University College of Southeast Norway

Shared Pilot Passage Plan and Navigational Safety During Pilotage

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Abstract

This study was initiated by major players in the shipping industry where a need for a better communication line between pilots and vessels were required. After a few accidents where the cooperation with the vessel's bridge team and the pilot did not functioned as required, the industry indicated that these accidents could be prevented if a Pilot Passage Plan (PPP) had been shared before the pilotage commenced. This led to the questions; of whether a shared PPP in the vessels Electronic Chart Display and Information System (ECDIS), lead to better navigation, more speedy recovery in case of navigational errors and higher navigational safety? 20 participants were recruited amongst 2nd and 3rd year nautical students at University College of Southeast Norway (USN) to act as captains and sail through a predefined route in narrow waters on USN's main navigation simulator together with a pilot. Two 3rd year students acted as pilots, ten participants had the route inserted in the ECDIS prior to the simulator run and could see the PPP through the entire exercise, and the last ten participants were not given the route prior the exercise and were only explained verbally where the pilot intended to go. In this study the pilot intentionally lost focus on the navigation at the same point in every simulator run and missed to make a specific turn. The study revealed that that the *time to express concern* and *time to recovery* is much shorter for the group with a shared PPP than for the group without a shared PPP. This difference was statistically significant and of a large effect size even after controlling for whether the participant where 2nd or 3rd year navigational students. The statistical significance of grounding was however too high to be accepted as statistically significant, but on the other hand the real-world implications of groundings are easy to envision. This study concludes that a shared PPP improves navigational safety during pilotage.

Abbreviations in this thesis are listed in Appendix 1.

Acknowledgement

I would not been able to carry out this work without valuable guidance from my supervisor Prof. Dr. Kjell Ivar Øvergård[1] who guided me through this master thesis with more effort that can be expected. This thesis' foundation was to perform a research in a real navigational environment as possible. Thomas Førli[1] made that possible by providing, setting up and running USN's main simulator "Horten" for this study. Thanks to Tine Viveka Westerberg[1] who made the initial and further contact with the students that participated in this study. Also thanks to Marius Imset[1] who was my first assigned supervisor and helping me getting started. Last but not least, thanks to Willy Arne Reinertsen (Vice President - Kristian Gerhard Jebsen Skipsrederi) who presented to me the original idea of sharing a passage plan between a pilot and a vessel. This would not have been a master thesis without his foresighted idea.

[1]University College of Southeast Norway (USN)

Table of Content

Introduction

In Norway there have been a few marine accidents that can be related to a bridge team not being sufficient prepared for a long or complex pilotage. The bulk ship Federal Kivalina ran aground October 2008 at Årsundøya in Møre and Romsdal (AIBN, 2010a). During the five hour long pilotage the pilot was occupied with talking in his mobile phone trying to establish whether the vessel could go directly to berth or not due to strong wind. At the same time the captain and the electrician were occupied with fixing the vessels Automatic Identification System (AIS) which was not working. The bridge team, including the pilot, did not notice that they passed a Way Point (WP) where they should have turned, and were now heading straight towards the island Årsundøya. At 05:10 hours 6. October 2008 in moderate visibility, Federal Kivalina grounded at Åresundøya in Møre and Romsdal county, Norway. The vessel got moderate damage to the hull and bow, but no water intruded into the cargo holds. The grounding resulted in no physical injuries and no oil spills (AIBN, 2010a).

Another accident was with Crete Cement, which grounded at Aspond island just outside Fagerstrand (Nesodden) in November 2008. At the WP south of Aspond, new course order was not given by the pilot and the vessel headed towards the island. The vessel grounded and took in water but managed to stay afloat. Due to the severe damage to the hull and the possibility that the vessel could sink, the captain together with the pilot decided to beach the vessel close to Fagerstrand. The Accident Investigation Board Norway (AIBN) concluded that one of the reasons for not following the planned route was that the pilot did not have enough rest before embarking and commencing the pilotage. The pilot’s behavior on the bridge just before the grounding implies that his attention was reduced probably due to sleepiness during a 90-100 seconds period (AIBN, 2010b).

In both cases the bridge team did not function as intended (AIBN, 2010a, 2010b). The owner of Crete Cement, Kristian Gerhard Jebsen Skipsrederi (KGJS), implied that accidents like these could be prevented if the vessel had received the Pilot Passage Plan (PPP) in advance and already inserted it into their navigation system such as an Electronic Chart Display and Information System (ECDIS) before the pilot embarks. With a shared PPP on board, the bridge team would have the opportunity to review and be familiarized with the route before the pilotage commences and be better prepared in case of an emergency situation.

The original idea presented by KGJS has transformed it into a master thesis project. Furthermore, the intention with this study is to evaluate whether sharing the PPP with the vessel, will enhance the safety of the pilotage. This study may give identification of the importance of sharing a PPP, and that may be in interest of the Norwegian Costal Administration (NCA) and other coastal administrations.

The aim and purpose of this study is related to the International Maritime Organization's (IMO) work on e-navigation. E-navigation is defined by IMO as *"…the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment."* (IMO, 2009, p. 173).

Three projects that are trying to establish route exchange in line with IMO's e-navigation strategy are; 1) the European Union (EU) project Sea Traffic Management (STM) (http://stmvalidation.eu/) led by the Swedish Maritime Administration which aims to provide vessels the ability to see each other's planned routes, 2) EfficienSea (http://www.efficiensea.org/) which aim to improve maritime safety and the environmental state of the Baltic Sea region, and finally 3) SESAME Strait (Secure, Efficient, and Safe maritime traffic Management in the Straits of Malacca and Singapore) (http://straits-stms.com/) that several Norwegian stakeholders like University College of Southeast Norway (USN), Kongsberg Maritime and NCA are heavily involved in. SESAME Strait aims to predict possible vessel traffic hot-spots in congested waterways and offers new strategies to avoid such congestions.

Regulation and Common Practice

The importance of employing qualified pilots in areas where local knowledge is required was formally recognized by IMO in 1968 when the Organization adopted Assembly resolution A.159(ES.IV) Recommendation on Pilotage (IMO, 1968). In this resolution IMO *"Recommends to governments that they should organize Pilotage services in those areas where such services would contribute to the safety of navigation in a more effective way than other possible measures and should, where applicable, define the ships or classes of ships for which employment of a pilot would be mandatory."* (IMO, 1968, p. 1).

In Norway the Norwegian Pilotage Act (Ministry of Transport and Communications, 2015) applies to Norwegian internal waters and territorial sea including Svalbard. The Act lays down the legal framework for compulsory pilotage, duties of the pilot and the master during pilotage, the principles of Pilot Exemption Certificates (PEC) and fees related to the pilot services (NCA, 2016a). This act together with the Compulsory Pilotage Regulation, which regulates which vessels that are subject to compulsory pilotage and the waters where the requirement applies (NCA, 2016b), forms the Norwegian legislation of pilotage.

IMO Resolution A.893(21) Guidelines for Voyage Planning (IMO, 1999) requires all vessels to perform *"...detailed planning of the whole voyage or passage from berth to berth,* *including those areas necessitating the presence of a pilot…"*(IMO, 1999, p. 2). This means that the vessel needs to plan the pilot passage as well as the sea voyage.

