National Transportation Safety Board

Marine Accident Brief

Fire aboard Towing Vessel *Jaxon Aaron*

Accident no.	DCA16FM050
Vessel name	*Jaxon Aaron*
Accident type	Fire
Location	Lower Mississippi River, mile marker (mm) 770, north of Memphis, Tennessee 35˚31.352' N, 089˚56.654' W
Date	August 13, 2016
Time	About 1140 central daylight time (coordinated universal time – 5 hours)
Injuries	None
Property damage	$10.2 million est.
Environmental damage	None
Weather	Mostly cloudy, visibility at 10 miles, winds south at 12.7 mph, air temperature 86°F
Waterway information	The river stage near mm 770 on the Lower Mississippi River was 8 feet and falling.

About 1140 local time on August 13, 2016, a fire erupted in the engine room on board the uninspected towing vessel *Jaxon Aaron* while it was pushing a flotilla of 16 barges upbound on the Lower Mississippi River near mile marker (mm) 770, approximately 24 miles north of Memphis, Tennessee. The fire spread from the engine room into the accommodation area and wheelhouse, causing an estimated $10.2 million in damage to the interior spaces. All nine crewmembers evacuated the vessel safely to the barge flotilla. No pollution was reported.

Towing vessel *Jaxon Aaron* before the fire. (Photo by Western Rivers Boat Management)

* All miles in this report are statute miles.

Accident location at mile marker 770 on the Lower Mississippi River where a fire erupted on the *Jaxon Aaron*. (Background by Google Earth and Google Maps)

Background

Built in 1982, the *Jaxon Aaron* was initially placed into service on the Western Rivers as the *Pegasus* by the American Barge and Towing Company. It was purchased by American Commercial Barge Line in 1989, renamed the *Butch Barras*, and continued to operate on the Western Rivers until 2009, when it was taken out of service for maintenance and repair. Four years later, on December 19, 2013, ownership of the vessel changed when it was purchased by Western Rivers Boat Management. After a major rehabilitation project that included overhauling both main diesel engines, replacing both Kort nozzles, and completely rebuilding the interior accommodation spaces, the vessel was placed back into service in the summer of 2015 as the *Jaxon Aaron*.[1] The renovation of the interior spaces included the installation of furnishings, wood bulkhead framing, wainscoting, baseboards, chair railing, and custom cabinetry. According to the port engineer, when these modifications were made the weight of the combustible material was not measured and no other assessments were conducted to determine the total fire load added to the vessel.[2]

The *Jaxon Aaron* completed an examination for uninspected towing vessels by the US Coast Guard on July 15, 2015. No deficiencies were found and the vessel was issued an Uninspected Towing Vessel Examination decal valid through July 15, 2018.

At the time of the fire, the *Jaxon Aaron*'s fire protection, detection, and suppression equipment was properly serviced and met the requirements of existing regulations. Included were

[1] A *Kort nozzle* is a rigid duct assembly that surrounds a vessel's propeller. The system improves the efficiency of the propeller and is often seen on towing, fishing, and industrial vessels whose propulsion systems operate under heavy loads that result from pulling, pushing, or dragging. It was designed in 1934 by Ludwig Kort, a German scientist.

[2] *Fire load* describes the amount of combustible material within a space that is available for combustion. Expressed in either kilogram per square meter (kg/m^2) or pounds per square foot (lbs/ft^2), fire load is measured by summing the total mass of combustible material and dividing by the deck area. Source: Navigation and Vessel Inspection Circular No. 9-97, Change 1, *Guide to Structural Fire Protection*, July 2, 2010.

12 portable fire extinguishers (type B, size II); multiple heat and smoke detectors, which provided both audible and visible alerts in the wheelhouse; and two semi-portable fire extinguishing systems (type B, size V) in the upper engine room flat. The two B-V fire extinguishing systems consisted of three mounted banks of paired 75-pound bottles of carbon dioxide (CO_2). The CO_2 bottle banks supplied a rigid piping installation that terminated at flexible hose reels mounted near the port and starboard entrances to the engine room. The systems were activated by pulling a safety pin and opening a plunger valve to charge the hose, before directing delivery of the CO_2 via a handheld discharge horn equipped with a trigger mechanism.

Crew lounge (at top) and adjacent galley area (at bottom) on the main deck of the *Jaxon Aaron* after renovations. The stainless-steel door (bottom, far left) is common with the upper engine room flat and located just aft of the chief engineer's stateroom. (Photo by Western Rivers Boat Management)

Accident

At 0315 on August 13, 2016, under the control of the master, the *Jaxon Aaron* departed Wepfer Marine's McKellar Lake fleeting area at mm 725.5 on the left descending bank just south of Memphis, Tennessee, en route to St. Louis, Missouri, with 15 dry cargo barges and 1 crane barge. The vessel was manned by a master, pilot, chief engineer, mate, four deckhands, and one cook. At 1100, the pilot, who alternated watch with the master on a 6-hours-on/6-hours-off rotation schedule, assumed navigational control of the vessel, while the master retired to his stateroom. At the time, the vessel was at mm 765.3 proceeding upbound at a speed over ground of approximately 4.3 knots.

