Norwegian Safety Investigation Authority

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REPORT MARINE 2022/10

Fall overboard from the cargo ship 'MV Titran' east of Stigen in Lurøy municipality on 6 March 2022

The Norwegian Safety Investigation Authority (NSIA) has produced this report exclusively for the purpose of improving safety at sea.

A safety investigation is conducted in order to determine the sequence of events and causal factors, study factors of importance for preventing marine accidents and improving safety at sea, and publish a report and any safety recommendations. It is not the NSIA's task to apportion blame or liability under criminal or civil law.

This report should not be used for purposes other than preventive maritime safety work.

Photo: Berge Rederi AS

This report has been translated into English and published by the NSIA to facilitate access by international readers. As accurate as the translation might be, the original Norwegian text takes precedence as the report for reference.

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Notification of the incident

On Sunday 6 March 2022, media reports made the Norwegian Safety Investigation Authority (NSIA) aware of a man overboard (MOB) accident involving the cargo ship ‘MV Titran’ that had taken place east of Stigen in Lurøy municipality. The rescue services were notified and a search operation was initiated that involved several vessels, a helicopter and people searching from shore. The missing person is presumed dead.

The NSIA initiated a safety investigation and travelled to Halsa on 7 March 2022 to interview the crew, obtain information and perform an onboard inspection.

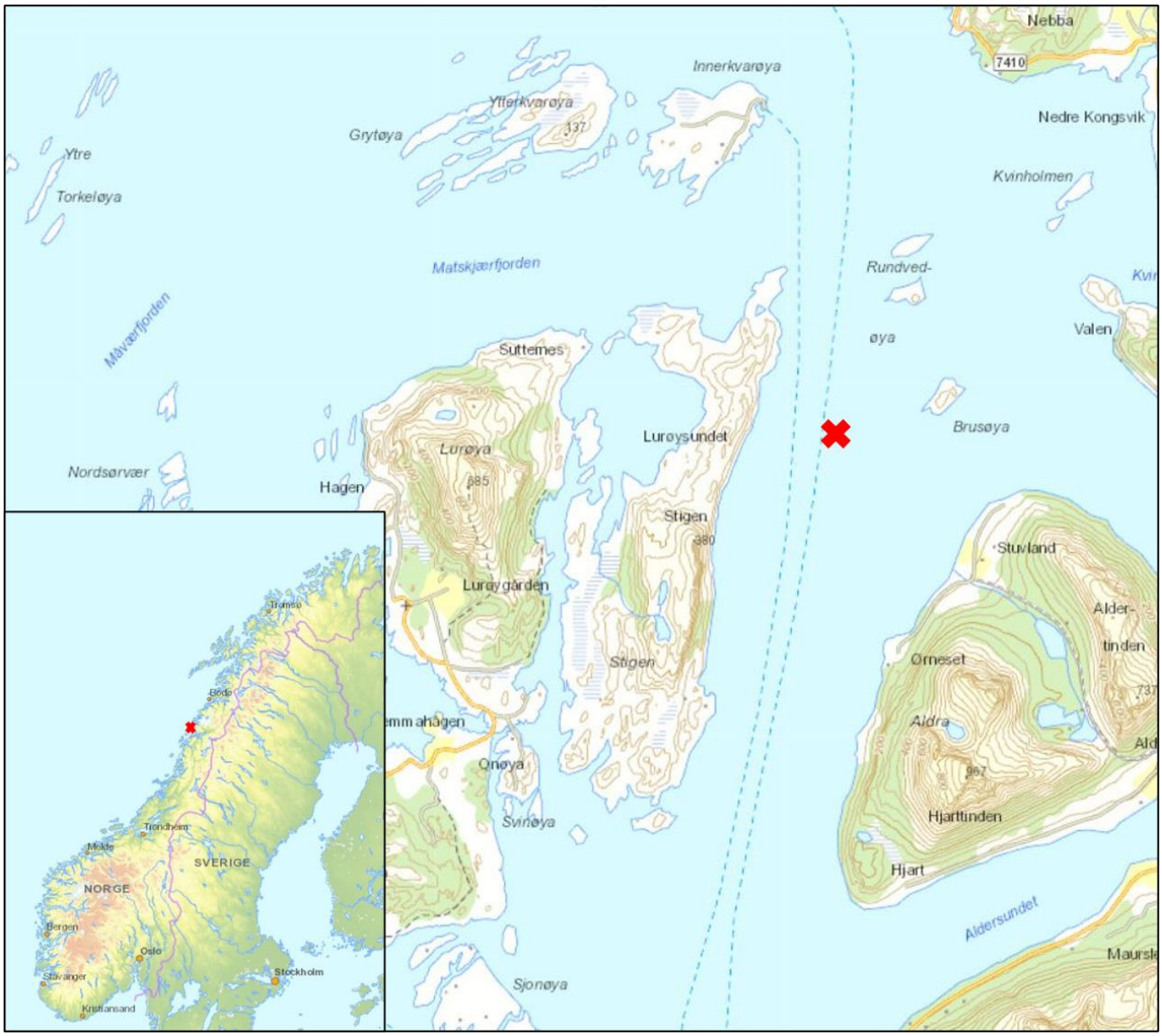

Figure 1: The red cross indicates where the accident occurred. Map: NSIA/Norwegian Coastal Administration

Summary

On Sunday 6 March, the cargo ship ‘MV Titran’ was en route to Halsa in Meløy municipality to unload fishmeal at a factory. The deck crew were in the process of readying the cargo hatches by removing wedges and other sea fastening equipment on the hatch deck. A member of the deck crew fell overboard as he was moving from the hatch deck down to the main deck. None of the other crew members witnessed the incident, and it consequently took about 20 minutes before they realised that the deck cadet was missing.

Shortly after it was discovered that the cadet was missing, the rescue services were notified, and the captain turned the vessel. Due to uncertainty about when the cadet fell overboard, the search area was initially set too far north. After approximately two hours, the correct time was determined using the ship’s CCTV footage, and vessels were deployed to search further south where the cadet had fallen overboard. A coverall and protective shoes were found, but not the missing person.

Preparing for unloading was considered a routine operation by the crew and shipping company, and they had therefore not considered or identified any risk reduction measures relating to this type of operation. No special safety measures had been introduced to prevent crew members falling overboard from the hatch deck, nor had sufficient measures been taken to reduce the consequences of falling into the sea.

The risk associated with routine tasks becomes normalised in the individual over time, resulting in the risk gradually being ignored or not perceived. Shipping companies and other stakeholders must therefore consider the need for risk assessments and safe job analyses in all areas of operation that may entail risk, including those defined as routine operations.

The vessel had no physical safety barriers against falling overboard from the hatch deck, only railings on the main deck along the cargo hatches. The NSIA considers that the way the deck was designed, with a short distance from the outer edge of the hatch deck to the railings at a considerably lower level, was inexpedient in relation to the work to be performed, and that it entailed a risk of falling overboard. However, this is not an unusual design for this type of ship.

As the crew did not witness the missing person fall overboard, it was impossible for them to estimate the exact time of the incident. The NSIA believes it is essential for the crew of a vessel to clearly communicate any uncertainty about when a person fell overboard to the rescue services, so that the search area can be defined accordingly.

The shipping company has implemented several measures to help to improve safety since the accident.

About the investigation

Purpose and method

The NSIA has classified the incident as very serious based on the definition in the Maritime Code. The purpose of this investigation has been to clarify what caused a cadet to fall overboard in connection with work on hatch deck. The NSIA has also considered what can be done to improve safety and prevent the recurrence of similar accidents and consequences in future.

The accident and the circumstances surrounding it have been investigated and analysed in line with the NSIA's framework and analysis process for systematic safety investigations (the NSIA method[1]).

Sources of information

The factual information is based on interviews with the crew and with representatives of the shipping company. In addition, the NSIA has been given access to documentation from the shipping company's management system, the police investigation documents, the Joint Rescue Coordination Centre's log and documentation from the Norwegian Maritime Authority (NMA).

The investigation report

The first part of the report, 'Factual information', describes the sequence of events, related data and information gathered in connection with the accident, what the NSIA has investigated and related findings.

The second part, the 'Analysis' part, contains the NSIA's assessment of the sequence of events and contributing causes, based on factual information and completed investigations/examinations. Circumstances and factors found to be of little relevance to explaining and understanding the accident are not discussed in any depth.

The NSIA's conclusions are described at the end of the report.

