

Analysis of Navigational Casualties within European Waters and Case Study

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ABSTRACT: Work shortly analyses statistics of maritime casualties registered by European Maritime Safety Agency (EMSA) for years 2014-2019 and gives short description of chosen collisions that took place in last ten years. Article points out main causes of navigational accidents and the need to keep improving navigators skills and operation of systems available on board to minimize risk of collision or grounding due to human error. In this work very small sample is presented and author mainly focuses on European waters and incidents investigated by only one maritime authority – Danish Maritime Accidents Investigation Board (DMAIB).

1 INTRODUCTION

EMSA was set up as a regulatory agency that would provide a major source of support to the European Commission and the member states in the field of maritime safety, security and prevention of pollution from ships. The Agency was established by Regulation

(EC) No. 1406/2002 and subsequent amendments have refined and enlarged its mandate to cover, among other measures, the efficiency of maritime transport. Based in Lisbon, the agency provides technical assistance and support to the European Commission and Member States in the development and implementation of EU legislation on maritime safety, pollution by ships and maritime security. It has also been given operational tasks in the field of oil pollution response, vessel monitoring and in long-range identification tracking of vessels. Every year EMSA is collecting reports and data about incidents which: involve ships flying a flag of one of the European Union Member State; occur within EU Member States' territorial waters as defined in

UCLOS (United Nations Convention on the Law of the Sea); or involve other substantial interests of EU Member State.

EMSA has developed the tool to be able to collect and classify data about casualties – EMCIP (European Marine Casualty Information Platform). System is unifying and simplifying way of reporting events by shore authorities and maritime personnel. Picture (pic.1) below shows simplified model of ship's accident report made with EMCIP. Thanks to use of very simple structure, report is easy to do. According to last annual report about 60% of incidents is reported by shore authorities, 23% of reports come from companies and about 12% from ships. As statistics show during last 5 years their total amount is similar every year and stays on the level of around 3000 reports per year.

DMAIB is in charge of investigation of accidents occurring in Danish territorial waters and on board of ships carrying Danish flag. Danish territorial waters main connection between Atlantic Ocean and Baltic Sea.

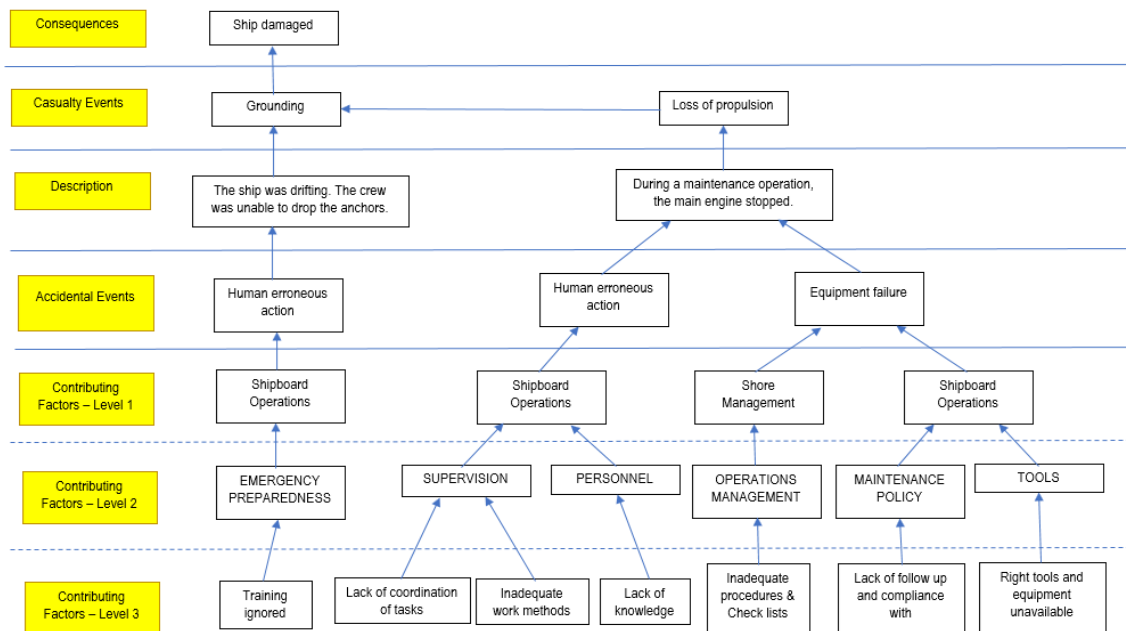


Figure 1. EMCIP model
Source: "Annual Overview of Marine Casualties and Incidents 2020"

As statistics show navigational accidents are still big part of all events reported to authorities. According to EMSA (European Maritime Safety Agency) report "Annual Overview of Marine Casualties and Incidents 2020" in years 2014 – 2019 44% of all reported casualties were navigational, constituted by collision, contact and grounding/stranding (pic. 2).

