January 29, 2025 MIR-25-05

Engine Room Fire aboard Cargo Vessel *Stride*

On January 8, 2024, about 0331 local time, a fire broke out in the engine room aboard the cargo vessel *Stride* during bunkering operations while it was docked at the Barbours Cut Marine Terminal in LaPorte, Texas (see figure 1 and figure 2).[1] Crewmembers shut down all ventilation to the engine room, and the fire self-extinguished. Shoreside firefighters and the ship's emergency teams removed three crewmembers from the engine control room who were unable to escape the fire; two died on scene, and one was seriously injured. No pollution was reported. The vessel was declared a constructive total loss, valued at $12 million.[2]

Figure 1. The *Stride* underway before the fire. (Source: Ye Chia-Wei, marinetraffic.com)

[1] In this report, all times are central daylight time, and all miles are nautical miles (1.15 statute miles).

[2] Visit ntsb.gov to find additional information in the public docket for this NTSB investigation (case no. DCA24FM015). Use the CAROL Query to search investigations.

Casualty Summary	
Casualty type	Fire/Explosion
Location	Barbours Cut Marine Terminal, Galveston Bay, LaPorte, Texas 29°40.82' N, 95°0.22' W
Date	January 8, 2024
Time	0331 central standard time (coordinated universal time –6 hrs)
Persons on board	22
Injuries	2 fatal, 1 serious
Property damage	$12 million est.
Environmental damage	None
Weather	Visibility 9 nm, overcast, winds east 10 kts, air temperature 63°F, morning twilight 0652, sunrise 0718
Waterway information	Harbor, depth about 48 ft

Figure 2. Area where the fire broke out aboard the cargo vessel *Stride*, as indicated by a circled *X*. (Background source: Google Maps)

1 Factual Information

1.1 Background

The 598-foot-long, Panama-flagged general cargo vessel *Stride* was owned by Speedcarrier (No. 3) Group and operated by Danaos Shipping Company LTD. The vessel had a single rudder and a single propeller directly driven by a slow-speed diesel engine rated at 26,740 hp. At sea, the vessel's main engine, electrical generators, and boiler burned very low sulfur fuel oil (VLSFO), also referred to as "fuel oil," which was stored in four tanks located forward of the engine room. The four tanks had a capacity of 1,721 cubic meters (m^3) (about 1,648.9 metric tons [mt]).[3] While operating in US waters, the vessel's engines and boiler burned low sulfur marine gas oil (LSMGO), also referred to as "diesel oil," which was stored in two double bottom tanks located beneath the tanktop in the forward section of the engine room.[4] The *Stride* engine room consisted of four levels: the 4th deck, 3rd deck, 2nd deck, and upper deck. Above the engine room upper deck, the accommodation decks on the vessel's superstructure were named A deck through F deck, with the bridge deck above that and the compass deck at the top. The engine control room (ECR) was located in the engine room on the 2nd deck, above the main engine (see figure 3).

[3] The vessel's fuel oil diagram provided fuel oil capacities in cubic meters. In order to calculate metric tons of fuel oil, cubic meters are multiplied by the fuel oil's specific gravity, corrected for the temperature of the fuel oil. One cubic meter of diesel oil is roughly equivalent to 0.85 metric tons or 315 US gallons, depending on the diesel oil's specific gravity. One cubic meter of fuel oil is roughly equivalent to 0.95 metric tons or between 295 and 330 US gallons, depending on the fuel oil's specific gravity.

[4] The tanks are described as double-bottom because they were located on the bottom of the ship, between the vessel's watertight outer hull and inner bottom plating, or tanktop.

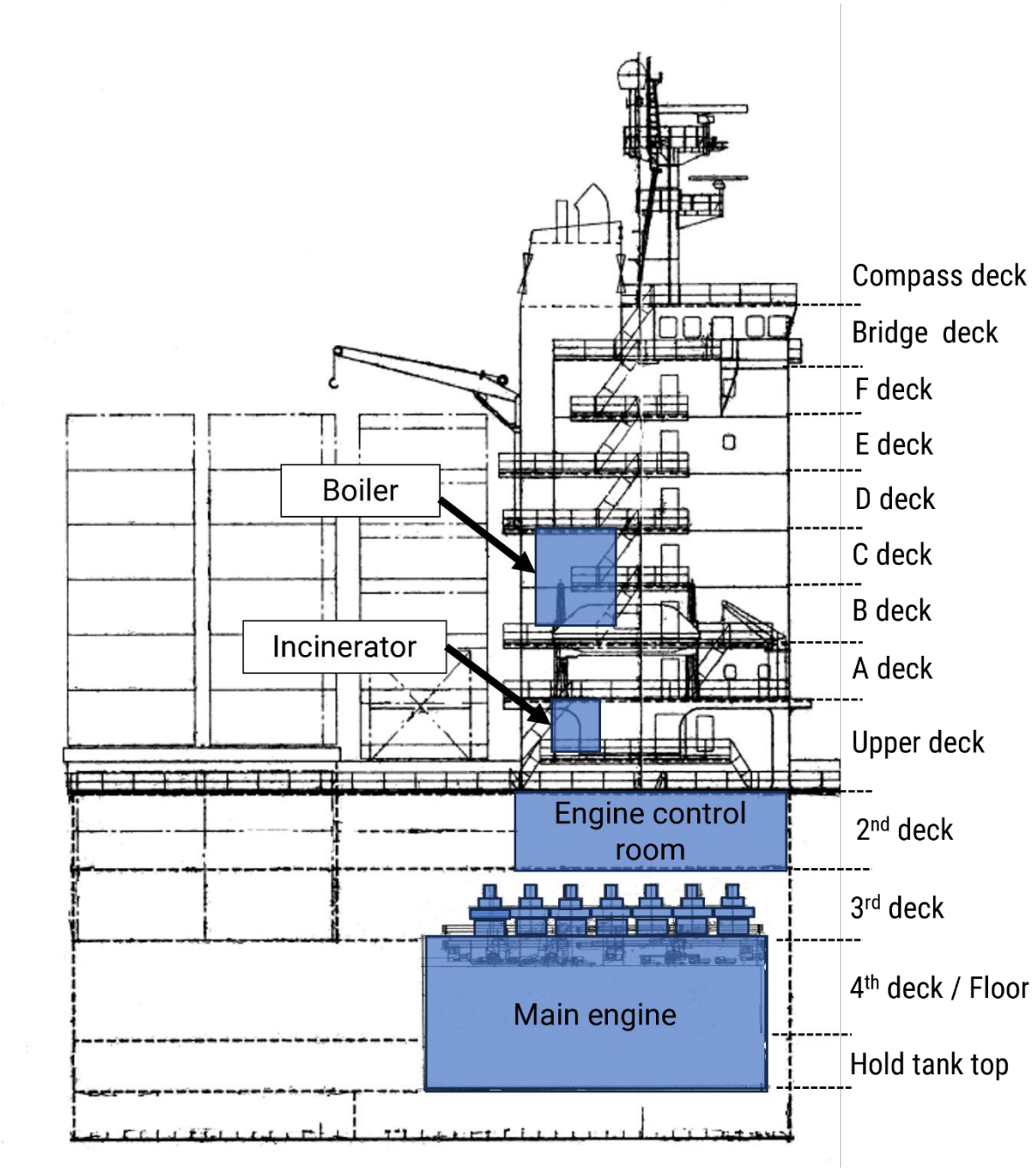

Figure 3. Side profile view of the *Stride* showing engine room and accommodation levels as well as the approximate locations of the boiler, incinerator, ECR, and main engine. (Background source: Danaos Shipping Company LTD)

