National Transportation Safety Board

Marine Accident Brief

Allision of Tanker *Aframax River* with Mooring Dolphins, and Subsequent Fire in Waterway

Accident no.	DCA16FM055
Vessel name	*Aframax River*
Accident type	Allision and fire
Location	Deer Park, Texas, 29° 44.90 N, 95° 05.97 W
Date	September 6, 2016
Time	About 0005 central daylight time (coordinated universal time – 5 hours)
Injuries	Minor burns to the two onboard pilots
Property damage	$1.5 million est.
Environmental damage	Release of 88,000 gallons of low-sulfur marine gas oil
Weather	Partly cloudy, visibility of 8 miles*, winds southeast at 4 knots, air temperature 86°F
Waterway information	Houston Ship Channel near the Intercontinental Terminals Company (ITC) facility. The terminal has five deep-draft tanker berths and ten barge docks located on the south side of the channel at the mouth of Tucker Bayou.

On September 6, 2016, about 0005 local time, the tanker *Aframax River* allided with two mooring dolphins in the Houston Ship Channel (HSC) near Deer Park, Texas. The allision punctured the ship's hull plating, and about 88,000 gallons of low-sulfur marine gas oil spilled into the water. The oil ignited and burned for about 45 minutes. The two onboard pilots sustained minor burns, and the property damage exceeded $1.5 million.

Aframax River **anchored on the Delaware River before the accident. (Photo by John Curdy)**

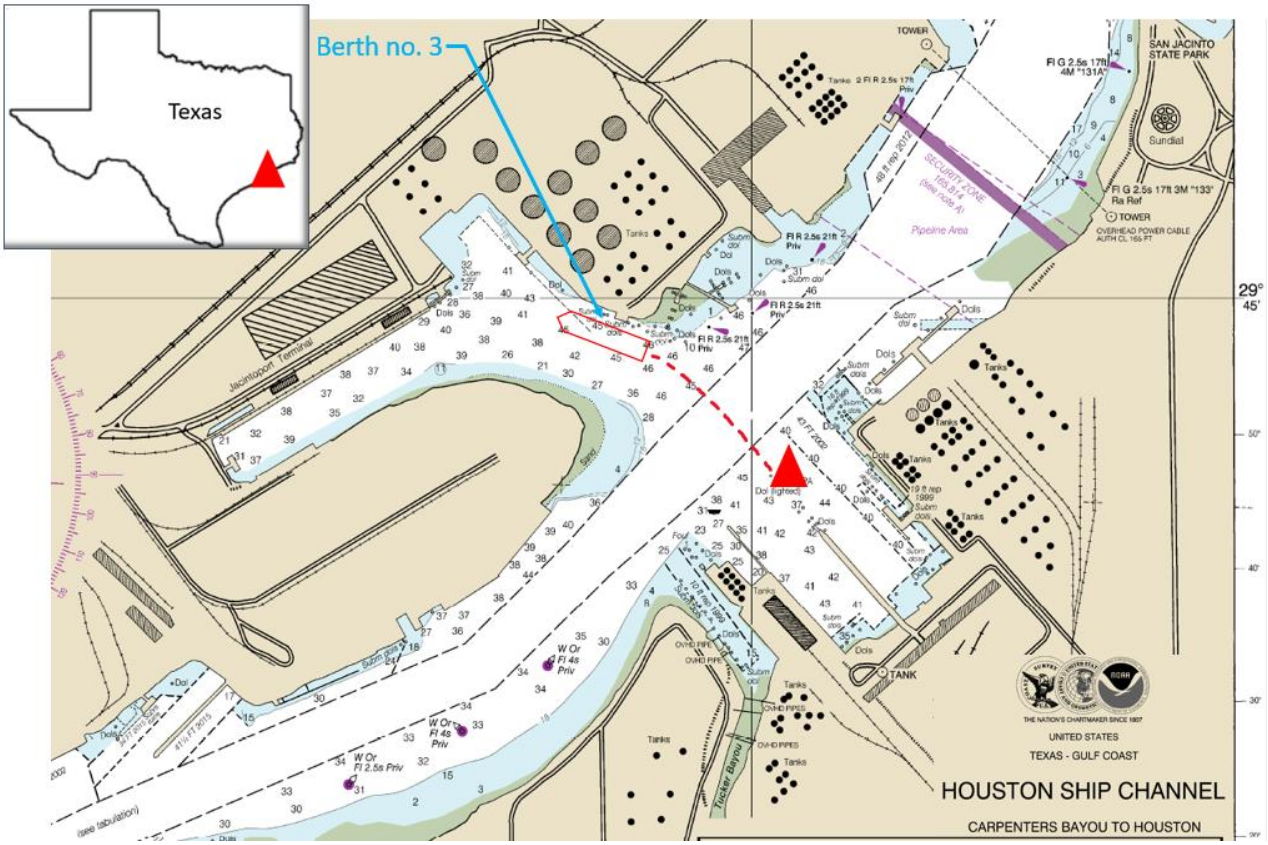
*All miles in this report are nautical miles (1.15 statute miles).

