UKP&I

Special Edition 2024

LOOKOUT

Consolidated articles focused on loss prevention for Japanese Members

UK P&I CLUB IS MANAGED BY **THOMAS MILLER**

Welcome

Lookout is a UK P&I Club publication distributing P&I focused articles on a range of current issues, including safe navigation and loss prevention to Japanese Members and the maritime community generally. The publication has been distributed as a biannual publication since its first issue in hard copy in 2017. Since October, 2020, it has been distributed electronically to deliver it quickly and efficiently to a wide audience globally.

This 2024 special edition is a consolidation of 5 articles distributed in 2023, which is focus on case studies of marine accident and the way that Management Responsibility of shipowner/ship management company should be. We hope that these articles will be of interest and assistance to our Members and readers concerned in safe navigation and loss prevention in particular.

We would like to thank our Japanese Members and readers for their continued support, and we would appreciate receiving any feedback, and requests to help improve our services.

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LOOKOUT - SPECIAL EDITION 2024

1. Case study

Container ship Collision with Gantry Crane 1
Navigation Accidents Caused by Defective Voyage Planning 5
Marine Accidents Caused by Cargo Liquefaction and Countermeasures 12

2. Management

Marine Accidents and Management Responsibility 18
Key Points for Safe Navigation 22

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1. Case study

Containership Collision with Gantry Crane

-Poor Communication between the Master and Pilot-

Summary

Under the direction of a pilot, a containership (about 40,000 GT) departed port A on a course for port B, which was a voyage of about two hours. While docking at port B, the Master believed the vessel's speed was excessive and had doubts about the pilot's operation of the vessel. As a result, the Master took the con.

However, a sudden reduction in speed and a strong wind made it impossible to control the vessel's momentum and the vessel collided with a gantry crane on the wharf. This accident damaged the ship's bow, the wharf and gantry crane. Thankfully, there were no injuries or loss of life.

Timeline of the accident

0722 At a distance of about 2,000 metres from the berth at port B, the pilot ordered a heading of 285 degrees. The vessel began to turn toward a marker on the wharf that was the target for the vessel's bow. The vessel was moving at dead slow ahead and the engine was subsequently used as needed. At that time, the speed was 6.8 knots and there was a northwest wind at an average speed of about 9.0m/s with gusts up to 13.3m/s.

0732 The pilot ordered a heading of 278 degrees and then used the bow thruster as needed.

0734 A crewmember reported that the vessel's course was unstable and that the vessel was being swept away heavily by the wind (leeway of about 10 degrees) toward a moored vessel (car carrier).

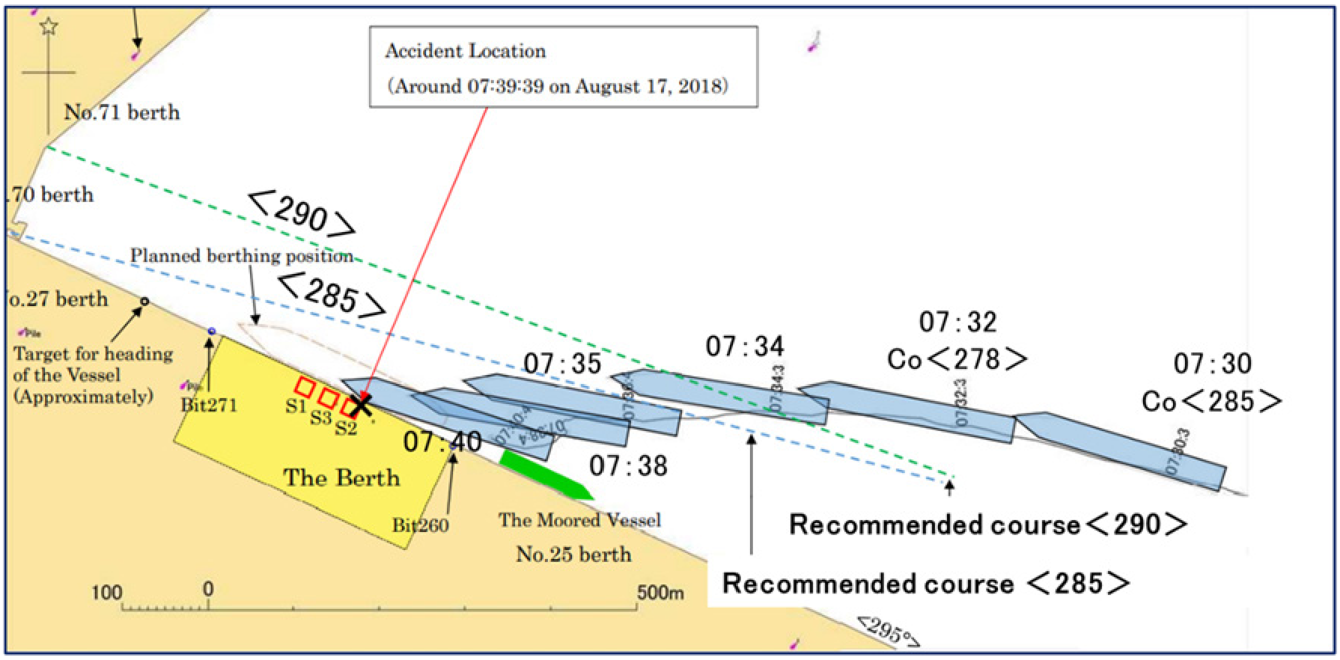
0735 The speed was 2.5 knots and the distance between the bow and wharf was about 260 metres.

0736 The Master warned the pilot that the speed was too high. Immediately after the warning, the Master took the con and ordered a tug to pull half astern and then full astern.

0737 At a speed of 1.4 knots, the vessel lost momentum and came close to the moored car carrier. At that time, the bow of the vessel was about 100 metres from the wharf.

0738 To avoid colliding with the moored car carrier, the Master ordered full ahead and gave several conning orders.

0739 The vessel collided with the gantry crane.



Analysis

1. Master-pilot exchange of information

When departing from port A, the Master gave the pilot a pilot card (see Note 1), which has information about the vessel's engine, steering and other items. The pilot provided information about the weather and submitted a pilot information card (see Note 2). There was an explanation of the vessel's course and an agreement to use one tugboat.

Although the pilot information card included the direction of the turn to leave the wharf, the number of tugboats and other items, there was no information about the bow target, heading and other items about berthing the vessel. The Master believed that the pilot's explanation was inadequate and closely monitored the pilot's actions.

Note 1: A pilot card is a document given to a pilot by a vessel's Master which contains information about a vessel's engine, steering and other characteristics.

Note 2: A pilot information card is a document given to a vessel's Master by a pilot which contains information about the intended course for entering a harbour and other items.

2. Testimony of the pilot

"I believe that I was able to communicate sufficiently with the Master because there was a discussion with the Master as the vessel was under way about measures to avoid a smaller vessel.

"Due to wind near the wharf, I decided to approach farther from the north than usual. However, due to the long distance from the wharf, I ordered a heading of 278 degrees in order to approach the wharf at a steep angle."

Pilot's navigation plan

The pilot intended to maintain the vessel's speed in order to resist the force of the wind pushing the vessel to port. After the stern had passed the moored car carrier, he then planned to increase reverse propulsion and run the main engine at half speed astern in order to move in front of the wharf and stop the vessel. Then he believed that astern propulsion would swing the bow to starboard due to the characteristics of a single-screw vessel with a right-handed propeller, bringing the vessel's attitude parallel to the wharf. However, the pilot did not explain his plan to the Master.

3. Testimony of the Master

"The pilot did not explain his plans for the vessel's heading, speed and berthing method. Therefore, I believed that I needed to closely watch the pilot's actions.

"When we were even with the moored car carrier, the wind rapidly pushed us toward the wharf. Our speed exceeded 4 knots, which I felt was faster than the normal speed.

"I realised that the pilot's speed reduction would not be enough to safely dock at the wharf. To stop the vessel, I took the con and ordered full astern."

4. The Pilots' Association's reference materials of standards for manoeuvring and mooring (see diagram)

The reference materials of the Pilots' Association for this location recommend the following measures when approaching this berth from the port side:

- Under normal conditions, the heading is 285 degrees (bow target: intersection of berths 27 and 70)
- Under a strong wind, the heading is 290 degrees (bow target: meeting point of berths 70 and 71).

When this vessel was approaching the wharf, there was a northwest wind with a Beaufort wind force of 5. With a heading of 285 degrees, there was probably leeway of 3 to 5 degrees. As a result, the vessel should have used the 290-degree heading recommended in the reference materials in order to maintain an adequate distance on the port side.

The pilot was aware of this recommendation but did not follow it for this approach.

