December 10, 2025 MIR-25-45

Contact of Bulk Carrier *Algoma Discovery* with BNSF Allouez Taconite Facility

On July 20, 2024, about 2215 local time, the Canada-flagged cargo vessel *Algoma Discovery* struck five of the loading shuttles at the BNSF Allouez Taconite Facility, in Superior, Wisconsin, after losing electrical power and main propulsion while docking (see figure 1 and figure 2).[1] There were no injuries, and no pollution was reported. Damage to the facility was estimated at $950,000, and damage to the *Algoma Discovery* was estimated at $130,000.

Figure 1. *Algoma Discovery* at unknown date before the contact. (Source: Carson Last, marinetraffic.com)

[1] (a) In this report, all times are central daylight time, and all miles are statute miles. (b) Visit ntsb.gov to find additional information in the public docket for this NTSB investigation (case no. DCA24FM052). Use the CAROL Query to search investigations.

Casualty Summary	
NTSB casualty category	Contact
Location	BNSF Allouez Taconite Facility, Superior, Wisconsin 46°41.83' N, 92°1.11' W
Date	July 20, 2024
Time	2215 central daylight time (coordinated universal time –5 hrs)
Persons on board	22
Injuries	None
Property damage	$1.08 million est.
Environmental damage	None
Weather	Overcast, visibility 10 mi, winds northeast at 15 kts, air temperature 61°F, water temperature 64°F
Waterway information	Bay

Figure 2. Area where the *Algoma Discovery* contacted the BNSF Allouez Taconite Facility, as indicated by a circled *X*. (Background source: Google Maps)

1 Factual Information

1.1 Background

The 729-foot-long bulk carrier *Algoma Discovery* was built in 1987 by 3. Maj Brodqradiliste in the former Yugoslavia and was owned and operated by Algoma Central Corporation. The *Algoma Discovery* had seven cargo holds and could transport up to 37,911 metric tons of bulk cargo.

The vessel had a single Sulzer 6RTA62, six-cylinder, two-stroke, turbocharged, slow-speed main engine directly driving the vessel's controllable pitch propeller. The main engine used a compressed air bottle system to supply the air start system and the control air system for its operation (see section 1.3.3).

1.2 Event Sequence

On July 14, 2024, the *Algoma Discovery* departed Hamilton, Ontario, with a crew of 20, en route to the BNSF Allouez Taconite Facility in Superior, Wisconsin, to load cargo. On July 17, while the vessel was underway in the Whitefish Bay waterway, with two of the vessel's three ship service, diesel-engine-driven electrical generators (no. 2 and no. 3) operating in parallel, the no. 2 ship service electrical generator high load alarm sounded.[2] The chief engineer determined that the no. 2 generator was not producing voltage, and it could not be paralleled with the other ship service generators—leaving the ship with only the ability to run the no. 1 and no. 3 generators together. The chief engineer notified the master of the situation and informed him that the bow thruster would not be available if needed because all three generators had to be in parallel operation to meet its electrical demand. As per the vessel's safety management system, the issue with the no. 2 generator was communicated to the company's head office. The chief engineer then worked with the electrical superintendent from the operating company to troubleshoot the problem with the generator.

On July 18, the *Algoma Discovery* anchored off Superior to wait for the facility to be ready to load the cargo on the vessel. After the vessel anchored, on July 19, the company requested an electrical technician to assist with fixing the no. 2 generator. The technician was initially scheduled to meet the vessel while it was at anchor off Superior. The chief engineer continued to work on solving the problem with the no. 2 generator that same day, and he emailed the electrical superintendent and copied

[2] Generators operating *in parallel* have a synchronized connection as a single power source sharing the total electrical load.

the master to inform them that he had "flashed" the no. 2 generator and the generator was able to produce operating voltage.[3] The chief engineer also passed that he had tested the no. 2 generator in parallel with the no. 3 generator by placing electrical loads on it to confirm it would maintain its voltage, which it did satisfactorily. However, within the same email, the chief engineer also expressed his concern that the cause of the generator's failure to produce voltage was not determined, and the generator could experience the same failure again. On July 20, based on the information provided from the chief engineer that the no. 2 generator was operating, the electrical superintendent canceled the request for the electrical technician to attend the vessel.

