REPORT

ASSESSMENT OF THE DISPOSITIONS OF MRCC-TÓRSHAVN WITH RESPECT TO THE SAR OPERATION "JØKULFELL"

For

MINISTRY OF FISHERIES AND MARITIME AFFAIRS - THE FAROE ISLANDS

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Summary:
At 19:53 UTC on the 7th of February 2005 Tórshavn radio received an automatic distress signal (DSC) from the general cargo vessel Jøkulfell. The Maritime Rescue Coordination Centre (MRCC) in Tórshavn initiated a Search And Rescue (SAR) operation involving both helicopters and ships. After the accident the MRCC Tórshavn was criticised for not having sent a Faeroe Bell 412 SAR helicopter earlier than what was done instead of sending a Danish frigate holding a Lynx helicopter.

This investigation revealed that the disposition of the Danish frigate instead of the Bell 412 helicopter was not unreasonable. It could however have been reasonable to send one of the helicopters to the scene at an earlier stage. The later response was a result of several factors ranging from training and preparedness, inadequate communication and inadequate procedures.

The investigation revealed several areas of improvement. These include review and quality assurance of MRCC's operational procedures and agreements as well as more training of all parties involved in SAR operations. Both these aspects should have a focus on communication and responsibilities both internally at MRCC Tórshavn and with the SAR resources. The investigation also revealed that an extended Automatic Identification System (AIS) coverage could have made it easier to confirm the distress signal.

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EXECUTIVE SUMMARY

At 19:53 UTC on the 7th of February 2005 Tórshavn radio received an automatic distress signal (DSC) from the general cargo vessel Jøkulfell at position 63 00 N 004 56W. The Maritime Rescue Coordination Centre (MRCC) in Tórshavn tried immediately to get an overview of the situation and simultaneously initiated a SAR operation. Except from the DSC, there was never any contact with the vessel during the entire operation.

In the SAR operation MRCC Tórshavn chose to send a Danish frigate with a helicopter, a coastguard vessel and the closest fishing vessel towards the position. The Faroese SAR helicopter Bell 412 was held back on standby until the situation was clarified. The frigate's Lynx helicopter was asked to go airborne when an EPIRB signal was received. At 23:04 the helicopter had managed to save five survivors out of the sea. Later four bodies were located. Today there are still two crewmembers missing from Jøkulfell. It took about 2.5 hours from the distress signal was received until the first helicopter was on the scene. After the accident the MRCC Tórshavn was criticised for not having sent the SAR helicopter earlier.

This investigation revealed that the disposition of the Danish frigate instead of the Bell 412 helicopter was not unreasonable. It could however have been reasonable to send one of the helicopters to the scene at an earlier stage, approximately 20:25. If this had been done, a helicopter would have been at the scene approximately 40 minutes earlier. The late arrival of SAR resources can however not be assigned to this inadequate decision alone. In an ideal SAR operation where both decision making and SAR operation went reasonable smooth, a helicopter would have been on the distress position about one hour and 20 minutes earlier than what was experienced.

The later response was therefore a result of several factors ranging from training and preparedness, inadequate communication and inadequate procedures. Many of these factors could have been mitigated if Ministry of Fisheries and Maritime Affairs (MFMA) had a closer interaction with MRCC Tórshavn.

The investigation revealed several areas of improvement. These include review and quality assurance of MRCC's operational procedures and agreements and more training of all parties involved in SAR operations. Both these aspects should have a focus on communication and responsibilities both internally at MRCC Tórshavn and with the SAR resources. The investigation also revealed that an extended Automatic Identification System (AIS) coverage could have made it easier to confirm the distress signal.

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1 INTRODUCTION

1.1 Background

On the 7th of February 2005 at 19:53, Tórshavn Radio received a Digital selective call (DSC) from cargo vessel M/V Jøkulfell with 11 people onboard. An inspection vessel was immediately sent to the distress position, and she arrived on scene approximately 3.5 hours later. Around the same time there were several other resources arriving, i.e. a Danish navy inspection vessel, a Russian fishing vessel and a Search and Rescue (SAR) helicopter that was sent out from the Faroe Islands. One hour before that, a Danish Navy helicopter had arrived on scene and observed that the vessel was capsized and people were floating in the sea. The helicopter airlifted 5 survivals from the water. The Jøkulfell sunk shortly afterwards. 4 bodies were later recovered, and two people are still missing.

The SAR operation "Jøkulfell" was under the command of the Maritime Rescue Coordination Centre (MRCC) in Tórshavn. In order to bring clarity to this particular situation, Det Norske Veritas (DNV) was asked by The Ministry of Fisheries and Maritime affairs (MFMA) to undertake a third party assessment focusing on the dispositions of MRCC Tórshavn with respect to the SAR operation and to identify possible areas of improvement.

1.2 Det Norske Veritas

DNV is a leading, independent provider of services for managing risk with a global presence and a network of 300 offices in 100 different countries – and totaling 6000 employees.

DNV assists its customers in managing risk by providing three categories of service: classification, certification and consultancy. Since establishment as an independent foundation in 1864, DNV has grown into one of the world's leading classification societies, and has become an internationally recognized provider of technical and managerial consultancy services to industry.

Maritime Solutions, started in 2002, is the highly specialized maritime consulting branch covering a range of services "*From the boardroom to the Engine room"*. Today, 60 consultants operate out of six offices – Oslo, Bergen, London, New York, Miami and Singapore.

For further information, see;

(http://www.dnv.com/maritime/maritimeconsulting/index.asp)

1.3 Objective

The objective of the project shall be to:

- Assess the dispositions of MRCC-Tórshavn with respect to the SAR operation "Jøkulfell", with focus on why the SAR helicopter Bell 412 was not sent to the scene of accident before 2.5 hours after the initial distress call.
- Evaluate possible actions to be taken in order to assure a rapid and accurate response in future SAR operations.

1.4 Scope & description

The project was divided into 3 main phases; pre-structuring and information gathering, analyze data and information (phase 2) and evaluation and reporting (Phase 3)

1.4.1 Phase 1: "Pre-structuring and info gathering"

The pre-structuring and information gathering included the work of reading background information, available logs documenting the scenario and a visit at MRCC Tórshavn. During this visit key persons involved in the scenario were interviewed and records of all telephone conversations to and from MRCC Tórshavn were considered. In order to get familiarized with the incident, understand the background for the assessment and prepare the visit, the following activities were performed:

Activities - Phase 1

- Received all relevant info by mail
  - Logs, tape recordings, minutes of debrief etc.
- Familiarized with incident and prepared visit
  - Processed received information to familiarize with incident
  - Identified persons to be interviewed and scheduled interviews
  - Finalized plan for visit
- Visit to Tórshavn
  - Conducted interviews and gathered relevant data

1.4.2 Phase 2: "Analyze data & information"

Based on the information gathering and the interviews, a step-analysis was conducted in order to understand the chain of events and reveal possible misconduct. These activities were performed:

Activities - Phase 2

- Step analysis, set up what happened the 4 first hours after the distress signal had been received:
  - Step analysis
  - Conducted follow up interviews by phone
- Assess the SAR dispositions of MRCC following the distress call
  - The assessment looked at:
    - relevant SAR guidelines
    - good SAR practices
  - Identify improvement areas
  - Evaluated if actions suggested after the debrief on the 10th of February are sufficient
  - Suggest additional improvement areas

1.4.3 Phase 3: "Evaluation and reporting"

In this phase an evaluation of all information gathered and the analysis was performed. The findings were summarized and made presentable. The following activities were included:

Activities – Phase 3

- Evaluate and summarize findings
- Verification and Quality assurance
- Write report and presentation
  - Chain of event
  - Assessment of disposition
  - Improvement areas

1.5 Sources of information

The information used in this reports originates from several sources. The main sources are listed in chapter 7. A short overview is presented in Table 1. In addition the project has utilized internal competencies and telephone conversations with other sources of knowledge.

Table 1: Overview of main information sources.

Logs from various SAR resources
Interviews
Tape recordings

1.6 Terminology and abbreviation

The following abbreviations have been used:

AA	Atlantic Airways
AIS	Automatic Identification System
CoD	Captain on Duty
DSC	Digital Selective Calling
EPIRB	Emergency Position Indication Radio Beacon
FI	Fisheries Inspection
FRK	Færøernes Kommando
JRCC	Joint Rescue Coordination Centre
LCM	Loss Causation Model
MFMA	Ministry of Fisheries and Maritime Affairs
MRCC	Maritime Rescue Coordination Center
POB	Persons On Board
SAR	Search and Rescue
STEP	Sequential Timed-Event Plotting
S N E W	South North East West
UTC	Universal Time Coordinated

2 BACKGROUND INFORMATION

2.1 Jøkulfell

Jøkulfell (Figure 1) was launched in Denmark in 1989 and previously named the *Nordland Saga*. It was manned by an 11-man crew. The liner was 87 metres long, had a cruising speed of 13.8 knots, and could carry up to 3,000 tonnes or 140 containers. At the time of the accident the ship was classed by Bureau Veritas (was classed by DNV until May 2003) and registered in Isle of Man.

Figure 1: Picture of Jøkulfell

Note that the information about and evaluation of ship characteristics, technical condition, classification society, flag state etc. is not part of scope in this project.

2.2 Weather and sea state

Information about weather condition and sea states for relevant areas of the SAR operation is presented in the table 2.

Table 2: Various weather information relevant for the SAR operation

Time	Wind	Wave height	Visibility	Temp	Pressure	Location
20:17	SSW 20 m/s					Vagar
21:32	SSW 13 m/s	6 m	Clear			North of Fugløy
23:10	SSW 15 m/s	Rough sea	Clear			On scene
00:01	SSW 19 m/s	4 m	1-2 nm	+7C	994 hPa	On scene
02:07	SSW 19 m/s	5 m	10-30 nm	+6C	995 hPa	On scene
05:27	SSW 19 m/s	5-6 m	10-30 nm	+7C	995 hpa	On scene
07:15	SSW 16 m/s	5 m	10-30 nm	+6C	994 hPa	On scene

2.3 MRCC Tórshavn

MRCC Tórshavn was established 1st April 2002 by the MFMA. Prior to this date the Danish Navy operated the Faroese rescue centre. The MRCC Tórshavn has the SAR responsibility for SAR operations in a sea area of 275,000 km^2 illustrated in figure 2.

MRCC Tórshavn has at all times at least two personnel on watch. During evenings and nights one of these is on call duty. All of the current personnel have been employed by MRCC Tórshavn from the start in 2002.

MRCC Tórshavn has about one SAR operation each week. These include Emergency Position Indication Radio Beacon (EPIRB) signals, transportation of ill or injured people etc. DSC's are very seldom received, approximately 1-2 times per year.

