid US Coast Guard-issued certificate of inspection documenting compliance with Title 46 *Code of Federal Regulations* Subchapter M.

The *Johnny M* was a shallow-draft vessel configured with a forward wheelhouse above the upper deck. The main deck was below the upper deck and included the upper level of the engine room, a galley, the crew berthing areas, and the carbon dioxide (CO_2) room (see figure 3).

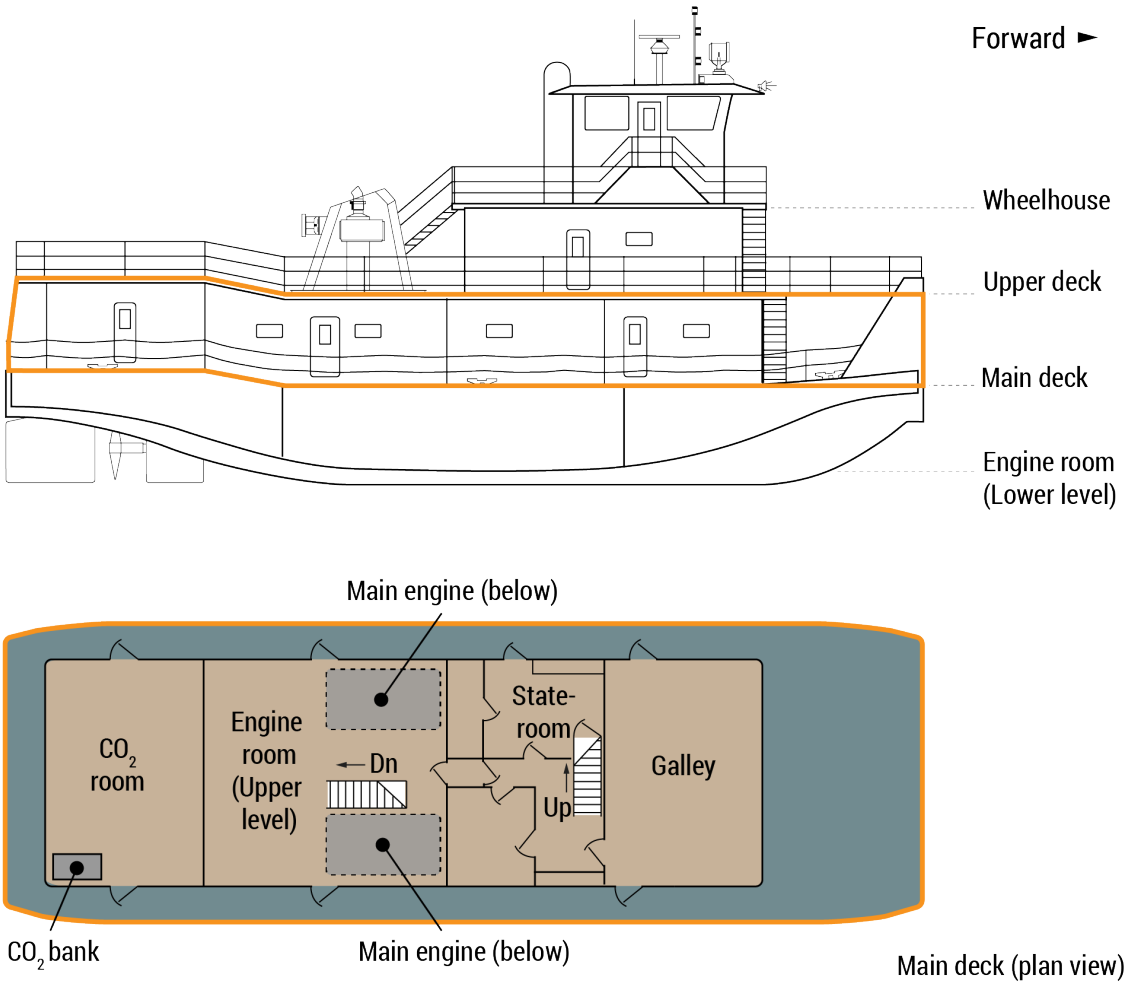

Figure 3. Profile view of *Johnny M* with plan view of the main deck.

The vessel's propulsion consisted of two Caterpillar model 3508C, 8-cylinder, turbocharged diesel main engines, each with a Twin-Disc reduction gear to conventional shafts and fixed propellers. The vessel was outfitted with six rudders: one steering rudder aft of each propeller, and two flanking rudders forward of each propeller.

1.2 Event Sequence

On January 28, 2024, about 1530, the *Johnny M* departed Olmstead, Illinois, with no barges in tow, en route to Vulcan Quarry (Vulcan Materials Company), located at mile 23 of the Tennessee River near Grand Rivers, Kentucky, to pick up barges. Over the next 12 hours, the vessel transited the Cumberland River and Ohio River at a maximum speed of about 10 mph. The six-person crew on board consisted of a relief captain (referred to as the captain), a pilot, and four deckhands.[3] The crewmembers stood rotating, three-person watches, changing at 0500, 1100, 1700, and 2300.

