The lifeboat

A study on how different practical operations is done with a lifeboat

Diploma thesis in the Master Mariner Programme

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CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2015

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Cover: Taken during the experiment when trying to make headway with the lifeboat.

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Abstract

This study investigates how various practical operations is carried out in a lifeboat, to compare how it performed during an experiment, with what regulations frameworks. To check if there is a difference between how works is done and how work is imagined to be done.

To investigate how different practical tasks is carried out in a lifeboat have an experiment been carried out, where a lifeboat was loaded to it's maximum capacity, to analyse how this is carried out. The experiment tested practical operations as, if it is possible to embark lifeboat in less than three minutes? If it is possible to launch the boat in an effective way? If it is possible to make headway with the lifeboat only using the oars? Or if it's possible to put a sea anchor? And if it is possible to put on a survival suit in less than two minutes, without assistance.

To analyse the experiment, the method HTA (Hierarchical Task Analysis) was used, the method is used to categorize and organize various tasks during the experiment. To make it possible to compare the practical tasks during the experiment whit the regulation framework.

The theory chapter presents the relevant regulations concerning lifeboats, and what they prescribe for example embarkation, launching, oars, survival suits and training.

The conclusion shows that in some cases it's a gap between work as imagined and how work is done, during the experiment. The gap is shown clear when using the oars during the experiment, it is not possible to make headway only using oars.

Keywords: IMO, SOLAS, STCW, LSA, LIFEBOAT, IMMERSION SUIT, EMBARKATION, SEA ANCHOR, OARS, HTA

Sammanfattning

Denna studien undersöker hur olika praktiska moment utförs i en livbåt, för att jämföra hur det utförs under ett experiment med vad regelverken föreskriver att det ska utföras. För att kontrollera om det finns en skillnad mellan hur det är tänkt att arbetet ska utföras och hur det utförs.

För att studera hur praktiska momenten utförs i en livbåt så har ett experiment genomförts, där en livbåt lastats full för att analysera hur praktiska moment så som, om det är möjligt att embarkera livbåten på mindre än tre minuter? Om det är möjligt att sjösättningen på ett effektivt sätt? Om det är möjligt att göra fram fart med livbåten endast medhjälp av åror? Eller om det är möjligt att sätta ett drivankare? Samt om det är möjligt att sätta på sig en överlevnads dräkt på mindre än två minuter, utan assistans.

För att analysera experimentet har metoden HTA *(Hierarchical Task Analysis)* använts. Metoden används för att lättare kategorisera och organisera de olika uppgifterna under experimentet.

Teorikapitlet presenterar de relevanta regelverk som berör arbete i livbåtar, samt vad de föreskriver om t.ex. embarkering, sjösättning, åror, drivankaren och överlevnadsdräkter.

Studiens slutsats visar att det i vissa fall finns ett glapp mellan hur arbetet är tänkt att utföras och hur det utförs enligt experimentet. Glappet gör sig tydligast när det gäller rodd, under experimentet lyckas det inte göras någon märkbar framfart med årorna.

Denna studie är skriven på engelska.

Nyckelord: IMO, SOLAS, STCW, LSA, LIVBÅT, ÖVERLEVNADSDRÄKT, EMBARKERA, SJÖSÄTTNING, DRIVANKARE, ÅROR, HTA

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Anja Divkovic & Henrik Dahlrot

Gothenburg, 25nd of December 2015.

Table of contents

List of figures

Abbreviations and definitions:

IMO: International Maritime Organization, is the international maritime authority.

SOLAS: Safety of Life at Sea, Conventiont of Standardization Safety of Ships.

LSA Code: Life Saving Appliances Code

STCW: International Convention on Standards of Training, Certification and Watchkeeping for Seafarers

HTA: Hierarchical Task Analysis

Lifeboat: A smaller boat onboard a ship for emergency escape when for example in distress

Embark: To get on a boat (includes also ships or airplanes)

Immerson suit: A waterproof survival suit that protects the wearer from hypothermia when immersion in water

Sea-anchor: A device used to stabilize a boat

1 Introduction

A dictionary describes emergency in the following manner, an emergency is "a serious, unexpected, and thwart dangerous situation requiring immediate action" (Oxford Dictionaries, 2015), and throughout the history several ships have been experienced emergency's scenarios, often under great stress. On these occasions it's necessary that life saving appliances such as a lifeboat is correctly used. To understand how a lifeboat should be used in an emergency scenario, it is interesting to explore any difference in how operations are imagined to be conducted and how they are actually done.

To get a better understanding of how work in a lifeboat is done this study have performed an experiment to test how various practical tasks works within a lifeboat in order to compare it with the regulation frameworks. The experiment tests whether it is possible to embark a lifeboat in less than 3min, how it works to launch a lifeboat and how practical tasks such as rowing a lifeboat and put a sea anchor works. The experiment has been analysed to find shortages in regulations and how today's lifeboats are working and is designed.

1.1 Purpose

The purpose of this study is to understand how different practical operations is done with a lifeboat, by testing a fully loaded lifeboat. The study will describe how it should be carried out in accordance with IMO regulations and how it was executed in reality. The main focus during the experiment and the study will be on the actual performance of the practical elements and not on the technical aspects of the lifeboat and its equipment.

1.2 Questions

In order to answer the main question, if lifeboat operations as imagined are the same as work actually done, five detailed questions are formulated:

- Is it achievable to board in no more than 3 minutes, with full complement of persons?
- Is it possible to launch by help of gravity by one person positioned within the lifeboat?
- Is it possible to put on an immersion suit in less then two minutes, with no assistance?
- Is it possible for the sea anchor to stabilize and prevent the lifeboat from drifting?
- Is it possible to use oars to make headway in calm seas?

1.3 Delimitations

The study is limited to certain practical elements in a fully loaded lifeboat and focus is the actual usage/operation. Technical or constructional aspects concerning the lifeboat and its equipment are not included in the scope of the study. The used lifeboat and additional equipment meets the IMO requirements and are duly classified by recognized societies.

2 Background and theory of regulations for a lifeboat and its equipment

The following chapter will provide understanding of the central regulations of safety for lifeboats and the crew handling it, such as Safety of Life at Sea (SOLAS), Standards of Training Certification and Watch keeping for Seafarers (STCW), and Life-Saving Appliances (LSA). in order to standardization the basic demands

2.1 Relevant regulations

This subtitle presents the most important regulatory frameworks for safety at sea.

2.1.1 SOLAS

The purpose of the SOLAS (Safety of Life at Sea) Convention is to standardize Safety of Ships. SOLAS was first published after the Titanic disaster, in 1914 (International Maritime Organization, 2015). The convention brings up ship construction, equipment and operation of ships. The convention is today divided in to 12 chapters, each chapter contains an own subject, as for example *general provision, construction, fire protection, radio communications* and *safe navigation.* The most relevant chapter for this study is chapter III *Life-Saving Appliances.* This chapter contains requirements for life-saving appliances and arrangements, for example lifeboats, rescue boats and lifejackets (International Maritime Organiztion, 2015).

