



# DMAIB

DANISH MARITIME ACCIDENT  
INVESTIGATION BOARD

# EXPRESS1 & BALTIC CONDOR

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Summary report on collision

10 MAY 2019

## Course of events

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Figure 1: EXPRESS 1  
Source: DMAIB, 2019

On 10 May 2019 at 1026, the high-speed passenger ship EXPRESS 1 (figure 1) sailed routinely from the port of Rønne towards Ystad, Sweden. The ship sailed in scheduled service between the two ports, and this was the second trip to Ystad that day.

The visibility had been limited throughout the morning, due to heavy fog which covered the waters between the two ports, and was down to approx. 100 m. This meant that it was not possible for the ship's navigators to visually identify buoys or other vessels during the voyage, as they could not see the sea surface. Therefore, navigation was carried out exclusively using the ship's radars and electronic nautical charts. The ship passed the breakwater at 1032 and began to increase the revolutions to reach the usual service speed of 32-34 knots needed to keep the schedule. Apart from a ship at anchor located on the ship's port side, the ship's navigators could not observe any traffic on the radar.

10 minutes after departure, when the ship was 1.65 nm from Rønne Harbour, the crew of the bridge heard a bump and wondered what could have caused the sound (figure 2, next page).

The master of the ship called up the ABs on the radio and asked them to check, whether the ship might have hit something. The master of the ship and the chief officer could not find an echo on the radars to indicate that they could have hit another ship. Shortly after, an AB reported over the radio that some passengers had seen the EXPRESS 1 hit a smaller ship and that a person from that ship had fallen overboard.

The master of the EXPRESS 1 immediately ordered the chief officer to interrupt the voyage and to turn the ship around. At the same time, the ABs were told to prepare the rescue boat. He then called Lyngby Radio and reported that EXPRESS 1 had hit a vessel. The watchkeeper at the rescue station in Rønne overheard the report on channel 16 and immediately sent a Fast Rescue Boat (FRB) and the lifeboat MADS JACOBSEN to EXPRESS 1, where they expected the rammed ship to be. EXPRESS 1 turned around to get back to the collision position to launch their rescue boat, but at the same time the master took care not to get too close, so as not to overrun the ship or the person who had fallen overboard. It was still not possible to find an echo on the radar to indicate the position of the rammed ship.



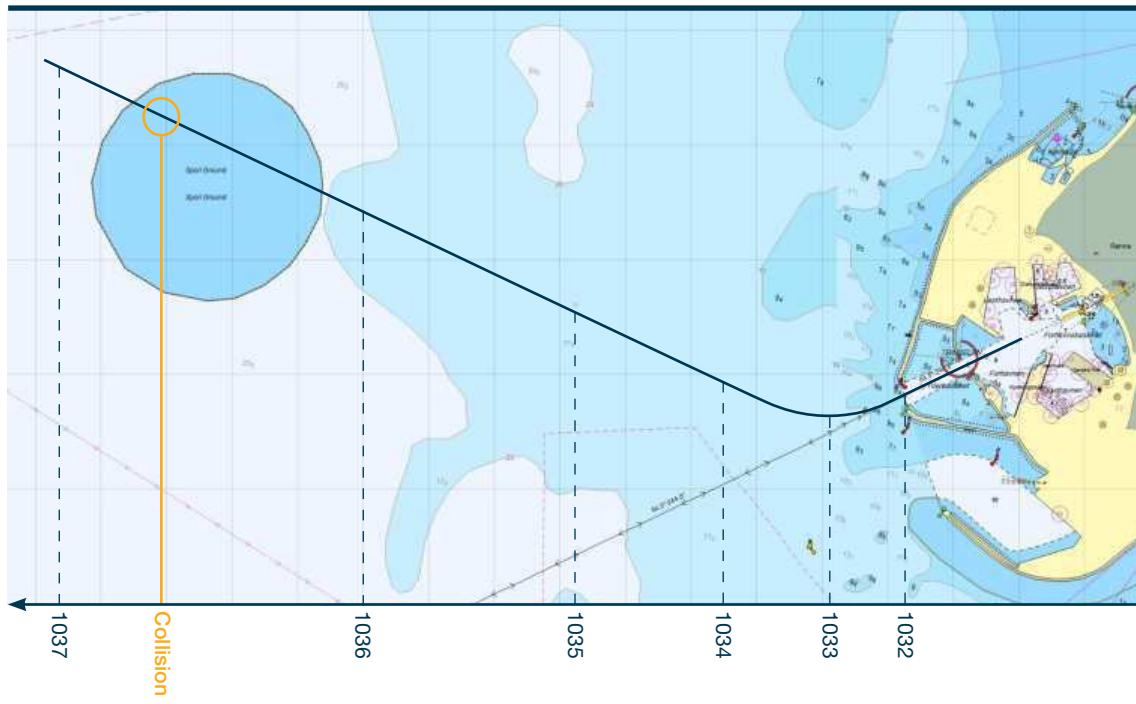


Figure 2: EXPRESS 1's route at the collision

Source: © Made Smart Group BV 2019; © C-Map Norway AS 2019 /DMAIB, 2019

The FRB reached the EXPRESS 1 first and searched for the rammed ship. Due to the strong fog it was impossible to find by visual search alone. In Rønne Harbour, the port control received the exact position of the rammed ship and passed it on to the rescue service. After that, the FRB and MADS JACOBSEN found the rammed ship.

The crew of the rammed ship had succeeded in getting the person who had fallen overboard back on board the ship, and the injured person was transferred to land with the rescue service's FRB. EXPRESS 1 returned to Rønne Harbour where the

ship's car deck was cleared and the passengers transferred to another ship. No one was injured on the EXPRESS 1 in connection with the accident, and the ship only suffered minor damage to the port hull (figure 3).

The ship with which the EXPRESS 1 collided was a Polish tour boat named BALTIC CONDOR (figure 4). BALTIC CONDOR had three Polish crew-members and nine German anglers on board.

