NTSB/MAR-02/04
PB2002-916404

Marine Accident Report

Fire on Board the Small Passenger Vessel *Seastreak New York* Sandy Hook, New Jersey September 28, 2001

National Transportation Safety Board
Washington, D.C.

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National Transportation Safety Board
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National Transportation Safety Board. 2002. *Fire on Board the Small Passenger Vessel* Seastreak New York *Sandy Hook, New Jersey September 28, 2001.* Marine Accident Report NTSB/MAR-02/04 Washington, DC.

Abstract: On September 28, 2001, the domestic high-speed vessel *Seastreak New York* was en route from Highlands, New Jersey, to New York, New York, with 198 passengers and 6 crewmembers on board. As the vessel passed Sandy Hook Point, New Jersey, about 0630, a fire broke out on the No. 3 engine in the starboard engineroom. Flames forced the deckhand who discovered the fire to flee the engineroom. Access hatches, ventilation, and fuel for the main engines in the starboard engineroom were secured. The fixed CO2 fire suppression system was then activated. The *Seastreak New York* proceeded to a nearby Coast Guard Station, using its port engines, and disembarked its passengers without incident. Local firefighters arrived on board at 0700. By 0730, a firefighter entered the engineroom and found that the fire had been extinguished by the CO2 suppression system. There were no personal injuries as a result of this fire, but the resultant damages were estimated at $81,000.

The major safety issues discussed in this report are the adequacy of the manufacturer's instructions for the installation of engine accessories; crew firefighting response; company maintenance and inspection procedures; and passenger management. As a result of its investigation of this accident, the Safety Board makes recommendations to Cummins Engine Company, Inc., and Circle Navigation Company of New York.

Contents

Acronyms and Abbreviations

COI	Certificate of Inspection
OCMI	Officer in Charge, Marine Inspection
NVIC	Navigation and Vessel Inspection Circular

Executive Summary

On September 28, 2001, the domestic high-speed vessel[1] *Seastreak New York* was en route from Highlands, New Jersey, to New York, New York, with 198 passengers and 6 crewmembers on board. As the vessel passed Sandy Hook Point, New Jersey, about 0630, a fire broke out on the No. 3 engine in the starboard engineroom. Flames forced the deckhand who discovered the fire to flee the engineroom. Access hatches, ventilation, and fuel for the main engines in the starboard engineroom were secured. The fixed CO_2 fire suppression system was then activated. The *Seastreak New York* proceeded to a nearby Coast Guard Station, using its port engines, and disembarked its passengers without incident. Local firefighters arrived on board at 0700. By 0730, a firefighter entered the engineroom and found that the fire had been extinguished by the CO_2 suppression system. There were no personal injuries as a result of this fire, but the resultant damages were estimated at $81,000.

The National Transportation Safety Board determines that the probable cause of the fire on board the *Seastreak New York* was the improper installation of the Centinel System's lube oil hose, which allowed the hose to come in contact with the hot exhaust manifold. Contributing to the cause of the fire was the absence of detailed guidance from the manufacturer of the Centinel System on the proper installation of the system. Also contributing to the cause of the fire was the lack of inspection and maintenance procedures by Circle Navigation Company that might have discovered the improper installation.

The major safety issues discussed in this report are the adequacy of the following:

- Manufacturer's instructions for the installation of engine accessories;
- Crew firefighting response;
- Company maintenance and inspection procedures; and
- Passenger management.

As a result of its investigation of this accident, the Safety Board makes recommendations to Cummins Engine Company, Inc., and Circle Navigation Company of New York.

[1] The Coast Guard defines vessels such as the *Seastreak New York*, which can attain speeds of 30 knots or more with a full complement of passengers, as domestic high-speed vessels. U.S. Coast Guard, *Navigation and Vessel Inspection Circular* (NVIC) *5-01, Guidance For Enhancing the Operational Safety of Domestic High-Speed Vessels* (Washington, D.C.: U.S. Coast Guard, April 23, 2001).

Factual Information

Accident Narrative

At 0620 on September 28, 2001, the catamaran ferry *Seastreak New York* (see Figure 1), with 6 crewmembers and 198 passengers on board, departed Highlands, New Jersey, for a regularly scheduled commuter trip to Manhattan piers on the East River in New York City, New York. The ferry proceeded out the Shrewsbury River Channel through Sandy Hook Bay and past Sandy Hook Point. All four main engines were running, and the starboard generator was providing electrical power to the vessel. At the start of the voyage, the master gave a safety briefing to the passengers over the public address system on the location of the lifejackets and buoyant apparatuses.

Figure 1. The *Seastreak New York* is one of a growing number of high-speed passenger vessels in use as commuter ferries. It had a capacity of 394 passengers.

After the vessel departed the Highlands dock, deckhand No. 4, who was serving as engineer, began a routine inspection of the enginerooms, which are accessed through hatches on the vessel's main deck. Deckhand No. 4 entered the port engineroom and visually inspected main engines 1 and 2. He observed that all equipment was operating normally. He then climbed back to the main deck and walked across to the starboard side of the ferry to enter the starboard engineroom.

Deckhand No. 4 said that when he opened the access hatch to the starboard engineroom, he immediately smelled a "strange odor" that he could not identify, which he later described as "maybe a wire melting … a plastic smell." As he descended the ladder, he looked forward at engine No. 4 and saw that it appeared to be operating normally. (See

Figure 2.) He proceeded aft and inspected the starboard generator, which also appeared to be operating normally. He continued aft toward the No. 3 engine. When he stepped on the platform in front of the engine and looked over the top of the radiator, he saw a "foot-long flame" on top of the engine. He immediately went forward to retrieve a CO_2 extinguisher mounted near the forward access ladder. He grabbed the CO_2 extinguisher and pulled the pin in preparation for applying the CO_2 to the fire. With the extinguisher in hand, deckhand No. 4 went back toward the No. 3 engine. Before reaching it, he stopped at the engine shutoff switch mounted on the starboard bulkhead just forward of the engine. He said that as he reached for the switch, the engine "just ignited and blew flames across the whole room," singeing his eyebrows and hair. Deckhand No. 4 did not activate the shutoff switch or use the CO_2 extinguisher. He dropped the extinguisher, rushed forward, and climbed up the ladder and out the engineroom access hatch. He stated that he thought his clothes were on fire and that he intended to jump overboard to extinguish the fire.

When deckhand No. 4 exited the engineroom he realized that his clothes were not on fire. He closed the engineroom access hatch, pulled the handle on the manual fire alarm box nearby, and told deckhand No. 3, who was standing at the snack bar, to notify the master on the bridge that there was a fire in the starboard engineroom.