2.1.2 LSA Code

The international Life-Saving Appliance (LSA) code purpose is to standardization Life-Saving Appliance such as lifejackets, immersion suits, lifeboat, launching and embarkation appliances, required by chapter III in SOLAS convention. The LSA code also contains recommendation for testing life-saving appliances. IMO’s Maritime Safety Committee (MSC) published the LSA code for the first time in June 1996 and has become mandatory since 1 July 1998 (Internation Maritime Organization, 2010).

2.1.3 STCW

The international convention on Standards of Training, Certification and Watch keeping for Seafarers (STCW) was first publish in 1978, in order to standardize the basic demands for training, certification and watch keeping for seafarers. Before 1978 each country’s government had to define their own regelation, which resulted in large differences worldwide (Internation Maritime Organization, 2011).

In Sweden training, certification and watch keeping for seafarers are implemented in Swedish Transport Agency regulation (TSFS 2011:116) with last revision (TSFS 2013:47). Training in basic safety is described in appendix 12, and training for rescue boats and survival craft is described in appendix 18 (Transportstyrelsen, 2015).

2.2 Relevant regulatory framework for a lifeboats and its equipment

This subtitle presents the relevant parts of the regulatory frameworks mention in Chapter 2.1, as for example embarkation, launching, oars, sea anchors etc.

2.2.1 Immersion suit

According to SOLAS, cargo ships shall carry at least three immersion suits for each lifeboat, or an immersion suit for each person on board if the cargo ship is traveling in cold water (SOLAS, 2004, pp. 326).

An immersion suit shall be constructed in such a way that it must be able to withstand a fall from at least 4,5 m height without the suit being damaged or the leakage of water into the suit (LSA, 2010, pp. 11-12). An immersion suit shall also be resistant to fire and resist melting when exposed to an open flame for the period of 2 seconds (LSA, 2010, pp. 11-12).

The immersion suit shall also be constructed so it can be packed up, put on without assistance during 2 minutes, including the associated clothing, and a lifejacket if the immersion suit is to be worn with it (LSA, 2010, pp. 11-12).

Figure 1: Immersion suit (6h). Published with the permission of *Viking Life-Saving Equipment A/S.*

The immersion suit must be constructed of waterproof material, cover the entire body, including the hands, but not the face (see figure 1). The suit must be constructed in such a way that it reduces the loss of body heat when the suit is worn in cold water. There are two different types of immersion suits. The first being of protection class 1 h, where the wearer should not loose more than 2 degrees of body temperature if the wearer is submerged for 1 hour in water temperature of 5 degrees. The second is protection class 6 h, where the wearer should not loose more than 2 degrees of body temperature if the wearer is submerged for 6 hours in water temperature of 0-2 degrees,
the 6h immersion suit is made of material with inherent insulation (LSA, 2010, pp. 11-12).

The wearer shall also be able to climb up and down at least five metres, swim a short distance, and should be able to move between land and water, as well as to perform normal tasks to the ship's abandonment (LSA, 2010, pp. 11-12).

2.2.2 Embarkation into a lifeboat

The IMO Life Saving Appliances (LSA) Code 4.4.3.1 and 4.4.3.2 states that every passenger ship shall be so arranged so that they can board the lifeboat in no more than 10 minutes with full capacity of people, and every cargo ship must be so arranged that they can board in no more than 3 minutes with full complement of persons, from the time the instruction to board is given. Rapid disembarkation shall also be possible (LSA, 2010, pp. 29).

SOLAS also states that you should be able to board and launch direct from the stowed position and that all lifeboats should be capable of being embarked if the ship has a trim of 10 degrees or have a list of 20 degrees (SOLAS, 2004, p. 304). The lifeboat should be designed in a way that makes it possible to take in helpless people from either the sea or on stretchers. The lifeboat shall have a boarding ladder that can be used in all boarding entrances and to help people who are in the water to climb in the lifeboat. The lowest step on the ladder shall not be more than 0.4 m under the lifeboat's light waterline (LSA, 2010, pp. 29).

All persons shall have easy accessibility to their seats from an entrance without having to climb over thwarts or other obstructions. Seat belt or a safety harness to be found for each seat, the seat belt and safety harness shall be able to keep a mass of 100 kg in place. Seats shall be of thwarts, benches or fixed chairs and constructed to be capable of supporting a static load equivalent of the number of persons, each weighing 100 kg (LSA, 2010, pp. 27-28).

The LSA Code 4.4.2.2 states that the design for the number of persons to be accommodated in a lifeboat shall be the average weight of 75 kg per person on passenger ships and 82.5 kg per person for cargo ships, all wearing lifejackets. The persons should be able to sit down at seats in normal position without interfering with the means of propulsion or the operation of any of the lifeboat's equipment. There must be clear indications for every seat in the lifeboat (LSA, 2010, pp. 28-29).

2.2.3 Launching of a lifeboat

Launching appliances

The lifeboat must be able to be launched when the ship has up to 10 degrees trim and up to 20 degrees heeling either way. The launching must be made by help of gravity or stored mechanical power independent of the vessels power supply system. Also, the launching mechanism shall be possible to be operated by one person, positioned on the ships deck. It also needs to be possible to operate by a second person positioned within the lifeboat. If the lifeboat is intended to be launched from the ship, it is important that the lifeboat is visible from the operators' position (LSA, 2010, pp. 60-63).

Launch test

A lifeboat on a cargo ship of 20,000 gross ton or more should be able to demonstrated that it can be launched as the ship is making not less than 5 knots speed ahead, in calm sea state and on an even keel. There can't be any damage on the lifeboat or it's equipment (LSA, 2010, pp. 60-63).

2.2.4 Mandatory equipment - Oars

Figure 2 shows an oar, and it is a tool that's used to make headway and according to LSA Code 4.4.8.1 (pp. 34), the normal equipment of every lifeboat shall consist of:

"*Sufficient buoyant oars to make headway in calm seas. Thole pins, crutches or equivalent arrangements shall be provided for each oar provided. Thole pins or crutches shall be attached to the boat by lanyards or chains.*"

Figure 2: Mandatory equipment in a lifeboat - an oar. Published with permission of *Viking Life-Saving Equipment A/S.*

2.2.5 *Mandatory equipment - Sea anchor*

According to LSA Code 4.4.8.6 (pp. 35), the normal equipment of every lifeboat shall consist of:

"*A sea-anchor of adequate size fitted with shock resistant hawser and a tripping line which provides a firm hand grip when wet. The strength of the sea-anchor, hawser and tripping line shall be adequate for all sea conditions.*"

Figure 3 shows a sea anchors, also known as drift anchor, drift sock, para-anchor or boat brake and it is designed to stabilize and prevent the boat from drifting too fast, and instead to drift controlled with minimal speed in strong winds or heavy seas. The sea anchor acts as a break (Handbok för överlevnad till sjöss, 2010, pp. 104).

Figure 3: Mandatory equipment in a lifeboat - A sea anchor drogue. Published with permission of Ship Store Malaysia.

2.3 STCW and the mandatory minimum requirements for seafarers

STCW Chapter VI (pp. 46-47) describes the standards regarding emergency, occupational safety, security, survival functions and medical care. Chapter VI describes mandatory minimum requirements for safety familiarization, basic training and instruction for all seafarers.