1.2 Event Sequence

On January 4, 2024, about 1242, the *Stride*, with a crew of 22, departed Puerto Barrios, Guatemala, bound for Houston, Texas, with a combination of dry and refrigerated containers of various goods. While in port, the vessel was scheduled to offload 131 containers and load fuel from a bunker barge.

1.2.1 Bunkering Operations

On January 6, while underway enroute to Houston, in preparation for bunkering (fueling) operations, the chief engineer conducted pre-bunkering training with 13 crewmembers from the engine and deck departments. As part of the company's safety management system (SMS), this training was required within 48 hours before bunkering operations began, and the person in charge (chief engineer) was required to discuss topics such as environmental compliance, penalties, pre-loading plan, oil transfer procedure, communications, deck watch requirements, and emergency procedures. The training also consisted of identifying each crewmember's assigned duties as well as tools required, such as handheld radios, sounding tapes, and oil spill kits. Each crewmember signed the pre-bunkering form. The form indicated that the estimated bunker quantity to be received was 1,100 mt of VLSFO and 80 mt of LSMGO.

The *Stride* arrived at Barbours Cut Marine Terminal on January 7 at 1630 and tied up port side to the pier. At arrival, the chief engineer and second engineer completed a pre-bunkering survey report by sounding all the diesel oil and fuel oil tanks to determine the amount of oil in each tank and calculate how much space was available for additional diesel oil and fuel oil. Three of the four fuel oil tanks were nearly empty, and one tank was about 90% full. The port double bottom diesel oil (DBDO) tank had a capacity of 83.6 m^3 (about 70.8 mt) of diesel oil and had 13 m^3 (about 11 mt) remaining in the tank (about 15% full). The starboard DBDO tank had a capacity of 121.6 m^3 (about 100.6 mt) of diesel oil and had 76.9 m^3 (about 63.4 mt) remaining in the tank (about 63% full). About 1906, cargo operations began, and shoreside stevedores began offloading containers using two of the terminal's ship-to-shore cranes.

The following morning, about 0150, the towing vessel *Jacques-Imo* arrived alongside the *Stride* with the fuel barge *Shamrock 500* to deliver VLSFO and LSMGO to the *Stride*. About 0235, the 4-inch-diameter bunker hose from the *Shamrock 500* was connected to the 8-inch fill pipe at the bunker manifold of the *Stride* on the A deck, starboard side (see figure 4). The fitter from the *Stride* crew was stationed, as required by company policy, at the bunker manifold with two handheld radios: one to

communicate with the crew of the bunker barge (the captain in the wheelhouse of the *Jacques-Imo* and the tankerman on the barge), and the other radio to communicate with the *Stride*'s chief engineer.

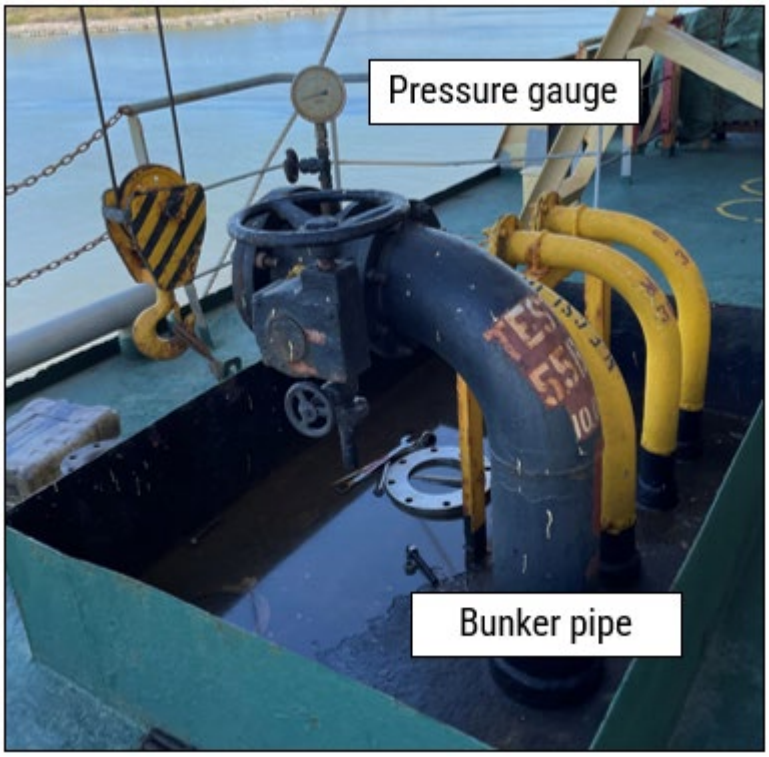

Figure 4. Bunker manifold of the *Stride* on the A deck, starboard side.

The *Stride*'s chief engineer and third engineer were in the engine room, where the fill valves for the diesel oil and fuel oil tanks were located. They opened both the port and starboard DBDO tanks to direct the 80 mt of incoming diesel oil, which would be transferred first. The vessel's fuel oil transfer diagram showed both tanks' valves were angle stop valves that, when open, would allow the fuel oil to flow in both directions: into the tanks from the bunker station, or out of the tanks into the suction side of the diesel oil transfer pump (see figure 5). The drawings also showed that these tanks were equipped with a tank vent, local level gauge, and a remote indicator for tank level and a high-level alarm.