A pilot is a skilled navigator with local knowledge and is authorized by the costal administration to give the captain speed and course advises in compulsory pilotage waters (NSA, 2016b, §8). The pilot does not have any formal responsibility for the navigation and safety of the vessel. The captain always has this responsibility and the command of the vessel (IMO, 2014, §5.2 p. 16). In theory, the pilot gives the captain advises on which course to steer and what speed to maintain, while the captain gives orders further on to his bridge team who in the end executes these orders. This is a theoretical and cumbersome way of performing the navigation, but it illustrates the responsibilities between the pilot and the captain. In real life, the pilot gives course orders directly to the helmsman (in manual steering) and engine orders to the Officer Of the Watch (OOW), while the captain supervises the whole situation. The captain can and must take over the control at any time he/she feels the pilotage is not conducted in a safe manner (IMO, 2014, §5.2 p. 16). While sailing on autopilot the OOW will normally change course on the steering console. It should always be the ship's crew that handles the bridge equipment since the pilot is not familiar with all types of engine telegraphs and steering consoles. Wrong handling of bridge equipment can result in unwanted incidents.

Information Sharing and Team Performance

Most early work on information sharing originates from Stasser and Titus' (1985, 1987) biased information model. This model demonstrates that groups spend more time discussing shared information (information they already know) than unshared information (Stasser & Titus, 1985, 1987; DeChurch & Mesmer-Magnus, 2009). Further, DeChurch and Mesmer-Magnus

(2009) did a meta-analysis on information sharing and team performance. They found that sharing unique information (sharing information not commonly known by all team members) increases the general knowledge which directly improves the outcome of a team. Openness of information sharing (breadth of information shared) was also related to performance but found less strongly than uniqueness (DeChurch & Mesmer-Magnus, 2009).

In a maritime domain both technical and non-technical skills are important. Technical skills are how a person operates technical equipment and handles standard operating procedures (Øvergård, Sorensen, Hontvedt, Smit & Nazir, In press; Flin, O´Connor & Crichton, 2008). Technical skills often define a profession and seen as the *hard skills* related to standard operating procedures and use of technical systems. Non-technical skills complements technical skills and involve Situation Awareness (SA), decision-making, communication, leadership, stress management, coping with uncertainty and teamwork (Øvergård et al., In press; Flin et al., 2008). Many maritime accidents can be related to failure in some form of non-technical skills rather that technical failure (Øvergård et al., In press; Hetherington, Flin & Mearns, 2006).

Teamwork on board a vessel's bridge and engine room is essential in order to maintain a safe voyage involving successful navigation, maneuvering and supervision of technical systems. Bridge teams are often complex and of variable compositions (Øvergård et al. In press). A bridge team composition can vary from one single navigator in open waters at day time, to include captain, OOW, helmsman, lookout together with a pilot during port arrivals and departures. Adding a pilot as a new member in a well function bridge team can lead to new safety challengers such as who is in charge and the knowledge of the vessels handling characteristics. On top of this the bridge team will likely be a mix of nationalities, cultures and languages.

Sorensen and Stanton (2012) suggested in their research that inadequate organization of a team and poor communication leads to poor task performance (see also Singleton, 1989), and concluded that organizational structure did appear to have an effect on team performance with noticeable difference between the different teams (Sorensen & Stanton, 2012). Following up on Sorensen and Stanton (2012), Øvergård et al., (2015) found that the relevancy of team communication and the situational correctness of communication could be a good indicator of both good and bad team performance. Hence, correct communication and Distributed Situation Awareness (DSA) within teams are important factors for successful team performance (please see e.g. Nazir et al., 2015; Øvergård et al., 2015).

As mentioned earlier the IMO resolution A.893 (21) (IMO, 1999) ensures that all vessels have to make a voyage plan from berth to berth including the pilotage. In many cases it can be difficult to predict exactly where the pilot intends to go. The result can be that the OOW is occupied with altering their voyage plan in the ECDIS because it is not according to the pilot's plan. This can create a scenario where the bridge team is occupied with other tasks than supervising the pilot's actions and not able to prevent incidents if unwanted situations occurs. Having the PPP in ample time before commencing the pilotage, the bridge team can insert it into their ECDIS and be well familiarized with the passage plan and have an improved understanding of the forthcoming voyage and better communication with the pilot.

Situation Awareness

Having an accurate understanding of what is going on is essential for any teams that are working together. SA is the term that is used within human factor circles to describe the level of awareness that operators have of the situation that they are engaged in (Stanton, Salmon, Rafferty, Walker, Baber & Jenkins, 2013). It focuses on how operators develop and maintain a sufficient understanding of what is going on in order to achieve a successful task performance (Stanton et al., 2013; Endsley, 1995).

This also applies for bridge teams that are working together for the same goal, such as; navigating a vessel safely to berth. Poor SA can be an incomplete overview over the situation, which can lead to poor or no decision-making at all in an emergency situation. SA focuses on how navigators develop and maintain sufficient understanding of what's going on in order to achieve success in task performance such as safe navigation (Endsley, 1995). DeChurch and Mesmer-Magnus (2009) found in their meta-analysis that sharing unique information (information not known by all team members) clearly increased the team's performance and shared SA. Shared SA refers to the "*degree to which team members possess the same SA on shared SA requirements*" (Endsley & Jones, 2001, p. 48). In other words, maintaining the effectiveness of a team requires that the knowledge of the situation is distributed to all team members. Otherwise, this may lead to errors and miscommunications and a high possibility of team performance deterioration (Saner, Bolstad, Gonzalez & Cuevas, 2010).

Hence, sharing a passage plan among a team may improve team work and communication by being an externalized representation of the goals for the voyage, and we would expect that a shared PPP would improve team performance and navigational safety.

Research Question

While establishing the research question for this study, three outcomes from shared information between a pilot and a vessel surfaced as obvious goals; 1) improve and perform better navigation in confine waters, 2) discover and respond quicker if an unwanted situation occurs, and ultimately 3) achieve higher navigational safety. These three outcomes formulated this study's hypotheses:

Hypothesis 1: A shared PPP represented in the vessel's ECDIS will lead to better situation awareness.

It is believed that enhanced information will allow navigators to better and quicker identify deviations from the PPP.

Hypothesis 2: A shared PPP represented in the vessel's ECDIS will lead to a faster recovery in the case of navigational errors.

It is believed that presence of PPP will lead to a quicker recovery and faster actions in case of navigational errors.

Hypothesis 3: A shared PPP represented in the vessel's ECDIS will lead to higher navigational safety.

It is believed that bridge teams with PPP will have a lower probability to run aground since navigators will identify deviations and correct them quicker.

Method

As mentioned in the introduction, the initial idea for this project was formulated by the author when KGJS, a major player in the shipping industry, saw the need to change the way pilotage in Norway was conducted after a number of serious incidents. The ideal research environment would naturally be on board real vessels during real pilot passages. However, this real test bed would be very time and resource consuming for a master thesis, along with several other challenges that arises such as; different type of vessels, various weather conditions, captains and navigation officers with a variety of experiences and cultural background, a variety of workload and fatigue levels prior to the pilotage and last but not least the pilot's interest to participate.