When looking closer to the statistics it is visible that every year the biggest part of navigational occurrences are contacts (pic. 4). EMSA defines those as "a casualty caused by ships striking or being struck by an external objects" (floating, fixed or flying). Every year there is also lower but still significant number of collisions and groundings. Their numbers are lower every year. EMSA does not specify but one may suspect that this is enhanced by development of tools helping navigational officers to make their decisions, better route planning tools and detection of a potential dangerous situation before it arises.

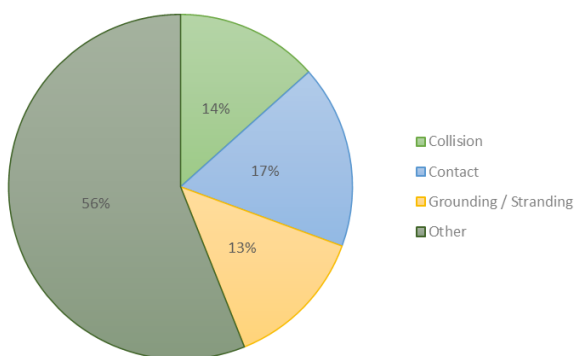


Figure 2. Type of occurrences reported to EMSA in years 2014-2019
Source: "Annual Overview of Marine Casualties and Incidents 2020"

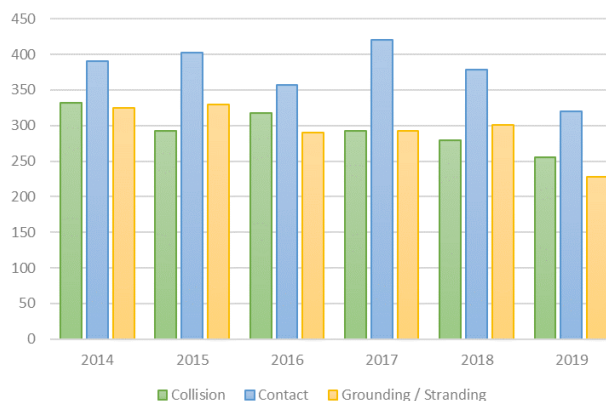


Figure 3. Registered amount of navigational occurrences reported to EMSA in years 2014-2019
Source: "Annual Overview of Marine Casualties and Incidents 2020"

Fig. 3 shows that the fall of number of accidents is not continuous. There are years like 2016 when number of incidents classified as contact is visibly lower but it averages around 380 accidents a year. Same for collisions. Even though number of collision has falling tendency within years 2017 – 2019 the average is still barely under 300 cases a year just within European waters and ships flying a flag of one of the European Union Member State.

Every year cargo ships are the biggest group of type involved in accidents. Fig. 4 shows that in years 2014 – 2018 it was over 1200 ships involved every year. In year 2019 number is slightly lower but still over 1000. Second biggest group are passenger ships. Their number averages around 560 vessels involved in accidents every year. And the third group would be fishing vessels with average of 340 vessels per year.

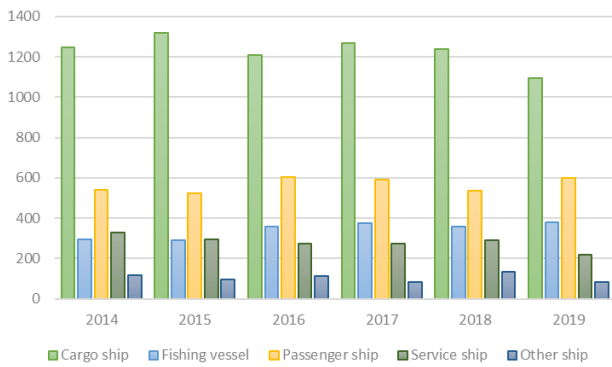


Figure 4. Main types of ships involved in accidents reported to EMSA in years 2014 – 2019.

Source: “Annual Overview of Marine Casualties and Incidents 2020”

Also the most accidents in general take place while ships are “en route” (fig. 5). This is not specific to only one type of the vessels. According to statistics departure seems to be relatively safe part of voyage. Arrivals show almost double amount of accidents comparing to departures.