On January 29, about 0400, the vessel transited through the Barkley Lock. At 0530, the vessel arrived at Vulcan Quarry. The crew picked up four barges loaded with rock cargo; the barges were arranged ahead of the *Johnny M*—in two strings (rows) of two barges each. Once the tow was configured, the vessel continued underway, en route to Cairo, Illinois. Combined, the vessel and tow's length was about 488 feet, and its width was 70 feet.

About 0600, while waiting to transit the lock, the *Johnny M* moored to federal mooring cells located about a mile southeast of the Kentucky Lock and Dam. The main engines were shut down, and the port generator provided electrical power to the vessel.

At midnight on January 30, two deckhands (referred to as deckhands 1 and 2) took the watch and completed a round of the engine room, which included checking the engine spaces, pumps, fluid levels, and temperatures, and conducting an overall visual check of the main engines and generators. (This type of round was required to be completed at the change of each watch.)

About 0250, the lock operator contacted the *Johnny M*'s wheelhouse by VHF radio, informing the pilot that it was the vessel's turn to transit the lock. At the

[3] *Pilot* is a term used aboard towing vessels on inland waterways for a person, other than the captain, who navigates the vessel. The *relief captain*, a position designated by the company, served as the towing vessel's captain when the designated captain was off rotation; at the time of the casualty, the captain was off rotation and ashore.

direction of the pilot, the two deckhands on watch completed a round of the engine room and started the two main engines.

At 0314, after allowing time for the engines to warm up, the *Johnny M* got underway, bound for the Kentucky Lock. Deckhands 1 and 2 went out to the head of the tow to prepare for lock operations. Over the next 19 minutes, the vessel transited toward the lock; the vessel's speed over this time varied and did not exceed 3 mph.

About 0333, the *Johnny M* was alongside the lock's long forebay wall to port, transiting at a speed of 0.9 mph (see figure 4). According to deckhand 1, the vessel "started acting a little funny … [and the crew] couldn't get over to the long [forebay] wall to tie off at all." The pilot stated that he had difficulty maneuvering the vessel to close the gap between the tow and the wall; he believed he was backing on the port main engine during the approach.

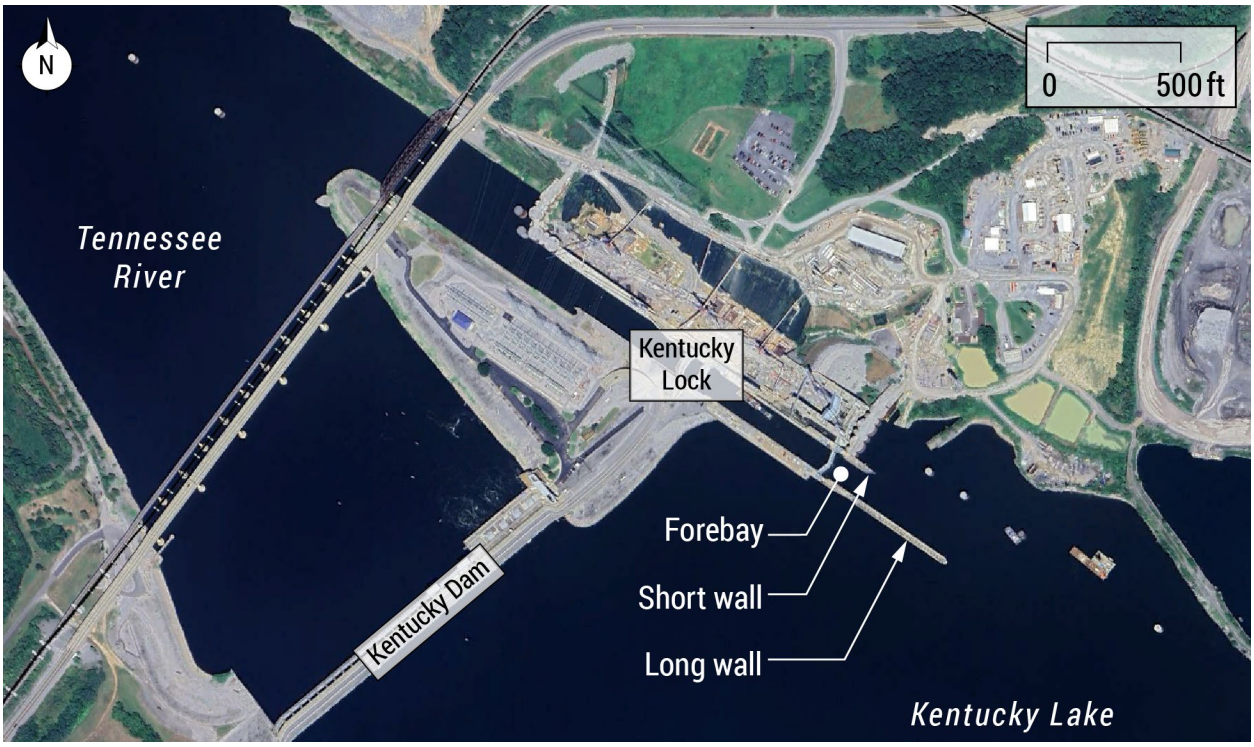

Figure 4. Aerial view of Kentucky Lock and Dam (vessels shown were not present at the time of the casualty). (Background source: Google Earth)