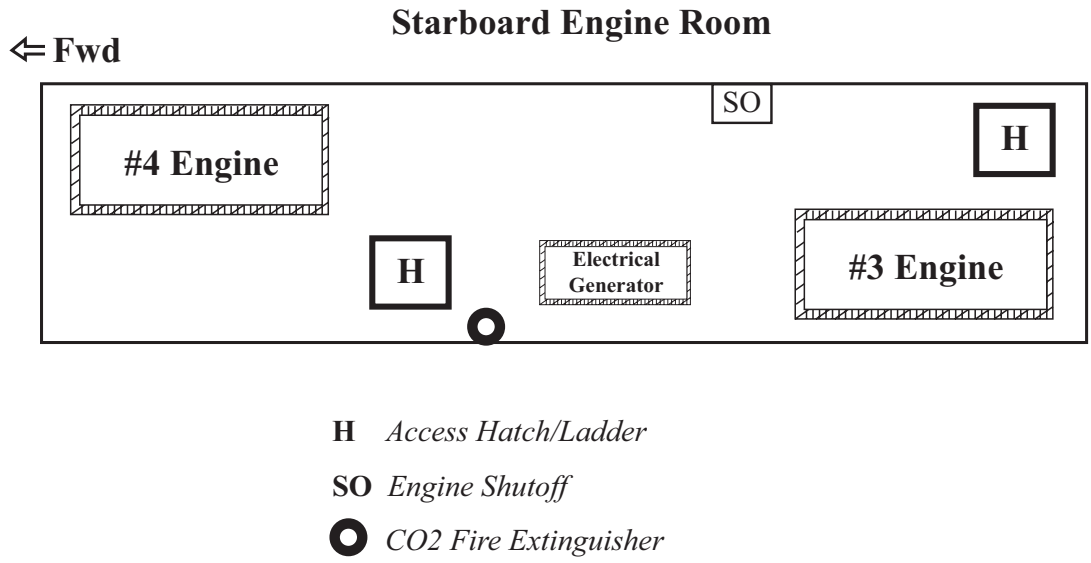

Figure 2. Sketch of the starboard engineroom of the Seastreak New York showing the arrangement of the access hatch, CO_2 fire extinguisher, shutoff switch, and main engines.

During this time, the master and two other deckhands (Nos. 1 and 5) were on the bridge, located on the second deck. The master said that, about 0630, while watching the video monitor of the enginerooms, he observed "a small black cloud" appear above the No. 3 engine. He then saw deckhand No. 4 run away from the engine. Immediately afterward, fire alarms sounded on the bridge alarm panel. The master sent deckhand No. 1 to investigate the alarms and instructed him to secure the fuel shutoff switches for the

starboard engineroom, which the deckhand did. The master then made a public address announcement requesting that all passengers move to the exterior decks and don lifejackets.

After exiting the engineroom, deckhand No. 4 closed the dampers for the starboard engineroom's air intake and exhaust plenums. However, the damper for the exhaust plenum had already been closed automatically when its heat sensor link activated. Deckhand No. 4 stated that he was then preparing to activate the engineroom's fixed CO_2 system, not realizing he needed the master's permission to activate it. At this point deckhand No. 1 arrived at the access hatch to the starboard engineroom and was told about the fire by deckhand No. 4.

When deckhand No. 1 reached the entrance to the starboard engineroom and was beginning to open the hatch, deckhand No. 4 warned him not to open it. Deckhand No. 1 went to the starboard electrical control locker, started the port generator, and shifted the vessel's electrical load to it. Upon confirming that the starboard engineroom dampers had been closed, deckhand No. 1 said that he returned to the wheelhouse and asked the master for permission to activate the fixed CO_2 system. According to deckhand No. 1, he received the master's permission, returned to the starboard locker, and activated the fixed CO_2 system. After the CO_2 system was activated, deckhands Nos. 1 and 4 donned lifejackets and helped the other deckhands move the passengers outside and don lifejackets.

The master stated that after he authorized the discharge of the CO_2 system, he used the VHF-FM radiotelephone to contact a Coast Guard patrol boat that was passing about a quarter mile away. He reported that he had a fire on board and requested permission to moor the *Seastreak New York* at the Sandy Hook Coast Guard station, which was the nearest dock (about 1 mile away). The patrol boat and the station acknowledged the master's call and gave him permission to moor at the station. The station's watchstander also contacted the Highlands, New Jersey, Volunteer Fire Department for assistance.

The only available pier space at the Coast Guard station was the outside wall of the western bulkhead. At 0641, the *Seastreak New York* moored with its starboard side next to the bulkhead and its bow partially aground on the sand beach. The deckhands and Coast Guard personnel helped the passengers disembark from the vessel. The passengers climbed over a walkway handrail mounted on the bulkhead and walked along the walkway to shore. All of the passengers on board were evacuated safely and none sustained injuries. Circle Navigation, the owner of the *Seastreak New York*, provided buses to allow the passengers to continue the trip to New York City.

The Highlands Volunteer Fire Department personnel arrived shortly after the passengers disembarked, at 0700. A 1 1/2-inch fire hose was run from the Coast Guard patrol boat, which had moored next to the *Seastreak New York*, to the forward hatch of the ferry's starboard engineroom. About 0730, after the access hatch had cooled to the point where it was only warm to the touch, a Highlands volunteer firefighter outfitted in full protective gear, including a breathing apparatus, entered the engineroom and found that the fire had been extinguished. The firefighters then ventilated the engineroom and declared the fire out.

Injuries

There were no injuries to the passengers or crewmembers.

Damages

The damages to the *Seastreak New York* were restricted to the starboard engineroom and the starboard side of the vessel. According to Circle Navigation, repair costs were estimated at slightly more than $81,000.

Crew Information

Regulatory Requirements

Small passenger vessels carrying more than six passengers for hire may not be operated without a valid Coast Guard Certificate of Inspection (COI), which is issued by the Coast Guard Officer in Charge, Marine Inspection (OCMI), for the zone. The COI, among other conditions, stipulates minimum staffing requirements. When determining the number and competencies of the crewmembers, the OCMI considers many factors, including the size of the vessel, its route, the type and horsepower of the vessel's propulsion machinery, the number of passengers, the type and location of lifesaving equipment, and the hazards peculiar to the route and service. According to its COI (issued April 26, 2001 by OCMI New York) the *Seastreak New York* was required to carry the crewmember complement indicated in table 1.

Table 1. Crewmember requirements for the Seastreak New York as required by its COI

Number of Passengers	Master	Licensed Mate	Deckhands
0 - 150	1	0	3
151 - 299	1	1	4
300 - 398	1	1	5

The COI allowed a qualified but unlicensed senior deckhand to be substituted for the licensed mate. The senior deckhand was required to be qualified in accordance with the standards set forth in NVIC 1-91. That NVIC requires that a deckhand have 30 days of experience on board the vessel and 30 hours at the helm under the supervision of a master or mate in order to qualify as the senior deckhand. Although it was not required by the COI, company policy required that one or two of the deckhands perform engineering duties such as engine start-up procedures and routine checks in the enginerooms while underway. The vessel's log listed the daily crewmember assignments as captain, mate, engineer, and deckhands.

At the time of the accident, a master and five deckhands were on board. The master was on the bridge at the controls. Deckhand No. 1 was on the bridge and was serving as the senior deckhand. Deckhand No. 5 was also on the bridge. Deckhand No. 2 was stationed on the second deck passenger cabin in position to assist passengers if needed. Deckhand No. 3 was serving at the snack bar on the main deck. Deckhand No. 4 was listed as the engineer in the vessel log and was inspecting the enginerooms.

There is no regulatory requirement for crews on small passenger vessels to have formal firefighting training. Deckhand No. 2 was the only crewman on the *Seastreak New York* who had received formal firefighting training, and that training had occurred 14 years earlier.

