aibn Accident Investigation Board Norway

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REPORT ON MARINE ACCIDENT – HUGIN, COLLISION IN HARSTAD ON 16 FEBRUARY 2017

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This report has been translated into English and published by the Accident Investigation Board Norway (AIBN) to facilitate access by international readers. As accurate as the translation might be, the original Norwegian text takes precedence as the report of reference.

Photo of ferry on the Norwegian west coast: Bente Amandussen

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NOTIFICATION OF THE ACCIDENT

At 16.46 on Thursday 16 February 2017, the Norwegian Maritime Authority notified the Accident Investigation Board Norway (AIBN) of an accident involving a RIB (Rigid Inflatable Boat) outside Harstad. Eleven people ended up in the water, and several of them were sent to hospital. The AIBN initiated a safety investigation and deployed a team to Harstad the following day.

Figure 1: The accident location. Source: The Norwegian Coastal Administration's online map service Kystinfo.

SUMMARY

On Thursday 16 February 2017, the RIB Hugin collided with the fountain Selsbanes Seil outside the port of Harstad when returning from a guided sightseeing trip. Ten of the eleven passengers and the skipper were thrown overboard. The skipper and one of the passengers were seriously injured and admitted to hospital, and several other passengers were treated for minor injuries. Several of the life jackets failed to function as intended, but this did not worsen the scope of the injuries.

The investigation has shown that the RIB was on a collision course with the fountain for seven seconds without the skipper becoming aware of this before the collision. The visibility of the fountain, the field of vision from the helm position and the skipper's situational awareness contributed to this.

At the time of the accident, the weather was grey with small waves, low cloud cover, and the daylight was fading. The fountain's marking light was not flashing, and the fountain was not active at the time. As a result, the fountain was not easy to distinguish from its surroundings.

The RIB did most likely not comply with the requirements to field of vision from the helm position. This may have reduced the skipper's possibilities to become aware of the fountain. In addition, the skipper's field of vision was impaired by the passengers in the front and possibly also by the bow of the RIB.

The operating company had not identified the boats' limited field of vision as a potential hazard. Nor had the trip been planned in detail, and the fountain had not been considered as a potential risk.

Moreover, the investigation shows that Harstad Port Authority based its approval of the fountain on the Norwegian Coastal Administration's original approval, without evaluating the risk the fountain could pose for small boats in the area.

Harstad municipality had not reported the fountain to the Norwegian Notices to Mariners (Efs), despite the fact that this was one of the conditions of its approval. The fountain had therefore not been included in nautical charts. The investigation has revealed that delays or failure to report projects to Efs is a general problem.

The operating company was unable to provide a declaration of conformity or other form of documentation proving that the boat complied with the applicable design requirements. The Norwegian Maritime Authority carried out an audit of the company following an incident in 2015, but did not uncover this.

The current competence requirements for drivers of small high-speed passenger boats do not focus on the skills required to operate safely at high speeds.

There is room for improvement of the operator's safety management system, particularly in terms of route planning, maintenance of life jackets and updating of nautical charts.

The AIBN submits a total of three safety recommendations as a result of this investigation.

1. FACTUAL INFORMATION

1.1 Introduction

This section of the report is based on interviews with the skippers, the passengers and other witnesses to the accident. The AIBN has also obtained information from the police and other emergency services, B&B Touring, Ring Powercraft, Grand RIB AB in Sweden, Harstad municipality and Harstad Port Authority, Harstad Marina, the Norwegian Maritime Authority (NMA), the Norwegian Coastal Administration (NCA), the Norwegian Mapping Authority, the Norwegian Directorate for Civil Protection (DSB), and the Norwegian Broadcasting Corporation (NRK).

The AIBN has also cooperated with the Marine Accident Investigation Branch (MAIB) in the UK to obtain information from the manufacturer Ring Powercraft. Technical examinations of the boat and on-board equipment have been carried out, as well as a reconstruction of the final part of the voyage.

1.2 Sequence of events

1.2.1 Prior to departure

On Thursday 16 February 2017, a group of 21 British tourists were in Harstad. The tour operator B&B Touring had been hired to take the tourists out in the company's two RIBs, Hugin and Munin.

At 10.00 the two owners of the local RIB company and an external skipper who worked for them regularly met the tour group in a conference room at a hotel in the centre of Harstad. The tour operator equipped all the passengers with immersion suits, goggles, gloves and inflatable life jackets. The passengers were also given a security briefing and assisted in putting on the equipment before proceeding as a group to the RIBs.

At approximately 10.45 the passengers had all chosen their seats on board and were ready for departure. On board Munin there were ten passengers and the two owners of the RIB company, and on board Hugin there were eleven passengers and the skipper.

The tour operator had agreed in advance that Munin would take the lead position, which was their normal practice. Hugin would normally maintain a position a little behind the lead boat on the starboard side. The tour operator considered this the best position, as it provided the skipper a good view of the lead boat from the helm position on the port side.

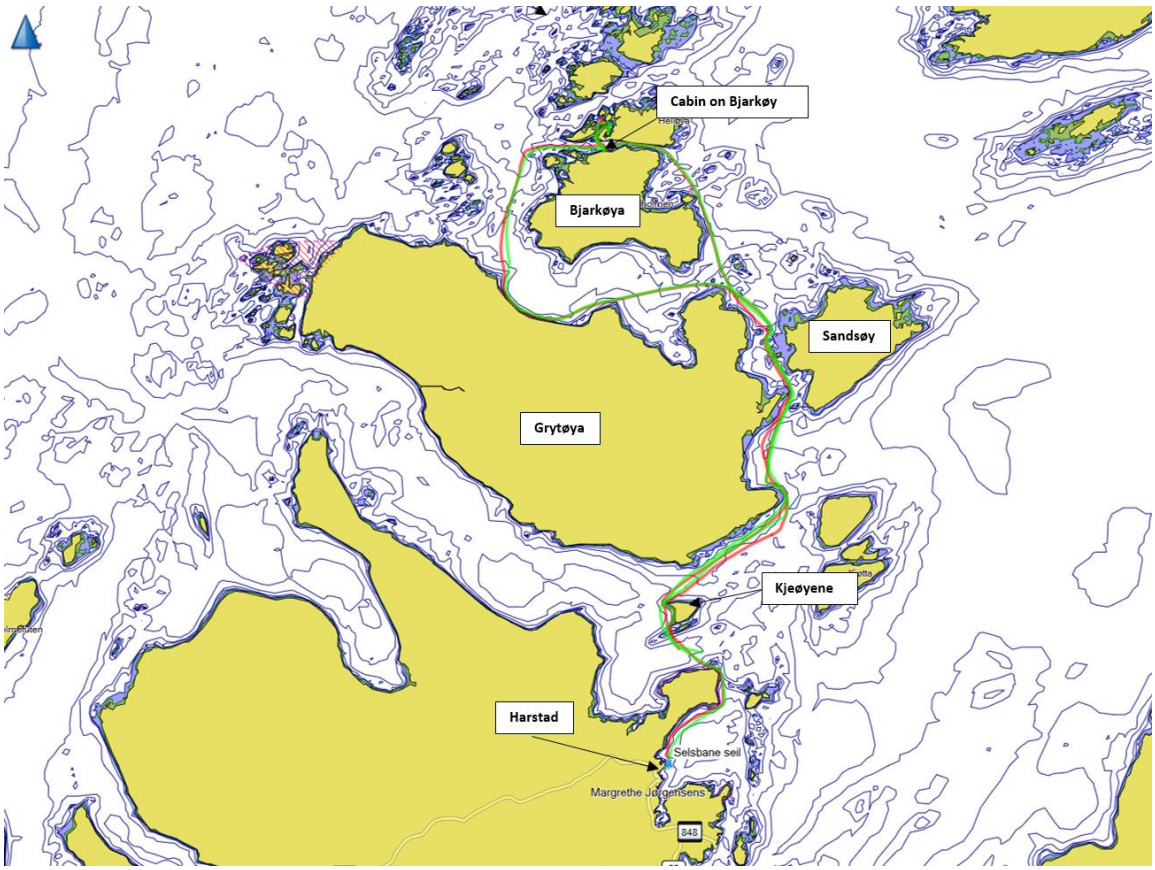

Figure 2: The map shows the route of the sightseeing trip. Source: Garmin electronic chartplotter, Homeport

1.2.2 The accident

The two RIBs left Harstad port at low speed. This was the external skipper's first trip since the fountain Selsbanes Seil had been installed in the port. The skipper stated to the AIBN that he had remarked to his passengers that it was a pity there was no water in the fountain that day.

The RIBs continued out into the archipelago, and the lead boat set a course west of Kjeøyene islands to shelter the passengers from the weather and avoid larger waves from the south-east. The RIBs first stop was by Store Kjeøy island.

The RIBs continued between the islands of Grytøya and Sandsøya before arriving at Bjarkøya island, where lunch was served in a cabin that the tour operator had at its disposal.

At approximately 14.15, they went back to the boats to start the return voyage to Harstad. They went around Bjarkøya to see the north side of Grytøya. They had agreed to take the same route back to Harstad as they had followed on the outbound journey.

The RIBs travelled at an average speed of 30–35 knots for most of the trip, but increased the speed to between 40 and 50 knots for the final two minutes of the voyage after passing Russevikneset (see Figure 3). There was some small waves and wind. The passengers were holding on tight.

The passengers have stated that they felt safe and taken care of during the trip, but that they found this part of the voyage a little uncomfortable.