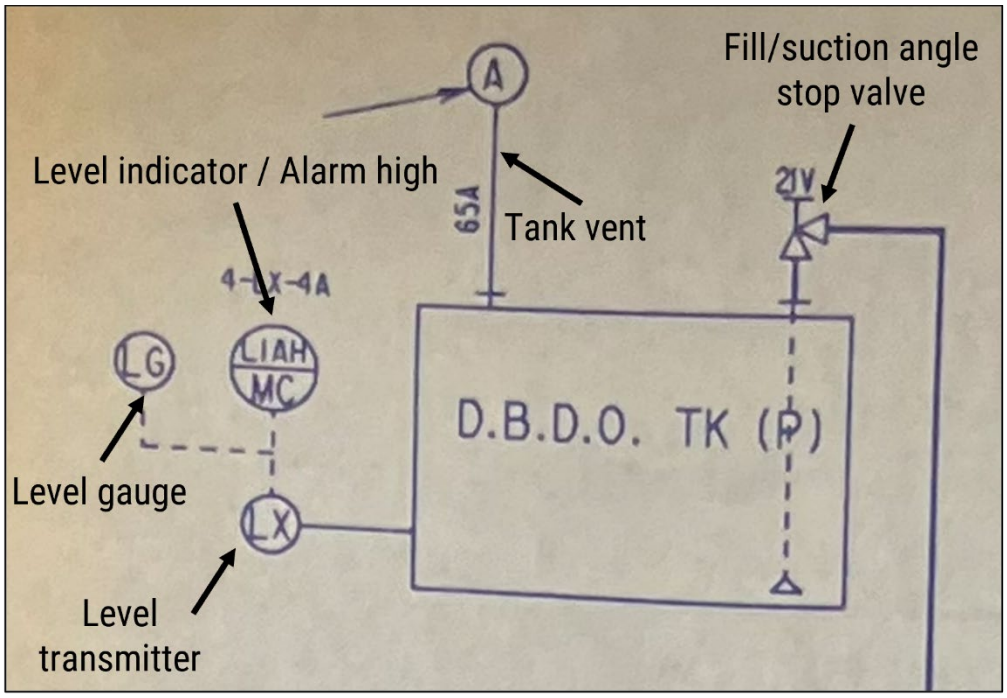

Figure 5. Vessel fuel oil diagram showing port DBDO tank, fill/suction angle stop valve, vent, and level instrumentation. (Background source: Danaos Shipping Company LTD)

About 0305, after all preparations were made and the declaration of inspection (DOI) form was completed, bunker operations began.[5] The maximum transfer rate stated on the DOI was 100 mt per hour. The tankerman aboard the barge started the diesel engine coupled to the fuel transfer pump at a slow speed and began transferring the diesel oil from the barge into the *Stride*'s bunker manifold, at an estimated 30–50 mt per hour.

About 0307, the *Stride* chief engineer requested an increase in pump rate. The tankerman sped up the engine to 1,200 rpm, which was a typical speed for transfers. About 0309, the *Stride* chief engineer requested another increase in pump rate. The tankerman slowly increased the engine speed to 1,400 rpm and noticed the discharge pressure of the pump was 90 pounds per square inch (psi) (the maximum allowable pipeline pressure on the fuel barge was 100 psi). The chief engineer requested another increase, but the tankerman said that he was at his maximum rate and wouldn't increase the engine speed anymore.

[5] A *DOI* is a document that must be signed by both parties involved in a fuel transfer operation before bunkering begins, confirming that all necessary safety checks have been completed and the vessels are ready to proceed with the transfer of fuel; it usually includes details about the fuel type, quantity, and inspection findings.

The *Stride*'s fitter was assigned to monitor the pressure gauge on the vessel's bunker manifold during the transfer, in accordance with company procedure. He stated that for about 20 minutes, everything was normal, and the pressure remained at zero, which was expected when the diesel oil was being pumped from a small hose from the barge into a larger pipe on the ship and being directed several decks below into double bottom tanks at the bottom of the engine room.

About 0325, the wiper, who was cleaning the main engine cylinders on the 3rd deck of the engine room, observed diesel oil dripping down from the upper levels of the engine room. He ran into the ECR on the 2nd deck to advise the chief engineer and third engineer. The three engine crewmembers left the ECR together to investigate the diesel oil in the engine room. The wiper heard the chief engineer yelling to the third engineer and into the handheld radio.

About 0328, the captain on the *Jacques-Imo* and the tankerman on the barge heard "excited chatter" on their handheld radios. The tankerman stated that it sounded like "kind of screaming over the radio" as he was sounding a tank about 10 feet from the pump on the deck of the barge. The tankerman could not understand the radio communication and asked the caller to repeat. The captain on the towing vessel, who also heard the chatter, told the tankerman to shut the pump down. The tankerman ran to the pump engine, "knocked it out of gear and closed my discharge real quick." The fitter stated that he observed the vessel's bunker manifold pressure gauge at 2 bar (about 29 psi) about this time.

1.2.2 The Fire

Soon after re-entering the engine room, the wiper observed what he described as an explosion and then a fire near the area where he had been working on the 3rd deck of the engine room. The three engine crewmembers ran into the ECR.

About this same time, two deck crewmembers in the ship's office on the upper deck of the *Stride* heard the chief engineer's request over the handheld radio to stop bunkering and a "boom" from the engine room, then they saw smoke coming from the bottom of the engine room door across the passageway from the office. (The incinerator was located on this deck inside the engine room funnel casing near this door.) The captain, who was in his office, smelled smoke and reported to the bridge.

At 0331, the fire alarm system sounded on the bridge. The captain pressed all the emergency stops for operating machinery (ventilation fans, boiler, and oil pumps) and sounded the emergency signal for the crew to muster to account for all crewmembers. He directed crewmembers over the handheld radio to prepare fire hoses and close the engine room and accommodation space ventilation dampers,

and he also directed the chief mate to get emergency escape breathing devices (EEBDs). He provided additional instructions to the crew using both English and Russian.

Crewmembers mustering on the upper deck reported seeing smoke from the engine room ventilation ducts and saw flames about 2 meters (6–7 feet) high coming from the open engine room hatch (also referred to as the "skylight hatch"). The chief engineer notified the captain via handheld radio that he and the third engineer were on the 4th deck of the engine room.

About 0334, the captain hailed the US Coast Guard on VHF radio channel 16 and reported a fire in the engine room. Crewmembers closed the engine room skylight hatch cover and manually closed the ventilation dampers for the accommodation spaces and engine room supply and exhaust fans. The crew prepared fire hoses, the captain started the emergency fire pump, and crewmembers began boundary cooling on the exterior engine room bulkheads.

About 0336, the chief engineer reported to the captain via handheld radio that three crewmembers were in the engine room: the third engineer, wiper, and himself. Emergency teams suited up in firefighting gear to search for the crewmembers and assess the situation in the engine room.

The chief engineer shut down all electrical power from the ECR, blacking out the vessel. Upon loss of power, the ECR became dark. All three engine crewmembers were coughing due to the smoke. The vessel's emergency diesel generator automatically started, providing electrical power to vital equipment and lighting circuits. The three engine crewmembers attempted to leave the ECR with their faces covered with shirts soaked in water, but upon opening the ECR door into the engine room, they were met with flames and smoke, so they retreated back into the ECR.