The *Seastreak New York* crewmembers had received firefighting instruction from the master periodically, the most recent being 5 to 6 weeks before the accident. That instruction typically consisted of rigging a fire hose, starting the fire pump, and discharging water over the side. The deckhands described additional instruction by the master that covered how to activate a portable fire extinguisher and procedures for using the engineroom fire suppression system.

Master

The master held a Coast Guard license as "Master of Steam or Motor Vessels of Not More than 100 Gross Registered Tons upon Near Coastal Waters." His license was endorsed to show qualification for Commercial Assistance Towing and Radar Observer. He had worked previously on charter fishing boats and had been working on small passenger commuter vessels since 1996. He had worked on other commuter ferries for 3 1/2 years and had been the master on the *Seastreak New York* since its delivery in April 2001. He had received on-the-job emergency procedures training, including firefighting, from masters on his previous vessels.

The master was 27 years old at the time of the accident. He started his working day at 5 a.m. His last day of work before the accident was on Tuesday, September 25. He had been off duty for the 2 days preceding the fire. The master slept for 8 hours Tuesday and Wednesday nights and 7 hours on Thursday night, which was the day before the accident.

Deckhand No. 1

Deckhand No. 1 did not have, and was not required to have, a Coast Guard license or document. He had earlier marine experience as a deckhand on commercial fishing boats and had served as a deckhand on the *Seastreak New York* since its delivery in April 2001. He was the senior deckhand who substituted for a licensed mate and had fulfilled the requirements for being designated a senior deckhand as indicated in the Coast Guard NVIC.

Deckhand No. 1 started his working day at 5 a.m. He had worked on Tuesday and was off work Wednesday and Thursday. Deckhand No. 1 slept for 12 hours Tuesday night, 10 hours Wednesday night, and 7 1/2 hours on Thursday night.

Deckhand No. 2

Deckhand No. 2 had approximately 16 years of experience on board various small commercial vessels. He had worked on the *Seastreak New York* for 1 week before the fire. He was awaiting completion of his United States citizenship process in order to obtain a Coast Guard license. He had taken a formal firefighting course in 1987.

Deckhand No. 2 started his working day at 5 a.m. He was off work on Tuesday and worked on Wednesday and Thursday. Deckhand No. 2 slept for 7 hours Wednesday night, and 6 1/2 hours on Thursday night.

Deckhand No. 3

Deckhand No. 3 had 4 1/2 years experience on board various small commercial vessels. He had served on the *Seastreak New York* for approximately 5 months. He did not have, and was not required to have, any Coast Guard licenses or documents.

Deckhand No. 3 was 23 years old at the time of the accident. He started his working day at 5 a.m. He had worked on Tuesday, Wednesday and Thursday. Deckhand No. 3 slept for 7 hours Tuesday night, 6 1/2 hours Wednesday night, and 7 1/2 hours on Thursday night.

Deckhand No. 4

Deckhand No. 4 was 44 years old at the time of the accident. He had served on the *Seastreak New York* for approximately 3 months. He did not have, and was not required to have, any Coast Guard licenses or documents.

He started his working day at 5 a.m. He had worked on Tuesday and was off work on Wednesday and Thursday. Deckhand No. 4 slept for 7 hours Tuesday night, 11 1/2 hours Wednesday night, and 7 1/2 hours on Thursday night.

Deckhand No. 5

Deckhand No. 5 was 19 years old and had less than 2 years of experience on board small commercial vessels. He had worked as a deckhand 1 year on charter fishing vessels and had served as a deckhand for 4 months on the *Seastreak New York*. He did not have, and was not required to have, any Coast Guard licenses or documents.

Deckhand No. 5 started his working day at 5 a.m. He had worked on Tuesday and Thursday, and was off work on Wednesday. Deckhand No. 5 slept for 10 1/2 hours Tuesday night, 5 1/2 hours Wednesday night, and 6 1/2 hours on Thursday night.

Vessel Information

Seastreak New York was owned by Banc One Leasing Corporation of Columbus, Ohio, and operated by the Circle Navigation Company of New York. It was the only

vessel that Circle Navigation operated at the time of the accident. A sister vessel was under construction at the time of the fire and was delivered in December 2001.

The *Seastreak New York* provided scheduled passenger service between Highlands, New Jersey, and New York City, New York (Manhattan). Its normal weekday schedule consisted of two trips in the morning and two in the evening. The maximum passenger capacity in this service was 394 passengers.

The *Seastreak New York* was a 133-foot-long high-speed catamaran ferry. The catamaran hulls were of welded aluminum construction. The vessel was built by Gladding-Hearn Corporation and delivered in April 2001. The Coast Guard inspected it under the provisions of 46 CFR Parts 114 to 122 (Subchapter "K").

The vessel had three passenger accommodation decks. The main deck had seating for 209 passengers with a snack bar area aft. The second deck had seating for 132 passengers inside and 12 passengers outside. The navigation bridge was also located on the second deck. The third deck, also accessible to passengers, was entirely outside with no fixed seating.

Each catamaran hull was divided into six watertight compartments. In each hull there were two propulsion engines connected to two water jets, one electrical generator, one fuel tank, and auxiliary systems. Each catamaran had an engineroom that contained two engines and a generator. Each engineroom was accessed through two deck hatches/vertical ladders. The electrical generators were 95 KW Cummins/Onan MDGDB95. Each engineroom had two air-intake plenums and one air-exhaust plenum. A fixed CO_2 fire suppression system was installed to protect each engineroom.

One 1,400 U.S. gallon-capacity fuel tank was located in a separate compartment forward of each engineroom. Each engine drove a KAMEWA A50 water jet that was located in a compartment aft of each engineroom.

Main Engines

Cummins Engine Company, Inc., manufactured the four main engines. Each was a Cummins KTA50M2 diesel engine capable of producing 1,875 horsepower. Engines No. 1 and No. 2 were in the port hull, No. 3 and No. 4 were in the starboard hull. The engines had less than 2,000 hours operating time. The engines were installed offset from the hulls' centerlines and located on opposite sides of a central catwalk. Engine No. 1 was located outboard forward and engine No. 2 was located inboard aft. Engine No. 3 was located inboard aft and engine No. 4 was located outboard forward. The diesel engines installed on the *Seastreak New York* were purchased and assembled by Cummins Northeast, an independent distributor of Cummins' products.

Centinel System

Each main engine had a Centinel System installed to maintain engine lubrication. Cummins Engine Company, Inc., manufactured the Centinel System. The product literature states that the Centinel System is "a continuous oil replacement system of

electromechanical design." It continuously replaced engine lube oil from a reservoir at a set rate and injected the used lube oil into the fuel line feeding the engines. Oil from the lube oil reservoir was introduced into the engine sump by the Centinel valve at a rate equal to the rate of consumption of the used lube oil. The Centinel System could be integrated into the engine at the factory or retrofitted. Cummins Northeast indicated that it had assembled the Centinel System on the *Seastreak New York* during construction.

The components of the Centinel System involved in this accident were the eliminator oil filter assembly, the Centinel control valve, and the lube oil monitor hose that connected the two components. On the *Seastreak New York*, the control valve was located on the port side forward edge of all four engines. So that crewmembers could easily access the oil filter assembly from the catwalk, the filter assembly was installed on alternating rear sides of the two engines. Engines Nos. 1 and 3 each had the oil filter assembly mounted on the starboard, rear side of the engine diagonally on the opposite side of the engine from the control valve, which was on the port side forward.

