



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

October 25, 2023

MIR-23-23

## Fire aboard Tank Vessel *S-Trust*

On November 13, 2022, about 1530 local time, a fire started on the bridge of the oil tanker *S-Trust* while the vessel was docked at the Genesis Port Allen Terminal in Baton Rouge, Louisiana.<sup>1</sup> Fire teams from the vessel's crew extinguished the fire about 1550. There were no injuries, and no pollution was reported. The damage to the vessel was estimated at \$3 million.



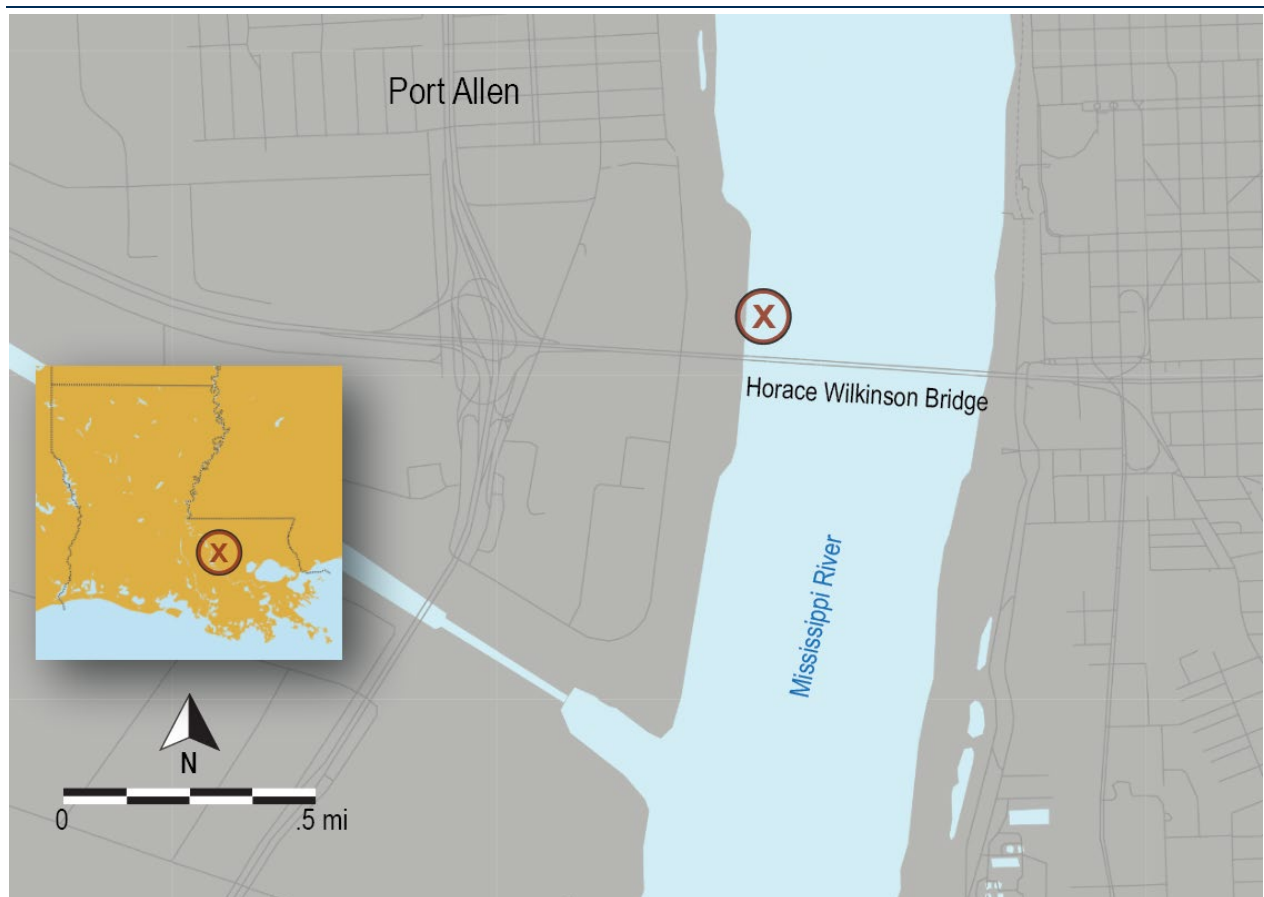
**Figure 1.** *S-Trust* at anchor following the casualty. (Source: US Coast Guard)

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<sup>1</sup> (a) In this report, all times are central standard time, and all miles are statute miles. (b) Visit [nts.gov](https://www.nts.gov) to find additional information in the [public docket](#) for this NTSB investigation (case no. DCA23FM005). Use the [CAROL Query](#) to search investigations.