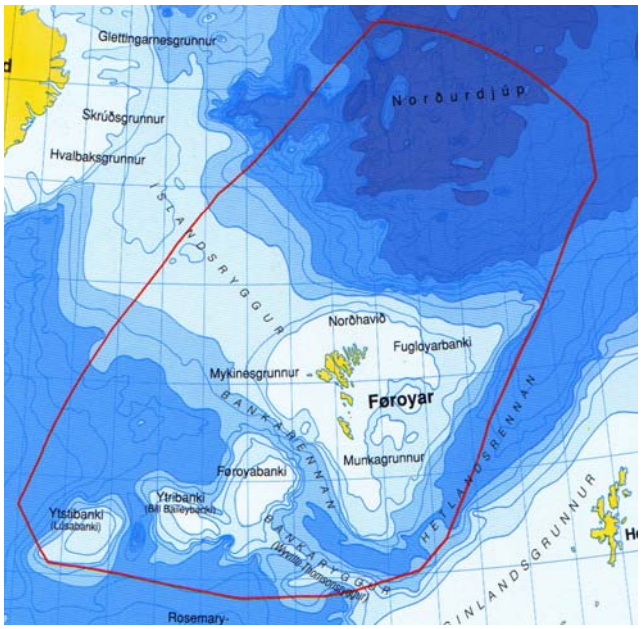


Figure 2: MRCC Tórshavn SAR area

Figure 3: MRCC Tórshavn

2.4 Tórshavn Radio

Tórshavn Radio was made a part of MRCC Tórshavn in March 2004. They have six ship radio antennas located various places on the Faroe Islands (Figure 4). When the MRCC took over Tórshavn radio the wall between them and MRCC Tórshavn was removed (Figure 5), making the cooperation between the radio station and MRCC easier.

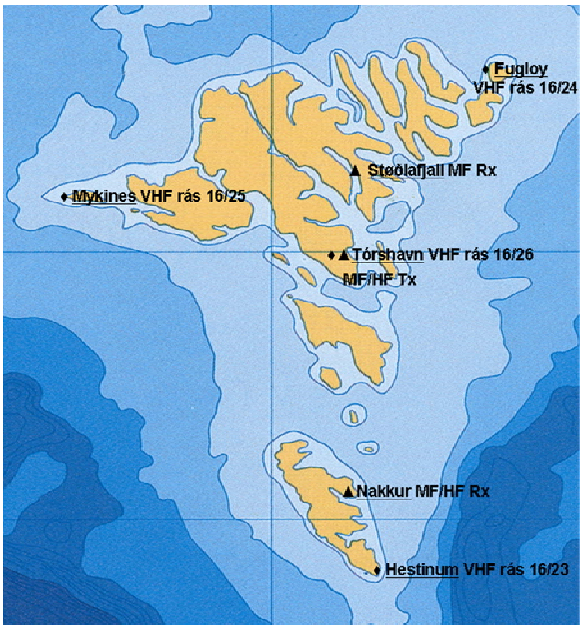


Figure 4: Tórshavn radio's antennas

Figure 5: Tórshavn radio behind entrance from MRCC Tórshavn

2.5 Available resources

MRCC Tórshavn has some dedicated resources that they use in SAR operations. The main SAR resources are:

- Fisheries Inspection (FI) vessel Brimil
- Fisheries Inspection (FI) vessel Tjaldrið
- Fully SAR equipped helicopter Textron Bell 412EP (Atlantic Airways)
- Partly SAR equipped helicopter Textron Bell 212 (Atlantic Airways)

In addition the Danish navy has a Thetis class frigate stationed around Faeroe Islands about 10 out of 12 months. MRCC has an agreement with Færøernes Kommando (FRK) covering the use of their resources in SAR operations. The Thetis class frigates have a Lynx helicopter onboard. The capacities of the resources are presented in Appendix 1.

3 CHAIN OF EVENTS

The chain of events is illustrated in a diagram developed through a technique called Sequential Timed-Event Plotting (STEP). In this diagram the participating actors are listed vertically to the left in the diagram and the time axis is presented horizontally. All relevant events are then plotted to the right side of the relevant actor and the correct point in time. The actors, events and point in time are collected from information sources A to I. The STEP-diagram with the relevant events in an abbreviated form is presented in Appendix 2. Together with the diagram there is also a table describing the same events more in detail.

In order to identify areas of improvement, this chapter summarise the STEP diagrams in addition to an assessment of the findings with respect to the DNV Loss Causation Model (LCM). The LCM (Figure 6) implies that behind any losses there is an incident. Behind any incident there are some immediate causes that could have been observed at the scene of events. Then the model illustrates that we need to ask why the immediate causes occurred in order to identify the basic causes. When the basic causes are identified it is possible to state what kind of control that was lacking; either if it was a lacking system, a deficient procedure or a violation of the procedures. When the lack of control is described efficient management control measures can be identified. It is unknown if aspects of the SAR operation had any impact on the losses in terms of human lives.

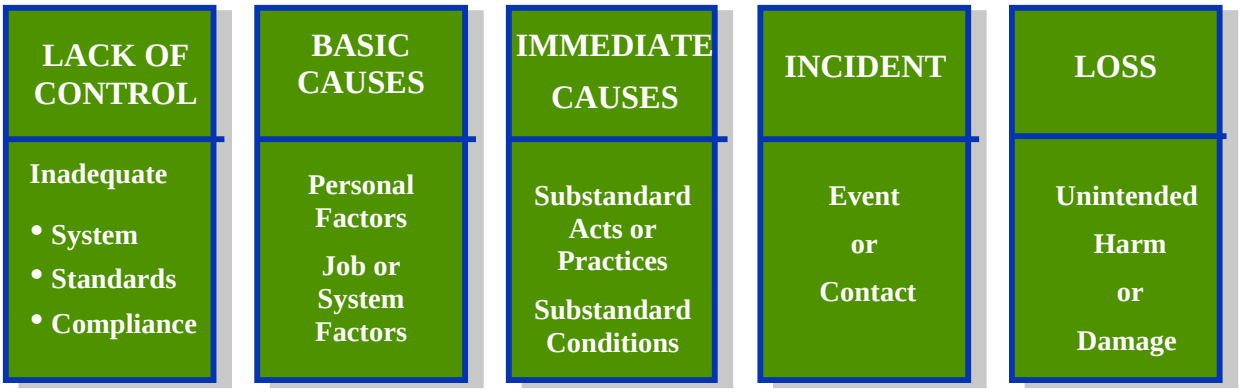


Figure 6: The DNV Loss Causation Model

3.1 What happened

At 19:53 UTC on the 7th of February 2005 Tórshavn radio received an automatic distress signal (DSC) from the general cargo ship Jøkulfell at position 63 00 N 004 56W. MRCC Tórshavn tried immediately to get an overview of the situation and simultaneously initiated a SAR operation. Except from the DSC, there was never any contact with the vessel during the entire operation.

MRCC Tórshavn ordered the inspection vessel, Brimil, and later the Danish frigate Vædderen, equipped with a Lynx helicopter to the position. At 21:08 UTC an EPIRB signal from Jøkulfell was received. Then MRCC Tórshavn and the commanding officers on the frigate agreed to send

the Lynx helicopter. At 23:04 the Lynx helicopter had managed to save five survivors out of the sea and did not observe any remaining survivors at the scene. The ship was however observed sinking in a capsized condition.

The following day four bodies were picked up from the water; all had a survival suit on. However, all suits were not completely zipped up and some of the bodies had serious injuries. Today there are still two crewmembers missing from Jøkulfell. It took about 2.5 hours from the distress signal was received until the first helicopter was on the scene. After the accident the MRCC Tórshavn was criticised for not having sent a helicopter earlier.

The whole scenario (outlined in more detail in Appendix 2) can be grouped into four phases (Figure 7). The first phase is characterised by the uncertainty related to the distress signal. Even though MRCC Tórshavn took the distress signal seriously, the scarce information about the situation imposed uncertainties to the decision making. The ship was unreachable on both radio and satellite telephone. When the EPIRB signal was received MRCC got a confirmation that the distress was real (phase 2). The severity of the situation was however not known. When the Danish navy Lynx helicopter arrived at the scene it was acknowledged that the situation was extremely severe (phase 3). For about one hour, the two helicopters were the only SAR resources at the scene. At about midnight three vessels arrived at the scene (Phase 4). The following day, an extensive search of the area was done both from ships, planes and helicopters.

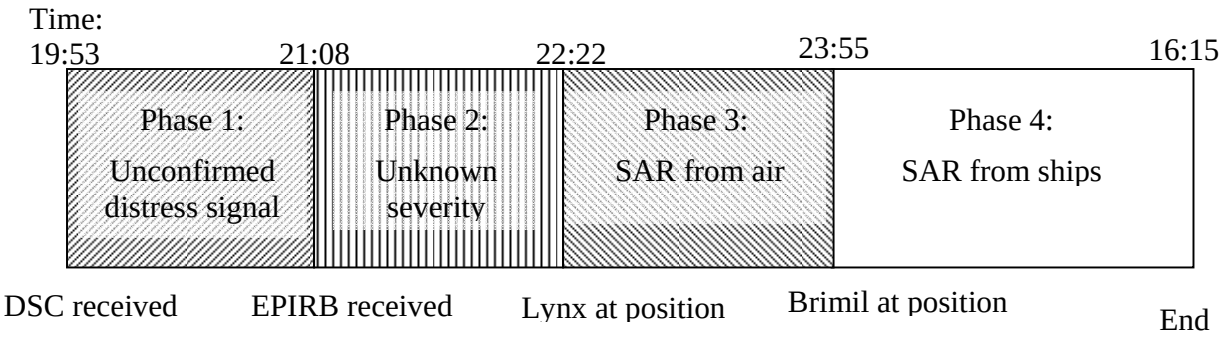


Figure 7: Outline of the main phases of the SAR operation

This report is focusing on the two first phases since they are the most important when it comes to the dispositions and decisions made. Phase 4 is outside the scope of the project. Therefore, the STEP diagram covers the events until the Bell 412 helicopter arrives at the scene in phase 3.

3.2 Circumstances

The distress position was about 50 nm NE of Faroe Islands (Figure 8). The few DSCs that have earlier been received at MRCC Tórshavn have been false. At the time of the incident there were no vessels close to the position, but both the coastguard vessel Brimil and the Danish Frigate, Vædderen, were in fortunate positions off the north coast having three to four hours sailing distance to the position. There was also a SAR helicopter (Bell 412) stationed at Vagar airport which was alerted 20:06 and asked to go 22:27. During the SAR operation the wind built up from strong breeze to gale. The weather conditions made takeoff, landing and rescue difficult for

the helicopters involved. From the time the helicopter were asked to go until they were airborne, it took respectively 45 minutes for the Lynx and 12 minutes for the Bell 412 which had better time to bunker etc. prior to this order.