On July 20, about 1945, the chief engineer arrived in the engine control room to prepare for the vessel to get underway. While the vessel was at anchor, only the no. 3 generator was in operation. The chief engineer started the no.1 and no. 2 generators and placed them in parallel with the no. 3 generator. At 2045, the main engine control was transferred to the bridge, and power was supplied to the bow thruster. About 2101, the crew raised the anchor, and the *Algoma Discovery* proceeded toward the BNSF Allouez Taconite Facility.

About 2139, the vessel was inbound, heading toward the facility. The crew's plan was to dock the vessel with its port side next to the dock. As the vessel approached the dock, the master realized that the vessel was not lined up as he intended and used the bow thruster to maneuver the bow slightly to starboard, away from the dock. When the bow was parallel to the dock at the facility, the master again engaged the bow thruster, this time to move the bow to port, closer to the dock. During the maneuver, about 2158, the high-load alarm sounded for the no. 2 generator, followed by the main switchboard non-essential consumer tip, and the generator shut down.[4] Afterward, the no. 2 generator breakers on the bus board tripped, and the no. 1 and no. 3 generators' high load alarms also sounded. About 2200, the no. 1 and no. 3 generators also tripped off the bus, and the vessel lost all electrical power. Subsequently, the main engine shut down due to the loss of its electrically powered fuel pump. According to the chief engineer, the emergency generator started "almost immediately" and powered the emergency switchboard. Rudder control (steering) was regained when the emergency generator powered the emergency switchboard.

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[3] *Flashing* is a method to re-establish the magnetic field of a generator by applying an external direct current (DC) source to the field windings.

[4] The main switchboard non-essential consumer tip removed non-essential electrical equipment off the generator loads to help keep the generators running and providing power.

The chief engineer, who was still in the engine control room when the vessel lost power, noticed that the prime movers (diesel engines) of all three generators were still running. He reset the breaker for the no. 3 generator, reconnecting it to the electrical board. This disconnected the emergency generator, and the vessel regained main electrical power. About 2205, after power was restored, the chief engineer restored propulsion by restarting the main engine using the air start system.