The research was conducted on the main navigation simulator "Horten" at the University College of Southeast Norway (USN) with 2^{nd} and 3^{rd} year nautical bachelor students as participants. On a simulator the research can be conducted in the exact same environment in every sample which minimizes any discrepancies when it comes to vessel, weather, fatigue, cultural background and more or less cooperative pilots.

Group 1 consisted of ten bridge teams that did not have the PPP, and group 2 consisted of ten bridge teams that were given the PPP before commencing the voyage. Initially the intention was to recruit two participants for each team – in total 40 students. The reason for teaming up two participants was to simulate a real bridge team during a normal pilot voyage (one captain and one lookout/helmsman).

With two participants on the bridge in addition to the pilot, it was expected that the team would mentality be more capable to supervise the pilot and detect any mistakes earlier. However, due to too few respondents it was decided to conduct the study with only one participant in the role as the captain in addition to the pilot. It was not optimal but an acceptable setup. Since the participants were recruited to be part of a study where communication and cooperation with a pilot was the concept, the students were very switched on and obviously expected something to happen during the simulator exercise. Therefor a bridge team consisting only of one navigation officer was considered as valid and in line with a real situation.

The author was merely acting as an observer, observing the exercise while noting performance indicators and observation points in addition to video record the entire session.

Figure 1: “Horten” Navigation Simulator at USN - Kongsberg Bridge Line 10 simulator (upgraded to K-Bridge software) with a 225˚ forward view (copyright author).

Participants

The 20 participants (two females) age ranged from 22 to 48 years (mean = 26.1 years, SD = 7.6). The participants for this study were recruited amongst 2nd and 3rd year nautical students at USN, in total twelve 2nd year students and eight 3rd year students. Both pilots were male 3rd year nautical students, age 22 and 25 years old. By choosing only students as participants this study ended up with a sampling group that was very homogeneous, even though there was a difference in their degree course level and simulator experience. The distribution of the participants´ study year where not balanced across the conditions (see Table 1), hence it was controlled for study year by using study year as a co-variate in statistical analysis.

Table 1: Crosstable of class year of participants and availability of shared PPP

		Shared Pilot Passage Plan		**Total**
		No	Yes	
Class year	2nd	8	4	12
	3rd	2	6	8
Total		10	10	20

All participants were familiar with the navigation simulator “Horten” (since simulator training is part of their degree courses) and they have the same professional and cultural background. An additional group of experienced navigation officers was considered to be a part of the study, but the idea was discarded in order to keep the group of participants homogeneous.

Initially a simulator instructor at USN was intended to take the role as the pilot, but this idea was also discarded because that scenario could create a teacher/student relationship where the students were reluctant to challenge the teacher’s (pilot’s) decisions. Therefore two 3rd year students were asked to take this role and they performed as pilot one day each.

Sampling Strategy

The first step of contact was an email that was sent to all 2nd and 3rd year nautical students, firstly to inform about the project and secondly to invite them to sign up for participation (Appendix 4). In order to achieve the required number of participants, they were also approached directly while having lessons and simulator training.

Ethical Considerations

Permission to conduct this study was sought and accepted by the Norwegian Social Science Data Service (Norsk samfunnsvitenskapelig datatjeneste – NSD). The application to NSD (Ref.

No. 45714) included a written consent form (Appendix 7) and a questionnaire. Each participant was presented the consent for signing prior the exercise in order to ensure anonymity and the participant's right to withdraw from the study at any time. All video recordings were kept available only to the author and supervisor at all time, and were deleted at the end of the research process.

Simulator Setup

The exercise was conducted on USN's main simulator "Horten" which is a Kongsberg Bridge Line 10 simulator (upgraded to K-Bridge software) with a 225˚ forward view that enables realistic and detailed simulation of vessel movement, weather, environments, sea condition and navigation marks.

The simulator was set up with a frigate as the vessel model. This is an easy maneuverable vessel so that the vessel's inertia and Rate Of Turn (ROT) would not be an issue for the results. The fact that the chosen vessel was a military frigate, and not a merchant vessel, was found to have no influence or significance for the exercise and its performance indicators. The weather was set to calm with good visibility while there were no interfering traffic to consider for the participants. Speed was set to 15 knots (kn) for all runs.

Experimental Design

This study was a true experiment with between group design where independent variables were presence or absence of a shared PPP.

Procedure. The study was conducted during two afternoons in January 2016 with 15 days apart. The actual simulator run took approximate ten minutes but each participant had allocated

Figure 2: “Horten” Navigation Simulator at USN - Kongsberg Bridge Line 10 simulator (upgraded to K-Bridge software) with a 225˚ forward view (copyright author).

Figure 3: Control center where the simulator instructor controls all navigation simulators at USN, including “Horten” (copyright author).

in total 20 minutes for inclusion of briefing, debriefing and the opportunity to adjust the radar to their preference.

The simulator exercises were conducted on two days with two separate groups of students. In both groups 2nd and 3rd years students were mixed. In total, 20 students signed up to participate as captains in the study. Two 3rd year students took the role as pilots. Pilot 1 took the first day and first group of ten participants which did not have the shared PPP. Pilot 2, who also participated as captain on the first day, was the pilot for the second group on the second day who had the shared PPP in advance.

Prior to the day of the simulator exercise, all participants received an email (Appendix 5) which described the correlation between a bridge team/captain and a pilot, other practical information including the consent form (Appendix 7) and a time table for the exercise. When showing up on the simulator, each participant was explained about the consent form and signing it accordingly, followed by a short briefing conducted by the author. The participant was then given the opportunity to adjust the radar as desired. When the participant was ready the pilot entered the bridge, the first course was given and the exercise started.

Group 1 on day one did not have the PPP inserted in to the ECDIS and were only explained about the route verbally and shown in chart where the pilot intended to go by the author. Group 2 on day two had the PPP inserted in to the ECDIS and could see which route the pilot intended to go during the whole exercise. Both groups had a working radar with Electronic Bearing Line (EBL) and Variable Range Marker (VRM), and visual means to secure the vessels position at all times.

The first two runs on day one had the GPS position displayed in the ECDIS. This means that they could see the vessels exact position real-time in the Electronic Navigation Chart (ENC) plotted continuously during the voyage. After these two runs it was decided to remove the GPS signal to the ECDIS in order to simulate a navigation bridge equipped according to minimum IMO requirements. Then the ENC would merely act as standard paper charts and the participants would have to take bearings manually and regularly to establish the vessels position. In order to eliminate discrepancies between the two groups it was decided to conduct the first two runs on day two with GPS position as well and the rest without GPS. This means that the measured result between the two days is directly comparable.

Chosen Route

The chosen route for this research is the same route as Crete Cement had planned to sail when it run aground on the island Aspond 19. November 2008. Crete Cement was heading for Slemmestad after having taken on board approximately 5,000 tons of cement at Norcem Brevik. The route is a normal northbound navigation route for smaller types of vessels such as Crete Cement.