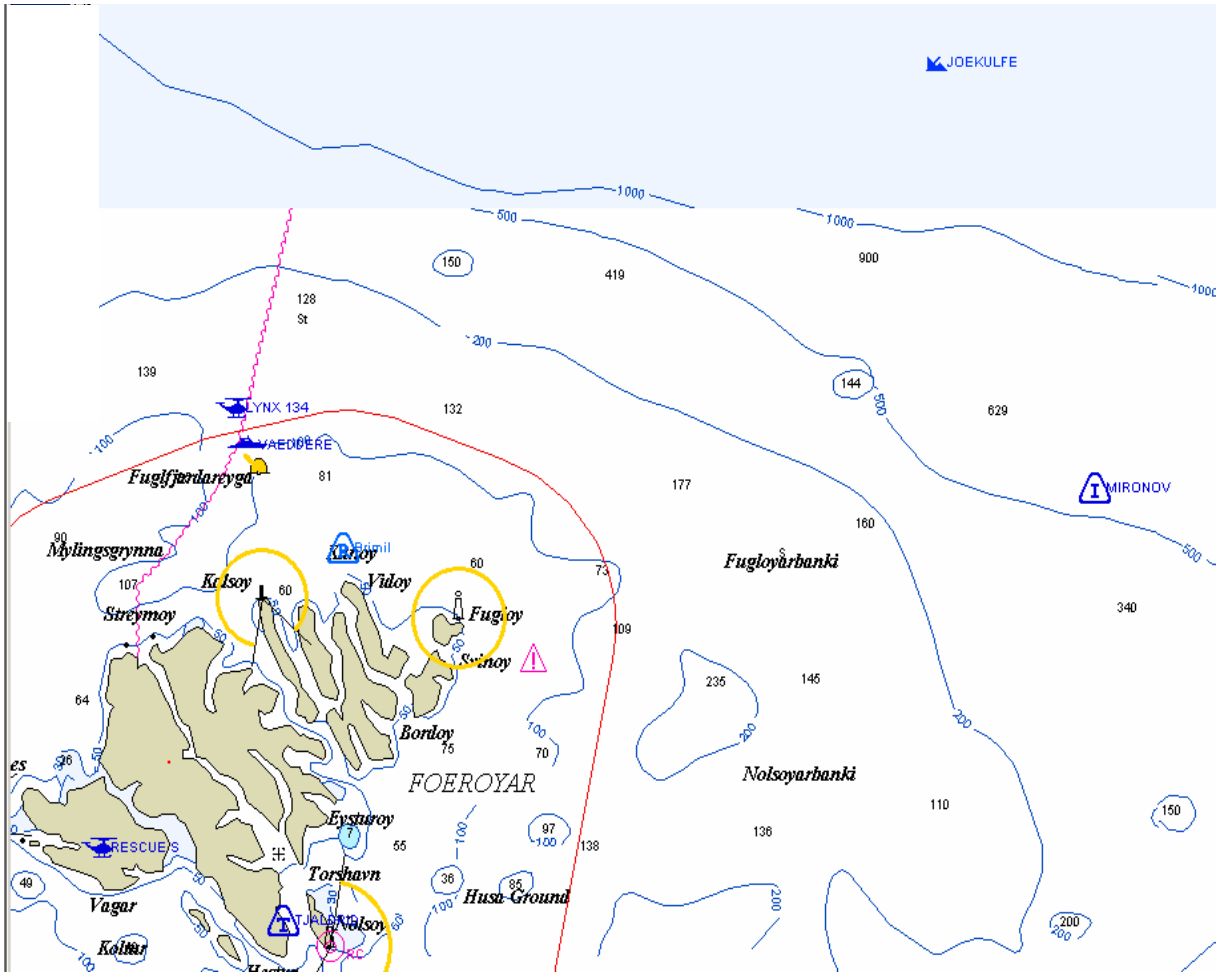


Figure 8: Overview of position of Jøkulfell, Brimil, Vædderen, and Tjaldrið

3.3 Incident and Loss

The incident in this investigation is the late arrival of SAR resources at the distress position (Figure 9). In general an incident may directly cause four main types of losses. These are losses to personnel, property, process and environment. In addition, an incident may have secondary losses like loss of confidence and reputation (Figure 9). The late arrival of SAR resources at the distress position is a special incident in the sense that it is unknown if this had any effects upon the four main loss categories. However, there is no doubt that the perceived late arrival of SAR resources represents a loss in public confidence and damage to the reputation of MRCC Tórshavn.

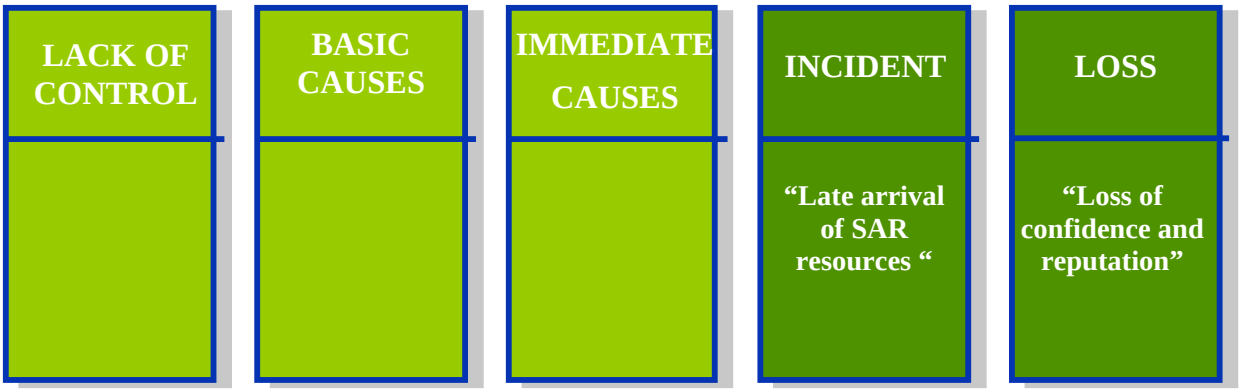


Figure 9: The LCM for Incident and Loss

3.4 Immediate causes

The immediate causes can be identified by asking why the SAR resources arrived late at the distress position (Figure 10). The immediate causes are typically observable acts and conditions. The term immediate causes is used as they imply that there is another set of causes that are of a more latent and unobservable nature. These are called basic causes and they are assessed in the next chapter. The main immediate cause of the late arrival of SAR resources is related to the decision making at MRCC Tórshavn. Other immediate causes will be pinpointed in chapter 4.

The decisions of what resources to use and when to use them were based on three parameters: The information about of the distress situation, available resources for the SAR operation and considerations of the remaining SAR capacity at the Faeroe Islands. The information about the distress situation in phase 1 was as follows:

1. The DSC containing name of ship and position
2. The knowledge that the ship did not respond to any calls on MF or satellite telephone
3. The confirmation from the charterer that Jøkulfell was on its route from Liepaja (Latvia) to Reydarfjørdy (Iceland) and therefore was assumed to be in the area of the received distress position.
4. The knowledge of the SAR resources was that no ships would be at the scene before midnight

Additional available information was that the antenna located at Fugløy was blocked on VHF channel 16 until 20:31. This may indicate that a VHF transmitter may have been active in this area NE of Faeroe Islands. It can not be out ruled that the VHF transmission was from Jøkulfell. Further, if the signal was from another vessel the disturbance would have interrupted a VHF mayday from Jøkulfell via VHF.

Regarding the available resources, Vædderen was considered to be an advanced SAR resource having special trained crew, a rescue boat, a helicopter and medical personnel. Regarding the available helicopters it was believed that the Lynx flies faster than the Bell 412, but that the Bell

412 has larger capacity to carry survivors. The Bell 412 has also an autohover installed, making it easier to lock the position of the helicopter over the survivors in the sea. In the north of Europe it is common for SAR helicopters to rescue survivors out of the sea by lowering a rescue man into the sea. The Bell 412 planned however to use a rescue basket to rescue potential survivors out of the sea. In sum it is difficult to judge which of the helicopters that were most suited in this situation.

If the Bell 412 was sent to the position, an older Bell 212 helicopter (only partly SAR equipped) would have been left to handle transportation to and from incidents at the Faeroe Islands.

Looking at the basis for the decisions that was made regarding the dispositions, it can be concluded that the view on the four listed parameters influencing the decisions changed during the operation. During the first phase (figure 7), it was the lack of confirmation of the distress signal and the attributes of the frigate that influenced the decision. The leader of MRCC felt more information was needed before they could send all resources. It was decided to send Vædderen, because it is an advance SAR resource (see above).

When the message about the EPIRB was received it was considered as the confirmation they had been waiting for. The decision at this stage was to send the Lynx helicopter because it was closer, faster and can land on Vædderen if needed. It was also decided to send only one helicopter at this stage because of considerations regarding the remaining SAR capacity on the Faroe Islands. It was first after the Lynx helicopter had arrived on the scene that the seriousness of the situation was clarified. Based on this knowledge the Bell 412 was then sent.

Figure 10: The LCM for Immediate Causes

3.5 Basic causes

There were at least four basic causes that influenced the decision making at MRCC Tórshavn the evening 7th February. These are described in more detail and presented in Figure 11.

3.5.1 Less than adequate training

MRCC Tórshavn was taken over by the MFMA from the Danish Navy in 2002. After the takeover several important steps were taken to further develop MRCC Tórshavn, which today is recognised as a quality MRCC station. For example, it was conducted initial training of the

personnel constituting of some days hosting at foreign MRCC stations. However, their statistics shows that they have a relatively low intensity of incidents compared to stations like Norway's JRCC Sola and JRCC Bodø. As the frequency of incidents happening in MRCC Tórshavn's area is lower, this should require a higher training intensity in order to reach the same level of preparedness. The investigation revealed that there is a lack of training and drill experience in SAR operation and leadership at MRCC Tórshavn. Hence, MRCC Tórshavn had never experienced a DSC of the kind received 7th February 2005.

3.5.2 Less than adequate operational procedures and practices

Under the start-up process in 2002 only the leader of the MRCC station was in a position to send SAR resources. When the station was up and running this procedure was not changed. Over time, however, the personnel got a closer relationship with the coastguard vessels Brimil and Tjaldrið as they also are organised under the MFMA. Consequently, a practice occurred that the personnel on duty sent the coastguard vessels themselves, even though they had to violate the procedures. The MFMA has an agreement with Atlantic Air (AA) to use the Bell 412 for 170 hours a year. However, the MRCC has not the same close relationship to AA and experience by using them. In sum both the procedures and the practice constituted an extra barrier for MRCC to send the Bell 412 compared to the coast guard vessels.

Another aspect is the updating of the operating procedures. There exists a manual containing all of MRCC Tórshavn's operational procedures, but these have seldom or never been updated, and are according to the MRCC employees difficult to follow /H/.

3.5.3 Less than adequate communication

Another basic cause is the communication between different parties. Firstly, in the agreement between AA and MFMA it is stated that the helicopter is to be ready in one hour. The logs and interviews reveal however that there is confusion about what the term "ready" implies. AA responded that the helicopter was "ready" 20:17. At that time the Bell 412 was not fully manned, not fully bunkered and still located inside the hangar. This was a source of confusion for MRCC Tórshavn. The communication weaknesses between AA and MRCC Tórshavn and AA's actions during the situation raise a reason to question the alertness of the Bell 412.

Another area of communication problems has been identified between the MRCC Tórshavn and Tórshavn Radio. Even though significant measures have been taken to improve the communication situation, the information that VHF channel 16 was blocked at Fugløy was neither logged by MRCC nor recorded in any telephone calls. Logs and tape recordings indicate that this information was never communicated to the leader of the SAR operation. Given the scarce availability of information, this fact could have been relevant for the decision making as it is a potential indication that something is seriously wrong.

A third area of communication failure was the delayed notification of the air traffic controller at Vagar. In principle the Bell 412 could have been airborne without the support from the air traffic controller, but in practice there is a general wish that he is on post. The missing notification of the air traffic controller was revealed through a telephone conversation with the CoD for the Bell 412 approximately 21:10. The notification was given immediately. However, the normal

operating practice is to give this notification approximately one hour earlier. The air traffic controller was in the tower 21:23.

