MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

ACCIDENT REPORT

SERIOUS MARINE CASUALTY | REPORT NO 10/2026 | MAY 2026

Catastrophic engine failure and subsequent fire on board the site investigation vessel *Kommandor Susan* in the Firth of Forth, Scotland on 25 January 2025

Email: maib@dft.gov.uk
Tel: +44 (0)23 8039 5500

SUMMARY

Image courtesy of fabianv (ShipSpotting.com)

Kommandor Susan

At 1305 on 25 January 2025, the site investigation vessel *Kommandor Susan* suffered a catastrophic failure of a diesel generator engine while conducting sea trials in the Firth of Forth, Scotland. The failure resulted in an engine room fire and a complete power blackout. The crew responded promptly, extinguished the fire and mustered safely. The vessel lost propulsion and began drifting eastwards. Attempts to deploy anchors were unsuccessful because the anchor winches required electrical power to operate. *Kommandor Susan* was eventually returned to Leith harbour with limited propulsion restored.

The investigation found that the engine failure was caused by premature wear of bearings fitted during a major overhaul in 2019. These components were not approved by the engine original equipment manufacturer and exhibited weaker material bonding than genuine parts. The extended service intervals applied to the engines were valid only for original equipment manufacturer components, making the use of substitute parts a critical factor in the failure.

The vessel's former owner had minimal oversight of the overhaul process and assumed that original equipment manufacturer parts were used. This lack of verification meant that the presence of substitute components remained undiscovered and was not communicated to subsequent owners. Additionally, the vessel's anchoring procedure did not account for the risk of power loss, leaving the anchors inoperable during the emergency.

The vessel's owner, Gardline Shipping Limited, has since rebuilt the affected engine, and overhauled all other generator engines on board *Kommandor Susan*, with original equipment manufacturer parts.

The Chief Inspector of Marine Accidents has written to the vessel's previous owner, Hays Ships Limited, outlining the importance of a structured supervision system that provides clear accountability measures and the need to adopt real-time progress monitoring for all critical maintenance activities.

FACTUAL INFORMATION

Narrative

On the morning of 25 January 2025, the crew of *Kommandor Susan* prepared the vessel for sea trials from the Port of Leith, Scotland.

At 1020, the chief engineer (C/E) started diesel generator (DG) 1 and DG4 to warm the engines. By 1142, a pilot had boarded, and the bridge team had completed their pre-departure checks. At 1220, *Kommandor Susan* entered the lock to exit Leith harbour, clearing the lock at 1252 before proceeding into the main channel of the Firth of Forth.

At 1305, the C/E heard a change in engine tone from one of the running DGs, followed immediately by a loud bang and the activation of the fire alarm. On opening the engine control room (ECR) door, the C/E observed that the engine room was filled with smoke and oil mist. One minute later, the C/E informed the bridge that there was a fire in the engine room.

In response to the incident, the second engineer (2/E) stopped both DGs from the ECR switchboard, resulting in a blackout and loss of propulsion. The emergency generator started automatically and restored power to essential systems, including emergency lighting, but not to propulsion.

The master sounded the general alarm from the bridge, prompting the crew to muster stations. Once everyone was accounted for, the chief officer (C/O) prepared a fire team to enter the engine room. Equipped with a dry powder extinguisher, the fire team located and extinguished several small pockets of burning oil in the bilges on both sides of DG1 before exiting the space.

With no propulsion available, *Kommandor Susan* began drifting eastwards. The master instructed the deck crew to drop anchor to arrest the drift, but both anchor winches were clutched into their respective electric motors and the clutches could not be released due to the lack of power.

The pilot advised the master that support had been requested and, at 1416, the tug *Kittiwake* was made fast to *Kommandor Susan*'s port quarter. Shortly after, the C/E advised that DG4 could be safely restarted. Limited propulsion was restored once DG4 was operational, which allowed *Kommandor Susan* to manoeuvre, and anchor winch clutches could also be released at this time.

Kommandor Susan berthed alongside at 1806, having returned to Leith harbour assisted by two tugs.

Environmental conditions

On 25 January 2025, the weather in the Firth of Forth was mostly dry with a south-westerly force 5 to force 6 wind. The visibility was good and the ebbing tide was running at around 2 knots to the east.