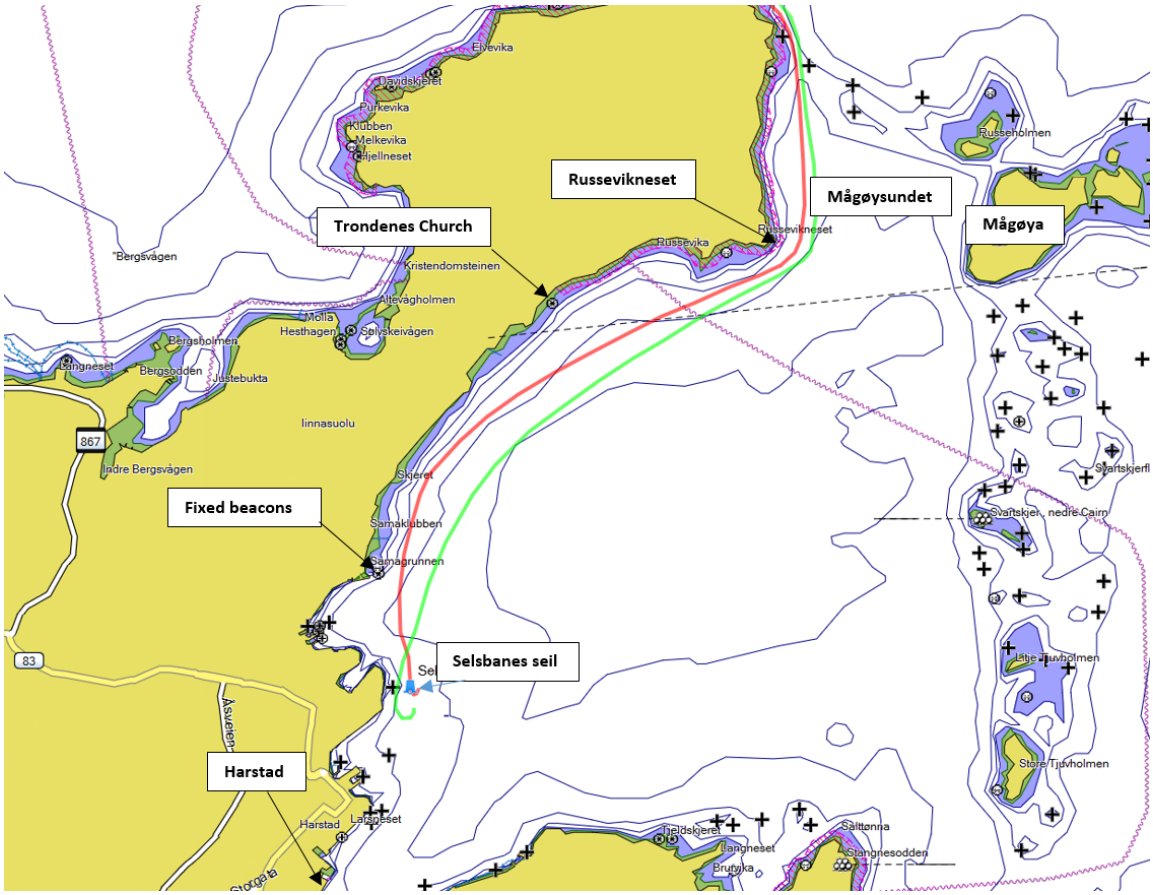

Figure 3: The figure shows the route the two RIBs took towards Harstad port. The green line represents Munin and the red line represents Hugin. Source: Garmin electronic chartplotter, Homeport

The RIBs continued along the shore of Russevika and passed Trondenes church. The waves died down as they approached Harstad, and both boats were travelling at speeds of more than 40 knots on their approach to the port.

The skipper of Hugin (red line) was in his normal position astern of the lead boat on the starboard side and kept an eye on it, while switching between looking ahead and glancing at the chart plotter. He last checked his position on the chart approximately as they were passing the last two fixed beacons (see Figure 3 and the top of Figure 4).

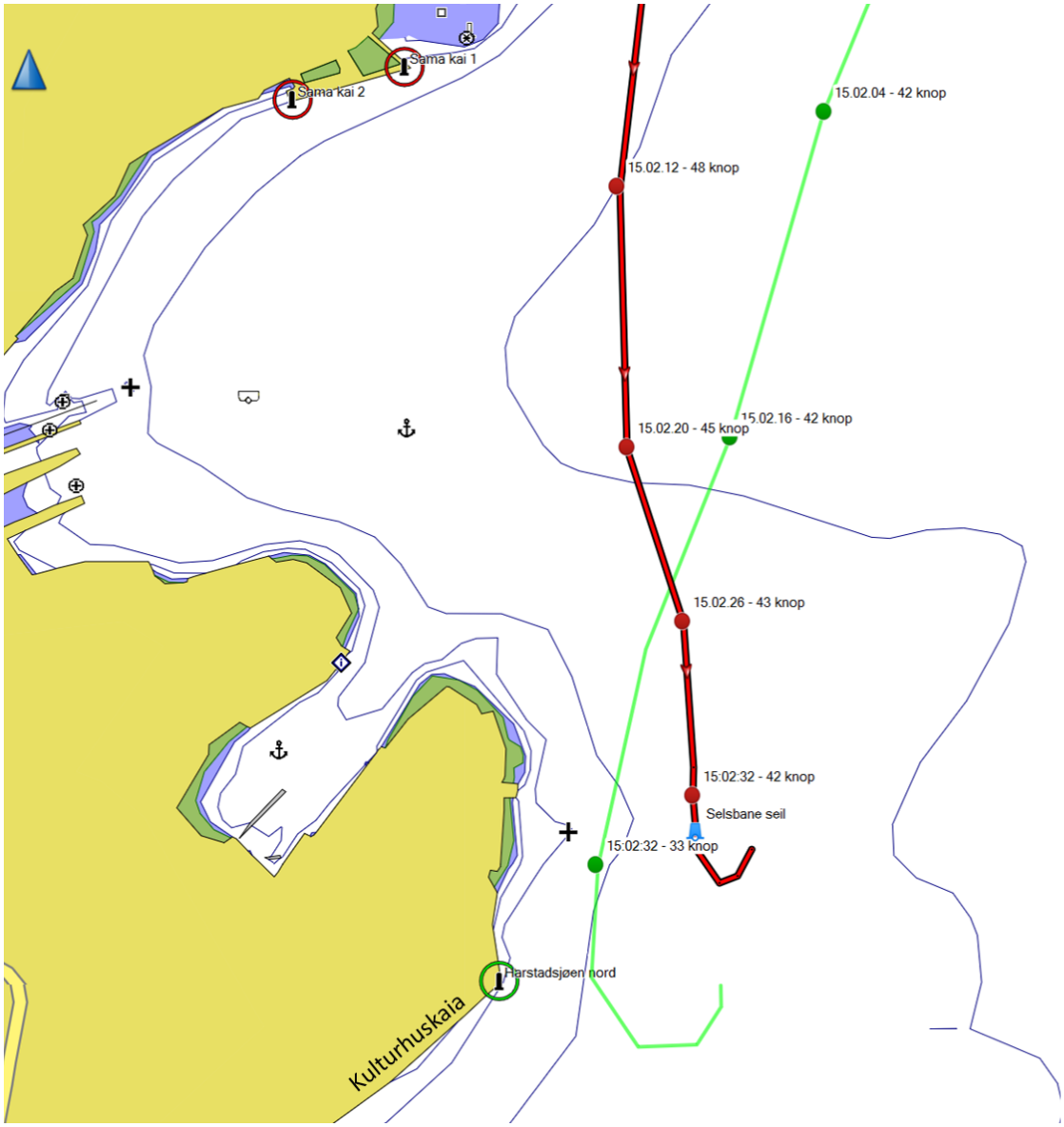

Figure 4: The map shows the final section of the two RIBs' approach to Harstad, including times and speed in knots. The green line represents Munin and the red line represents Hugin. Source: Garmin electronic chartplotter, Homeport

The skipper of Munin (green line) was aware of Selsbanes Seil and chose a course on the landward side of the fountain to allow the passengers a close-up view of the culture centre. Just after the RIBs had passed the two fixed beacons, Hugin's skipper found that the lead boat's course would soon leave less space between the lead boat and shore than he was comfortable with.

At 15:02:16, Hugin's skipper reduced the engine speed. He then crossed the lead boat's wake to increase his distance to the shore and to the lead boat. When Hugin crossed Munin's wake, the distance between the boats was approx. 65 metres. The speed had been reduced from 49 to 43 knots.

At 15:02:26, Hugin had passed the lead boat's wake, and the skipper changed course again to travel approximately parallel to the shore, but to the lead boat's port side. This put Hugin on a collision course with Selsbanes Seil.

At 15:02:33, Hugin collided with Selsbanes Seil at a speed of 42 knots. All occupants with the exception of one passenger seated at the rear of the boat were thrown overboard.

Some of the passengers seated at the front of Hugin later stated that they had seen Selsbanes Seil before the collision, but had assumed that the skipper was also aware of the fountain and would turn away in time.

The skipper stated after the accident that he had forgotten about the new fountain and did not see Selsbanes Seil during the approach to Harstad.

1.2.3 The rescue operation

The occupants of Munin heard a bang just after passing Selsbanes Seil. Munin's skipper immediately turned the boat around and headed towards the accident site.

When Munin arrived at the scene of the accident, the skipper and ten passengers were picked up from the sea by the crew and passengers of Munin. The last person in the water was picked up by the one passenger who remained on board Hugin.

Munin's assistant skipper notified the police at 15.09, and the police in turn notified the Joint Rescue Coordination Centre and other emergency services.

The fire service sent a boat out to Selsbanes Seil to assist. The boat picked up the two passengers on board Hugin and took them to a waiting ambulance.

Figure 5: The rescue operation. Photo: NRK

At 15.44, all the passengers had been accounted for and were transported to Harstad hospital, where they were followed up by health personnel, the police and the municipal crisis management team.

The rescue vessel RS Kjøpstad towed Hugin to Harstad Marina.

1.3 Extent of damage and injuries

1.3.1 Personal injuries

All occupants of the boat involved in the accident were sent to hospital.

The skipper and one of the passengers were admitted with serious injuries. The injuries were partly caused by the impact and partly by being thrown into the sea. Several other passengers were treated for minor injuries.

Table 1: Personal injuries

Injuries	Crew	Passengers	Others
Dead	-	-	-
Serious injuries	1	1	-
Minor injuries/uninjured	-	10	-

1.3.2 Damage to the RIB

The RIB sustained significant damage in the collision. There was significant damage to the bow, and the rear starboard section of the inflatable tube was punctured, but the boat nonetheless stayed afloat after the accident. The motor mountings snapped, and the outboard motors were left hanging under water by their cables behind the boat. There was also some damage to other equipment on board.

Figure 6: Damage to the bow (left) and damage to the stern (right). Photo: AIBN

1.3.3 Other damage

The fountain Selsbanes Seil sustained minor damage as shown on the photo below.

Figure 7: Selsbanes Seil after the accident. Photo: The police

1.4 Weather conditions

Data from the meteorological station at Harstad stadium, which is the nearest meteorological station, show an air temperature of 3 °C and gusts of up to 6.3 m/s (moderate breeze) between 14.00 and 16.00 on the day of the accident.

The weather was cloudy, mainly dry with occasional drizzle, but the total precipitation for the day was less than 1 mm. Air humidity was 88%, and visibility was good with no fog.