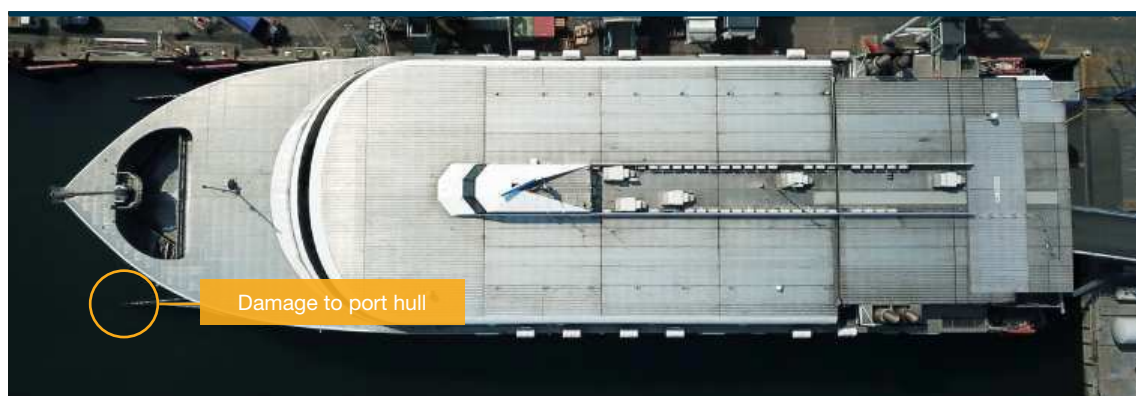


Figure 3a: Damage to EXPRESS 1, port hull

Source: DMAIB, 2019

Earlier in the morning, the ship had been at anchor off Rønne, where the passengers had fished. Then BALTIC CONDOR had sailed north towards Hasle, where fishing was to be resumed. On the way, there was a problem with a pump in the machinery, which made it necessary to stop the ship while the skipper rectified the problem. Meanwhile, the anglers was on the deck and the engine was running idle.

The skipper had just returned to the wheelhouse to check the gear temperature, when he suddenly heard the persons deck scream that a ship was coming towards them. The skipper immediately tried to sail away. In that instant, EXPRESS 1 emerged from the fog at high speed and struck the edge of the stern of BALTIC CONDOR at an angle. BALTIC CONDOR heaved over so suddenly and forcefully that a person fell overboard, but was quickly rescued.

One passenger suffered more serious injuries while other passengers sustained minor bruises. In the collision, the ship sustained damage to the hull and rudder and was towed ashore after the accident (figure 5).



Figure 3b: Damage to EXPRESS 1, port hull  
Source: Molslinjen, 2019



Figure 4: BALTIC CONDOR  
Source: DMAIB, 2019



Figure 5a: Damage to BALTIC CONDOR's stern  
Source: DMAIB, 2019



Figure 5b: Damage to BALTIC CONDOR's stern  
Source: DMAIB, 2019



# BALTIC CONDOR

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The investigation on the BALTIC CONDOR intended to clarify why the crew did not realise that the ship was in a situation where there was a risk of collision with EXPRESS 1, before the accident was inevitable.

The investigation thus focused on the ship's lookout and the use of radar.

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## Manning in the wheelhouse

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Prior to the collision, the skipper of BALTIC CONDOR was in the ship's engine room, where he was rectifying a problem with a pump for the ship's machinery. The other two crewmembers were employed in the ship's galley and assisting the fishing passengers on the deck, respectively. The ship's wheelhouse was thus unmanned until just before the collision, where the skipper briefly entered the wheel house during his attempt to rectify the problem with the pump.

To signal to other ships that BALTIC CONDOR was not under command, the ship displayed two red lights, one above the other. The ship was not equipped with an AIS transmitter and, hence, could not by means of an AIS signal that it was not under command.

## Visibility

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Visibility was down to about 100 metres at the time of the accident. At the time, the BALTIC CONDOR was not in motion, while the EXPRESS 1 came towards them with accelerating speed, which at the time of collision had reached 33.9 knots.

EXPRESS 1 with the naked eye for no more than 10 seconds, before the collision happened. This limited time for visual identification of EXPRESS 1 meant that the lookout alone did not provide sufficient opportunity to react to the collision hazard.

Due to the low visibility and EXPRESS 1's speed, it had been possible from BALTIC CONDOR to see

## Radar

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EXPRESS 1 sailed from Rønne 10 minutes before the collision. As the skipper was mainly in the ship's engine compartment during that time and only briefly entered the wheelhouse just before the collision, EXPRESS 1 was not visually identified

and plotted on the ship's radar. Thus, the master held no perception that there was a risk of collision between BALTIC CONDOR and EXPRESS 1.

# EXPRESS 1

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The investigation on EXPRESS 1 intended to clarify why the navigators on the ship did not realise that there was a risk of collision between EXPRESS 1 and BALTIC CONDOR before the accident occurred.

The investigation focused on the ship's bridge discipline, the physical bridge environment and the use of the ship's radars.

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## Bridge disciplin

EXPRESS 1 was a high-speed passenger ship regulated by the international requirements described in the HSC code<sup>1</sup>. The code takes into account the fact that high-speed ships are associated with greater risks in relation to collision accidents. Therefore, the requirements regarding navigation and ship operation are more rigorous for HSC ships. Among other things, requirements state that there must be two navigators on duty on the bridge during the voyage and that the operating stations must be arranged in such a way that both navigators can carry out their work from the steering chairs.

On 10 May 2019, the EXPRESS 1 was manned by two navigators: the master of the ship and a chief officer. While the ship was leaving the berth, the master manoeuvred the ship and handled the radio contact to the ABs handling the ship's hawser. Up until departure, the chief officer was busy loading the ship and came reached the bridge just as the ship was about to depart, taking over radio communication, while the master turned

EXPRESS 1 in the harbour. The chief officer then assumed control from the middle steering chair, and the master assisted from a standing position behind the starboard steering chair (figure 6). The chief officer was in charge of the ship's course and speed, while the master supervised the voyage and instructed the chief officer on how to proceed with other ships in the area and on choice of course and speed.

When the ship passed the port's breakwater, the master told the chief officer to set the course more westerly than usual to make distance to a ship lying at anchor north of Rønne. When the ship passed the breakwater, the chief officer made a turn to lead the ship onto the planned route to Ystad. When the ship came out of the turn, the chief officer increased the ship's revolutions to reach the planned service speed. The acceleration to service speed took less than three minutes, and during this time the chief officer supervised that the acceleration progressed as expected.