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<b>Casualty type</b>	Fire/Explosion
<b>Location</b>	Lower Mississippi River, mile 229, Genesis Port Allen Terminal Dock No. 2, Baton Rouge, Louisiana 30°26.47' N, 91°11.99' W
<b>Date</b>	November 13, 2022
<b>Time</b>	1527 central standard time (coordinated universal time -6 hrs)
<b>Persons on board</b>	23
<b>Injuries</b>	None
<b>Property damage</b>	\$3 million est.
<b>Environmental damage</b>	None
<b>Weather</b>	Visibility 10 mi, clear, winds south 7 mph, air temperature 57°F, water temperature 64°F
<b>Waterway information</b>	River, width 3,050 ft



**Figure 2.** Location of the *S-Trust* at the time of the fire, as indicated by a red X. (Background source: Google Maps)

# 1. Factual Information

## 1.1 Background

The *S-Trust* was a Liberian-flagged, 800-foot-long, steel-hulled liquid bulk cargo vessel (oil tanker) owned by New Trend Ltd and operated by Stalwart Management Ltd. The vessel was built in 2005 and had a cargo capacity of 741,732 barrels. The vessel's superstructure contained living quarters, the galley, a ship's office, the cargo control room, and the bridge; it consisted of five decks: the main deck, A deck, B deck, C deck, and the bridge deck.

## 1.2 Event Sequence

On November 11, 2022, at 1142, the *S-Trust* docked port side to the pier at the Genesis Port Allen Terminal Dock No. 2 in Baton Rouge, Louisiana, with 464,926 barrels of high-sulfur fuel oil to offload. Cargo offloading started shortly after the vessel was docked, with personnel managing and controlling the transfer from the cargo control room.

On November 13, the master of the vessel was working at the desk in his office, one deck below the bridge. He had a video monitor next to his desk that showed closed-circuit camera feeds from throughout the vessel, including one from the vessel's bridge. About 1530, the master noted that the camera feed for the bridge was no longer visible, so he went up to the bridge to investigate. When he opened the door to the bridge, smoke came out and activated the smoke detector at the top of the stairwell just outside the door. The master quickly closed the door, went down to the cargo control room, and told the chief mate to stop all cargo operations. After doing so, the chief mate notified the terminal of the fire on the vessel; terminal personnel then contacted the West Baton Rouge Fire Department.

The master returned to the bridge deck to fight the fire; on the way, he used a radio to notify the other crewmembers of the fire. After arriving on the starboard bridgeway, the master opened the starboard-side door to the bridge to evaluate the situation. He stated that the fire was coming from the communications table. He then proceeded to the port bridgeway and opened the portside door to the bridge, but the smoke was too thick to see into the bridge. He returned to the starboard bridgeway. The master directed the crew to muster into two fire teams—one on the portside bridgeway and the other on the starboard-side bridgeway.

Once the master received notification that all of the electrical power to the bridge was secured, the fire teams began fighting the fire through the port and starboard bridge doors using hoses. At 1550, the fire was reported to be out. At

1600, the West Baton Rouge Fire Department arrived at the docked vessel and confirmed that the fire was extinguished.

Investigators from the Coast Guard and the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) discovered extensive damage throughout the bridge, including significant smoke and thermal damage. There was no damage noted to any of the lower decks in the superstructure. The navigation systems, communication systems, and alarm systems were damaged beyond repair.