About 0338, the vessel's fire team, donned in firefighting gear and using self-contained breathing apparatus, attempted to enter the engine room via the emergency escape hatch, but, due to the smoke, they were unsuccessful. At 0340, the captain called the operating company's designated person ashore and advised him of the emergency.[6] About 0341, the captain reported to the Coast Guard that he "had a fire in way of the incinerator and still have three persons down in the engine room," and he also advised that a bunker barge was alongside and the crew was "investigating the reason for the fire and evacuating people from the engine room."

[6] A *designated person ashore* is a person or persons ashore—with direct access to senior management—that implements and monitors the requirements of the SMS.

About 0345, the vessel's fire team made another attempt to enter the engine room, first through the entrance on the upper deck near the incinerator, and then through the emergency escape hatch; again, the team could not enter the space due to being "affected by the fire heavily." About 0350, a member of the vessel's fire team entered the engine room via the emergency escape hatch but was unable to locate the three crewmembers before retreating. The captain requested that a crewmember bring a pipe and sledgehammer to assist other crewmembers attempting to close a fire damper on the funnel.

After receiving the captain's call, Coast Guard Sector Houston-Galveston Command Center contacted the Port of Houston Fire Department about the fire on the *Stride*. The Port of Houston Fire Department dispatched firefighters and requested backup from nearby fire departments. Firefighters from multiple departments arrived on scene between 0343 and 0408. A fireboat arrived and sprayed the bunker barge with water as a precaution. A shoreside fireteam leader met with the captain and suggested releasing carbon dioxide (CO_2) into the engine room, but the captain advised that crewmembers were still in the engine room, and he would not activate the system until they were accounted for.

About 0415, the vessel's fire team entered the engine room and located the three crewmembers in the ECR. They did not encounter any fire or flames; at some unknown time before they entered the engine room, the fire had self-extinguished. A few minutes later, a crewmember from the vessel's firefighting team escorted local firefighters into the engine room and down to the ECR from the upper deck entrance. The local firefighters reported that visibility was limited to a couple feet in front of them. According to one of the local firefighters, "smoke conditions were present (black in color), heat was minimal, but I could still feel warmth on the railing through my gloves as we descended."

The firefighters found the door into the ECR open; the three crewmembers were lying in front of the ECR console. The firefighters assessed the crewmembers' conditions and determined that only the wiper was breathing. The firefighters evacuated the wiper from the engine room through the door on the upper deck. The vessel's fire teams evacuated the other two crewmembers through the engine room skylight hatch. By 0450, the three crewmembers had been removed from the engine room, and, about 0517, the wiper was transported via helicopter to a local hospital. Local paramedics pronounced the chief engineer and third engineer dead on scene.

None of the fire teams that entered the engine room reported seeing flames from a fire; they only saw smoke. No water was applied within the engine room during the incident; water was applied only to the exterior bulkheads for boundary

cooling, using the emergency fire pump, which was powered by the emergency generator.

1.2.3 After the Fire

About 0710, the towboat and bunker barge cast off from the *Stride*, and, about 0800, the captain ordered all crewmembers to depart the vessel and muster on the pier.

About 0740, Coast Guard personnel boarded the *Stride*, met with the local fire department and the captain, and requested that the CO_2 fixed gas fire extinguishing system be discharged into engine room, with the engine room to remain sealed for 24 hours to ensure the fire was extinguished. The emergency generator was shut down, and the captain attempted to activate the CO_2 system remotely, but the system did not discharge. According to the captain, the system had been successfully tested about a year before the fire. The captain manually opened each of the CO_2 bottles into the engine room, and the system was fully released about 0916.

On January 12, a fire protection service company inspected the CO_2 system and reported that 55 bar (798 psi) of CO_2 was "trapped in manifold." The company also found a leaking main valve flange, a pneumatic bleed valve that needed replacement, and that the air test line was not operating. Additionally, technicians reported bulging and bubbling of all flexible discharge hoses connecting the CO_2 cylinders to the discharge manifold. The report stated that "automatic pilot operation failed to work from local/remote station pilot stations. Need to prove pilot operation and time delay function." There were no follow up reports received to identify the issue with the failed release.

1.3 Additional Information

1.3.1 Damage

Damage from fire, heat, and soot was present throughout all levels of the engine room, especially within the funnel casing and the area in the engine room directly below the funnel casing down to the lowest level (see figure 6). Outside these areas, several combustible items, such as cardboard boxes and wooden crates, were not damaged by the heat of the fire. There were several electrical cabinets on the starboard side of the 4th deck that were damaged and could not be identified.

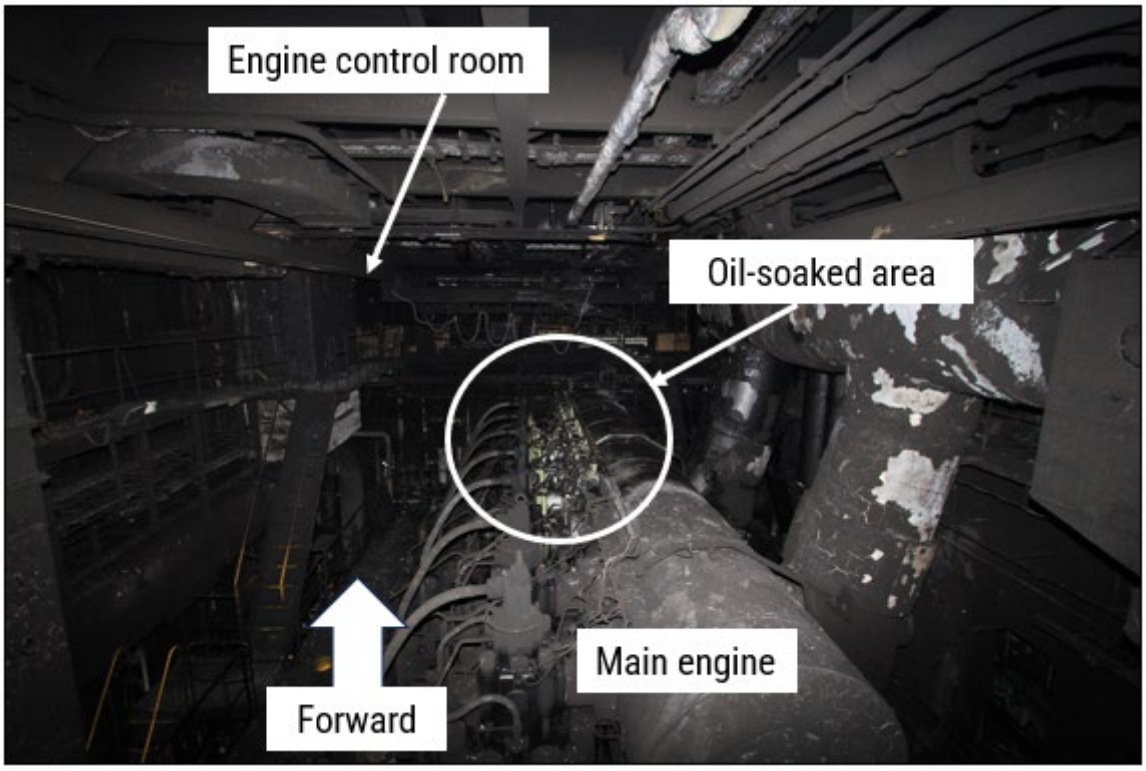

Figure 6. View of the *Stride* engine room 3rd deck looking forward, after the fire, showing the main engine and surrounding areas covered in soot and an oil-soaked section of the main engine.