The area is not characterized as particularly challenging but the water is confined and has numerous shallows. The pilot on board Crete Cement had according to AIBN (2010b) a momentarily lapse of consciousness just before WP2 (see Figure 4) and they grounded on the island Aspond before she was beached close to Fagerstand (north of WP3).

In this study WP4 was chosen as the point where the pilot loses his focus, mainly due to the limited time frame after passing WP2. If WP2 was chosen as where the pilot slips, the participants would only have 0,2 nautical mile (nm), or 48 seconds, to realize that something was wrong and decide an appropriate action to avoid grounding. After passing WP4 the participants have more time to perceive deviation from the PPP and a fair chance to act accordingly.

Execution of the Exercise

The northbound route had Slemmestad in the Oslo Fjord as destination. The exercise starts just before WP2 with the course 326˚. The pilot takes the vessel through WP2 to course 014˚ and WP3 to course 333˚ as intended and according to the PPP. Just before WP4 the pilot becomes occupied with his mobile phone and loses focus on the navigation while continuing on the course 333˚ through WP4 towards the island Langåra. On this course the vessel is heading directly for a red buoy on the shallow Sydostgrunnen. The distance between WP4 and Sydostgrunnen is approximate 0,5nm and with a speed of 15kn the vessel would ground within two minutes if the captain does not interfere. The stipulated line in Figure 4 and 5 is the course the vessel will continue on if the captain does not make a starboard turn at WP4.

Group 1 – the first ten participants went through the scenario without any information about the route other than; shown where the pilot intended to go in the chart, the destination (Slemmestad), the position where the exercise started, vessels heading and speed, and that it was a normal pilotage scenario where the pilot gives course and speed advises and the captain executes these changes if he/she agrees.

Group 2 – the last ten participants were given the same information as group 1, but in addition they had been given the PPP in advance of the exercise, which was ready and inserted in the ECDIS. In all 20 runs (i.e. for both groups) the pilot intentionally lost focus at the same point before WP4 and maintained the same course until the captain interrupted or intervened.

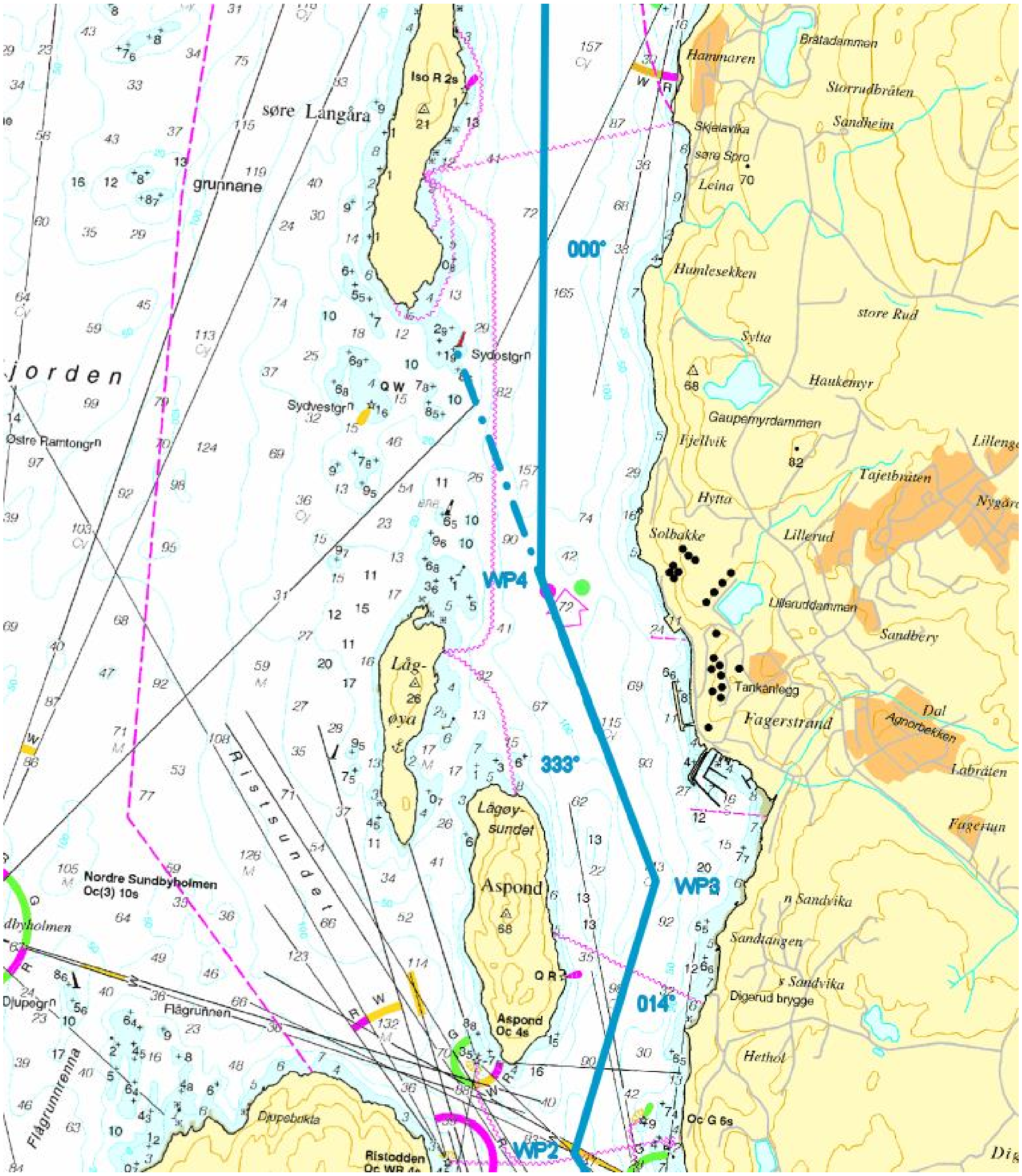

Figure 4: Planned route in solid line and course towards Sydostgrunnen in stipulated line.
Source: Kart.kystverket.no