### 1.3 Additional Information

#### 1.3.1 Video Footage

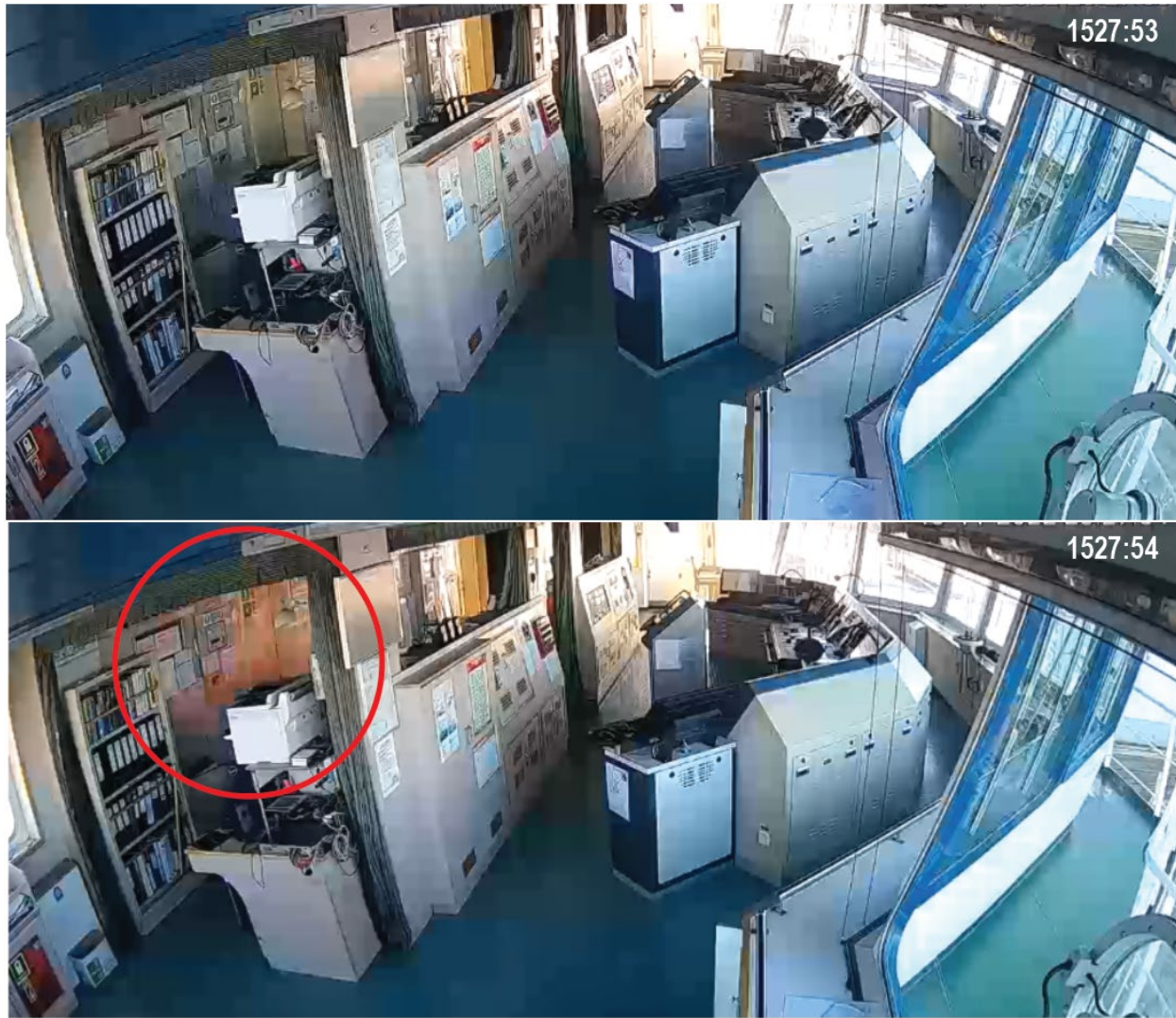
The vessel operator provided investigators with video footage from a closed-circuit camera positioned on the starboard side of the bridge, forward. The camera faced inboard and aft and showed the entire bridge space except for areas directly behind equipment and cabinets. One end of the communications table was visible, but the rest of the table extended behind a bank of cabinets. The time stamp on the video was 8 hours ahead of the local time.

At 1527:54 local time, the footage showed an orange flash immediately followed by a puff of smoke by the communications table. Following the initial flash, the video showed smoke rising up and increasing in volume and thickness.



**Figure 3.** The damage to the bridge. (Source: Coast Guard)





**Figure 4.** The bridge closed-circuit camera footage showing the bridge before the initial flash (top), and the flash and smoke, circled in red, at the communications table (bottom). (Background source: Stalwart Management Ltd)

At 1529:04, the footage showed another orange flash in the same area as the first one, followed by an object on fire, which flew from the area of the flash to the starboard side of the bridge, where it landed on the deck in front of the lifejacket locker and continued to burn.



**Figure 5.** Photos from the bridge closed-circuit camera showing (1) a second explosion, (2) an object on fire propelled into the air (circled in red), and (3) the object, still on fire, landing on the floor (circled in red). (Background source: Stalwart Management Ltd)

In the video, the fire on the communications table continued to grow. The visibility on the bridge decreased rapidly, and the camera lens became covered in ash and started to deform at 1536:26, preventing any further view of the fire within the bridge.