The Cummins Engine Company documentation for installing the Centinel System does not contain any guidance for routing the lube oil hose from the oil filter assembly to the control valve around heat sources. However, hose installation instructions in the hose manufacturer's catalog include the statement, "When hose lines pass near an exhaust manifold or other heat source, they should be insulated by a heat resistant boot, fire sleeve, or a metal baffle."

Routing of Lube Oil Hoses

Because the oil filter assembly and the control valves on engines No. 1 and 3 were on opposite sides of the engine, the monitor hose connecting these components was routed forward and across the top of the engine. (See Figure 3.) Product literature provided by the Cummins Engine Company contained no guidance with regard to the routing of the monitor hose. Investigators observed that on the *Seastreak New York,* these hoses came forward on the right side of the engine and then were routed across the top of the forward section of the engine and down to the control valve. The hoses were routed near the forward edge of the exhaust manifold water-cooling shield. The hoses were secured to other hose bundles by tie wraps as they passed along the side of the engine, but they were not secured across the top of the engine.

According to Cummins Engine Company, at full power, the temperature of the water-cooling shield is 170° F to 180° F, and the operating temperatures of the exhaust manifold banks underneath the shield are 785° F to 847° F. The flash point of the lube oil was between 400º F and 500º F.[1]

[1] According to the Exxon Mobil Corporation, a major producer of marine lubrication products, the flash point of its marine lubricating oils is in the range 442º F to 510º F. Information obtained on August 22, 2002 <http://www.mobil.com/mobil_marine_lubes/index.html>.

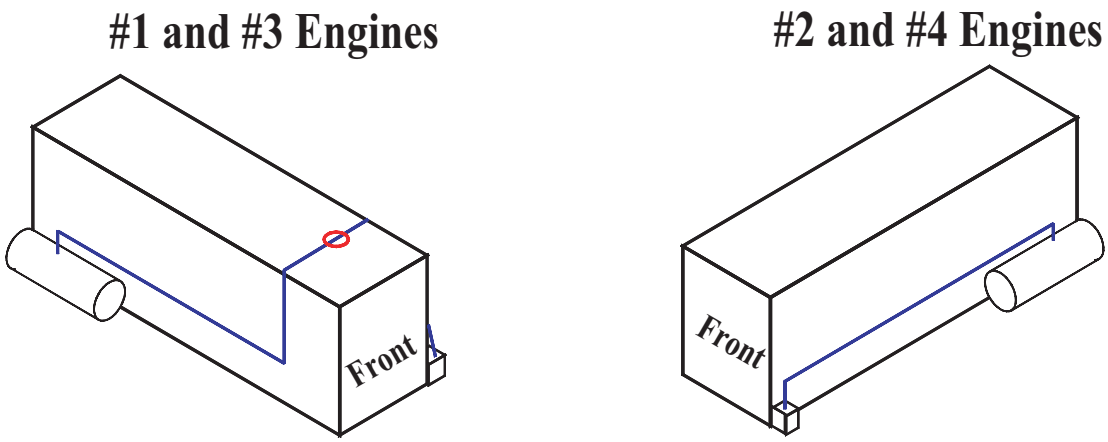

Figure 3. Sketch of the main engines showing differing routing of the lube oil monitor hoses.

Maintenance and Inspection

The company had no established preventive maintenance and inspection program for the vessel's engines and auxiliary systems and none was required. On the *Seastreak New York*, deckhands conducted checks of oil and coolant levels and made visual inspections of the enginerooms as the vessel was operating.

Waterway Information

When the fire began, the *Seastreak New York* was transiting Sandy Hook Bay, which is located in the southern part of Lower New York Bay. The bay is bounded on the east by Sandy Hook, a low-lying peninsula that juts out into Lower New York Bay and on the west by the New Jersey mainland. Sandy Hook Coast Guard Station is located at the northern end of the Sandy Hook peninsula on its western shore.

Meteorological Information

On the morning of the fire, the temperature was 55° F, and the wind was from the west-northwest at about 10 knots. The visibility was 10 miles.

Medical and Pathological

The regulations concerning drug and alcohol testing require testing of marine crews in the event of a serious marine incident.[2] Law enforcement officers or the marine

employer may require testing at any time if they have "reasonable cause."[3] This accident did not meet the definition of a serious marine incident, so testing was not required.

Coast Guard station personnel boarded the vessel immediately after it arrived at the station. Investigators from Coast Guard Activities New York arrived at Sandy Hook about 2 hours after the accident. None of the responding Coast Guard personnel observed any indication of impairment in the actions of the *Seastreak New York* crewmen. The Circle Navigation manager and the master stated that no Coast Guard personnel asked about nor directed the company to have the *Seastreak New York* crewmembers undergo drug and alcohol testing.

Circle Navigation had a contractor who provided drug-testing services. Upon an informal recommendation by a Safety Board investigator 2 days after the accident, the company directed all crewmen to be tested at the contracted testing facility. This testing took place 96 hours after the accident. The specimens were tested for the presence of drugs, and the results of the tests were negative. Since the time delay for testing was so prolonged, testing for alcohol was not undertaken.

Wreckage

Fire Damage

Examination by Safety Board investigators revealed that the fire damage was confined to the starboard engineroom. The primary damage was to the forward portion of engine No. 3, the engineroom overhead immediately adjacent to the engine, and the electrical fixtures and cables routed through that overhead area. There was soot residue in the majority of the aft section of the starboard engineroom. The fire melted the heat detector mounted over the engine.

Investigators noted fire damage patterns that originated at the top forward section of engine No. 3. From the top of that engine, a pattern of heat damage spread up and to port in the engineroom. Investigators found the broken end of the lube oil monitor hose coming from the filter assembly in this area, resting on top of the exhaust manifold cooling shield of the engine. The other end of the broken hose, leading to the control valve, was beneath the cooling shield, resting near the forward edge of the left side exhaust bank.

Because the hose routing for engine No. 1 was similar to that of engine No. 3, Safety Board investigators examined the routing on the former to gain insights into what might have caused the fire. On engine No. 1, the monitor line had been routed over the top

[2] A serious marine incident is defined by 46 CFR Part 4.03-2 as one that results in death, injury beyond first aid, damage to property in excess of $100,000, loss of an inspected vessel, or loss of a vessel of 100 gross tons or more.

[3] According to 33 CFR Part 95.035, reasonable cause exists when the individual was directly involved in a marine casualty, which is defined as material damage affecting the efficiency of the vessel.

of the engine, underneath the cooling water hoses leading to the cooling jacket. Investigators found the hose resting near the forward edge of the engine exhaust banks. It had been routed (or had fallen) in between the forward edge of the cooling shield and the engine. The sheathing on the hose was partially melted away and the hose was discolored in the area where it came into direct contact with the engine.

The monitor hoses on engines No. 1 and No. 3 were removed under the supervision of Safety Board investigators and delivered to the Safety Board Materials Laboratory for examination (see Tests and Research section of this report).