Before being assigned duties on board a vessel, all employed or engaged persons of a seagoing ship must have completed an approved "Safety familiarization training" in personal rescue technology. The training involves, among other things, to be able to communicate with others about basic security issues, understand the information symbols, signals and alarm signals, know what to do in case of fire or the abandon ship alarm sounds, locate and don a lifejacket and immersion suit etc. (STCW, 2011, pp. 217).

It is also crucial that employees or engaged seafarers on board a ship have undergone a "basic training" and able to perform tasks with designated safety or prevention of pollution in the operation of the ship before the employees are assigned to any duties on board. These duties are specified in the STCW table A-VI/1-1, A-VI/1-2, A-VI/1-3 and A-VI/1-4 (STCW, 2011, pp. 217). Examples of such duties are:

Survival at sea in the event of ship abandonment, the employee should be aware of various emergency situations that can occur, for example in a collision. The employee should have understanding, knowledge, proficiency and be able to demonstrate competence on the equipment in a survival craft, the type of life-saving appliances that is normally on board, locate personal life-saving appliances and take actions in various situations that is described in STCW Table A-VI/1-1 (pp. 219):

- When called to survival stations; the use and don of a lifejacket and immersion suit
- When required to abandon ship; jump from heights in water
- When in water; swim wearing a lifejacket and keep afloat without a lifejacket,
- When aboard a survival craft; board a survival craft from ether the ship or water, operate survival craft equipment and stream a drogue or sea-anchor

The employee shall also have knowledge of shipboard contingency plans for response to emergencies, emergency signals and know the duties according to the muster list.

Crewmembers shall know where muster stations are located and the use of personal safety equipment. Crewmembers must also know what to do when you the emergency alarm is sounded, know the escape routes, internal communication and alarm systems according to STCW Table A-VI/1-4 (pp. 223).

There are mandatory minimum requirements for proficiency in a survival craft, rescue boat and fast rescue boat. The requirements on seafarers are as follows according to STCW A-VI/2-1 (pp. 227-228):

- Be able to take command of a survival craft or rescue boat during and after launch
- Interpret the markings on a survival craft and understand the capacity of persons for the survival craft
- Give correct orders for launching and boarding the survival craft, handle embarkation and disembarking persons to and from the survival craft
- Prepare and safely launch the survival craft
- Keep well away from the ship's side
- Safely recover the survival craft
- Be able to row and steer the survival craft by compass after abandoning the ship
- Use the equipment of the survival craft
- Use the portable radio equipment and
- Apply first aid

Every five years, the training must be maintained by repeating a reintroducing basic training, survival craft and rescue boats other than fast rescue boats. STCW Section A-VI/1.3 and A-VI/2.5 require the training. It is also included in addition to personal survival techniques as already described in this chapter, the minimum standard of competence in fire prevention and fire fighting, advanced fire fighting, personal safety and social responsibilities, elementary medical first aid and medical care, manage fast rescue boats, ship security officers, security-related training and instructions, security awareness and designated security duties (STCW, 2011, pp. 218 and pp. 225).

2.4 SOLAS required drills for seafarers on-board

SOLAS Chapter III Regulation 19 describes the emergency training and drills that have to be carried out on board all ships. If more than 25% of the crew on board a ship just signed on, the ship must have an abandon ship drill and fire drill within 24 h of the ship leaving the port. Each crew must also participate in at least one abandon ship and fire drill every month (SOLAS, 2004, pp. 307).

According to SOLAS Regulation 19 3.3.1 (pp. 307) the following shall include in each abandon ship drill:

1. Summoning of passengers and crew to muster station with the alarm required by regulation 6.4.2 followed by drill announcement to the public address or other communication system and ensuring that they are made aware of the order to abandon ship;
2. Report to stations and preparing for the duties described in the muster list;
3. Checking that passenger and crew are suitable donned;
4. Checking that lifejackets are corrected donned;
5. Lowering of at least one lifeboat after any necessary preparation for launching;
6. Starting and operating the lifeboat engine;
7. Operation of davits used for launching liferafts;
8. A mock search and rescue of passengers trapped in their staterooms; and
9. Instruction in the use of radio life-saving appliances.

Each lifeboat shall also be launched and operated in water at least once every three months; the assigned operating crew shall also be on board the lifeboat during the launching. The rule also applies to free fall lifeboats but this should be done at least once every six months and the lifeboat may be lowered instead of launched. Some exceptions exist, for example, ships with short international voyages but it is clear that each lifeboat shall be lowered at least once every three months, and launched at least once a year. If the abandon ship drill is carried out while the ship is making headway the drill shall be carried out with supervision by an experienced officer and in sheltered waters due to the danger involved otherwise (SOLAS, 2004, pp. 307-308).

3 Method

This chapter describes the choice of method and the data gathered through to carry out one experiment on Maritime Safety Centre (Lindholmen), with 25 students that study to Master Mariner at Chalmers University of Technology. The authors also conducted focus groups with the participants after the experiment was done where the same goals were discussed. This chapter presents how the participants were selected, how the experiment and focus groups were conducted and how the data was analysed using the Hierarchical Task Analysis (HTA).

3.1 Data collection

The experiment included practical tasks where there is no material, such as manuals or instructions. The manual for the lifeboat that was used during the experiment contained technical information and not how the lifeboat or its equipment was intended to be used. Therefore it was required to do an experiment so the steps to achieve the main goal could be recorded.

The study was carried out through observation of the various actions during the experiment. To complement the experiment, two focus groups were conducted with the aim of getting more validity in the study by discussing the same sub-goals. Literatures used in the study were different regulatory framework such as SOLAS, STCW and the LSA code.

Focus groups has the advantage to discover different aspects of the subject (task) in a deeper and broader understanding of the actions taken during the experiment due to the participants own experience, as the group is encouraged to talk freely about their thoughts and experience (Wibeck, 2000, pp. 45). As well as it has the advantage of a loose structure interview so the group dynamics makes it possible to get different information than with a structured interview (Karlsson, Osvalder, &Rose, 2009, pp. 476).

Using observation offers the researcher a way to collect data based on the researchers direct observations, and does not rely on what people say they do or what they think they would do (Denscome, 2014, pp. 271). Instead observe what is actually happening in the experiment and what steps the participants’ take to achieve the main goal of the operation.

3.2 Method of analysis

For the presentation of the result, Hierarchical Task Analysis was used. It is used for making detailed description of the stages a user must go through in order to carry out a task and reach a certain goal. Input data for the method is gained through observations and interviews with users and through manuals and instructions (Karlsson, Osvalder, &Rose, 2009, pp. 482). Since the manual for the lifeboat is about the technical aspects and not the use of the lifeboat and its equipment, the authors will primarily use observation but also two focus groups.

The reason why this method is good and popular is its flexibility, and an HTA gives the user a great insight into the task under analysis as well if performed correctly, the HTA should show everything that needs to be done in order to complete the task in question (Stanton, 2013, pp. 50).