Causes

1. Direct causes

a. The Master ordered full astern when he decided that the vessel was moving too fast toward the wharf at port as a force 5 northwest wind pushed the vessel toward the shore. However, the vessel lost momentum. As a result, the vessel was pushed toward a moored car carrier. The Master ordered full ahead to prevent a collision but was unable to control the vessel's attitude and the bow collided with the gantry crane.

b. The pilot did not use the course recommended in the Pilots' Association's reference materials for berthing during a strong wind and, as a result, the vessel came too close to the wharf and a moored vessel.

2. Root causes

a. *Poor communication between Master and Pilot*

The Master and pilot were unable to establish a working relationship. As the vessel approached the wharf, the Master decided on his own to take the con. This action was the result of uncertainty about the pilot's plan for berthing the vessel, which in turn was caused by insufficient communication about how the vessel was to approach the wharf.

b. *Bridge resource management (BRM)/bridge team management weakness (BTM)*

Due to the lack of good communication, it was impossible to establish effective BRM/BTM between the bridge team and the pilot.

Lessons learnt from this accident

1. Responsibility for conning the vessel after boarding pilot

When a pilot is on board, the Master is still responsible for the operation of the vessel. Consequently, the Master and bridge team must constantly be aware of the pilot's intentions when the pilot is giving helm commands. If there are doubts about the pilot's actions, the pilot's plan must be confirmed and the Master must always be prepared to take the con if there is a risk to the vessel's safety.

2. Intentions of the pilot

Immediately after the pilot boards the vessel, the pilot card, pilot information card and other items must be used to confirm the pilot's intentions and plan for operating the vessel. Most of all, a discussion must take place about the pilot's planned method for approaching the wharf and berthing the vessel. This discussion must include specific information about headings, speed, method for turning the vessel, use of tugboats and other items.

If the plan needs to be altered to match the vessel's characteristics, steering performance or other reasons, the final plan for operating the vessel must be determined after holding a discussion with the pilot. This plan must be explained to the entire bridge team and entered in the ECDIS and chart.

3. Bridge resource management/Bridge team management

The pilot and members of the bridge team are often meeting each other for the first time. Language problems may make it difficult to communicate. As a result, there is a significant risk of a misunderstanding concerning the intentions and plans of the pilot and the bridge team. Discussions must cover all points thoroughly and care is needed to ensure that both sides understand each other. This is vital for establishing a relationship based on mutual trust.

The bridge team needed to report information that they believed was required by the pilot as much as possible and to be willing to question the pilot if there was even a minor doubt about the intent or plan concerning the vessel's operation. The key point is that participation of the pilot as a member of the bridge team and BRM/BTM are essential for the safe operation of a vessel.

REFERENCE

Japan Transport Safety Board

Marine Accident Investigation Report MA2020-7

https://www.mlit.go.jp/jtsb/eng-mar_report/2020/2018tk0012e.pdf

Navigation Accidents Caused by Defective Voyage Planning

Introduction

Before departure, a ship's officer has an obligation to establish a voyage plan that will ensure a safe voyage and arrival at the destination with no unforeseen problems. Guidelines for the preparation of voyage plans are provided in IMO Resolution A 893(21) – Guidelines for Voyage Planning. These guidelines contain the four steps summarised below (detailed information about the steps is provided in the SMS manual kept on all ships). All of these steps must be performed thoroughly in order to determine a proper voyage plan.

1. Appraisal

Appraisal of the voyage is performed after collecting all information involving the planned voyage or route. This process identifies risks involving the proposed voyage prior to departure and, as needed, incorporates this information in the voyage plan.

2. Planning

Using as much information as possible from the appraisal stage, a detailed voyage plan is prepared which covers the voyage from the departure berth to the destination berth, including times when a pilot will be on the bridge.

3. Execution

If the voyage plan is approved, it must be used as the basis for specific actions. There may be times when the plan will have to be revised to reflect changes in various factors while the voyage is under way. If revisions are made, the voyage plan must be appraised again and the revised plan must be followed.

4. Monitoring

Thorough and constant monitoring is required to confirm that the ship is on course according to the approved voyage plan. This is the most important duty of the officer of the watch. Several methods must be used to confirm the status of the ship at any moment. If this process reveals that the ship is not following the voyage plan, the Master must be notified and corrective measures taken.

Case studies of accidents caused by inadequate voyage plans

This section explains accidents caused by errors or negligence in one or more of the four steps.

1. Inadequate appraisal: Grounding of the CMA CGM Libra

On 18 May 2011, the containership CMA CGM *Libra* (130,000 tons, 353 metres in length) departed from Xiamen, China. The second officer prepared the voyage plan, but information about shallow areas outside the departure channel was not written on the chart. In addition, there were no "no go area" entries on the chart, including the shallow area where the accident happened. Although the Master approved the voyage plan, he was not aware of the shallow areas. Believing that an area outside the planned course was safe (i.e. it was deeper than shown in the chart), he took the ship off course and it ran aground. This accident demonstrates that the voyage plan prepared prior to departure was not appropriate and, as a result, the ship was not seaworthy. More information about this incident is available on the website. (https://www.ukpandi.com/ja/news-and-resources/articles-new/passage-planning-and-seaworthiness/).

An enormous amount of information is required during the appraisal stage and, as this accident highlights, even one insufficiency can result in a major accident.

2. Inadequate planning: Grounding of the Kaami[1]

On 23 March 2020, the general cargo vessel *Kaami* (2,715 tons, 89.95 metres in length) was on a course from Drogheda, Ireland, to Slite, Sweden, when the ship ran aground on Stgeir Graidach shoal in the Little Minch off the west coast of Scotland. The Master did not use the route recommended by the IMO and instead selected a course based on previous experience from a voyage on a different vessel.

This accident was the result of the failure to use a sufficient volume of data during the appraisal step of the voyage plan preparation process, resulting in the establishment of an erroneous course. Furthermore, there were many deficiencies and oversights involving the execution and monitoring of the plan (see Figures 1 and 2).

Particulars of the accident

At Drogheda, the Master carried out chart updates on the ship's ECDIS and planned the voyage to Slite, as the chief officer was overseeing cargo operations. At 2030 on 1 March 2020, the *Kaami* (draughts of 4.90m forward and 5.40m aft) departed Drogheda and proceeded up the Irish Sea through the North Channel. The weather deteriorated after the ship departed. There was a south-westerly Beaufort force 6 to 9 wind, a very rough sea and total cloud cover with good visibility.

Just before 2300, the chief officer and an able seaman arrived on the bridge to relieve the Master. At 0058, the chief officer notified the Coastguard that the ship was approaching reporting point "F", which is the start of the IMO recommended northerly route. However, the *Kaami* did not use the recommended route and instead used a route about one nautical mile north of Eugenie Rock, which was the planned track.