Background

The *Aframax River*, a Panama-flag, double-hull crude-oil tanker, was built in 2002 by Imabari Shipbuilding Saijo Dockyard in Saijo, Japan. Originally named the *Singapore River* and classified by Nippon Kaiji Kyokai (ClassNK), the vessel was purchased by Aframax River Marine Co. in Athens, Greece, and renamed in November 2011. The new owner continued to classify the vessel with ClassNK. Executive Ship Management PTE in Singapore provided the crew and technical management of the vessel.

Accident Events

The *Aframax River* had arrived at the Houston Fuel Oil (HFO) facility 2 days before the accident with a cargo of Marlim crude oil and was moored starboard side to at berth no. 3. On September 5, 2016, about 2130, the vessel had completed discharging the cargo; soon thereafter, the crew commenced preparations to sail outbound with the ship in a ballast condition. The crewmembers completed their departure checklist, which included mechanical testing of the steering and main propulsion systems. All tests were satisfactorily completed from both the bridge and engine room, and no problems were recorded in the bridge or engine log books.



Section of the Houston Ship Channel where the *Aframax River* allision occurred (red triangle overlaid on NOAA chart 11325, *Houston Ship Channel*).

At 2306, two pilots from the Houston Pilots Association boarded the fully ballasted *Aframax River* at the HFO dock. Two pilots were required for the transit to mitigate fatigue and provide assistance to each other as needed; the conning pilot provided direction during maneuvering while the second pilot monitored the situation. Both pilots, the ship's master, and the bridge crew held a predeparture conference on the navigational bridge, including a review of the ship's pilot/master information exchange card. Following the conference, the crew conducted tests

of the navigation and communication equipment (such as checking in with tugboats and vessel crew assigned to lookout duties); everything was satisfactory. At 2335, the main propulsion engine was ready for maneuvering and was placed in stand-by. The engine control system remained in bridge-control during maneuvering.

At 2336, the conning pilot ordered the mooring lines let go and then ordered dead-slow-ahead on the main engine. About 15 seconds later he ordered all stop; about 30 seconds thereafter, dead-slow astern; and then again, all stop. The engine responded as expected. At 2342, with the tugboat *Jess Newton* made up alongside the tanker's port quarter and the tugboat *Gasparilla* alongside its port bow, the *Aframax River* was pulled away from the dock. The conning pilot and the master were positioned on the starboard bridge wing while the second pilot observed from the bridge and port bridge wing. The third officer was positioned at the engine order telegraph (EOT) executing the pilot's orders; a helmsman was at the wheel; and the chief officer, the bosun, and two lookouts were on the bow. The voyage plan included bringing the ship to a safe location in the middle of the channel and, with the assistance of the two tugboats, turning the ship about 90 degrees to starboard for the outbound transit.

At 2359, the conning pilot ordered dead-slow-astern propulsion (30 rpm). The third officer acknowledged the engine order and used the EOT to initiate the astern propulsion; he observed the ship's rpm indicator reach 30 rpm, confirmed the completion of the order to the bridge team, and continued with his navigational duties.