Ainsworth describes the path of a HTA: *"Hierarchical Task Analysis provides a way to identify, organise and present the tasks and sub-tasks that are involved in the activity"* (2004, pp. 86).

HTA starts with identifying the main goal for the task, which is at the top of the Hierarchical Task Analysis. The main goal is then divided into a set of sub-goals, which must be carried out in order to fulfil the main goal (Karlsson, Osvalder, &Rose, 2009, pp. 482). The amount of sub-goals depends on what the analysis is used for, but it is usually enough with four to eight sub-goals (Karlsson, Osvalder, &Rose, 2009, pp. 482). The main purpose of HTA is to provide a framework for the analyst to understand the relationships between different task elements and to ensure that no components are missed. It is also important to produce a set of HTAs rather than to attempt to cover all situations within a single HTA (Ainsworth, 2004, pp. 86).

Stanton (2013, pp. 46) describes, "*HTA involves describing the activity under analysis in terms of hierarchy of goals, sub-goals, operations and plans. The end result is an exhaustive description of task activity.*"

3.3 The experiment

This subtitle presents and describes the experiment, the selection of participants, the ethical aspects as well as the conduction of the experiment.

3.3.1 Selection of participants

In view of time limitations, the authors chose to look for participants for the experiment and focus groups among students who studies to Master Mariner at Chalmers University of technology. The authors' hope was to collect 23 students. The authors began to introduce the experiment for the third-and fourth-year classes, and check the interest among them. For the students that volunteered an email message was sent with information about the experiment, the focus group as well as with time and place. The authors chose to redo the experiment after the first one failed, due to the fact that it was too many participants that couldn't attempt. The authors took advantage of sixteen first-year students that was going to have basic safety and managed to get seven other fourth-year students to participate in the experiment, it resulted in 25 participants including the authors.

3.3.2 Ethical aspects

The participants were informed that the experiment was going to be recorded and filmed at the first presentation, as well as in the email message and at the information meeting before the experiment. They were informed that it was essential for the authors to record and film the experiment, in order to not miss important actions. As well as they were informed that the identity of the participants would be kept confidential.

3.3.3 Conduction of the experiment

Place: Maritime Safety Center, at Lindholmen

Date and duration: 21 October 2015, 1 hour

Weather: Cleary visibility 12 °C. Wind 5,6 m/s - 284°

The experiment consisted of 25 students at Chalmers University of Technology, sixteen of the students were first-year students and nine of the students were fourth year students. The participants have no professional experience from working life at sea. The participants have only sailed during their internships and the education they have is basic safety and it is conducted during the first year in school. Their experience comes from the various internships they have over the years as a master mariner students.

The experiment began with an introduction of the authors and the study, and a master was appointed. He would make sure everyone was wearing an immersion suit, manage the embarkation, the launching of the lifeboat and the use of sea anchor and oars. The master gave orders that the ship was going to be abandoned and that everybody would put on a survival suit and gather at the embarkation station. The participants were ordered by the master to embark into the lifeboat and when this was done the lifeboat was launched. At last the participants tested the oars and to put out the sea anchors before the lifeboat was recovered back.

3.4 Focus groups

This subtitle presents and describes the conduction of the focus groups.

3.4.1 Selection of participants

The process was the same as in the selection of participants for the experiment. The authors chose to use the same participants for the experiment as for the focus groups. The reason why the focus groups was held after the experiment was because the participants' memory was fresh from the experiment and the authors hoped for a deeper discussion among the participants.

3.4.2 Ethical aspects

The participants were informed that the focus group meetings was going to be recorded at the first presentation, as well as in the email message that was sent and before the experiment started. As well as they were informed that the identity of the participants would be kept confidential.

3.4.3 Focus group 1

Place: Chalmers University of technology, at Lindholmen

Date: 16 October 2015

Duration: 1,5 hours

The focus group consisted of seven participants of third-year and fourth-year students with training in basic safety and experience from various internships during their years in school.

The moderator began to introduce the topic and explain to the participants that the main goal is broken down into four parts and that all four parts will be discussed. The activity was written up on the board, which was then filled in by the participants with how one would go about achieving each activity. This created a mind map of the various actions taken to achieve the activity, which was documented by the authors when the participants didn't have more to add to the mind map.

3.4.4 *Focus group 2*

Place: Chalmers University of technology, at Lindholmen

Date: 21 October 2015

Duration: 1 hour

The focus group consisted of nine participants of fourth-year students with training in basic safety and various experience from internships during their years in school.

The process was the same as in focus group one.

3.5 Analysis of data

After the experiment and focus groups were completed, the process began of transcribe the materials collected. The video recording was cut in different parts depending on the main activity. This was carried out in order to go back and look at the data that was relevant during the analysis. Data that came with the audio recordings, video recordings, notes, and view maps during the focus groups and experiment began to be analysed. This led to several hierarchical diagrams that are presented in the result chapter, one that shows the main goal and its sub-goals, and another four diagrams that have one sub-goal as main objective that is broken down further.

4 Results of the experiment and focus groups

The results chapter aims to answer the main questions, and will be presented by using hierarchical charts and will show the various actions taken to achieve the goals. The various charts are based on data collected during one experiment consisting of master mariner students at Chalmers University of Technology. The main objective have been split into several smaller charts, each chart have also a descriptive text.

The structure of the results chapter follows the order during the experiment and the sub-goals shall be followed from the left to the right.

4.1 Main goal and sub-goals

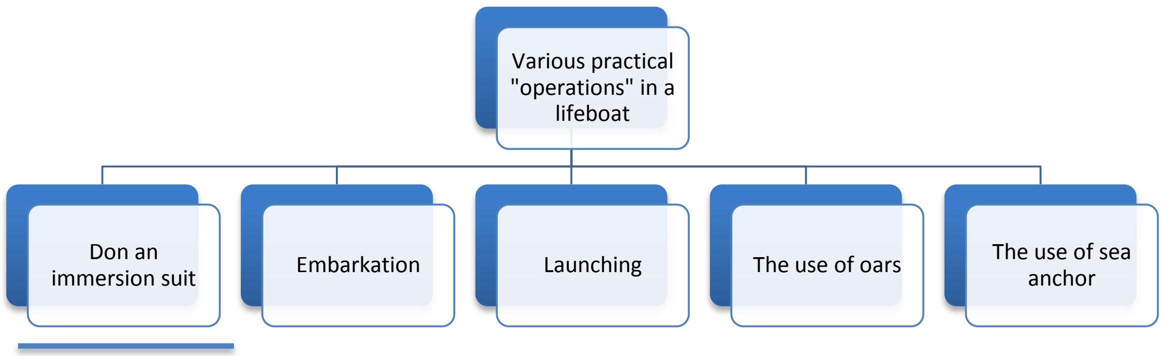

Figure 4: The main goal and sub-goals

Figure 4 shows the main goal and the five sub-goals. The reason why the first sub-goal is underlined is because the sub-goal will not be examined more than if it is possible to don an immersion suit in less than two minutes.