On the 4th deck, an NTSB fire and explosion specialist observed an area exhibiting evidence of a high temperature exposure on the starboard side of the main engine. A lube oil filtration system was centered within this area. This area exhibited steep gradients of thermal damage over short distances and sharp demarcation between charred and undamaged surfaces. Charred and flaking paint was observed on ducting and structural elements. This area also exhibited the most concentrated and severe thermal damage on the 4th deck.

Several light signal columns throughout the engine room were damaged, and multiple electrical panels had melted plastic components, such as push buttons, indicator lights, and control boxes (see figure 7).

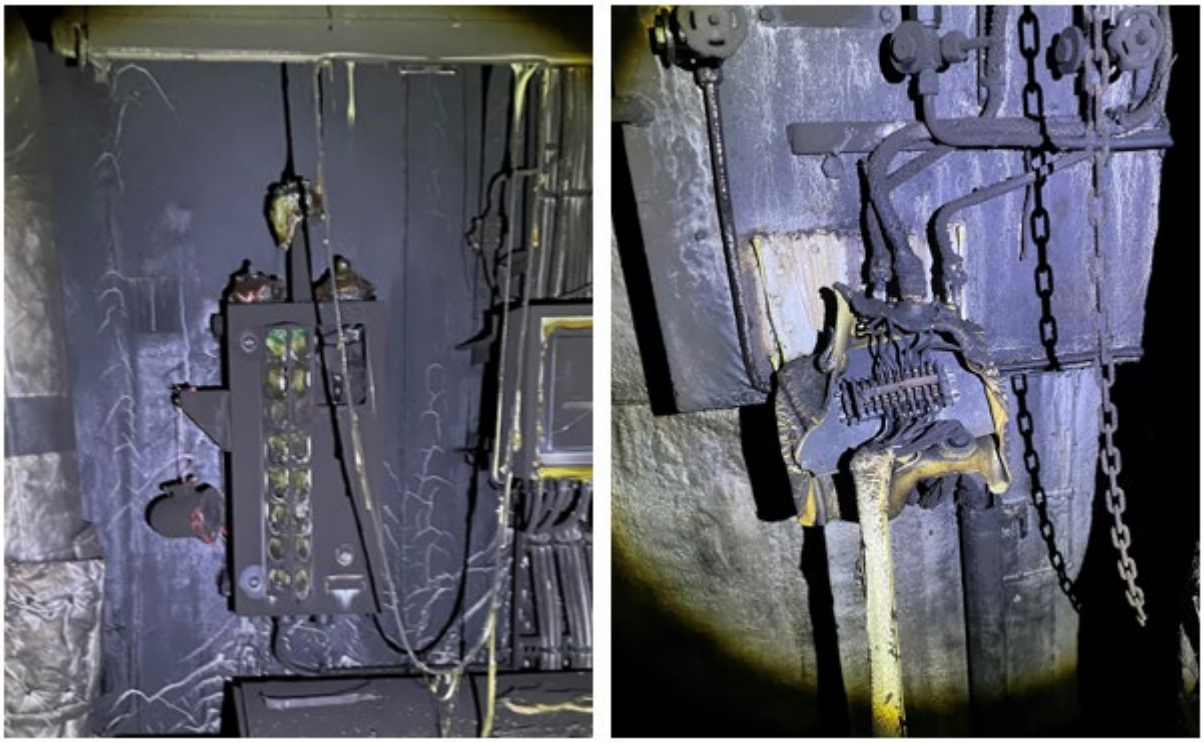

Figure 7. *Left to right*: Damaged light signal column in funnel casing and melted electrical component on boiler on D deck.

A surveyor from the vessel's classification society reported that the vessel was "not fit for voyage" due to damaged lighting fixtures; junction boxes; insulation stringers; and smoke, flame, and heat detectors throughout all decks of the engine room. Additionally, all mountings on the boiler and several components of the incinerator were found to be damaged by the fire. Other systems, such as the main engine, electrical panels, motors, compressors, gantry crane, and other pieces of equipment, were identified as damaged and required repair or replacement.

Unburned diesel oil was observed on all decks from the top of the D deck down to the 4th deck in the lower engine room below the funnel casing (see figure 8). Diesel oil was found visibly dripping from oil-soaked components in the funnel casing below the upper part of D deck, coating all bulkheads within the funnel casing, and pooling on machinery below the funnel casing. There was no diesel oil observed in the funnel casing above the D deck.

After the fire, the vessel was declared a constructive total loss, and the operating company scrapped the vessel.

Figure 8. *Left*: Diesel oil puddled alongside base of main engine on tanktop. *Upper right*: Diesel oil puddled in main engine air intake manifold. *Bottom right*: Diesel oil puddled in deck containment by boiler on D deck.

1.3.2 Personnel

The chief engineer who was aboard the *Stride* at the time of the fire had 38 years of experience in the maritime industry and had worked with the company as a chief engineer on six other company vessels since 2016. This was his first trip aboard the *Stride*, and he joined the vessel about 7 weeks before the fire.

The third engineer joined the company in 2004 as a wiper, and he had completed 26 contracts aboard various company vessels as a motorman, fourth engineer, and third engineer. This also was his first trip aboard the *Stride*; he joined the vessel about 3 weeks before the fire.

The wiper had about 4 years of experience in the maritime industry and had about 16 months of sea service, all on company vessels. This also was his first trip aboard the *Stride*; he joined the vessel about 5 weeks before the fire.

Each crewmember received vessel familiarization and safety training, including lifesaving and firefighting equipment, EEBDs, emergency procedures, SMS overview, and environmental plans. The safety officer conducted these training sessions. The engineering crewmembers also received specific engineering equipment familiarization, which consisted of the operation and maintenance of several engineering systems throughout the vessel. Scenario-based fire drills were held about once a month and included an evaluation of the crew's response, familiarity with safety equipment, and performance.

1.3.3 Company Bunkering Procedures

The company provided procedures for bunkering within its SMS. The Fleet Instruction Manual designated the chief engineer as the person in charge for bunkering operations and stated that the chief engineer was required to conduct a pre-bunkering training session before operations began. During bunkering, a crewmember was required to remain at the bunker manifold. Other crewmembers were required to report regular soundings to the person in charge so they could determine a load rate "irrespective of the good operation of the auto level indicators in the engine room" and report when the oil reached 80% of tank capacity. No tanks were to be more than 90% full. A continuous sample of fuel was required to be taken throughout the bunker delivery period. A minimum of two engineering officers, two engine ratings (engine crewmembers), one deck officer, and one able-bodied seafarer were required to be on duty during bunkering. A checklist was to be used as guidance for key personnel during fuel transfers.