Hull Damage

The *Seastreak New York* suffered hull damage while it was moored to the bulkhead at the Sandy Hook Coast Guard station. During the passenger evacuation and fire evaluation, wind and seas repeatedly pushed the starboard catamaran hull against the bulkhead. That bulkhead was not designed to be a mooring site and had protruding bolts on its pilings. Wave action pushing the vessel against the bolts in the bulkhead punctured the starboard hull in about 10 places. The holes caused limited flooding in two of the five starboard hull compartments. Using damage control equipment, Coast Guard personnel temporarily sealed the holes in one compartment. *Seastreak New York* deckhands sealed the holes in the other space. After dewatering pumps cleared the water from each space, the tug *Paul Andrew* towed the *Seastreak New York* to Bay Shipyard in Staten Island, New York, where the ferry was put into dry dock to repair the damaged hull plating.

Survival Aspects

Muster/Evacuation

Immediately after the fire alarm was sounded, the master made an announcement over the public address system requesting passengers to don lifejackets, proceed to the outside decks, and follow the instructions of the deckhands. The deckhands passed out lifejackets to each passenger and assembled the passengers on the open decks. The *Seastreak New York* moored to the outside wall of the bulkhead at 0641, about 11 minutes after the first indication of fire. The deckhands and Coast Guard personnel from the station assisted the passengers off the vessel, over a handrail and onto the bulkhead walkway, and then to shore. All passengers were evacuated safely.

Passenger Comments

Safety Board investigators interviewed several passengers after the fire. They stated that, during the incident, the crewmembers were very helpful and professional, and that they were kept informed of the actions being taken by the crewmembers, the company, and the Coast Guard.

Lifesaving Equipment

Primary life saving equipment on the *Seastreak New York* consisted of lifejackets and inflatable buoyant apparatuses. A total of 410 adult lifejackets and 40 child lifejackets were distributed in various marked locations on all three decks. Eight 50-person inflatable buoyant apparatuses were stowed in four containers on the third deck amidships, with two on each side. These containers were stowed in gravity cradles near the deck edge and were equipped with hydrostatic releases.

Firefighting Equipment

The *Seastreak New York*'s firefighting equipment consisted of a fire main system, portable dry chemical and CO_2 extinguishers, and a fixed CO_2 fire suppression system for each engineroom. Two electric centrifugal pumps, one in each engineroom, supplied water to the fire main. The vessel had four fire stations, three on the first deck and one on the second. Each fire station was equipped with an adjustable stream nozzle and 50 feet of 1 1/2-inch fire hose. Five dry chemical extinguishers were located in the passenger compartments on the first and second decks. A 15-lb. CO_2 portable extinguisher was located in each engineroom by the forward access ladder. Each engineroom had fire detectors wired to a remote panel on the bridge and could be monitored via video cameras from the pilothouse.

Emergency Procedures

The *Seastreak New York* had a station bill posted on the vessel and provided in the operating manual. The station bill provided duties for the master and five crewmembers in the event of fire, man-overboard, or abandon-ship emergencies. In case of a fire, the master and licensed mate were assigned to the bridge, the "senior deckhand" and two other deckhands were to attend to the fire scene and passenger control, and one deckhand was assigned to the engineroom.

Communications Equipment

The *Seastreak New York*'s internal communications system consisted of a public address system and a seven-station internal telephone system. The telephones were located at the snack bar, in each engineroom, in each waterjet room, on the bridge, and at the bow ramp control station. Four portable UHF radios were stored on the bridge. The crewmembers stated that the hand-held UHF radios were used during excursion trips but not during commuter runs.

Tests and Research

The lubricating oil monitor hoses installed on the No. 1 and No. 3 main engines were delivered to the Safety Board's materials laboratory for examination. Examination of the hose assemblies revealed that a loose woven nylon sleeve surrounded the hose. The oil monitor hoses were style FC 332, manufactured by Aeroquip, Inc. The Aeroquip

industrial connectors catalog indicates that the FC 332 hose consists of a proprietary AQP elastomer (rubber-like) tube with a textile braid and an AQP elastomer cover. AQP elastomer is a proprietary formulation of hose material exclusive to Aeroquip.

The oil monitor hose identified as being from engine No. 1 was damaged in an area approximately 10 inches long and centered approximately 52 inches from the straight connection end. The oil monitor hose from engine No. 3 was in two pieces—one 98 inches long and the other 49 inches. The loose nylon sleeve on the hoses was intended to protect them from abrasion. An Aeroquip representative indicated that the sleeve had a maximum working temperature rating of 248° F. A plastics encyclopedia indicated that nylon could melt at a temperature of 410° F.[4]

Aeroquip's equipment catalog indicates that the lubricating oil monitor hoses had an operating temperature range of -40° F to +300° F when conveying gasoline, fuel, or lubricating oils. Hose installation instructions in the catalog included the statement, "When hose lines pass near an exhaust manifold or other heat source, they should be insulated by a heat resistant boot, fire sleeve, or a metal baffle." The data sheet for the fire sleeve indicated that it was a braided fiberglass sleeve with a bonded and seamless silicone rubber cover and had a temperature range of –65° F to +500° F. A fire sleeve was not used in the installation on board the *Seastreak New York*.

Engine No. 1 Hose Assembly. The No. 1 engine hose had a slightly discolored area approximately 6 inches long. Squeezing the hose revealed that the discolored length was hardened when compared to the area that was not discolored. The inside surface of the removed portion of the abrasion sleeve, approximately at the middle, had melted and partially melted resolidified strands. In the same area of the hose was a drip consisting of resolidified material and individual strands.

Engine No. 3 Hose Section. The damaged portion of the No. 3 engine hose sleeve was cut circumferentially, allowing the damaged portion to be removed for examination. Portions of the damaged section of the hose were discolored, and the end of the damaged sleeve was flat. Squeezing of the hose revealed that the discolored length had hardened when compared to the nondiscolored area.

The tube retained its black color, but the fracture surface was smooth, with radially oriented lines. Separations were observed within the tube wall consistent with heat differentials between inner and outer surfaces during operation. The surface of the cover was discolored and felt hard to the touch. The underlying material had retained some of its blue coloration, and the visible edges displayed a rounded appearance consistent with re-solidification from a liquid phase. No residual material was observed that would indicate the presence of the braid. The fracture face indicated separations within the tube wall consistent with heat differentials between inner and outer surfaces during operation.

[4] Modern Plastics, *Modern Plastics Encyclopedia* (New York: McGraw Hill Companies, Inc. 1995): B-160.