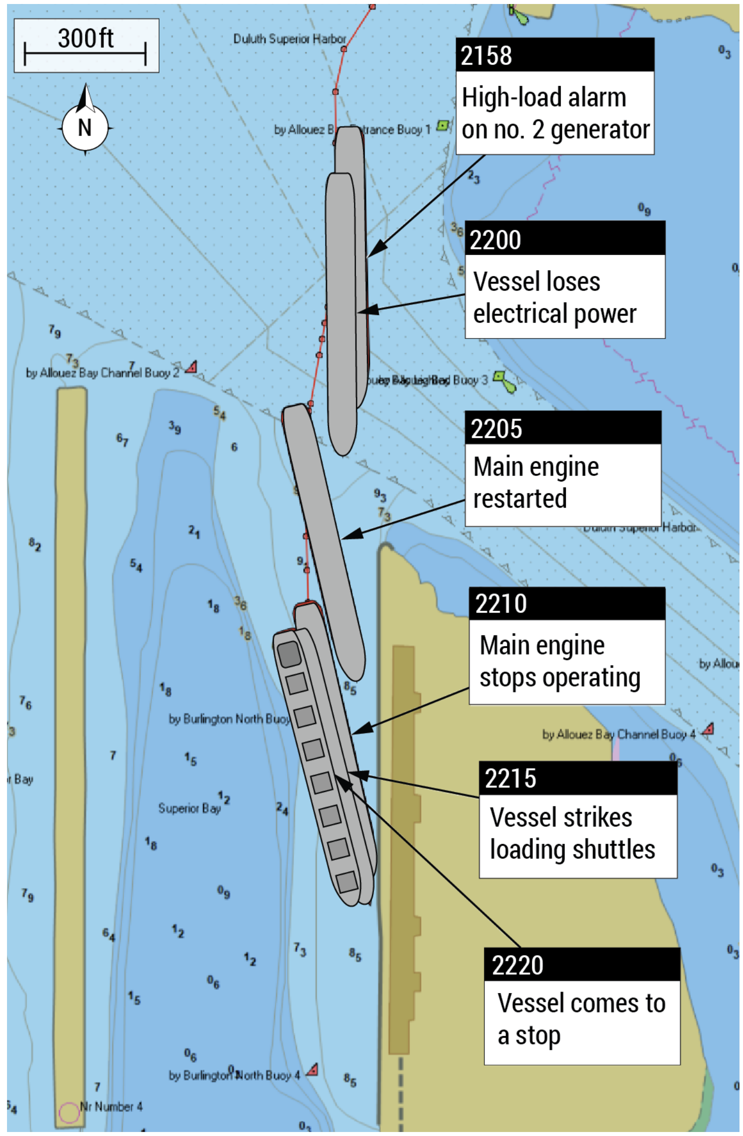

Figure 3. Trackline of *Algoma Discovery* as it approached the dock, from the time of the high-load alarm about 2158 to the time it came to a stop, about 2215, after striking the loading shuttles. (Background source: National Oceanic and Atmospheric Administration Electronic Navigation Chart US5DLHCG as viewed on MadeSmart automatic identification system.)

The chief engineer paralleled the no. 1 generator with no. 3 generator and saw that the no. 2 generator diesel engine was still in operation but was not producing voltage. The chief engineer tried to flash the no. 2 generator to restore its ability to produce voltage, as he had done on July 19, but that procedure did not work. With only two of the three generators in operation, the chief engineer informed the master that there was not enough power available to operate the bow thruster (which had been offline since the initial power loss).

Once power and propulsion were restored, the master proceeded to give engine commands to maneuver the vessel toward the dock. As the vessel continued toward the dock, the main engine stopped operating a second time following a low control air alarm about 2210 (see figure 3). The chief engineer tried to restart the main engine again, but after several attempts, it would not start. He stated that the interlocks for the main engines would not open and the compressed air bottle pressure and the control air pressure had both dropped.

The master ordered the starboard anchor and the stern anchor be let go as the vessel was still moving forward, toward the dock. Crewmembers let go the anchors. However, about 2215, the vessel started to strike the facility's loading shuttles, as the vessel moved down the dock at a speed of about 0.9 knots. At 2220, the *Algoma Discovery* came to a stop, with the bow touching the dock and the stern about 100 feet away from the dock. Five loading shuttles were damaged.

Shortly after the vessel made contact with the shuttles, the crew conducted a damage survey of the vessel. The chief engineer determined that the control air system was not being supplied from the compressed air bottle system, and, about 2230, he opened the bypass for the air dryer system. Opening the bypass routed air around the dryer unit, directly to the control air system. Once the air compressors had recharged the compressed air bottle system to operating pressure, which restored both start air and control air pressure, the main engine was started.

The master contacted tugs to assist the vessel to the dock, as well as the vessel owner and the US Coast Guard to inform them of the casualty. Before the tugs arrived, the crew and shoreside personnel worked together to secure a mooring line to the facility, and the crew used the vessel's winches to move the vessel's stern to the facility. On July 21, about 0030, the vessel was docked at the facility.

1.3 Additional Information

1.3.1 Damage

A postcasualty survey of the BNSF Allouez Taconite Facility identified that five loading shuttles (nos. 24, 26, 28, 32, and 35) sustained impact/crushing damage (see figure 4). Damage to the facility was estimated at $950,000.

Figure 4. Damage to one of the loading shuttles at the BNSF Allouez Taconite Facility following the casualty. (Source: Coast Guard)

The *Algoma Discovery* sustained hull damage above the main deck on the port side of the bow, estimated at $130,000 (see figure 5).

Figure 5. *Left to right*: Damage (*circled*) to the *Algoma Discovery*, as seen from the interior and the exterior, following the casualty. (Source: Coast Guard)

1.3.2 Generators

The *Algoma Discovery* had three generators to provide electrical power to the vessel. The no. 1 and no. 2 generators were MAN 6T23 generators that each produced 630 kilowatts. The no. 3 generator was a Wärtsilä 6L20 generator that produced 1,050 kilowatts. While the no. 3 generator was self-exciting, and, thus, able to produce its own magnetic field, the no. 1 and no. 2 generator were not self-exciting. These generators required capacitors, which store and release electrical energy, to induce excitation to create a magnetic field for the alternator to start producing power and to maintain it during operational load demands. The no. 1 and no. 2 generators each had four capacitors.

The voltage produced by the generators was controlled by an automatic voltage regulator (AVR), which maintained each generator's output voltage by automatically adjusting its excitation system (magnetic field). The AVR continuously sensed each generator's output voltage, comparing it to a preset setpoint, and then increased or decreased the excitation (magnetic field) to keep the output stable and compensate for changes in load.