Kommandor Susan

Kommandor Susan was built in 1999 as an 83m offshore supply vessel. In 2018, the vessel was sold to Hays Ships Limited (Hays Ships). In 2022, *Kommandor Susan* was sold to Gardline Shipping Limited (Gardline).

In 2019, significant works had been undertaken to convert the vessel to work in the specialist site investigations sector. Site investigation vessels performed offshore geotechnical and geophysical surveys.

Kommandor Susan's propulsion system comprised four Caterpillar 3516B-TA diesel generators **(Figure 1)**, each with a rated output of 1,901 kilowatts (kW). This system was used to power two 2,200kW azimuth propulsion units, an 883kW drop-down azimuth thruster and an 800kW tunnel bow thruster.

Kommandor Susan's crew were all appropriately qualified to serve on a UK registered vessel. Regular fire drills were completed on board to prepare the crew to deal with emergency situations. This included the use of portable extinguishers, fire hoses, and breathing apparatus.

The emergency response teams also practised raising the alarm, isolating fuel and ventilation systems, and deploying fixed firefighting installations such as carbon dioxide or water mist systems. Communication protocols were tested to maintain coordination between the engine room, bridge, and emergency response teams. Drills also emphasised evacuation routes, muster points, and casualty handling.

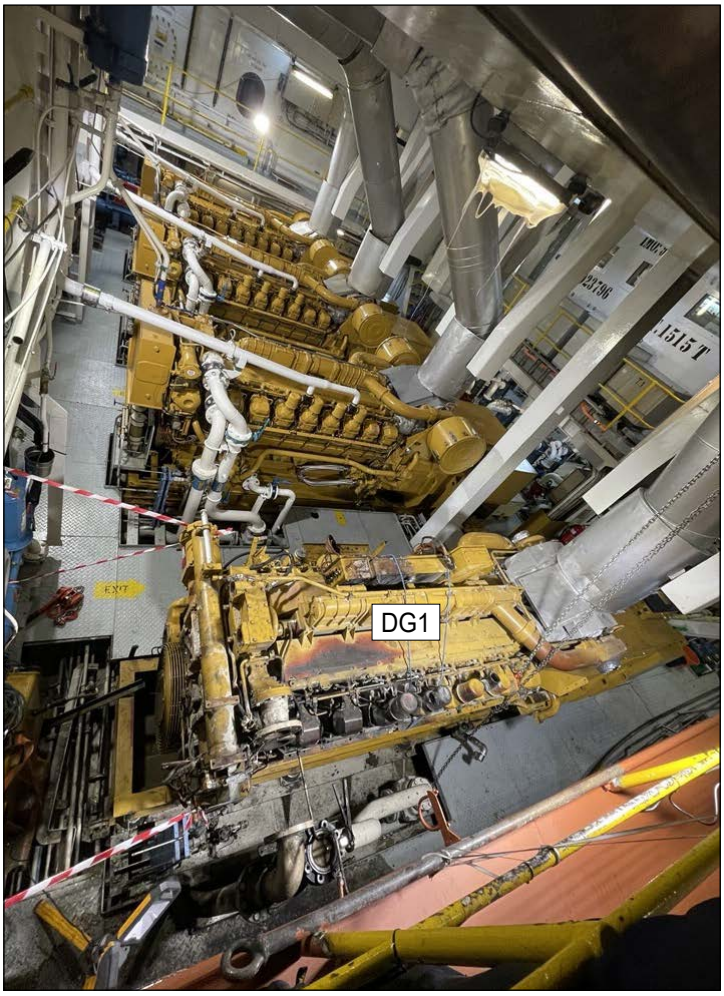

Figure 1: *Kommandor Susan*'s four diesel generators

Diesel generators

The standard service intervals for Caterpillar 3516B-TA engines were based on load, operating environment and fuel quality. For marine applications using Ultra Low Sulphur Diesel, Caterpillar's recommended service intervals were 5,000 hours for a top-end service and 10,000 hours for a major overhaul. The top-end service included cylinder head removal and inspection. The major overhaul included the removal of components such as pistons, liners and bearings as well as the replacement of all bearings, pistons and piston rings. Connecting rods could also be replaced at this time based on their condition.