During the bunkering operations on January 8, the chief engineer and third engineer were in the engine room conducting bunkering operations, and the fitter was at the bunker manifold on the A deck.

1.3.4 Postcasualty Investigation

After the fire, investigators and company representatives sounded the two DBDO tanks that were intended to be filled on the morning of the bunkering operation. The port DBDO tank had not received any additional diesel oil. The starboard DBDO tank was completely full and overflowing from the sounding tube on the 4th deck of the engine room. Investigators found both port and starboard DBDO valves in the open position.

Initial soundings on the barge before the discharge began showed there were 624.3 mt of LSMGO in the tanks on the barge. After discharging the LSMGO to the *Stride*, soundings were taken again, and 572.3 mt remained aboard, indicating that

52 mt had been discharged from the bunker barge to the *Stride* during the roughly 25 minutes of bunkering.

Investigators obtained the ECR alarm log from the engine room monitoring system printer. There were no alarms recorded on the alarm history printout associated with detected high levels of any diesel or fuel tanks before the fire. Investigators were unable to retrieve data such as trend history, alarm limits, alarm delays, or inhibited alarm status, from the ECR monitoring system computers due to the lack of power to the systems. The computers were removed from the vessel, but Coast Guard Document and Exploitation teams had not successfully accessed the data as of the date of this report.

The vessel's emergency escape trunk was located on the port side of the 4th deck in the engine room, one deck below the ECR. There was an EEBD at the entrance to the trunk. After the fire, the EEBD was found unused and still in its case. Another EEBD was located in the ECR, and it was also found unused with its case unopened. There was not an emergency escape hatch from the ECR, nor was one required.[7]

1.3.5 Fuel Tank Vent Piping Arrangement

Multiple fuel tanks in the engine room, such as the fuel oil settlers, diesel oil day tank, overflow tank, sludge tank, incinerator settling tank, and the port and starboard DBDO tanks, were equipped with vent pipes at the top of each tank. These vent pipes were connected into a common 12-inch steel pipe that ran from the 4th deck in the engine room up through the engine room and the funnel casing alongside the exhaust stacks for the main engine, auxiliary generators, boiler, and incinerator, and led to a gooseneck to open atmosphere on the compass deck above the wheelhouse (see figure 9). The approximate height of the gooseneck on the compass deck was about 125 feet above the DBDO tanks.

After the fire, in the overhead of the D deck above the boiler, investigators observed a 7-inch-wide-by-11-inch-long "inspection port" that had been cut out of the upper section of the fuel vent pipe on a horizontal run in the fuel vent piping (see figure 10). The section of pipe that had been cut out at some unknown time was found on the deck below the pipe after the fire, leaving the upper section of pipe open to the funnel casing in the upper engine room. This cut out was about 98 feet

[7] The *Stride* was built in 1997, when *International Convention for the Safety of Life at Sea* (*SOLAS*) regulations required one emergency exit from the machinery space. In 2020, *SOLAS* required an emergency exit from the ECR.

above the tank top level of the vessel. The company's technical director stated that the company was not aware that a section had been cut out of the tank vent piping.

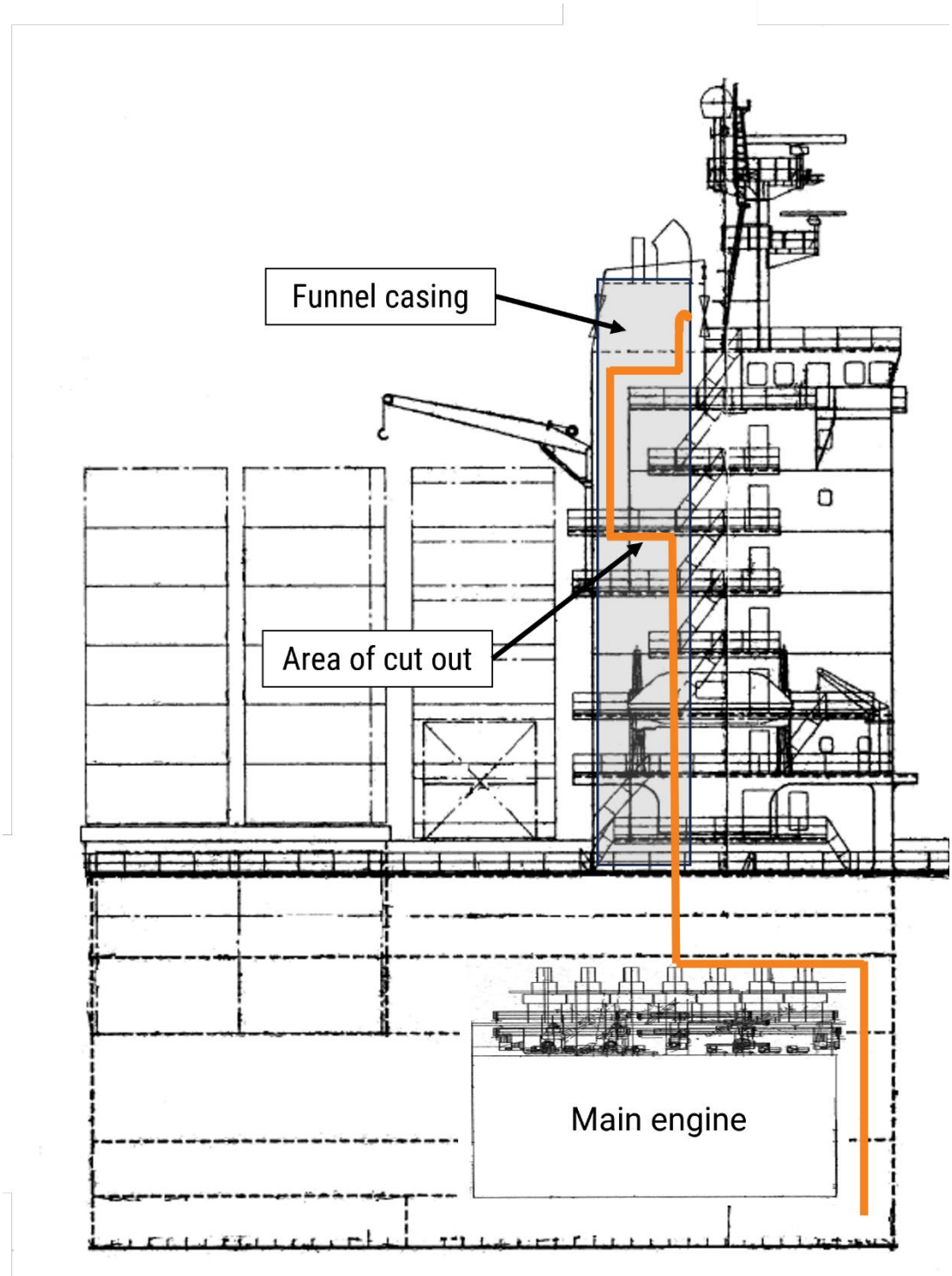

Figure 9. Side profile view of the engine room and funnel casing area with the combined fuel tanks vent pipe, annotated in orange, up to compass deck. (Background source: Danaos Shipping Company LTD)

Figure 10. *Left to right*: Circled area identifying the open section of fuel vent piping and cut out placed back in position after the fire.