Figure 8: *Visibility immediately after the accident. Photo: NRK*

1.5 Description of the fairway

1.5.1 The port of Harstad

There are several possible entrances to the port of Harstad, and the fairway leading to the town is uncomplicated with ample space for vessels to manoeuvre, see Figure 9. Both recreational boats, passenger and cargo vessels use the fairway going in and out of the port area. The fountain, Selsbanes Seil, is located in the fairway and within Harstad Port Authority's port limits.

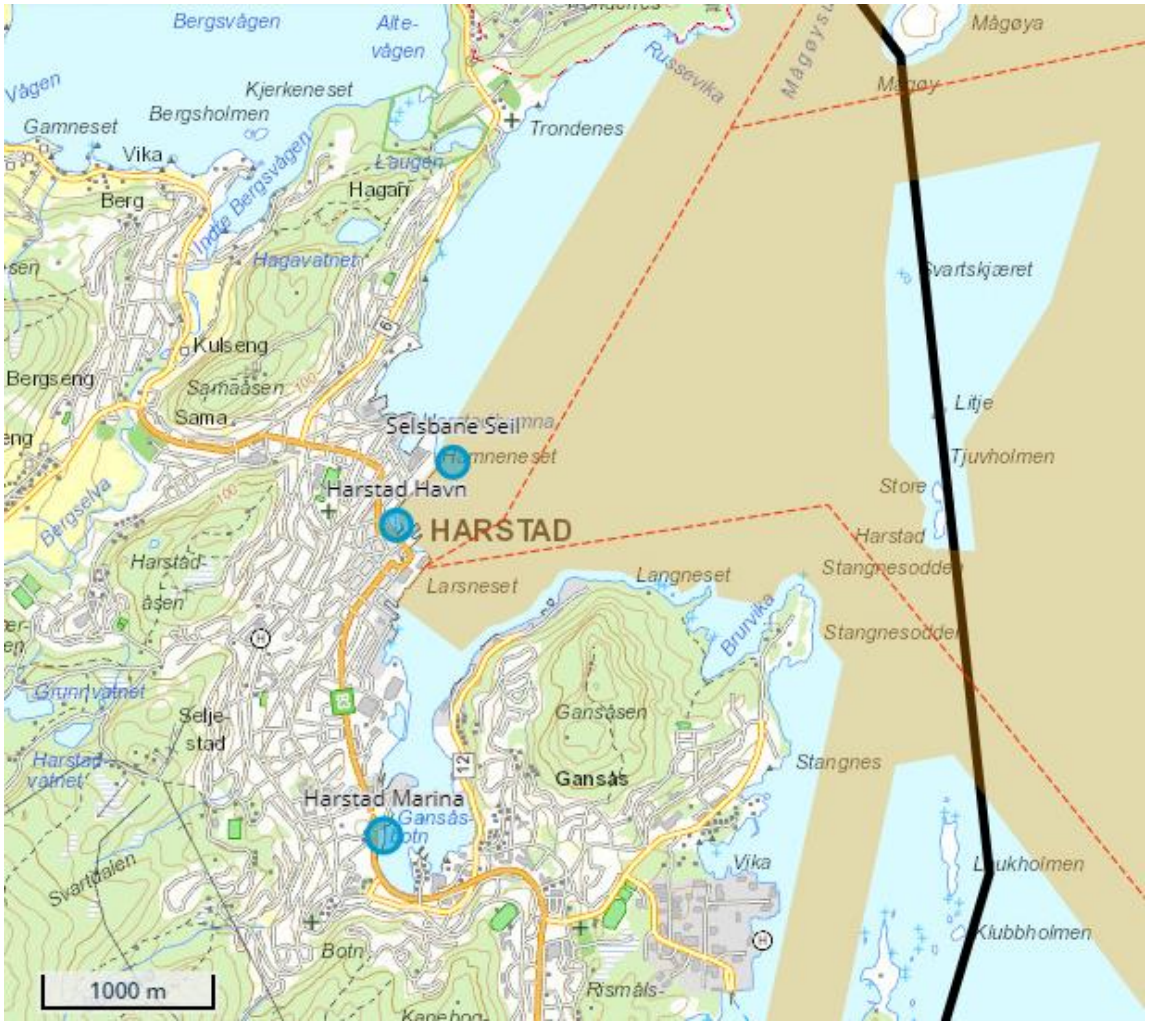

Figure 9: The area highlighted in yellow shows the main and secondary fairways. The black line marks Harstad port's limits. Source: The Norwegian Coastal Administration's online map service Kystinfo

A speed limit of 5 knots applies when entering the port of Harstad, as shown in Figure 10. At the time of the accident, there was no sign showing this limit at the entrance to the port. According to Harstad Port Authority, the sign was temporarily removed in connection with a construction project around 2009. The skippers have stated that they knew where the 5-knot speed limit applies.

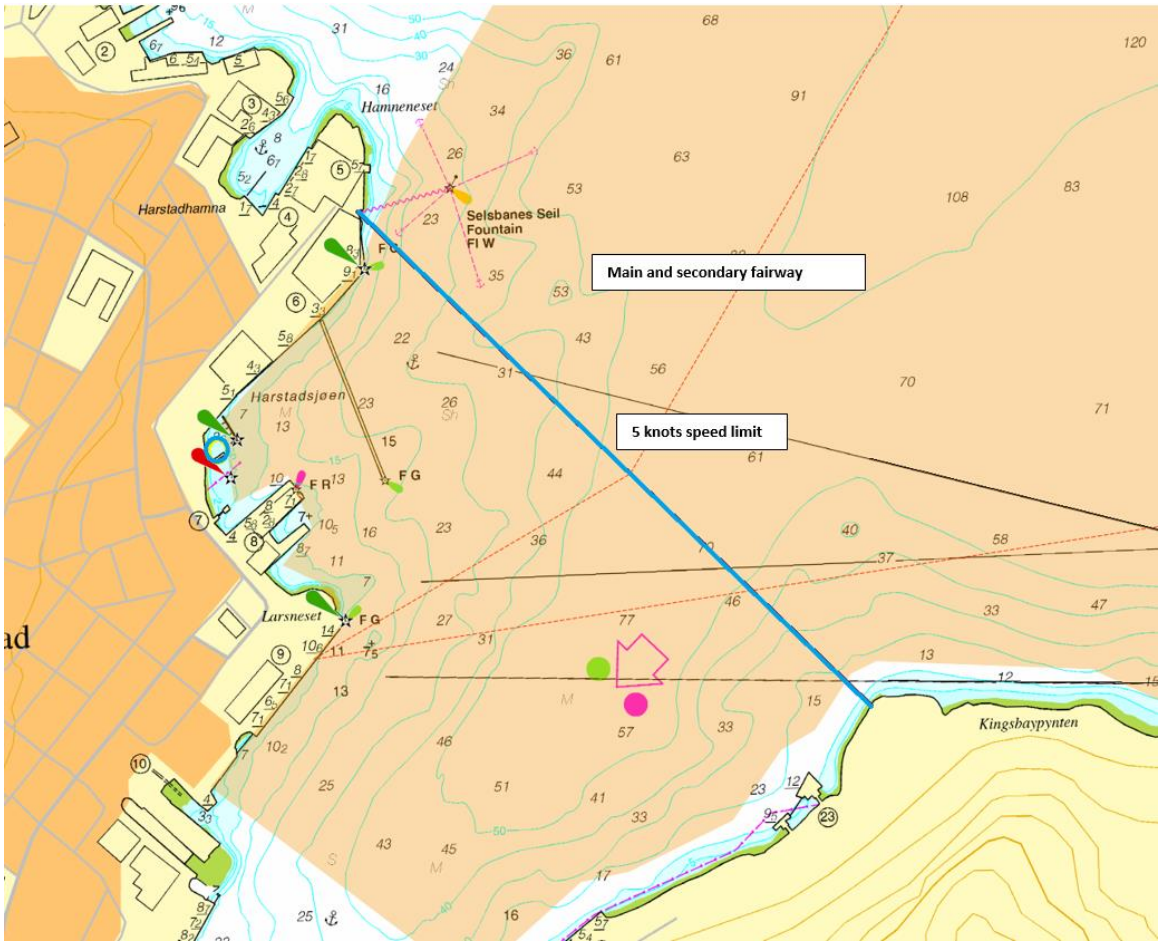

Figure 10: Selsbanes Seil is anchored at the position 68° 48.313' N, 16° 33.243' E. It is located about 120 metres north-east of the culture centre quay, in an area with no speed restrictions just outside the area where the 5-knot speed limit applies, but in the fairway. Source: Norwegian Coastal Administration, kystinfo.no

1.5.2 Selsbanes Seil

Selsbanes Seil is a tribute to the Viking chief Asbjørn Selsbane, who lived at Trondenes near Harstad. The artist Geir Samuelsen launched the idea in 2007–2008. A project group continued the work, and the installation was inaugurated on 12 November 2016.

The fountain consists of a floating platform in reinforced concrete with a polystyrene core, and a pump that projects seawater approximately 50 metres into the air. Four projectors light up the water in ‘the colours of the northern lights’. The installation measures 3x3 m and extends 1.5 m below the surface of the water, while the platform deck is 0.5 meters above the sea surface and is surrounded by a wooden ‘fender’.

Figure 11: Selsbanes Seil. Photo: Geir Samuelsen

The fountain was equipped with a radar reflector and a Jotron Tron ML-300 marking light with a daylight sensor. Until after the day of the accident, the light was programmed to switch off in daylight. The light was mounted approx. 2.5 metres above the platform deck.

AIBN has been given access to video footage from the first minutes after the accident. This recording shows that the light started flashing a few minutes after the accident.

The water jet automatically turned on every day at 07.00 and off again at 23.00. To avoid water hitting nearby buildings, the water would automatically turn off at wind speeds exceeding 3 m/s from north-east/east/south-east and at wind speeds exceeding 8 m/s regardless of wind direction.

1.6 The skipper

The skipper was a 50-year-old male. He had held a Offshore certificate for Pleasure Craft up to 50 GRT and up to 12 paying passengers (D5L) since September 2014 and stated that he had many years' experience of driving fast pleasure boats. He had also driven the RIB in question on several occasions over the past two or three years, both on private occasions and with paying customers.

Selsbanes Seil was installed about three months before the accident took place, and the skipper has stated that he had seen the fountain nearly every day during this period and was thus well aware of its existence. He was used to seeing the fountain with the water jet activated, but had not previously passed it by boat.