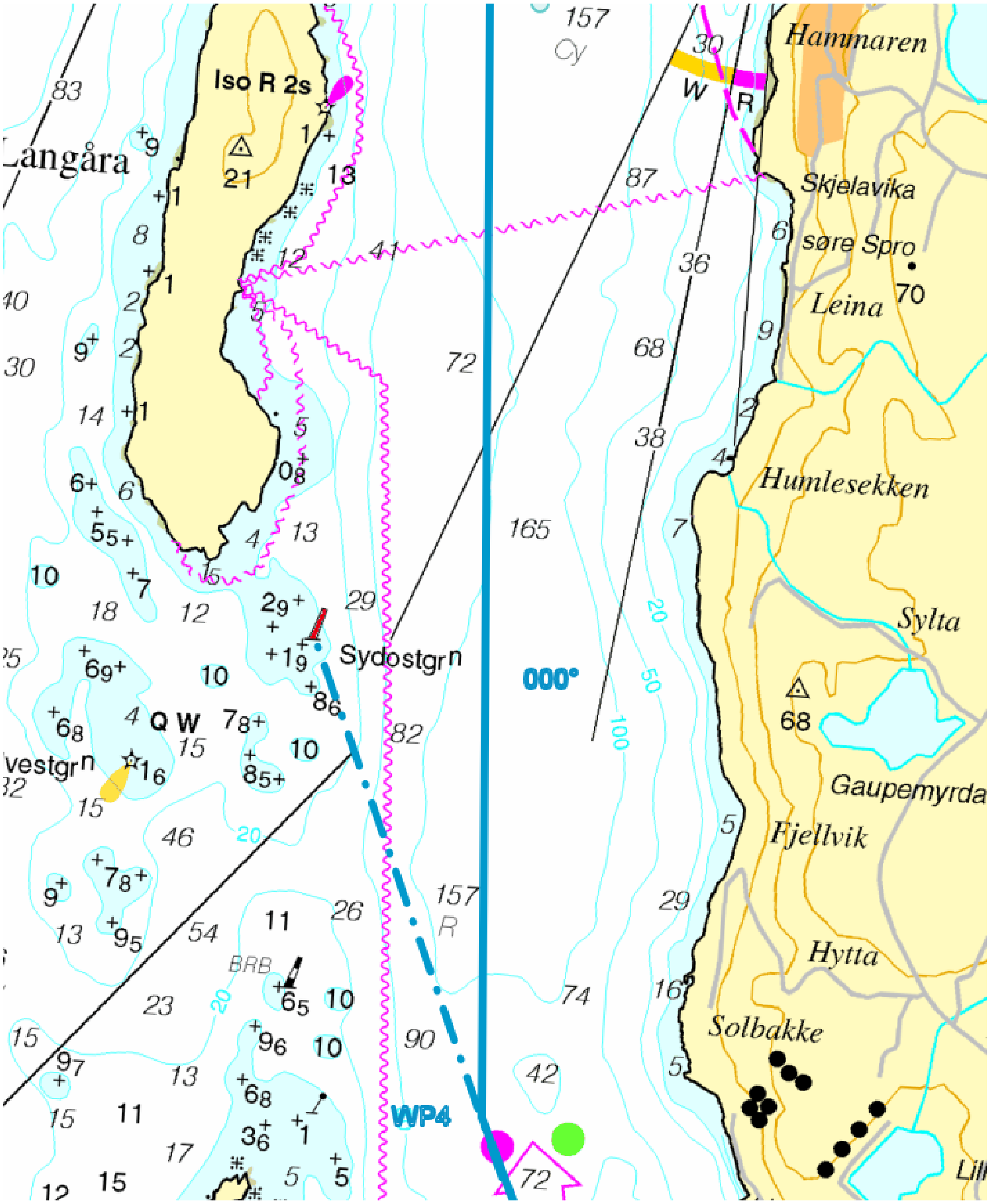

Figure 5: Planned route with course towards Sydostgrunnen in stipulated line. Source: Kart.kystverket.no

Measures

The time observed in this study is taken from when the vessel passes WP4. If no route is inserted in the ECDIS it can be difficult for the observer to determine exactly when the vessel passes a certain point. Therefore, observing all simulator runs from the exact same place on the bridge, one can use a visual aid to determine when the vessel passes WP4. It was established that the vessel passed WP4 when a buoy on port side reached the sill of a bridge window. This is a common and highly used method for determine a vessels position e.g. when passing buoys in narrow waters. It is estimated that the recorded time is exact within one to two seconds. Watching the video recordings after the exercise, the measured time was verified by using the same visual aid. The following performance indicators were recorded:

Time to expressing concern. It was recorded the time in seconds from when the vessel passed WP4 to when the participant verbally expressed concern about the absence of the pilot's focus, vessels heading or position. Some participants clearly showed by body language that they were not comfortable with the situation, but only when they expressed it verbally it was recorded. However, some participants commented after the exercise that they did react on the pilot's use of mobile during the voyage. A common expression by the participants afterwards was that *"he had been here the whole day and I thought he was bored or fed up with the task as a pilot"*.

Time to action. It was recorded the time in seconds from when the vessel passed WP4 to when the participant took command and physically made a maneuver of the vessel. When the participant expressed concern about the pilot's performance, the pilot did not immediately correct the course. He continued having focus on his phone and gave vague answers. Therefore the participants had to make their own decisions without any help from the pilot after passing WP4.

Action. It was also recorded what kind of maneuver the participant did to prevent a dangerous incident or grounding. In all instances the participants made a turn to starboard towards the planned course 000˚.

Communication. Communication between the pilot and the participant prior, during and after passing WP4 was also recorded. Most of the communication between the pilot and the participant consisted of the participant's desire to know what the next course was and when to perform it. This was more or less consistent with all participants.

The main measure in this study was *time to expressing concern* and *time to action*. These two measures is the foundation of the study and subject for the calculated statistical result.

Table 2: Observer Rating Form

Performance indicators	
Team #:	Pilot passage plan (Y/N):
Age:	
Male or female (M/F):	
2nd or 3rd year nautical student (2/3):	
Start exercise:	Stop exercise:
Time after WP4 when expressing concern:	
Time after passing WP4 before action:	
Action:	
Grounding (Y/N):	
Communication prior passing WP4:	
Communication after passing WP:	

Table 2 shows the form used by the observer during the simulator exercise to record the participant's performance indicators along with personal information such as age, gender and 2nd or 3rd year nautical student. In addition the observer had a chart with the route to mark the measure points geographically (see Figure 5).

Each simulator run was video recorded with a regular photography camera (Canon EOS 70D) in HD 1080p from the same position on the bridge; starboard aft side shooting forward and diagonally covering the entire bridge. These video recordings were used to verify measured time for the participant's expression and actions along with observed communication with the pilot.

Questionnaire. All participants were given a printed questionnaire directly after the exercise to answer and deliver it before they were dismissed. The questions in the questionnaire were formed in a way to capture the participant's thoughts and perceptions during the exercise. Table 3 shows the questions in the questionnaire given to the participants. In addition to this they received a chart (Figure 5) to mark where they realized that something was wrong (question 2) and when they acted to prevent grounding (question 5). See Appendix 3 for questionnaire answers from all participants.

Table 3: Questionnaire

	Questions
1	How did you experience the communication between you and the pilot?
2	When did you realize that something was wrong? (mark #1 in chart)
3	What in your opinion was wrong?
4	Did you decide to act on the situation? Explain why/why not. (If NO, go to question 8)
5	When did you decide to act? (mark #2 in chart)
6	What did you decide to do? Explain why.
7	Did your action prevent grounding? Explain why/why not.
8	What in your opinion would be helpful to preventing a critical situation or grounding in this case? (E.g. equipment, information or other resources)

Briefing and Debriefing of the Participants

Before the exercise all participants received an email (Appendix 5) with information about the study. In this email they were informed that the study was part of a master thesis and the purpose of the exercise was to measure information flow and interaction between a pilot and a bridge team. Further it was explained the legal correlation between a pilot and a captain on board a vessel, and basis information of how the exercise practically was going to be conducted. Finally they were urged not to inform the other participants about the concept and the plot of the exercise. This was stressed further before the simulator exercise commenced so that all participants had the same base of information before they attended the simulator. The first group was not given much explanation afterwards regarding the purpose of the exercise. This was to limit the information leakage to the other participants because this could affect the result. The second group got some more information after the exercise but not given the whole picture due to limited time allocated for each participant. Therefor all participants received an email with a thorough explanation of the background, purpose and goal of the study when all simulator runs had been conducted (Appendix 6).