As the pilot was making his approach to the forebay of the lock chamber, an alarm sounded in the wheelhouse. The pilot believed it was a "low water or low coolant temp" alarm for the port main engine (he could not recall with certainty). Shortly after, another unidentified alarm sounded in the wheelhouse. The pilot called one of the deckhands back to the vessel to check the alarm panels. About 0340, as deckhand 1 headed aft from the head of the tow to the towing vessel, he saw the

whole vessel engulfed in smoke and the distance from the vessel to the long forebay wall had increased.

The vessel's internal fire alarm system sounded in the accommodation spaces, waking up the captain. He exited his cabin, where he met deckhand 1. He instructed deckhand 1 to report to the wheelhouse and direct the pilot to first sound the general alarm, then wake the crew. Deckhand 1 reported to the wheelhouse and informed the pilot of the captain's orders. The pilot activated the general alarm, and deckhand 1 proceeded below to the crew's quarters to wake up the off-watch deckhands. In accordance with the vessel's emergency procedures, the crew mustered on the bow of the towing vessel.

After waking the off-watch deckhands and mustering on the bow, deckhand 1 viewed the engine room through the window of the main deck interior door (located on the forward bulkhead of the engine room upper level leading to the accommodation spaces), recalling "it was black with streaks of orange all through the engine room door." He and another crewmember then attempted to enter the space from the main deck exterior through the portside engine room door to fight the fire with an extinguisher. They stated that they were unable to open the door to the upper level of the engine room because it was too hot. In the wheelhouse, the pilot continued maneuvering the vessel toward the long wall.

About 0345, the captain attempted to enter the engine room through the interior engine room door. He was unable to see through the window of the door, recalling it was "black with smoke." He went outside and saw flames rising from the port side of the engine room through a window on deck. The captain told investigators that he instructed crewmembers to stand by the remote pull station for the CO_2 fixed fire extinguishing system and at the two remote fuel shutoff stations, which were located on the exterior main deck outside the upper level engine room doors (one on the port side and one on the starboard side).

In preparation for activating the CO_2 fixed fire extinguishing system, the captain fitted metal covers over ventilation exhaust openings—located aft of the wheelhouse on the main deck—for the engine room space (see section 1.3.4). The covers were to prevent any air from entering the engine room spaces once the fans were stopped (once the CO_2 system was activated, electricity was automatically shut off to the fan motors and ventilation fans associated with the engine room spaces would stop).

At the captain's direction, the crew pulled the remote fuel shutoff handles, which were connected by a wire to the port and starboard fuel oil service tank supply valves, thus securing the flow of fuel to the engines. Shortly thereafter, the captain directed a crewmember to activate the CO_2 fixed fire extinguishing system. When the

deckhand at the remote station pulled the handle, however, the wire connecting the handle to the activation valve parted, preventing the system from activating. The deckhand went to the CO_2 room (also called the rudder room by the crew)—where the CO_2 system was located—and released the CO_2 manually by pulling the release lever. The crew heard the gas release through the piping network. The main engines stopped running shortly after the fuel shutoff handles had been pulled and the CO_2 system was activated.

About 0350, the captain contacted the vessel's shoreside office and updated management. He then instructed the crew to again muster on the vessel's tow. Ten minutes later, the crew successfully evacuated to the barges.

Crewmembers told investigators that, at this point, the fire appeared to be extinguished, and the smoke had dissipated. About 0407, the *Clarence G. Frame*, a towing vessel that had been near Kentucky Lock, responded to assist.

The *Johnny M* operating company's safety manager notified the Coast Guard of the fire at 0440.

About 0454, the crew was still on the barges when they once again saw smoke coming from the towing vessel and increasing in volume. The captain contacted the office to report that the fire was still burning, and he determined that the crew should evacuate. He then led the crew from the barges back to the vessel to retrieve their personal belongings, and the crew abandoned ship to the *Clarence G. Frame*.

After ensuring all crewmembers were present and accounted for on the *Clarence G. Frame*, the captains of both vessels discussed using the *Clarence G. Frame*'s fire hoses to suppress the fire aboard the *Johnny M*. They decided the risk involved with attempting to extinguish the fire was too great because the *Clarence G. Frame* was lightboat (without a tow) and susceptible to wind drift, making it more difficult to safely maneuver near the *Johnny M*.