[1] *See https://www.nsia.no/About-us/Methodology*

1. Factual information

1. Factual information

1.1 Sequence of events

1.1.1 THE ACCIDENT

On Thursday 4 March, the cargo carrier 'MV Titran' left the port of Florø, setting course for Halsa in Meløy municipality to unload fishmeal at one of Ewos's factories. On Sunday 6 March, as the vessel started nearing Halsa, the deck crew started routine preparations for unloading cargo on arrival. The vessel was passing through inshore waters, and the wind and wave conditions were calm; see Figure 2.

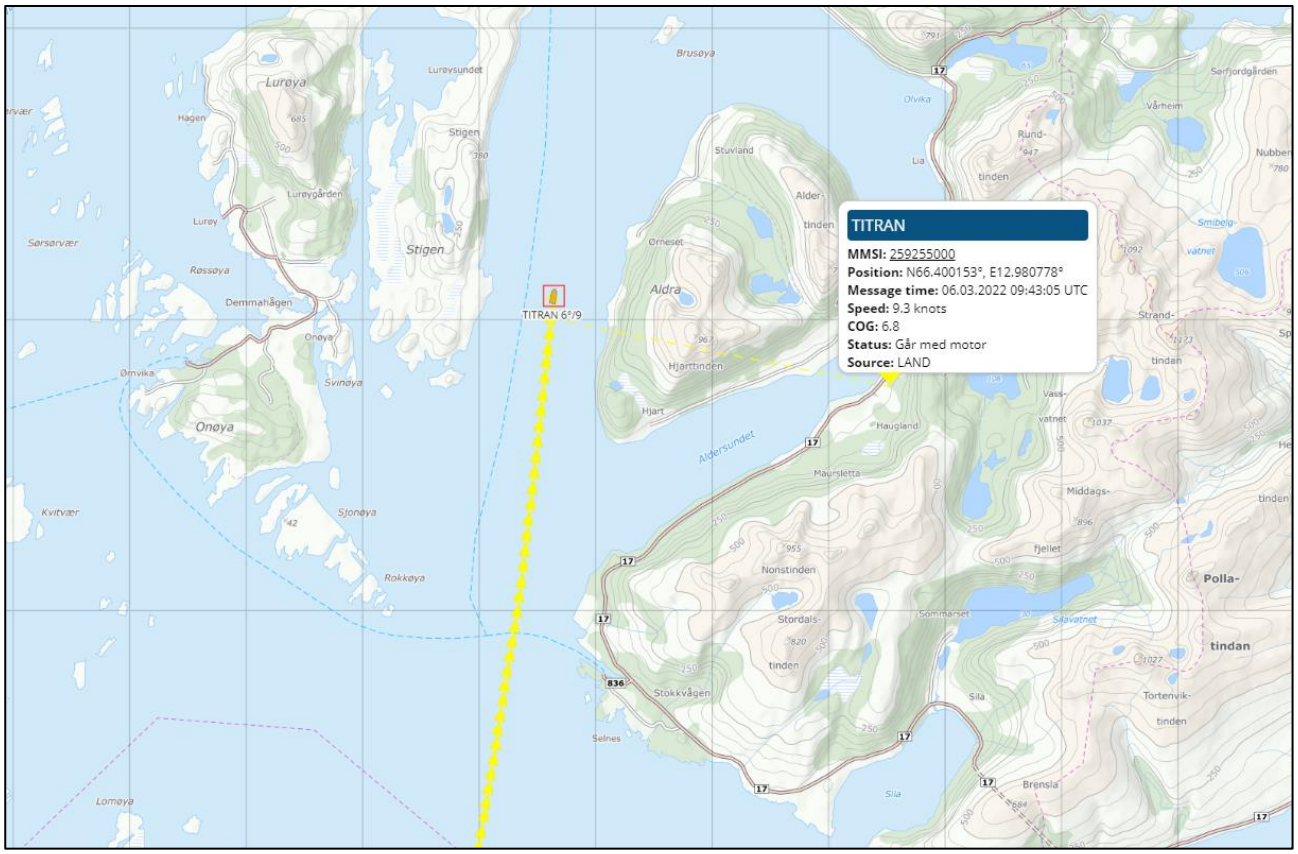

Figure 2: 'MV Titran' sailing north towards Halsa. Map: The Norwegian Coastal Administration

At 10:43, three members of the deck crew went to the port side together to commence the work. The photo in Figure 3 shows the cargo hatches, the passageway on the main deck alongside the cargo hatches, and the excavator on the aft deck section, among other things.

Figure 3: Passageway along the main deck and cargo hatches. Photo: Berge Rederi AS.Illustration: The NSIA

At approximately 10:57, one of the able seamen moved along the passageway on the starboard side of the main deck to start loosening cleats. The cleats holding the aft hatches had already been loosened earlier that morning, on both the starboard and port side. Around the same time, another able seaman and the deck cadet (hereafter referred to as the cadet) started loosening the sea fastening for the excavator.

The cadet loosened the port strap which was attached to the excavator bucket and placed it on the hatch deck. He then moved towards the port side, intending to climb down to deck level by cargo hatch 8; see Figure 4 and Figure 5. A CCTV[2] recording from the ship shows that the cadet first climbed down onto the rail track, placing his right arm on the hatch deck for support. He then brought his left foot down, closer to the railings, but his foot slipped and he fell across the railings and overboard at approximately 11:00. None of the crew witnessed the fall. One of the able seamen was behind the excavator, and the other was on the starboard side of the main deck loosening cleats by hatch 4.

[2] *Closed-circuit television.*

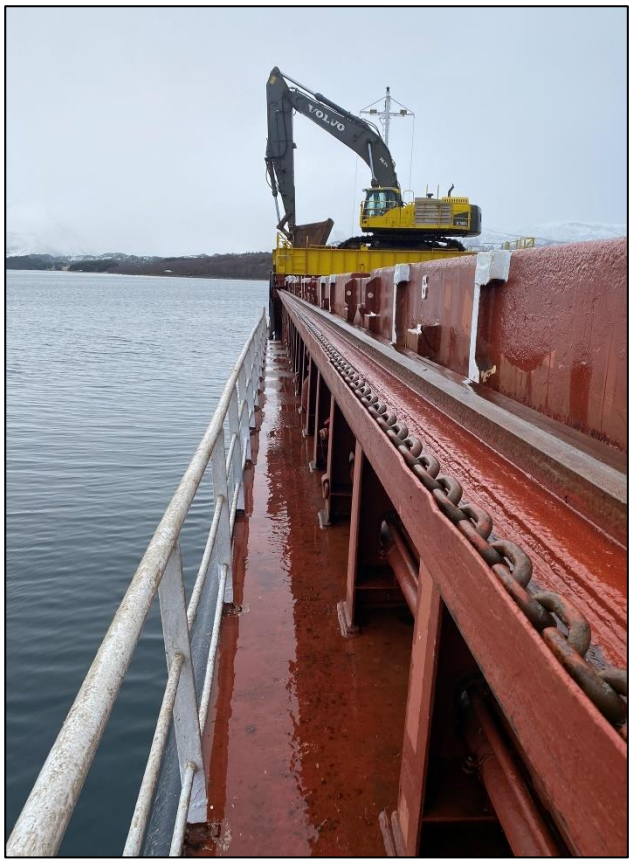

Figure 4: Passageway on the main deck along the cargo hatches. Photo: NSIA

Figure 5: Rail track along the cargo hatches. Photo: NSIA

About 30 seconds after the cadet fell overboard, the able seaman who was behind the excavator came out onto the hatch deck, but he did not immediately notice that the cadet was missing. Approximately one minute after the fall, the able seamen who had been opening cleats on the starboard side crossed the hatch deck in the direction of hatch 8. The two of them continued the work of unfastening the remaining sea fastening around the excavator and bucket. At approximately 11:05, the excavator was started to help loosen its sea fastening, before the bucket was lowered to the hatch deck again at 11:10. At that time, one of the able seamen had started to loosen the wedges on top of the hatch deck.

At 11:12, the able seaman who had been operating the excavator walked around the hatch deck where the cadet had been working. He then approached the other able seaman, who was working a little further forward on deck, and asked him if he had seen the cadet, which he had not. The able seaman climbed down onto the main deck by hatch 6, in the same way as the cadet, and proceeded aft to check whether the cadet might have gone inside. The able seaman became concerned as it was unusual to leave the deck with a job half done without letting anybody know. The able seaman checked in several places in the ship and asked several of the crew, but nobody had seen the cadet.

He then reported to the captain that they could not find the cadet. Some of the crew were instructed to watch the water, while others continued to search on board the vessel.