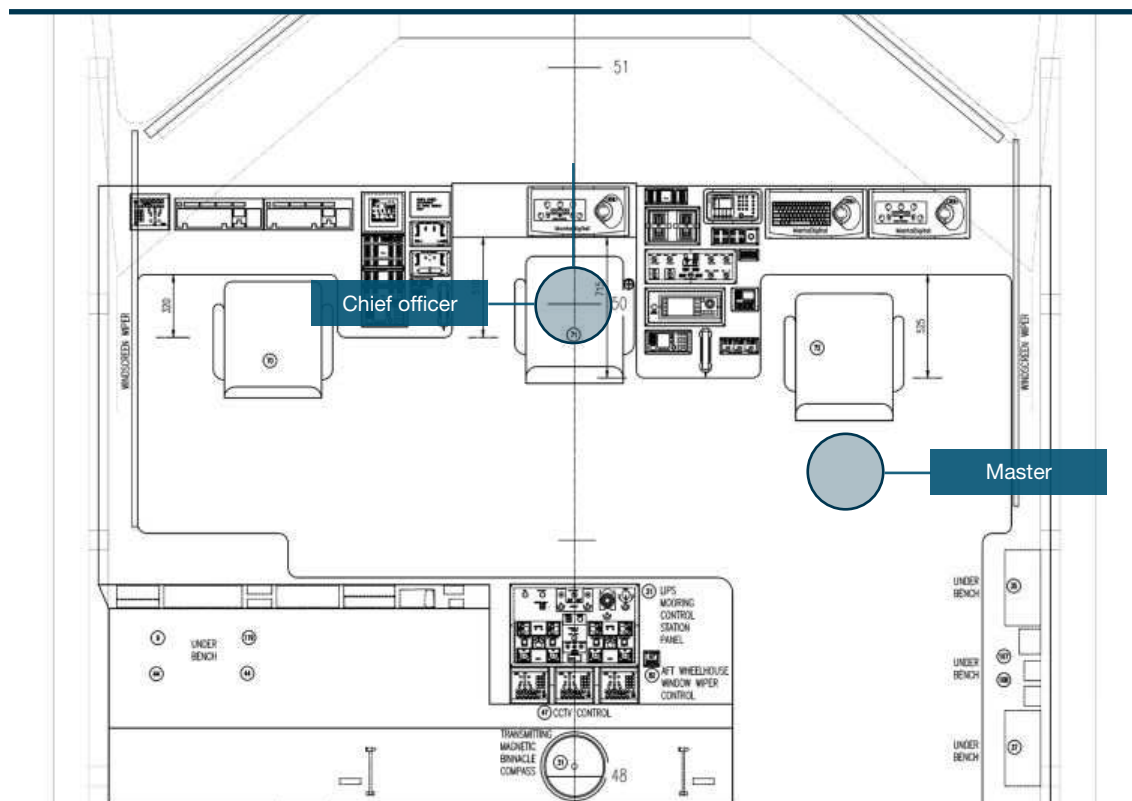


Figure 6: Location of the navigators on EXPRESS 1 on the day of the accident  
Source: DMAIB, 2019

1 International Code of Safety for High-Speed Craft (2000)

While the ship accelerated, the master sent information regarding the number of passengers and baggage trolleys to the administration on land. The bridge crew would always send this information as soon as possible after departure, while there was still an adequate internet connection.

The master thus left the position behind the starboard steering chair and walked into the office area from which the information was to be sent (figure 7). While in the process of sending the information, he was interrupted by an alarm that had to be addressed. When that had been taken care of, he returned to the service computer and sent the information. The master was engaged in these chores for about 1-2 minutes. During that time, EXPRESS 1 travelled a distance of more than one nautical mile.

On the day of the accident there were two navigators on the bridge, but this did not mean that both

navigator chairs were occupied throughout the voyage, because the navigators had other tasks during the voyage not directly related to the navigation of the vessel.

In connection with the investigation of the collision, DMAIB joined a number of voyages on EXPRESS 1, where it was observed that it was common to have only one navigator present on the bridge on EXPRESS 1 at intervals during the crossing. This would be necessary when one navigator had to, for example, eat or use the toilet. In addition, it would also be necessary for one of the navigators to leave the operating station, if a passenger were indisposed and needed assistance. On the day of the accident and in general, the manning of the ship thus signified that it was not possible to maintain a bridge discipline on the EXPRESS 1, where two navigators performed the navigation from the operating stations throughout the crossing.

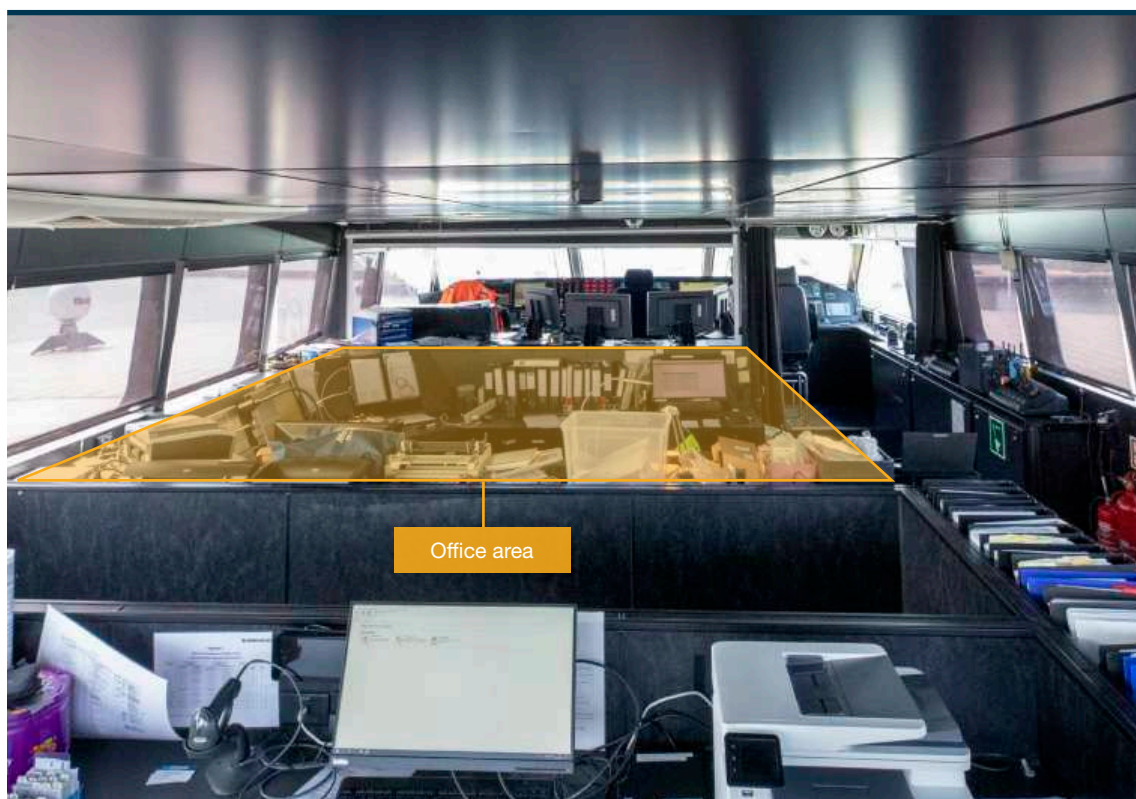


Figure 7: Office area seen from the aft of EXPRESS 1's bridge  
Source: DMAIB, 2019

## Bridge environment

The HSC code requires that the area from which the ship is navigated is sterile in relation to activities that are not essential to the safe operation of the ship. The bridge on the EXPRESS 1 was furnished with three front operating stations: two for the navigators and one for the chief engineer. Behind the operating stations there was an area with three office spaces for the navigators, the first engineer and the team leader of the catering

staff (figure 8). This meant that there was often a lot of activity on the bridge when the catering staff needed to contact their team leader, and when the engineering personnel had to solve technical problems during the crossing. In addition, the proximity to the navigators' office computer made it possible to handle administrative tasks, while they were on duty on the bridge.