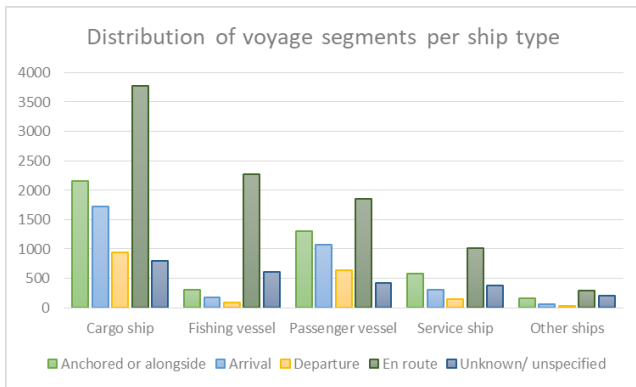


Figure 5. Distribution of voyage segments per ship type in years 2014 – 2019.

Source: “Annual Overview of Marine Casualties and Incidents 2020”

About 50% of all recorded accidents in years 2014 – 2019 took place on internal waters, 27% on territorial sea and only 18,6% on open waters (fig. 6). Most of the navigationally restricted waters like passages, port approaches are located internal and territorial waters.

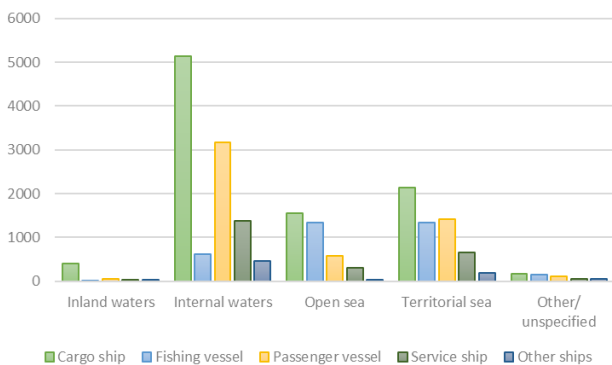


Figure 5. Distribution of marine incidents and casualties by ships type and location in years 2014 – 2019.

Source: “Annual Overview of Marine Casualties and Incidents 2020”

As visible in fig. 6 cargo ships and passenger vessels are the most accident prone on internal waters and territorial seas. On open waters lead is taken by cargo ships and fishing vessels. That may be caused by the fact that little of passenger ships is spending long time in open seas as they have a lot of ports on their routes and stay a lot within territorial waters. Fishing vessels depends on their specifics will be engaged in fishing on shallows closer to shore (territorial waters) or on deeper waters of open seas. These are the locations where most of the accidents is appearing. Also often as showed in case study fishermen are busy during their return to port with their catch and they are not exactly focused on the navigation and keeping proper lookout.

EMSA report states that over 54% of accidents were attributed to “human factor”, 28% to “system/equipment failure”. That shows how important human factor is in safety of navigation and accidents prevention. Within “human factor” two main contributing factors are pointed: 27,3% to ‘personnel and manning and general’, 14,3% to ‘crew resource management’.

In case study below it is visible that navigational accidents are in great deal dependent on human factor – crew resource management and proper use of tools like radars and ARPA. Accidents described in this paper show that they are occurring not only to young and unexperienced ship’s officers. In most of the cases senior officer was present on the bridge. In case of Kraslava there was a pilot onboard. All of the accidents could have been avoided if equipment available onboard was used more effectively. It is not authors intention to question proper training of the crew but to emphasize that tools and methods used to avoid collision can be still improved. That is also authors target for future studies.

2 CASE STUDY

2.1 ICE ROSE & 311 KAZANETS (23 OF SEPTEMBER 2020)

Refrigerated cargo vessel Ice Rose was on her way from St. Petersburg towards Falmouth in Great Britain approaching western channel. Planned route was passing via The Sound and Skagen where ship was to take fuel for further voyage to destination port. Vessel was in ballast condition. Russian Navy warship 311 Kazanets was entering Baltic Sea waters navigating south-east via eastern channel accompanied by 304 Urengoy.

After the event warships sailed away, DMAIB (Danish Maritime Accident Investigation Board) had no jurisdiction to investigate 311 Kazanets. Investigation was therefore based on the information available from Ice Rose crew interviews, her VDR records, records from VTS Sound (Sound Vessel Traffic Service) and their radar screens records.

Collision took place south of Drogden Lighthouse. Ships were navigating in very dense fog. Visibility at the time of collision was estimated to about 50 meters. On Ice Rose third officer was on duty and Master was present on the bridge to assist him. Speed was