A fourth area of less than adequate communication can be seen in the notification of the Danish frigate Vædderen. In this communication several aspects failed. This advanced SAR resource seems to have missed the "Mayday Relay" message sent from Tórshavn Radio 20:18 on medium frequency 2148kHz. Vædderen was first aware of the situation at 20:30. Given its position and sailing speed, this advanced SAR resource should have been asked to go to the distress position at the same time as Brimil was alerted 19:57. There was also a communication weakness regarding the orders of when to send and prepare the Lynx. This is discussed in more detail in chapter 3.5.4.

3.5.4 Unclear responsibilities

A fourth area of unclear responsibility and communication was between MRCC Tórshavn and the naval frigate Vædderen. In principle the frigate could on its own initiative have sailed towards the distress position and contact MRCC Tórshavn at an earlier stage. The decision to send the Lynx could both be taken by the commanding naval personnel and by MRCC Tórshavn. In the given scenario the personnel onboard Vædderen had more experience with the use of helicopters in such situations compared to MRCC Tórshavn, and also had the power to send the helicopter independently of MRCC's requests. The dual responsibility roles and the bias in experience may both have affected the fact that Vædderen did not instantly sail towards the distress position and the fact that the Lynx was not sent before the EPIRB signal was received.

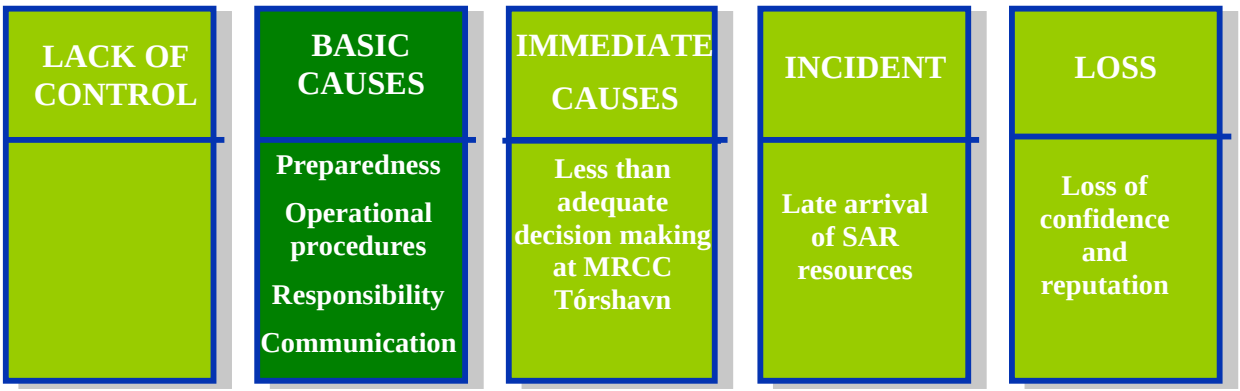


Figure 11: The LCM for Basic Causes

3.6 Lack of control

The LCM indicates that behind a basic cause there is a missing standard, an inadequate procedure or lacking compliance to the procedures. Most of the identified basic causes could have been identified and controlled in advance, if MFMA had implemented systems to assure a high quality of MRCC Tórshavn. There exists no formal system that assures that the competence of the MRCC personnel is adequate. There are neither implemented systems to assure adequate communication, nor systems that maintain clear levels of responsibility. Further, there exists no overall quality assurance system for MRCC Tórshavn (Figure 12).

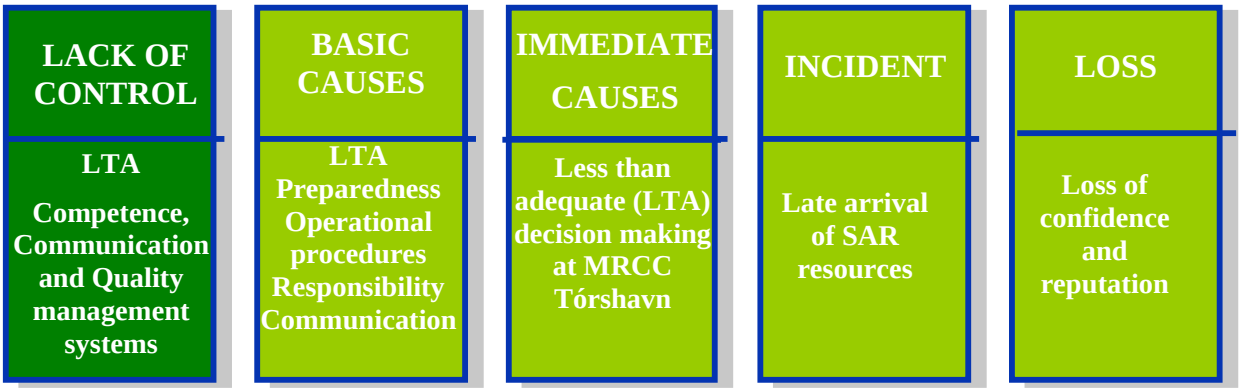


Figure 12: The LCM for Lack of Control

3.7 Uncertainties

In this report the received data has been at a satisfactory level. Written logs from all main actors have been reviewed, relevant telephone calls to and from MRCC Tórshavn have been reviewed, relevant faxes have been copied and the main parties have been interviewed. The chain of event contains no statement that is not confirmed by at least two sources of information for all essential events. It should also be stressed that little, if any, relevant information has been left out of the report due to lacking confirmation from two sources.

4 ALTERNATIVE POTENTIAL SAR SCENARIOS

This chapter outlines two alternative potential scenarios for the SAR operation for Jøkulfell the 7th February 2005. The first of these two scenarios outlines the effects of making an earlier decision to send SAR helicopter to the distress position holding all other aspects of the SAR operation constant. The second alternative potential scenario is more of an ideal character where not only the decision making is improved but also the performance of all other aspects of the SAR operation is improved. The gap between the two alternative potential scenarios and the actual scenario (Figure 7) give input to the understanding of what areas to improve. These areas are further described in chapter 5.

4.1 Earlier decision to send a helicopter to the distress position

This alternative potential scenario outlines the effects of an earlier decision to send SAR helicopters. In this scenario MRCC Tórshavn use only five minutes of decision making after the confirmation of Jøkulfell's position from the charterer 20:20. This is assessed by DNV to be a reasonable point in time to send a helicopter and this is indirectly confirmed by the practice of other rescue centres.

If the Bell 412 had been given a "go" 20:25 it is likely that it still would have needed roughly 35 minutes before being airborne. The estimate of 35 minutes is based on the fact that they were told to be relaxed and check the weather, instead of being given a clear order which is the case in the ideal scenario. This means that in this analysis, the Bell 412 would be airborne 21:00 and on the scene 21:45.

Alternatively the Lynx would be airborne 21:10 and arriving at the scene approximately around 21:45. In both cases the decision would have resulted in at least one helicopter at the distress position at 21:45, approximately 40 minutes earlier than what was experienced on the 7th February (see Figure 13).

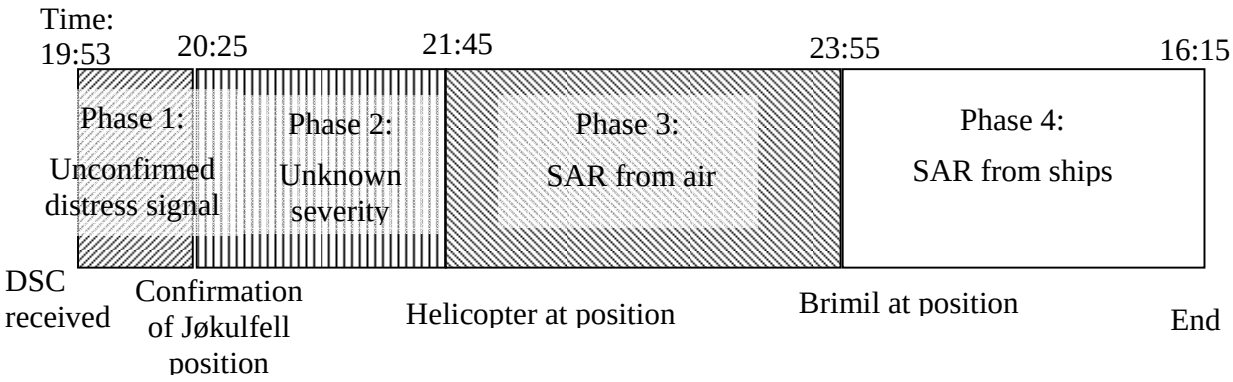


Figure 13: Outline of the main phases of a potential SAR operation based on an earlier decision

4.2 Ideal SAR operation

The other alternative potential scenarios outline the effects of an ideal use of the given SAR resources. The term "ideal" is not used in the sense that it is unachievable, but rather that all decisions and operations are carried through as smoothly as reasonable practicable (Appendix 3a). It can not always be expected that the Danish Frigate is in such a favourable position as it was on the 7th of February. Therefore an ideal SAR operation with the use of the Bell 412 is also outlined (Appendix 3b).

In an ideal scenario it is assessed that it should be possible to get the confirmation that Jøkulfell was on its route in the area of the distress position at around 20:15 (at the latest) and that either one or both of the helicopters would be given a "go" at that time. In these cases the Lynx would be airborne approximately 20:35 and the Bell 412 would be airborne 20:30. The Lynx would be at the distress position approximately 21:05 and the Bell 412 at the distress position 21:15 (Figure 14).

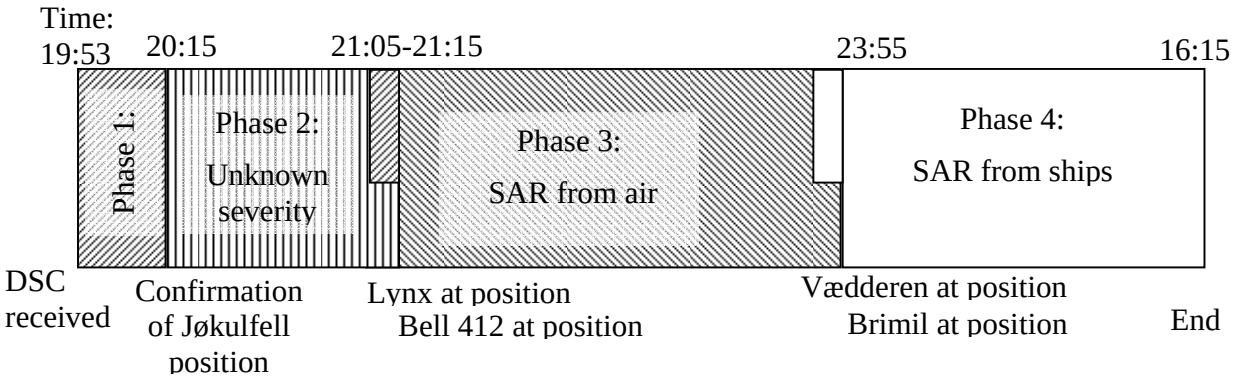


Figure 14: Outline of the main phases of an ideal SAR operation.