Figure 1: Location of grounding

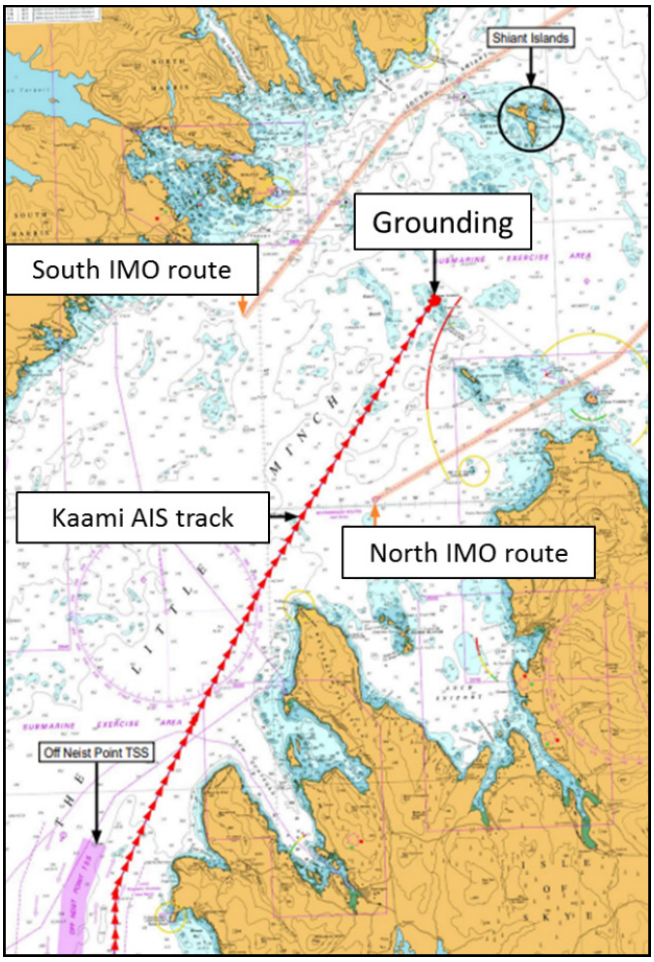


Figure 2: Kaami's track

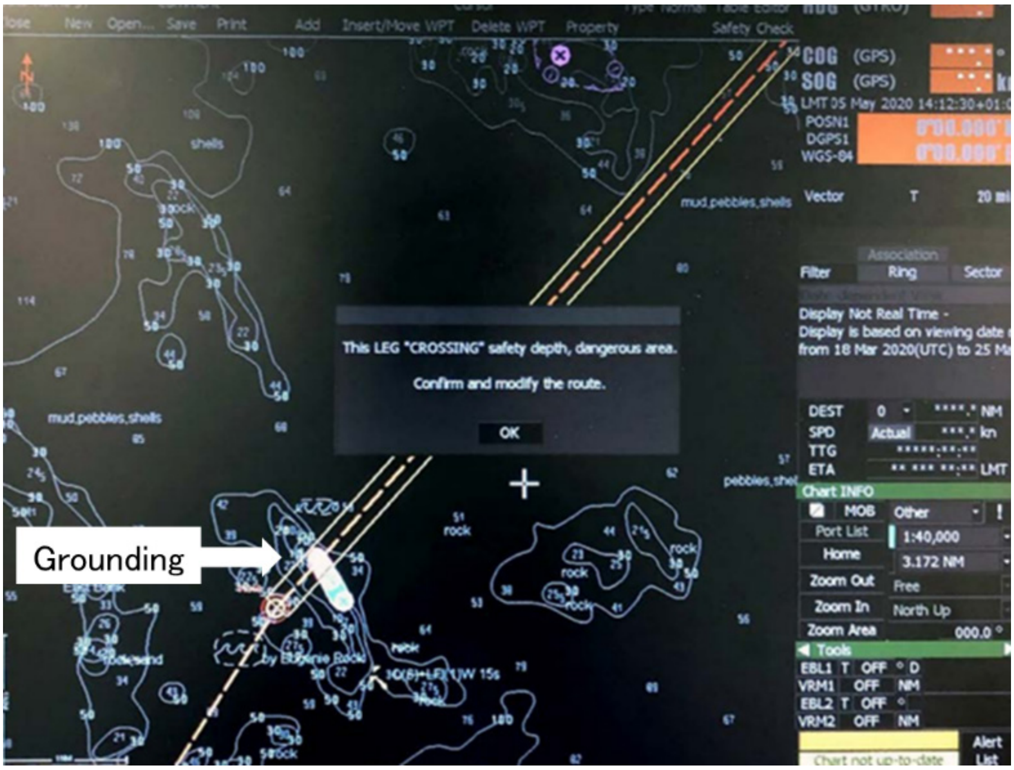


Figure 3: The ECDIS safety check displays the following warning in the centre of the screen: This Leg "CROSSING" safety depth, dangerous area. Confirm and modify the route.

At 0135, a crewmember of the fishing vessel *Ocean Harvest* contacted *Kaami* on VHF radio to warn that *Kaami* was heading into shoal waters. The chief officer replied promptly and thanked the *Ocean Harvest* for the information. A few minutes later, the *Kaami's* chief officer used the autopilot to alter course 10˚ to starboard at waypoint 19 in accordance with the voyage plan. At 0141, the chief officer and watch felt two heavy impacts as the ship ran aground.

Analysis of the causes that directly contributed to the accident

The *Kaami* ran aground because the voyage plan was configured to take the ship over an area with dangerous obstacles. The Master had passed through this area before. When preparing the voyage plan, he relied on his previous experience concerning the weather, sea conditions and other considerations. In addition, he only used the *Kaami's* electronic navigation chart (ENC) data.

The accident was the result of a number of failings during both the appraisal and monitoring steps. In particular, failure to use the ECDIS correctly was a major cause of the grounding, as explained below.

1) No setting of safety contour

The Kaami departed with a maximum draught of 5.40 metres but the safety contour was still at the previous setting of 5.00 metres. Determining the under-keel clearance (UKC) is essential for setting the proper safety contour, but this was not done on the Kaami. Furthermore, the safety management system of the company managing the Kaami did not have any specific provisions concerning the UKC.

2) Improper use of the ENC

The electronic chart in use when the ship ran aground was missing part of the route recommended by the IMO.

3) Waypoint input

When the Master prepared the voyage plan, he used the mouse to drop waypoints on the ENC. This makes it easy to enter the route on the ECDIS. However, this route took the *Kaami* over a hazardous (shallow) area. The International Hydrographic Organization (IHO) has issued a strong warning concerning the need to use an ENC at the proper scale and to perform visual confirmations.

4) Safety check

The Marine Accident Investigation Branch (MAIB) was unable to ascertain whether the ship had used the ECDIS safety check function (see Figure 3). When a safety check was conducted after the accident, it revealed 479 errors (hazards) on the route. The ECDIS safety check function is an extremely effective way to supplement visual checking.

5) Look ahead sector and vector

The Kaami was not using the look ahead sector and vector, which issues a warning when a ship approaches a safety contour or other hazard. If this function had been selected, a safety contour alarm would have activated on the ECDIS three minutes before crossing the contour line.

Lessons from this accident

When the voyage plan was prepared, the determination of the route was made in a simplistic manner. However, errors and negligence were present in each of the voyage appraisal, planning, execution and monitoring steps.

In particular, the ECDIS allows the user to skip some steps of the proper voyage planning process. Officers must always be aware of this problem, where there is a general lack of in-depth understanding of new and modern equipment on board.

3. Improper execution of a voyage plan: Grounding of the Inazuma[2]

At 1210 on 10 January 2023, the Marine Self Defense Force (MSDF) destroyer *Inazuma* (4,500 tons, 151 metres in length, crew of 190) ran aground on the Sengai shallows, which is about 5km south of Suo-Oshima Island in Yamaguchi prefecture. This location is marked by the Sengai Shoal beacon (see Figure 4).

On the morning of 10 January, *Inazuma* departed the Innoshima Island shipyard for a test run after the completion of maintenance work. The ship planned to turn back near where the grounding occurred in order to return to the MSDF base at Kure. The screw apparently hit a rock or other objects and there was a small oil leak. Repairs are expected to take a few years and cost about 4 billion yen.

Result of the investigation

On 9 May 2023, the MSDF announced at a press conference that the cause of this accident was improper safety management.

After the *Inazuma* completed testing at about 1135, the captain ordered a revision to the voyage plan but failed to follow adequate safety measures:

- The ship's route was changed without confirmation of the safety of the new route.
- The officers responsible for navigation did not check the chart.
- There were several warnings from the command information centre about shallow water, but this information did not reach the captain and others on the bridge.
- Prior to departure, there was no meeting to confirm the safety of the route or examine the region where the *Inazuma* was going.

The MSDF announced that it would introduce five preventive measures, including:.

- Re-examination of the process used to train officers to become captains of ships; and
- Research into a communication system that facilitates the sharing of required information.

Analysis

Bridge management on a military ship differs significantly from that on a commercial ship, in many ways. Below are two examples of these differences.

- **Transmission of information from the command information centre (not located at the bridge):**

  The command information centre on a military ship provides a supplementary source of information about other ships and hazards. Information is transmitted to the bridge by using a communication system.

- **Division of roles of bridge personnel:**

  The bridge of a military ship includes the captain, navigator and many others, each with a clearly defined role. For example, the navigator receives information from subordinates on the bridge and from the command information centre.

Figure 4: Location of the grounding of the Inazuma
(Google map background)

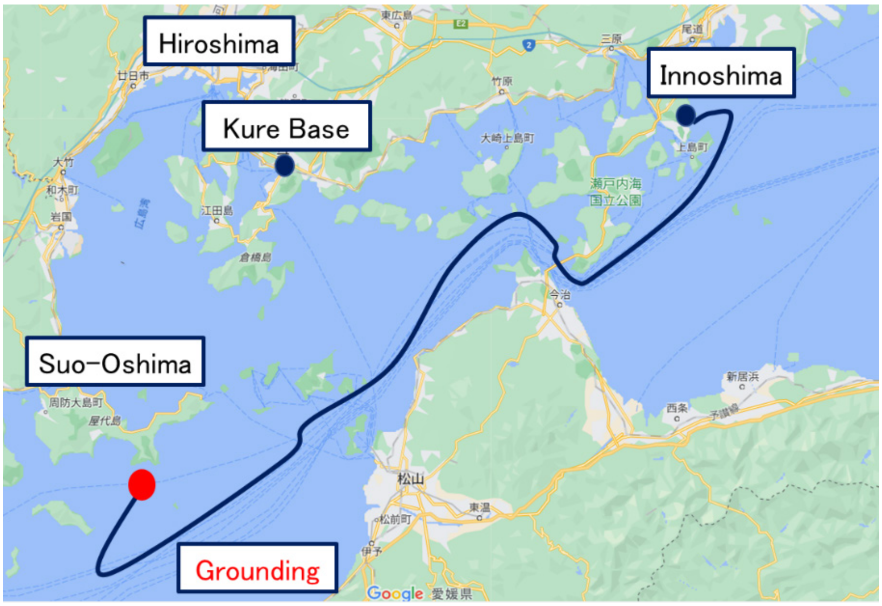


Figure 5: Estimated route of the Inazuma and location of grounding
(Google map background)
(Prepared by the author based on media reports)

Lesson learnt: Change of voyage plan during voyage

The crew of a ship frequently revises a voyage plan while under way for a variety of reasons. Changing the voyage plan involves the same four steps that are used to prepare the original plan: appraisal, planning, execution and monitoring. On the *Inazuma*, the captain made a sudden change in the voyage plan, but an appraisal of the new plan was not conducted. This process should have included checking for shallow areas and other hazards in the new course, positions of nearby ships, and other considerations. In addition, as part of bridge resource management, the captain and navigator must constantly confirm the receipt of advice and other input from subordinates. This accident is an example of the result of a defective process used to determine a voyage plan, as well as poor bridge management.