The AVR also converted alternating current (AC) power from the generator's output (or a separate exciter winding) into direct current (DC) power to supply the rotor's field winding. Capacitors in the AVR's internal rectifier circuit filtered and smoothed this power, removing unwanted ripples and providing a steady DC voltage. This ensured the magnetic field was stable and consistent, which was necessary for stable output voltage of the generator.

The power-generating system (three generators and a switchboard) did not have automatic synchronization, so when more than one generator was in operation, engineers had to manually synchronize the generators in order to place them in parallel to share the load. During normal operations, when the vessel was underway, the no. 1 and no. 3 generator were operated in parallel to meet electrical requirements. When the crew wanted to use the vessel's bow thruster to maneuver the vessel, they had to bring the no. 2 generator online since all three of the generators were needed to accommodate the bow thruster. (The bow thruster had a fixed-pitch impeller, and the motor, which could be operated at two speeds, was rated at 1,000 kilowatts, 440 volts, 60 hertz, and 1,570 amps).

Following the casualty, an electrical technician determined that the four capacitors for the no. 2 generator were not operating properly, and, as a result, the generator malfunctioned and could not maintain the magnetic field and constant voltage during the operation of the bow thruster. The operating company's supervisory electric technician informed investigators that three of the four capacitors for the no. 2 generator were not connected to the alternator, and the only capacitor that was connected had failed prior to the casualty. All of the capacitors for the no. 2 generator were replaced, and the generator was tested to ensure proper operation under load. As a precaution, and to prevent a similar casualty with the no. 1

generator (which was the same type as no. 2), all of the no. 1 generator's capacitors were replaced and tested to ensure proper operation.

1.3.3 Control Air System and Compressed Air Bottle System

The main engine control air system used a pressure of 116 pounds per square inch (psi) (8 bar) to operate essential pneumatic valves and automated systems for starting, securing, monitoring, and regulating the engine as well as its direction and speed. If the control air system experienced low control air pressure below 80 psi (5.5 bar), an alarm would sound to alert the engineers. If the pressure was not corrected, the pneumatic signal being sent to the engine components would decrease and close the interlocks—normally kept open with control air pressure—on the engine, causing the engine to stop.

Both the main engine air start system and the control air system received air supply from the vessel's compressed air bottle system. The compressed air bottle system had an operating pressure of 435 psi (30 bar). A reduction station maintained the air pressure supply from the higher-pressure bottle system to the control air system.

The compressed air bottle system had four air compressors (three main and one emergency) to maintain operational air pressure. If the vessel lost main electrical power, the three main air compressors would automatically restart following the restoration of main electrical power. The emergency air compressor was connected to the emergency electrical switchboard. Two of the three main air compressors were in standby and arranged to start in succession (primary and secondary) if the pressure for the compressed air bottle system could not be maintained. The primary main air compressor would start when the compressed air pressure dropped to 319 psi (22 bar), and the secondary would start when the pressure dropped to 290 psi (20 bar). They would run until the system reached the 435 psi operating pressure.

To protect the control air system from corrosion due to humidity, there was an air dryer system to remove any particulates and moisture from the air prior to it entering the system. The air dryer system consisted of a filter, an Ultra Air UA150-A refrigerator air dryer, and water traps. The refrigerator air dryer put the warm, moist, humid compressed air around a refrigerated coil. Any moisture contained in the compressed air condensed on the coil, collected, and drained off, reducing the humidity of the air.

The refrigerator air dryer would shut down if it experienced any of the following four conditions:

- high-pressure,
- a dirty condenser,
- a fan motor failure, or
- excessive high ambient air temperatures.

These shutdowns were not connected to the engine room alarm system in the engine control room. The refrigerator air dryer was not connected to the emergency electrical system, and, in the event of a loss of main electrical power, it would not restart automatically following the restoration of main electrical power.

To bypass the entire air dryer system, the bypass valve to the control air system had to be opened (see figure 6). For compressed air to bypass the refrigerator air dryer but flow through the air filter and the water trap, the bypass valve for the refrigerator air dryer had to be opened.