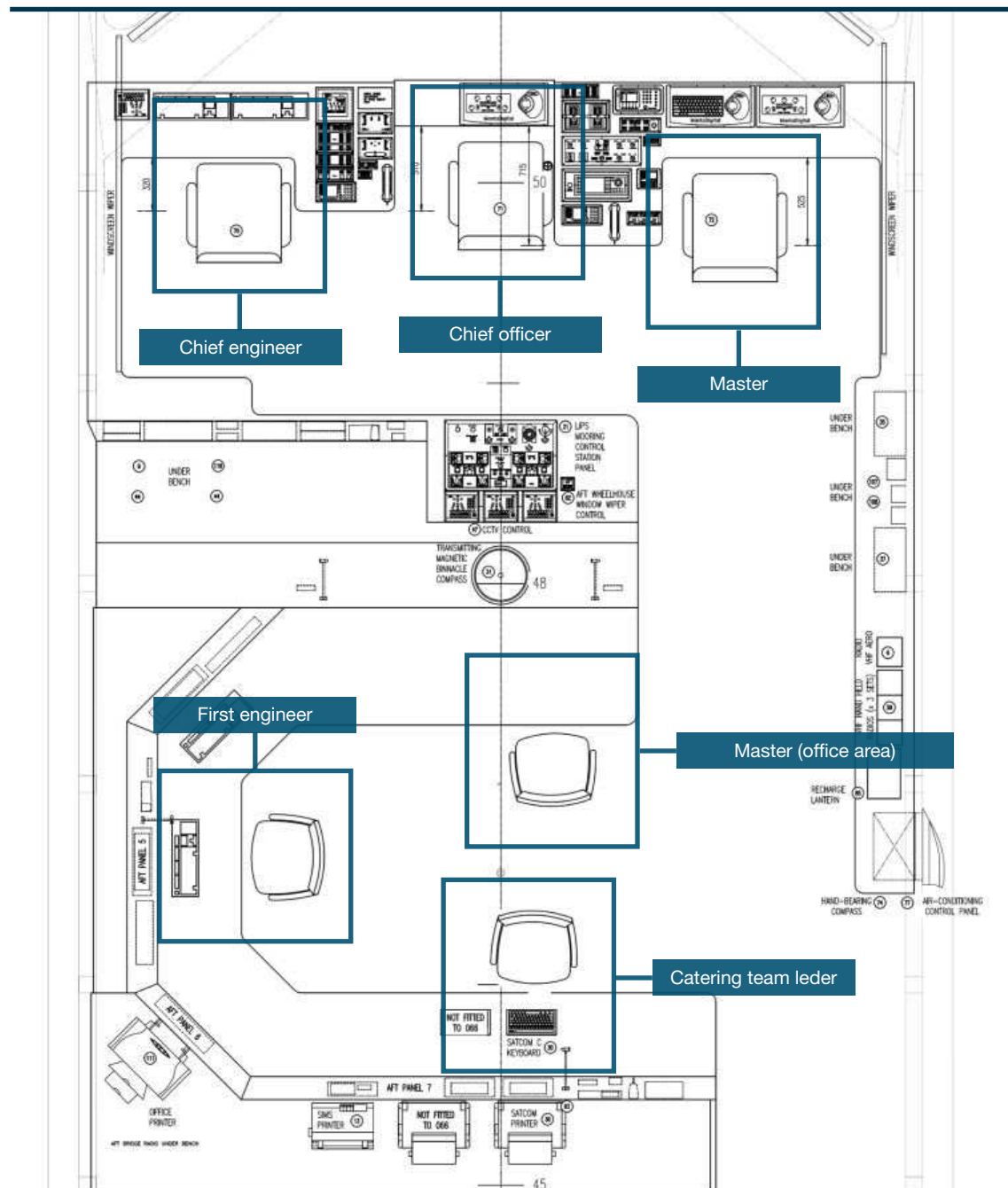


Figure 8: Bridge layout on EXPRESS 1  
Source: Molslinjen/DMAIB, 2019



Underneath the bridge, there was a technical room only partially shielded from the bridge. Noise from the technical room thus carried directly to the bridge above. The entrance to the mess room was in connection to the technical room, and since the space in the mess room was limited, conversations among the ship's staff would often take place in the technical room. This led to the navigators often being exposed to noise from the technical room and from the office area on the bridge.

A roller curtain was installed on the bridge, which allowed a partial shielding between the operating stations at the front of the bridge and the office area behind it. However, it was not possible to roll down the curtain without moving equipment that was placed in the opening between the two areas (figure 9). The curtain would not necessarily offer significant shielding, since the engineering personnel's conversations would then be shifted from being going back towards the office area to going over the navigators, due to the location of the chief engineer's steering chair.

DMAIB observed that there had been various types of noise and activity on the bridge in the

period from the ship left the port of Rønne, until it collided with BALTIC CONDOR: Problems with ventilation in the passenger area led to activity and loud communication from the engineering personnel, and the sound from the passenger safety video was played in the loudspeakers on the bridge and added to the noise.

During the voyages that DMAIB joined, it was found that the bridge area on EXPRESS 1 testified to the shortage of staff space on the vessel, which in general meant that many different activities took place on the bridge apart from navigation. Space shortage in the ship's mess, for example, meant that some crew members had their meals on the bridge. In addition, no toilet was installed on the bridge, which meant that the navigators would have to leave the bridge to make use of the facilities. Thus, the bridge on EXPRESS 1 could not be described as a sterile bridge environment in which the navigators were ensured the least possible disturbance from the rest of the staff and from tasks not related to navigation.