4. Improper monitoring: Grounding of the Royal Majesty [3]

The passenger ship *Royal Majesty* (32,396 tons, 173.16 metres in length) ran aground on the Rose and Crown Shoal at about 2225 on 10 June 1995. The ship was en route from Bermuda to Boston, Massachusetts. The shoal is approximately 10 miles east of Nantucket. Although the accident caused deformation of the ship's double-bottom hull, there was no penetration or cracking and no fuel oil was spilled. Damage to the ship was estimated at $7 million.

Particulars of the accident

One hour before the scheduled departure time of 1200 on 9 June from the port in Bermuda, the navigator performed tests of navigation equipment (compasses, repeaters, radar, NACOS 25, GPS, Loran-C) and confirmed that everything was operating normally. The navigator stated that when the Bermuda pilot left the ship (about 1230 on 9 June), he compared the position data of the GPS and Loran-C, and confirmed that the two positions within about one mile of each other.

At 1000 on 10 June, the watch changed and the navigator and two quartermasters were on duty. The navigator maintained a course of 336 degrees and a speed of 14.1 knots. At 1600, the watch changed and the chief officer relieved the navigator.

The chief officer used GPS data to check the ship's position once every hour during his watch and used Loran-C as a backup system.

At about 1920, the ship passed a radar target that was believed to be the BA buoy, which was on the port side at a distance of 1.5 miles. However, visual confirmation of the target was not possible because of glare on the ocean surface caused by the setting sun. The Master was notified that the ship had passed the BA buoy.

At 2000, the second officer and two quartermasters relieved the chief officer.

At about 2030, the lookout on the port bridge wing reported to the second officer the sighting of a yellow light off the ship's port side. The second officer acknowledged the report but took no action.

Shortly after the yellow light was sighted, both starboard and port lookouts reported sightings of several red lights on the port side of the ship, but the second officer took no action.

At 2145, although the BB buoy had not been sighted, the second officer reported to the captain that he had seen it. The report was based on the second officer's belief that the ship was on course and that perhaps the radar did not detect the buoy.

Shortly after 2200, the port bridge wing lookout reported the sighting of blue and white water dead ahead. The second officer acknowledged the information, but no action was taken. The port lookout subsequently reported that the ship had passed through the blue and white water.

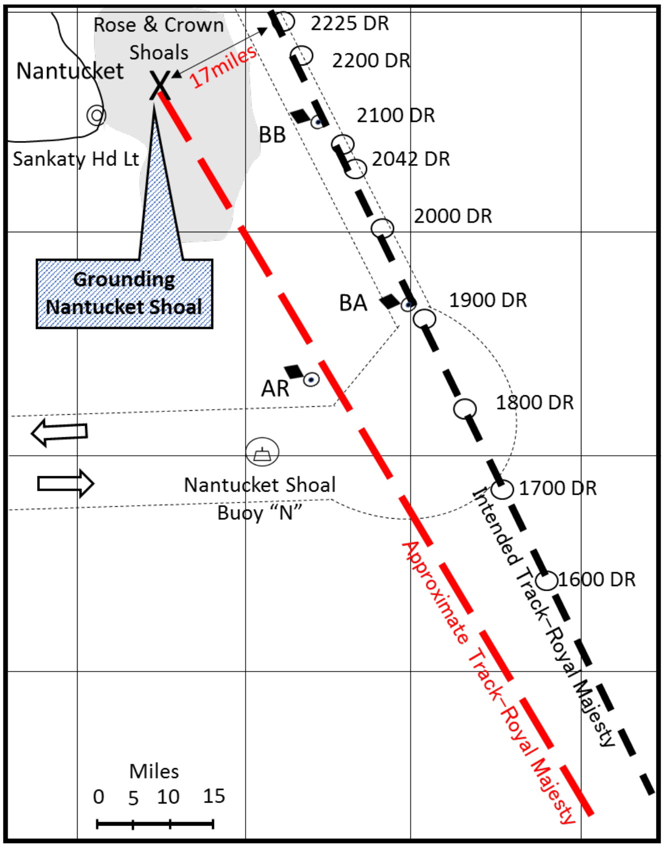


Figure 6: Course of the Royal Majesty
(prepared by the author based on the investigation report)

At about 2220, the ship suddenly veered to port and then sharply to starboard and heeled to port. The Master ran to the bridge and confirmed that the ship had run aground. The Master checked the GPS and Loran-C position data and, for the first time, realised that there was a difference of at least 15 miles.

Analysis

The *Royal Majesty* had an integrated bridge system (NACOS 25) and GPS was selected as the source of position data for this system. After the accident, an examination of the GPS antenna and receiver revealed that the antenna cable had separated from the antenna connector. As a result, the GPS receiver had been sending to the NACOS 25 autopilot position data determined by dead reckoning rather than by signals from satellites. Longitude data was calculated by using dead reckoning and there were no corrections to reflect the effects of the wind, tide or ocean currents. Over time, an east-northeasterly wind and sea had pushed the ship to the west-southwest, eventually resulting in an error of 17 miles.

Failures and errors involving monitoring

The crew's failure to detect for more than 34 hours that the ship was not using GPS data raised serious concerns about the performance of the watch officers and the Master. The chief officer and second officer were on watch prior to the grounding and failed to realise that the *Royal Majesty* was not following the voyage plan, despite several indications of trouble. This was gross negligence.

1. Master

The master visited the bridge frequently and asked the chief officer and second officer to visually confirm the sighting of the BA buoy and BB buoy. Therefore, the Master took reasonable actions to confirm that the ship was on course. However, he did not ask for a cross-check of the GPS and Loran-C position data and did not perform a comparison of his own. Consequently, he was relying on the automated navigation system together with the other officers.

2. Chief officer

The buoy detected by radar at about 1900 was the AR buoy that marks the location of a sunken ship about 17 miles to the west of the *Royal Majesty's* intended route. Although the buoy could not be visually identified, a positioning cross-check (GPS and Loran-C) would probably have made the chief officer aware of the navigation error.

3. Second officer

The second officer gave a false report to the Master about the sighting of the buoys. Furthermore, he took no action despite receiving reports from the lookout of unusual sightings near the ship and on the ocean surface.

Lessons learnt from this accident

The direct cause of this accident was the loss of GPS position data. Moreover, the navigator failed to cross-check the ship's location by using the two methods that are used when GPS position data is lost. Nonetheless, all members of the bridge team were guilty of significant negligence as well as numerous small errors. The bridge team was unable to break the chain of errors and the result was the grounding of the ship. This accident underscores the importance of the using suitable measures to frequently monitor a voyage in order to have accurate information about the status of the voyage at all times.

Closing message

Accident cases related to passage planning have been described under the four headings of appraisal, planning, execution, and monitoring. Each case demonstrates that some or all of these four items are closely related. Therefore, to achieve a safe voyage, the bridge team is required to formulate a passage plan every time, making the most of available resources and without skipping routine procedures.

REFERENCE

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https://assets.publishing.service.gov.uk/media/60acb4bd8fa8f520bde56d16/2021-07-Kaami.pdf

2. Sankei Newspaper, TBS News Dig, Mainichi Newspaper, dated 9 May 2023

3. NTSB/MAR-97/01
https://www.ntsb.gov/investigations/AccidentReports/Reports/mar9701.pdf

Marine Accidents Caused by Cargo Liquefaction and Countermeasures

Introduction

In July 2023, INTERCARGO published its Bulk Carrier Casualty Report 2023. According to INTERCARGO, there were 26 accidents involving bulk carriers of over 10,000 dwt during the 10-year period between 2013 and 2022 that resulted in total losses. The most frequent cause was grounding, which accounted for 12 of these accidents. Cargo liquefaction (see Note 1) was second, having caused the loss of five ships. Accidents during the 10-year period caused the deaths of 104 crewmembers and sinking due to cargo liquefaction was responsible for 70 (67%) of these deaths (see Table 1).