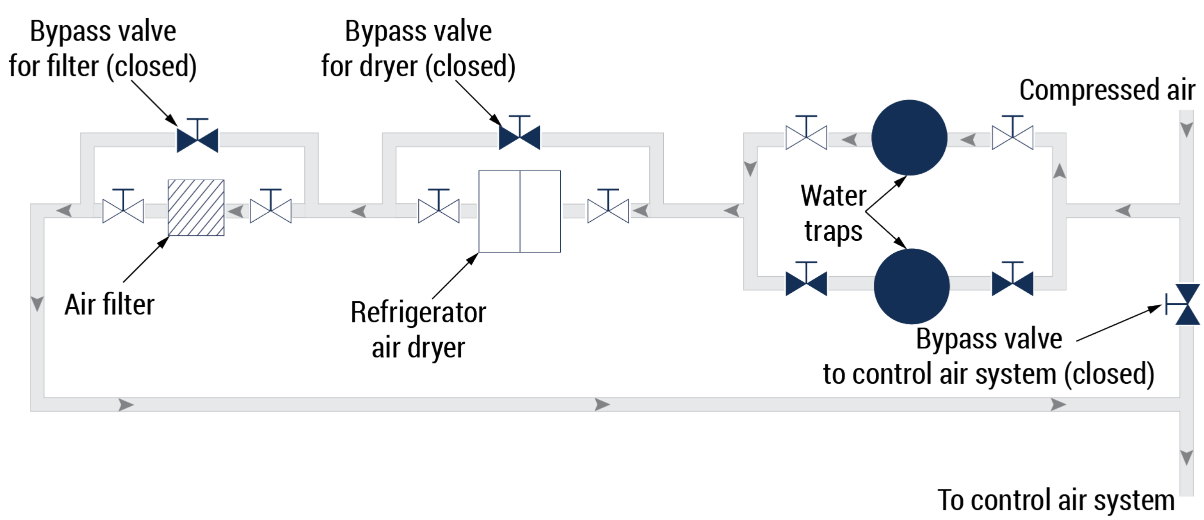

Figure 6. Typical flow of compressed air through the water traps, refrigerator air dryer, and air filter before reaching the control air system. (Background source: Algoma Central Corporation)

The operating company's postcasualty investigation found that the main engine stopped a second time because the refrigerator air dryer had likely shut down after the loss of power—the company identified a fan motor failure alarm—and thus prevented the supply of compressed air to the main engine control air system.

2 Analysis

On July 20, 2024, the bulk carrier *Algoma Discovery* lost main electrical power and propulsion while attempting to dock at the BNSF Allouez Taconite Facility, resulting in the vessel striking five of the facility's loading shuttles.

Three days before the casualty, while the vessel was en route to the facility, engineers discovered that one of the vessel's three generators (the no. 2 generator) was not producing voltage. The vessel's chief engineer restored the voltage by "flashing" its field and tested it by placing it in parallel with the no. 3 generator. On the day of the casualty, the no. 2 generator again stopped producing voltage, resulting in a loss of vessel electrical power and the first of two shutdowns of the main engine.

After the casualty, an electrical technician examined the no. 2 generator and found three of the four capacitors in the generator's AVR internal rectifier circuit were not connected and the fourth had malfunctioned, which prevented the generator from maintaining its voltage. For the no. 2 generator, the AVR drew power from the main windings and rectified it to DC power, and capacitors within the AVR helped to stabilize fluctuations. If rectified voltage began to drop, a capacitor would discharge its stored energy into the circuit. This would fill in the "gaps" between the pulses, preventing the voltage from falling sharply. However, because the no. 2 generator on the *Algoma Discovery* did not have capacitors capable of providing a stable DC reference, the use of the bow thruster—a large inductive load—caused a momentary voltage drop that the AVR could not quickly correct, resulting in the generator disconnecting and ceasing to produce voltage. Once the malfunctioning capacitors were replaced and connected, the generator operated properly.

During the accident, the chief engineer was able to initially restore vessel electrical power (the no. 1 and no. 3 generators were placed online), but there was not enough power to operate the bow thruster. Rudder control (steering) was regained when the emergency generator powered the emergency switchboard less than a minute after the loss of power. Additionally, the chief engineer restored the main engine at 2205. About 5 minutes later, at 2210, as the master maneuvered the vessel, the low air control pressure alarm sounded. Because the main engine relied on a minimum control air pressure to operate, the loss of control air caused the interlocks on the engine, normally kept open with air pressure, to close, resulting in the engine shutting down a second time at 2215. Without main propulsion and a bow thruster, the master could not effectively maneuver the vessel to avoid striking the facility's loading shuttles.