Investigators looked into the opening in the vent pipe and found diesel oil in the horizontal section of piping, which was eight decks above the diesel oil tanks that were being filled (see figure 11). Remnants of tape and a flexible adhesive were observed in the area where the cuts had been made. The removed section of pipe had a bolt threaded into a nut that had been welded onto the removed piece as well as tabs on two sides creating a flange so the piece could be held in position when placed onto the vent pipe. There were no records of this alteration, approvals, or inspections to the vent pipe. Below this cut out, diesel oil was observed on the boiler on the C deck, the incinerator on the upper deck, and all decks, equipment, and surfaces below the funnel casing on the starboard side of the engine room, down to the tank top and base of the main engine. No diesel oil was observed above the cut out on the D deck.

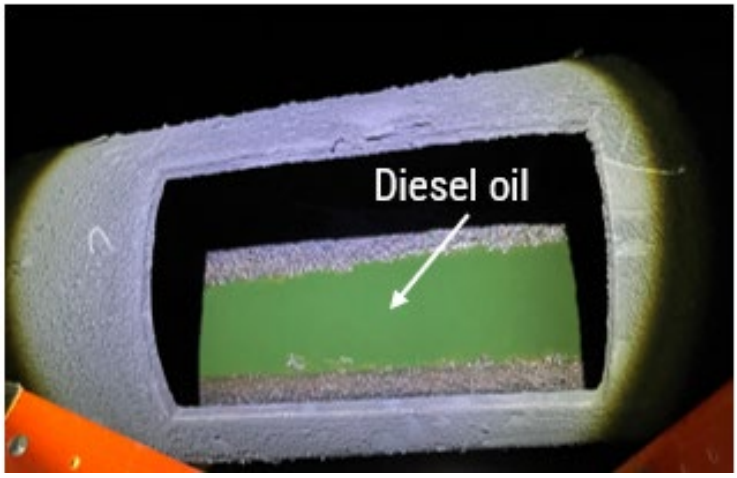

Figure 11. Diesel oil observed in vent piping, seen from above, through cut out section on D deck.

The NTSB and Coast Guard requested that the classification society expand their inspections of the company's seven similarly built vessels and examine the vent pipes for any unauthorized cut outs. The classification society reported that on three of the vessels (*Bridge*, *Highway*, and *Advance*), surveyors observed a cut out on the vent pipes and confirmed that the "restoration was completed by the shipowner during the KR [classification society] attendance verification." The other four vessels (*Future*, *Phoenix D*, *Progress C*, and *Sprinter*) were examined by a surveyor from the classification society, and no cut outs were observed.

1.3.6 Port Double Bottom Diesel Oil Tank Valve Replacement

On November 11, 2023, the chief engineer who was aboard the *Stride* (different from the chief engineer on board during the fire) ordered a replacement valve—a "screw down check angle valve, cast iron, JIS F-7354"—for the port DBDO tank using the company's computerized ordering system. This chief engineer had 23 years of experience in the maritime industry, had worked for the company for over 11 years, and had been aboard the *Stride* for about 4 months. The chief engineer was listed in the computer system as the requisition user and also as the approver. The requisition did not specify that this valve was to be used in the fuel oil system, nor did it show any fields for shoreside company approval on the requisition form, but a company representative reported that the superintendent engineer approved the purchase of the valve.

The company considered this valve as a "store" and not a spare part or equipment. The written supply procedure stated:

> the requisition lists are directed to the supply department who reviews, checks for the adequacy to specified requirements and enters the requisition in the supply software program. The requisition form shall clearly describe the specification/type of the product to be purchased, indicating, where applicable, the International Ship Suppliers Association catalogue reference number, a description or other precise identification, quantities on board and quantities required.

On November 19, the chief engineer who ordered the valve departed the vessel and was relieved by the chief engineer who was aboard the vessel at the time of the fire. On November 23, the valve was delivered to the vessel; the receipt described it as a "screw down check angle valve, cast iron, JIS F-7354, 100 mm" (the same type and size that had been ordered). The following day, crewmembers installed the new valve, replacing the previous valve on the port DBDO tank. The valve replacement was recorded in a "weekly engine jobs" document for the week of

November 20–26, including pictures of the original valve, open flanges with the valve removed, and the newly installed valve. There were no details explaining the reason for the replacement, other than "the previous valve required replacement."

Due to the configuration of the new valve (an angle stop check valve), once installed, diesel oil would only be able to flow out from the DBDO tank; even when the valve was in the fully opened position, diesel oil would be prevented from flowing into the tank due to the check function of the valve. (A stop check valve is a modified version of a stop valve, which has a sealing disc attached to the valve stem. In a stop check valve, the disc floats on the valve stem and allows fluid to flow in one direction only.) The previous stop valve that had been removed from the port DBDO tank was not a stop check valve; it had allowed diesel oil to flow in both directions when open.

The vessel bunkered on December 18, 2023, adding 80.7 mt of diesel oil to the starboard DBDO tank but none to the port DBDO tank. The vessel did not bunker diesel oil into the port DBDO tank between the time of the port DBDO tank valve replacement and the date of the fire.

1.3.7 Postcasualty Actions by the Operating Company

In June 2024, the operating company updated the pre-bunkering training procedure to "ensure that crew is familiar with the piping related to the bunkering (filling line, transfer line, vent line, and respective valves) and confirm the lines [*sic*] integrity and water tightness."

2 Analysis

On January 8, 2024, about 0330, while the cargo vessel *Stride* was docked in LaPorte, Texas, and conducting bunkering operations, a fire broke out in the engine room. The fire self-extinguished after crewmembers shut down all ventilation to the engine room from outside air by closing supply and exhaust ventilation dampers. Two crewmembers died as a result of the fire; one crewmember was seriously injured.