No information about the skipper's state of health that could be of relevance to the accident has emerged. The skipper has stated that he felt rested and fit on the day of the accident.

1.7 The boat

1.7.1 General information

Hugin was a rigid inflatable boat manufactured by Ring Powercraft in Southampton, England. The boat was 10.5 metres long and equipped with twelve jockey seats with back rests facing forward, as well as two individual seats at the rear of the boat behind the steering console. Munin is of the same type with an identical hull, but the seats and steering console are placed somewhat further to the rear of the boat and the rest of the equipment is not quite identical.

Figure 12: The sister boat Munin. Photo: AIBN

The tour operator ordered both RIBs in February 2007 from a Norwegian dealer to whom they were delivered via the Scandinavian importer Grand RIB AB, which is based in Sweden. Ring Powercraft delivered the hulls with seats and consoles already installed. According to Grand RIB and the Norwegian dealer, neither of them made any modifications before the boats were delivered to B&B Touring in Harstad in late summer 2007.

The primary purpose of procuring the RIBs was commercial use. They were not CE marked, and the company has stated that it did not receive a declaration of conformity or owner's manual. In 2011, the boats were registered in the Norwegian Ordinary Ship Register (NOR) as commercial vessels.

1.7.2 Equipment

The motors, steering systems and the electrical system were installed by the company Harstad Marina Båt AS. Both boats were originally equipped with two 250 hp Yamaha outboard motors, but Hugin was fitted with two 300 hp Evinrude E-TEC motors after an incident in 2015.

Both vessels were equipped with a Garmin chart plotter with integrated radar display. There were no up-to-date electronic charts on board, and the radar was not turned on at the time of the accident. The operating company has stated that they had chosen not to use the radar, since the waves could generate false and distracting radar echoes.

The RIBs were equipped with VHF radio, but the operating company has stated that, due to noise, this equipment was not used while the boats were underway.

AIBN has retrieved the motor data history from the outboard motors and the voyage history from the chart plotters.

1.8 Special investigations

1.8.1 Reconstruction

AIBN performed a reconstruction of the final part of the voyage. The purpose of this was, among others, to map the field of vision from the helm position, assess the fountain's visibility and gain a better understanding of the skipper's experience and conditions during the trip when the accident happened.

Several aspects of the trip could not be accurately recreated, including the weather, wind, light and wave conditions. In addition, Hugin was not operational, so Munin was used to simulate it during the reconstruction. Another boat was used to simulate the lead boat. Nor was it possible to accurately recreate the boat's speed, position or course or the distance between them.

Munin was loaded in approximately the same way as Hugin had been on the day of the accident in terms of passenger seating, height and weight, and several cameras were installed on board. Several tests were conducted to recreate the voyage as accurately as possible and, despite the above-mentioned limitations, the reconstruction yielded valuable information (see Figure 13).

Figure 13: From the reconstruction. This photo shows the field of vision from the helm position. The fountain can be seen in front of the boat between the heads. Photo: AIBN

1.8.2 Boat measurement

The AIBN measured the boat to check whether the field of vision from the helm position meets the requirements stipulated in the standard *EN ISO 11591 Small craft, engine driven – Field of vision from helm position (ref. section 1.14.1.2)*. This is described in Annex A, and the conclusion is that Hugin most likely does not meet the requirements.

1.8.3 Life jackets

Several of those involved stated that their life jacket had failed to inflate automatically when submerged. Video footage obtained after the accident confirms these statements.

The AIBN examined 15 of the company's life jackets. The other life jackets disappeared after the accident.

The AIBN found that CO_2 cylinders and/or bobbins were missing from several life jackets. Several life jackets also had bobbins that were several years old. All the bobbins were more than one year old, and the oldest one was ten years old. Two of the life jackets were tested and triggered in water, and one was found to be leaking.

1.9 Manufacturer

Ring Powercraft has been building motorboats since 1960 and RIBs since 1995. According to the company, it produced more than 100 boats a year around 1980, but its production is now down to about 6–10 boats per year. The company consists of the owner and two production workers.

The AIBN has been in contact with Ring Powercraft and requested declarations of conformity, owner's manuals, drawings, technical documentation and the manufacturer's calculations of the boat's field of vision. The company has responded to the AIBN's requests, but has been unable to provide the requested documentation for the boat in question. However, Ring Powercraft has enlightened that the trim of the boat does not exceed 2,3° and claims that requirements regarding the field of vision from the helmsman position are satisfied.

The UK accident investigation authority, Marine Accident Investigation Branch (MAIB), has assisted in the investigation and visited the manufacturer at the AIBN's request. The company was not able to present the requested documentation concerning the boat or the type of boat in question to the MAIB either.

1.10 The tour operator

1.10.1 General information

B&B Touring AS was established in December 2006 and is operated by the two owners. The company's offices are in Harstad Marina. The company has no other permanent staff, but they use an acquaintance as a guide and/or skipper as necessary. The tour operator offers maritime experiences with a focus on the coastal culture, history and maritime flora and fauna of Northern Norway.

The company's first season of operation was 2007, and it has had regular operations since. It ran 41 day trips in 2015 and 55 day trips in 2016 with one or both boats.

1.10.2 The safety management system

The tour operator had established a safety management system that contained the following chapters:

1. A description of the organisation
2. A description of the area of operation
3. Risk factors for passengers
4. Risk factors for crew
5. Measures to reduce risks
6. A system for planning of operations
7. The boat and technical specifications
8. On-board equipment
9. Passenger clothing
10. Skipper competence

A registration form for undesirable incidents, a form for voyage planning, an emergency preparedness plan and documentation that a man overboard drill had been held were also enclosed. The safety management system was available in the tour operator's premises, and the staff were familiar with its content and the company's procedures. The company conducted an annual self-inspection using the Norwegian Maritime Authority's template.

1.10.3 Voyage planning

According to chapter 6 on planning of operations, a separate planning form must be completed for each assignment. The AIBN has received an assignment planning form for the destination Bjarkøy and an operations log from a similar assignment carried out for the same tour company in February/March 2016. The form deviates somewhat from the description in the management system and is only partially completed. The form includes a route description with points to note. Selsbanes Seil did not exist at the time when the form was completed and is not mentioned.

The tour operator has stated that the assignment was not re-planned before the trip when the accident took place, but that the two owners had reviewed the documents from the previous year when they received another booking for a corresponding assignment. The documents were not reviewed with the person who drove Hugin.

1.10.4 Updating of nautical charts

The tour operator had no procedures for updating the electronic charts on-board. New charts were last installed when the chart plotter was repaired some years ago. There was also a paper chart posted on the wall of the office, but that was not kept up to date either.

1.10.5 Life jacket maintenance

The tour operators stored equipment for passengers' use in an office at Harstad Marina. Among other things, everyone going aboard one of the company's RIBs had to wear an inflatable life jacket.

The company stated that they have replaced the CO_2 cylinders and bobbins in the life jackets that had been inflated. Other than this, the company had no procedures for life jacket maintenance.

1.10.6 Communications

The company's safety management system states that the boats shall be equipped with a VHF radio with headset. A maintenance checklist had been prepared that covered checks of the VHF radio, batteries, headset and mountings.

The tour operator stated that they have tried, unsuccessfully, to find a suitable solution for communication between the boats while underway.

1.10.7 Previous incident

The tour operator was involved in a grounding in 2015. None of the passengers were injured. The AIBN has been informed that the boat was travelling at a speed of approx. 20 knots just before it ran aground, but that the skipper slowed down when the passengers made him aware that they were on a collision course with an islet. The skipper made an evasive manoeuvre, but the motors hit the skerry underwater.

After the incident, the company used the registration form for undesirable incidents and identified four preventive measures, including two that are relevant to this accident:

- Planning the route carefully and following the plan
- When deviating from the planned route, one must be extra vigilant and come to a complete stop if one is uncertain

1.11 The Norwegian Maritime Authority's supervision

The Norwegian Maritime Authority (NMA) made an unannounced inspection of the tour operator in summer 2015 as a result of the accident mentioned in section 1.10.7. The checklist used did not include a check of whether the boat complied with the applicable design requirements. Nor was any inadequate documentation of compliance with design requirements identified.

However, the checklist did include two items relating to maintenance of life-saving appliances, including control of maintenance instructions. Both items were accepted without remarks.

The checklist also included control of the radio safety certificate and checking that the radio (VHF) equipment was CE marked. The radio safety certificate was found to be missing, and an order to remedy this was issued.

1.12 Approval and establishment of Selsbanes Seil

1.12.1 Planning and ownership

Selsbanes Seil was a collaboration between the artist Geir Samuelsen and local enterprises Polarkonsult, Seaworks, Høvik AS and Harstad Elektro. The partners gave the fountain to Harstad municipality as a gift, and the municipality is therefore formally the owner and developer.

1.12.2 Case processing and risk assessments

Two preparatory meetings were held (in 2008 and 2010) between Harstad Port Authority, the Norwegian Coastal Administration (NCA) and representatives of the coastal express Hurtigruten and the high-speed boat company Veolia. Minutes of these meetings show that the fountain's location and marking were discussed based on the condition that it should not represent a risk or inconvenience to shipping in the area. The meetings focused on conditions for the coastal express and high-speed boats and other large vessels in the area, while the risk that the installation could represent for small boats was not discussed.

The project group behind Selsbanes Seil has stated that safety aspects relating to the installation were discussed in the course of the project, but that no systematic risk assessment was carried out.

Harstad Port Authority was initially of the opinion that they were to consider the application for the installation's construction, but later asked Harstad municipality to submit the application to the NCA for approval. The NCA approved the project on certain conditions, including that it would be marked with lights and a radar reflector and that it would be reported to the Norwegian Notices to Mariners (Efs). The NCA later withdrew its permit on the grounds that the proposed project was within the area administered by Harstad Port Authority, and that the port authority therefore had to make its own decision. Harstad Port Authority granted Harstad municipality permission to go ahead with the project in a decision whose wording was almost identical to that of the NCA's decision and that set the same conditions.

Harstad Port Authority has stated that it assumed that the NCA's assessments and decision were in accordance with proper fairway management. Therefore, Harstad Port Authority based its decision on the NCA's approval and granted an almost identical permit.

1.12.3 Follow-up of conditions

One of the conditions of the permit granted by Harstad Port Authority was that the developer should report the project to Efs immediately upon completion. Harstad municipality failed to do this, and the fountain was therefore not shown in the official nautical charts at the time of the accident.