The study tested if it was possible to don an immersion suit in less than two minutes without assistance, so that the immersion suit covers the entire body including the hands, but not the face. The majority of the participants were able to don an immersion suit in less than 60 seconds, and none exceeded SOLAS 120 seconds requirement. The authors chose not to test any other requirements SOLAS has set for immersion suits.

4.2 Embarkation of the lifeboat

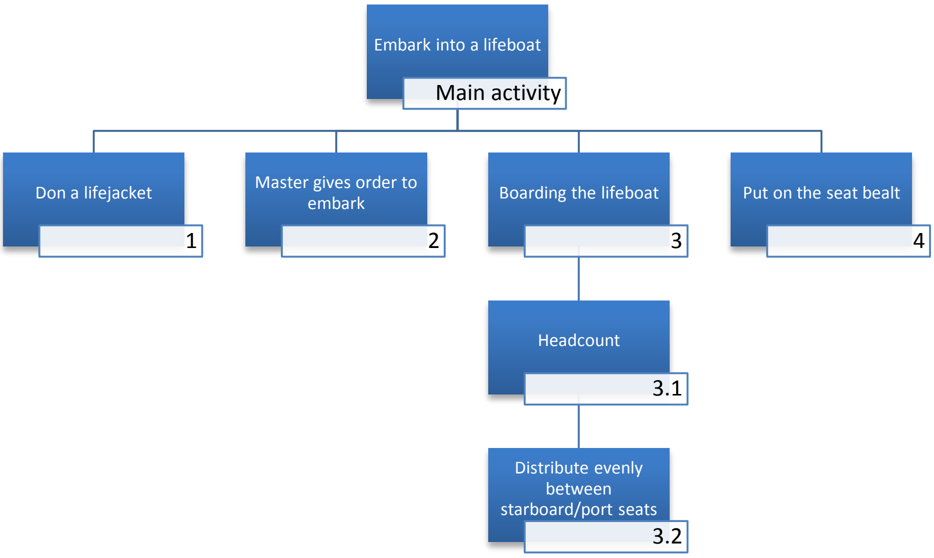

Figure 5: Embarkation of the lifeboat

Figure 5 shows the first sub-goal of Figure 4, the embarkation of the lifeboat.

The immersion suits was already donned, and the master made sure that everyone was wearing a lifejacket and that the lifejackets sat in the proper way and was fasten. The master then gave the order for the embarkation into the lifeboat; he counted the crew so that the lifeboat did not exceed the number of allowed persons. A participant also saw to it that the persons who embarked the lifeboat were distributed evenly between starboard and port seats so the lifeboat should not have a list. When everyone was on board the lifeboat, a participant saw to that the crew put on his or hers seat belts.

The study tested whether it was possible to embark into the lifeboat under 3 minutes from the time the instruction to board was given. The result shows that it took 3 minutes and 52 seconds to embark in to the lifeboat during the experiment and the focus groups discussion of the reason why it took so long was due to the underestimating of the space in the lifeboat when the last five persons tried to get in.

4.3 Launching of the lifeboat

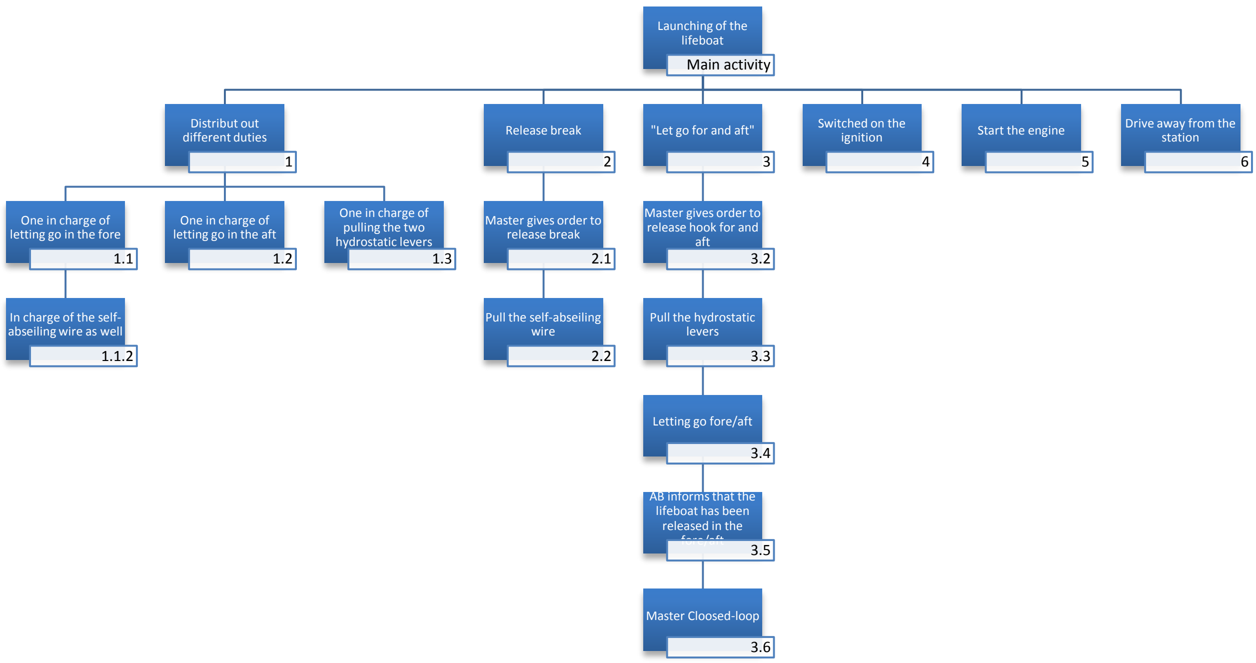

Figure 6: Launching of the lifeboat

Figure 6 describes the different actions taken when launching the lifeboat. The maser distributed out different duties to three participants, one participant was in charge of both letting go in the fore and to pull in the self-abseiling wire, one participant was in charge of letting go in the aft, and the third participant was in charge of pulling the two hydrostatic levers. When this was done the master gave orders to release the break and the participant in the fore pulled the self-abseiling wire until the lifeboat touched the water. The "master" then gave orders to pull the hydrostatic levers and to let go in the fore, and when the participant informed that the lifeboat hade been released in the bow the master gave order to the participant in the aft to let go in the aft as well. When the participant informed the master that the lifeboat hade been released in the aft as well the master switched on the ignition and started the engine to drive away from the station.

This studies focus is to investigate the difference in how a lifeboat crew manage various within a lifeboat compering with how the regulation framework describe the working process, therefore is possible risks with the fixt lunching equipment on the vessel not managed in this study. During the experiment the launching was working fine.