5 IMPROVEMENT AREAS

If you compare the times in figure 7 with figure 13 or figure 14, you find several areas of improvement. In the following text four areas of improvement are listed. These areas are described with reference to specific improvement measures with reference to the late arrival of SAR resources at distress position the 7th February 2005. However, it should be stressed that the main finding is that there are no adequate systems in place that assures a continuous control and improvement of the quality of MRCC Tórshavn.

5.1 Procedures and guidelines

There exist evident needs for new and improved procedures and guidelines at MRCC Tórshavn, which is not uncommon for a young organization. Many procedures are not as clear as they should be and they leave a potential room for misunderstandings, which contributes to that it potentially takes a longer time before decisions can be made. This report does not include a thorough analysis of the existing procedures, but during the investigation the following areas has shown that they have improvement potential:

- **Map over Resources** – There should exist a clear and updated map of all the available resources and what they can and cannot be used for. This includes maximum POB, different types of equipment, speed, operating times etc. The personnel at MRCC Tórshavn (as well as AA, FRK and FI) should all be aware of each others capacities.

- **SAR manual (overall)** – The SAR manual is in a general need of improvement. This is especially true since MRCC has expressed wishes to be ISO certified.

- **SAR Plan (Distress / Mayday procedure)** – The SAR plan is in need of improvement. The plan should include elements such as “Step-by-step”-guideline, time frames and a guide to which resources that can be used in different situations. It should be perfectly clear for everyone what to do when an emergency happens.

- **Change of watch during emergency situations** – There should be a procedure for how the change of watch should work if the change happens during an emergency situation.

- **Communication with external parties** – There should be established a common “language” between MRCC and external parties such as Atlantic airways, FRK and FI. The “language” can be clearly defined with for example different levels of alert (green, yellow and red) and defined wording for each level.

- **Meetings** – There should be established regular internal meetings (monthly, weekly etc.) with a defined agenda where all people employed at MRCC Tórshavn should be able to bring up thoughts and ideas. They should also be informed about current news, future technologies, special situations, etc. There should also be established a procedure for “accident review” (experience sharing) meetings. (Note: MRCC Tórshavn has already taken some measures when it comes to meetings).

5.2 Organization and responsibilities

Most of the organization and responsibilities during rescue operations at the Faroe Islands today are perceived as clear to those involved, but there are some areas that need to be better defined.

For example should the cooperation between Atlantic airways, FRK, MRCC, FI and Tórshavn radio be reviewed (more of this in chapter 5.4). It is essential that everybody knows who does what and when.

Another area where improvement is needed concerns the decision authority at MRCC. The procedures states that the leader of MRCC has responsibility over and is the only one allowed to make most of the urgent and difficult decisions (for example which resources to send, whom to call in, etc.). This could potentially lead to that it takes longer time before crucial decisions can be made.

5.3 Training and exercises

Today, there seem to be some good exercises held each year. However, it is recommended to conduct joined (MRCC, FRK, FI and AA) night training and joined rescue from the sea training with both rescue basket and rescue man.

In order to increase understanding and improve relationships we also recommend joined teambuilding events including all parties involved.

5.4 Agreements

The agreement between Atlantic airways and MRCC is in an urgent need of improvement. The persons revising the agreement should look into changes to common language (see chapter 5.1), use of time, use of money, time before helicopter can be airborne and ownership. Today, the cooperation between the two parties is not working as it should.

The agreement between MRCC and FRK could also be looked at and discussed. However, a lot of improvement can also be achieved through regular meetings and communication between the parties.

The cooperation between MRCC and FI seems to be working well. There should however, in the future, also be written an agreement between these two parties as well, in order to avoid potential future misunderstandings.

5.5 Technical improvements

An Automatic Identification System (AIS) is a good way to keep the vessels in an area under control and a good way to get information faster. The AIS development should be continued.

6 CONCLUSION

The investigation revealed that the disposition of the Thesis class frigate instead of the Bell 412 helicopter was not unreasonable. It could however have been reasonable to send one of the helicopters to the scene at an earlier stage, approximately 20:25. If this had been done, a helicopter would have been at the scene approximately 40 minutes earlier than experienced. In

an ideal SAR operation where all resources involved are used effectively and the execution is going smoothly, the Lynx helicopter could have been at the distress position approximately 21:05. The Bell 412's corresponding arrival at the distress position would be 21:15. Hence, in an ideal SAR operation the helicopter would have been at the position approximately one hour and twenty minutes earlier than experienced.

The later response was not due to one single cause alone, but a result of several factors ranging from training and preparedness, inadequate communication and inadequate procedures. Many of these factors could have been mitigated if MFMA had a closer interaction with MRCC Tórshavn.

The investigation revealed several areas of improvement. These include review and quality assurance of MRCC's operational procedures and agreements, and more training of all parties participating in SAR operations. Both these aspects should have a focus on communication and responsibilities both internally in MRCC Tórshavn and with the SAR resources. The investigation also revealed that an extended Automatic Identification System (AIS) coverage could have made it easier to confirm the distress signal.

7 REFERENCES

/A/ Færøernes Kommando. Report of Jøkulfell operation by Danish navy inspection vessel M/S Vædderen, including appendices (15.02.2005).

/B/ Færøernes Kommando. Minutes of meeting from debriefing of Jøkulfell SAR operation (10.02.2005).

/C/ Atlantic Airways. Flight plan for SAR helicopter Bell 412, February 7th 2005 and February 8th 2005.

/D/ MRCC Tórshavn. Log book, 19:56 February 7th 2005 to 23:56 February 8th 2005. This also includes listening to recordings of telephone calls.

/E/ Inspection vessel Brimil. Log book, February 7th 2005 to February 8th 2005.

/F/ Inspection vessel Tjaldrið. Log book, February 7th 2005 to February 8th 2005.

/G/ Tórshavn Radio. Log book, 19:53 February 7th 2005 to 10:36 February 9th 2005.

/H/ Interviews and follow-up e-mails with the following persons:

- Djóni Weihe, leader MRCC (May 13th 2005)
- Eli Lyngvej-Larsen, Commander FRK (May 13th 2005)
- Elmar Højgaard, Director Faroe Islands Fisheries Inspection (May 11th 2005)
- Jákup M.E. Müller, Captain Brimil (May 12th 2005)
- Johannes Mortensen, Radio operator Tórshavn Radio (May 11th 2005)

- Johan J. Jakobsen, acting leader MRCC (May 13th 2005)
- Kári Horn, Watch officer MRCC (May 13th 2005)
- Magni Rasmussen, Watch officer (May 20th 2005)
- Niels S. Johannessen, Radio operator Tórshavn Radio (May 11th 2005)
- Peter Gram, Officer FRK (May 13th 2005)
- Regin Zachariasen, Watch officer MRCC (May 11th 2005)
- Terji Jacobsen, Chief pilot deputy Atlantic airways (May 12th 2005)

/I/ MRCC Tórshavn. Fax from MRCC to FRK regarding DSC Distress Jøkulfell (07.02.2005).

/J/ Samskip. www.samskip.com

/K/ Various background documents from the MFMA

/L/ MRCC Tórshavn operational manual

/M/ MRCC Tórshavn agreement with FRK

APPENDIX 1: MRCC Tórshavn's SAR resources

Ships

Tjaldrið

Callsign:	XPRT
Build:	1976
Length:	44.5 m
GRT	437
Max.speed	15 knots
Cruise speed	12 knots
No of crew	11

Brimil

Callsign:	XPYM
Build:	2000
Length:	63,60 m
GRT	1503
Max.speed	17 knots
Cruise speed	11,5 knots
No of crew	12

Spógvin

Callsign:	XPRC
Build:	1986
Length:	9,45 m
GRT	6,1
Max.speed	9 knots

Thetis class (Danish Navy)

Usually there would one of these operating within the Faroese 200 nm boundary equipped with one navy Lynx helicopter.

Units:	F357 Thetis F358 Triton F359 Vædderen F360 Hvidbjørnen
Build:	1988-1995
Length:	112,50 m
GRT	3.500 t
Max.speed	21 knots
No of crew	60

Helicopters

Textron Bell 412EP (Atlantic Airways)

SAR helicopter with autohover function

Build:	1996
Cruise speed:	125 knots
Max. speed:	140 knots
Range:	472 nmi
No of crew	2-4
Maximum POB (excl. crew):	10-13

Textron Bell 212 (Atlantic Airways)

Build:	1974
Cruise speed:	100 knots
Max. speed:	120 knots
Range:	350 nmi
No of crew	2-4
Maximum POB (excl. crew):	10-13

Westland Lynx Mk91 (Danish Navy)

Shipborne helicopter for fishery protection and search and rescue.

Operational speed:	125 knots
Range:	320 nmi
Service ceiling:	12500 feet
No of crew	2-3
Maximum POB (excl. crew):	5-7

APPENDIX 2: STEP Diagram

The STEP analysis contains both a list of describing all relevant events and a diagram illustrating these events in a time perspective.

Time	Text	Reference
19:53	Tórshavn Radio receives a digital selective calling (DSC), an automatic distress signal with position 6300N 004.56w and nr. 235006870. The vessel name is Jøkulfell MCZV2. Tries to call him on the radio but there is no response.	G, H
19:56	MRCC receives the DSC information from Tórshavn Radio.	D, H
19:57	MRCC calls Brimil and ask her to sail to the position of the distress call.	D, E, H
19:58	MRCC "On-hold" watch is called and asked to come down to the station. He arrives 4 minutes later.	D, H
20:00	MRCC changes officer on watch.	D, H
20:06	MRCC calls Atlantic airways SAR Captain on duty (CoD) and informs him about the situation. AA are asked to check the weather and to be "stand by", but stay calm until MRCC knows more.	D, H
20:09	MRCC leader is informed about the situation. He asks if they have made contact with the ship. When told that they haven't he tells them to call Iceland.	D, H
20:17	AA SAR CoD calls and says that the weather is windy but good enough to fly. The CoD says that they are ready ("Klare") but that the helicopter still is in the hangar. We are on "stand by".	D, H
20:18	Tórshavn radio sends mayday relay on 2148khz because channel 16 is blocked.	G, H
20:19	MRCC calls Tjaldrið and informs about the situation. Tjaldrið is asked to be "stand by".	D, F, H
20:20	After request from MRCC Tórshavn 20:12 MRCC Reykjavik confirms that the vessel is Jøkulfell. Provides telephone numbers to the vessel. The shipping company Samskip confirms that Jøkulfell is expected to arrive at Iceland the morning of 8th February.	D, H
Approx. 20:20	AA SAR CoD leaves to visit a local seaman and ask about the current weather.	H
20:30	M/S Vædderen receives a message that Brimil is sailing towards potential accident.	A
20:31	Channel 16 is not blocked anymore	G, H
20:31	MRCC calls FRK and informs about the situation ("This is only for your information"). FRK is to contact M/S Vædderen.	D, H
20:33	FRK calls back and asks if MRCC can get the information on fax	D, H
20:33	Tórshavn radio sends out mayday relay on 2182 khz and channel 16	G
20:35	M/S Vædderen receives mayday relay from Tórshavn radio.	A
20:38	MRCC watch calls the MRCC leader. Says that they cannot get hold of the vessel. Informs the leader that Brimil is on its way (ETA 23:45), Tjaldrið is "stand by", Vædderen is somewhere around Tórshavn (ETA ~4 hours from now) and AA Bell 412 CoD says the weather is good enough to fly. Discussion about distances and the weather. MRCC leader decides to send Vædderen. Decision basis: Vædderen is a fast ship and has a helicopter ("full package").	D, H