Data Analysis

The statistical analysis was performed by using IBM SPSS Statistics v.23 ® to evaluate if the difference between the two groups were significant. For hypothesis 1 and 2 Univariate GLM (ANCOVA) was used to calculate if the difference between the groups were of statistically significant and of a large effect size. For hypothesis 3 a Fischer´s Exact Test was used to calculate whether the difference in number of groundings per group was statistically significant.

Result

Measured result recorded during the simulator exercise can be viewed in Appendix 2 together with the calculated mean values (not corrected for participants' year of study). The simulator runs have also been extracted from the Kongsberg Polaris Navigation simulator system and can be viewed graphically in Figure 6 and 7. In Figure 6 all ten runs by the group without shared PPP is pasted on top of each other, and in Figure 7 all ten runs by the group with shared PPP is displayed. Here the actual sailed track (brown track) can be visualized up against the planned route (blue line). The red lines indicate the vessels heading when the exercise was stopped.

Evaluating Impact of Shared PPP on SA (Hypothesis 1)

To investigate whether there was a difference between the groups without (group 1) and with a shared PPP (group 2) an Univariate GLM (ANCOVA) with *Time to Expressed Concern* as dependent variable, group (shared vs no shared PPP) as independent variable and the participant´s study year as a covariate was calculated.

The results supports Hypothesis 1 by indicating that the time to express concern (which is an indicator of SA) is much shorter for the group with a shared PPP (Mean = 10 seconds, SD = 12.028) than for the group without a shared PPP (Mean = 37.6 seconds, SD = 18.638). This difference was statistically significant and of a large effect size even after controlling for whether the participant where 2nd or 3rd year navigational students ($F_{(1, 17)}$ = 13.354, p = .002, η_p^2 = .44, Adjusted R^2 = .404). Hence, participants that had a shared PPP realized on average that something was wrong much faster than the participants that did not have a shared PPP.

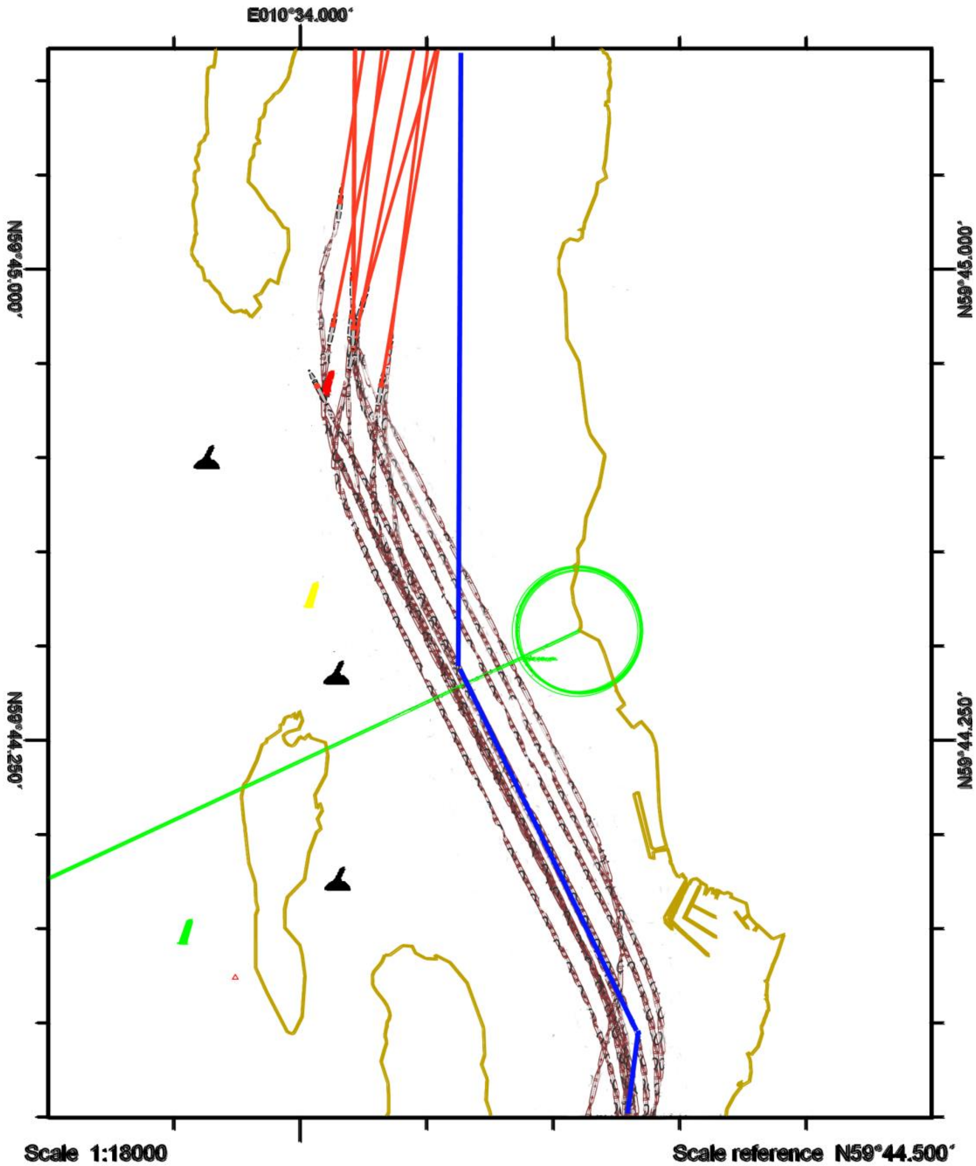

Figure 6: Group 1 without a shared PPP. Extract from Kongsberg Polaris Navigation simulator.

Evaluating Impact of Shared PPP on Speed of Recovery (Hypothesis 2)

To investigate whether there was a difference between the groups without (group 1) and with a shared PPP (group 2) a Univariate GLM (ANCOVA) with *Time to Action* as dependent variable, group (shared vs no shared PPP) as independent variable and the participant´s study year as a covariate was calculated. Results again supports Hypothesis 2 by indicating that the time to recovery is much shorter for the group with a shared PPP (Mean = 24.6 seconds, SD = 25.544) than the group without a shared PPP (Mean = 68.9 seconds, SD = 30.701).