The service interval could be extended with Caterpillar's agreement following the first major overhaul. Several factors were considered in Caterpillar's decision to approve an increase, including total fuel usage, oil analysis, historic power loading and the condition of the parts removed during the major overhaul. Caterpillar had extended the service intervals on *Kommandor Susan*'s 3516B-TA engines to 24,000 hours, which was not an uncommon decision for similarly loaded engines if genuine Caterpillar components were used in subsequent overhauls. Major overhaul service intervals could be extended up to 40,000 hours.

At the time of the accident DG1 had operated for 65,700 hours in total, of which 13,466 running hours were since the 2019 overhaul.

The previous four oil analysis reports for DG1 did not show any significant amounts of wear particles. The most recent of these was based on an oil sample taken on 6 January 2025, some 19 days and 127 running hours before the failure.

All four of *Kommandor Susan*'s DGs underwent major overhauls during Hays Ships' ownership: DG1 and DG3's overhauls were completed in January 2019; DG2 and DG4's overhauls were

completed in November 2020. All four overhauls were carried out by Holderness Ship Repairers Limited (Holderness)[1], which sourced many of the major components required for the engine overhauls from G&T Engineering Limited[2].

Hays Ships' technical management was made aware that some of the component parts for the engine overhauls would be sourced from the USA, but Holderness did not provide specific supplier details or certification.

During the 2019 major overhaul of the engines, Hays Ships' technical management simultaneously oversaw *Kommandor Susan*'s conversion with several major engineering projects demanding their attention.

Post-accident inspection of DG1

It was observed, post-failure, that DG1's cylinder 5 and cylinder 6 pistons had fractured and released their connecting rods from the piston gudgeon pins and the big ends had detached from the crankshaft. The loose connecting rods had punched through their respective sides of the crankcase **(Figure 2)**. The cylinder 5 and cylinder 6 pistons remained in their cylinder liners. The remains of the small end and big end bearings were found in the crankcase; all were found in a high state of degradation and were heat affected. Other detached parts included crankshaft counterweights and lower sections of the pistons, and both gudgeon pins were found in the crankcase.