20:44	MRCC sends fax to FRK where they request FRK to send Vædderen to position.	D, H, I
20:45	MRCC leader arrives to the station.	D, H
20:45	Vædderen calls FRK and asks for instructions. FRK says that they are to be informed and keep helicopter ready. Vædderen sails towards the position with full speed. ETA 23:59.	A
20:52	FRK confirms that they have received the fax and sent Vædderen to position. MRCC asks if they can send down their duty officer ("stabsvakt"). He arrives 9 minutes later.	D, H
21:08	Aberdeen calls and says they have received an EPIRB from Jøkulfell at 20:59. They will send a fax with the information. This is by the leader of MRCC regarded as the confirmation they have been waiting for. Decides to send a helicopter.	D, H
21:10	MRCC calls AA SAR CoD. Asks them to make the helicopter ready. When asked if they are ready AA replies that they need to bunker. MRCC tells them to do so. At 21:12 MRCC calls the airport traffic controller and request that he makes himself ready because the AA Bell 412 is getting prepared to fly.	D, H
21:11	MRCC calls MRCC Reykjavik, tells them about the EPIRB and asks about the crew. MRCC Reykjavik responds that there are 11 people onboard. Nationalities: Estonian and Russian.	D, H
21:18	Vædderen has received a message about the EPIRB signal. Decides to send the Lynx helicopter HSR-134. During communication with Tórshavn radio they say they are preparing the helicopter and ask if they should take off. They are given an "ok" from MRCC (through Tórshavn radio). Decision base: Lynx helicopter is closer, faster and can land on Vædderen if needed.	A, D, G, H
21:19	MRCC informs Tjaldrið about the EPIRB and asks them to make the ship ready.	D, F
21:22	Vædderen starts to prepare Lynx helicopter 134.	A
21:23	The air traffic controller is now in the tower. Asks about the situation. MRCC informs that they now have received two signals and that Vædderens helicopter is getting ready to take off. The controller says that the helicopter hangar is now opening its doors.	D, H
21:25	MRCC calls AA SAR CoD and says that the situation is serious now, we have received an EPIRB. 11 people onboard. Several ships are on their way. Vædderen Lynx helicopter is getting ready. MRCC says they will send the Bell 412 when the situation has been made clear. AA answers that they are ready but need bunker.	D, H
21:37	AA SAR CoD calls MRCC and asks if they have a new position. MRCC answers that the position is the same. AA SAR CoD says that the weather is getting worse and that they should take off soon. Have begun start procedures.	D, H
21:42	MRCC sends first SAR Siterep.	D
21:58	MRCC informs AA about new position and that Lynx helicopter is on its way.	D, H
22:03	Halifax calls and informs about new beacon signal (EPIRB).	D
22:04	Lynx helicopter 134 is airborne. ETA 22:24.	A
22:12	MRCC call AA SAR CoD and asks if they can fly to Klaksvik. AA replies that it is not possible because of the wind conditions. MRCC says there are 11 POB and asks if that is possible to pick up. AA answers that it works, but it will be crowded.	D, H
22:22	Lynx helicopter 134 spots flashing lights. At 22:23 they see 5 lights that they at 22:25 believe is lights from 5 life rafts.	A

22:27	MRCC informs AA about the lights and gives them a “Go” for take off. Together they discuss the position and frequency.	C, D, H
22:31	MRCC talks with the air traffic controller about the situation.	D, H
22:34	Lynx helicopter 134 is now seeing the first man alive (they have right before this seen one empty life raft and one man floating with his face down).	A
22:36	MRCC informs the air traffic controller that there are people in the water.	D, H
22:39	Air traffic controller informs that AA Bell 412 is airborne. ETA 45 min.	D, H
23:04	The Lynx helicopter 134 has now picked up 5 survivors in very difficult conditions. After a search of the area they decide to leave the scene because of several reasons: 1. They did not see any more people in the water. 2. The SAR Bell 412 helicopter would be in the area within 10 min. 3. They had to have enough fuel to fly to Vagar, in case it would not be possible to land on Vædderen.	A
23:22	Lynx helicopter 134 lands on Vædderen.	A
23:24	AA Bell 412 arrives on scene and starts to search for survivors.	C

MANAGING RISK

Appendix 2

Sequential Timed-Event Plotting

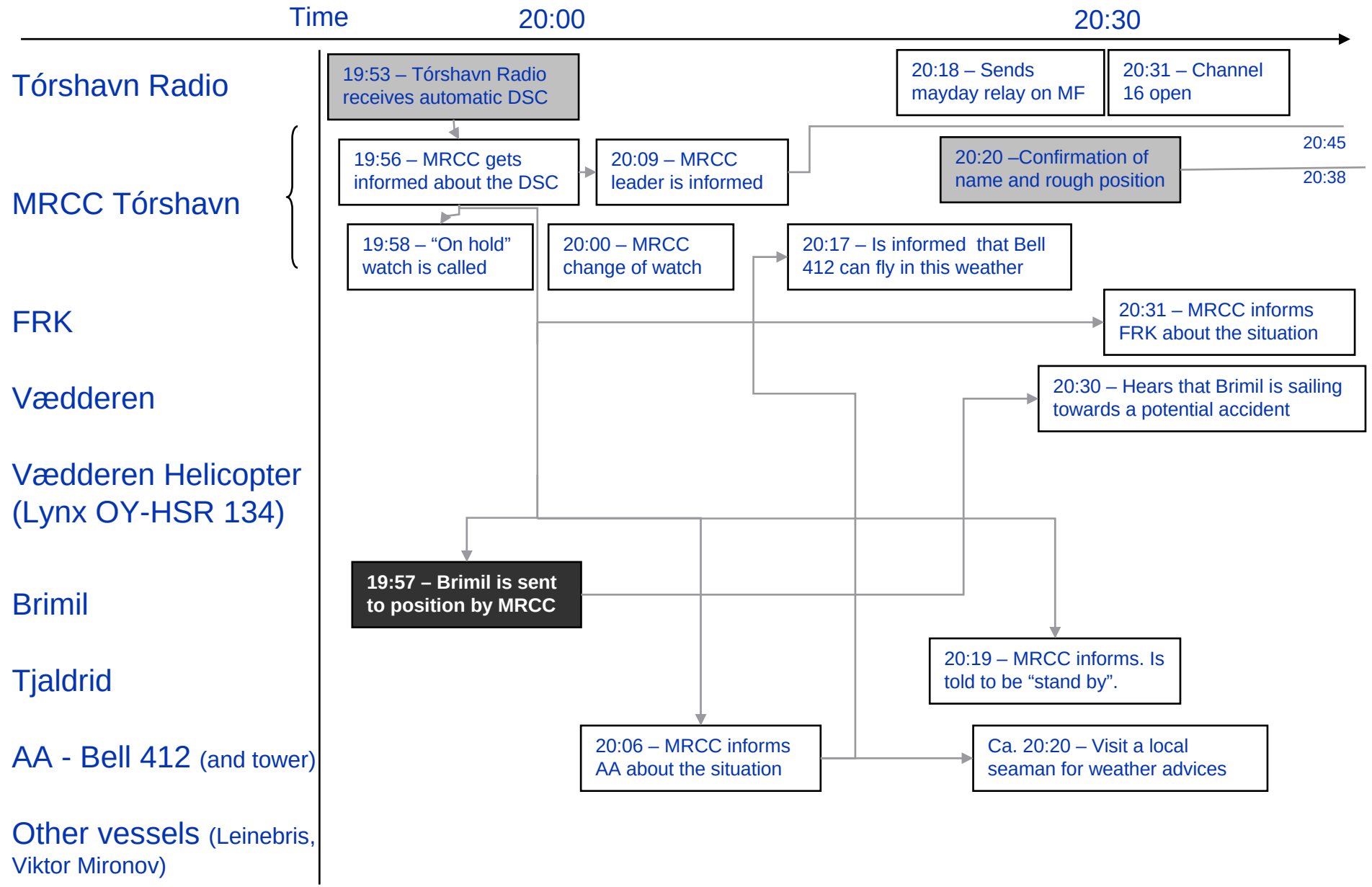
Maritime Solutions
June 2005

STEP Diagram

MANAGING RISK

- The following five foils outline the scenario describing the first phases of the SAR response to Jøkulfell 7th February 2005.
- Actors involved is plotted vertically to the left
- Time is plotted horizontally
- Relevant events with time is plotted for the relevant actor and point in time.
  - Black event-nodes illustrate decisions to dispose SAR resources.
  - Grey event-nodes illustrates events that bring information about the ship to MRCC Tórshavn.
  - White event-nodes are the most important remaining events.
- The STEP diagram is supported with a list of the events that contain more detailed descriptions.

Response – DSC received



Response – DSC received

MANAGING RISK

Time 20:30 → 21:00

Tórshavn Radio

MRCC Tórshavn

FRK

Vædderen

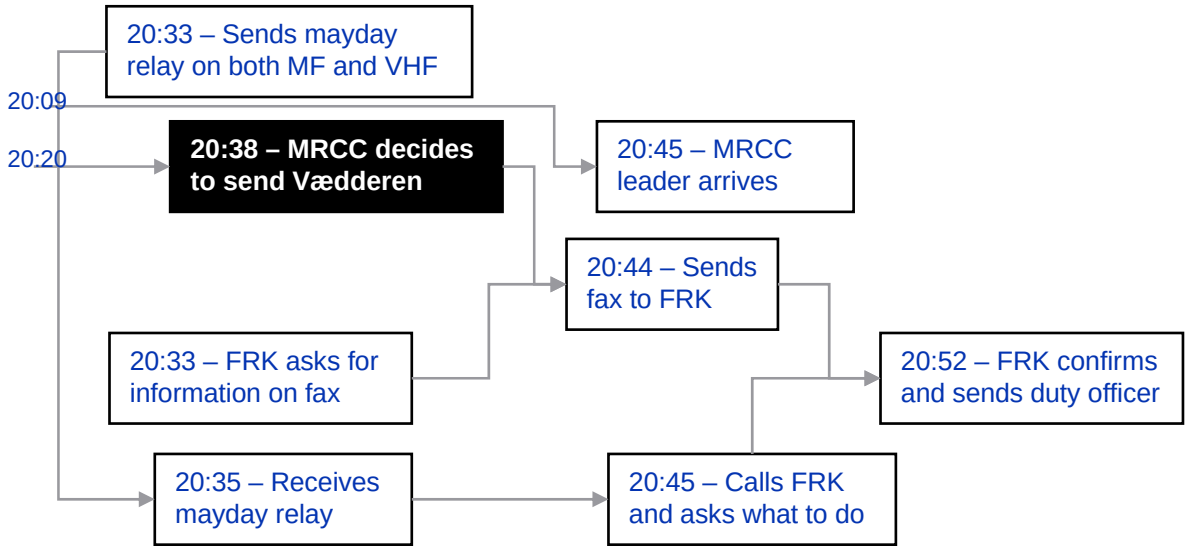
Vædderen Helicopter (Lynx OY-HSR 134)