### 1.3.2 Vessel Radios and Batteries

The *S-Trust* carried 20 ultra high frequency (UHF) handheld radios for the crew to use to communicate during vessel operations; the vessel's radio manifest included 15 Motorola radios and 5 Entel radios. Four of the Entel radios were assigned to the fire team. The other radios were either assigned to a specific crewmember or designated for use on the bridge or in the engine room.

A postcasualty battery inventory identified that the vessel carried twenty-seven 7.4-volt batteries for the radios: 14 of the batteries had lithium-ion cells, and 13 of the batteries had nickel-metal hydride cells. The vessel also had 16 battery chargers: 8 for lithium-ion batteries and 8 for nickel-metal hydride batteries; 6 of the lithium-ion chargers were Motorola



**Figure 6.** A Motorola DP4400e radio and lithium-ion battery used on the bridge of the *S-Trust*.



chargers and 2 were Entel chargers. The chargers were located throughout the vessel, including the bridge, the engine room, the pump control room, and the vessel officers' cabins. While the radios, batteries, cells, and chargers were manufactured in different countries, they were all Underwriters Laboratories certified.

The two radios assigned to the bridge were a Motorola DP4400e radio, which used a lithium-ion battery, and a Motorola GP328 radio, which used a nickel-metal hydride battery. A crewmember informed investigators he believed that the batteries for those radios were not charging the day of the fire.

When investigators examined the area around the communications table on the bridge where the video showed the orange flash, smoke, and fire, they found the remains of a lithium-ion battery charger and a nickel-metal hydride battery charger. A closer examination found the remains of three batteries among the charger remains— one nickel-metal hydride battery (which contained six cells) and two lithium-ion batteries (which each contained two cells).

All six of the nickel-metal hydride battery cells were found among the charger remains and exhibited fire damage. Of the remains of the two lithium-ion batteries on the communications table, two cells from the same battery were found among the charger remains and had sustained fire damage. Although investigators found components of the second lithium-ion battery among the charger remains, its two cells were not found.



**Figure 7.** The remains of the lithium-ion and nickel-metal hydride battery chargers on the communications table. (Source: ATF)



**Figure 8.** The nickel-metal hydride battery's cells (*left*) and remains of the lithium-ion battery cells and components (*right*) found on the communications table. (Source: ATF)

The ATF origin and cause report for the fire stated that “the cause of this fire was determined to be an energetic event [explosion] involving a lithium ion battery located on the navigation [communication] desk.” The report detailed the examination of the other electronic devices, including a computer and a radio, on the communications table as well as all six electrical outlets that provided power to the desk. While all of the electronic devices and the outlets sustained fire damage, the ATF report ruled them out as potential sources of the fire. The ATF report also noted that there was a second explosion from within the ensuing fire on the communications table.

### 1.3.3 Bridge Fire Detection

Per DNV, the classification society for the vessel, the *S-Trust* smoke detection and alarm system complied with Method IC from the *International Convention for the Safety of Life at Sea (SOLAS) 1974 (IMO/MSC.1/Circular 1456 Annex 1)* for fire protection. This only required fixed fire/smoke detection in all corridors, stairways, and escape routes within the accommodation spaces. According to *SOLAS*, the bridge of a vessel is defined as a control station and is not required to have fire and/or smoke detectors.

## 2. Analysis

On November 13, the oil tanker *S-Trust* was docked at the Genesis Port Allen Terminal in Baton Rouge, Louisiana, when a fire was discovered on the bridge.

The closed-circuit camera on the bridge captured an orange flash immediately followed by a puff of smoke in the area of the communications table where batteries and chargers for hand-held radios assigned to the bridge were located. Following the flash, smoke and flames were seen growing and expanding as combustible material was consumed by the fire. The ATF concluded that the fire was caused by one of the lithium-ion battery cells on the communications table exploding. The video and other evidence support the ATF findings.

Investigators found the remains of three batteries (one nickel-metal hydride and two lithium-ion) on the communications table. The single nickel-metal hydride battery (all of its six cells) was intact; one of the lithium-ion batteries (both cells) was found intact in the remains of the chargers (one nickel-metal hydride charger and one lithium-ion charger). Investigators only found components of the second lithium-ion battery (a two-cell battery). Lithium-ion battery cell explosions are typically caused by a thermal runaway; as such, the initial orange flash and puff of smoke on the video feed was likely the result of one of the missing lithium-ion cells exploding due to a thermal runaway.