At 11:22, the captain made a sharp turn to port, turning the vessel 180 degrees; see Figure 6. The captain then ordered the chief mate and deck officer to ready the MOB boat, so that it could be lowered quickly should the need arise.

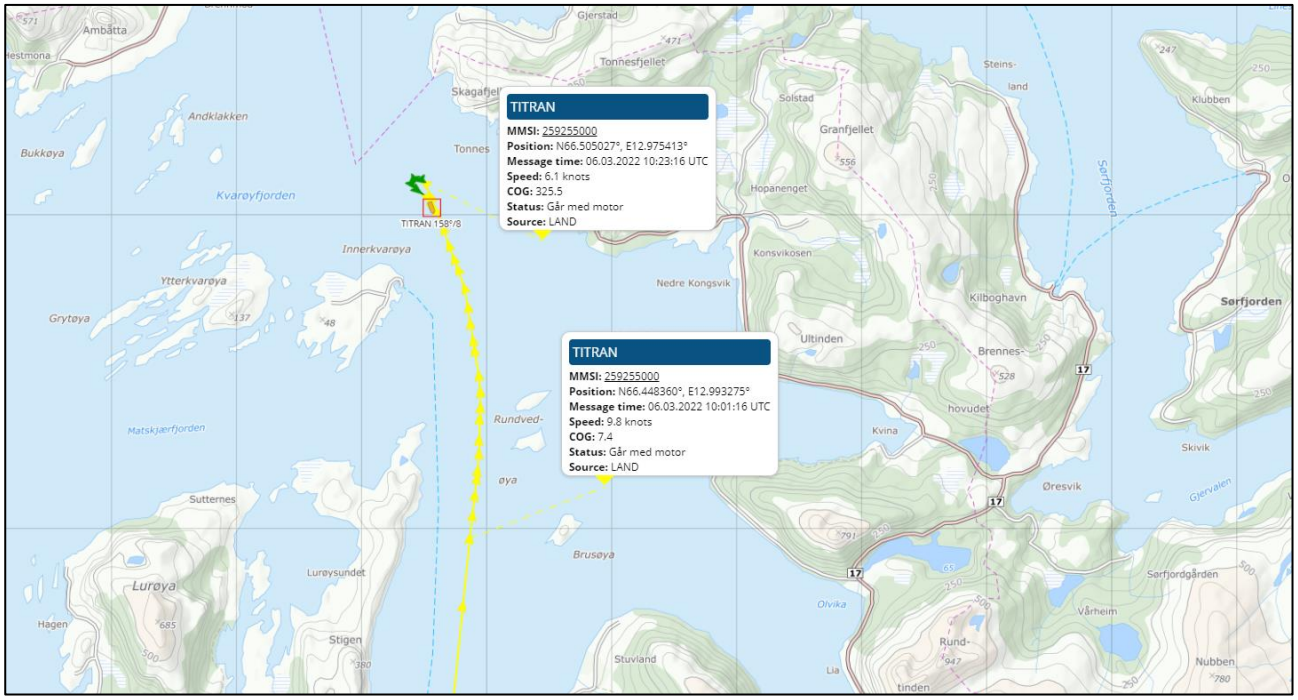

Figure 6: The ship's position when the missing person fell overboard at approximately 11:00 and when the ship turned at 11:23. Map: The Norwegian Coastal Administration

According to the deck log, the captain notified the Norwegian Coastal Radio North (KRN) of a man overboard accident at 11:30. The radio station then transmitted a 'mayday relay'.

1.1.2 SEARCH OPERATION

When they realised what had happened, the captain woke up the chief mate. They discussed when the cadet might have fallen overboard, and estimated that it must have happened a few minutes before the captain had been notified by the able seaman. Hence they assumed that the cadet had fallen overboard at approximately 11:20.

At 11:32, the coastal radio station (KRN) notified the Joint Rescue Coordination Centre Northern Norway (JRCC-N) of the accident. Several vessels in the area reported that they were available to assist in the search operation. At 11:37, KRN contacted 'MV Titran' and asked how long it had been since they saw the missing person. It was stated to be 10 minutes ago. At 11:40, KRN contacted 'MV Titran' again for more specific information about when the missing person had last been seen on board, which was then said to be at 11:20, one minute later corrected to no more than 20 minutes ago. The JRCC-N then requested that other vessels and the SAR helicopter (Sea King) search the area north and east of the island *Innerkvarøya*, the area the vessel had passed through at that time. A search from shore was also initiated. The rescue helicopter reported starting the search at 12:15.

At 12:30, JRCC contacted 'MV Titran'. The crew still stated 11:20 as the time of the last observation, and that, around that time, they were approximately abreast of the beacon on Indre Kvarøy.

At 13:09, the ship was informed by the shipping company that the CCTV images from the vessel showed that the cadet fell overboard at 11:00, which was 20 minutes earlier than previously assumed. This meant that the MOB position had to be updated, and the search area shifted further south.

Nearby vessels started searching for the cadet at around 11:40. They were searching an area based on the vessel's position when the crew believed the cadet had fallen overboard. It later

emerged that the cadet had fallen overboard further south, and the vessels changed their search area at approximately 13:15; see Figure 7.

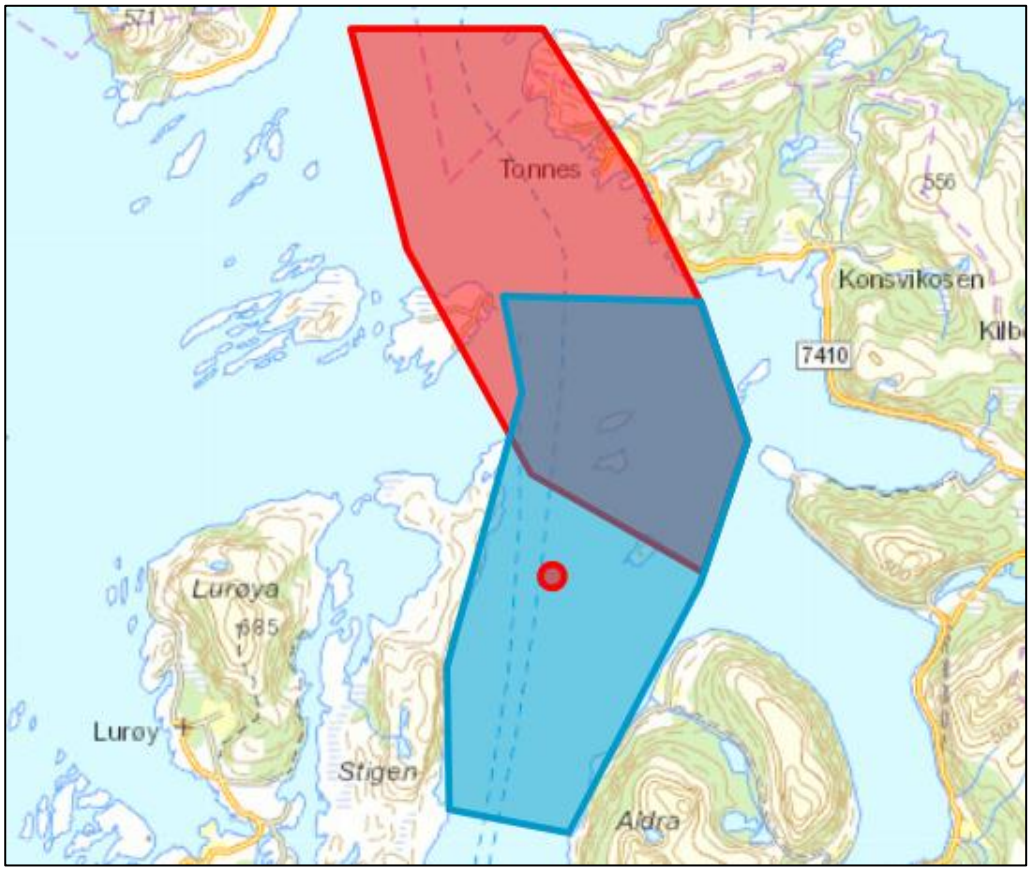

Figure 7: The search started in the area marked in red and was later moved to the area marked in blue based on new information about where the accident occurred. The red dot shows where the cadet fell overboard. Map: NCA/NSIA

At 13:55, the rescue helicopter concluded its search operation and returned to Bodø.

At 14:56, the rescue vessel 'Hans Herman Horn' reported finding a shoe. Approximately 20 minutes later, it was confirmed that the shoe belonged to the missing person. The search continued until 16:30. It was then decided to reduce the search efforts at sea, while the search from shore would continue until 18:00.