Brimil

Tjaldrid

AA - Bell 412 (and tower)

Other vessels (Leinebris, Viktor Mironov)



Response – EPIRB received

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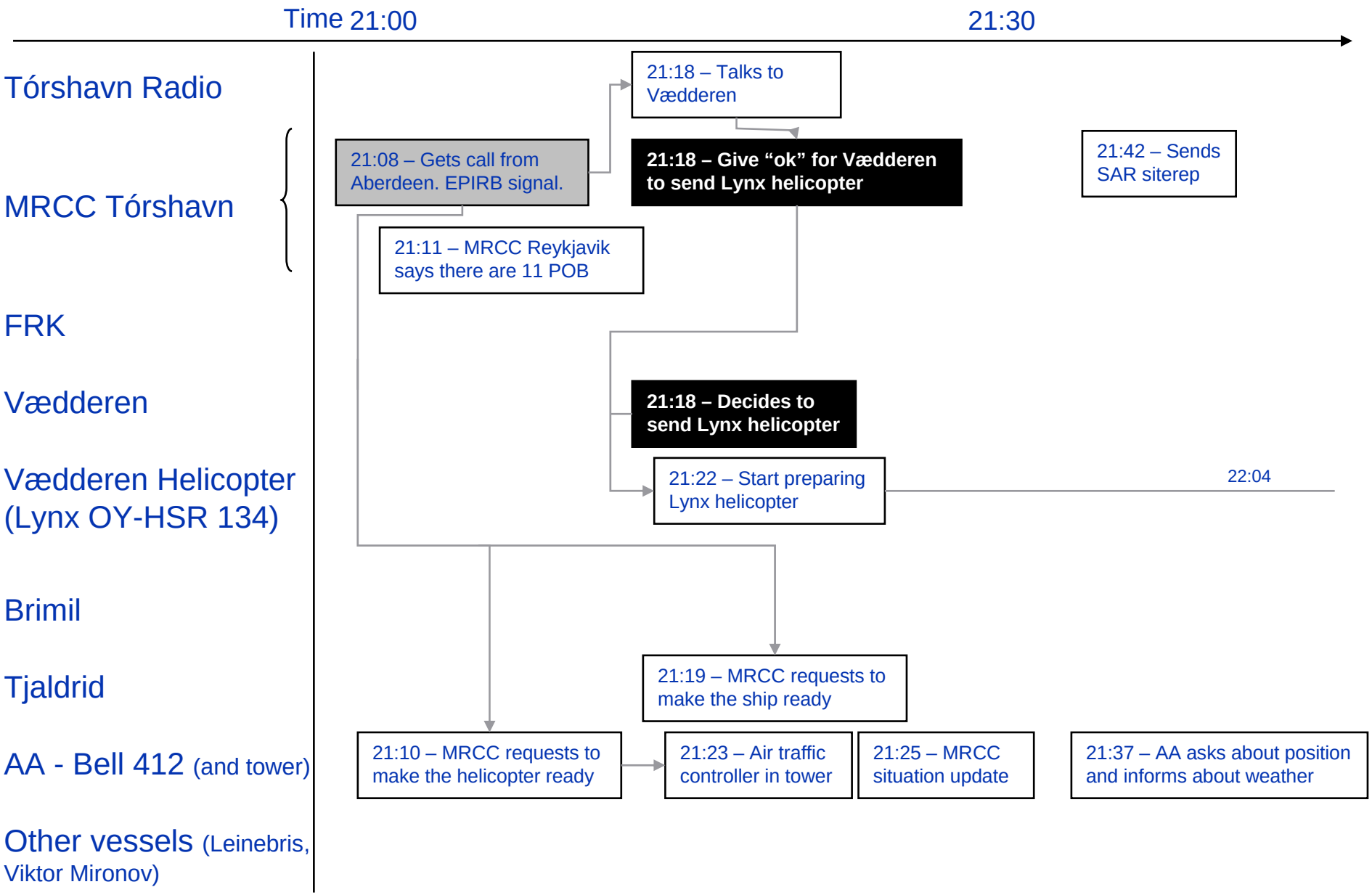
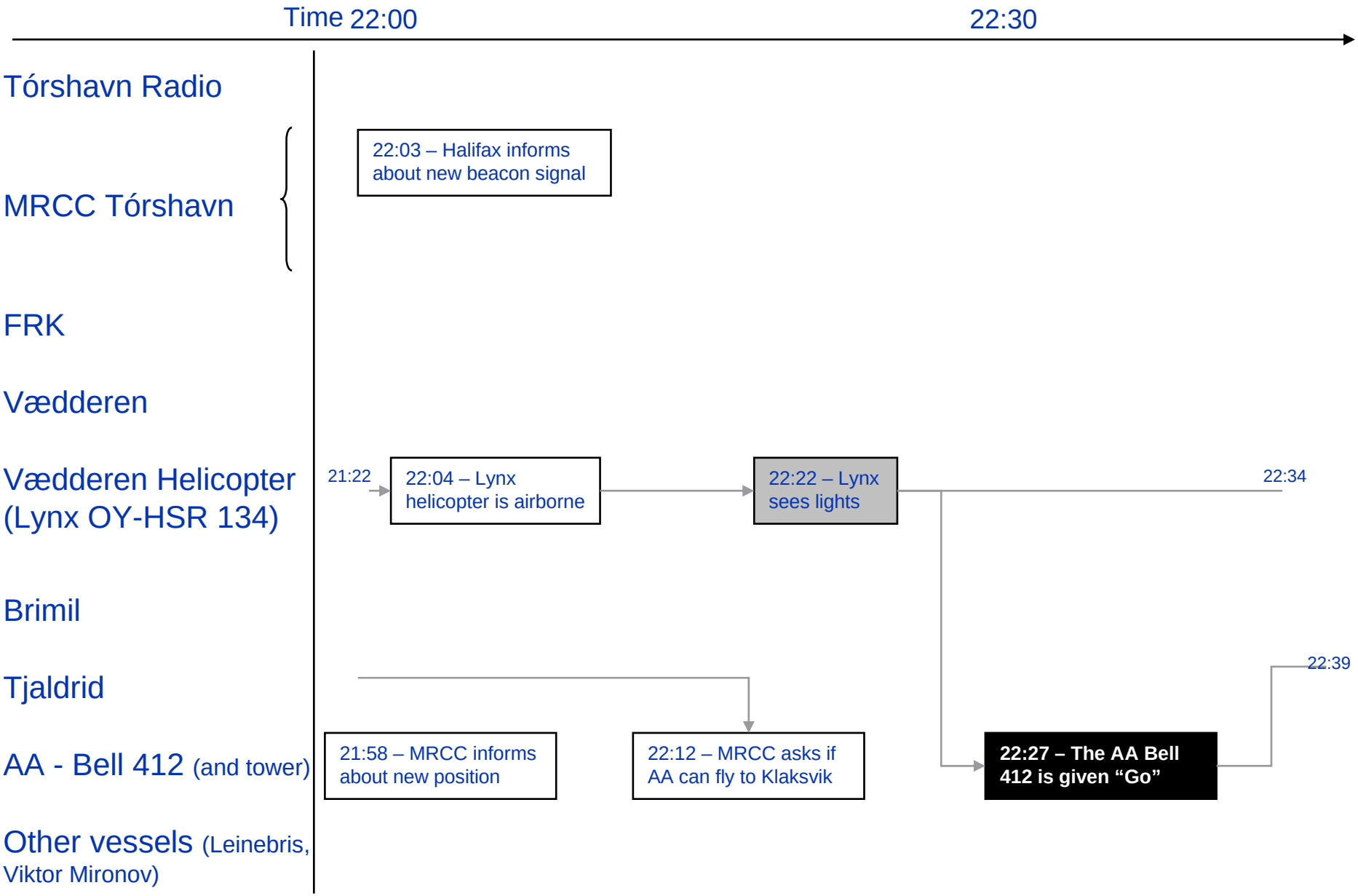
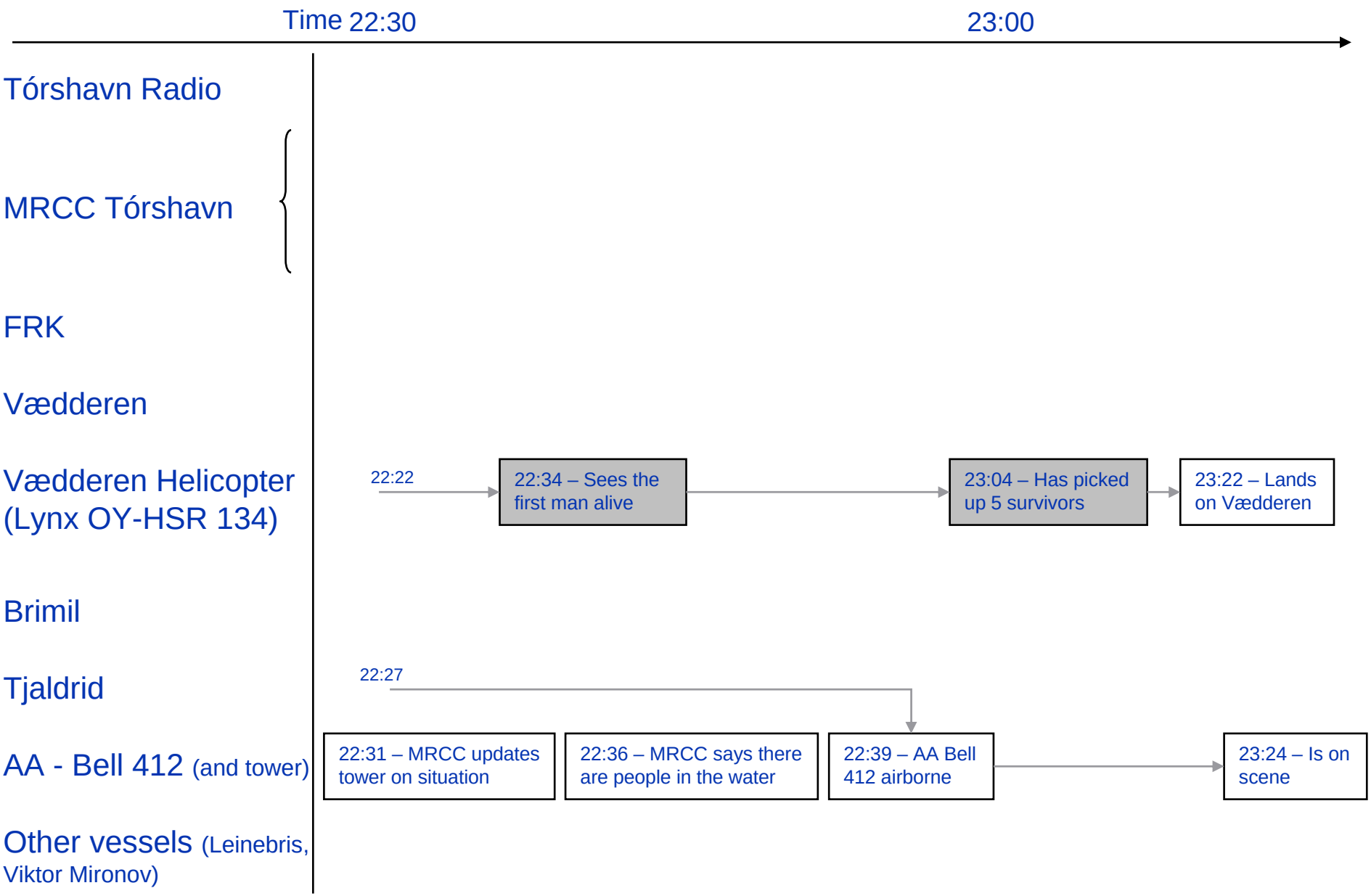


Helicopter rescue

MANAGING RISK



Helicopter rescue



Helicopter and ship SAR

MANAGING RISK

Time 23:30 — 23:00

Tórshavn Radio

MRCC Tórshavn

FRK

Vædderen

Vædderen Helicopter (Lynx OY-HSR 134)

Brimil

Tjaldrid

AA - Bell 412 (and tower)

Other vessels (Leinebris, Viktor Mironov)

23:30 to 16:30 – The Bell 412 helicopter (once at night and once in the morning), Vædderen (On scene commander from 00:06), Brimil, Tjaldrid, Viktor Mironov, Leinebris and a Fokker airplane from Iceland search the area.