At 0002 on September 6, the second engineer who was monitoring the engine tachometer in the engine control room (ECR) called the bridge to check the bridge's rpm indicator. He said that the ECR's rpm indicator was showing 80 rpm even though the ECR's EOT showed the bridge command input of dead slow astern—which should have been only 30 rpm. The third officer replied that the bridge rpm indicator was also showing 80 rpm, and he informed the bridge team of this fact as well. On hearing this information, the conning pilot immediately ordered "all stop." The third officer acknowledged the order and placed the EOT in the stop position, but all on the bridge noticed that the rpm indicator was still showing 80 rpm and that the vessel's astern movement was increasing. At 0003, to counteract the ship's astern speed, the conning pilot ordered dead slow ahead, but the astern movement continued. At 0004, the conning pilot ordered slow-ahead propulsion, then half ahead, and then full ahead, but the ship's astern movement was not slowing, and the engine was not responding.

The conning pilot also issued commands to the two harbor tugboats to help reduce the tanker's astern movement, but they had little success. Realizing that there was imminent risk of striking the nearby docks or any of the four tankers moored at the Intercontinental Terminals Company (ITC) facility, the conning pilot ordered the tugboats to use all available means to counter the ship's astern movement. The mate on the *Jess Newton* relayed back to the pilot via VHF radio the approximate distance to the two ITC mooring dolphins directly behind the ship. *Aframax River* was now moving at about 3.5 knots, still in an astern direction. The conning pilot ordered the *Jess Newton* to go full ahead, but the mate replied that he could not do so at that time because the first of the two dolphins was about to pass between the tugboat and the tanker. The mate stated he never saw a change in the propeller wash from the *Aframax River*, an indication that the propeller did not engage in a forward direction.

The conning pilot ordered both anchors released. The master was relaying via phone to the chief engineer in the ECR that the main engine was not responding to any bridge EOT commands.

At 0005, the chief engineer took control of the main engine and pressed the emergency stop button in the ECR; he told investigators that once he did so, the engine tachometer started to decrease from 80 rpm.

When an allision with the mooring dolphins was imminent, the master ordered the deck crew to stand clear of the stern of the vessel and brace for impact. At 0005, the port side of the *Aframax River* struck the first ITC dolphin, no. 78A, at 3.2 knots. Within seconds of that impact, the tanker's port quarter struck the second ITC dolphin, no. 78B. The second allision tore an approximately 30-foot-long opening on the ship's port quarter hull plating at frame 26, about 8 feet above the waterline near the centerline of the no. 2 fuel oil tank. Marine gas oil (MGO) immediately began pouring out of the hull opening. As the tanker continued aft, its hull plating was further cut and deformed inward by contact with the mooring dolphins. The friction and the cutting of the hull plating generated heat, which ignited the MGO and triggered a large fire with thick, black, bellowing smoke that engulfed the ship's port quarter and the adjacent main deck, all the way up and past the port bridge wing. The general alarm was sounded.

***Aframax River* after the allision with dolphin no. 78B. Tractor tugboat *David B* is in the foreground rendering assistance. (Image courtesy of ITC City Dock security video)**

The chief officer on the bow ran back to the fire control muster station. All crew were accounted for, and four teams were assigned to fight the fire. The conning pilot immediately notified Coast Guard Houston/Galveston's Vessel Traffic Services (VTS) to alert nearby vessels of the fire and fuel in the water, and he informed VTS that the tanker had lost main propulsion. The second pilot requested that VTS contact local fire boats for assistance.