reduced to 14 knots and manual steering in place. Third officer was mainly by the radar and ECS (Electronic Chart System) monitoring the traffic and progress of the route. Master was by the front windows assessing the visibility and occasionally looking at the radar and ECS. The first ship noticed by 3rd officer was echo without AIS signal on a south-westerly course crossing ahead of Ice Rose at about 1 Nm distance from starboard side. Ship was spotted when crossing bow and recognized as Russian warship. After that visibility suddenly decreased to about 50 meters. Third officer observed on the radar another echo with no AIS signal approaching from starboard side. Observation was voiced and master head back to the radar. Echo was plotted on the radar and apparently on collision course with Ice Rose. As the other ship approached closer, master hesitated to turn hard to starboard, he also didn't turn to port (that would not resolve situation in case the other ship turn to starboard). Sound signal was activated and small changes of course to starboard (to 010°) and then to port (to 005°) were ordered. The collision happened at 0946, then it was noticed that Ice Rose collided with Russian warship similar to on passing ahead few minutes earlier. Ice Rose dropped anchor 1 NM south of Drogden Lighthouse at 1015. Warship 311 Kazanets was assisted by 304 Urengoy, did not reply to any call from VTS Sound and left the area of accident same afternoon proceeding southwards out of Danish waters.

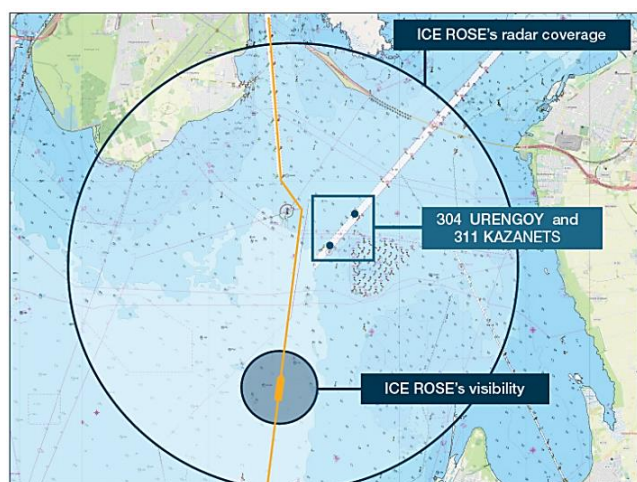


Figure 4 . Approximate radar coverage and visibility on Ice Rose at around 0935.
Source: DMAIB accident report [4].

Ice Rose's X-band radar was set to 6 Nm with 1 Nm range rings, 3 minutes relative trails and 60 minutes relative vectors, north up, no any target is acquired for tracking, auto-acquisition off. In the report it is stated that radar was set to master's preferences but third officer was the one mainly observing it's screen. Both of the Warships were visible on the screen (fig. 5) but located between buoys of eastern channel and blurred by the trails so their detection is difficult for unexperienced person. The master and third officer were mostly relying on visual cues to detect danger of collision and randomly checking targets by selecting them and analysing their CPA and TCPA values. EMSA is pointing out two main disadvantages of that radar configuration. Firstly possibility of delayed detection of moving

target and acquisition of it. Secondly not enough time for ARPA to show accurate data of acquired target. It is clearly stated that at 0935 neither master nor third officer were aware of warships presence in the area. First observations of them was made few minutes later when third officer reset trails to true and first of the echoes was clearly distinguished from the buoys. Second echo was not recognized properly until only minutes before collision.

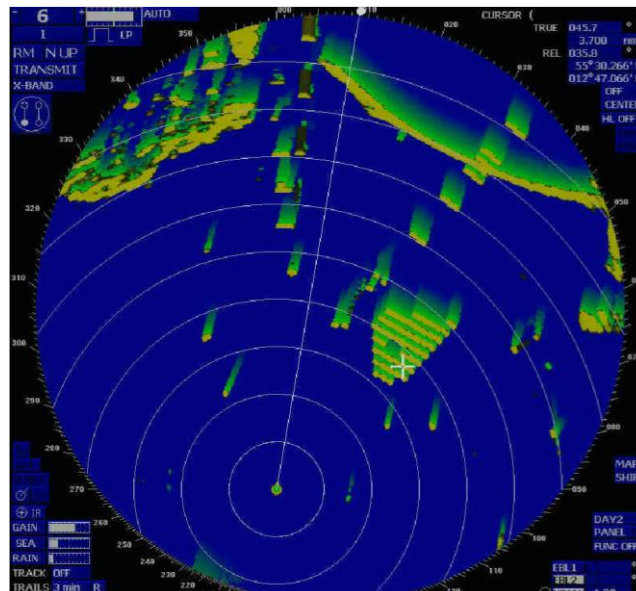


Figure 7. Ice Rose's radar image at 0935.
Source: DMAIB accident report [4].

According to COLREG (Convention on the International Regulations for Preventing Collisions at Sea, 1972, as amended) both vessels were power-driven vessels under way, navigating in restricted visibility not in sight of each other. Ice Rose was giving sound signals according to Rule 35(a). It is not stated if Kazanets was using any sound signals. Therefore according to Rule 19 there was no stand on vessel and both were required to take action to avoid close-quarters situation and collision. Rule 19 should be used in conjunction with rules 4-10 and rule 35. Those rules give officers some field of interpretation and ability to take action according to their judgment for of safe speed and discretionary space based on their previous experience and perception of risk. Within that discretionary space the officer can and should take any necessary action to avoid immediate danger.