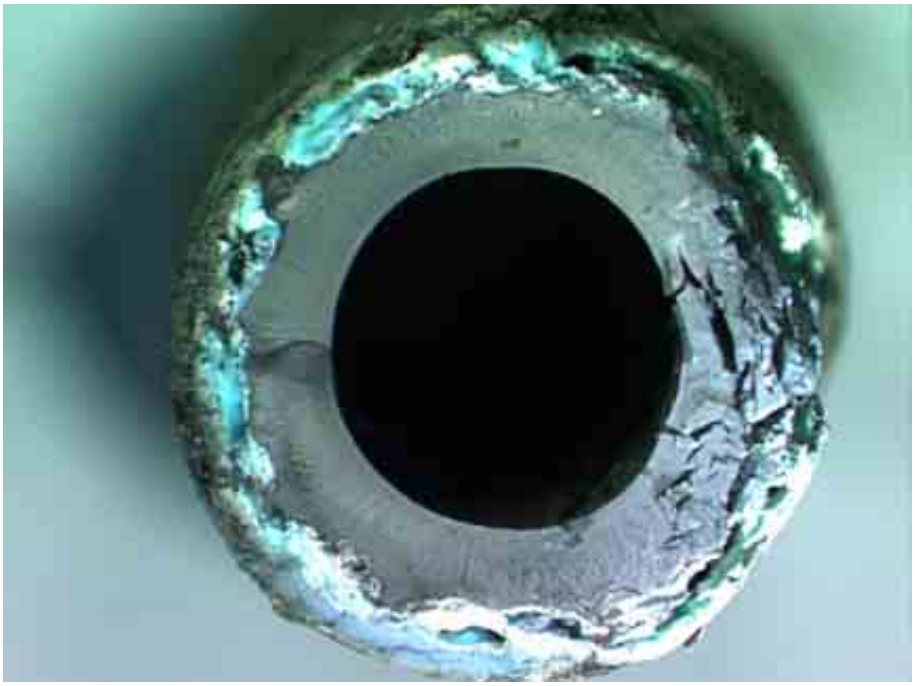

Figure 4. The fracture face of engine No. 3's lube oil monitor hose.

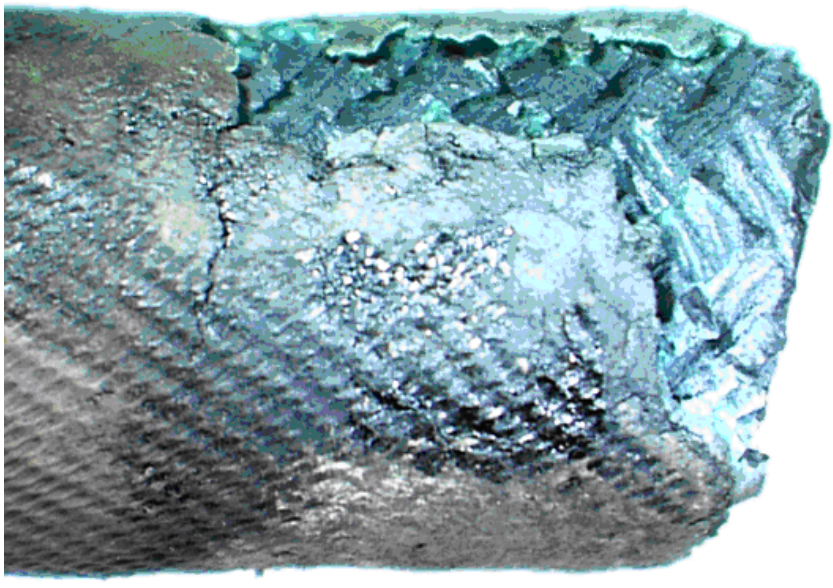

Figure 5. A side view of the fracture face of engine No. 3's lube oil monitor hose.

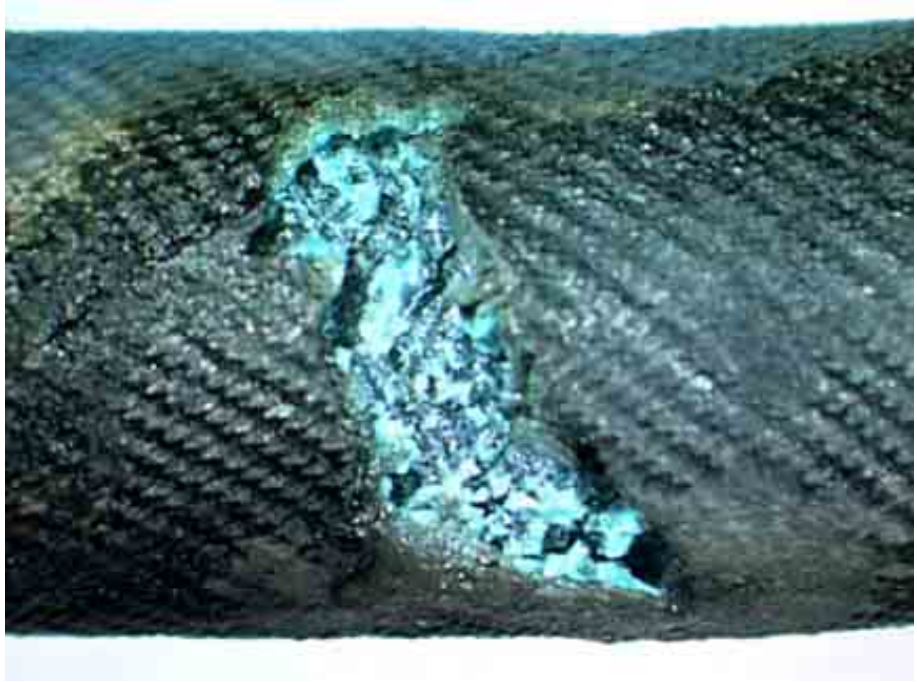

Figure 6. The damaged area on engine No. 3's lube oil monitor hose approximately 2.5 inches from the fracture face.

Analysis

General

This analysis first identifies factors that can be readily eliminated as causal or contributory to the fire and then describes where and how the fire started. The report then discusses the adequacy of the following safety issues:

- Manufacturer's instructions for the installation of engine accessories;
- Crew firefighting response;
- Company maintenance and inspection procedures; and
- Passenger management.

Exclusions

Before the accident, the *Seastreak New York* did not suffer a propulsion or steering failure. The crewmembers' actions did not cause or contribute to the cause of the fire. The weather conditions were mild and did not hamper detection of the fire or interfere with the firefighting efforts. Crewmembers had just begun their workday and were well rested. The crewmembers tested negatively for drugs after 96 hours. No alcohol tests were given, however, because Coast Guard personnel who were on board the vessel immediately following the fire reported that the crewmembers did not appear to be impaired, the Safety Board does not believe that alcohol was a factor. Consequently, the Safety Board concludes that none of the following were factors in this accident: major propulsion or steering failure, weather, crewmember actions, fatigue, drugs, or alcohol.

Cause and Origin of Fire

When deckhand No. 4 opened the access hatch to the starboard engineroom before entering it, he immediately smelled a "strange odor" that he could not identify, but later described as "maybe a wire's melting … a plastic smell." As he descended the ladder, he looked forward at engine No. 4 and saw that it appeared to be operating normally. He proceeded aft and inspected the starboard generator, which showed no evidence of abnormal operating conditions. The deckhand continued aft toward engine No. 3. When he stepped on a platform in front of it and looked over the top of the radiator, he saw a "foot-long flame" on top of the engine No. 3. Moving away from the engine to reach for the CO_2 extinguisher and then the fuel shut-off valve, deckhand No. 4 looked back to see the fire flash. He dropped the extinguisher and left the engineroom quickly by the ladder to the deck above.

When investigators examined the starboard engineroom after the fire, they found clear fire damage patterns indicating that the fire had originated at the top forward section of engine No. 3. From the top of engine No. 3, the pattern of heat damage spread upward and to the port side of the engineroom. This finding matches the reports of the master and deckhand No. 4 that the fire began on the top forward section of engine No. 3.