Images courtesy of MAIB and *Kommandor Susan* 2/E

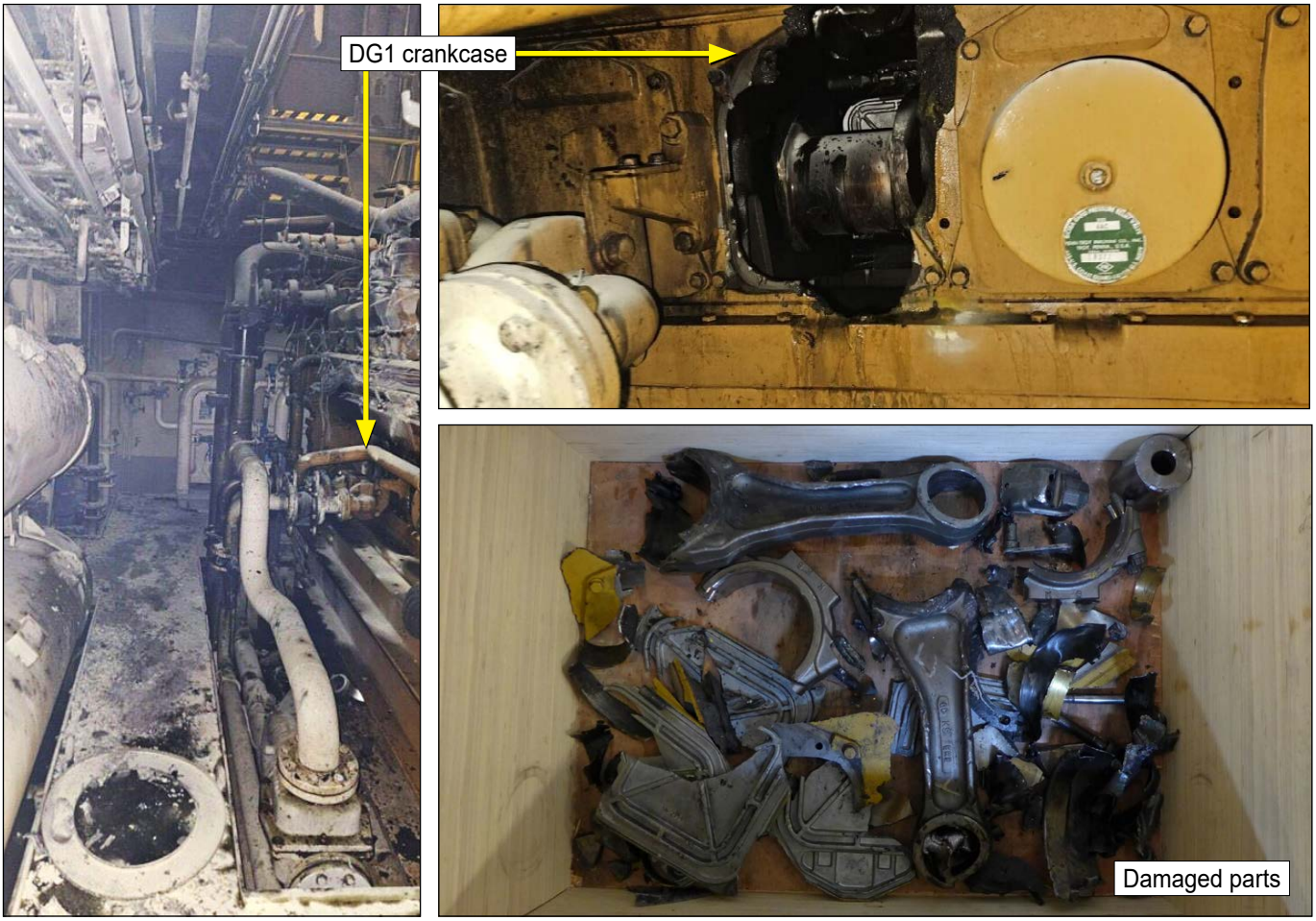

Figure 2: Damage to DG1

[1] Holderness Ship Repairers Limited ceased trading in November 2024.

[2] G&T Engineering Limited ceased trading in February 2023.

The failed DG1 was removed from *Kommandor Susan* and transported to a Caterpillar authorised agent, Pon Power, in Papendrecht, the Netherlands. Pon Power technicians stripped the engine into its component parts for detailed inspection. The technicians found that many of the major components of the rotating assembly were not original equipment manufacturer (OEM) parts. The non-OEM parts identified in DG1 were manufactured by Costex Tractor Parts (CTP).

The USA-based CTP stated on its website that it provided *New Replacement Parts for Caterpillar*. CTP was not listed as an authorised dealer on Caterpillar's official dealer locator. The DG1 components identified as CTP parts included pistons, connecting rods, small end and big end bearings, and main bearings.

The Pon Power technicians compared a CTP big end bearing found in DG1 and a genuine OEM big end bearing and identified that the white metal surface of the OEM big end bearing had an aluminium backing layer, while the white metal surface of the CTP big end bearing had a copper backing layer **(Figure 3)**.

Image courtesy of Pon Power

Figure 3: Comparison between genuine OEM (left) and CTP bottom end bearings (right)

Pon Power produced a report on its findings that stated the *most likely order of events* to be:

- *Run out of connecting rod bearing five*
- *Bearing hammered thin*
- *Connecting rod cap number five breaks at a normal stress raiser*
- *Connecting rod number five damages counterweight five and bottom of liner five and six*
- *Counterweight five comes loose and falls into the oil pan*
- *Piston number 6 gets stuck due to the damaged liner*
- *Connecting rod bolts break by overload and connecting rod cap number six comes off.*

Pon Power's report concluded that:

> *With the facts gathered the most likely root cause is failure of connecting rod bearing number five. The excessive wear on the other connecting rod bearings show that the most likely root cause for the bearing failure is weak bonding of the copper layer.*

Evidence of weak material bonding was found in several bearings **(Figure 4)**.