Harstad Port Authority has stated that the intention behind the condition for a marking light was that it was to flash around the clock, but this was not explicitly communicated. Until after the day of the accident, the installation was equipped with a photo sensitive marking light that did not flash during daylight.

1.13 Reporting of basic data to the Norwegian Mapping Authority

The Norwegian Mapping Authority is the official nautical chart authority and responsible for keeping nautical charts up to date. In order to do this, the authority needs to receive immediate and correct information about relevant changes. In addition to the NCA and municipal authorities along the coast, several other authorities also approve projects for public and private developers.

The Norwegian Mapping Authority has pointed out that delays or failure to report projects to Efs is a general problem. The AIBN has received documentation confirming that this is a problem and that it has been a concern for the Norwegian Mapping Authority since 2008.

The Norwegian Mapping Authority states that it has proposed improvement measures to the NCA, and that internal work is under way on solutions to ensure that such information is received.

1.14 Rules and regulations

The following laws and regulations are relevant to this accident:

1.14.1 The Regulations on the operation of small passenger craft

Regulations of 24 November 2009 No 1400 on the operation of vessels carrying 12 passengers or less, etc. (Regulations on the operation of small passenger craft) applies to companies that operate RIBs for commercial purposes.

1.14.1.1 *Requirements for a safety management system*

Section 4 states that the company shall establish a safety management system where compliance with the requirements for each boat is documented. The management system shall include the following:

- A description of risk factors for the crew and passengers, and plans and measures to reduce such risks
- A system for the registration of undesirable incidents and a description of corrective measures to prevent the recurrence of such incidents
- A system for the planning of operations, including for obtaining necessary information
- A description of the boat, including technical specifications and equipment

1.14.1.2 *Design*

In 2007, when the boats were purchased and put into use by the Norwegian tour operator, no design requirements applied to RIBs used for commercial purposes.

The Regulations on the operation of small passenger craft came into force on 1 January 2011 and required craft to meet relevant design requirements set out in the Regulations on the manufacturing and placing on the market of recreational boats and personal watercraft (see section 1.14.2). Alternatively, it must be documented that the craft meets equivalent or stricter requirements.

Section 12 (3) stipulates the explicit requirement that the field of vision from the helm position shall satisfy EN ISO 11591 (see section 1.8.2).

1.14.1.3 *Life-saving appliances*

Section 15 of the Regulations contain requirements concerning maintenance of life-saving appliances, including that all life-saving appliances shall comply with rules and regulations and be ready for immediate use. Instructions for maintenance of life-saving

appliances shall be in accordance with SOLAS Chapter III, which entails, among other things, a requirement for planned and logged periodic maintenance.

The inspection of life-saving appliances shall be carried out in accordance with the relevant guidelines prepared by the Norwegian Maritime Authority. The AIBN has requested these guidelines, but has been informed by the Norwegian Maritime Authority that no such guidelines have ever existed.

1.14.1.4 *Radiocommunications and radio equipment*

Section 10 of the Regulations include a requirement that the craft shall at all times be capable of transmitting and receiving distress calls and communicating with other vessels. Vessels without a superstructure, and which may attain a speed of 20 knots or more, shall have a headset with a microphone that can be connected to the VHF equipment.

1.14.1.5 *Qualification requirements*

The qualification requirements are set out in Chapter 6. The master shall hold a certificate appropriate for the size of the craft, minimum D5L (Offshore certificate for Pleasure Craft up to 50 GRT and up to 12 paying passengers or Master Fisherman Class C certificate), a medical certificate, and have basic safety training.[1]

The NMA has published a curriculum for the Offshore certificate for Pleasure Craft up to 50 GRT and up to 12 paying passengers. The curriculum does not mention skills relating to high speed.

1.14.2 Regulations on the production and placing on the market of recreational craft etc.

Hugin was used for commercial purposes (see section 1.14.1.2), but the same boat model is also sold as a recreational craft. The Regulations of 14 June 1996 No 580 on the production and placing on the market of recreational craft etc. implemented Directive 94/25/EC of the European Parliament and of the Council in Norwegian law. The Directive introduced common European safety and environmental requirements for recreational craft between 2.5 and 24 metres in length. As a rule, recreational craft that were put into use or made available for the first time in the EEA area after 16 June 1998 shall meet the requirements set out in the Directive and be CE marked.

The Directive was replaced by Directive 2013/53/EU of the European Parliament and of the Council, implemented in Norwegian law through Regulations of 15 January 2016 No 35 on the manufacturing and the placing on the market of recreational craft and personal watercraft (the Regulations on Production etc. of Recreational Craft etc.). The Directive is supported by a set of harmonised ISO standards, including *EN ISO 11591 Small craft, engine driven – Field of vision from helm position*. This ISO-standard was first published in 2000, but was later revised in 2011.

The Regulations set out requirements for manufacturers of completed and partly completed recreational craft of between 2.5 and 24 metres. Among other things, there are requirements for internal production control and quality control and for marking of craft,

[1] See also Section 67 of the Regulations of 22 December 2011 No 1523 on qualifications and certificates for seafarers.

as well as for the technical documentation, declaration of conformity and owner's manual that must accompany the craft when it is placed on the market.

Pursuant to Section 30, the Norwegian Maritime Authority supervises compliance with the Regulations.

1.14.3 The Harbour and Fairways Act

The purpose of Act No 19 of 17 April 2009 relating to harbours and fairways (the Harbour and Fairways Act) is, inter alia, to facilitate good navigability, safe maritime traffic and the proper use and administration of fairways, and facilitate the efficient and safe operation of ports.

1.14.3.1 *Administrative responsibility and authority*

Under Section 7 of the Act, the administrative responsibility and authority for main and secondary fairways are assigned to the Ministry of Transport and Communications. The Ministry has delegated responsibility to attend to this administration within Norwegian territorial waters and internal waters to the NCA.

Section 9 describes the municipalities' administrative responsibility and authority. Harstad Port Authority has been delegated the authority to make decisions and approve projects on behalf of Harstad municipality in matters relating to the port.

According to the Regulations of 30 November 2009 No 1477 on fairways, the Ministry's administrative responsibility and authority regarding main and secondary fairways within a port area only covers the establishment and improvement of fairways.

1.14.3.2 *Permits and requirements for projects*

Section 26 states that projects for which a permit are required shall be planned, implemented, operated and maintained in such a way that considerations for good navigability and safe traffic in the fairways and considerations for life and health, the environment and material assets are addressed in a satisfactory manner.

Section 27 stipulates that projects that could affect safety or navigability in a municipality's sea areas requires a permit from the municipality where the project is to be implemented. If such measures are to be implemented in main or secondary fairways or otherwise outside the municipal sea area, a permit from the ministry is required. The same applies to projects to be implemented within a municipality's sea area, but that could affect the safety or navigability of main or secondary fairways.

1.14.3.3 *Guide to the Harbour and Fairways Act*

The NCA has published a guide to the Harbour and Fairways Act to help to ensure that municipal case processing is as correct and uniform as possible.

Section 7.5 of this guide points out that the application must contain a thorough description of the project and the plans for its implementation, and that the project must be marked on a map. This is necessary to allow the NCA or the municipality to assess the project's effect on safety and navigability in the area in question.

Section 7.6 of the guide states that a concrete assessment of the project's effect on safety and navigability must be carried out based on the nature of the project and its size, location, and other local conditions. Similar projects can be assessed very differently in different cases, since local conditions will be a factor. Such conditions include wind and currents, traffic density, type of traffic, how deep, wide and complicated the fairway is, seabed conditions etc.

1.15 Guidance and supervision relating to inflatable life jackets

1.15.1 Manufacturer's guidelines

Life jackets are sold with a user manual. The consumer is expected to comply with the user manual to ensure that the product remains functional.

The following information is taken from the user manual:

> *Check the following before use:*
>
> *Check that the CO_2 cylinder is full and securely screwed into place.*
>
> *Ensure that the bobbin cage is securely screwed in and that the green indicator is clearly visible.*
>
> *Regular maintenance will extend the life jacket's useful life. For commercial use, the bobbin must be replaced annually.*

1.15.2 DSB – Supervision of consumer products – Inflatable life jackets

In 2016, the Directorate for Civil Protection and Emergency Planning (DSB) carried out a market survey in relation to inflatable life jackets available on the Norwegian market. The purpose of the campaign was to verify whether the inflatable life jackets available complied with the applicable safety requirements. Another important purpose was to communicate information about the importance of proper life jacket maintenance to consumers.

Inflatable life jackets require more maintenance from users than traditional life jackets with permanent integrated flotation elements. If the consumer fails to inspect and maintain the life jacket, it may lose its floatation function.

The survey was carried out as a quality control of products in different price ranges from several different importers, manufacturers and distributors. The selection of life jackets reflected the range of life jackets available on the Norwegian market. Thirty-three life jackets were visually inspected before 18 of them were sent to an accredited test organisation for function testing.

The results from the rotating shock bin test was that the CO_2 cylinders of several of the life jackets had become unscrewed or come loose. DSB is of the opinion that this fault could result in the life jackets not inflating automatically as the consumers expect. DSB also pointed out that there is a considerable risk involved in leaving too much responsibility for safety to the consumer. Based on the above, information campaigns have been launched to inform consumers of their responsibility for and how to carry out life jacket maintenance.

Work is under way to amend the applicable regulations as regards requirements concerning measures to ensure that gas cylinders cannot come loose. Another focus area is communicating to manufacturers, importers and distributors etc. of life jackets that they have an independent responsibility for the products they place on the market.

The report is available on the DSB website.

1.16 Relevant previous investigations

1.16.1 Fall over board from RIB in Olden

On Wednesday 22 July 2015, an accident occurred with a charter RIB in Olden in Sogn og Fjordane County. During a sudden turn, two passengers and the skipper fell into the water. The skipper later died as a result of drowning.

In connection with the investigation (see report Marine 2017/06), the AIBN pointed to the differences between the Scandinavian countries when it comes to regulating the RIB industry. One of the things pointed out was that the Swedish authorities have since 2005 required a special course to drive a craft carrying 12 or fewer passengers at speeds exceeding 35 knots, and the AIBN is of the opinion that a competence requirement for driving small high-speed passenger boats could have a positive effect on safety at sea.

The AIBN submitted four safety recommendations, including revising the company's safety management and to the NMA to obtain a better overview of the RIB industry and check that the companies are operating within the regulatory framework.