During the investigation DMAIB did not find any clues suggesting that ships equipment experienced a failure. Both ships were operating in restricted visibility in a narrow geographical area constricted by shallow waters. As investigation of 311 Kazanets was impossible DMAIB focused on Ice Rose. It was found that there was a few factors that contributed to bridge team not recognizing risk of collision. Firstly division of work between bridge team members – third officer and master. This resulted in only third officer monitoring radar, and when he missed the visual clues on the radar screen only few minutes left to decide on a maneuver to avoid collision. Secondly lack of decision to make big course alteration due to uncertainty of 311 Kazanets course and intentions, and restricted waters around Ice Rose. So when there

was no course alteration from Kazanets the collision became reality.

2.2 Spring Glory & Josephine Maersk (5 June 2012)

A bulk carrier SPRING GLORY was en route from Singapore (Singapore), where she loaded iron ore, towards Qingdao (China). Container vessel JOSEPHINE MAERSK was on her way from Port Chalmers (New Zealand) to Tanjung Pelepas (Malaysia) with load of general cargo in containers. Ships collided with each other about 7 nm NE of Horsburgh Lighthouse in eastern approaches to Strait of Singapore around 22.34 local time. Meteorological conditions were good with SE wind of 8 knots, southerly seas of 2 meters and visibility of 10 nm.

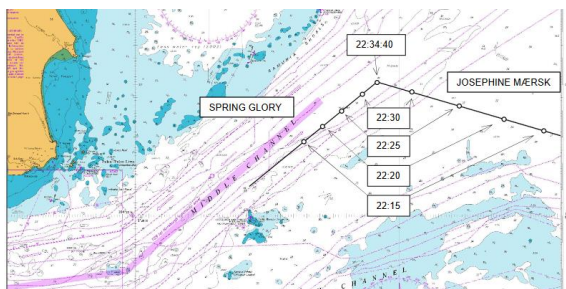


Figure 8. Site of the incident and the ships positions prior to the collision.
Source: DMAIB accident report [4].

The SPRING GLORY'S radar was set to 6 nm range head up, off centre and relative motion, ARPA was not in use, but 3 minutes long true trails were used. Radar had AIS overlay. About 17 minutes before collision radar range was changed to 12 miles for short moment. Then JOSEPHINE MAERSK could have been observed, from that moment until collision JOSEPHINE MAERSK remained visible on the radar, also when it was set back to 6 nm. About 8 minutes before collision JOSEPHINE MAERSK was selected as a target and identified with expanded data on the AIS (fig. 9). Even when CPA was indicated as 0.03 nm SPRING GLORY maintained course and speed. 4 minutes before collision duty officer of SPRING GLORY tried to establish communication with JOSEPHINE MAERSK. That was successful at first but later communication on channel 15 failed. A minute before collision and after few missed trials to communicate over the radio SPRING GLORY was put to hard turn to port.

On JOSEPHINE MAERSK 3rd officer took watch at 20.00. He had an able seaman for a lookout duty on the bridge. The main focus of the OOW was on passing the anchored vessels and three ships he had detected on his starboard bow, that were entering TSS. He planned to follow them and overtake later when westward bound. The officer did not detect any vessels approaching from port side (only anchored vessels), nor did lookout. Duty officer was concentrated on starboard side traffic and port turn that he had to do to enter TSS. SPRING GLORY became visible on the radar at a distance of approx. 11 nm and was visible on the radar until collision. About 10 minutes before collision SPRING GLORY was visible on the radar screen at a distance of approx. 5 nm and it could be identified on AIS (fig. 10).

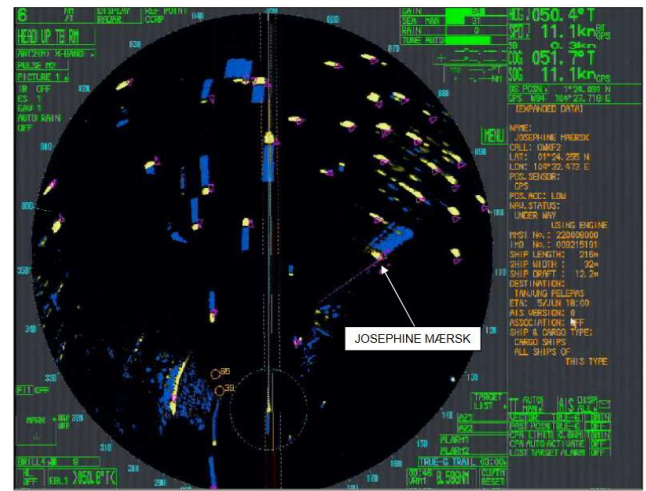


Figure 9. Radar screen on SPRING GLORY about 10 minutes before collision.
Source: DMAIB accident report [...].