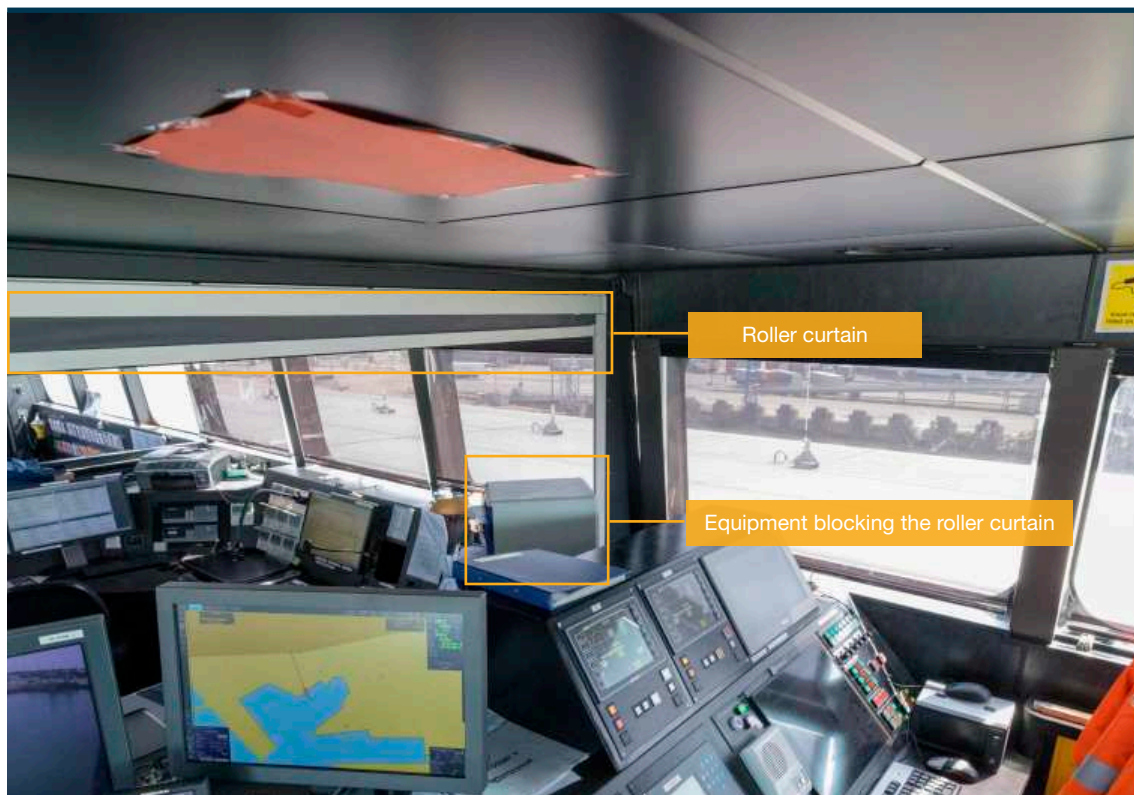


Figure 9: Shielding roller curtain on EXPRESS 1's bridge  
Source: DMAIB, 2019

## Visibility

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The fog on the day of the accident meant that visibility was reduced to a level where the navigators could not see the water surface from the bridge. It was not possible to visually identify breakwater, buoys or other ships, and navigation was thus carried out exclusively by means of the ship's electronic nautical charts (ECDIS) and radars. Due to the blind spots of the ship, the navigators of EXPRESS 1 were accustomed to navigating entirely by means of the navigational instruments on board. There was a general perception among the navigators and in the shipping company that reduced visibility did not give cause for the cancellation of crossings, because the ships' radars provided high-quality information. The ship thus operated as usual on the day of the accident.

EXPRESS 1 was designed to sail at high speed, and it was necessary for the ship to achieve a certain speed in order to function as intended. In addition, it was necessary to get up to a speed above 30 knots to keep the schedule of the ferry service. It was generally difficult to catch up a delay during port stays and reduced speed would thus lead to accumulated delays throughout a day.

In the shipping company's contract with the Danish Transport Authority, it had been agreed that the shipping company would be fined for delays in the schedule. However, the shipping company was exempted from fines in case of fog, where it was necessary to cancel a departure. However, as mentioned earlier, the fog did not give rise to any considerations regarding cancellation prior to the collision. According to the ship's procedures, only high winds and solid sea ice gave cause for the cancellation of a voyage.

According to the master's standing orders on the ship, both the ship's navigator chairs should be manned in the case of visibility below 1½ nautical miles. If this was not possible, the chief officer on duty's radar should be set to show S-band or alternatively X-band with long pulse. On the day of the accident, the chief officer on duty was using the ship's X-band radar with short pulse. The master of the ship monitored the voyage from a standing position and watched the radar set for S-band, albeit with short interruptions due to administrative tasks.

## Radars

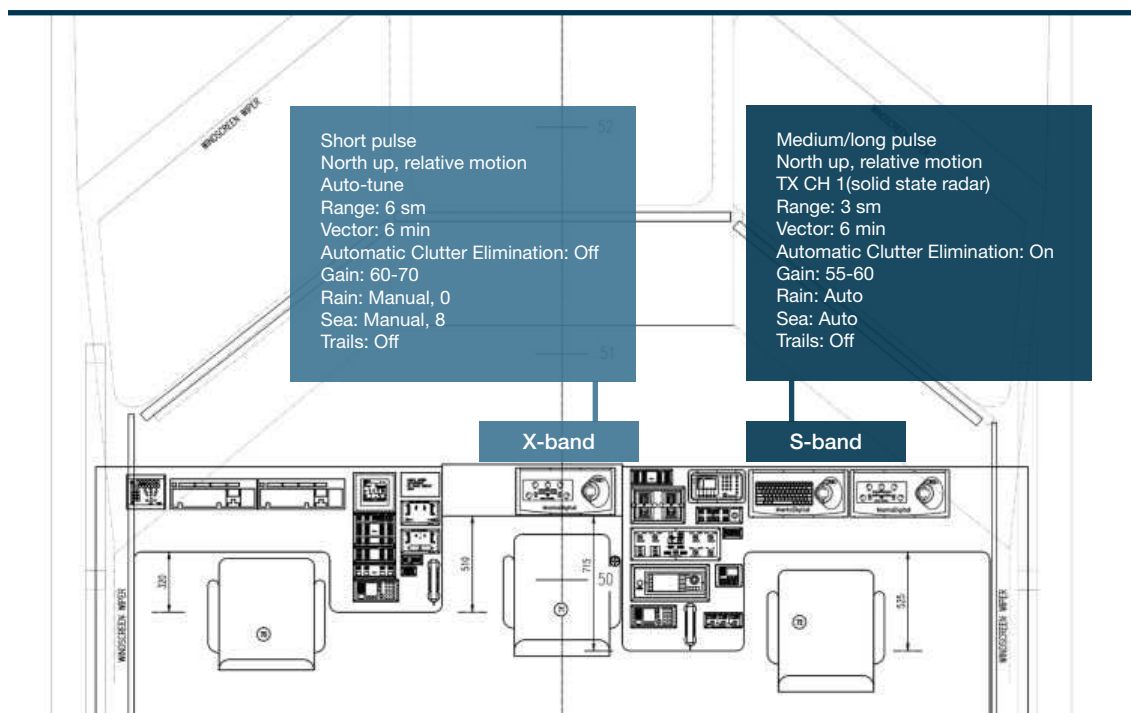
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The two navigators on EXPRESS 1 did not see BALTIC CONDOR on the radar prior to the collision. This could be due either to the fact that the construction of the BALTIC CONDOR made it difficult to detect on the radar of the EXPRESS 1, or that the setting and use of the ship's radars allowed the echo of the BALTIC CONDOR to be overlooked. Due to a technical failure, the EXPRESS 1's VDR had not recorded images from the ship's radars (see Appendix 2). Therefore, DMAIB has not had the opportunity to examine the radar images that were shown on EXPRESS 1 prior to the collision.