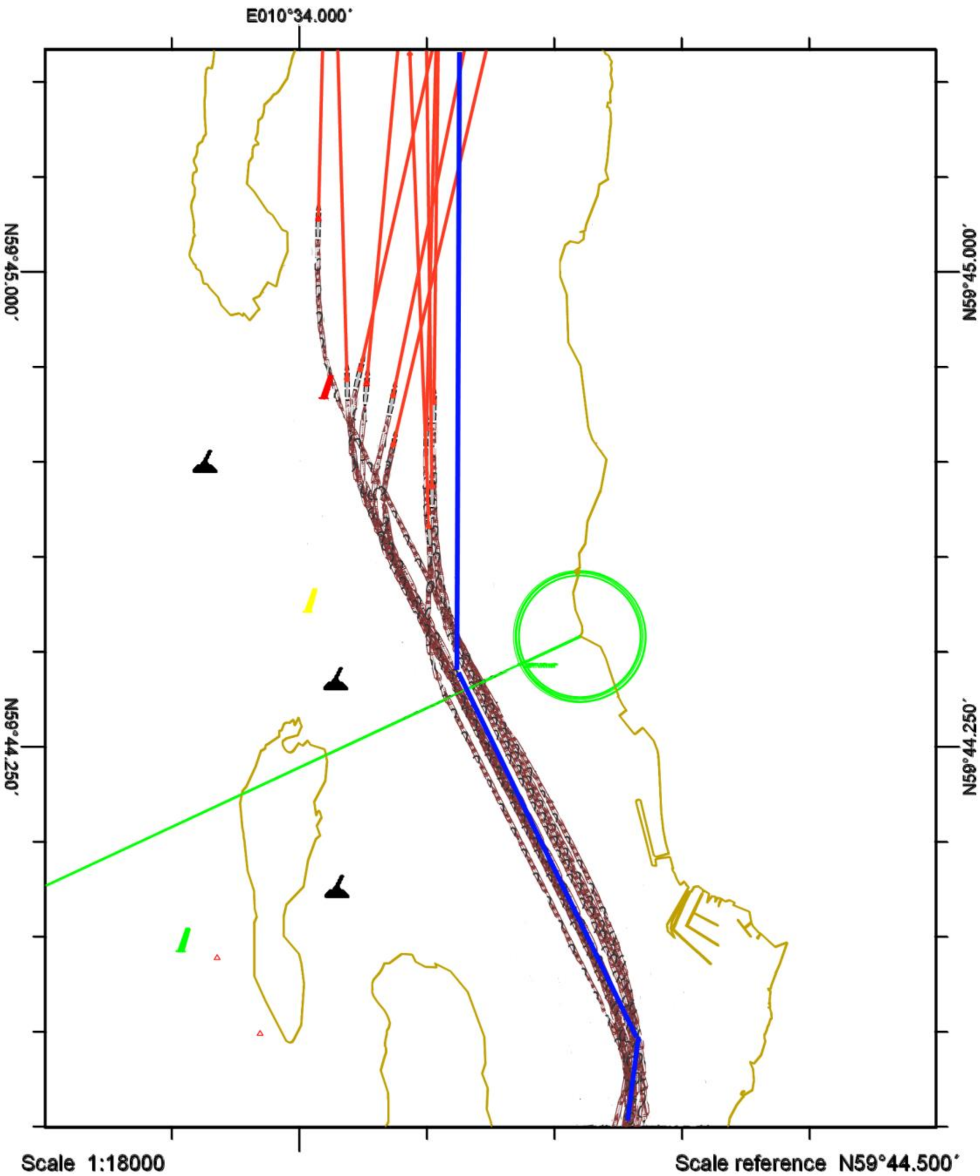

Figure 7: Group 2 with a shared PPP. Extract from Kongsberg Polaris Navigation simulator.

The difference was of a large effect size and statistically significant even after controlling for whether the participant where 2nd or 3rd year navigational students ($F_{(1, 17)}$ = 9.537, p = .007, η_p^2 = .359, Adjusted R^2 = .336). Clearly, the results are in accordance with Hypothesis 2, a shared PPP enables navigators to more quickly recover from navigational errors done by the pilot, hence improving navigational safety through ensuring passage according to plan.

Evaluation of Navigational Safety (Hypothesis 3)

As a measure of navigational safety the number of groundings was recorded. As can be seen in Table 4 the group without shared PPP had three groundings while the group with shared PPP had none.

Table 4: Crosstable of shared PPP and groundings

		Shared Pilot Passage Plan		**Total**
		No	Yes	
Grounding	No	7	10	17
	Yes	3	0	3
Total		10	10	20

When taking class year into account the result can be seen in Table 5.

Table 5: Crosstable of shared PPP and groundings taken class year into account.

PPP	**Class year**	**Grounding**		**Total**
		Yes	No	
Yes	2^{nd}	0	4	4
Yes	3^{rd}	0	6	6
No	2^{nd}	3	5	8
No	3^{rd}	0	2	2
Total		3	17	20

The statistical significance as measured by a Fischer´s Exact Test (Fischer, 1922) is p = .105, hence indicating that the probability that the outcome in Table 5 may arise in 1 out of 10 cases due to randomness under the assumption that the probability of grounding is equal in both cases. However, even though the given sample size is not sufficient to identify the observed effect as significant, it must be clear that the real-world implications of groundings are easy to envision. Groundings can result in personal injuries, environmental damage and economical liability for both the owner, authority and insurance companies.

Questionnaire to the Participants After the Exercise

In order to measure whether the participants experienced the situation any different than what could be observed, they were given a questionnaire after the exercise (see Table 3 for questions and Appendix 3 for all answers). It would also be interesting to see if there was any difference between the two groups answer. The questions were formulated so the participants could express how they experienced the exercise.

Question number one was "*How did you experience the communication between you and the pilot?"*. Both groups answer were more or less aligned; poor, bad and almost non-existing. One participant reported the communication to be good in the beginning but eventually it evaporated, while another one meant the communication were moderate.

Second question was "*When did you realize that something was wrong? (mark #1 in chart)".* Together with the questionnaire they were given a chart with the route to mark where they realized that the pilot had lost focus on the voyage. The marking the participants did themselves were in general not so far from where the observer observed reaction. However, the marking was regarded as a guess by the participants, and therefore not taken into consideration in this research. Four participants reported that they realized it when the pilot was occupied with his mobile phone, which were before WP4 and before any real danger. Majority of both groups reported that they realized it when they approached the red buoy and saw the possibility of grounding.

Third question was *"What in your opinion was wrong?".* Both groups reported in general that lack of communication and the pilot's lack of focus on the voyage was the reason for misconducting the intended route. One participant in group 1 reported "*Missing a voyage plan"* as the reason for not turning at WP4.

Fourth question was *"Did you decide to act on the situation? Explain why/why not."* All participants but one reacted to the situation. 19 participants turned to starboard when they were sure that they were off course. The one participant that did not react reported that he realized early that something was wrong. Why he did not react was not reported.

Fifth question was *"When did you decide to act? (mark #2 in chart).* Both the marking in the chart and answers were somewhat not precise. The marking in the chart was regarded as a guess by the participants and not taken into consideration in this research.

Sixth question was *"What did you decide to do? Explain why".* All participants reported that they decided to turn starboard to the intended northerly route.

Seventh question was *"Did your action prevent grounding? Explain why/why not".* There were three participants that grounded. Two reported that they turned too late and the one that did not act reported that he should perhaps have communicated better with the pilot.

Eighth question was *"What in your opinion would be helpful to prevent a critical situation or grounding in this case? (E.g. equipment, information or other resources).* 7 out of 10 in group 1 reported that a voyage plan or information about the route in advance would be preferred. Group 2 also reported that a passage plan received in advance was preferred, but also better communication between the pilot and the captain.