Figure 10. Radar screen on JOSEPHINE MAERSK about 10 minutes before collision.
Source: DMAIB accident report [...].

About 5 minutes before collision duty officer observed green light at about 2 nm distance on his port side bow. That was first moment duty officer observed SPRING GLORY. He heard VHF call, but as mentioned before communication was not effective. 2 minutes before collision he initiated hard turn to starboard and called master on the bridge. Master hurried to the bridge as he felt ship's turn but when he arrived ships very close to each other with JOSEPHINE MAERSK being still in starboard turn. Soon after ships have collided with each other.

It has been pointed out by DMAIB that there may be violation of certain rules of COLREG highlighted. As the vessels were operating in sight of one another in good visibility the rules from section II of COLREG should be analysed. Particularly Rule 5 (Lookout), Rule 6 (Safe Speed), Rule 15 (Crossing situation), Rule 16 (Action by Give-way Vessel) and Rule 17 (Action by Stand-on Vessel).

Neither of the vessels managed to notice each other presence. In this situation SPRING GLORY was a give-way vessel and should have turn to starboard to give way to JOSEPHINE MAERSK approaching from her starboard bow.

2.3 Buster & Stavfjord (16 May 2021)

STAVFJORD is a general cargo vessel. She was en route on northerly course from Kolding (Denmark) to Jelsa (Norway). Buster was fishing vessel on her way to Strandby after a night of fishing langoustines.

Both vessels were equipped with AIS and radars. BUSTER's skipper determined that there was no vessel on his route that he would need to give way and after setting autopilot went to manage fished langoustines. On STAVFJORD chief officer took watch at 0400. AB from lookout duty was released as the sun was rising. Chief plotted BUSTER on the radar about 15 minutes after taking watch. Vector indicated that target will pass astern at a safe distance. He could see fishing boat approximately 15-20 degrees on starboard bow at about 1,2 nm distance (figure 11). He decided to signal his presence with ALDIS lamp pointed at BUSTER. After that officer left the lookout position to go to toilet. While in the toilet he heard a loud noise and realized the ship had collided with something – fishing boat BUSTER.

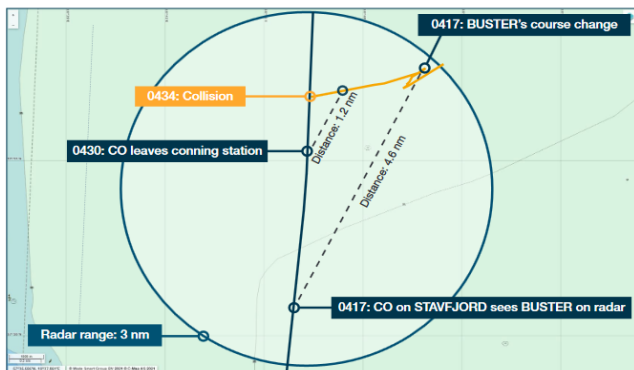


Figure 11. Distance and bearing at 0417 and 0430. Source: DMAIB accident report [6]

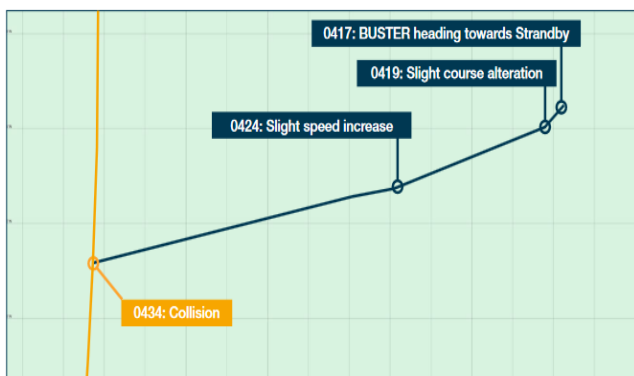


Figure 12. BUSTER's sailed route prior to collision. Source: DMAIB accident report [6].

No data from VDR was retrieved as STAVFJORD suffered VDR malfunction resulting in no data being recorded since April 2021. In the course of investigation it was found that chief officer did not look or verify BUSTER's radar echo and CPA for about 17 minutes prior to collision and that the conning station was unattended for about 4 minutes prior to the collision. No alarm were set on STAVFJORD radar to inform chief about dangerous change of CPA of acquired targets. BUSTER's skipper was adjusting his course and speed before proceeding to work on deck (fig. 12), he trusted that ships on his

port side will give him way according to COLREG rules. Because of BUSTERS construction skipper had no chance to see traffic on the port side of the vessel. He also could not see signals given with ALDIS lamp from STAVFJORD.