About 0630, the captain of the *Johnny M* saw flames coming from the window of the engine room. Four minutes later, the captain contacted emergency responders. At 0700, a land-based firefighting crew arrived on scene. Fifteen minutes later, marine firefighters arrived (see figure 5) and began fighting the fire using equipment on their fire boats. The fire was extinguished about 1130. The *Johnny M* was towed downriver to Paducah, Kentucky, for overhaul and investigation.

Figure 5. Local firefighters fighting the fire aboard *Johnny M*. (Source: East Marshall Fire Department)

1.3 Additional Information

1.3.1 Damage

1.3.1.1 Vessel

After the fire, Coast Guard and the National Transportation Safety Board investigators boarded the *Johnny M* to examine the vessel damage. The vessel sustained fire damage throughout all the decks. The engine stacks' interior and exterior and the engine room windows exhibited soot where the space ventilated to the atmosphere. The paint on the exterior of the upper engine room bulkheads was charred where the structural frames intersected with the bulkhead. Fire and heat damage was heavily concentrated in the lower level of the engine room where the main engines were located.

The engine room window frames and the deck above the engine room were warped due to heat exposure (see figure 6). The outboard side of the portside stack

had an area of charred/burned-off paint that corresponded with the location of the port main engine exhaust system. The starboard-side stack did not exhibit this severity of damage.

Figure 6. Portside view of *Johnny M* after the fire, showing fire-damaged portside window on exterior of engine room upper level and portside main engine exhaust stack heat and fire damage. (Source: Coast Guard)

Both the port and starboard main engines' combustion air was supplied through two flexible ducts originating through air intake openings on the upper deck on the aft side of each stack and extending down through the upper level of the engine room and to each engine's turbochargers (see section 1.3.4). A flange adapter affixed to the top of the turbocharger connected the flexible ducting to the top of the inlet of the turbocharger on the aft end of the engine. The fabric material covering the four flexible ducts was incinerated during the fire, leaving only the metal wire helix (backbone) structure (see figure 7). The exterior bulkheads of the engine room, exhaust stacks, and surface of the main deck were severely heat-damaged.