At 16:52, 'MV Titran' reported a possible observation of the missing person to the aft of the ship. Accordingly, the rescue vessel 'Hans Herman Horn' went to check this out. At the same time, 'MV Titran' lowered her MOB boat to approach the place where the observation was made, but was unable to locate it. At 17:54, 'Hans Herman Horn' reported finding a red coverall, but the missing person was not found. Shortly afterwards, it was confirmed that the coverall belonged to the cadet. Figure 8 shows where the coverall and shoe were found. Figure 8 also shows the MOB position based on the vessel's AIS track at 11:00.

Figure 8: MOB position and position in which the missing person's coverall and shoe were found. Map: Norwegian Coastal Administration/NSIA

The search was called off at 18:21, and at 19:00 it was decided to switch to the search phase for a person missing presumed dead (SEAO).

1.2 Weather and sea conditions

Weather data retrieved from the website yr.no show an air temperature of approximately 4–5°C, little precipitation and a gentle north-westerly breeze (approx. 5 m/s) at the nearest weather station around the time of the accident. The strongest wind speed recorded was approximately 12 m/s. The sea temperature in the area was around 4–5°C. The crew observed the weather conditions to be calm.

1.3 Description of waters

The accident occurred in the Stigfjord between the islands of Aldra to the east and Stigen to the west, in Lurøy municipality. The distance to shore from where the cadet fell overboard was approximately 1,200 metres to the west (Stigen) and 1,400 metres to the east (Brusøya island).

1.4 Vessel

1.4.1 GENERAL INFORMATION

'MV Titran' is registered in the Norwegian International Ship Register (NIS). The vessel is a self-unloading cargo ship carrying bulk cargo such as flour, fishmeal, gluten etc. Details of the vessel are shown in Table 1.

Table 1: Vessel data

Name of ship	**'MV Titran'**
Maximum length	89.90 metres
Breadth	13.17 metres
Moulded depth	7.15 metres
Gross tonnage	2,744
Net tonnage	1,590
Build year	1996

1.4.2 DECK DESIGN

The hatch deck consisted of a total of 10 cargo hatches covering the cargo hold, which had a total length of more than 63 metres. The hatches were secured by cleats installed under the rail track, and by wedges between each hatch. These had to be opened and closed manually; see Figure 9 and Figure 10.

Figure 9: Cleat placed under the rail track to secure the cargo hatches to the coaming. Photo: NSIA

Figure 10: Wedges (see red circle) that ensure that each cargo hatch is fastened to the adjacent hatch. The chain was used to fasten the bucket to the excavator. Photo: NSIA

Figure 11: The main deck relative to the hatch deck. Photo: NSIA

The level of the hatch deck was 45 cm above the rail track, and from the track there was another 144 cm down to the main deck, where it was possible to walk along the hatch coaming; see Figure 12 and Figure 11. The 110 cm railings were intended as a safety barrier against falling overboard. There were ladders forward and aft for access from the main deck to the hatch deck.

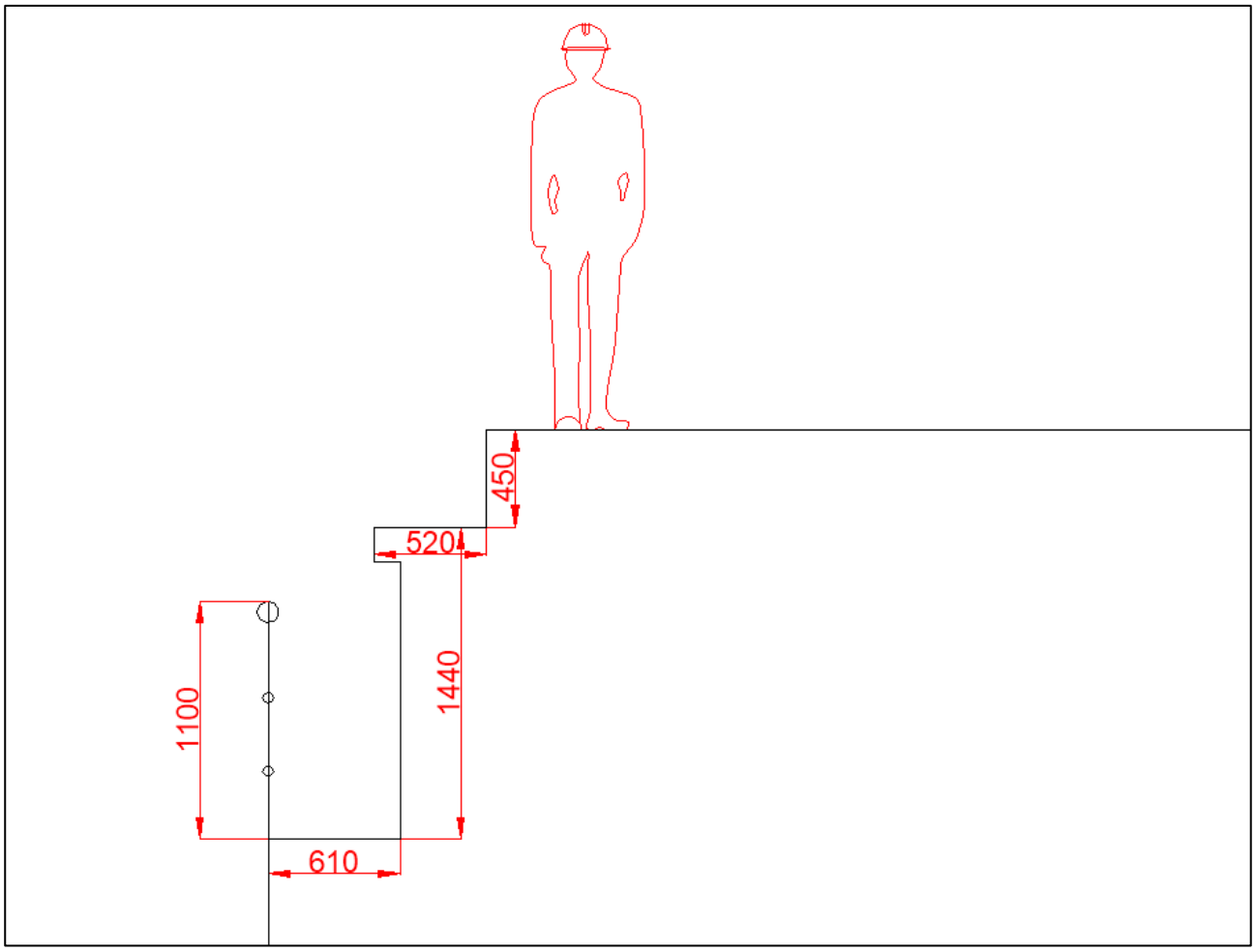

Figure 12: Cross section of the deck design, with measurements in mm. The person in the illustration is standing on top of the hatch deck. Illustration: NSIA

1.5 Operating conditions

1.5.1 WORK ON THE HATCH DECK

When departing from the quay, the cargo hatches were secured to the hatch coaming, and each hatch was fastened to the adjacent hatch with wedges. The cleats were fastened from the passageway on the main deck (see Figure 9), while the wedges were inserted from the hatch deck (see Figure 10). Sea fastening was also provided for the excavator in that the trolley it was placed on was secured by safety bolts, and the bucket was secured by a chain to the hatch coaming. The sea fastening had to be loosened before the vessel could be unloaded. In calm sea conditions and good weather, this could be done before the vessel arrived in port. If work on deck was not considered safe, the crew waited until arriving in port.

It has emerged from interviews with the crew that it was not uncommon for the crew to access and leave the hatch deck using the rail track and railings instead of the dedicated ladders. Some of the crew have stated that they considered this slightly risky, but that they resolved the situation by moving carefully up and down. At the time of the accident, there were no procedures in the safety management system that addressed sea fastening work on the hatch deck. As sea fastening was considered a routine operation, no need for carrying out special risk assessment had been identified.

1.6 Crew

The vessel had a crew of nine: the captain, chief mate, chief engineer, greaser, deck officer, cook, two able seamen and a deck cadet.

At the time of the accident, the captain was on the bridge and two able seamen were on deck, in addition to the cadet. The remaining crew members were elsewhere on the vessel.

The cadet was wearing warm coveralls without flotation elements, as well as protective footwear and a hardhat. None of the deck crew were wearing a buoyancy vest, nor were they required to.

The duties of the able seamen and the cadet typically included maintenance work on deck, preparation for mooring, loading and unloading, and sea fastening of the cargo hatches, excavator and other equipment. At the time of the accident, the cadet had been on board for five months and had one month left.