The fire broke out in the engine room of the *Stride* about 25 minutes after the crew of the bunker barge began pumping diesel oil from the barge to the *Stride*. The chief engineer aboard the *Stride* had ordered 80 mt of diesel oil, which was to be loaded into the port and starboard DBDO tanks. According to the bunkering survey report completed before bunkering operations began, the port DBDO tank had room for about 60 mt of diesel oil, and the starboard DBDO tank had room for about 37.2. mt until they were completely full. Using both DBDO tanks, there was room for about 97.2 mt of diesel oil. Therefore, there was sufficient capacity in the *Stride*'s port and starboard DBDO tanks to receive the 80 mt of diesel oil that had been ordered.

Six weeks before the fire, a replacement valve was ordered for the port DBDO tank. The vessel's fuel oil system drawing clearly showed an angle stop valve for the port DBDO tank. This valve would have allowed fuel to flow through it in both directions when open. However, after the fire, investigators discovered that although the replacement valve that was ordered and installed looked similar from the outside and was of the correct dimensions, it was not the same type of valve specified by the vessel's fuel oil system drawing; instead, an angle stop check valve, which allows flow in only one direction, even when open, was ordered. Therefore, even when the crew fully opened the valve, as installed in the *Stride*'s fuel oil system, the check valve feature would only allow flow out of the tank. The vessel had not bunkered diesel oil into the port DBDO tank since the valve replacement, and therefore the crew had no prior indication that the wrong valve type was ordered and installed.

Unaware that diesel oil would not be able to flow into the port DBDO tank, engineering crewmembers on the *Stride* had opened the fill valves for both the port and starboard DBDO tanks to receive the diesel oil. However, none of the estimated 52 mt of diesel oil that was transferred from the barge went into the port DBDO tank; instead, it went solely into the starboard DBDO tank, which only had capacity for about 37.2 mt until it was completely full. Additionally, all the diesel oil pumped from the barge was received into the starboard DBDO tank at a faster rate than expected, since only one tank was being filled.

The company's bunkering procedures required a minimum of two engineering officers and two engine ratings to be on duty during bunkering operations. However, at the time of the fire, only three engineering crewmembers (two engineering officers and one engine rating) were involved with bunkering operations. The fitter was positioned at the bunkering station on the A deck, and the chief engineer and third engineer were the only other engineering crewmembers conducting the bunkering operation in the engine control room when the wiper reported seeing diesel oil in the engine room.

Prudent marine practice while starting a bunkering operation would be to fill slowly at first, and then establish a fill rate by locally sounding each tank at frequent intervals and comparing those readings to any automated level indicators to verify proper operation. Once a safe bunkering rate has been established, then the person in charge could request an increase in the transfer speed to a safe rate. On the *Stride*, based on vessel drawings, a tank high-level alarm likely would have been available and sounded in the ECR. Two engineering officers were in the ECR and may have been monitoring tank levels on the ECR computer monitor. If the starboard DBDO tank high-level alarm sounded, it should have been recorded. However, there was no record of an alarm. The company SMS bunkering procedures required local sounding of tanks during bunkering operation; however, when the diesel oil tank overflowed, no crewmembers were using sounding tapes or observing the local tank gauges near the sounding tubes in the engine room to check the levels of the two tanks being filled. As a result, the engine crewmembers did not notice the incoming diesel oil was not flowing into the port DBDO tank. Within 2 minutes of the start of bunkering, the chief engineer quickly requested two increases in pumping rates, without establishing a filling rate into both tanks, resulting in the starboard DBDO tank quickly filling to its maximum capacity within about 25 minutes.

After the starboard DBDO tank became full, the incoming fuel was forced up the tank's vent piping as the barge continued to pump diesel oil to the *Stride*. Investigators estimated that about 14.8 mt of diesel oil was pushed into the vent piping. The vent piping had several engine room fuel tanks' vents connected into a common 12-inch pipe that ran upward within the funnel casing directly above the lower engine room and was designed to vent to open atmosphere through a gooseneck on the compass deck above the bridge.

At some unknown time in the vessel's 26-year history, a 7-inch-by-11-inch section of pipe had been cut into the top of a horizontal section of the 12-inch vent pipe on the D deck (see figure 9 and figure 10). The vent pipe ran from the lower engine room up to the compass deck. There were no records of this alteration and no records of approvals, nor were there any records of inspections of this unauthorized

alteration. The cut out section of pipe had been replaced with a flexible sealant and then wrapped in tape.

Once the diesel oil reached the area of the vent piping with the cut out affixed with a flexible sealant and tape, the diesel oil pressure in the pipe exceeded the flexible sealant's capacity and ejected the cut out section of vent pipe onto the deck below. Diesel oil then poured out of the opening in the vent pipe and cascaded down through the funnel casing, onto the incinerator, the running boiler, the main engine, various lighting fixtures, operating equipment, and machinery. The diesel oil ignited, resulting in a fire in the engine room. Had the cut out not been present, the diesel oil would have likely exited the vent pipe on the compass deck and spilled onto the exterior of the vessel and into the water, rather than directly into the engine room, which contained operating machinery and other ignition sources.

Fire investigators stated that the hottest area of fire damage was on the lower level, starboard side of the engine room near the lube oil filtration system. Due to the extensive area that was exposed to the overflowing fuel, it was not possible to definitively identify the initial ignition source.

3 Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on board the cargo vessel *Stride* was diesel oil cascading onto operating machinery in the engine room during bunkering due to an incorrect valve type installed into a diesel oil tank fill line, which prevented diesel oil from filling the tank and directed it up the common vent line, where it flowed from a cut out section of the vent pipe down into the engine room. Contributing to the overfilling of the bunkering line was engine crewmembers not monitoring the levels of the tanks being filled aboard the vessel, as required by the bunkering procedure in the operating company's safety management system.

3.2 Lessons Learned

Consulting Vessel Drawings when Ordering Replacement Components

Vessel drawings contain piping symbols for equipment such as valve types, sizes, and functions. Owners, operators, and crews should carefully note all components of a vessel's drawings and diagrams to ensure that proper spare or replacement parts are ordered to maintain functionality.

Ensuring Adequate Personnel for Bunkering Operations

During bunkering operations, vessel owners, operators, and crews should ensure adequate personnel are available to take frequent soundings, establish fuel tank filling rates, and communicate to the person in charge, so tanks are monitored and do not overflow.

Vessel Particulars

Vessel	*Stride*
Type	Cargo, General (Containership)
Owner/Operator	Speedcarrier (No. 3) Corp. / Danaos Shipping Company LTD (Commercial)
Flag	Panama
Port of registry	Panama City, Panama
Year built	1997
Official number	N/A
IMO number	9149835
Classification society	Korean Register
Length (overall)	597.5 ft (182.0 m)
Breadth (max.)	99.1 ft (30.2 m)
Draft (casualty)	19.8 ft (6.0 m)
Tonnage	21,611 GT ITC
Engine power; manufacturer	1 x 26,740 hp (19,940 kW) Man B&W 7S70MCMK6 diesel engine

NTSB investigators worked closely with our counterparts from **Coast Guard Sector Houston-Galveston** throughout this investigation.