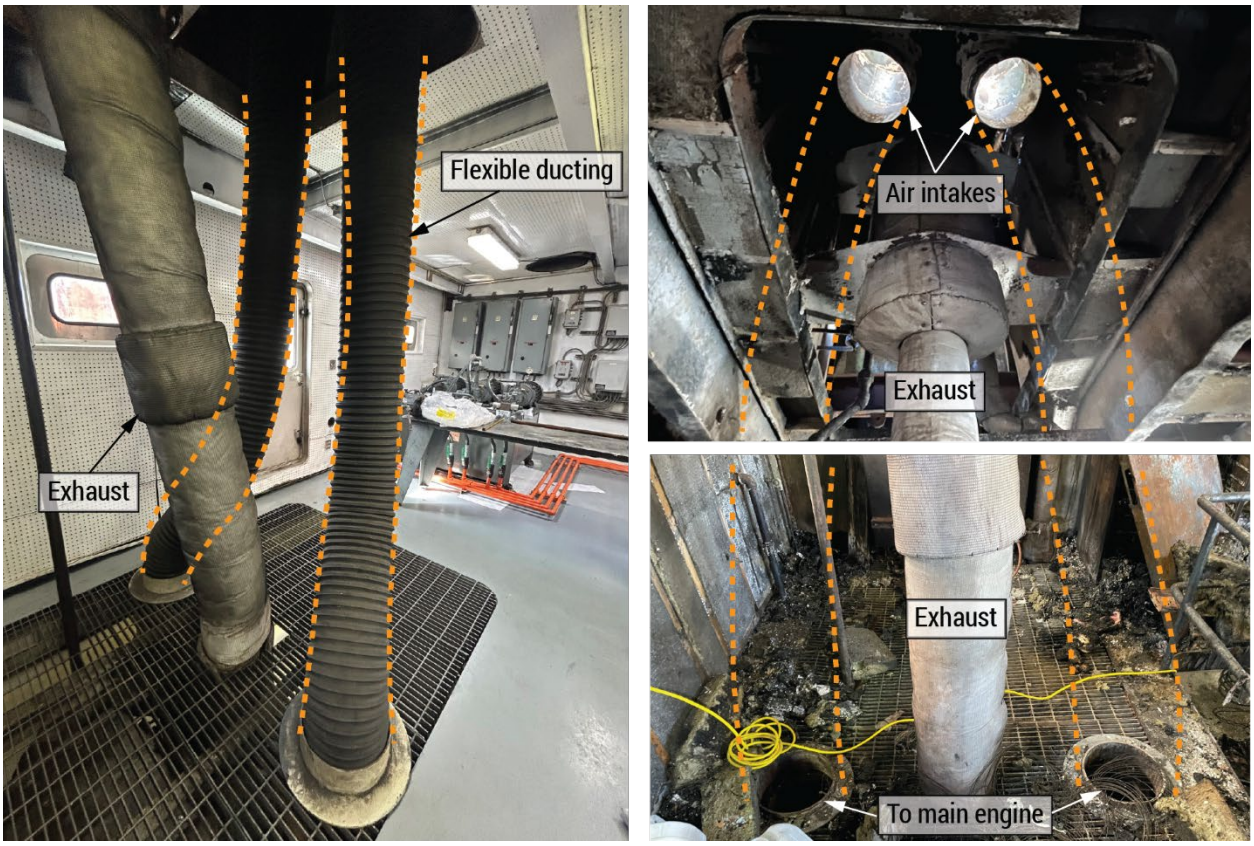

Figure 7. *Clockwise from left*: Starboard main engine's air combustion air intake flexible ducting on sister vessel *Amy T* (the insulated engine exhaust pipe is shown between the two flexible ducts.). Missing (incinerated) ducting from *Johnny M*'s port main engine after the fire (dashed lines show the approximate location of the ducting). (Background source [*left*]: Terral RiverService)

The plastic sight glasses for the waste oil and lube oil tanks—located on the aft bulkhead of the lower level of the engine room—melted and became deformed in the fire. Investigators found fluid from the sight glasses near the aft bulkhead of the engine room.

1.3.1.2 Port Main Engine

The port main engine was severely damaged during the casualty. The crankcase had ruptured, via the crankcase covers, on the port and starboard sides in the area of the nos. 1 and 2 cylinders (see figure 8). Additionally, components of the engine—including a connecting rod bearing cap—were found outside the engine. The engine block in the area around the crankcase covers of the nos. 1 and 2 cylinders was also damaged. The larger of the crankcase holes and most of ejected components were located on the port side of the engine.

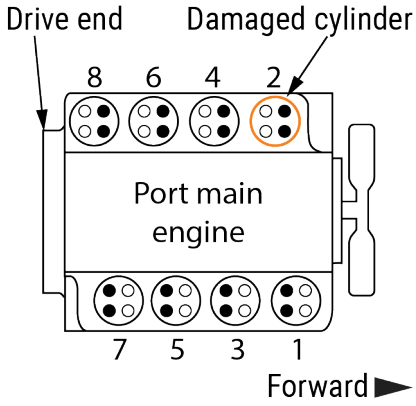

Figure 8. Diagram of port main engine showing location of damaged cylinder no. 2.

Inside the engine, both the nos. 1 and 2 connecting rods were found to be disconnected from the crankshaft and their bearing caps separated (see figure 9). One of the connecting rod caps was forcibly wedged between the cylinder liner and crankcase directly above the damaged area of the crankcase (engine block). The crankshaft showed signs of what appeared to be both impact and thermal damage to the nos. 1 and 2 journals. The crankshaft webs in that area were also damaged, as was the lube oil sump suction tube.