1.7 Medical and health information

1.7.1 HEALTH INFORMATION

No medical or health information has emerged about the missing person that is considered relevant to the accident.

1.7.2 SURVIVABILITY

The special report on recreational craft accidents (Marine 2019/02) included an assessment of the chances of survival after falling overboard. It showed that, when people fall into the water, there will always be a risk of cold water shock that can lead to rapid drowning. The chances of survival after falling into the sea depend on factors such as clothing, water temperature and wave height. The cold water shock causes increased heart rate, increased breathing rate and gasping for air. The ability to hold your breath is significantly impaired, and the increased breathing rate increases the risk of inhaling water. Susceptible persons are also at risk of being taken ill when falling into cold water. For example, people with cardiopulmonary diseases will be at risk of acute cardiac arrest.

Generally speaking, a wind force of more than 5 on the Beaufort wind force scale (fresh breeze, 8–10.7 m/s) is considered sufficient to cause waves to break,[3] which will make it more difficult to keep the airways clear of water and avoid drowning. The estimated survival time in water at different temperatures, wind forces and with different clothing is indicated in Figure 13.

[3] *Review of probable survival times for immersion in the North Sea (Robertson & Simpson, 1996).*

CLOTHING ASSEMBLY (WORN WITH LIFEJACKET)	BEAUFORT WIND FORCE	TIMESCALE WITHIN WHICH THE 'STANDARD MAN' IS LIKELY TO SUCCUMB TO DROWNING	
		WINTER (WATER TEMP 5°C)	SUMMER (WATER TEMP 13°C)
WORKING CLOTHES (NO IMMERSION SUIT)	0-2	within 3/4 hour	within 1 1/4 hours
	3-4	within 1/2 an hour	within 1/2 hours
	5 and above	within significantly less than 1/2 an hour	within significantly less than 1/2 hours
DRY MEMBRANE SUIT WORN OVER WORKING CLOTHES - NO LEAKAGE INTO SUIT	0-2	within 2 hours	> 3 hours
	3-4	within 1 hour	within 2 3/4 hours
	5 and above	within significantly less than 1 hour	within significantly less than 2 3/4 hours
MEMBRANE SUIT WORN OVER WORKING CLOTHES WITH 1 LITRE LEAKAGE INSIDE SUIT	0-2	within 1 1/4 hours	within 2 1/2 hours
	3-4	within 1/2 an hour	within 1 hour
	5 and above	within significantly less than 1/2 an hour	within significantly less than 1 hour
DRY INSULATED SUIT WORN OVER WORKING CLOTHES - NO LEAKAGE INTO SUIT	0-2	> 3 hours*	> 3 hours *
	3-4	> 3 hours	> 3 hours*
	5 and above	⩾ 3 hours	> 3 hours
INSULATED SUIT WORN OVER WORKING CLOTHES 1 LITRE LEAKAGE INSIDE SUIT	0-2	> 3 hours	> 3 hours*
	3-4	within 2 3/4 hours	> 3 hours*
	5 and above	within significantly less than 2 3/4 hours May well exceed 1 hour	> 3 hours*

Figure 13: Estimated survival time in water at different temperatures, different wind forces (as an indication of wave conditions) and with different clothing. The model is based on young, slim and healthy men wearing lifejackets. Source: Review of probable survival times for immersion in the North Sea (Robertson & Simpson, 1996)

1.8 Vessel owners and safety management

1.8.1 GENERAL INFORMATION

The shipping company owns ten bulk carriers between 3,700 and 8,400 dwt. All the vessels are equipped with an excavator for loading and unloading.

1.8.2 SAFETY MANAGEMENT

The shipping company had established a quality and safety management system that was designed to meet the requirements set out in Regulations of 5 September 2014 No 1191 on safety management systems for Norwegian ships and mobile offshore units. Among other things, the system was intended to ensure that the shipping company's operations met requirements relating to safety at sea, and that mandatory rules and regulations were complied with.

The safety management system was made available to the crew on board. The shipping company's safety management was required to be aligned with the ISM Code, and the captain was responsible for ensuring that the crew were familiar with the ISM Code.

1.8.2.1 Procedures for working on the hatch deck and personal protective equipment

The procedure for cargo hold operations and cleaning of cargo holds, which also included work and time spent on the hatch deck, stipulated a requirement for the crew to wear personal protective equipment. This included high-visibility workwear, gloves, a hardhat and fall protection equipment appropriate for work near the hatch coaming and other work at height.

Readying cargo hatches and the excavator for unloading was considered a routine operation and was not described as a separate work operation in the procedures in the shipping company's

safety management system. No description was therefore provided of what type of personal protective equipment was to be worn or the risks associated with work in the outer areas of the hatch deck.

After the accident, the shipping company has made several changes to procedures, including for work on the hatch deck; see section 1.12.1.

1.8.2.2 Risk assessment

The shipping company had defined a series of high-risk operations for which documented risk assessments had been carried out. A fall overboard resulting from moving between the hatch deck and the main deck was not identified as a risk in the shipping company's safety management system and was therefore not mentioned in the procedures.

After the accident, the shipping company has made several changes to procedures, including for work on the hatch deck; see section 1.12.1.

1.8.2.3 Emergency response

The management system contained an overview of different emergency drills to be carried out annually, including a man overboard (MOB) drill. The MOB drill included three different scenarios, one of which was 'man overboard at unknown time'. According to these procedures, the crew's duties in this scenario included:

- Establishing when and where the person was last seen, and, if possible, from which side of the vessel the person fell overboard.
- Turning the vessel around.
- Posting a lookout.
- Reporting the accident.

Moreover, it was specified that, in search operations with uncertain time estimates, it is of critical importance to be able to estimate where the person may have drifted and establish a systematic search area.

The procedures also specified that time is of the essence and that the chances of survival depend on the sea temperature and the person's ability to withstand the cold.

The vessel carried out drills in accordance with the ISM Code, and six MOB drills were carried out in 2021, most recently on 25 October 2021. In addition, five drills were carried out in which the MOB boat was launched, and the most recent test was conducted on 2 August 2021.

1.9 Rules and regulations

The rules and regulations of relevance to this incident are described in the sections below.

1.9.1 ACT RELATING TO SHIP SAFETY AND SECURITY

The Act of 16 February 2007 No 9 relating to ship safety and security (the Ship Safety and Security Act) describes overarching requirements of a shipping company's safety management.

Pursuant to Section 7, the shipping company shall ensure that a safety management system that can be documented and verified is established, implemented and developed in the company's organisation and on board the individual ships. The purpose is to identify and manage risks and

also to ensure compliance with requirements laid down in or pursuant to legislation or in the actual safety management system.

1.9.2 REGULATIONS ON SAFETY MANAGEMENT SYSTEM FOR NORWEGIAN SHIPS AND MOBILE OFFSHORE UNITS

The Regulations of 5 September 2014 No 1191 on a safety management system for Norwegian ships and mobile offshore units were adopted in pursuance of the Ship Safety and Security Act and implement the International Safety Management Code (ISM) in Norwegian legislation.

According to the ISM Code Part A, 1 General, section 1.2.2, the safety management objectives of the company should, inter alia:

> *1. provide for safe practices in ship operation and a safe working environment;*
>
> *2. assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards; and*
>
> *3. continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection.*

1.9.3 REGULATIONS ON THE WORKING ENVIRONMENT, HEALTH AND SAFETY OF PERSONS WORKING ON BOARD SHIP

The objective of the Regulations of 1 January 2005 No 8 concerning the working environment, health and safety of persons working on board ships is to ensure that work and off-duty time on board is arranged and organised so that the safety and physical and mental health of those working on board is ensured in accordance with the technological and social development of society.

Section 2-2 sets out a requirement for carrying out risk assessments, including that:

> *(1) Hazards on board shall be identified. When the hazard has been identified, an assessment of the risk represented by the hazard shall be made. Such risk assessment shall be made on a regular basis and:*
>
> *a. whenever new working equipment or new technology is introduced, and*
>
> *b. whenever other modifications are made to the organisation or planning of work, which may affect the health and safety of persons working on board.*
>
> *(2) The results of the risk assessment shall be documented in writing.*
>
> *(3) If a risk to the safety and health of persons working on board is identified, the necessary measures shall be taken to eliminate or reduce the hazards.*
>
> *(4) If a risk cannot be avoided in any other way, appropriate personal protective equipment shall be made available and shall be used.*
>
> *Section 3-3. Requirements for personal protective equipment*
>
> *(6) The conditions for use of personal protective equipment shall be determined on the basis of the seriousness of the risk, the special conditions of the individual worker's working condition and the protective characteristics of the equipment.*

Section 6-1. The cooperation of persons working on board

Planning and evaluation of the working environment and the implementation of necessary preventive measures shall take place in cooperation with the persons working on board.