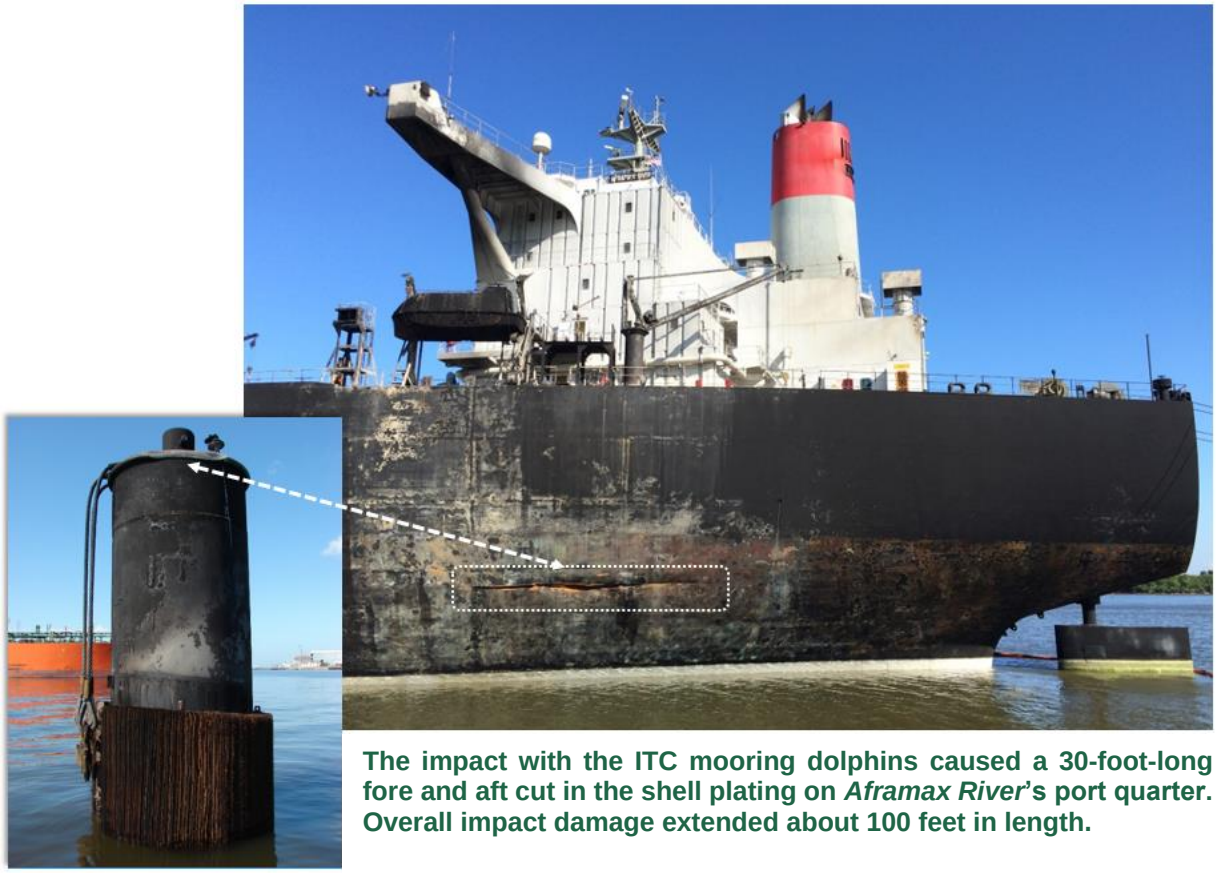
The fire on the water's surface extended to the bow of harbor tugboat *Jess Newton*, which was secured to the tanker's port quarter. The tugboat's deckhand closed all doors and activated the fire sprinkler system. The heat of the fire melted and parted the line at the ship's chock. The *Jess Newton* crew repositioned the tugboat just forward of the *Aframax River*'s superstructure and applied full-ahead propulsion to move the tanker farther from the ITC terminal.

The ship's crewmembers donned their firefighting gear and reported to their four assigned fire stations. As an additional firefighting measure, the chief officer with the approval of the master began to press up the no. 1 port and starboard ballast tanks that were already 90-percent full. Consequently, ballast water started to flow out onto and down the main deck, providing a 15—18-inch-deep water blanket that ran aft across the entire cargo deck (the tanker was trimmed by the stern) and overboard via the scuppers.