Cause	Ships	Deaths	Root cause/Number of ships
Grounding	12	0	Human element/9, Navigation/2, Weather/1
Liquefaction	5	70	Liquefaction/5
Flooding	3	22	Structure/1, Unknown/2
Fire	2	0	Human element/1, Unknown/1
Weather	2	12	Machinery failure/1, Unknown/1
Cargo shift	1	0	Unknown/1
Collision	1	0	Unknwon/1
Total	26	104	

Table 1: Bulk carrier losses and causes (2013-2022)

Accidents caused by the liquefaction of cargo on bulk carriers tragically result in the deaths of many crewmembers. Table 2 shows a summary of such accidents between 2013 and 2022. Four of the five accidents involved nickel ore that was loaded in Indonesia and the fifth involved bauxite that was loaded in Malaysia.

Note 1: Cargo liquefaction occurs when shaking and vibrations in a ship cause granular solid bulk cargo to shift in a manner that reduces gaps between the granules. Surface friction of the granules is lost as the pressure of water separating the granules rises due to the smaller gaps. As a result, the cargo is abruptly transformed from a solid dry state to an almost fluid state.

The INTERCARGO report includes the following information concerning cargo liquefaction:

- Cargo liquefaction may occur slowly over a long time but can also happen suddenly with no warning.
- The risk involving cargo increases significantly when the properties of cargo differ from the information in the shipper's documents provided to the ship operator.

Date	Ship	DW	Fatality	Loading	Cargo	Remarks
17-Feb-13	Harita Bauxite	48891	15	Indonesia	Nickel	The main engine was stopped for repairs. 30 minutes later the ship capsized and sank. 10 crew members were rescued.
14-Aug-13	Trans Summer	56824	0	Indonesia	Nickel	Capsized and sank during a typhoon while at anchor off the coast of Hong Kong. All 21 crew members were rescued.
2-Jan-15	Bulk Jupiter	56009	18	Malausia	Bauxite	One crew member was rescued (see text for more information)
13-Oct-17	Enerald Star	57367	10	Indonesia	Nickel	The ship suddenly started rolling violently, abruptly tilted to port and capsized 90 minutes later. Six crew members were rescued
20-Aug-19	Nur Allya	52378	27	Indonesia	Nickel	Ship was lost near Buru Island and was found in October at a depth of 843 meters in the Maluku Islands.

Table 2: Ship sinkings caused by cargo liquefaction (2013-2022)

- Amendments 06-21 of the International Maritime Solid Bulk Cargoes (IMSBC) Code will become effective on 1 December 2023. The revised code includes provisions about liquefaction as well as dynamic separation (see Note 2). The revised code is expected to facilitate preventive measures concerning the moisture of cargo, which is involved with the mechanism that can cause cargo and vessel instability.
- Group A cargoes, as defined in the amended IMSBC Code, can be hazardous due to excessive moisture. If moisture exceeds the transportable moisture limit (TML), there is a risk of cargo liquefaction or dynamic separation.

Note 2: Dynamic separation of cargo can occur during a voyage when engine vibrations or the ship's movements cause compaction of the cargo from underneath. The resulting pressure pushes the water in the cargo to the surface. As a slurry consisting of water and fine particles accumulates on the surface of the cargo, the free water effect occurs within the hold. As a result, the apparent metacentric height (GM) decreases. Over time, the movement of this slurry causes the loosened cargo to become unevenly distributed within the hold, such as by building up on one side. This can cause the ship to tilt. If the free water effect on the surface of the cargo increases, a ship may even capsize.

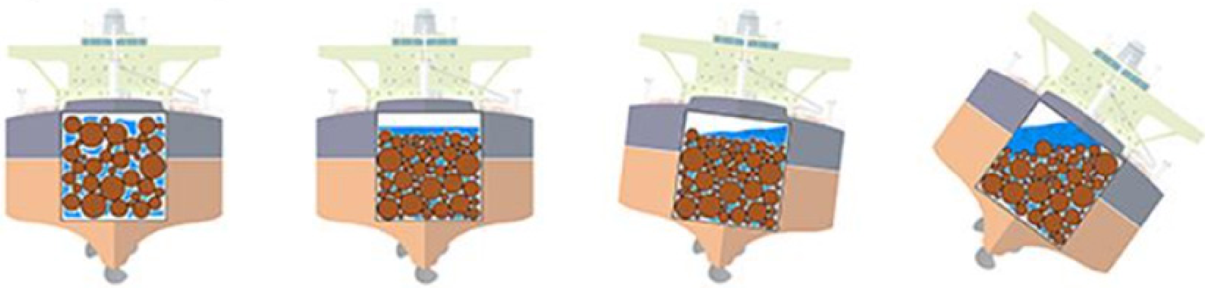


Figure 1: How dynamic separation can cause a ship to tilt

Case Study:
Sinking of the *Bulk Jupiter*

1. Summary

The bulk carrier *Bulk Jupiter* (31,256GT, crew of 19) arrived at Kuantan, Malaysia on 16 December 2014, but loading operations were delayed because of heavy rain. At 2100 on 17 December, loading of holds 1, 3, 4 and 5 started. There was a monthly record of 1,806.4mm of rain on the west coast of Malaysia during a 22-day period in December. Loading cargo took a long time because of the heavy rain and a crane malfunction. At 2124 on 30 December, *Bulk Jupiter* departed for Qingdao, China, with 46,000 tonnes of bauxite. On the way to China, the ship headed to Hong Kong for bunkering. On 31 December, a weather routing company sent an email that provided the ship with an alternative route due to bad weather. But this route was to go directly to Qingdao, and the captain did not use it.

The following information is the testimony of the chief cook, who was the sole survivor of the sinking of the *Bulk Jupiter*.

At about 0640 on 2 January 2015, the general alarm sounded and the Master ordered all crew members to the bridge. The chief cook put on his overalls and headed for the bridge. However, other crewmembers he saw before reaching the bridge told him to go to the port side lifeboat. The chief cook went back to his cabin for his lifejacket, immersion suit and driving licence. He then left his cabin to make his way to the port side lifeboat, but the ship's electric power cut off. Emergency lights came on, the ship stopped rolling but listed about 45 degrees to starboard. The tilting prevented the chief cook from going to the port side access door, so he used the internal staircase to reach deck C where he saw the Master. The chief cook left the port accommodation block and saw the Master jump into the sea wearing a lifejacket. The chief cook immediately followed the Master into the sea. Neither were wearing an immersion suit. Although the chief cook saw a life raft, he could not reach it. The Master and chief cook moved away from the sinking ship and, looking back, were able to see through the heavy seas that the ship was already almost entirely below the surface.

On 2 January, the Japanese Coast Guard received a distress call at 0654 and immediately started a search and rescue operation. The *Bulk Jupiter* reportedly sank between 0654 and 0700. According to the distress call, the ship was approximately 150 nautical miles southeast of Vietnam at 09-01-01 N and 109-15-26 E. At 0945, the containership *Zim Asia* received an emergency call via NAVTEX and began searching for survivors. At 1410, the Master and chief cook were found. At 1556, the tugboat *ONLG Muttrah* rescued the two men, but tragically only the chief cook survived. The *Zim Asia* ended its search and rescue activities on 5 January. The Vietnamese Coast Guard continued searching the area but stopped on 16 January.

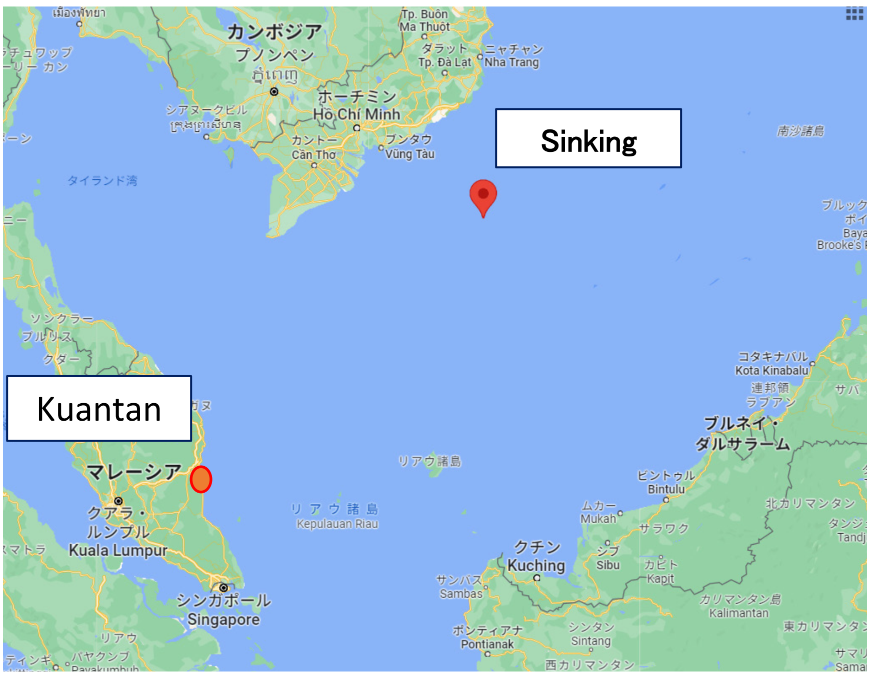


Figure 2: Location where the *Bulk Jupiter* sank

2. Analysis

Cargo Declaration of the shipper

The shipper's Cargo Declaration stated that the moisture content was no more than 10%. However, this was very unlikely because of the heavy rain prior to the start of the loading operations and the conditions of the mining, transport and storage operations for the bauxite.