4.4 The use of the oars

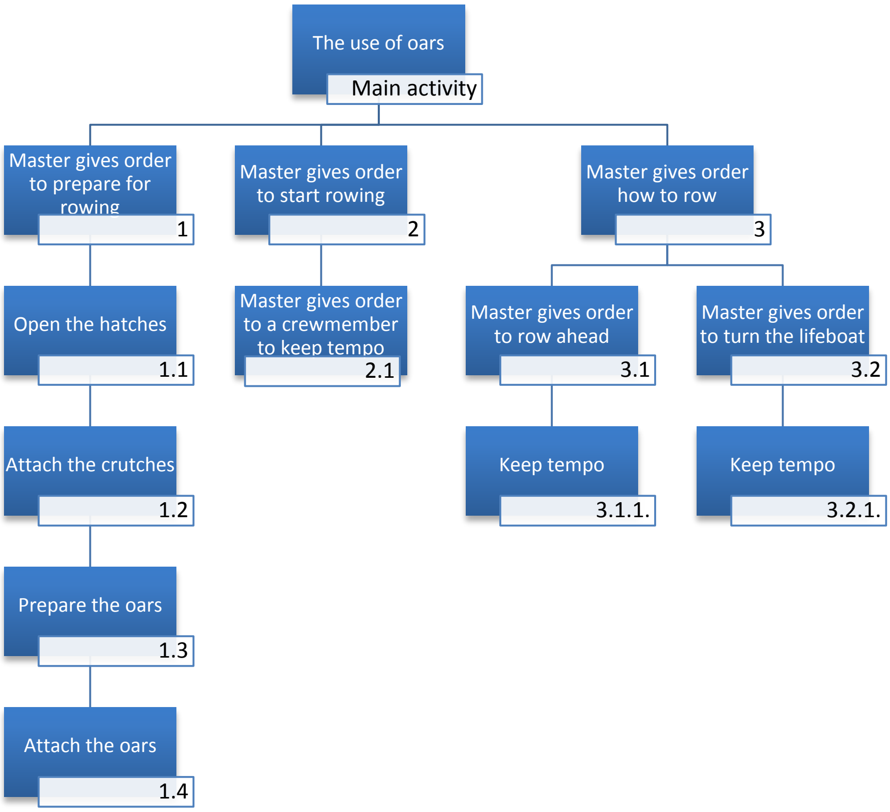

Figure 7: The use of the oars

Figure 7 describes how the oars were used during the experiment. The lifeboats master gave order to prepare for rowing, and the crewmembers closest to the hatches opened them and attached the crutches to their fitting near the hatches. The crewmembers preparing the oars attached the oars to the crutches and when this was done the master have order to a third crewmember to start shouting “row” (for example) in an evenly tempo every time a new rowing sequence is starting.

The master then gave orders how to steer the boat by the oars.

The experiment shows clearly that it is very difficult to use the oars in a lifeboat. Crewmembers didn’t manage to make headway with the lifeboat during the experiment, in calm sea, which is exactly what the oars are provided for according to the LSA Code.
One of the thoughts during the focus groups was the material the oars was build with, a more solid material should have been used such as wood instead of plastic because the oars failed to make headway due to the oars ability to bend.

4.5 The use of the sea anchor

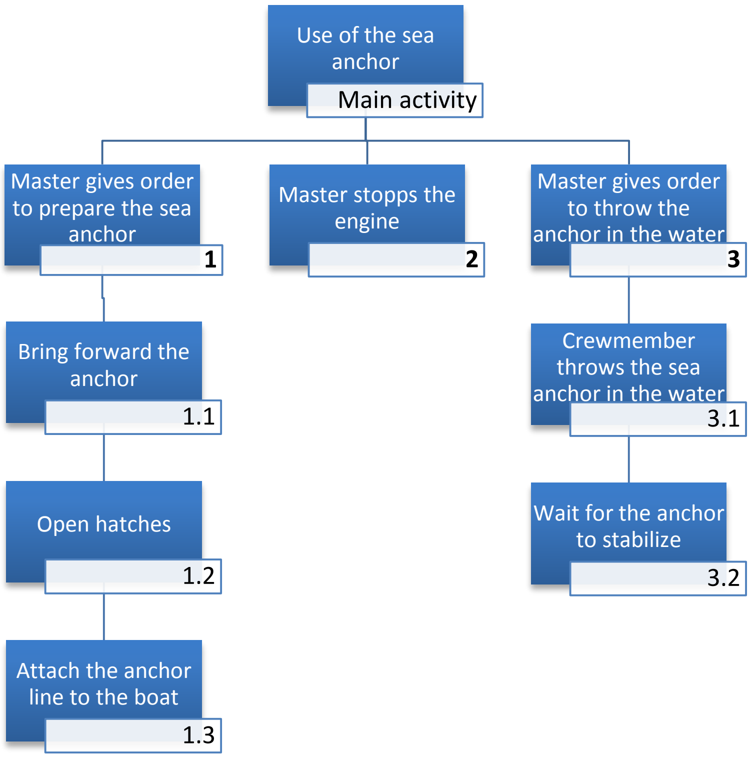

Figure 8: The use of the sea anchor during the experiment

Figure 8 describes how the sea anchor was used during the experiments. The master gave orders to a crewmember to prepare the sea anchor for use. The crewmember started with bringing forward the sea anchor from its fitting, and opens the hatch closest to a lashing point. The crewmember then secured the sea anchors line in a lashing point.

The sea anchor was then ready for deployment so the master stopped the engine and gave orders to throw the sea anchor in the water and wait for the sea anchor to be filled and stabilized.

The sea anchor was used with suitable result during the experiment. The sea anchor never stretched out because the lifeboat didn't make headway. The focus groups discussion didn't reveal any other thoughts about the sea anchor but the importance of it in bad weather and high seas and its ability to stabilize and prevent the lifeboat from drifting.

5 Discussion

The discussion chapter reviews methods for recruitment, data collection and analysis. Furthermore, this chapter reviews the results that emerged during the experiment and focus groups.

5.1 Recruitment

Recruitment for the experiment proved to be the hardest part of the work. Recruitment for the first planned experiment went relatively well when 23 third-year students and fourth-year students volunteered to participate. The day before the first experiment 15 students called and cancelled the participation. This meant that the experiment was not possible to conduct and the date of the experiment was postponed. In the end, one experiment was conducted with 16 first-year students that was undergoing "basic safety" that day, and a further 9 fourth-year students that resulted in 25 participants. This experiment was the only one conducted in the study.

Individuals who might be suitable as participants needed to have good knowledge of the tasks in an abandonment of the ship and the lifeboat, as well as having undergone "basic safety". In practice, persons working on board vessels or is undergoing education and training in order to work on board ship. Students from Chalmers University of technology have more or less the same or similar training and education as professional mariners, and they have similar but less experience in the area and could therefore be used for the experiment.

The usage of deck master mariner students, however, has its disadvantages because the fourth-year students have their own thesis to conduct which resulted in the requested quantity could not participate. The advantage of using the first-year students, however, was that they were undergoing their basic safety and had the basic knowledge fresh. As well as the fourth-year students have more experience in lifeboat drills than students in the younger classes, due to more internships than the first-year students.

The fact that such a high percentage of respondents were busy to participate was not calculated before the first experiment. This was alerted after the first experiment was due to be conducted. An offer by the instructor in charge of the basic safety training was presented that the authors could make use of 16 first-year students the following week, as they would already be in place and undergoing various exercises with the lifeboat. The recruitment had to step up at that point through the usage of social media and personal contacts. The result was that the second experiment was possible to conduct when the recruitment by using personal contacts and a small part of the social media gave results and another 9 people was able to participate.