2.4 RIG & Inger Marie (10 of July 2014)

RIG was general cargo vessel underway from Riga (Latvia) to Keadby (UK) with cargo of timber on pallets with 10 crew members on board. Three navigational officers were keeping watch for 4 hours and had 8 hours of break. During the day officers were alone on the bridge. INGER MARIE was a fishing vessel (stern trawler) used to for fishing langoustine in the Kattegat, primarily in area approx. 15 NM is of the Læsø island. INGER MARIE was driven by only one person – skipper that perished in the accident.

At the time of accident RIG was underway along Route T, visibility was good, force 3 winds and a slight sea. Rig radar was set on 3 nm range, 0,5 distance rings, trails, north up and relative motion. Image on the radar was clear. Officer of the watch was familiar with traffic patterns in the area of accident as he sailed these waters before. Overview of the accident position is shown in figure 13.

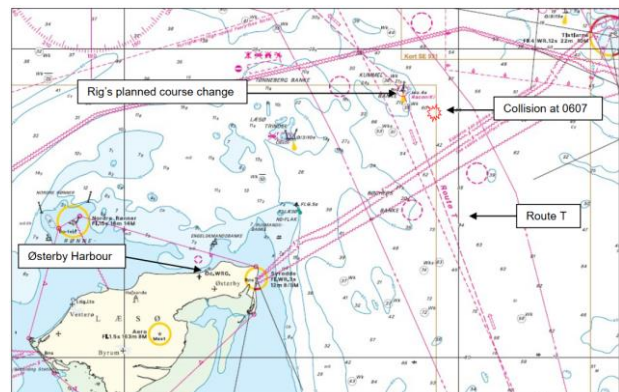


Figure 13. Overview of area of collision. Source: DMAIB accident report [5].

“Approximately 10 minutes before the planned course change at buoy no. 3 by Kummel Banke, the officer of the watch suddenly saw a small fishing vessel approaching on a crossing course at close quarters on the starboard side. He then went to the center of the bridge, disengaged the auto steering and put the rudder to full starboard. As the ship was in the starboard turn, RIG's port side collided with INGER MARIE's port side at 0607 LT.

After the collision INGER MARIE moved down the side of RIG's port side while sinking rapidly with a port list. The officer of the watch on RIG saw one person wearing orange clothing on board INGER MARIE outside of the wheelhouse as the ship was about to founder.” [5]

After the accident master was awoken and RIG was turn around. Rescue boat was launched to search for survivors but no one was found. Around 0700 the skipper from INGER MARIE was located. Skipper was found with head injuries and he had drowned without having donned life-saving equipment.

Both of the ships were equipped with AIS and radars. INGER MARIE was on 245° with 8 knots of speed. RIG was on a north-westerly course of 341 with speed over ground of 9 knots. The ships courses did not change within 60 minutes before the collision occurred. The visibility was good and ships were in sight of each other with no significant change of bearing. At about 0535 RIG was in similar situation with other fishing vessel with RIG taking initiative to alter course to starboard to avoid collision.

According to COLREG vessels were power-driven vessels in a crossing situation. Therefore Rule 15 should have been followed. RIG was supposed to give way to INGER MARIE and INGER MARIE was a stand on vessel but obligated to take action to best avoid collision. None of the vessels managed to follow Rule 5 about proper lookout as skipper was most probably occupied with sorting langoustines and duty officer on RIG failed to notice INGER MARIE approaching. RIG officer reacted properly initiating a starboard turn but the action was taken way to late to be effective to avoid collision. It was suspected that officer of the watch did not keep proper lookout by all means available. Setting of the radar were giving little time to react if target appeared on the screen. No targets were acquired in ARPA. Similar situation of RIG being involved in the close quarters situation with other fishing boat just 30 minutes before suggested that improper lookout was taking prolonged time. Collision was classified as very serious as loss of life had been a result of it.

2.5 Atlantic Lady & Kraslava (1 November 2014)

Atlantic Lady is a 139 meters long refrigerated cargo vessel. At the time of accident she was on her way from St. Petersburg (Russia) towards fishing grounds near Bear Islands (Norway). Kraslava (presently San Carlos) is a 182 meters long chemical/product tanker. She departed Tenerife (Spain) and was heading for St. Petersburg (Russia) passing through The Sound with "In the Sound" pilot onboard. At the time of accident ships were operating in restricted visibility (about 100 m) with southerly gentle breeze, 0,5 m high waves and NE current of 2 knots.