Image courtesy of Pon Power

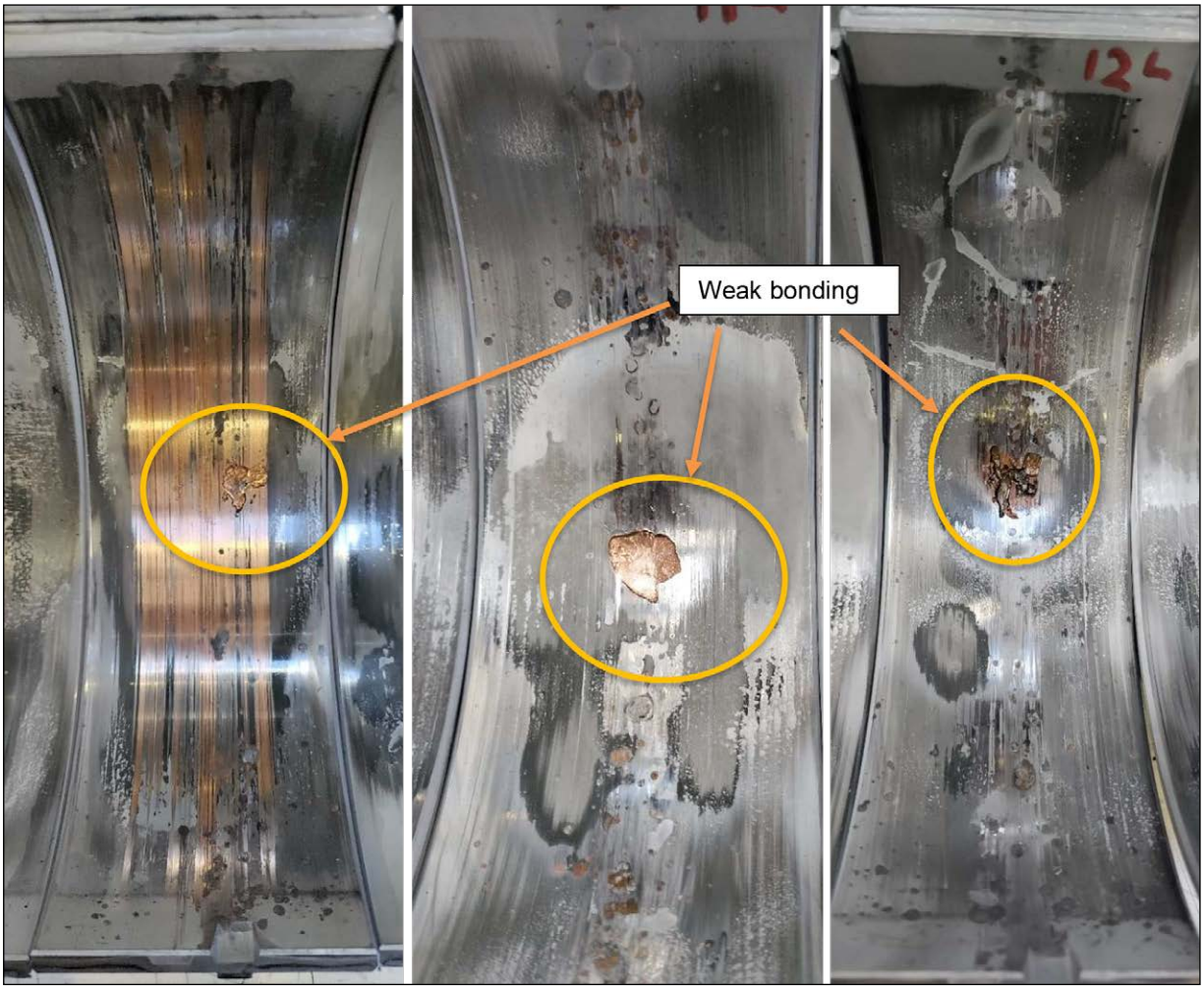

Figure 4: Evidence of weak material bonding on several bottom end bearings

The report made two recommendations:

- *Make use of original Caterpillar parts as service interval schedules are only applicable for these parts. Non-Caterpillar parts used in the engine tent to have a shorter service life.* [sic]
- *Check the use of non-Caterpillar bearings in the other engines on the vessel. If so, plan a early change of the main and connecting rod bearings.* [sic]

Parts approval process

The approval process for a ship's engine parts involved several steps to ensure compliance with safety and performance standards. Classification societies required manufacturers to submit detailed documentation, including their manufacturing process descriptions, quality control measures, and test results. Typically, there were four steps:

1. Application submission – manufacturers to provide technical specifications, factory layout drawings, and quality control procedures.