Around 1140, the fire alarm sounded in the wheelhouse, at which time the pilot observed smoke coming from the port side of the engine room. He stated that he did not notice any vibrations, unusual noises, or other irregularities before the fire alarm sounded. As the vessel was passing mm 769.2 proceeding upbound at a speed over ground of approximately 4.1 knots, the pilot called the mate via VHF radio on standby channel 61 to inform him about the fire in the engine room. The radio broadcast was overheard by a deckhand who was tightening the wire connections of the barges at the head of the flotilla. Looking aft, the deckhand saw smoke emanating from the port side of the engine room and began to make his way back to the vessel to assist.

The pilot then sounded the general alarm. Within an estimated 2–5 minutes, the vessel experienced a total loss of electrical power and steering control. In response, the pilot took both main diesel engines out of gear and broadcasted a request for assistance over VHF radio on channel 16. The towing vessel *Miss Allie*, which was located about 7 miles downriver at the time, responded to the distress call and began to proceed northbound toward the *Jaxon Aaron*.

The chief engineer, who was in his bathroom, noticed the intensity of the lighting in his stateroom fluctuating just prior to the loss of electrical power. He headed towards the starboard-side entrance of the upper flat of the engine room on the main deck, where he observed near the port main diesel engine flames that he said were extending to the top of the engine room. He attempted to manually release the CO_2 located near the starboard entrance to the engine room and then attempted to do the same with the system on the port side. He stated to investigators that he "dropped the hose, pulled the pin, and closed the door," before pulling the manual emergency shutdown cables on both main diesel engines and on both generators, but he did not see or hear any fire extinguishing agent being released.

The master, who stated that he had been awakened by the general alarm and the loss of electrical power, left his stateroom and entered the wheelhouse, where he saw black smoke and fire. He ordered the crew to begin the process for abandoning ship to the barge flotilla. Once all crewmembers were on the barge flotilla and accounted for, the master directed them to initiate the firefighting effort. Although they were able to set up the portable pumps, the crewmembers were forced to attempt the firefighting effort in the clothing they were wearing at the time because the vessel was not outfitted with firemen's suits or other bunker gear. (At the time of the accident, the regulations for uninspected towing vessels did not require the *Jaxon Aaron* to carry firemen's outfits.)

When forward movement had stopped, the vessel and flotilla of barges began drifting downriver with the current, stern first. The stern of the *Jaxon Aaron* partially grounded on the right descending bank near mm 768.2 and the barge flotilla began to swing around with the current. About 1225, the *Miss Allie* arrived on scene to assist the crew and assume control of the barge flotilla.

Another towing vessel, named the *Joe Ellis*, which had been upriver at a mooring location in Osceola, Arkansas, also responded to the initial distress call; it arrived on scene around 1300. Local shoreside firefighters attempted to assist but were unsuccessful in reaching the *Jaxon Aaron* due to the remote location and lack of suitable access roads. Coast Guard personnel arrived on scene at 1609 with the assistance of the towing vessel *Amy Ross*. At 1634, the firefighting effort was suspended due to safety concerns. Flames were still visible in the upper decks of the vessel. The fire burned itself out at an unknown time later that evening.

On August 15, at 0854, the *Jaxon Aaron* was taken under tow by the *Janice E Strait* and moved to the First Marine shipyard at mm 12 on the Tennessee River in Calvert City, Kentucky, for repair.

Jaxon Aaron **on the right descending bank during the firefighting effort. (Photo by** ***Joe Ellis*** **crewmember)**