The NMA has stated that it is considering introducing a system for self-declaration or registration of activities in connection with the ongoing revision of the Regulations on the operation of small passenger craft.

1.16.2 The Viking 7 capsizing north-west of Mehamn

On Sunday 6 July 2014, a 23-foot hire boat with five Swedish fishing tourists and one guide on board capsized. One tourist died as a consequence of the strain suffered in the ordeal and another was taken to hospital with arrhythmia caused by hypothermia.

The AIBN found that a life jacket had failed to inflate in the water (see Report Marine 2016/10). It was also found that the boat did not comply with the requirements in the ISO standards underlying the Regulations on the production and placing on the market of recreational craft etc.

1.16.3 Work accident on board M/F Røst near Skrova

On 18 May 2013, a work accident occurred on board the motor ferry Røst. A crew member came in contact with a high-voltage cable, received an electric shock and died as a consequence of falling from the fore mast.

The AIBN's investigation (Report Marine 2014/05) pointed out shortcomings in the reporting of map data to the Norwegian Mapping Authority and the updating of nautical charts.

1.17 Measures implemented

1.17.1 B&B Touring

Since the accident, the tour operator has informed that it has implemented procedures for life jacket inspection and maintenance by an external enterprise.

1.17.2 Harstad municipality

Following the accident, the marking light on Selsbanes Seil has be re-programmed to flash continuously around the clock. In addition, twelve Viking shields have been fitted around the platform and a new radar reflector has been installed.

Figure 14: Selsbanes Seil with the Viking shields attached. Photo: AIBN

Harstad municipality has also notified the Norwegian Notices to Mariners (Efs) of the project, and Selsbanes Seil is now shown on up-to-date nautical charts.

1.17.3 Port of Harstad

Since the accident, Harstad Port Authority has identified more than ten other projects in their coastal area that were not marked in the nautical charts. The port authority has stated that it is in the process of implementing measures to ensure that conditions in future permits are complied with.

Harstad Port Authority has confirmed that, after the accident, they have assessed the risk the fountain represents for small boat traffic in the area, including when it is not active, taking into consideration that it is located in an area without speed restrictions.

2. ANALYSIS

2.1 Introduction

The accident involving Hugin was serious. Twelve persons were directly involved, and there was a considerable potential for greater consequences. It is the AIBN's opinion that the level of safety in connection with RIB trips must be high because these trips involve high speeds and the potential consequences of a collision could be significant.

The analysis begins with an assessment of the sequence of events and a discussion of why the skipper did not notice the fountain. The visibility of the fountain, the field of vision from the helm position and the skipper's situational awareness is further discussed. Further the focus will be on the process of establishing Selsbanes Seil, the boat's design, the authorities' role, and the company's role and safety management.

Rescue resources were notified and quickly arrived at the scene of the accident. The passengers were rescued from the sea after a relatively short time. The AIBN has not found reasons for further investigation of the rescue operation, and has chosen to focus on the factors that contributed to the accident itself. However, the inflatable life jackets did not function as intended, and this will be discussed in the analysis.

The investigation and analysis were conducted in line with the AIBN's framework and analysis process for systematic safety investigations (the AIBN method).

2.2 The sequence of events

Hugin's skipper has stated that his attention shifted between the lead boat, the waters in front of his own boat and the chartplotter. The skippers had not agreed on an exact route in advance, and there was no communication between the two boats while they were underway. Considering that the boats were travelling at speeds of between 40 and 50 knots and were less than 200 metres apart during the final part of the trip, the AIBN finds that the skippers had to be particularly alert in order to ensure a safe voyage. In addition, the skipper on board Hugin had to continuously adapt his position, speed and course to the lead boat, and the AIBN is therefore of the view that this was a more demanding task than the skipper of the lead boat.

In the AIBN's opinion, radio communication between the skippers and better planning of the route could have helped to make the second boat's task easier and reduce the risk of such an accident. This is discussed in more detail in section 2.8 about the company's planning and routines.

Munin's skipper was aware of Selsbanes Seil and chose a course in between the fountain and the culture centre quay. Since the fountain is about 120 metres from shore, this meant that the route left a clearance of about 60 metres between the quay and the lead boat. The skipper of the second boat has stated that he found that the distance between the lead boat and the shore was becoming too small, considering the speed. He therefore decided to move to open waters to the port side of the lead boat, see Figure 15 below. Based on his statement that he had forgotten about Selsbanes Seil and did not see the fountain either, this is an understandable course of action.

If the skippers had suitable radio communication equipment, the lead boat's skipper could have reported his observations and his intention to pass between the fountain and the culture centre quay, and the skipper of the second boat could have requested more room or informed him of his change of position.

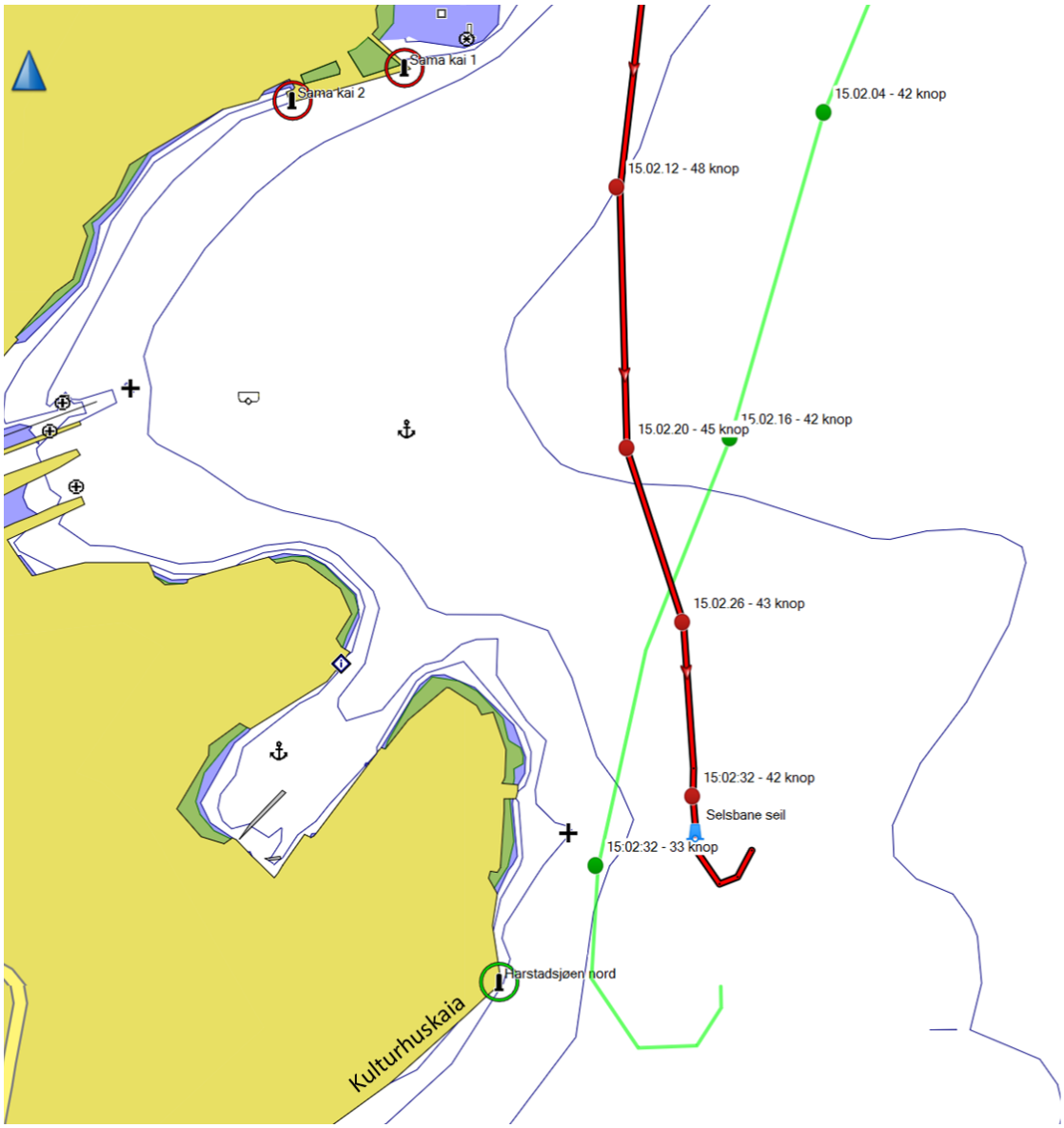

Figure 15: The map shows the final section of the two RIBs' approach to Harstad town centre, including times and speed in knots. The green line represents Munin and the red line represents Hugin. Source: Garmin electronic chartplotter, Homeport

After Hugin had passed the lead boat's wake, the skipper positioned the boat on collision course with Selsbanes Seil, which was then about 150 metres away. The AIBN does not consider this a safety problem in itself. The decisive factor was that the skipper did not become aware of the fountain in the course of the seven seconds when the boat was on a collision course. This will be discussed in more detail in section 2.3.

2.3 Why did the skipper not become aware of the fountain?

2.3.1 Introduction

The AIBN has tried to uncover the factors that contributed to the skipper not becoming aware of the fountain in time. In order to understand this, the AIBN has looked at the fountain's visibility, the field of vision from the helm position and the skipper's situational awareness.

2.3.2 The fountain's visibility

Video footage recorded during the first minutes after the accident shows that the marking light started flashing a few minutes after the accident. The AIBN therefore finds that the light was not active at the time of the accident, and would thus not have constituted an effective barrier. The light has now been reprogrammed to flash around the clock.

The radar reflector was not an effective barrier, since the boat's radar was not activated. Anyhow the radar is a weak barrier, since one cannot expect all high-speed recreational and small boats to be equipped with or use radar.

When the fountain was not active and the light was not flashing, Selsbanes Seil appeared as a colourless and relatively small object. The AIBN has observed how its visibility varies with different weather and light conditions.

At the time of the accident, the weather was grey with some small waves, low cloud cover, and the daylight was fading. Therefore, the fountain was not easily distinguishable from its surroundings at the time of the accident (see Figure 16). The fact that it was located in an area without speed restrictions, particular importance should be on the object's visibility.

Figure 16: Photo of the fountain taken the day after the accident. Photo: The police

Selsbanes Seil was not shown on the nautical chart because the project had not been reported to the Norwegian Notices to Mariners (Efs). This will be discussed further in

section 2.5.2. The nautical chart's shortcomings were probably not important in relation to the accident in any case, as the tour operator did not have up-to-date electronic charts on board and had not used an up-to-date chart to plan the trip. This is analysed further under the company's planning and routines in section 2.8.