Boat crews from Coast Guard Station Houston and Station Galveston and personnel from the Harris County Sheriff's Office marine division responded to the emergency. At 0008, the Coast Guard closed the Houston Ship Channel and established an approximately 2-mile-long safety zone. At 0009, tractor tugboat *David B* arrived on scene and was positioned just forward of the *Aframax River*'s starboard-side superstructure. Several other tugboats and fire boats also eventually arrived and assisted. Despite the serious danger to life and property, the vessels remained alongside the *Aframax River*, maneuvering the disabled ship away from the other tankers and adjacent chemical facilities. The second pilot, who was coordinating the firefighting effort, told investigators, "The harbor tugs, the guys on the boats . . . deserve a medal of meritorious service or whatever might be available. They did an outstanding job."

The conning pilot helped maneuver the tanker to the middle of the channel to prevent the flames from spreading further. Applying their firefighting training, the crews battled the flames and eventually extinguished the fire about 0118. A one-mile stretch of the Houston Ship Channel remained closed for 14 hours.

The *Aframax River* crew conducted soundings on all of the tanks to determine the extent of damage to the hull. As a result of the breach in the no. 2 fuel oil tank, about 88,000 gallons of MGO spilled into the waterway. The fire severely damaged the portside lifeboat and davit system, two liferafts, the port crane at frame 27, and an embarkation ladder. Damage extended about 100 feet along the portside hull between frames 24 and 41. Several of the tugboats involved in the response effort also sustained damage to their equipment.



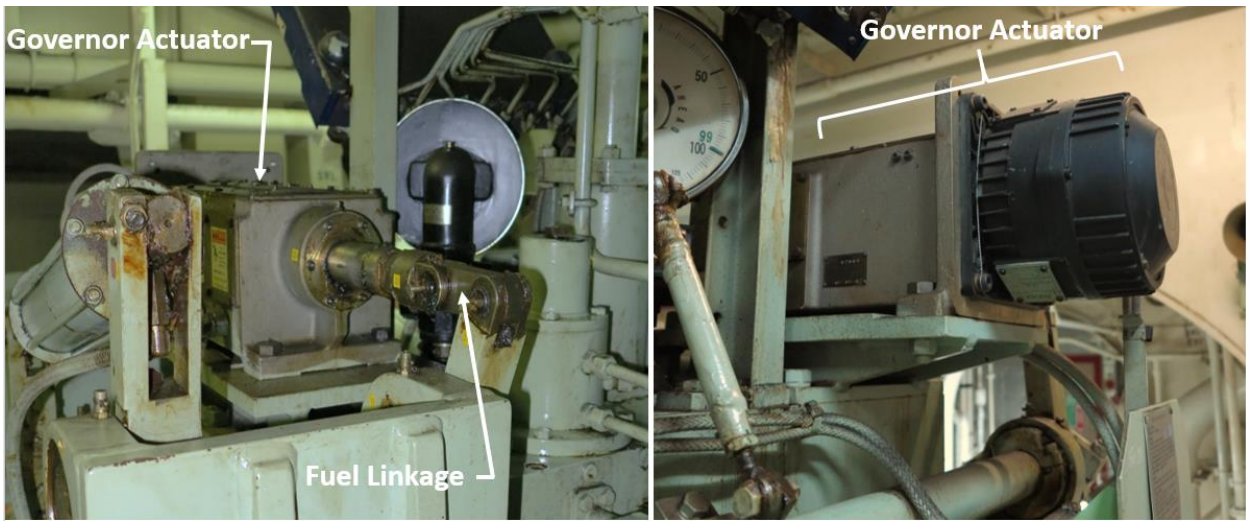
The impact with the ITC mooring dolphins caused a 30-foot-long fore and aft cut in the shell plating on *Aframax River*'s port quarter. Overall impact damage extended about 100 feet in length.

Fire damage to *Aframax River*'s portside bridge wing (where the conning pilot was standing when the fire erupted), lifeboat, and main deck.