Section 6-2. Duties of persons working on board

(1) Each individual person working on board has a duty to comply with orders and instructions, including to accept assignments, show caution and otherwise in every way cooperate to safeguard life, health and welfare in accordance with these Regulations.

(2) Any person working on board shall use the required protective equipment and otherwise cooperate to prevent accidents and health injuries.

(3) Off-duty time shall be organised so that the person working on board is rested and otherwise fit to carry out his work.

(4) If a person working on board becomes aware of defects or deficiencies which may involve a risk to life or health, he shall, unless the risk cannot be averted, notify the person responsible on board or the safety representative as soon as possible.

(5) Any person working on board has a duty to cooperate with the company, the master and other persons working on board to ensure a good and appropriate environment and to achieve the objectives laid down in these Regulations.

Section 6-3. The right of persons working on board to stop hazardous work

(1) If work, in the opinion of a person working on board, cannot continue without a risk to life or health, that work shall be stopped in accordance with section 5-7 first paragraph. The person working on board shall as soon as possible notify the master, who shall decide whether work is to continue.

(2) A person working on board who stops work as provided in the first paragraph shall not be liable for any damage or loss resulting from such stoppage.

1.9.4 INTERNATIONAL CONVENTION ON LOAD LINES (ICLL)

Regulation 25 of the Load Line Convention describes requirements for when guard rails shall be fitted to exposed parts of the freeboard and superstructure decks. The height of the bulwarks or guard rails shall be at least 1 metre.

On ‘Titran’, the hatch deck was not part of the freeboard deck, and the requirement for guard rails consequently did not apply.

1.10 Supervision of the vessel owners and vessel

The Norwegian Maritime Authority (NMA) conducted an unannounced audit of the safety management system for ‘Titran’ in July 2017. An order was issued concerning lack of documentation of the management review. The NMA issued no remarks or orders concerning lack of risk assessments relating to, *inter alia*, work on the hatch deck.

1.11 Previous incidents and accidents

1.11.1 'ØYSUND'

In report no 2018/03 on the accident on board the wellboat 'Øysund' in which a crew member fell overboard, the NSIA (then the AIBN) pointed out that no documented guidelines or procedures had been established for traffic on deck, or for the use of personal protective equipment when spending time or working on deck.

The investigation authority submitted two safety recommendations in connection with the report. The following safety recommendations are relevant to this accident:

The accident with Øysund on 16 November 2017 occurred when a person walked on the main deck in rough sea. The person most likely fell overboard as a wave broke inwardly. The investigation has shown that the wellboat company had not established documented guidelines or routines for the use of means of communication or personal safety equipment when staying or working on deck.

The Accident Investigation Board Norway recommends Sølvtrans to undertake a documented risk assessment of the dangers of traffic on the main deck and implement procedures and guidelines for this on board.

1.11.2 'HOVDEN VIKING'

In report no 2022/02 on an occupational accident on board the fishing vessel 'Hovden Viking' in which a fisherman fell overboard as he was climbing onto the railing in an attempt to release a buoy, the NSIA pointed out the following:

In this incident, the railing, which is a physical safety barrier, was used as a work tool. For the work to be carried out in the safest possible way, it is important that the shipping company focuses on the crew's understanding of risk in their work routines. They should also take into account unexpected events.

1.11.3 'MULTI VISION'

In report no 2022/05 on the accident on board the service vessel 'Multi Vision' in which a crew member fell into the water and was crushed between the vessel and a sea cage in connection with mooring of the vessel, the NSIA pointed out the following:

Arrival and mooring were considered routine jobs, and the risk of falling into the water was thus normalised. As a result, there was insufficient awareness about the risks that the operation entailed, both in the onshore organisation and among the crew on board the vessel. It is important that risk assessments are carried out for all tasks that could entail a risk and that risk reduction measures are implemented into procedures and work operations.

1.12 Implemented measures

1.12.1 VESSEL OWNERS

The shipping company has implemented several measures as a result of the accident. According to the shipping company, several of the measures have been developed in dialogue with the crews of their vessels to ensure that the measures can be implemented in operations.

- The shipping company has decided as an immediate measure that buoyancy vests must be worn when working outside and spending time on the hatch deck. In the longer term, it will be considered whether to make it a permanent solution.
- The shipping company is considering solutions for the use of personal locator devices as an aid in MOB situations, but the measure had not been implemented at the time of publication of this report.
- The outermost parts of the hatch deck is marked as an ‘unsafe zone’. All traffic in this zone requires the use of a fall protection harness. There are plans to install a wire along the hatch deck that the deck crew can attach themselves to.
- The shipping company is planning to change the railings on ‘Titran’ and its similar vessels by increasing their height in the areas that experience shows that the deck crew habitually used to access and leave the hatch deck. The measure is intended as additional security in the event that operational barriers are not complied with and has already been introduced on some vessel; see Figure 14 and Figure 15.
- The relevant procedures have been updated, among other things by specifying that only dedicated access routes shall be used to and from the hatch deck. Other methods of entering the hatch deck have also been defined as involving a high level of risk.
- All the company’s vessels have been informed about the accident and the measures that are implemented as a consequence thereof.
- The shipping company has informed that work is under way to ensure that the crew are more actively involved in safety meetings held after drills for the purpose of obtaining additional input on improvements needed with regard to safety and the work situation in general. In addition it is informed that the crew shall be further involved in reporting and processing of findings, deviations, accidents and improvement measures.
- The shipping company has also informed that an arrangement is under development, where the crew is further given training within safety. The arrangement is to be initiated and tested locally at the crew agency were the crew come from.

Figure 14: Higher railings installed locally on similar vessel (seen from the quay). Photo: Berge Rederi AS

Figure 15. Higher railings installed locally on similar vessel (seen from the hatch deck). Photo: Berge Rederi AS

2. Analysis

2. Analysis

2.1 Introduction

The accident on board 'Titran' happened in connection with a routine operation that the crew performed on all voyages. Many accidents happen in connection with routine operations, and it is thereby important to identify the factors that played a role in this incident to be able to prevent similar accidents. The NMA's focus areas for 2022 are safety culture and risk understanding. The NSIA recognises that this accident points to aspects highlighted by the NMA. Among other things, the Authority writes that it often emerges in causal analyses after accidents that a difference in the understanding or perception of risk is an important underlaying factor. That is an issue that is also addressed in this investigation.

The analysis starts by assessing the sequence of events and the immediate causes. Then the survivability aspect is considered, followed by the shipping company's safety management relating to traffic on the hatch deck. The chapter concludes with a discussion of the vessel's design and how design features can prevent falls overboard.

2.2 Sequence of events

2.2.1 CREW TRAFFIC ON THE HATCH DECK

The accident occurred as the deck crew were loosening cleats and other sea fastening devices to prepare the cargo hold for unloading in the next port. The cadet, who had loosened the excavator's sea fastening, was moving to the main deck via the rail track and railings when he lost his footing on the railings and fell overboard. No one witnessed the accident, but the NSIA has been given access to CCTV footage on board and seen what happened in detail. It emerged from the footage that other members of the crew also used this way of moving between the hatch deck and the main deck.

None of the crew were wearing flotation devices or other safety equipment on the hatch deck, which was also not required by or described in the shipping company's guidelines. It was standard practice for the deck crew to get from the hatch deck to the main deck by using the railings. It was something the crew habitually did to avoid having to walk all the way to the end of the hatch deck, then walk down the ladder and then round again, which would take more time.

The NSIA believes they used this 'shortcut' to and from the hatch deck to save time and because it was considered the easiest way of getting down to the main deck. The risk it entailed was not fully understood, nor was the practice corrected by the vessel's shipboard management.

The crew and shipping company both considered readying the vessel for unloading a routine operation that did not require a risk assessment. Risk reduction measures had therefore not been considered or identified for this type of operation. No special safety measures had been introduced to prevent crew members falling overboard from the hatch deck, nor had sufficient measures been taken to reduce the consequences of falling overboard. This will be discussed in more detail in section 2.4 on the shipping company's safety management. There were also no physical barriers along the hatch coaming to prevent someone falling overboard. This will be discussed in more detail in section 2.5 on the vessel's design.

After the accident, the shipping company has introduced several measures to reduce the risk of falling overboard from the hatch deck and to reduce the consequences of a possible fall overboard.