2. Testing and inspection – classification societies to conduct inspections and tests to verify compliance with industry standards.

3. Certification and approval – issued if the parts met the required standards.

4. Regular renewal and compliance checks – to ensure continued regulatory compliance.

The investigation found no evidence that CTP manufactured parts had been class approved by any marine classification societies.

REGULATION AND GUIDANCE

Emissions of nitrogen oxides (NO_x) from marine diesel engines were regulated under the International Convention for the Prevention of Pollution from Ships (MARPOL Convention)[3] Annex VI[4], Regulation 13, which applied to all engines over 130kW. Compliance was achieved through certification under the NO_x Technical Code[5] 2008 and required an Engine International Air Pollution Prevention (EIAPP) certificate and ongoing in-service verification. This verification was usually in the form of a NO_x file that recorded all NO_x-emitting components and documented post-maintenance and post-overhaul updates.

The NO_x limits were defined within a set of tiered emission standards based on the ship's construction date and engine speed, with the earliest compliance applicable to vessels constructed on or after 1 January 2000.

Kommandor Susan was built in 1999, so was not required to comply with the MARPOL Convention Annex VI, Regulation 13 on NO_x limits. This meant that no NO_x file existed, which would have tracked compliant components and spare parts.

Previous accidents

At 2003 on 16 April 2018, the Lithuania registered roll-on/roll-off (ro-ro) cargo vessel *Finlandia Seaways* suffered a catastrophic main engine failure that caused serious structural damage to the engine and a fire in the engine room (MAIB report 2/2021[6]). The vessel's third engineer suffered serious smoke-related lung, kidney and eye injuries during their escape. The investigation identified that non-OEM maintenance techniques introduced latent defects, which led to engine failure.

At 2013 on 19 September 2021, a fire broke out in the auxiliary engine room on the Finland registered ro-ro cargo ship *Finnmaster* during departure from Hull, England (MAIB report 13/2025[7]). *Finnmaster* lost power, but the fire was later extinguished and the vessel safely re-berthed with the assistance of tugs. The auxiliary engine room was significantly damaged, but there were no injuries. The flexible hose installed in the fuel system during a modification did not meet the required standard, was fitted in an inappropriate position, and had not been subject to approval or oversight by the responsible classification society.

ANALYSIS

Overview

The catastrophic engine failure fire on board *Kommandor Susan* occurred when DG1 suffered a mechanical breakdown, leading to a fire in the engine room and a complete blackout. Emergency response procedures were followed, all crew were accounted for, and the fire was successfully extinguished. However, the vessel lost propulsion and drifted until limited propulsion was restored and tug assistance arrived. *Kommandor Susan* eventually returned to Leith harbour.

[3] The MARPOL Convention was adopted on 2 November 1973 at the International Maritime Organization.

[4] Prevention of Air Pollution from Ships (entered into force 19 May 2005).

[5] Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines.

[6] MAIB report 2/2021: Finlandia Seaways

[7] MAIB report 13/2025: Finnmaster

Engineering oversight

Hays Ships had overseen major engine overhauls during its ownership of *Kommandor Susan*. The company expected that Holderness would use genuine Caterpillar parts for these overhauls based on a long-standing relationship and mutual trust. Coupled with competing priorities during the vessel's conversion project, this resulted in Hays Ships providing minimal oversight to Holderness and no verification of authenticity for the parts used, enabling the installation of non-OEM components that later contributed to the engine failure.

Similar to the lack of oversight highlighted in both the *Finlandia Seaways* and *Finnmaster* cases, the lack of structured supervision and verification during *Kommandor Susan*'s main engine overhaul process meant that Hays Ships was unaware that non-OEM parts had been used. This oversight created a latent risk that was not communicated to Gardline when it later purchased the vessel.