There were no indications that the radar of the EXPRESS 1 could not detect BALTIC CONDOR, since the BALTIC CONDOR had a size that would be visible on the radar and had a radar reflector which has been verified as being functional. In addition, the navy surveillance radars on Bornholm,

the port radar in Kołobrzeg (Poland) and the radars on the rescue services ships were able to detect the BALTIC CONDOR. This indicates that the ship did not possess characteristics to inhibit the detection of its echo. However, the BALTIC CONDOR was not equipped with an AIS transmitter and would therefore not be shown with an AIS marker on the radar screen. This means that the display of its position on the radar screen was less salient compared to ships with an AIS.

It is deemed unlikely that the radars of EXPRESS 1 should not have been able to intercept the echo of the BALTIC CONDOR. On the other hand, DMAIB found indications that the failure to observe the BALTIC CONDOR on EXPRESS 1's radars could be due to a combination of the settings and use of the radars on EXPRESS 1.



Figur 10: Indretningen af EXPRESS 1's bro  
Kilde: Molslinjen/DMAIB, 2019

### Radar settings

On EXPRESS 1, there were two ARPA radars with screens in front of each of the navigation chairs, an X-band magnetron radar and an S-band solid state radar. Both the X-band and the S-band radar antennas rotated at a speed adapted to high-speed vessels and were therefore able to detect targets on the sea surface, despite the fact that the ship sailed significantly faster than conventional ships. Figure 10 shows the position and setting of the radars at the time of the accident. In the following, the properties, setting and application of each radar will be reviewed.

### X-band radar setting

The X-band radar (3 cm) was a magnetron radar that used an older technology, which meant a greater need for the navigator to continuously adjust the radar settings, so the maximum object detection could be achieved. The X-band radar was best suited for coastal navigation, as it was sharper and thus better at distinguishing objects from one another than the S-band radar. However, the X-band radar was sensitive to fog, which may have reduced its reach and impaired echo display.

BALTIC CONDOR was stationary in EXPRESS 1's heading line. This means that BALTIC CONDOR's echo on the radar would have been in the vector and heading line of EXPRESS 1.

A smaller echo may be overlooked on the radar, when it is in the vector and the heading line, unless there is a consistent practice to turn them off at regular intervals. That was not the case on EXPRESS 1.

After the accident it was concluded that the magnetron radar was not maintained according to the manufacturer's guidelines. This meant that the magnetron had not been replaced according to the recommended intervals, which may have led to an impaired function of the radar.

The combination of 1) the X-band radar being sensitive to the impact of fog, 2) the possible impaired function of the radar caused by insufficient maintenance 4) that BALTIC CONDOR was in EXPRESS 1's heading line on the radar, meant that the possibility of detecting BALTIC CONDOR on the X-band radar was likely impaired prior to the collision.

### Application of the X-band radar

The X-band radar was used by the chief officer, who handled the steering of EXPRESS 1 from the ship left the port, until the collision happened. The chief officer sat in the navigator's chair throughout that time and had no other task than navigating the ship.



In the previous section, it was concluded that the possibility of detecting BALTIC CONDOR on the X-band radar was likely impaired due to the characteristics and setting of the radar. The following will explain in what circumstances the chief officer used the radar.

The time from the chief officer arrived on the bridge, until he took control, was a span of three minutes. During this time, the chief officer was in contact with the ABs who handled the ship's mooring lines and received the handover from the master of the ship. The master and chief officer briefly spoke about the speed and visibility with regards to the passage of the breakwater, and the master provided information on how to pass a ship at anchor located north of the port. From the time the chief officer took control, until the breakwater had been cleared, two minutes passed. The display on the radar in the harbour has probably been characterised by noise due to the port facility, and the chief officer has primarily been focused on navigating the ship out through the breakwater in the dense fog.

When the breakwater had been cleared, the chief officer entered into a large turn to take the ship onto the planned route to Ystad. While the ship was turning, the radar image is likely to have been unstable. There was thus a further diminished possibility of detecting the echo of the BALTIC CONDOR. Whilst turning, the chief officer received instruction from the master regarding what course to choose to distance himself from the ship at anchor. The focus of the chief officer was thus on adjusting the course and speed of the ship and on the ship at anchor that they were passing. At this point, the chief officer held a perception that there was no other traffic in the area than the ship at anchor.

When EXPRESS 1 came out of the turn and onto the route to Ystad, the ship's speed had to be accelerated. From the acceleration started to the collision happened, three minutes passed. It was important that the acceleration proceeded smoothly in order to comply with the schedule, and the chief officer watched the progress of speed continuously during the acceleration. From the acceleration began, until the collision occurred, three minutes passed.

During this time, the chief officer's attention was likely directed primarily at the ship's speed and the ship at anchor, and there was some activity on the bridge from the engineering personnel during the same period.

There is a significant difference between verifying the presence of a known or suspected ship on the radar and searching for unknown ships on the radar. Detecting an unknown ship on the radar requires the full attention of the navigator for a longer period of time, especially if the display of the ship's echo is weakened. In addition, it is likely that the repeated instructions regarding the ship at anchor may have contributed to the chief officer feeling assured that there was no other traffic in the area. Together, this may have contributed to the chief officer not seeing the already diminished echo on the radar.

#### **S-band radar settings**

The S-band radar (10 cm) had a greater range than the X-band radar and had a better ability to penetrate rainfall and fog. The S-band radar was a solid state radar. This type of radar was more technologically advanced than the magnetron radar and could continually recalibrate itself to show as many objects on the screen as possible. Therefore, it to a lesser degree demands that the navigator make continuous adjustments.

The Automatic Clutter Elimination (ACE) function was turned on on the S-band radar. The ACE function is a noise cancelling function that automatically adjusts the amplification of the received echo impulses as well as the sea and rain filters optimally. The feature, however, has the disadvantage that it not only removes noise on the radar image, but may at the same time also exclude smaller objects, such as buoys and smaller ships, from the image. Due to the influence of the fog, the ACE function may have reduced the noise of the EXPRESS 1 S-band radar display to such an extent that the echo of the BALTIC CONDOR has not been visible. BALTIC CONDOR's echo was, as on the X-band radar, situated on the EXPRESS 1's heading line, without moving, and may thus also have been less discernible.