2.3.3 Field of vision from the helm position

The reconstruction of the final part of the voyage showed that the passengers seated in the front of the boat partly obstructed the skipper's field of vision, see Figure 13. The bow was also moving up and down, thus obstructing the view for short moments at a time.

After Hugin had crossed the lead boat's wake, it was on a collision course with the fountain for approximately seven seconds before the accident happened. During the last part of this time period, the fountain's platform was probably not visible to the skipper because it was in the blind sector in front of the bow. However, during the first part of the time period, the fountain had probably been possible for the skipper to see. However, it is probable that the fountain was hidden by the passengers seated in the front row for all or part of this time period. The movements of the boat can also have caused the bow to obstruct the skipper's view during some of this time period.

The investigation has therefore shown that the skipper's field of vision was probably obstructed by passengers, and possibly also by the boat's own bow, during the crucial seconds when the boat was on a collision course with the fountain. Neither the skipper nor the operating company had identified the limited field of vision as a potential hazard. This will be discussed in more detail in sections 2.3.4 and 2.8, respectively.

The AIBN has also found that the boat most likely did not meet the applicable requirements for field of vision from the helm position, see Annex A. This will be discussed further in section 2.6.1.

2.3.4 The skipper's situational awareness

The skipper did not think about the fountain at all during the final part of the trip. As a result, identifying the fountain and manoeuvring around was not included in the skipper's situational awareness and mental map of the area, cf. Endsley's situational awareness model.[2] He was therefore dependent on spotting the installation without looking for it in order to manoeuvre safely.

The skipper paid close attention to the lead boat's movements, and his attention was mainly focused on maintaining a good position in relation to the lead boat as well as keeping a sufficient distance to shore. Due to the high speed the boats were travelling, this was a demanding task. Most of the skipper's attention was probably focused on positioning and manoeuvring the boat, and any visual impression of the installation would not have been incorporated into his situational awareness process.

Nor did the skipper benefit from the effect of recognition in relation to his awareness. He had passed the installation by boat for the first time that same day, and his mental image of the fountain was a tourist attraction, and not a potential obstacle in the fairway. A more detailed planning of the voyage, in which the fountain was identified as a potential

[2] Endsley, M.R. & Jones, D. (2012). Designing for Situation Awareness. An approach to User-Centered Design, Boca Raton, CRC Press – Taylor & Francis Group.

obstacle and the location of the installation was included, might have resulted in the skipper remembering the fountain and avoid the accident.

Regardless of known obstacles, a skipper must always be prepared for possible objects in the water. The skipper must therefore have good overview of the waters ahead at all times. If anything obstructs the field of vision, it is essential that the skipper take actions to compensate for this. In the AIBN's opinion, the skipper had the opportunity to compensate for restricted field of vision from the helm position, but did not compensate adequately.

2.4 Competence requirements

The skipper held a Offshore certificate for Pleasure Craft up to 50 GRT and up to 12 paying passengers (D5L) since September 2014 and stated that he had many years' experience of driving high-speed recreational craft. The AIBN has no basis for assessing whether a lack of competence played a part in this incident. However, special skills are required to safely operate a craft at high speeds, and the current competence requirements (e.g. D5L) do not focus on such skills. Sweden has since 2005 required a special course to drive a craft carrying 12 or fewer passengers at speeds exceeding 35 knots, and two crewmembers with this course are required for craft capable of travelling at speeds exceeding 45 knots. The AIBN is of the opinion that both these measures likely makes a positive contribution to reducing the risk of such accidents. In report Marine 2017/06 concerning a fall over board from a RIB in Olden, the AIBN also pointed out that competence requirements for driving high-speed craft could have a positive effect on safety at sea.

It is crucial that the safety of paying passengers is ensured, and it is the authorities' duty to facilitate this by regulating activities in a manner that ensures an acceptable level of safety. The AIBN therefore submits a safety recommendation to the NMA to introduce distinctive competence requirements for driving high-speed boats with up to twelve passengers.

2.5 The process of establishing Selsbanes Seil

2.5.1 Case processing and risk assessment

It is described in section 1.12.2 that Harstad Port Authority and the NCA was initially uncertain about which of them was the correct approving body for such a project. The AIBN will not consider this, but instead focus on how safety considerations were addressed.

No systematic risk assessment was prepared before the project was approved and installed. A risk assessment should i.a. have taken into consideration recreational and small boat traffic, the fountain's visibility when the water jet is not active, and the fountain's location outside the area where speed restrictions apply.

Sections 7.5 and 7.6 in the guide to the Harbour and Fairways Act, point out that the approving body shall consider a project's effect on safety and navigability in the waters in question. Regardless of any assessments carried out by the developer, Harstad Port Authority should perform such an assessment.

Harstad Port Authority has stated that it assumed that the NCA's assessments and decision were in accordance with the applicable law and proper fairway management. When the NCA decided that it was Harstad Port Authority that was to consider the application, the port authority therefore based its decision on the same interpretation and granted a permit with virtually identical wording. In the AIBN's opinion, Harstad Port Authority should have processed the case independently of the NCA's original decision.

Harstad Port Authority has confirmed that, after the accident, they have assessed the risk the fountain represents for small boat traffic in the area, including when it is not active, taking into consideration that it is located in an area without speed restrictions. The AIBN will therefore not submit any safety recommendations to Harstad Port Authority.

2.5.2 Follow-up of conditions in the permit/Efs

The permit to construct Selsbanes Seil was granted by Harstad Port Authority based on several conditions. One of these conditions was that the project would be reported to the Norwegian Notices to Mariners (Efs) immediately upon completion. This had not been followed up at the time of the accident, but was not relevant to the accident in question, since the tour operator did not have up-to-date charts.

Since the accident, Harstad Port Authority has identified more than ten other projects in their coastal area that were not marked in the nautical charts. The port authority has stated that it is in the process of implementing procedures to follow up all conditions for permits, including checking that the developer reports the project to Efs.

The investigation of the accident involving MF Røst (Report Marine 2014/05) uncovered a failure to report a change in vertical clearance beneath overhead power cables. According to the Norwegian Mapping Authority, inadequate reporting to the Efs is a general problem. The AIBN has received documentation confirming that this has been a concern to the Mapping Authority since 2008.

The Norwegian Mapping Authority is the official nautical chart authority and responsible for keeping nautical charts up to date. However, in order to do this, the authority needs to receive immediate and correct information about relevant changes. In addition to the NCA and municipal authorities along the coast, many other authorities also approve projects for an even greater number of public and private developers. The NCA has stated that they are in dialogue with the above-mentioned authorities and that the situation has improved somewhat in recent years. The AIBN will therefore not submit any safety recommendations following this investigation.

2.6 The boat and design requirements

2.6.1 Field of vision from the helm position and design requirements

The RIB was not CE marked and the tour operator had no declaration of conformity, owner's manual or other documentation of the boat's design, maintenance or operational limitations. When the boat was acquired in 2007, no design or documentation requirements applied to RIBs in commercial use. The current design requirements was enforced in 2011, and the AIBN is of the opinion that the tour operator should then have identified that the boats were lacking a declaration of conformity or other documentation.

The investigation has shown that Hugin most likely did not meet the requirements to field of vision from the helm position, which may have contributed to making it more difficult for the skipper to notice the fountain.

The Ring Powercraft RIB 1050 model has been in production since the 1990s, and the manufacturer has stated that the shape of the hull has remained unchanged since production started. Even if the hull shape is identical, the field of vision will nevertheless vary with the helm position. Both the manufacturer and the Scandinavian importer has stated that many boats of this model have been sold with CE marking and that the helm position in question is very common.

The AIBN think it has been produced and sold similar Ring RIB Powercrafts with CE marking most likely without complying with the field of vision requirements. The AIBN therefore recommends that the NMA investigate this in more detail and take any necessary action in relation to owners of such boats in Norway and initiate notification procedures in relation to other European authorities.

2.6.2 The Norwegian Maritime Authority's supervision

As mentioned in section 1.11, the NMA's checklist for unannounced inspections did not include checkpoints for the boat's design. It was also not uncovered that the company lacked procedures for inspection and maintenance of lifesaving appliances, despite this being covered in the checklist.

It was uncovered that the company did not have a radio safety certificate, but not that it lacked suitable equipment for communicating while the boat were underway.

The NMA has stated that the checklist is under revision and that verification of compliance with design requirements will be included in the new version of the checklist.

In the investigation of the accident involving a fall over board from a RIB in Olden (Report Marine 2017/06), the AIBN found that the NMA had limited overview of the RIB industry and found supervisory activities relating to this category of boats to be inadequate. The NMA has stated that it is in the process of obtaining an overview of boats and enterprises that fall under the scope of the Regulations on the operation of small passenger craft.

2.7 The life jackets

The AIBN found faults and defects in several of the company's life jackets. Several of them lacked the CO_2 cylinder, and many had activator bobbins that were several years old. The oldest bobbin was dated from 2007, the year of the company's start-up. The company stated that it has no procedures for regular life jacket maintenance, but has replaced the CO_2 cylinders and bobbins on life jackets that have been inflated. In the AIBN's opinion, the lack of procedures put passengers at risk and could have resulted in more serious consequences. Since the accident, the operating company has stated that it has implemented procedures for regular life jacket inspection and maintenance by an approved enterprise.

During the investigation of the Viking 7 accident (see section 1.16.2), the AIBN also found that a life jacket had failed to inflate in the water. During its survey, the DSB found (see section 1.15.2) that 8 out of 18 life jackets failed the rotating shock bin test because

the CO_2 cylinder was loose or had come loose during the course of the test. These results show that the CO_2 cylinder's fastening mechanism is a vulnerable point, and that this problem is not limited to one particular manufacturer or type of activator mechanism. The DSB identified several measures and initiatives in relation to different parties in order to both spread information about faults and improve the life jackets' technical solutions.

In the AIBN's opinion, this emphasises the importance of the users of inflatable life jackets being familiar with and complying with the manufacturer's guidelines for regular inspection and maintenance in order to ensure that the product maintains its safety function. This also illustrates the lack of competence with lifesaving appliances in some companies that operate small passenger boats. The AIBN therefore sees a need for guidance to be provided to the industry and considers it unfortunate that the guide described in Section 15(2) of the Regulations on the operation of small passenger craft has not been prepared (see section 1.14.1 of the factual information).