Analysis

Investigators and shipping company representatives focused their efforts on identifying the potential sources that caused the engine to ramp up to 80 rpm and not respond to EOT command inputs from the bridge. After interviewing the pilots and the ship and tugboat crews, it became apparent that the engine's governor and printed circuit board, which control the engine speed, may have played a role in the accident.

The Diesel United - Sulzer Type 7RTAC2 is a single-acting, slow-speed, two-stroke, reversible marine diesel engine. The engine was directly connected to the propeller, and the engine was designed to come to a complete stop when changing propeller direction from astern to ahead. In the presence of investigators and ClassNK surveyors, technicians from Diesel United, Ltd. inspected and tested the mechanical components of the governor input, fuel control linkage, and other related components. All items were determined to be in good working order.



Front and back of the main engine governor actuator and mechanical fuel linkage.

Technicians from Nabtesco Marine Control Systems Company (the manufacturer of the main engine control system and governor) troubleshot the system and tried to identify the fault. In the presence of Coast Guard personnel and a marine surveyor from ClassNK, the technicians examined the system's electrical and mechanical components and conducted tests from both the bridge and the ECR. No failures or causes were identified during the test. The technicians concluded that the governor actuator system had encountered a momentary abnormality, one which they could not replicate. Nabtesco technicians replaced the governor actuator pictured above. As a precautionary measure, they also replaced the printed circuit board in the ECR, which mechanically supports and electrically connects the governor motor actuator to the bridge's EOT command inputs. The technicians then carried out a series of calibration and simulation tests, as well as started and stopped the main engine ahead and astern several times, confirming that the system was functioning as designed. The ClassNK surveyor concluded in his report:

> The main engine started without any delay, ahead and astern, on the command input from the EOTs. The main engine rpm was in accordance with design, dead slow 30 rpm, and slow 38 rpm. This surveyor believes the main engine is ready to answer all orders.

According to the manufacturer's technicians, the governor's actuator system experienced a momentary abnormality. Investigators believe that the abnormality likely resulted from an electrical and/or mechanical failure of the system, which led to loss of engine control while the vessel was engaged in astern propulsion.

Further, due to the oil spill that resulted from this accident, investigators also reviewed ship design standards pertaining to fuel oil tank protection. The International Maritime Organization's Regulation 12A (an amendment to MARPOL Annex I) applies to all vessels delivered on or after August 1, 2010, and requires that individual fuel oil tanks aboard ships with a fuel oil capacity of less than 500 cubic meters be located at least 760 mm inboard of the molded line of the hull plating, thus helping prevent tank breaches and oil spills in case of collision or grounding. However, because the *Aframax River* was delivered in May 2002, Regulation 12A did not apply to its construction. If the *Aframax River* had been built after the new standards took effect, fuel would not have spilled in this accident because the maximum inward deformation of the hull plating at the damaged fuel tank was only about 300 mm.

The actions of the *Aframax River* crew, the tugboat crews, and the pilots successfully prevented the spread of fire to other vessels and structures.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the *Aframax River*'s allision with mooring dolphins and the subsequent fire in the waterway was a momentary abnormality of the tanker's main engine governor actuator system in responding to command inputs from the bridge.

Vessel Particulars

Vessel	*Aframax River*
Owner/operator	Aframax River Marine Co./ Executive Ship Management PTE LTD
Port of registry	Panama
Flag	Panama
Type	Crude oil tanker
Year built	2002
Official/IMO number	9259173
Classification society	Nippon Kaiji Kyokai (ClassNK)
Construction	Steel
Length	810 ft (246.8 m)
Draft	28.2 ft (8.6 m)
Beam/width	137.8 ft (42 m)
Gross tonnage	57,943 tons
Engine power; manufacturer	17,403 PS (12,800 kW) Diesel United - Sulzer Type 7RTAC2
Persons on board	25 crew, 2 pilots

NTSB investigators worked closely with our counterparts from Coast Guard Sector Houston/Galveston Investigations Division throughout this investigation.

For more details about this accident, visit www.ntsb.gov and search for NTSB accident ID DCA16FM055.

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