BALTIC CONDOR could not be detected on the radar after the collision. This could be due to both the ACE function and the noise that occurred on the radar screen, as the EXPRESS 1 subsequently circled round. In addition, BALTIC CONDOR attempted to move towards Rønne Havn after the collision, and was therefore not in the expected position after the collision.

#### **Application of the S-band radar**

Upon departure from the port, the master carried out several tasks within a few minutes, such as radio communication, initiation of the instruction video, handover to the chief officer and monitoring the voyage.

During the departure from the port, the master was particularly attentive to the reduced visibility while the ship passed the breakwater and the ship at anchor north of the harbour. Before leaving the steering of the ship to the chief officer, the master had manoeuvred the ship from the operating station, used from a standing position, behind the steering chairs.

When the control was handed over, he did not sit down in the navigator chair. This was for several reasons: 1) The master was occupied with lookout while passing the breakwater, 2) There were tasks to be carried out from the office area immediately after the breakwater had been cleared, 3) The navigation chair was uncomfortable as it could not be adjusted to fit the master's height, and neither was it possible to move the chair back to allow the master to stand in front of it. The master thus used the radar from a standing position behind the chair, which may have impaired the ability to detect small, unidentified echoes on the radar. In addition, the many chores during the departure from the port meant that the master did not pay continuous attention to the ship's radar.

While the chief officer was in the process of turning the ship after the breakwater had been cleared, the master instructed the chief officer regarding which course to sail to distance himself from the ship at anchor.

At this point, the radar image will have been unstable, and it is therefore likely that the instruction was given on the basis of the AIS display on the ship's ECDIS, which was located midway between the two navigator chairs.

Half a minute after EXPRESS 1 came out of the turn and entered the course to Ystad, the master announced that he was going to send the information to the administration on land and went back to the bridge's office area. While performing the administrative task, he was interrupted by an alarm that had to be addressed. He then returned to the administrative task. From the information was sent, until the EXPRESS 1 collided with BALTIC CONDOR, a maximum of one and a half minutes passed. This meant that the master in fact had an interrupted period of two minutes to discover BALTIC CONDOR on the radar after the ship's departure. During this time, there was also activity on the bridge from the ship's engineering personnel, which may have disrupted the master's attention. While this time span may be sufficient to verify the presence and movement of a known ship, detection of unknown plots requires a longer and more concentrated stretch of monitoring.

## Cause of the accident

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On EXPRESS 1, the navigators did at no point observe BALTIC CONDOR and could thus not manoeuvre to avoid collision. On BALTIC CONDOR, the crew observed EXPRESS 1 too late to effectively avoid collision. Due to the dense fog on the day of the accident, the use of radar was the only way to effectively observe other ships and thereby prevent collision. For various reasons, neither the navigators of BALTIC CONDOR nor EXPRESS 1, respectively, saw the ship they were on a collision course with on the radar, before the collision occurred.

On the BALTIC CONDOR, the skipper was only briefly present in the wheelhouse due to a malfunction in the ship's engine compartment and was thus not using the ship's radar, before the accident occurred. That is why he did not see EXPRESS 1. BALTIC CONDOR carried lights signalling that it was not under command. However, this signal was not effective given the visibility conditions on the day of the accident.

On EXPRESS 1 there were two navigators on the bridge, but none of them saw the BALTIC CONDOR on the ship's radar screens. It is not clear what exact conditions led to the fact that the navigators did not see the BALTIC CONDOR on the radar screens, but DMAIB has been able to ascertain a number of different factors which, taken together or separately, may have led the navigators to oversee BALTIC CONDOR on the radar.

On EXPRESS 1, navigation was carried out using only the ship's radars due to the reduced visibility. There were two navigators present on the bridge, handling the navigation. DMAIB has, however, been able to conclude that although there were two navigators on the bridge, this did not mean that both navigators could give the radar full attention in the run-up to the accident, even though the radars were their only means of forming an impression of traffic in the area.

The BALTIC CONDOR was not equipped with an AIS transmitter and was therefore shown only as an echo on the radar, and the display of the echo on the radars' screens is affected by the characteristics and setting of the radar.

The chief officer, who was on duty before the collision, used the ship's X-band radar. The functioning of X-band radars is affected by fog, and there-

fore the range and echo display of the X-band radar has probably been impaired. The inadequate change of the X-band radar's magnetron might have contributed to the impaired display of BALTIC CONDOR's echo. In addition, the BALTIC CONDOR was in EXPRESS 1's heading line on the radar which may have made the echo less discernible. From a record of the activities aboard the EXPRESS 1 up to the collision, DMAIB has estimated that the chief officer had three minutes available to detect the BALTIC CONDOR's plot. In the three minutes, however, he was also paying attention to the ship's acceleration.

The master of the ship acted as assistant navigator prior to the collision and used the ship's S-band radar. This type of radar works better in fog than the X-band radar. However, the radar's ACE function was activated, which may have led to the BALTIC CONDOR's echo being filtered away on the radar's screen. As on the X-band radar, BALTIC CONDOR's echo was situated in the heading line, which may have made the echo less clear. The master used the S-band radar standing, which has impaired the possibility of detecting small echoes by continuously adjusting the radar settings. Based on a record of the activities on the bridge leading up to the collision, the Accident Investigation Board has determined that the longest, continuous period of time the master would have had for monitoring the S-band radar was one and a half minutes. This means that the radar that had the best prerequisite for displaying an echo in heavy fog was the one that received the least attention due to the other chores that the master had during the voyage.

The ship had a procedure which indicated that the officer in charge had to use the S-band radar, if there was only one navigator in the steering chairs. On the day of the accident, both navigators held the perception that they were two navigators in the chairs, because carrying out the necessary administrative tasks was only a short interruption for the master. This did not give rise to reconfiguring the radar screens.

The time the navigators each had available to monitor the radar was quite short. This was significant in circumstances where navigation was carried out exclusively by radar. There is a difference between verifying a known ship on the radar and detecting an unknown one. The latter requires



a longer period of time with full attention. Since EXPRESS 1 only had radar available to see traffic in the area, detection of unidentified ships without AIS would require longer and more concentrated monitoring of radar screens with continuous adjustments to the radars' settings than was possible on EXPRESS 1 prior to the collision. The combination of lack of time for detecting unidentified ships and adjusting radar settings probably led to an impaired display of BALTIC CONDOR's echo. The impaired display may have helped to confirm the navigators' perception that there was no traffic in the area other than a ship at anchor, and thus led to both navigators overlooking BALTIC CONDOR.

It may be concluded that although EXPRESS 1 was manned by two navigators, there was in fact only one navigator paid full and continuous attention to the navigation during the entire period between the departure and the collision. It

was normal working practice on the ship that one navigator left the steering chair – or the bridge – during the voyage. This was a necessary result of the company's manning of the ship, the organisation of work and the ship's interior, which did not allow for the maintenance of a bridge discipline where navigation was carried out by two navigators during the entire voyage.