2.2.2 SEARCH OPERATION

The crew did not witness the missing person fall overboard. This led to difficulties pinpointing the exact time when the cadet had fallen overboard, and the initial information provided to the JRCC about the time and place of the accident was therefore incorrect; see Figure 16.

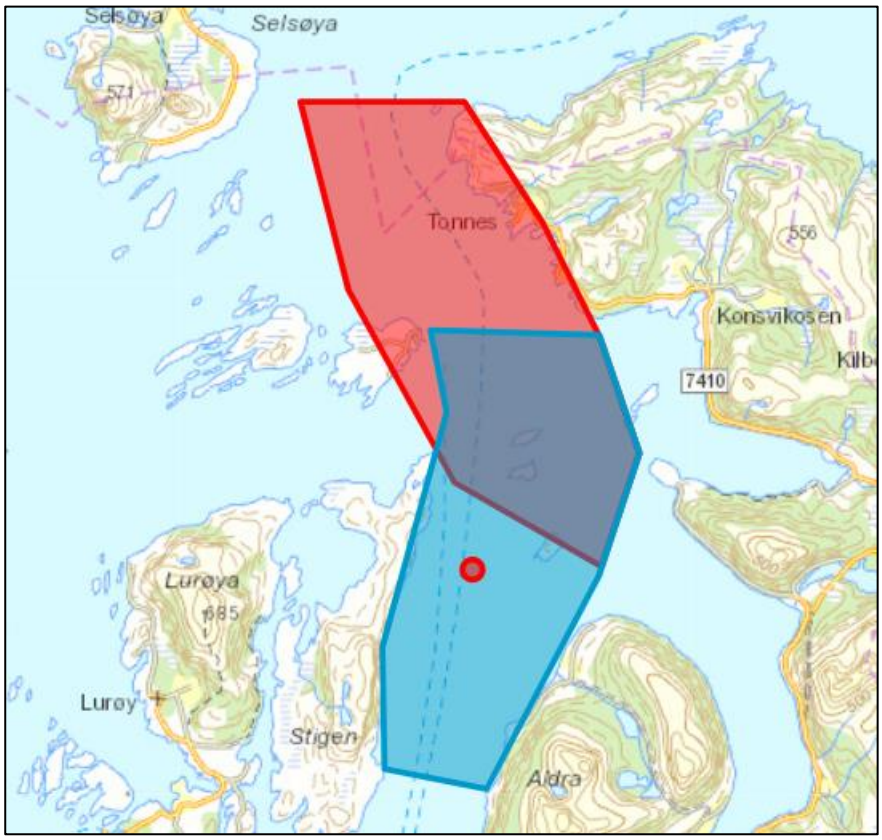

Figure 16: The search started in the area marked in red and was later moved to the area marked in blue based on new information about where the accident occurred. The red dot shows where the cadet fell overboard. Map: NCA/NSIA

Even though the estimated time when the crew last saw the cadet was uncertain, the information was communicated to the JRCC and KRN as a certain indication several times until the captain received information from the shipping company that CCTV footage showed the missing person falling overboard 20 minutes earlier than initially assumed. This information was an important factor when the JRCC defined the search area. It meant that the vessels searched too far north for 1.5 hours before they received new information from the shipping company, which had confirmed the time and MOB position based on the CCTV footage. The rescue helicopter searched a larger area, including the place where the cadet fell overboard, but it did not initiate the search until 1 hour and 15 minutes after the incident. The NSIA believes it is essential for the crew of a vessel to clearly communicate any uncertainty about when a person fell overboard to the rescue services, so that the search area can be defined accordingly. In addition, the JRCC must consider the reliability of the information received from the vessel in such situations.

In a survival situation, time is crucial. It took approximately 20 minutes from the cadet fell overboard until the deck crew realised that he was missing. The search and rescue team also searched too far north and did not start searching in the correct area until more than two hours had elapsed since the accident. The cadet's chances of survival were significantly reduced by the fact that he remained in the cold water for such a long time, without flotation devices or other clothing than work coveralls and with no possibility of notifying anyone. Nor was the cadet carrying a personal locator device that could have made tracking him in the water easier. The survivability aspect will be discussed further in section 2.3.

2.3 Survivability

There are numerous factors that have a bearing on an individual's chances of survival in water. They include the water temperature, clothing, the use of buoyancy aids, state of health and time in the water. The NSIA has been informed that the missing person could swim and was in good shape. No information has emerged about the missing person's state of health that may have had a bearing on the outcome of the accident.

The cadet's clothing was probably a hindrance as the clothes became soaked. This would have restricted his mobility in water and the possibility of making it to shore. The fact that the cadet's coveralls and protective footwear were found suggests that he attempted to remove them to improve his chances of swimming to shore. If he had been wearing a life jacket, his chances of staying afloat and remaining visible would have improved. As it was not normal practice to use flotation devices on board, it was natural for the missing person to also not wear such equipment. Whether he sustained any injuries when he fell overboard that may have affected his ability to stay afloat is unknown. A personal locator device might also have alerted the bridge crew of the person falling overboard sooner.

The cold water (around 4–5 degrees) caused the missing person's body temperature to drop quickly, and put him at great risk of developing hypothermia. The cadet's chances of survival significantly decreased during the 20 minutes it took from he fell into the water until the search was initiated. This is also apparent from Figure 13, which shows that, when wearing work clothes, the expected survival time in water is up to 30 minutes at a sea temperature of 5 degrees, with a gentle breeze. The fact that no search was initiated in the area where the cadet fell overboard until more than an hour had passed since the fall also significantly reduced his chances of survival in the cold water (see also section 1.7.2). It was also far to the nearest shore.

2.4 The shipping company's safety management

2.4.1 TRAFFIC ON THE HATCH DECK

The shipping company had not identified the risk of falling overboard from the hatch deck in connection with readying hatches. The shipping company and the crew considered such preparations a routine operation, and it was not defined as a high-risk operation. The shipping company's safety management system therefore did not describe how traffic on the hatch deck was to take place, nor were specific safety measures defined. It was nonetheless known on board that the crew were meant to use dedicated ladders located at the front and aft of the hatch deck to move between the hatch deck and the main deck.

The investigation has shown that it was not uncommon for the deck crew to move to and from the hatch deck using the railings on the main deck. The shipboard management had also observed and was familiar with this practice. The railings, which were initially intended as a physical safety barrier for persons on the main deck, were in this case used as a means of getting the work done quicker and thereby avoid having to walk round via the forward or aft ladder.

The NSIA has been informed that some of the crew members considered it risky to move from the hatch deck to the main deck via the rail track. This suggests a certain understanding among the crew of the risk associated with taking this 'shortcut', but that the practice was accepted by people 'exercising caution' and by not being corrected by the shipboard management. The risk associated with routine tasks becomes normalised in the individual over time, resulting in the risk gradually being ignored or not perceived. Shipping companies and other stakeholders must therefore consider the need for risk assessments and safe job analyses in all areas of operation that may entail risk, including those defined as routine operations. It is important that such reviews include

the management, safety delegate and crew who perform the work operation so as to enhance the understanding of risk and ensure effective implementation of any measures.

After the incident, the shipping company has made several changes to documented procedures and guidelines, and the crews of the different vessels have been involved in this process. Among other things, it has been specified that the dedicated ladders are the only permitted exit route from the hatch deck. It has also been made mandatory to wear a buoyancy vest when working outside, and on the hatch deck and to use a safety line when accessing the 'unsafe zone', which is now marked on the hatches.

According to the shipping company, several of the measures have been developed in dialogue with the crews of their vessels to ensure that the measures can be implemented in operations. The NSIA believes the involvement of the crew will increase the likelihood of compliance with the safety measures.

Even though the shipping company has introduced operational measures, the vessel's design will represent an inherent residual risk. The physical barriers in place to prevent a fall from the hatch deck remain insufficient. The passageway along the main deck is narrow, and the height of the railings is not sufficient to prevent the possibility of a fall from the hatch deck. The design will be discussed further in section 2.5.

2.4.2 EMERGENCY RESPONSE

The shipping company had introduced MOB procedures that included a scenario in which the time of the fall is unknown. Among other things, it highlighted the importance of searching for the missing person in the right area, as time is an essential factor for survivability in cold water. The procedure did not specify how the crew was supposed to pinpoint the exact time of the fall. It has subsequently emerged that CCTV was an important aid in determining the time at which the missing person fell overboard. CCTV should not be introduced as a safety measure to replace other measures, but may be used in an emergency situation to gain a better understanding of and more accurate information about the situation.