Examining the top forward section of engine No. 3, investigators found the end of a broken lube oil hose on top of the exhaust manifold cooling shield of the engine. The other end of this hose was found beneath the cooling shield, resting near the forward edge of the exhaust manifold.

Deckhand No. 4 arrived in the engineroom just as the fire was beginning. The foot-long flame was probably the result of the ignition of the initial leak of lube oil as it came into contact with the hot engine. The flash of fire was probably the result of the ignition of pressurized oil spraying from the ruptured hose. The hose began to leak lube oil onto the exhaust manifold. The heat generated by the exhaust manifold (785° F to 847° F) provided the ignition source for the lube oil (flash point between 400° F and 500º F), causing a small flame initially. The flare-up resulted from the complete failure of the hose. The pressurized end of the hose sprayed lube oil upward and toward the port side. The major fire damage pattern found during the investigation supports this scenario. Laboratory analysis of the lube oil hose that ran from the oil filter assembly to the control valve on engine No. 3 revealed that, before the fire, heat from the exhaust manifold had discolored the hose and hardened it. The hardening increased until the hose became brittle enough to fracture when exposed to vibrations and contact with engine parts. The Safety Board concludes that the failure of the hose caused lube oil to come in contact with the exhaust manifold and ignite, which resulted in the fire that damaged the *Seastreak New York*.

Manufacturer's Instructions for the Installation of Engine Accessories

The fire damage to engine No. 3 precluded Safety Board investigators from identifying all possible failure mechanisms. Investigators, therefore, examined engine No. 1, which according to Circle Navigation, had been configured similarly to engine No. 3. They found that the lube oil hose was routed from the oil filter assembly at the rear starboard side of the engine over the top of the engine and underneath the cooling water hoses leading to the cooling jacket. The lube oil hose then led to the control valve on the front port side of the engine. The hose was not secured. Investigators found that this routing and the failure to secure the hose above the engine had allowed the lube oil hose on engine No. 1 to slip down past the forward edge of the cooling shield either during installation or operation. The hose was found resting on or very near the hot exhaust manifold of engine No. 1.

The Safety Board is convinced that the lube oil hose was routed similarly on engine No. 3. When investigators examined engine No. 3 after the fire, they found no evidence that the hose had been secured. They found that one end of the broken lube oil

hose was resting on top of the engine's exhaust manifold cooling shield and the other end of the hose was underneath the cooling shield, lying near the forward edge of the exhaust manifold.

In the absence of any securing of the lube oil hose in the space underneath the cooling water hoses, the vibrations of engine No. 3 could have provided the mechanism for the migration of the hose from its original position to the hazardous location below the exhaust manifold cooling shield and on or near the forward edge of the exhaust manifold, where the oil hose was subject to heat stress that eventually caused it to fail.

The Cummins Engine Company's documentation for the Centinel System does not contain any guidance for routing the lube oil hose from the oil filter assembly around heat sources to the control valve. However, hose installation instructions in the hose manufacturer's catalog state, "When hose lines pass near an exhaust manifold or other heat source, they should be insulated by a heat resistant boot, fire sleeve, or a metal baffle." In this case, the routing of the hose and the failure to secure it as it passed over the engine allowed the hose to come in contact with the exhaust manifold. Had the hose been properly secured as it passed over the engine, it would not have come into contact with the exhaust manifold, and the fire would have been prevented. The Safety Board concludes that the lack of guidance for the proper installation of the lube oil hose resulted in the lube oil hose on engine No. 3 being improperly routed and secured, allowing it to migrate to the forward edge of the exhaust manifold, where it was subject to unintentional heat stress that eventually caused the hose to fail. Consequently, the Safety Board believes that Cummins Engine Company should revise its manufacturing and installation literature for the Centinel System to specify how to safely route and secure the lube oil hose between the oil filter assembly and the control valves on the engines.

Crew Firefighting Response

Deckhand No. 4 discovered the fire and acted instinctively to try to extinguish it using the nearby portable CO_2 extinguisher. His first action, however, should have been to notify the master before attempting to control the fire.[5] Training indicates that the proper procedures would have been to call the master on the telephone that was located in the engineroom. This would have given the master the opportunity to shut down the engine, either remotely or by directing deckhand No. 4 to do so locally. With the engine secured, the hose would no longer have been pressurized, and the flare-up may not have occurred or, at least, might have been greatly reduced. This could have lessened the severity of the emergency, and, possibly, instead of a fire it might have been only an engine failure.

After deckhand No. 4 retrieved the portable extinguisher, he pulled its safety pin and moved toward the fire. He did not check to see if the extinguisher was operational by

[5] "The first actions are to sound the alarm and report the fire location…Do not attempt to extinguish a fire, however small it may seem, until sounding the alarm by voice, telephone, pull box, etc." Barbara Adams, *Marine Fire Fighting* (Stillwater, Oklahoma: Fire Protection Publications, 2000) 241.

making a quick discharge. Checking the extinguisher in this manner before approaching a fire is critical to ensuring personal safety. Attacking a fire only to discover that the extinguisher is not operational creates a serious personal risk.

Had deckhand No. 4 been overcome by the flare-up and unable to exit the engine room, the situation could have been worse. No personal fire protection equipment (including SCBA[6]) was carried on the *Seastreak New York,* nor is such equipment required. Entry into the burning engineroom by another crewman would not have been possible. The crewmembers would have been faced with the choice of closing the engineroom and using the CO_2, which probably would have killed Deckhand No. 4, or leaving the engineroom open, which could have allowed the fire to spread to the passenger cabins.

As the deckhand evacuated the engineroom, he believed his clothes were on fire and had planned to jump into the water to extinguish the fire. If the deckhand had jumped overboard, the crewmembers' attentions would have in all likelihood been focused on responding to the man overboard. The delay in securing the access hatch and responding to the fire could have created a situation where the fire would have spread to the passenger cabins. If the deckhand who had left the engineroom collapsed after securing the space and had not prevented deckhand No. 1 from reopening the access doors to the space, a sudden introduction of additional oxygen could have caused the fire to flash and could have resulted in the fire spreading to the passenger cabins. Had the fire spread into the passenger cabins, there would have been a greatly increased risk to passengers and crewmembers. Smoke would have filled most if not all of the passenger cabins. The primary area of refuge from the smoke would have been the exterior third deck. Quick movement of 198 passengers to that space would have been difficult and hazardous. Without proper training in firefighting, it is doubtful whether the crewmembers could have prevented the spread of the fire. Fortunately, the fire extinguishing efforts on the *Seastreak New York* were successful. The fire was extinguished quickly and there was limited damage to the engineroom. The Safety Board concludes that, while the fire was successfully extinguished, the crew's lack of training could have negatively impacted passenger safety.

Once deckhand No. 4 had exited from the engineroom, the crewmembers followed the proper procedures as far as physical actions required before activating the fixed fire suppression system. They closed the access hatches, secured the ventilation dampers and the blower, shifted the electrical load to the port generator, and secured the fuel to all equipment in the engineroom. However, there was some confusion about getting permission from the master prior to activation of the CO_2 release. Deckhand No. 4 was unaware that he needed to get permission to activate the system. Accepted industry practice is as follows: "When to use a fixed fire suppression system is an important decision that the designated officer in charge of fire control must make after becoming well informed of the situation and its surrounding circumstances."[7] On the *Seastreak New*

[6] Self-Contained Breathing Apparatus

[7] Adams, 201.