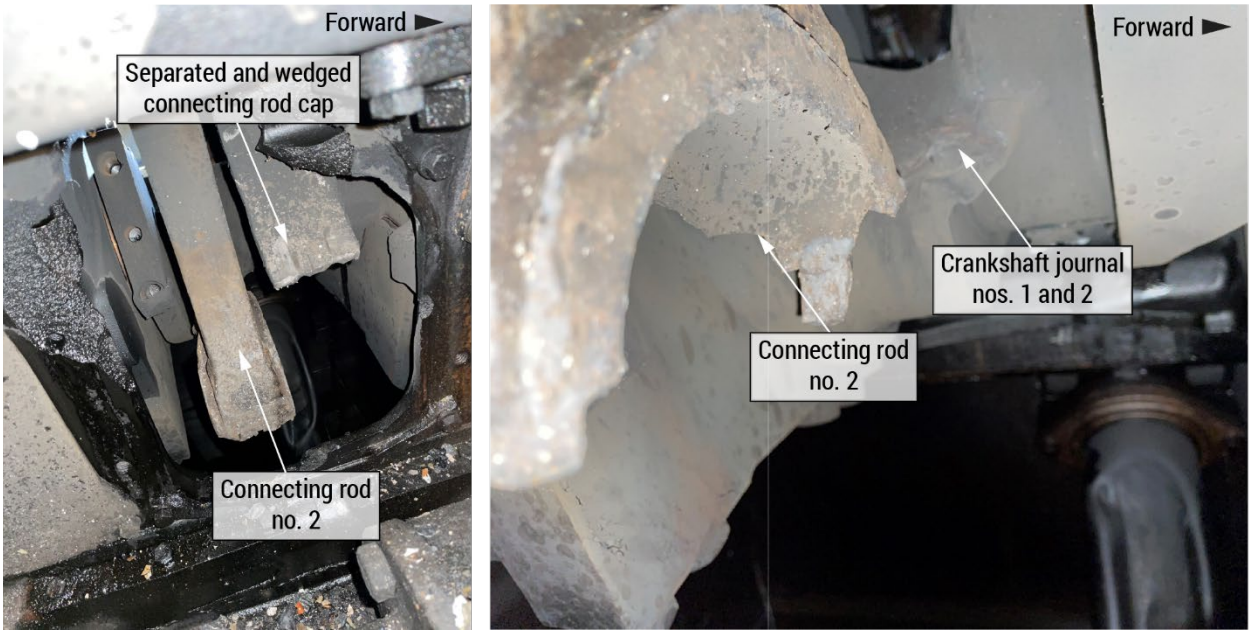

Figure 9. *Left to right*: Damage to the port main engine connecting rod and crankcase.

In addition, the exterior of the engine exhibited fire damage. Most of this damage was on the port side of the engine, which displayed signs of exposure to higher temperatures. The aluminum valve covers on the port side of the engine were deformed, and the aluminum air intake pipe had partially melted from the heat.

Investigators reviewed the vessel's wheelhouse log after the casualty. According to the log, on the day before the casualty (January 28), about 0550–0620, while the vessel was at mile 10 of the Tennessee River bound for Olmstead, the crew "stopped to check port main [engine], called [port engineer] for code info."[4] (The operating company did not provide additional information about this logbook entry.)

According to the vessel owners, there were no plans after the fire for a forensic examination or disassembly of components of the port main engine by either themselves, service technicians, or the engine manufacturer.

On May 13, 2024, a marine surveyor completed a damage report, which stated that the port engine "suffered a base explosion, which apparently broke the piston off the crank and blew a hole in the side of the port main engine under load, thus causing the subsequent fire" on board the *Johnny M*.

1.3.2 Port Main Engine Maintenance and Overhaul

The *Johnny M* did not have a full-time engineering crew; instead, engineers and technicians were brought on board for major engine maintenance issues. Technicians from the vessel's operating company overhauled the vessel's Caterpillar 3508C diesel main engines in June 2023. (The engines had been operating since this overhaul without major incident.) During this 40,000-hour overhaul, the engine cylinder packs and the connecting rod and main bearings were replaced. Between the June overhaul and the time of the casualty, the port engine had about 4,600 running hours. The next scheduled inspection/overhaul was after another 15,000 running hours.

1.3.3 Fixed Fire Extinguishing System

The *Johnny M* was equipped with a CO_2 fixed fire extinguishing system to protect the engine room. The system had a bank of five cylinders and eight nozzles to distribute the gas. An annual inspection of this system, conducted on June 1, 2023, found that all components of the system were functioning properly, and all lines were

[4] Modern engines are equipped with Electronic Control Modules (ECM) that monitor the operating conditions of the engine and adjust engine settings. The ECM will also register faults or codes that can be referenced to help determine the overall performance of the engine.

clear. The last hydrostatic test of the bottles—to check the CO_2 bottles for leaks—was successfully completed in August 2013.

After the fire, on February 15, 2024, a third-party service weighed the vessel's CO_2 bottles. All cylinders had been depleted of CO_2, and all valve safeties remained intact, indicating that the CO_2 was discharged into the piping network before the increase of heat and pressure was beyond allowable tolerances. The third-party service found that despite the broken pull cable, there was no evidence of anything that would have deterred the CO_2 fire extinguishing system from performing as designed.

1.3.4 Engine Room Ventilation

Eight structural ventilation openings provided combustion air to the two main engines and ventilation to the engine room (see figure 10). There were two engine room supply fans, independent of the stacks, located aft on the upper deck, one on the port side and the other on the starboard side. There were two engine room exhaust fans located on the stacks' inboard sides. Each main engine drew in fresh air for combustion from outside the vessel via air intake openings on the engine's corresponding stack (four openings in total); these openings connected to fabric-covered flexible ducting that extended down to each respective engine's turbocharger. The two combustion air intake openings for each engine were housed under a single metal hood (one hood on each stack's lower aft side).