5.2 Experiment method

The study could only be done in one way, through an experiment where the authors got the data by "direct observation". The authors were only able to conduct one experiment due to time limitations and the difficulty finding participants. The advantage of getting first-hand information is that it is based on the direct observation of the event. The authors could observe what was actually happening and not what the participants said or thought they would do (Denscome, 2014, pp. 271). The experiment took place in a natural environment as possible; the whole point of the study was to note the actions taken as they normally occur (Denscombe, 2014, pp. 271-281).

The disadvantage of the authors participating in the experiment was the risk to influence the situations being examined, therefore, the authors tried to minimize their presence. The person who received the master’s role was given a more thorough review of the parts to be examined but the authors were asked at times over the next steps in the experiment. The question was raised whether the observers/authors were able to blend into the background and not disturb the natural environment.

The authors also chose to record video and sound during the experiment, which facilitated the data collection. This was done to be able to go back after the experiment and look through the different actions take, so the study would not be affected by the ability not to remember everything in detail. There were two cameras taped to the inside of the lifeboat's hull, one that filmed forward and one that filmed the aft. There were two additional cameras that the authors themselves held to be able to film the different parts of the experiment easier.

5.3 Focus group method

The reason why it was chosen to combine participatory observation with two focus groups was with hope that the focus groups would complement the experiment and the design of the HTAs. What can be achieved by supplementing an ethnographic study with focus groups are first and foremost a concentrated insight on how team members think about the topic (Wibeck, 2009, pp. 58).

The discussion of a focus group can either be controlled structured with targeted questions or unstructured with a crosscutting issue that the group will discuss freely (Wibeck, 2009, pp. 45). It was chosen a semi - structured form because the participants were already familiar with the various issues and an experiment was done previously, where they were subjected to the same main objectives that would be discussed during the focus groups. The moderator explained that the same objectives and issues would be discussed as during the experiment they had been involved in previously.

The focus group results turned out as expected and it discussed the actions taken to achieve the main goals and no deeper understanding was required at that point. The moderators' role was extremely small in comparison with the participants. The moderator asked follow-up questions at the end of each main question completed about difficulties with each "operation", and there was a discussion at the end when all the main questions were completed on various difficulties in a lifeboat, waiting for rescue.

The advantage of using focus groups as a complement to the experiment was to gain a deeper understanding of each "operation" and the difficulties of being in a lifeboat and waiting for rescue. What are the obstacles and difficulties that may arise along the way such as urination, sick or injured people etc. Although, this was not something the study examined but it felt essential to raise and discuss for further studies in the future.

The focus groups were partly designed to give the experiment and observations more validity if the members came up with the same results as the experiment did and qualitative interviews was needed to get substantial quantities to get the equivalent amount of data as focus groups provide (Nyström & Dahlgren, 2013).

5.4 Hierarchical Task Analysis

A hierarchical diagram was chosen to express the result, with simple structure as an HTA provides a way to identify and organize the tasks and sub-tasks (Ainsworth, 2004, pp. 86). The authors also chose to produce a set of HTAs rather than to attempt to cover all situations within a single HTA (Ainsworth, 2004, pp. 86). The choice was made to divide the analysis in five different charts. The first diagram shows the main goal and sub-goals in order to get an overview of the study, and the other diagrams shows the sub-goals separately declaring their respective subordinate sub-goals.

The HTA method was a good choice for the authors to show the result as all actions taken to achieve the sub goals have been accounted for. The HTA is an extremely flexible method to work and analyze as the output provides a comprehensive description of the tasks and can be described in detail different depending on the purpose (Stanton, 2013, pp. 50). The downside of an HTA is that the method does not measure the cognitive components of the tasks and provides mainly descriptive information than analytical information (Stanton, 2013, pp. 51). The charts have been supplemented with a descriptive text under each sub-goal, so one who is not familiar with the type of operations or the language can follow the charts.

According to Stanton (2013, pp. 52): "*The HTA method achieves an acceptable level of validity but a poor level of reliability. It seems that different analysts with different experience may producer different analyses of the same task, and the same analysts may produce various analyses of the same task*." This is important to mention when the results of the same experiment can distinguish between different analysts as well as by the same analyst.

The authors don't see any other way this study could be carried out, but an alternative would be to carry out one or several experiments and apply grounded theory after the experiment was done with all the participants. Interviewing each participant about the various stages. In this case, the authors had possibly been able to get a deeper understanding of the actions taken to achieve the main goal of each task. As it was only conducted one experiment in this study it was more important with qualitative data rather than the quantity option. Had there been more experiments done, it maybe would be possible to get more data out of a quantitative questionnaire.

5.5 Discussion of the result

In this subtitle is the result of the experiment reviewed and analysed.

5.5.1 Immersion suit

Most of the participants were able to don the immersion suit under two minutes, during the experiment. The immersion suit was don a shore; therefor the participants weren’t affected by possible rolling and pitching that can be the case on a ship. This can affect the possibility to don an immersion suit under two minutes.

5.5.2 Embarkation

The result shows that it took 3 minutes and 52 seconds to embark into the lifeboat during the experiment, but it is reasonable to assume that the normal crew on board is capable of meeting the LSA’s requirement and be able to embark into the lifeboat under 3 minutes. This is also supported by the discussion during the focus groups, where the participants agreed on that the normal crew usually is well aware of the limitations that exist and have regular drills on embarkation. The test was only done once and with the one lifeboat (Harding), but either the focus groups or the authors think the results would be different with another lifeboat. If the embarkation test was done more than once though, it is likely that the results would be different and that the participants would have met the LSA requirement of 3 minutes due to the understanding of the lifeboats space limitations.

The study didn’t test any other requirements IMO has set for the embarkation. Namely, that it wasn’t achievable to test whether it is possible to embark if the "ship" has a trim of 10 degrees and has a list of 20 degrees, which is one of the requirements for embarkation. The study also didn’t test whether it is possible to take in people from either the sea or stretchers, if the safety belts or safety harnesses was able to keep a mass of 100 kg into place or the average weight of 82.5 kg per person on cargo ships, all wearing lifejackets. It was estimated that the average weight didn’t exceed 82,5 kg per person but the participants weighs was never asked.

5.5.3 Launching

During the experiment the launching was working fine. The experiment shows that the lifeboat that was used, was able to launch only by gravity. The test was only done once and with one lifeboat. It is possible that it may have been another result with another lifeboat.

During the experiment, one of the problem with launching is the communication between the involved crew members. On the lifeboat that was use during the experiment, four persons was involved in the boats launch, the master, one at the bow, one at the stern and one to operate the releases mechanism. To launch the boat in a satisfactorily way these four persons needs to cooperate and communicate, this gets harder due to sound mostly from the engine.

5.5.4 The use of the sea-anchor

One of the difficulties that came up during the focus groups with the sea anchor was how it is attached to the lifeboat; the sea anchor used during the experiment was attached to the lifeboat by a smaller bollard in the aft. This required that the crewmember needed to stay outside the lifeboat during an unnecessarily long time and exposing him or her selves to a greater risk, for example falling into the water. This could be solved more easily, by attaching the sea anchors line with a quick fastening hook.