Testing of samples

Ten tests of bauxite samples were conducted between 17 and 30 December. The average moisture content was 21.3%, which was 11.3 percentage points higher than the figure in the Cargo Declaration. The operators of the *Bulk Jupiter* were not aware of the results of the tests.

Can test

On 24 December, the management company of the *Bulk Jupiter* asked the Master to perform a "can test" (see Note 3) because the cargo was extremely wet. No one knows whether the Master conducted the test.

Note 3: A can test involves a wet sample of the cargo being placed in a can to a height of about 20 centimetres and the can then being banged against a hard, flat surface 25 times at intervals of one or two seconds. The test is used to determine if liquefaction of the sample is possible.

IMSBC Code 8.4.2 states that: "If samples remain dry following a can test, the moisture content of the material may still exceed the Transportable Moisture Limit." Therefore, the can test can be used on the ship to determine the possibility of liquefaction. At the very least, cargo that does not pass the can test should not be loaded on the ship.

Figure 3: The bauxite open-pit mine at Kuantan and loading on the *Bulk Jupiter*

1. Place sample in the can

2. Bang the can against a flat surface

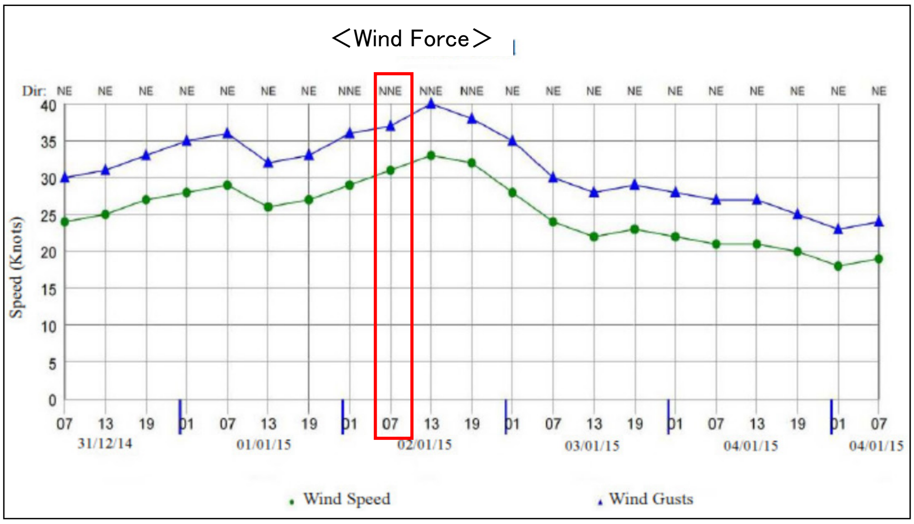
3. Check for liquefaction

Figure 4 : Can test

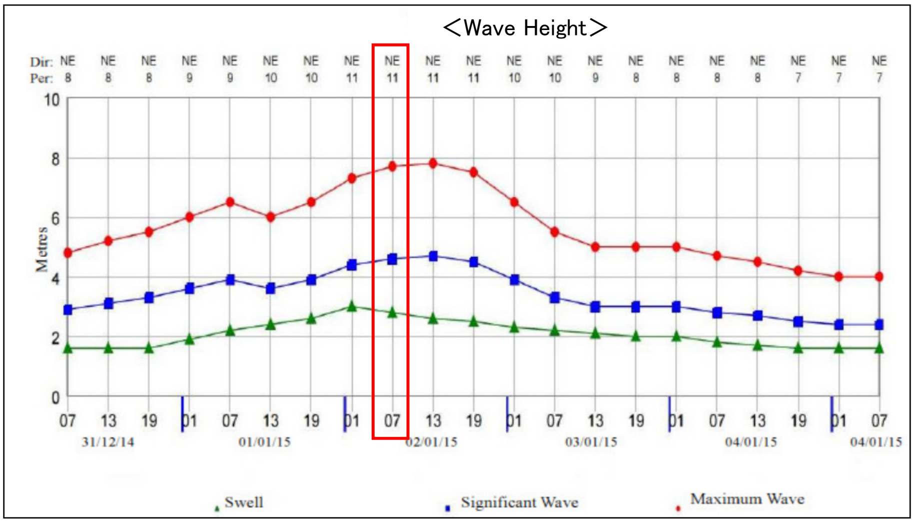
Weather and sea conditions

Information about the weather and sea conditions when the *Bulk Jupiter* sank (according to information from the *Tosia Dauntless*, a ship used for rescue operations) show that the *Bulk Jupiter* was rolling and moving up and down violently. Consequently, the possibility of the occurrence of liquefaction cannot be discounted.

Wind: NNE 31 knots(16m/s~19m/s)



Swells: NE 4.6 to 5.8 meters



Noon report

According to the SMS procedure of the ship management company, the crew of the *Bulk Jupiter* was required to submit a noon report every day. However, the ship's noon report did not include the relative humidity of the cargo, open-air exposure, temperature, venting and cargo status. On the other hand, performing these tests may have been physically impossible because of the strong wind and swells.

3. Summary of the conclusions (Bahamas Maritime Authority)

- The average moisture content of the bauxite on the *Bulk Jupiter* was 21.3%. This was determined after the ship sank. However, there is no physical evidence to confirm the reason for the ship's violent tilt to port followed by its capsizing.
- During loading, the crew continuously opened and closed the hatch covers to reduce the amount of water that entered the holds. Despite these measures, the bauxite was exposed to the rain during

transport by truck and when piled on the waterfront.

- Before the cargo was loaded, the Master did not ask for an independent test to determine the properties of the cargo. As a result, the cargo was loaded with no verification of the physical properties or moisture content in relation to the parameters of the IMSBC Code schedule or Cargo Report.
- The ship management company was supervising the *Bulk Jupiter* properly and submitting instructions properly. However, the management company did not act properly regarding the need to reduce the ship's speed significantly, report the result of a can test and check the information in the noon report.
- The conclusion is that the most likely cause of the sinking of the *Bulk Jupiter* was the rolling of the ship to a point that led to capsizing due to liquefaction or the free water effect.

It is also possible that the cargo slid to one side of the ship and could not return to its original position. If the surface of the cargo is not trimmed, the angle of tilt may become greater than the angle of repose of the cargo.

Lessons learnt

Transporting cargo that has liquefied creates the risk of the ship suddenly capsizing. Operators of ships must therefore be extremely cautious about this risk during cargo loading and navigation. Regulatory authorities, shipping organisations and other entities have issued numerous warnings in response to the occurrence of cargo liquefaction accidents. See the reference materials 6 and 7 below for more information.

This report includes the following basic precautions regarding cargo liquefaction for ship operations.

1) Before loading cargo:

- The Master must be aware of the cargo schedule of the IMSBC Code
- Documents concerning the cargo must be received (Cargo Report, TML certification, moisture content declaration, etc.)
- If necessary, the Master or an agent must test the cargo
- Group A cargo should not be loaded in the rain.

2) During navigation

- Check the condition of the cargo regularly (keep records, take photos)
- Keep records of the hold bilge measurements and bilge discharge
- Reduce rolling as much as possible
- If any of the following signs of liquefaction are apparent, immediately go to the nearest safe port or take some other action for safety:
    - Surface of the cargo is flat or looks like putty
    - The cargo is shifting
    - Free water is on the surface of the cargo
    - The ship is unstable.

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2. Management

Marine Accidents and Management Responsibility

Introduction

On 23 April 2022, off the coast of Shiretoko, Hokkaido, contact with the sightseeing ship "K", with a crew of two and 24 passengers, was lost and a search for the ship found that it had sunk with the loss of everyone on board. This tragedy was an enormous shock to the Japanese public. The Japan Transport Safety Board is conducting an investigation and more information about the causes of this accident are expected to be revealed.