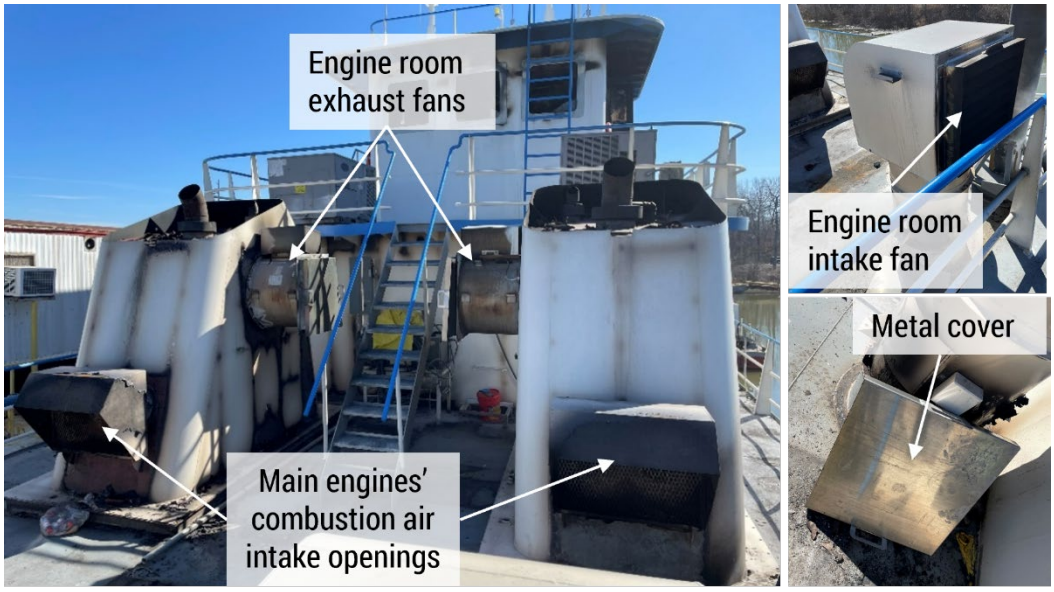

Figure 10. *Clockwise from left*: *Johnny M* exhaust stacks showing covered engine room exhaust fans and engine air intake openings (two openings under each hood); engine room intake fan (there were two intake fans—one port and one starboard); and metal cover, all located on upper deck.

The engine room intake and exhaust fans could be blocked with metal covers to prevent air from entering the space (the covers were intended for emergency use with the CO_2 fire extinguishing system). Unlike the other ventilation openings on the main deck, the main engine air intake openings did not have metal covers.

According to the captain, on the day of the fire, he put the four metal covers on the ventilation openings, including the engine room intake fans and exhaust fans. During the postcasualty examination of the vessel, investigators found all four main engine air intake openings uncovered.

1.3.5 Crew

1.3.5.1 Experience

The captain had held a Coast Guard credential as master of towing vessels upon Great Lakes, inland waters, and Western Rivers since February 22, 2023. He had worked for the operating company about 6.5 years. He started as a deckhand in 2017 and had sailed as captain for about 6 months before the fire.

The pilot had held a Coast Guard credential as master of towing vessels upon Great Lakes, inland waters, and Western Rivers since November 13, 2023. He had 19 years of experience working on towing vessels. It was his third trip with the operating company, all on board the *Johnny M*.

Deckhand 1 had 6 months of experience as a deckhand, all on board the *Johnny M*. Deckhand 2 had 1 year and 3 months of experience; the most recent 2 months were on board the *Johnny M*.

1.3.5.2 Fire and Emergency Response Drills

The operating company required the crew to conduct at least one firefighting drill each month. Crewmembers were also required to conduct at least one other emergency response drill, including scenarios such as man overboard, sinking, collision, or operator incapacitation. According to the vessel's safety drill records, all crewmembers aboard the vessel had completed at least one drill within the past 3 months (except the pilot, who had recently joined the vessel).

2 Analysis

While the towing vessel *Johnny M* was maneuvering from a federal mooring cell in Kentucky Lake into the forebay of the Kentucky Lock and Dam, a fire started in the lower level of the engine room. Alarms sounded in the wheelhouse just before deckhand 1 noticed smoke coming from the *Johnny M*. Although the pilot, who was operating the vessel at the time, could not confirm with certainty the nature of the alarms, he recalled that one was for the port main engine.

A postcasualty examination of the vessel found that the port main engine was severely damaged. A report completed by a marine surveyor attributed the fire to the port main engine base "exploding." Investigators found the nos. 1 and 2 connecting rods were forcibly separated from the crankshaft and their bearing caps broken off. Investigators attempted to determine the cause of the connecting rod failure. There were no indications that the port main engine was overloaded leading up to the casualty. Additionally, given that the port main engine had been overhauled about 7 months before the fire, with new components and bearings installed, excessive wear of engine components was likely not a reason for the connecting rod failure. Although the wheelhouse log noted the crew had "stopped to check [the] port main [engine]" the day before the fire, the operating company and crew did not provide additional information about this logbook entry. Neither the vessel owner nor the engine manufacturer completed a forensic examination or disassembly of components of the port main engine after the casualty. Therefore, investigators could not definitively determine why the connecting rod failed.

Pieces of the bearing caps for the disconnected nos. 1 and 2 connecting rods were found forcibly wedged between sections of the engine crankcase, in the immediate area, and the surfaces of the crankshaft journals were deformed, indicating the engine continued to run and the crankshaft continued to turn after the connecting rods had become disconnected. Parts from the disconnected connecting rods (including the bearing caps) would have collided randomly and chaotically as the crankshaft continued to turn, damaging other internal engine components—such as the crankshaft journals—blowing open the crankcase covers, and rupturing the crankcase (as the marine surveyor noted in his report). Hot, atomized lube oil would have vented through the openings. After the casualty, the outboard side of the port main engine showed signs of elevated temperatures. Therefore, the catastrophic engine failure likely resulted in the venting and ignition of hot atomized lube oil through the openings of the damaged port main engine.