The sea anchor was used with suitable result during the experiment. The sea anchor never stretched out because the lifeboat didn’t make headway but it can be considered that the sea anchor would work without major defects and meet the LSA requirement by stabilizing and preventing the lifeboat to drift away.

5.5.5 The use of the oars

The quality of the oars in the lifeboat was questionable, as it greatly limited its use. It was made of plastic, which clearly showed not suitable. The oars needed to be made of a more resistant material with sufficient buoyancy; wood could be a good option. It would also be appropriate that SOLAS and LSA Code implements regulations of the equipment's strength and quality.

One of the main issues that came up during the focus groups was the available volume; it also results in problems when rowing. The oars are placed in the bottom of the lifeboat, under the crewmembers feet and legs, resulting in movements when the oars are to be attach. A large part of the crewmembers must move to get the oars in position. This could be solved easier by for example stowing the oars just under the roof of the boat. It also appears difficulties for those engaged in rowing, since the space for rowing is limited.

It may be necessary to check the rudder angel when rowing; the rudder may work like a break in the water and make it impossible to make headway only using oars. During the experiment was the rudder angle not checked, which may have led to increased water resistance.

Given the many difficulties presented during the experiment with the oars, the crewmembers were unable to make headway with the lifeboat. Therefore, is it reasonable to question the relevance of the oars as mandatory equipment in the lifeboat? The lifeboats oars were made of plastic and it is also reasonable to question if the crewmembers would have made headway if the oars were made of more resisting material such as wood or if the experiment was done with another lifeboat. The discussions during the focus groups were that it is unlikely that another lifeboats construction would have made a difference but if the oars were made out of wood instead of plastic could have changed the outcome.

5.6 Other that emerged during the experiment and focus groups

During the experiment thoughts, ideas and experiences about lifeboats was brought to light, this study have not touched those subjects, but the authors would still like to highlight some of these.

5.6.1 Thoughts on difficulties on board a lifeboat

In the conversation with the participators of the experiment, there are three things that most of the participant was brought forward as difficulties they may be contrasted in a lifeboat, congestion and seasickness.

Congestion in the boat were experienced by a majority of participating, and by one described as a possible obstacle in the survival process. The boat used under the experiment is only 5.35 meters long and 2.30 meters wide, giving a surface area of 12.3 square meters to share with 25 other people all wearing survival suits and life jackets, it can easily be said that it is very crowded, every move from a person will directly affect those around.

That people in a lifeboat will become seasick is probably difficult to avoid, same asked about how vomit will be take care of a lifeboat, and they get very surprised when realise that there is no equipment for this task. There were a several of the participants who mentioned that vomit in the boat is one of the greater dangers, and thought it would be easier if the boat was equipped with garbage bags.

One problem that the majority of participants believe was a greater problem is how to carry out their needs, in the form as urinate and defecate. There is no equipment in the boat for this task, party participants described it as they probably had done its defecate on the outside of the boat, despite the unfavourable design, which does not leave much room for such activity. Someone also mentioned that there had probably been very difficult to do this in bad weather with high waves.

Some of the participants may even see difficulties of transporting an injured crew member in a lifeboat, and to carry out medical help as such as cardiopulmonary resuscitation (CPR), while same don't see it as a major problem, describe that the boat not is design for this task, but they had gone to solve it anyway, for example by placing the injured in the lap of some other crew members.

6 Conclusions

The result showed with help of the sub-goals that it is possible and achievable to don an immersion suit, launch by help of gravity within the lifeboat, to board the lifeboat and that it is possible for the sea anchor to stabilize and prevent the lifeboat from drifting in accordance with IMO regulations. The attempt to use oars to make headway in calm seas failed when the lifeboat did not make headway, and the oars went bent because they were made of plastic.

The study shows that there is a gap between work as intended and work as although, the study looked only at a small portion of the regulations for lifeboats and its equipment. Neither did the authors test all the requirements in the regulations. The question is whether there is a further gap that the authors have not looked at . This is an important subject to study since it is paramount that safety equipment, procedures and training are as close to the operative reality in which they must perform their functionality as to safe lives.

The authors suggest further research and experimentation around the lifeboat, its equipment, congestion and how humans are affected both physically and mentally while waiting for rescue under as realistic conditions as possible.

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Appendix 1 – Letter to the participants in swedish

Hej.

Vi är två studenter från Sjökaptensprogrammet på Chalmers Tekniska Högskola och vi ska skriva ett examensarbete under vårt fjärde och sista år.
Vi har valt att genomföra ett experiment där vi testar olika praktiska moment, från embarkering, sjösättning till hur det fungerar i praktiken att sätta ut ett drivankare m.m.

Insamling av data till vårt studie kommer att ske genom observation under övningen, samt under ett tillfälle där vi kommer att hålla i en fokus grupp.

Övningen kommer att genomföras fredagen den 21: e oktober, då vi alla 25 personer samlas på Sjösäkerhetscentrum på Chalmers Lindholmen 13.00. Övningen kommer att hålla på under eftermiddagen.

Fokus grupperna kommer att delas upp i två olika tillfällen á 7-8 personer under varje tillfälle och kommer att pågå under 1,5-2h där de olika momenten diskuteras.
Datum för fokusgrupperna är följande:

Grupp 1: 16:e Oktober 13:00-15:00
Grupp 2: 21:e Oktober 13:00-15:00

Insamlingen av data i livbåten kommer att spelas in via kameror, och fokus grupperna kommer att spelas in med hjälp av diktafon. Allt material behandlas konfidentiellt och kommer att transkriberas av oss.

Ert deltagande är frivilligt och ni kan välja att avbryta ert deltagande genom att meddela oss via telefon eller mail. Ni kan höra av er till oss om ni har några frågor kring studien eller ditt deltagande.

Vänliga hälsningar Anja Divkovic och Henrik Dahlrot

Kontaktuppgifter

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Appendix 2 – Letter to the participants in English

We are two students from the master mariners program at Chalmers University of Technology and we're writing a thesis in our fourth and final year. We have chosen to conduct an experiment where we test various practical parts, from embarkation, launching, put out a sea anchors and more.

Data collection to our study will be done by observation during the exercise, and during a time in which we will hold a focus group.

The exercise will be held on Friday, 21 October, when we all 25 people gather at the Maritime Centre at Chalmers Lindholmen 13.00. Exercise will keep on during the afternoon.

The focus groups will be split into two separate occasions á 7-8 people in any occasion and will last for 1.5-2 h, where the various stages are discussed. Date for the focus groups are:

Group 1: 16 October 13:00-15:00
Group 2: 21 October 13:00-15:00

Cameras will record the experiment, and focus groups will be recorded using a voice recorder. All materials will be kept confidential and will be transcribed by us.

Your participation is voluntary and you may choose to cancel your participation by notifying us by telephone or mail. You can contact us if you have any questions about the study or your participation.

Sincerely, Anja Divkovic och Henrik Dahlrot

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