Japan established a Transport Safety Management System in October 2006 for all coastal ships in Japan. This system is also called the Japanese version of the ISM Code. The system requires operators of these ships to adopt rigorous safety measures. Furthermore, a PDCA cycle must be used for the continuous improvement of safety management systems for an even higher level of safety.

On 11 May, the Japanese government established a committee to study ways to prevent an accident like the one in Hokkaido from happening again. The committee announced an intermediary report on 14 July. The first in a list of items that require immediate attention is the need for operators of ships to establish an even more rigorous safety management system. The report includes the following statement about strengthening the safety management of ships and requirement of ship management company presidents to have a stronger commitment to safety.

> "Operators of small passenger ships must reinforce transport safety management measures and the presidents of these companies must increase their awareness of the importance of safety. In particular, companies where there is a new president need to be evaluated thoroughly."

The need for a higher level of safety also applies to ships involved in international shipping. The ISM Code clearly states that companies, in other words management, are responsible for safety. In fact, there have been many marine accidents that have highlighted the need for management to take responsibility for the safe operation of their ships.

This report analyses the responsibility of management in relation to several marine accidents and considers the actions that managers need to take to improve safety.

Capsizing of the *Herald of Free Enterprise*

The RORO ferry Herald of Free Enterprise departed the port of Zeebrugge, Belgium on 6 March 1987 for a routine voyage to Dover, England. However, the ship departed with the bow doors open. A large volume of water flowed into the vehicle deck, which caused the ship to lose its stability and capsize. This tragedy resulted in the deaths of 193 passengers and crewmembers.

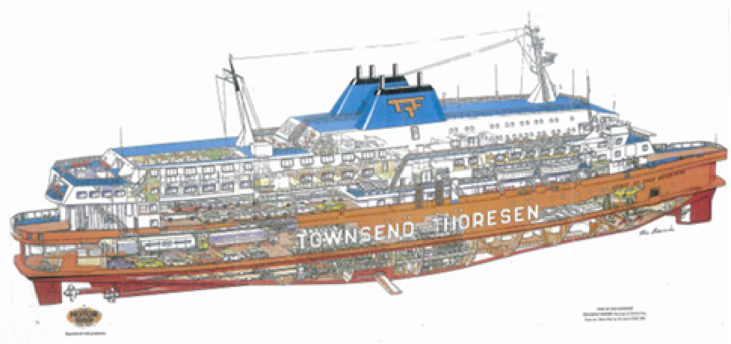
The primary cause of this accident resided with the assistant boatswain, who was responsible for closing the bow doors, but overslept and did not close the doors. However, the investigation concluded that the ferry company's management carried responsibility because there was no foolproof system for preventing problems caused by the oversight of a single crewmember.

The investigation revealed that management did not respond properly to the following past incidents involving the *Herald of Free Enterprise* and her sister ferry:

- On several occasions, ferries had departed with the bow doors open.
- The captains of these ferries had asked management to install an indicator on the bridge to show the status of the bow doors, but these requests were ignored.
- The Bridge and Navigation Manual stated that the officer responsible for loading vehicles and cargo must be on the bridge by 15 minutes before departure. This was contradictory to their duty to confirm that the bow doors were closed after loading had been completed.

Legal proceedings resulted in the conclusion that there was gross negligence of the captain, chief officer and assistant boatswain concerning the performance of their duties. However, the judgment also stated that there was gross negligence on behalf of the ferry operator. The court made the following statements regarding the management of the ferry operator:

- The underlying or cardinal faults lay higher up in the company.
- The Board of Directors did not appreciate their



Herald of Free Enterprise

The route from Zeebrugge to Dover
The location of the ferry's grounding in Zeebrugge

responsibility for the safe management of their ships.

- Everyone involved with management, from the company's directors to junior superintendents, were guilty of the failure to recognise that everyone is responsible for a failure of management.
- From top to bottom, the body corporate was infected with the disease of sloppiness.

This was one of the accidents that led to the establishment of the ISM Code. This Code was established in 1993. In 1994, this Code became mandatory due to the addition of Chapter IX to the SOLAS Convention.

The duties of management (senior executives and onshore personnel)

Many other marine accidents over the years have highlighted problems involving the management of companies that operate ships. The table below describes a few such accidents:

The causes of the accidents described in the case studies and table above highlight four key issues concerning the responsibility of management (applicable ships are shown in parentheses).

- Company's inadequate commitment to safety / insufficiencies regarding ship management responsibilities (HFE, EV, SS, KW)
- There was an outstanding requirement to establish procedures for certain tasks (HFE, GR, AC, EV, SS, QE, KW)
- Insufficient monitoring/communication by the ship management company (HFE, GR, SS, QE, KW)
- There was an outstanding requirement to train personnel in the use of onboard systems (GR, QE, RM).

Key:
HFE: Herald of Free Enterprise
GR: Golden Ray
AC: Amoco Cadiz
EV: Exxon Valdez
SS: Scandinavian Star
QE: Queen Elizabeth 2
RM: Royal Majesty
KW: Kaiwo Maru

All of these issues are addressed in the ISM Code, but these accidents demonstrate that there is a need to once again place emphasis on the establishment and use of safety management systems.

Ship's Name (Type)	Year	Accident	Area	Damage
	Management responsibility			
Amoco Cadiz (Tanker)	1978	Grounding	France	Total Loss, 220,000t Oil Spil
	Restrictions on captain authority at the time of salvage contract			
Exxon Valdez (Tanker)	1989	Grounding	Alaska	Total Loss, 40,000t Oil Spill
	Promotion of long working hours and personnel management			
Scandinavian Star (Passenger)	1990	Fire	Denmark	Total Loss, 158 people died
	Lack of safety awareness of shipowners, insufficient preparation for service			
Queen Elizabeth 2 (Passenger)	1992	Grounding	New York	USD 60 Mil
	BRM / Lack of display and provision of maneuvering performance			
Royal Majesty (Passenger)	1995	Grounding	Boston	USD 7 Mil
	Lack of training for Bridge Integrated System and BRM			
Kaiwo Maru (Training Ship)	2004	Grounding	Toyama	Serious damage
	Insufficient support / Lack of understanding of SMS, not implemented			

Proper management of ships

Companies that manage ships must be well aware of their responsibilities regarding safety management on their ships. In addition, these companies must understand that management and the entire organisation are responsible when an accident occurs.

The accidents listed in this report led to the conclusion that the management of companies operating ships must implement safety management systems on their ships. This requires the managers of these companies to build a system capable of determining the true status of their ships at all times, using every method possible to acquire the necessary information for their onshore teams to monitor their ship operations.. Taking these actions will ensure that there are procedures in place for specific tasks, that the required resources are available, and that everyone has an understanding of the need for training and education, and facilitate the availability of these programmes.

In other words, management (the onshore organisation) must always have a strong commitment to supporting ships (crewmembers).

REFERENCE MATERIALS

- Intermediate Conclusions of the Shiretoko Sightseeing Boat Accident Investigation Committee, Ministry of Land, Infrastructure, Transport and Tourism
- mv HERALD OF FREE ENTERPRISE
  Report of Court No. 8074, Formal Investigation
- DEPARTMENT OF TRANSPORT
  Capsizing of Roll-on/Roll-off Vehicle Carrier Golden Ray
  Marine Accident Report NTSB/MAR-21/03

Key Points for Safe Navigation (Onshore support for ships)

The three factors that can lead to an accident (environment, hardware, people)

The operation of ships is constantly becoming more advanced because of the use of the latest software and hardware. Despite this progress, we are still seeing many of the same types of accidents that occurred 50 or even 100 years ago. An analysis of the causes reveals that negligence and carelessness continue to be prevalent.

The behaviour of people is obviously a major factor in accidents, as these reports have stated before. Operating ships involves at all times a "human element", encompassing the crews of ships, the onshore management of ships (senior executives) and oversight by regulatory agencies for shipping. Over time, the people involved in operating ships are replaced with a new generation of personnel, but unfortunately, this is when vital information often is not passed on. For example, the new people may not be aware of the lessons learnt from past accidents, and the precautions introduced and preventive measures implemented..

Why do accidents happen?

The answer requires a close look at the three primary factors affecting the operation of ships:

(1) environment, (2) hardware and (3) people.

(1) The environment includes the weather, sea conditions, the route and congestion of areas along the route. Risk factors involving the environment are always present.

(2) Hardware comprises the ship and includes risks involving maintenance, the use of the ship's equipment and other items.

(3) People refers to both the crew on the ship and the onshore management team.

Since the environment and hardware are always the basic components of any voyage, the people involved must be able to skillfully handle these two factors. In other words, people have an obligation to minimise the vulnerability to risk factors concerning the environment and hardware.