Collision happened at 13.19 UTC close to buoys 16 & 17 marking southern entrance/exit to Drogden Channel (fig. 14). Kraslava was proceeding south with "In The Sound" pilot on board. The arrangements to disembark pilot were in progress and pilot boat was alongside Kraslava adjusting speed to take pilot on board. Atlantic Lady was approaching buoy 16 after passing Drogden Lighthouse on her port side. Buoy 16 was a marker to turn to starboard to align with direction of the Channel. Though visibility was restricted only Kraslava was giving appropriate sound signals prescribed by Rule 35 of COLREG for vessel restricted in her draught, as that was AIS status advised by the pilot. Pilot also was keeping Kraslava closer to the center of the Channel to avoid shallow waters located just aside of it. Going out of dredged channel may have cause the risk of grounding the vessel. Atlantic Lady also had a status of constrained by her draught but was not giving any fog signals. She was planning to pass buoy no. 16 and then initiate turn to starboard to go along eastern part of the

Channel. Master of Atlantic Lady, on the grounds of his experience, presumed that Kraslava would hold a position on the westerly side of a channel and allow Atlantic Lady to turn into easterly side of it.

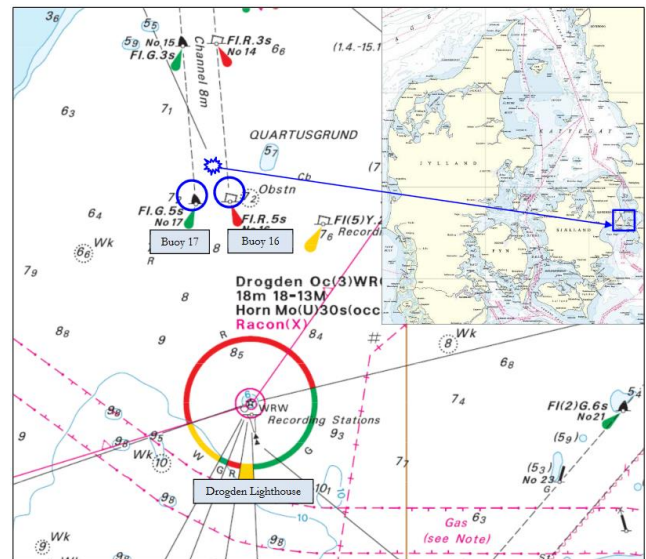


Figure 14. Scene of collision. Southern part of The Sound, Denmark.
Source: DMAIB accident report [6].

Both ships were equipped in working AIS, had 2 radars working. Kraslava was equipped also in ECDIS, Atlantic Lady had ECS. Vessels were observing each other on their radars. When they became visible by sight to each other they were less than 100 meters away from each other. Kraslava took no action to avoid collision as her crew realized that it was too late. Atlantic Lady's master ordered hard to starboard but that was also too late.

Both vessels were operating on restricted visibility with no sight of each other but only Kraslava was giving appropriate fog signals. Both vessels were having a status of 'constrained by draught'. According to COLREG regulations Rule 19 was to be applied, therefore there was no stand-on and give-way vessel. Both vessels were obligated to maneuver to avoid collision. But it must be noticed that neither of the bridge team recognized risk of collision until seconds before it had happened. Conjunction of few factors like restricted visibility, pilot boat alongside Kraslava, north-easterly current, navigating in narrow channel and Atlantic Lady making a big course alteration to starboard resulted in this two ships colliding with each other. "The factor instrumental in the collision was thus that ATLANTIC LADY's approach to the Drogden Channel, in the absence of other better alternatives, necessitated a large turning manoeuvre. Due to the north-easterly current and the restricted visibility, which delayed the start of the turn until buoy no. 16 was abeam, turning manoeuvre brought the ship into the center of the channel, where it crossed ahead of KRASLAVA." [6]

3 CONCLUSIONS

Case study show that occurrence of accidents in restricted waters is highly dependent on proper use of

equipment and tools on board of every vessel, no matter for it's type or size. Given examples show that often radars, ARPA tools and AIS are not utilized to it's best. Misinterpretation of radar picture or over reliance on ARPA's information leads to lowered vigilance of duty officers therefore to lack of proper lookout and lack of recognition of developing dangerous situation.

In her future studies author would like to focus on improving methods used in nowadays navigation for detection of dangerous situation and collision avoidance. With autonomous vessels being on the horizon and technology going forward improved and/or new methods of detecting potential collision situations must be introduced and available for those responsible for safety at sea. Duty officers should have easy to understand and use methods to be able to predict how situation can develop and what they can do to prevent danger. Especially in difficult restricted areas where there is no place to manoeuver and make big course alterations they have to be able to do it early enough to solve problem before it becomes a real danger.

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