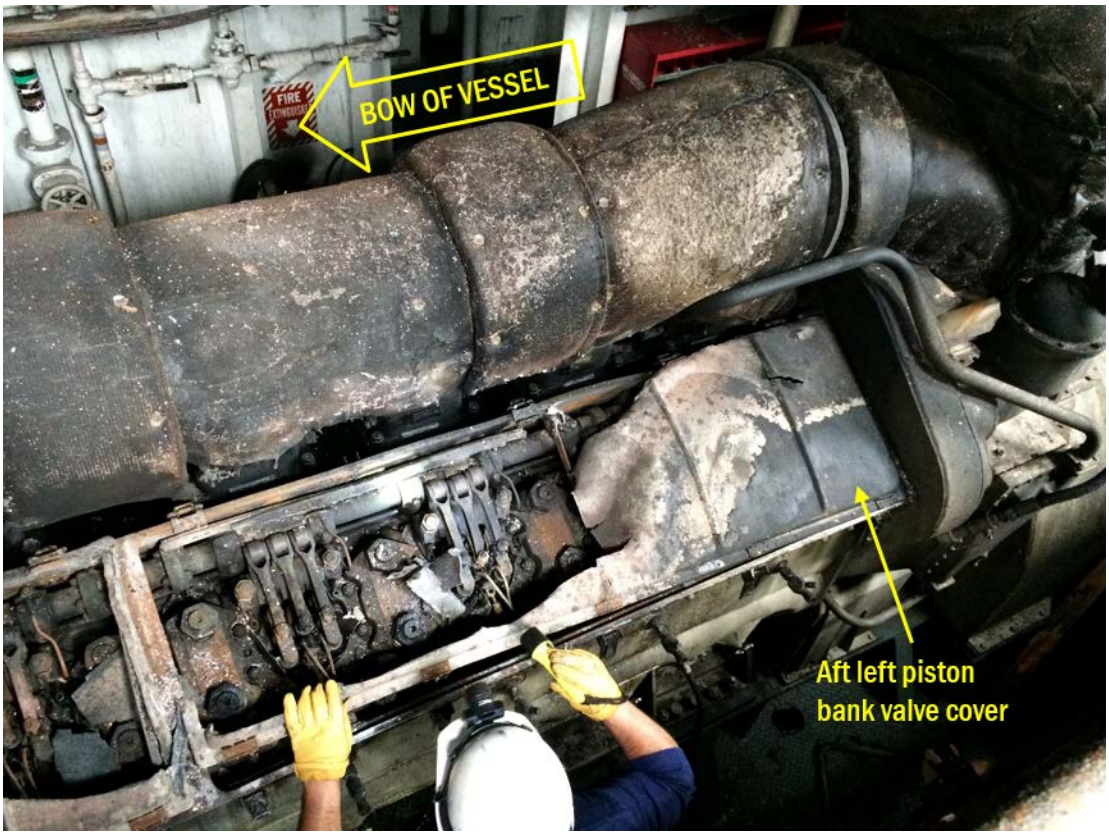
Analysis

Drug tests were conducted on the chief engineer and the pilot; both test results were negative. Alcohol testing was not performed on the crew because the saliva alcohol test strips were destroyed in the fire and, due to the remote location of the accident, the 8-hour time limitation for testing had lapsed before testing could be conducted.

Coast Guard and NTSB investigators, along with an independent surveyor from North American Marine Consultants, boarded the *Jaxon Aaron* at the repair yard in Kentucky after the vessel was deemed safe for entry. They found that the fuel tanks were not compromised and the hull itself was intact. There was extensive damage in all interior spaces, including the engine room, main deck, quarters deck, and wheelhouse deck, totaling an estimated $10.2 million. The temperature at which the fire burned, combined with the duration of heat, caused deformation of structural framing and steel plating on multiple decks and bulkheads.

The cause of the fire was determined to be a catastrophic failure of components of the no. 15 power assembly or “power pack” on the port main diesel engine. As with most other large internal combustion engines used in marine or other industrial services, this engine was designed to allow replacement of the cylinder head assembly, cylinder liner, piston, piston rings, and piston rod without removal of the entire engine. These parts were pre-assembled into a power pack unit, which then could be removed or installed during a maintenance period. When the no. 15 power assembly was removed from the main diesel engine of the *Jaxon Aaron* after the fire, severe damage was found in the cylinder head and the lower casing.

Although the spring toggles on the aft left piston bank valve cover held the cover in place at the time the no. 15 power assembly components failed, the cover surface itself was damaged from the fire, allowing lube oil to spray on the exhaust manifold. However, the explosion cover located on the lower side of the crankcase for the no. 15 cylinder showed no damage or signs of oil spray.



Damage discovered during the post-fire forensics examination to the left bank, rocker cover, and cylinder heads on the port main diesel engine.

The engine had approximately 9,100 hours of service since the last replacement, which took place during the overhaul before the vessel was placed back into service by the new owner. Although a detailed metallurgical failure analysis of the no. 15 power pack assembly components was not performed, investigators requested that the owner arrange for an independent laboratory to perform an oil sample analysis on the lube oil from the port main diesel engine. The results from this analysis indicated that there was a "marginally high" level of water contamination in the engine's lubricant.

Low levels of water contamination are normally found in an engine's lubrication, but high levels of contamination are troubling, as water accelerates internal corrosion of metal components and oxidation of the oil, which decreases the oil's lubricating performance and effectiveness. Investigators could not determine whether water was introduced into the lubrication system during the firefighting effort or possibly as a consequence of an internal coolant leak into the no. 15 cylinder during operation. The leak would have resulted in a condition known as hydrostatic lock, or hydrolock, in which the piston, designed to compress gases, cannot compress the liquid coolant introduced into the combustion chamber and thereby a catastrophic failure ensues. The port engineer stated to investigators that the company did not have a program for scheduled lube oil sampling and analysis for the vessels in the fleet but did check periodically the lubrication oils for fuel oil

contamination using the black light fluorescence method.[3] This method will detect, but not precisely quantify, levels of water contamination.