It can also be concluded that the bridge on EXPRESS 1 could not be characterised as a sterile bridge environment. On the contrary, it was organised in a way which caused unnecessarily many disturbances to the work of the navigators in the form of noise and activities of other crew members. This might have had a negative impact on the attention of the navigators.

## Learnings

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*In connection with this accident, DMAIB became aware of the following points of learning:*

### 1

High-speed ships are associated with a higher risk of collision than in conventional shipping. Collision situations evolve faster at high speed, and the consequences will be correspondingly more serious due to the force that speed entails. To match this increased risk, high-speed ships are manned with two on-duty navigators. It is not only imperative that their work is supported by both the right equipment and good ergonomic conditions, but also that they are not exposed to distractions in the form of noise, conversations or other work tasks that can distract them from their primary task of navigating and avoiding collision.

It is thus not expedient for the bridge to evolve into a space where other tasks are solved that

are not directly related to navigation, such as a meeting room, office space for administrative tasks, archives, etc. Not only does it cause disruption, but it can also induce the navigators to take on tasks they should not be performing during navigation.

### 2

AIS is not a tool designed for anti-collision. However, it may be helpful to make your own ship visible to others and, if necessary, communicate the ship's current status. The Accident Investigation Board has previously pointed out that particularly small ships, such as fishing vessels, touring boats and the like, can benefit from using an AIS to make their presence visible.

## Preventive measures

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The Danish Maritime Accident Investigation Board has received information from the Molslinjen on the preventive measures that has been initiated in order to prevent similar, future accidents. The information on the preventive measures are quoted below.

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- *"Administrative tasks in connection to departure are limited to reporting the passenger number to the company's 24-hour office. The company plans to automatise this task by means of the booking system in the nearest future.*
- *The ship's catering team leader now runs the safety video from the shopping area instead of from the bridge.*
- *Quiet time periods has been established on the bridge: 15 minutes before arrival and 10 minutes after departure. In these periods, access to the bridge is prohibited for all persons, other than those engaged in the navigation of the ship.*
- *It has been emphasised that phone calls are not allowed in the quiet periods.*
- *Equipment obstructing the use of the roller curtain has been removed.*
- *The company has called for a tender offer on alteration on the bridge ventilation system. Thereby the roller curtain can be kept closed while maintaining a comfortable temperature by the navigational station.*
- *Type-rating must ensure that the navigations are instructed in the use of the radars' automatic functions and the limits of these functions.*
- *Based on the incident it has been decided to replace the X-band radar magnetron more frequently.*
- *It has been emphasised that only the officers can take their meals in the operating compartment.*
- *A work station for the employees who needs access to the company's systems has been established in the technical room below the bridge.*
- *ISM procedures on the master's standing orders concerning the navigators' tasks during restricted visibility has been revised.*
- *The company arranged a project day for the officers and the safety committee with the theme "Safe everyday". The focus was how the company can raise the safety level – e.g. bridge discipline. A follow-up meeting will take place ultimo October.*
- *Daily verification of the VDR's function has been implemented.*
- *Crew control will be carried out in the technical room when it has been ensured that the necessary information is available to the master on the bridge. This is to minimise disturbing elements on the bridge during the voyage."*

# **Appendix 1:**

# **Ship particulars**

## EXPRESS 1

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|                         |  |
|-------------------------|--|
| Name:                   | EXPRESS 1                                    |
| Ship type:              | HSC passenger vessel                         |
| Nationality:            | Denmark                                      |
| Port of registry:       | Aarhus                                       |
| IMO number:             | 9501590                                      |
| Call sign:              | OUYM   |
| DOC company:            | Molslinjen A/S                               |
| IMO company no.:        | 0251203                                      |
| Year built:             | 2009   |
| Shipyard/no.:           | Incat Tasmania Pty Ltd – Hobart TAS Yard/066 |
| Classification society: | DNV-GL                                       |
| Lenght overall:         | 112.60 m                                     |
| Breadth overall:        | 30.50 m                                      |
| Draught:                | 3.93 m                                       |
| Dead weight:            | 1,508 t                                      |
| Propulsion power:       | 9,000 kW                                     |
| Hull material:          | Aluminium alloy                              |

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## BALTIC CONDOR

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|                         |                                  |
|-------------------------|----------------------------------|
| Name:                   | BALTIC CONDOR                    |
| Ship type:              | Tour boat                        |
| Nationality:            | Poland                           |
| Port of registry:       | Kołobrzeg                        |
| Call sign:              | SPS2797                          |
| Year built:             | 1961                             |
| Shipyard/no.:           | Schottel-Werft Josef Becker GMBH |
| Classification society: | Polish Register of Shipping      |
| Lenght overall:         | 14.40 m                          |
| Breadth overall:        | 3.60 m                           |
| Draught:                | 1.20 m                           |
| Dead weight:            | 17 t                             |
| Propulsion power:       | 132 kW                           |
| Hull material:          | Steel                            |

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# Appendix 2: VDR error

EXPRESS 1 was equipped with a Voyage Data Recorder (VDR). There was no requirement for a VDR on board the BALTIC CONDOR.

A VDR is a data recording system that collects and stores data from the ship in order to allow accident investigators, other authorities and the ship's owners, in the event of an accident, to analyse data in order to identify the circumstances of the accident. A VDR stores data which, among other things, shows time and date, the position of the ship, course and speed, radar images, AIS information, VHF communication and the internal bridge communication. In addition, there is a requirement for an annual functional test to ensure that the VDR is working as intended.

All activity on a VDR is documented in a log file. In connection with the accident, EXPRESS 1's VDR generated a log file for all data, except for radar data. Furthermore, it was found that the ship's hard disk had not stored any data from the ship's radars. DMAIB has thus not had access to the radar information which would otherwise have provided significant insight into the circumstances of the accident.

A technician was commissioned by the shipping company to investigate the cause of the missing data from the radar to the VDR.

The radar was new and as such had high resolution (HD), while the VDR was older. The technician was able to ascertain that the missing data was due to the VDR not being able to handle the high resolution the images had, before they had gone through a framer that converted the images into low resolution. The manufacturer of the radar had, when installed a so-called framer, which was tasked with converting the images from high to low resolution. The technician was able to determine that the framer was set to the wrong setting (HD), which meant that radar data was not being stored.

Normally, the logs would display an error code that showed what was wrong with the system, but the files from EXPRESS 1's VDR did not contain any error codes. The VDR would only generate an error code, if power to the framer was disconnected, which it had not been in this case.

The crew of EXPRESS 1 had not experienced any alarms or error messages from the VDR. The technician who examined the VDR thus encouraged the ship's crew to in future always check, whether the framer was switched on and set to the correct setting (DVI).