2.8 The company's safety management

A safety management system must be adapted to the company's activities and requirements and help to ensure that the company's operations are carried out safely. The tour operator had established a safety management system, but the investigation has shown that it was inadequate in some areas and that the procedures could have been better implemented.

The AIBN identified the following shortcomings in the course of this investigation:

- The safety management system covered a general procedure for the planning of operations and a form for planning of assignments. The form completed for the trip to Bjarkøy had not been updated after Selsbanes Seil was built, and the fountain was therefore not identified as a potential hazard.

- The company operated boats that lacked the necessary documentation.

- The company did not have up-to-date nautical charts or procedures for updating the charts.

- The company had no procedures for regular life jacket inspection and maintenance, and the investigation uncovered several defects in the company's life jackets.

- The company had no procedure or suitable equipment for using the VHF radio equipment while the boats were underway.

- After the incident in 2015, the tour operator identified two measures that were relevant for this accident, but neither of the measures on thorough planning or stopping in the event of uncertainty appear to have been implemented.

The AIBN made comparable findings in the investigation of the RIB accident in Olden in 2015 (see section 1.16.1).

Based on the above, the company's safety management system should be improved to enable it to contribute more to reducing the risk of accidents and better ensuring the safety of the passengers. The AIBN therefore submits a safety recommendation to the operating company to improve its safety management system.

3. CONCLUSION

3.1 The sequence of events

a) The fountains water jet and marking light were not active at the time of the accident, and this made it difficult to distinguish Selsbanes Seil from its surroundings.

b) The field of vision from the helm position was limited by the passengers seated at the front of the boat and possibly by the boat's own bow.

c) Neither the operating company nor the skipper had identified the fountain as a hazard prior to departure, and the skipper had not thought about the fountain at all during the final part of the trip.

d) The skipper did not ensure sufficient field of vision to the front and therefore failed to notice that he was on a collision course with Selsbanes Seil.

3.2 The tour operator's safety management

a) The trip had not been planned in detail, and the fountain had not been identified as a potential hazard. The tour operator had a procedure for planning the route in place, but the procedure was not adequately implemented.

b) The tour operator had no procedures for updating of nautical charts, and the electronic nautical charts on board the RIB had not been updated.

c) The tour operator had no procedure for regular maintenance of the life jackets, and several of them had serious defects.

d) The tour operator operated the boats without the necessary documentation.

e) The tour operator had no procedure or suitable equipment for using the VHF radio equipment while the boats were underway.

3.3 Approval of Selsbanes Seil and updating of nautical charts

a) Harstad Port Authority had not conducted a systematic risk assessment taking into consideration the small boat traffic in the area before approving the project.

b) Harstad municipality had not reported Selsbanes Seil to the Norwegian Notices to Mariners (Efs), despite the fact that this was a condition of its approval. The fountain was therefore not marked on nautical charts.

c) Inadequate reporting to the Efs is a general problem.

3.4 Regulatory framework and supervisory activities

a) During inspection of the company in 2015, the NMA did not uncover that the boat had no declaration of conformity or other documentation of compliance with design requirements. Nor was it uncovered that the company had no life jacket maintenance procedures.

b) The boat did most likely not meet requirements for field of vision from the helm position. It is produced and sold Ring Powercraft RIB 1050 with CE marking most likely without complying with this requirement.

c) The current competence requirements for drivers of small high-speed passenger boats do not focus on the skills required to operate safely at high speeds.

4. SAFETY RECOMMENDATIONS

The investigation of this accident has identified three areas in which the Accident Investigation Board Norway deems it necessary to propose safety recommendations for the purpose of improving safety at sea.[3]

Safety recommendation MARINE No 2018/01T

The Accident Investigation Board Norway's investigation of the accident involving Hugin on 16 February 2017 has shown that the operating company's safety management system was inadequate in some areas and that procedures had not been adequately implemented.

The Accident Investigation Board Norway recommends that B&B Touring review its safety management system, with focus on preparing and implementing safety procedures adapted to the company and its activities.

Safety recommendation MARINE No 2018/02T

The Accident Investigation Board Norway's investigation of the accident involving Hugin on 16 February 2017 has uncovered that the boat most likely did not meet the requirements for field of vision from the helm position. It is produced and sold several Ring Powercraft RIB 1050 with CE marking, both in Norway and in the rest of Europe, most likely without complying with the field of vision requirements.

The Accident Investigation Board Norway recommends that the Norwegian Maritime Authority inspect boats of the Ring Powercraft RIB 1050 type and take any necessary actions in relation to owners and dealers of such boats in Norway and initiate notification routines towards other European authorities.

Safety recommendation MARINE No 2018/03T

The Accident Investigation Board Norway's investigation of the accident involving Hugin on 16 February 2017 has shown that the current competence requirements for drivers of small high-speed passenger boats do not focus on the skills required to operate safely at high speeds.

The Accident Investigation Board Norway recommends that the Norwegian Maritime Authority to introduce distinctive competence requirements for driving high-speed boats with up to twelve passengers.

Accident Investigation Board Norway

[3] The investigation report is submitted to the Ministry of Trade, Industry and Fisheries, which has the overall responsibility for the follow up of safety recommendations..

Lillestrøm, 1 October 2018

DETAILS OF THE BOAT AND THE ACCIDENT

The boat	
Name	Hugin
Flag state	Norway
Class society	-
IMO Number/Call signal	-
Type	Rigid Inflatable boat (RIB)
Build year	2007
Owner	B&B Touring
Operator/Responsible for ISM	-
Construction material	Plastic strengthened by fibres of glass (GRP) and rubber
Length	10.5 metre
Gross tonnage	-
Safety crew	-
The voyage	
Port of departure	Port of Harstad
Port of arrival	Port of Harstad
Type of voyage	Inshore
Cargo	11 passengers
Persons on board	12
Information about the accident	
Date and time	16 February 2017 at 16:02:32
Type of accident	Impact/collision
Place/position where the accident occurred	Harstad
Place on board where the accident occurred	-
Injuries/deaths	Injuries to skipper and passengers
Damage to vessel/the environment	Hull and motor damage
Vessel operation	Sightseeing trip with paying passengers
At what point of the voyage was the boat	En route
Environmental conditions	Low cloud cover, occasional drizzling rain, light winds and small waves

ANNEXES

Annex A: Measurements of RIB Hugin

ANNEX A – MEASUREMENTS OF RIB HUGIN

The measurements were performed by AIBN on 6 December 2017 in Harstad Marina AS's premises.

1. Introduction

The boat was measured for the purpose of checking the field of vision from the helm position. The boat's profile, including the location of the deck and helm position, was established. In addition, (half) the widths to the gunwale were measured to examine the horizontal field of vision. The field of vision was also checked with persons located in the two front seat rows.

Hugin was placed on a trailer in a workshop building with a levelled concrete floor. Since the inflatable pontoon was punctured on the starboard side, it was most expedient to measure the port side. The boat's 'list' on the trailer was corrected using a level placed at the stern on a transverse part of the structure with a straight and in principle horizontal surface (parallel to the top of the stern). Corrections were made by adjusting the air pressure in the trailer tires. The workshop floor was used as a point of reference for vertical measurements.

2. Investigation of visibility in relation to regulatory requirements

L_H

The boat's L_H pursuant to ISO 8666 was measured to 10.54 metres. The length stated by the manufacturer is 10.50 metres.

Requirements for field of vision

EN ISO 11591:2000 Small craft, engine driven – Field of vision from helm position forms the basis for the requirements concerning field of vision from helm position. The standard stipulates requirements for the skipper both in a standing and a seated position. Only the field of vision for a standing skipper has been examined.

Some definitions and requirements for field of vision for craft with L_H 10-12 meters:

> 'Vertical range of vision' is the range between the lowest unobstructed line of vision from the 'low eye position' (1,480 mm above the deck surface at the helm position) and the highest unobstructed line of vision from the 'high eye position' (1,730 mm above the deck).
>
> The vertical range of vision is to be determined with the craft observed trim and waterline at cruising speed as defined in the standard.
>
> Throughout the vertical range of vision, the field of vision forward shall extend to at least 15° at either side of the line forward from the eye position to the obstructed vision distance to the water's surface (lowest unobstructed line of vision). The obstructed vision distance to the water's surface from the bow shall not exceed four times the L_H.
>
> The ISO-standard was revised in 2011, as such above mentioned requirements was made applicable for boats over 12 meters. For boats less than 12 meters the requirements for field of vision from helm position were met with 4° trim and with a point of intersection with the waterline $L_H/3$ from the bow.

Possible alternative interpretation of the requirements
In principle, the requirements are interpreted as described above. The standard specifies the front/highest point of the bow as a typical example of a 'point of visual obstruction' for the lowest line of vision. It also emerges from the standard that fixed obstructions can be accepted in the field of vision subject to certain conditions. Examples of fixed obstructions mentioned are instruments, deck hardware, horns, lights, and stanchions.

Parts of the hull are thus not listed as something that could be defined as a fixed obstruction. However, it may be natural to interpret a tall and narrow prow ('Viking ship') or a tall, narrow bow as a fixed obstruction if the boat has such a distinct design. Since Hugin has a relatively narrow bow, this investigation includes such an alternative interpretation.

Further details about obstructions in the field of vision
In the above-mentioned field of vision extending to at least 15° on either side (centre field of vision) fixed obstructions of the type mentioned above are permitted. They shall not obstruct vision so much that clear vision cannot be achieved by a movement of the head from the eye position not exceeding 35 mm in any horizontal direction. In addition, the total angle measured from the eye position subtended by fixed objects shall not exceed 8° and the objects shall not overlap when viewed from the eye position.

Conditions for calculations
Ring Powercraft has enlightened that the trim of the RIB does not exceed 2,3°, but has not specified the observed waterline. The AIBN base our calculations therefore on the above mentioned trim and a point of intersection with the waterline as observed during the reconstruction, i.e between the first and second row of seats.

3. Results

The line of sight from low eye position that hits water surface 4 x L_H = 42.16 metres in front of the bow meets starboard and port gunwale at an total angle formed by the 'obstruction bow' is 14° horizontal. It's impossible to achieve clear vision by moving the eye position 35 mm to either side.

Based on the new requirements in the ISO-standard from 2011 would the same angle amount to 20° horizontally.

4. Conclusion

Hugin does most likely not meet the requirements stipulated in the standard EN ISO 11591 Small craft, engine driven – Field of vision from helm position, even with a liberal interpretation of what constitutes fixed obstructions.