The chief engineer informed investigators that he had no problem starting the main engine following the loss of power. However, he was unable to restart the main engine after it shut down the second time, despite several attempts to do so. When the vessel lost power, the refrigeration air dryer for the control air system shut down, most likely due to the loss of electrical power to the fan motor, preventing the supply of compressed air to the control air system. This series of events was supported by the fan motor failure alarm identified by the company. The refrigeration air dryer system was not configured to restart automatically; instead, the crew would have to manually restart it after main electrical power was restored. Following the first main engine shutdown, the main engine was able to be quickly restarted, indicating that there was sufficient pressure within the control air system for a start. However, after the second main engine shutdown, the chief engineer noted that both the start air and control air pressures were low after trying to restart the main engine several times.

The low start air pressure was likely due to the vessel's compressed air bottle system pressure being depleted from the multiple attempts to restart the engine the second time. A low compressed air bottle system pressure could, if approaching the 116-psi control air system operating pressure, result in a low control air pressure as the control air system was supplied through a reduction station from the bottle system. However, with the control air dryer shut down, the air supply to the control air system was stopped. Therefore, the air used for multiple maneuvering commands (from the bridge engine controls to the control air system for the main engine) following the first engine shutdown, combined with keeping the interlocks for main engine operation open, likely drained the remaining control air pressure—resulting in a low control air alarm, shut down of the main engine, and the inability to restart the main engine again. After the chief engineer opened the bypass to the air dryer system for the control air system, the air supply was reestablished. Then, it took about 10 minutes for the air compressors to recharge the compressed air bottle system to operating pressure. Once that was completed, the main engine was able to be restarted. Therefore, the loss of control air was likely due to the air dryer system not restarting automatically after it shut down following the initial loss of power, resulting in the second loss of propulsion.

When the chief engineer discovered that the no. 2 generator was not producing voltage on June 17, he informed the master and the operating company of the situation and worked with the electrical superintendent to identify the cause of the generator's inability to produce a magnetic field. The chief engineer was able to restore the magnetic field and the voltage output by "flashing" the generator. Following the restoration of the no. 2 generator, the chief engineer placed it in parallel with the other two generators prior to the vessel entering the port. Although he was able to restart the generator, the chief engineer did not identify the cause of the loss of the generator's magnetic field. In addition, the no. 2 generator was not tested with a significant demand, such as operating the bow thruster. Had the chief engineer or operating company required further testing of the no. 2 generator at a significant load before the vessel's docking, they may have identified that the malfunction with the no. 2 generator had not been corrected. Because all three generators were required to operate the bow thruster, the crew and operating company then could have implemented measures to ensure a safe docking without the use of the bow thruster.

3 Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the contact of the bulk carrier *Algoma Discovery* with the BNSF Allouez Taconite Facility was the chief engineer and operating company not sufficiently evaluating and repairing the cause of an online generator's previous automatic voltage regulator malfunction, resulting in the vessel's loss of electrical power and propulsion while maneuvering toward the dock, and subsequent low control air pressure, which led to a second loss of propulsion.

3.2 Lessons Learned

Mitigating Risks of Electrical Generating System Failures While Maneuvering

Electrical generating system failures during maneuvering can result in a loss of propulsion and steering. Therefore, mitigating the loss of electrical power is paramount in restricted waters or during maneuvering, where immediate hazards (grounding, traffic, objects) are in proximity, and therefore, response time is critical to avoiding a casualty. Electrical generating system components, such as generators, should be tested to full capacity (or as close to full capacity as possible) following any maintenance or repair to ensure that they can meet electrical demand while the vessel is being maneuvered. Additionally, when electrical system failures cannot be completely resolved, the implementation of alternate measures to ensure a safe transit should be considered, such as the use of tugs to assist in maneuvering or docking.

Vessel Particulars

Vessel	*Algoma Discovery*
NTSB vessel group	Cargo, Dry Bulk (Bulk Carrier)
Owner/operator	Algoma Central Corporation
Flag	Canada
Port of registry	St. Catharines, Canada
Year built	1987
Official number	834989
IMO number	8505848
Classification society	Lloyds Register
Length (overall)	729.8 ft (222.4 m)
Breadth (max.)	75.5 ft (23.0 m)
Draft (casualty)	48.1 ft (14.7 m)
Tonnage	23,306 GRT ITC
Engine power; manufacturer	1 × 15,490 hp (11,551 kW); Sulzer 6RTA62 diesel engine

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

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