It may not be the right word, but I think the environment and hardware can be 'controlled' to some extent by the crew and management. For the environment, storms and dangerous areas can be avoided by preparing a suitable passage plan. In addition, the risk of a collision with another ship can be reduced by identifying regions where there are many ships. For hardware, risk can be minimised by properly maintaining and operating the ship and its equipment.

Earlier, I stated that people often neglect to pass on lessons learnt from accidents to the next generation. A safety management system that uses documents is needed to be certain that knowledge gained from accidents and proper responses to accidents are not forgotten. Furthermore, all ships on international routes are required to use a safety management system that complies with the International Safety Management (ISM) Code.

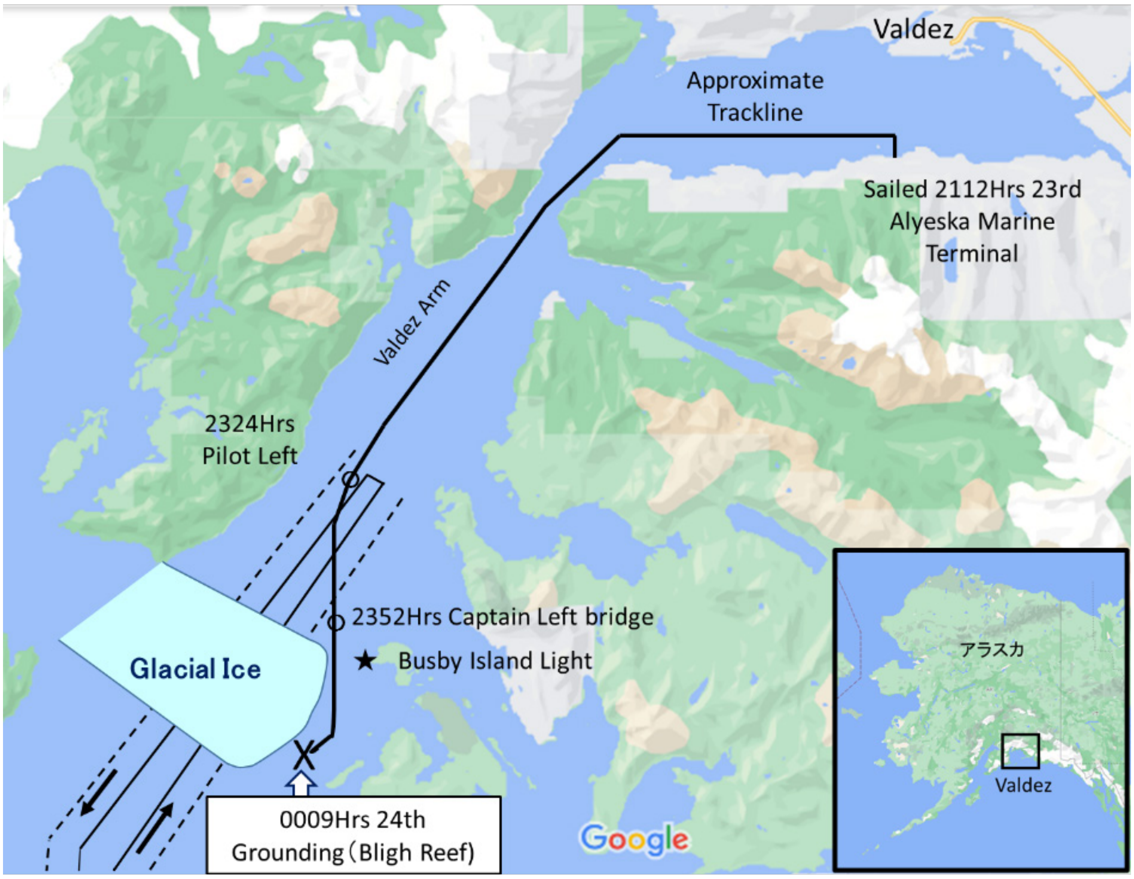


Diagram 1: Location of the grounding of the *Exxon Valdez*
(Source: NTSB/MAR-90/04)

Learning from accidents of the past

On 24 March 1989, the VLCC *Exxon Valdez* ran aground in Prince William Sound near Valdez, Alaska. The vessel spilt approximately 41,000 kilolitres of crude oil which soiled about 2,400 kilometres of coastline. Removal of the oil required an expenditure of $2 billion.

Let's examine the direct causes of this accident from the standpoint of the three primary factors:

- The **environment** forced the ship off its course in order to avoid floating ice in the channel. At that time, the width of the passable channel was less than one mile (1,852 metres). The *Exxon Valdez* was using the same route as other ships had taken in order to go around the ice. As a result, the National Transportation Safety Board (NTSB) stated that the ship's course was reasonable.
- There was no problem with **hardware** regarding a breakdown or malfunction of the ship's instruments and other equipment. However, there was a problem concerning how the ship was steered. The third officer, who was on duty at that time, intended to move the rudder but did not confirm that the rudder's position had changed.
- Numerous problems involving **people** played a role in this accident. For example, the third officer, who was navigating the ship, made a large number of errors, such as failure to monitor and confirm the ship's position, and the use of an improper steering method, due in part to fatigue. However, the NTSB concluded that the ship's owner was responsible for creating an environment that caused the third officer's fatigue. The investigation also revealed that the ship's owner had a personnel management system that encouraged people to work long hours. Consequently, a causative factor of the grounding of the *Exxon Valdez* was the inability of people to adapt to the environment and properly use the hardware.

Many other unsafe acts and conditions contributed to this accident. Preventing accidents of this type therefore requires minimising errors and breaking any chain of errors.

The role of onshore management in ship operations

Management (company executives and onshore ship management personnel) must support ships and their crews as much as possible in an appropriate manner.

The business operations of a company that operates ships will be successful only if the ship, which can be viewed as a tool for accomplishing a goal, is used skillfully. Management is fully responsible for the safety management of ships and must not rely entirely on the ship's Master and chief engineer, who are responsible for the operation of the ship. As stated in the ISM Code, everyone involved must be aware that onshore and ship personnel are a single, unified team.

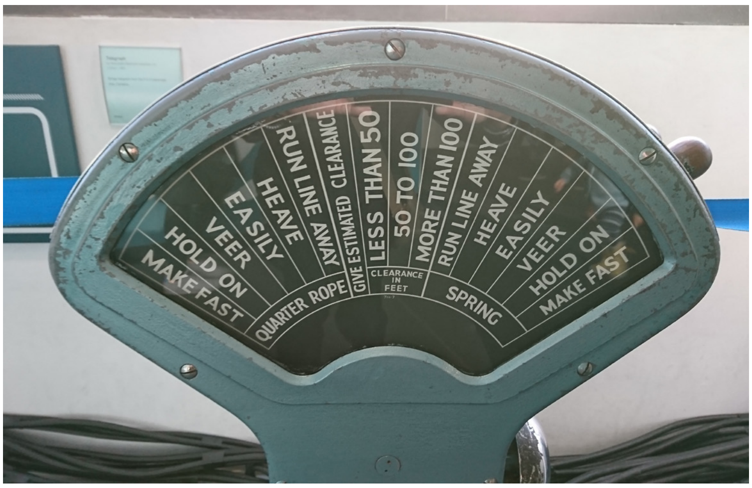
When a management team has a strong sense of responsibility, responses to marine accidents are different and actions can be taken quickly to contain damage and end the emergency. Individuals who are responsible for the day-to-day management of ships must also be aware of their responsibilities in the event of an accident.

Key points for safe navigation

The fundamental premise for safe navigation is onshore ship management that is able to keep track on a real-time basis of events within the management organisation itself and on board its ships. This premise is the same as the thinking behind situational awareness for bridge resource management (BRM) and bridge team management (BTM). Here, situational awareness means the constant awareness of whether or not the ship is operating in compliance with the standards and rules of the ship and the organisation to which the ship belongs. One more critical point is the need to realise when a situation occurs that causes a ship to no longer comply with a standard or rule and to make improvements promptly.

The operation of ships must comply with the SOLAS Convention (the International Convention for the Safety of Life at Sea, which was passed in 1914) and other international rules. In addition, safe navigation extends to internal regulations, ship/shore safety management systems established by ship management companies, and other frameworks. Furthermore, based on this situational awareness, vulnerability to risks must be minimised by improving procedures for performing tasks and conducting drills and education programmes as needed.

In summary, the mission of onshore management is to provide as much support as possible to ships, which are the front line of activities for safe navigation. Safe and sound navigation is possible only when this type of appropriate and effective support framework is in place.



SOURCE

This report was prepared by using an article titled "Safe and sound maritime transportation can be established with the support of the ship by onshore management", which is an interview with the author in *Kaiun* (*The shipping*, May 2023/ No. 1148), a periodical issued by The Japan Shipping Exchange, Inc.