York, this officer was the master. If the system is activated without the master's knowledge or permission, it may adversely affect the results of decisions and actions he is directing. If he were to direct that an engineroom hatch be opened after the CO_2 was discharged, it would negate the effectiveness of the CO_2. The CO_2 would also be hazardous, possibly fatal, to anyone entering the engineroom.

New York Waterway, another company that operates commuter ferries in the metropolitan New York area, has voluntarily provided formal firefighting training to its marine crews. This shows that companies can take action to improve fire safety on their vessels without having to wait for the development of regulations requiring them to do so. Firefighting training is critical, not only for the safety of the vessels and crews, but also for the safety of the passengers carried on board. The Safety Board concludes that the actions of the crewmembers of the *Seastreak New York* in this fire show that Circle Navigation Company marine personnel lacked adequate firefighting training. Consequently, the Safety Board believes that Circle Navigation Company should develop and implement a training program in marine firefighting for its crewmembers.

Company Maintenance and Inspection Procedures

The *Seastreak New York* had been in service less than 6 months when this fire occurred. Although there could be a reasonable expectation that components should not fail in such a short period, attachments to engines are subject to vibration, abrasion, and heat and may be vulnerable to failure long before the manufacturers recommended replacement date. Attachments such as hoses are particularly vulnerable and should be visually inspected frequently and regularly to ensure that they are not subject to stresses that could materially lessen their service life. The condition of hoses is particularly important because they typically hold flammable liquids under pressure, and, if the hose fails for any reason, the likelihood of fire is very high. As can be seen from this accident, even relatively new hoses can fail, if the conditions are appropriate.

A comprehensive maintenance and inspection program starts when the vessel is delivered to the owner and should include frequent inspections of the condition, routing, and securing of hoses attached to the main engine and to other operating diesel engines. If a comprehensive inspection program had been in place at Circle Navigation, the hose resting on the manifold would probably have been identified and the hose rerouted and secured before the hose ruptured, and this fire could have been avoided. The Safety Board therefore concludes that the lack of a preventive maintenance and inspection program set the stage for this fire to occur.

As discussed in the Safety Board's report on the fire on the *Port Imperial Manhattan*, the airline, rail, and motor carrier industries require preventive maintenance programs.[8] As a result of its investigation into the *Port Imperial Manhattan* fire, the Safety Board recommended (Safety Recommendation M-02-5) that the Coast Guard require that companies operating domestic passenger vessels develop and implement preventive maintenance programs for all systems affecting the safe operation of their vessels, including the hull, mechanical, and electrical systems. At the time of this writing, the Safety Board is still awaiting the Coast Guard's response to this recommendation. However, recognizing that the Coast Guard rulemaking requiring preventive maintenance programs is likely to be a time-consuming process, the Safety Board believes that, in the interim, Circle Navigation should develop and implement a preventive maintenance and inspection program for systems affecting the safe operation of its vessels, including the hull and the mechanical and electrical systems.

Passenger Management

The mustering of, lifejacket distribution to, and disembarking of passengers were accomplished without difficulty. The master remained on the bridge and in positive control of the situation and the crew's response. The crewmembers controlled the passengers, directed and assisted them as needed, and kept them informed of the status of the situation. The Safety Board concludes that the actions of the crewmembers in managing the passengers during the emergency were appropriate and effective.

Because the passengers were daily commuters, they were very familiar with both the vessel and its crewmembers. When the *Seastreak New York* moored alongside the bulkhead at the Coast Guard Station, the passengers were able to disembark with assistance through the starboard gangway, over the railing, onto the walkway at the top of the bulkhead, and onto shore. As an additional precaution, the master had positioned the vessel's bow on the beach in the event it became necessary to use the bow ramp in the evacuation of passengers.

Although they resulted in some damage to the vessel's hull, the Safety Board concludes that the master's actions in coming alongside the bulkhead at the Coast Guard Station to disembark the passengers as quickly and safely as possible were appropriate.

[8] National Transportation Safety Board, *Fire On Board the Small Passenger Vessel* Port Imperial Manhattan, *Hudson River, New York City, New York, November 17, 2000*. NTSB/MAR-02-02 (Washington, D.C.: NTSB, 2002)

Conclusions

Findings

1. None of the following were factors in this accident: major propulsion or steering failure, weather, crewmember actions, fatigue, drugs, or alcohol.

2. The failure of the hose caused lube oil to come in contact with the exhaust manifold and ignite, which resulted in the fire that damaged the *Seastreak New York*.

3. The lack of guidance for the proper installation of the lube oil hose resulted in the lube oil hose on engine No. 3 being improperly routed and secured, allowing it to migrate to the forward edge of the exhaust manifold, where it was subject to unintentional heat stress that eventually caused the hose to fail.

4. While the fire was successfully extinguished, the crew's lack of training could have negatively impacted passenger safety.

5. The actions of the crewmembers of the *Seastreak New York* in this fire show that Circle Navigation Company marine personnel lacked adequate firefighting training.

6. The lack of a preventive maintenance and inspection program set the stage for this fire to occur.

7. The actions of the crewmembers in managing the passengers during the emergency were appropriate and effective.

8. Although they resulted in some damage to the vessel's hull, the master's actions in coming alongside the bulkhead at the Coast Guard Station to disembark the passengers as quickly and safely as possible were appropriate**.**

Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on board the *Seastreak New York* was the improper installation of the Centinel System's lube oil hose, which allowed the hose to come in contact with the hot exhaust manifold. Contributing to the cause of the fire was the absence of detailed guidance from the manufacturer of the Centinel System on the proper installation of the system. Also contributing to the cause of the fire was the lack of inspection and maintenance procedures by Circle Navigation Company that might have discovered the improper installation.

Recommendations

To Cummins Engine Company, Inc.:

Revise your manufacturing and installation literature for the Centinel System to specify how to safely route and secure the lube oil hose between the oil filter assembly and the control valves on the engines. (M-02-22)

To Circle Navigation Company of New York:

Develop and implement a training program in marine firefighting for your crewmembers. (M-02-23)

Develop and implement a preventive maintenance and inspection program for systems affecting the safe operation of your vessels, including the hull and the mechanical and electrical systems. (M-02-24)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

CAROL J. CARMODY
Acting Chairman

JOHN A. HAMMERSCHMIDT
Member

JOHN J. GOGLIA
Member

GEORGE W. BLACK, JR.
Member

Adopted: September 17, 2002

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Appendix A

Investigation

The U.S. Coast Guard notified the Safety Board of this accident at 1222 on September 28, 2001. The Safety Board launched a three-person investigative team to the scene that afternoon and they arrived early that same evening. The Safety Board team examined the fire scene, interviewed company management officials, ship's crewmembers, and other witnesses, and examined Coast Guard inspection records. The on-scene investigation was completed on October 2, 2001. The Safety Board investigated the accident under the authority of the Independent Safety Board Act of 1997, according to the Safety Board's rules. The designated parties to the investigation were Circle Navigation of New York, the U.S. Coast Guard, and Cummins Engine Company.

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