Rapid notification is of material importance to the response time in a MOB situation. In the present incident, it took nearly 20 minutes before it was discovered that the cadet was missing and another 10 minutes before the JRCC was notified. After about two hours, it was established, based on the shipping company's CCTV footage, that the missing person had fallen overboard 20 minutes earlier than initially assumed, and the search area was moved further south.

Even though the crew followed the procedure described for a fall overboard at an unknown time, the measures of notifying the rescue coordination centre and turning the vessel around were probably initiated too late for it to be possible to rescue the missing person in the present incident; see section 1.7.2. In addition, the search area was set too far north for the first few hours. It would be an advantage if the shipping company's procedures described that it is essential to communicate any uncertainty relating to when and where the crew member fell overboard to the search and rescue services, so as to ensure that the search area is big enough.

After the accident, the shipping company has considered measures such as personal locator devices, which may considerably reduce the response time and thereby increase the chances of survival when falling overboard.

2.5 The vessel's design

'Titran' was a typical bulk carrier on which most of the foredeck consisted of cargo hatches, with a passageway along the hatches on the main deck. To be able to loosen the cargo hatches' sea

fastening, it was necessary for the crew to enter the hatch deck. There were no physical safety barriers against falling overboard from the hatch deck, only railings on the main deck along the cargo hatches. However, this is not an unusual design for this type of ship.

The NSIA considers that the way the deck was designed, with a short distance from the outer edge of the cargo hatches to the railings at a considerably lower level (see Figure 17) was inexpedient in relation to the work to be performed and that it entailed a risk of falling overboard.

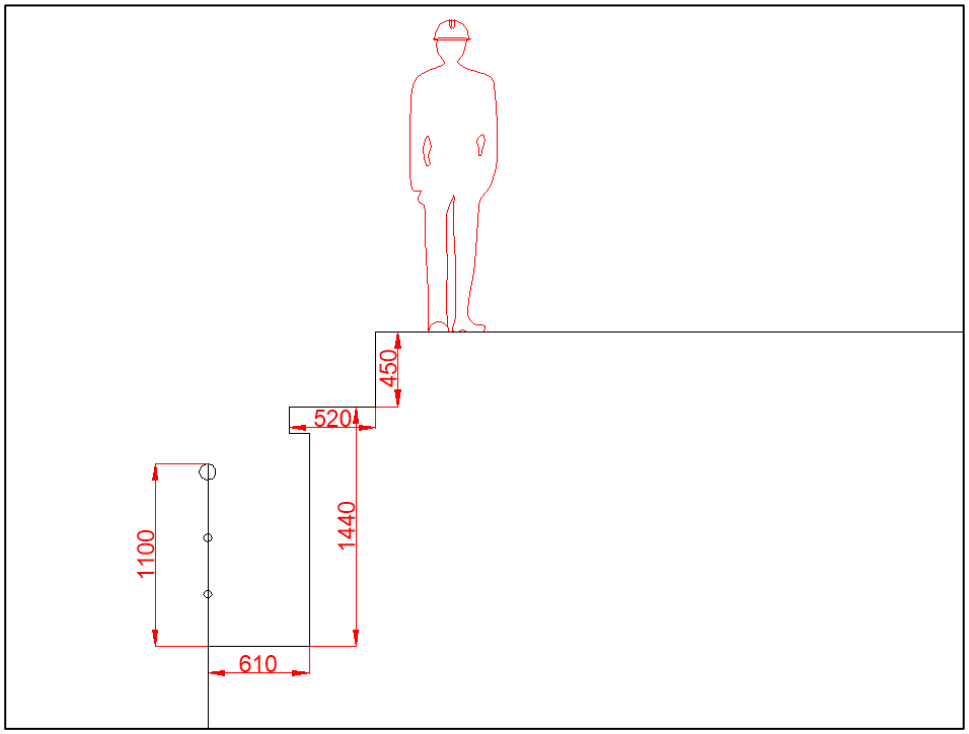

Figure 17: Cross section of the deck design, with measurements in mm. The person in the illustration is standing on top of the cargo hatches. Illustration: NSIA

Furthermore, the investigation has shown that the crew's use of this 'shortcut' was a well-known practice. The NSIA considers it unfortunate that the design enables crew to move up and down on the hatches using the track and railings.

A requirement for railings on exposed parts of the freeboard deck to protect the crew is set out in Regulation 25 of the Load Line Convention. Since the hatch deck was not part of the freeboard deck, no particular requirements for protection applied to this area. The NMA believes the risk could be addressed by introducing operational barriers, which the shipping company has done after the accident. Compliance with these measures in practice will require dedicated focus from the shipping company and the shipboard management.

If railings or other physical barriers along the hatch coamings are not operationally feasible, there will always be a risk associated with moving on the hatch deck. It will therefore not be possible to eliminate the risk involved in working on the hatch deck by means of operational measures only. After the accident, the shipping company has also decided to increase the height of the railings in some areas along the ship's side to prevent a fall in the event that operational barriers are breached. The NSIA believes that this measure may give rise to uncertainty among the crew, as the design of the railings suggests that they may be used as a ladder between the hatch deck and the main deck, at the same time as the updated procedures prohibit such access. The shipping company must therefore be aware that it may be perceived as double communication and may challenge loyalty to procedures in general. This is something the shipping company has informed that they are aware of, however has considered that this is the best solution for reducing the risk as far as possible.

3. Conclusion

3. Conclusion

3.1 Main conclusion

The incident happened as the deck crew were loosening cleats and other sea fastening to prepare the vessel for unloading in the next port. The cadet, who had loosened the excavator' sea fastening, was moving down to the main deck via the rail track and railings when he lost his footing on the railings and fell overboard.

The crew and shipping company both considered readying the vessel for unloading a routine operation that did not require a risk assessment. Risk reduction measures had therefore not been considered or identified for this type of operation. No special safety measures had been introduced to prevent crew members falling overboard from the hatch deck, nor had sufficient measures been taken to reduce the consequences of falling overboard.

The risk associated with routine tasks becomes normalised in the individual over time, resulting in the risk gradually being ignored or not perceived. Shipping companies and other stakeholders must therefore consider the need for risk assessments and safe job analyses in all areas of operation that may entail risk, including those defined as routine operations.

3.2 Investigation results

- The shipping company had not identified the risk of falling overboard from the hatch deck in connection with readying hatches. The shipping company's safety management system therefore did not describe how traffic on the hatch deck was to take place, nor were specific safety measures defined.
- The crew did not witness the missing person fall overboard. This made it difficulty for the crew to pinpoint the exact time when the incident occurred.
- The initial search area was set too far north before they received new information about the time and MOB position from the shipping company based on the CCTV footage. The NSIA believes it is essential for the crew of a vessel to clearly communicate any uncertainty about when a person fell overboard to the rescue services, so that the search area can be defined accordingly.
- There were no physical safety barriers against falling overboard from the hatch deck, only the railings on the main deck. The NSIA considers that the way the deck was designed, with a short distance from the outer edge of the hatch deck to the railings at a considerably lower level, was inexpedient in relation to the work to be performed and that it entailed a risk of falling overboard.
- If railings or other physical barriers along the hatch coamings are not operationally feasible, there will always be a risk associated with moving on the hatch deck. It will therefore not be possible to eliminate the risk involved in working on the hatch deck by means of operational measures only.

4. Safety recommendations

4. Safety recommendations

The investigation of this marine accident has not identified new areas in which the NSIA deems it necessary to propose safety recommendations for the purpose of improving safety at sea.

Norwegian Safety Investigation Authority
Lillestrøm, 28 September 2022

Appendices

Appendix A Details of the vessel and the accident

Vessel	
Name	Titran
Flag state	Norway (NIS)
Classification society	DNV
IMO Number/Call signal	9100188/LAZS7
Type	Bulk carrier
Build year	1996
Owner	Berge Rederi AS
Operator / Responsible for ISM	Transmar AS
Construction material	Steel
Length	84.992 metres
Gross tonnage	2,744
Voyage	
Port of departure	Florø
Destination port	Halsa (Meløy municipality)
Type of voyage	Coastal voyage
Cargo	Fishmeal
Persons on board	9
Information about the accident	
Date and time	11:00 on 6 March 2022
Type of accident	Very serious marine accident
Location where the accident occurred	East of Stigen island in Lurøy municipality
Place on board where the accident occurred	Deck
Injuries/deaths	1 fatality (crew)
Ship operation	Readying for unloading
At what point in the voyage was the vessel	Under way
Environmental conditions	Good weather. Sea temperature in the area around 4–5°C