After the fire ignited, the crew responded to contain the fire in accordance with the firefighting/emergency drills they performed regularly. They pulled the remote fuel shutoff cables for each engine, isolating the main fuel source from each engine.

They also placed all available (four) covers on the intake fans and exhaust fans to the engine room on the upper deck and activated the CO_2 fixed fire extinguishing system. Afterward, the fire appeared to be extinguished, and the smoke dissipated. However, the main engine combustion air intake openings—which supplied air through fabric-covered flexible ducting that extended from the aft side of each stack to each engine's intake turbochargers—remained uncovered because the vessel was not outfitted with covers for these intake openings.

During their postcasualty investigation, investigators found that the fire had consumed the flexible ducting for the air intake openings. The flexible ducting was designed to be part of a closed system to provide combustion air to each engine's turbochargers. However, the flexible ducting was made of combustible material; it was not structurally protected from fire (nor was it required to be).[5] Therefore, as the ducting was consumed by the fire, it allowed oxygen from outside the vessel to enter the engine room through the uncovered air intake openings and feed the fire. Investigators could not determine when the ducting burned—before or after the crew activated the CO_2 fixed fire extinguishing system (a postcasualty examination of the CO_2 system indicated it had functioned as designed). However, given that the CO_2 was ultimately ineffective in completely extinguishing the fire, it is likely that the ducting burned before or during the activation of the fixed fire extinguishing system. Additionally, nearby combustible materials—the plastic sight glasses for the waste oil and lube oil tanks—would have melted, allowing oil to leak out and further fuel the fire. Fixed fire extinguishing systems in machinery and other hazardous spaces require a minimum concentration of extinguishing agent to either halt the chemical reaction producing the fire, displace the oxygen feeding the fire, or effect a combination of both. To ensure the effectiveness of the system and prevent the reintroduction of oxygen to the space, ventilation (both natural and forced draft) must be completely secured to all fire-protected spaces. Had the vessel been outfitted with covers for the main engine combustion air intake openings or the flexible ducting been made of a fire-resistant or noncombustible material or structurally protected from fire, oxygen likely would not have been able to enter the engine room, and the CO_2 fixed fire extinguishing system likely would have been effective.

[5] *Structural fire protection* is a component of an overall vessel fire-protection strategy that uses passive design features in a vessel's structure to slow the expansion of a fire from one compartment to another. Structural fire protection uses fire-resistant materials and insulation installed on the horizontal and vertical surfaces of a compartment, on doors/hatches, and in pipe and cable openings to slow the transfer of heat and smoke, thus providing additional time for evacuation and firefighting to contain and extinguish a fire. Towing vessels are inspected under the regulations in 46 *Code of Federal Regulations* Subchapter M; however, these regulations currently do not require vessel owners to incorporate structural fire protection on their vessels.

3 Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the engine room fire on the towing vessel *Johnny M* was a catastrophic main engine failure that caused the venting and ignition of hot atomized lube oil. Contributing to the ineffectiveness of the carbon dioxide fixed fire extinguishing system was the lack of structural fire protection for the main engines' combustion air intake ducting, which allowed oxygen to enter the engine room once the fire consumed the ducting.

3.2 Lessons Learned

Structural Fire Protection

The flexible ducting providing combustion air to the main engines on board the *Johnny M* extended from the engine stacks on the main deck down to the engine room and did not have any insulation or other barriers to prevent the passage of smoke, heat, and fire—known as structural fire protection. This type of unprotected ducting has the potential to provide a pathway for fixed fire extinguishing agents, such as carbon dioxide, to escape and air to enter the engine room if the ducting is compromised by a fire within the space. Identifying potentially unprotected openings and ducting into a fire-protected space and incorporating structural fire protection can ensure the effectiveness of a fixed fire extinguishing system and prevent the spread of fire.

Vessel Particulars

Vessel	*Johnny M*
Type	Towing/Barge (Towing vessel)
Owner/Operator	Terral RiverService Inc. (Commercial)
Flag	United States
Port of registry	Lake Providence, Louisiana
Year built	2009
Official number (US)	1222731
IMO number	N/A
Classification society	Inland Towing Operators (Third-party organization)
Length (overall)	88.3 ft (26.9 m)
Breadth (max.)	30.0 ft (9.1 m)
Draft (casualty)	9.9 ft (3.0 m)
Tonnage	326 GT
Engine power; manufacturer	2 x 1,000 hp (745 kW); CAT 3508C turbo diesel engines

NTSB investigators worked closely with our counterparts from **Coast Guard Marine Safety Unit Paducah** throughout this investigation.