Since no NO_x file was required for *Kommandor Susan* and Hays Ships was not directly supervising the work, there was no control of the suitability of parts used in the vessel's engine overhauls.

The failure to implement robust contractor assurance measures allowed critical safety vulnerabilities to persist undetected, ultimately leading to DG1's catastrophic failure.

Bearing failure

Post-failure inspection revealed that non-OEM bearings manufactured by CTP were fitted during the overhaul. These bearings had a copper backing layer instead of the aluminium layer found in genuine Caterpillar bearings; weaker bonding of these layers reduced durability.

The extended service interval agreed by Caterpillar was approved on the basis that genuine parts were used. The CTP parts were designed for a standard service interval. Use of the CTP parts beyond their design life led the connecting rod bearings to fail, initiating a chain of mechanical failures that culminated in the engine failure and subsequent fire. The extended service intervals were inappropriate for these substitute components, accelerating the risk of failure.

Anchoring

The crew attempted to deploy the anchors to arrest the vessel's drift when propulsion was lost. However, both anchors were clutched into their electric motors and could not be released without power. Industry good practice is to have anchors cleared away and ready to drop when navigating in pilotage conditions, and any procedural oversight posed a significant safety hazard during emergencies involving total power loss.

The inability to anchor increased *Kommandor Susan*'s vulnerability to environmental conditions, grounding and collision risks until tug assistance arrived.

CONCLUSIONS

- The catastrophic failure of *Kommandor Susan*'s DG1 engine and resultant engine room fire was caused by the premature wear of non-OEM components, fitted without Hays Ships' knowledge during the engine's last major overhaul.
- The agreed extended service intervals were inappropriate when non-OEM components were in use, accelerating the risk of failure.
- Hays Ships exercised limited oversight of the contractors performing the engine overhauls. The company was therefore unaware that non-OEM parts had been used, and unable to adequately determine the risk of failure or inform the vessel's new owner that non-OEM parts were fitted in the engines.

- The failure to implement robust contractor assurance measures allowed critical safety vulnerabilities to persist undetected, ultimately leading to the catastrophic engine failure.
- The inability to anchor increased *Kommandor Susan*'s vulnerability to environmental conditions, grounding and collision risks until tug assistance arrived. *Kommandor Susan*'s onboard procedure for emergency anchoring did not identify the risk of having the winch drum permanently clutched in.

ACTIONS TAKEN

MAIB actions

The Chief Inspector of Marine Accidents has written to Hays Ships Limited, outlining the importance of robust oversight during critical maintenance activities and the need to adopt a system of structured supervision, ensuring clear accountability and real-time progress monitoring.

Actions taken by other organisations

Gardline Shipping Limited has:

- Rebuilt DG1 with genuine spares, including a new engine block;
- Completed major overhauls of DG2, DG3 and DG4 using genuine Caterpillar parts;
- Changed the onboard anchoring procedure, highlighting that clutches must remain disengaged when the winches are not in use to ensure they remain ready for use in the event of power failure.

RECOMMENDATIONS

In view of the actions already taken, no recommendations have been made.

SHIP PARTICULARS	
Vessel's name	*Kommandor Susan*
Flag	UK
Classification society	Det Norske Veritas
IMO number/fishing numbers	9177844
Type	Site investigation vessel
Registered owner	Gardline Shipping Limited
Manager(s)	Gardline Shipping Limited
Year of build	1999
Construction	Steel
Length overall	83.7m
Registered length	75.36m
Gross tonnage	3,388
Minimum safe manning	10
Authorised cargo	Not applicable

VOYAGE PARTICULARS	
Port of departure	Leith, Scotland
Port of arrival	Leith, Scotland
Type of voyage	Sea trial
Cargo information	Not applicable
Manning	14

MARINE CASUALTY INFORMATION	
Date and time	25 January 2025 at 1305
Type of marine casualty or incident	Serious Marine Casualty
Location of incident	The Firth of Forth, Scotland
Place on board	Engine room
Injuries/fatalities	None
Damage/environmental impact	Substantial damage to diesel generator
Ship operation	Sea trials
Voyage segment	Departure
External & internal environment	Wind south-westerly force 5 to force 6; mostly dry; good visibility
Persons on board	14