The heat produced from a thermal runaway of a lithium-ion battery cell can exceed 1,100° F, which can easily cause any nearby combustible material to ignite, including adjoining cells of the same battery. As the fire expanded, the closed-circuit



video captured a second flash, followed by a flaming object being propelled from the fire and landing on the deck of the bridge, where it continued to burn. This was most likely the other missing lithium-ion cell from the same battery. Based on the video, investigators determined that the second missing lithium-ion cell also experienced a thermal runaway, most likely initiated from the heat of the fire started by the initial battery cell thermal runaway.

A thermal runaway occurs when a cell overheats and combusts; it is a chemical reaction that can occur to any type of battery cell if it is damaged, shorted, overheated, defective, or overcharged. It is possible, based on the battery remains' location among the charger remains, that one of the batteries had been left in the charger, which could have led to overcharging. However, a crewmember told investigators that the batteries were not in the chargers before the fire. Further, investigators were not able to find the missing cells, and, due to the explosion, the extensive heat from the thermal runaway reaction, and subsequent fire on the bridge, the battery cells may have been completely consumed. Therefore, investigators could not examine the first cell that exploded to determine the exact cause of the initial thermal runaway.

Once the vessel was docked at the terminal and cargo operations began, the bridge watch ended, so no one was stationed on the bridge at the time the fire started. The first indication crewmembers had of a possible fire aboard was the loss of the closed-circuit camera feed to the monitor in the master's office. Had the fire occurred while the vessel was underway, there would have been personnel on the bridge, and the fire would have been immediately detected. Additionally, the vessel's bridge did not have a smoke or fire detection system (nor was it required to), which also allowed the fire to grow undetected.

## 3. Conclusions

### 3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on the bridge of the *S-Trust* was the thermal runaway of one of the cells in a lithium-ion battery for a UHF handheld radio.

## 3.2 Lessons Learned

### Lithium-Ion Battery Fires

A lithium-ion battery cell, if damaged, shorted, overheated, defective, or overcharged, can spontaneously experience a thermal runaway, a chemical reaction that can cause the cell to ignite and explode. A cell that has exploded can be propelled from its initial position within a battery. Due to the potential for rapid expansion of a lithium-ion battery fire, detection, containment, and extinguishment are essential to prevent damage to a vessel.

Crews can help prevent thermal runaways and ensuing fires by doing the following:

- follow manufacturers' instructions for the care and maintenance of lithium-ion batteries,
- properly dispose of damaged batteries,
- avoid unsupervised charging, and
- keep batteries and chargers away from heat sources and flammable materials.

Additionally, companies should ensure that lithium-ion batteries and devices that use lithium-ion batteries are certified by Underwriters Laboratory or another recognized organization.

Should a lithium-ion battery fire occur, crews can attempt to extinguish the fire with water, foam, CO<sub>2</sub>, or other dry chemical or powdered agents. However, if the battery fire cannot be extinguished, personnel should attempt to allow the pack to burn in a controlled manner; this includes watching for nearby cells that may also experience thermal runaway and extinguishing other combustibles that may catch on fire.

Vessel	<i>S-Trust</i>
Type	Cargo, Liquid Bulk (Oil tanker)
Owner/Operator	New Trend Ltd/Stalwart Management Ltd (Commercial)
Flag	Liberia
Port of registry	Monrovia, Liberia
Year built	2005
Official number (US)	N/A
IMO number	9299771
Classification society	DNV
Length (overall)	800.0 ft (243.8 m)
Breadth (max.)	137.8 ft (42.0 m)
Draft (casualty)	31.2 ft (9.5 m)
Tonnage	57,243 ITC
Engine power; manufacturer	1 x 18,184 hp (13,560 kW) Hyundai - B&W 6S60MC-C diesel engine

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

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For more detailed background information on this report, visit the [NTSB Case Analysis and Reporting Online \(CAROL\) website](#) and search for NTSB accident ID DCA23FM005. Recent publications are available in their entirety on the [NTSB website](#). Other information about available publications also may be obtained from the website or by contacting—

National Transportation Safety Board  
 Records Management Division, CIO-40  
 490 L’Enfant Plaza, SW  
 Washington, DC 20594  
 (800) 877-6799 or (202) 314-6551