From left to right: (1) the power assembly of the no. 15 cylinder removed from the port main diesel engine, with the cylinder head and cylinder liner separated; (2) damage discovered to the lower casing of the assembly base; (3) the damaged cylinder head. (Photos by US Coast Guard)

Based on the fire-pattern analysis, the fire likely migrated rapidly up the port exhaust stack and into the overhead of the engine room, where it damaged the electrical wiring between both generators and the main switchboard causing the loss of power. Because the common bulkhead between the aft portion of the accommodation space and the forward portion of the engine room did not provide any significant structural fire protection, the heat and flame migrated into the chief engineer's stateroom and then into the hallway just forward of the engine room. The furnishings and wood materials used in the interior areas of the *Jaxon Aaron* served as a fuel source supporting a significant and rapid growth of the fire, which migrated forward and upward through the accommodation spaces and into the wheelhouse.

Although the chief engineer succeeded in pulling the emergency shutdown cables on both main diesel engines and on both generators, he failed to manually release the extinguishing agent during the initial attack on the fire in the engine room. An examination of the port and starboard semi-portable, B-V CO_2 firefighting systems indicated that the plunger valves on each bottle bank, which would release the CO_2 into the flexible hose, had not been activated. Even if those valves had been activated, the discharge horn on each hose had a manual trigger mechanism that would have to be pressed by the user and directed at the fire.

New regulations took effect on July 20, 2016, requiring towing vessels, like the *Jaxon Aaron*, to meet several fire protection standards. Title 46 of the *Code of Federal Regulations*, Part 142, known as Subchapter M, requires that crewmembers on all towing vessels be trained and proficient in firefighting techniques as well as in the use of installed fire extinguishing appliances.

[3] Carbon-based petroleum products have varying degrees of fluorescence when exposed to black light, so many tests can be performed using this type of lighting, including those as simple as looking for oil leaks. To conduct the test, a few drops from an oil sample is placed on a sheet of chromatographic or "blotter" paper, then examined after several hours under black light to determine if there are abnormalities visual in the sample plots, compared to what would be expected in an uncontaminated or exemplar sample. Fuel, coolant, and other contaminants found in lube oils all would have a different appearance and/or pattern.

It was unclear why the chief engineer did not properly deploy the fire extinguishing agent. Despite facing a high-stress situation, as a chief engineer he should have been familiar with the fire extinguishing system and how to deploy it correctly. He mistakenly believed it was a fixed halon firefighting system, when in fact it was a semi-portable CO_2 firefighting system, which would have required him to attack the fire with manual deployment of the fire extinguishing agent.

Fire damage to the *Jaxon Aaron*. At top, looking forward through both the stainless-steel door in the engine room and the opening where the window was located in the bulkhead between the chief engineer's stateroom on the main deck and the forward portion. At bottom, looking forward into the wheelhouse.

Furthermore, the vessel was not equipped with closure mechanisms or dampers in the engine room's air intake and exhaust ventilation ducts. These dampers were not required by regulation at the time of the fire. Not only did the lack of dampers or closure mechanisms in the engine room allow the fire an unlimited supply of oxygen during its early phase, but the significant combustible load in the interior areas of the vessel served as a fuel source once that initial flame and heat penetrated the forward engine room bulkhead.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire aboard the towing vessel *Jaxon Aaron* was the failure of the power assembly components on the port main diesel engine's no. 15 cylinder. Contributing to the extent of the fire damage was the substantial use of combustible materials in the interior spaces and the chief engineer's unfamiliarity with the firefighting equipment.

Vessel Particulars

Vessel	*Jaxon Aaron*
Owner	Strait Maritime Group, LLC
Operator	Western Rivers Boat Management
Port of registry	Paducah, Kentucky
Flag	United States
Type	Towing vessel
Year built	1982
Official number (US)	646544
IMO number	N/A
Builder	Dravo Corporation, Neville Island, Pennsylvania
Construction	Steel
Length	129.5 ft (39.5 m)
Draft	10 ft (3.3 m)
Beam/width	42 ft (12.8 m)
Gross / net tonnage	592 / 402
Engine power; manufacturer	(2) 3,070 hp (total 6,140 hp / 4,474 kW); Electro Motive Diesel, Model GM 16-645-E7
Persons on board	9

NTSB investigators worked closely with our counterparts from Coast Guard Sector Lower Mississippi River throughout this investigation.

For more details about this accident, visit www.ntsb.gov and search for NTSB accident ID DCA16FM050.

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