Between 07:58 and 11:07 4 bodies were picked up from the water. Tjaldrid picked up 3 and Brimil 1.

There are many containers floating around, together with a lot of other debris. Several life rafts, life jackets and EPIRB's were picked up.

MANAGING RISK

Appendix 3

Ideal SAR scenarios

Maritime Solutions
June 2005

STEP Diagram

MANAGING RISK

- The following foils outline how the ideal SAR response scenario could have looked like if improvements are implemented.
- Actors involved is plotted vertically to the left
- Time is plotted horizontally
- Relevant events with time is plotted for the relevant actor and point in time.
  - Black event-nodes illustrate decisions to dispose SAR resources.
  - Grey event-nodes illustrates events that bring information about the ship to MRCC Tórshavn.
  - White event-nodes are the most important remaining events.
- The STEP diagram is supported with a list of the events that contain more detailed descriptions.

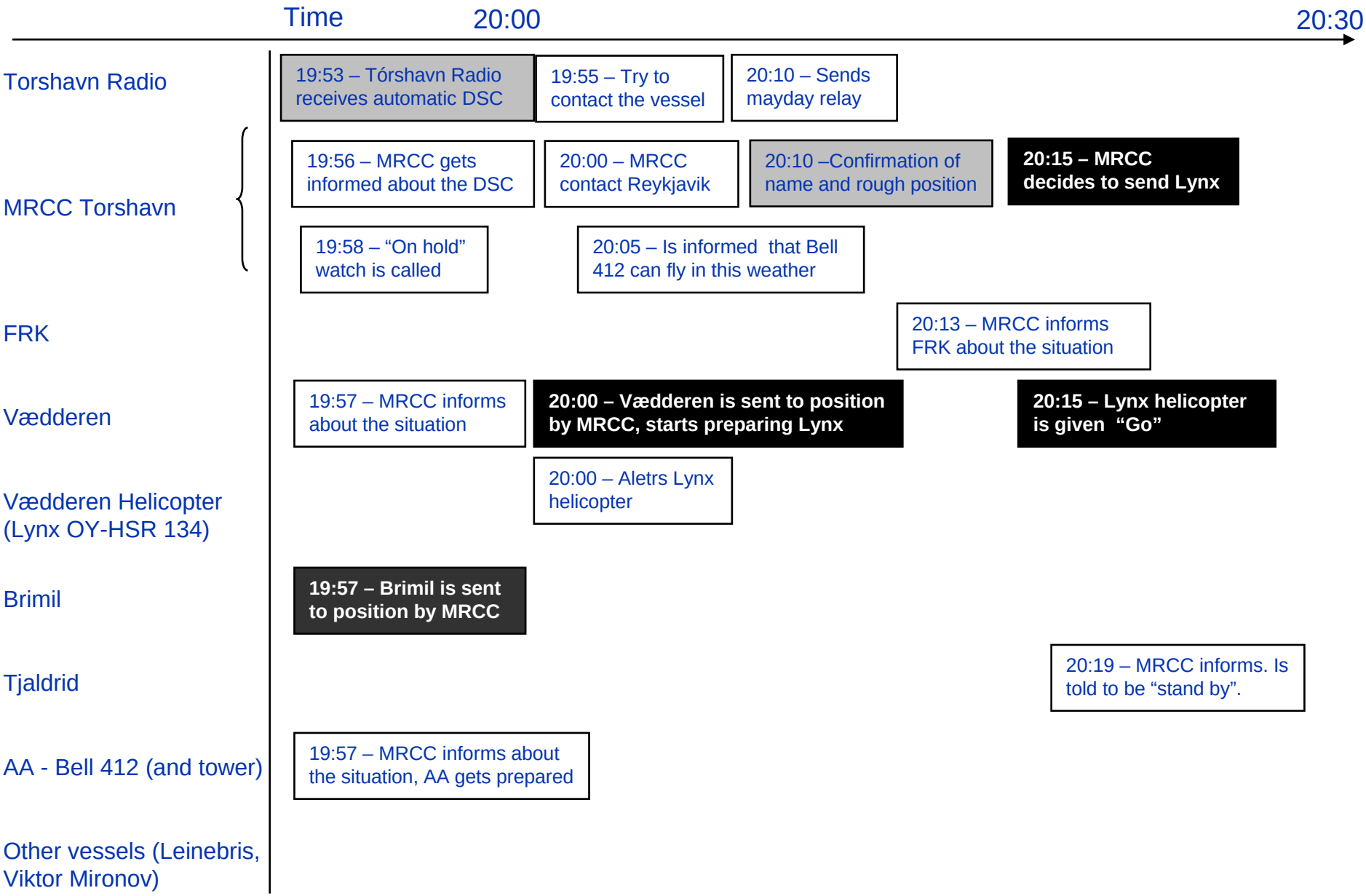
APPENDIX 3a

MANAGING RISK

- STEP ideal scenario – Vædderen is in a favorable position

Response – DSC received

MANAGING RISK



Response – DSC received

MANAGING RISK

Time 20:30 → 21:00

Torshavn Radio

- 20:31 – Channel 16 open
- 20:33 – Sends mayday relay

MRCC Torshavn

- 20:30 – MRCC change of watch

FRK

Vædderen

Vædderen Helicopter (Lynx OY-HSR 134)

- 20:30 – Lynx helicopter is airborne
- 21:05 – Is on scene

Brimil

Tjaldrid

AA - Bell 412 (and tower)

Other vessels (Leinebris, Viktor Mironov)

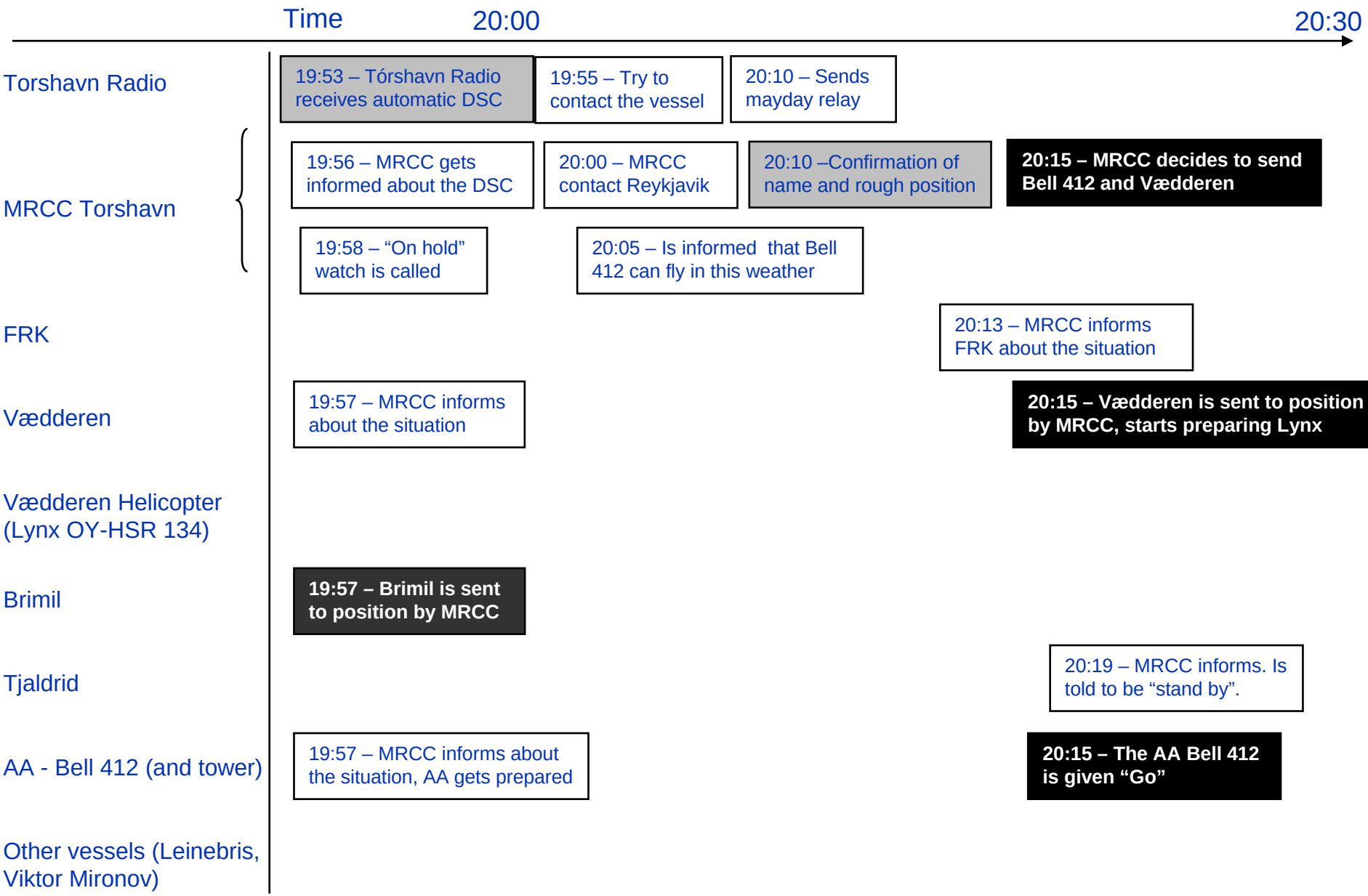
APPENDIX 3a

MANAGING RISK

- STEP ideal scenario – Vædderen is not in a favorable position

Response – DSC received

MANAGING RISK



Response – DSC received

MANAGING RISK

Time 20:30 → 21:00

Torshavn Radio

- 20:31 – Channel 16 open
- 20:33 – Sends mayday relay

MRCC Torshavn

- 20:30 – MRCC change of watch

FRK

Vædderen

Vædderen Helicopter (Lynx OY-HSR 134)

Brimil

Tjaldrid

AA - Bell 412 (and tower)

- 20:30 – AA Bell 412 airborne
- 21:15 – Is on scene

Other vessels (Leinebris, Viktor Mironov)

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