Discussion

This study was conducted on USN's main navigation simulator where ten participants were given the PPP in advance of the voyage and ten participants without the PPP. The pilot took the vessel through a predefined route and intentionally lost focus on the navigation at the same position on every run. The observation points were 1) when the participant expressed verbally that the pilot had lost focus and they were off planned track, and 2) when the participant acted on the situation and maneuvered to regain control over the voyage. The purpose of this study was to examine if participants performed better and discovered the pilot's absence earlier when the PPP had been shared before the voyage commenced. The results indicates that the difference between the groups were statistical significant and of a large effect size in both enhancing the bridge teams SA and faster recovery in case of navigational errors done by the pilot. However, the sample size was not sufficient to identify whether the observed effect of grounding was significant.

Impact of Shared PPP on SA and Speed of Recovery (Hypothesis 1 & Hypothesis 2)

The performance for group 1 and 2 can be seen graphically in Figure 6 and 7 respectively. Regardless of this study one can argue, and it is common sense, that people perform better when given more information about a task compare to having less or no information. This was also the understanding before this study was performed.

The result reveals statistical significance and effect size of magnitudes much higher than expected. Considering the result in this study, receiving the PPP prior to the pilotage reduces the time a navigator needs to realize errors of the pilot compared to not having the shared PPP.

Taking into consideration that the participants had two minutes to react before the vessel grounds at the shallow marked with a red buoy after passing WP4, the mean difference in both *express concern* and *action* to prevent grounding between group 1 and 2 is significant. Group 1 (without shared PPP) used in average 37.6 seconds to express that the pilot did not pay attention, and as much as 68.9 seconds before they made a maneuver to prevent grounding. This group is on average more than half way passed the distance between WP4 and the shallow before turning to starboard to regain control of the vessel and the voyage. Group 2 on the other hand expressed on average concern about the pilot's error within 10 seconds and reacted within 24.6 seconds, only going 1/5 of the same distance. This result correlates to DeChurch and Mesmer-Magnus (2009) study that sharing unique information (for example a shared PPP) increases the team's performance and SA.

Studying the extract from Kongsberg Polaris Navigation simulator (Figure 6 and 7) and measuring the distance each participant travelled after passing WP4 before turning, the measured distance for group 1 is in average 0.38nm compared to 0.24nm for group 2. When comparing this measured distance up against *observed time before acting*, there is a substantial difference. The time a vessel with 15kn speed travels 0.38nm is 91.2 seconds (group 1). Observed time before acting for group 1 is 68.9 seconds, not 91.2 seconds as the measured result shows. This discrepancy can be explained by the inertia of the vessel. Observed time (68.9 seconds) is when the observer noted that the participant started to make a turn, while the measured time (91.2 seconds) is when one can see on the extract (Figure 6) that the vessel actually started to turn. The same is for group 2 where observed time before acting is 24.6 seconds, while average measured distance is 0.24nm which equals 57.6 seconds.

Bearing in mind that the total distance from WP4 to the red buoy is 0.5nm, the difference of 0.14nm between group 1 and 2, can be the difference of grounding and not grounding. The participants in group 1 have all a Closest Point of Approach (CPA) between 0.0nm and 0.1nm from the red buoy and the shallow, while group 2 have a CPA between 0.02nm and 0.2nm from the red buoy.

This result clearly supports Hypothesis 1 and 2 that providing a bridge team with the PPP prior the pilotage commences, leads to better navigation and more speedy recovery in case of navigational errors.

Navigational safety (Hypothesis 3)

Group 1 had three groundings compared to none in group 2. The difference between the groups is not statistically significant but the practical effect is easy to envision. Grounding is mainly an environmentally damaging accident that can result in large oil spill which severely affect sea animals, birds and vegetation in the area. It is also a costly affair for the both the authorities responsible for up cleaning, and obviously for the ship owner and insurance companies. In some events there can be human injuries and even fatalities due to the impact or capsizing of the vessel.

Studying the results of the three participants that grounded in this simulator exercise (Appendix 2), one can see that a long response time before taking action is not the sole reason for grounding. Participant in run number two reacted after 97 seconds but did not ground, while participants number three and six used 10 to 17 seconds less before reacting but both grounded. The participants solved the task of preventing grounding differently. Some relied on the autopilot and let the automatic take control over the turn by setting the next course on the autopilot, while others switched over to manual steering and lay the rudder hard to starboard. The autopilot has a preset ROT and will turn the vessel considerably slower than going hard to starboard manually on the helm. Participant two used manually steering and made a sharper turn than the autopilot managed to perform for participant three and six. Participant 10 is not taken into consideration in this matter because he did not take any action at all to prevent grounding.

Limitations of the Study

Participants of this study were recruited amongst 2^{nd} and 3^{rd} year nautical students at USN and not experienced navigation officers with knowledge of the area where the simulator exercise took place. It is assumed that experienced navigators would interfere earlier and handled the situation with more assertiveness than nautical students. Studies in other fields indicate the effectiveness of assertiveness training and experience (e.g. Lee & Crockett, 1994). However, the students have a good knowledge of the rules of the road (COLREG) (IMO, 2003) and a broad experience with the navigation simulator. Unlike experienced navigators, which would have a variety of experience and knowledge, the students were regarded as a homogeneous group with similar experience, background and culture. The purpose of this study was to measure the difference between the groups to establish if a shared PPP enhanced the SA and navigational safety. Taking this into account, the result with a homogeneous group of participants is more valid than with navigators with different experience, background and culture. All participants were given the same information about the simulator exercise and were briefed about the relation between a pilot and a captain.

The lack of equal distribution of 2^{nd} and 3^{rd} year students in the two groups is also a possible limitation. The students signed up for which day they could attend according their lecture plan. It just so happens that this led to an overweight of 3rd year students in the second group (six against four) which were given the PPP, and overweight of 2nd year students in group 1 (eight against two). This has however been taken into account by controlling for study year in the statistical analyses, i.e. calculating statistical significance and effect size.

Additional bias between the groups could arise if students that had been through the exercise explained the setting to those who came in later, even though they were given strictly confidentiality.

The exercise should ideally have been conducted with the same pilot both days to ensure that the voyage was conducted in the same manner with both groups. However, both pilots were 3rd year students, had the same experience and had the same briefing before the simulator exercise started.

When participants are recruited to an exercise like this one can assume they expect that “something wrong is going to happen”. This was also expressed by some participants after the exercise. However, this is not necessarily a bias but can on the other hand enhance their SA.

Validity. The exercise was performed on a bridge simulator that provides a realistic and detailed navigation environment. In a simulator the environment and navigation condition can be identically produced in every run in order to measure different scenarios under the same conditions. For this study it was chosen to solely recruit nautical students to have a homogeneous group. With these two parameters in place the study has an environment and condition that is comparable.

The disadvantage with a simulator is that sense of real danger and real consequences might not occur (Nielsen, 2015), and can give the participants false sense of safety and responsibility (Øvergård, Bjørkli, Hoff & Dahlmann, 2005). Grounding a vessel in a simulator is not a real danger and do not have any consequences other than impaired personal and professional pride. Furthermore, some participants may have a low fidelity when operating a simulator which can evoke unnatural navigational behavior (Nielsen, 2015; Lee, 2004). The behavior of participant number ten could be explained by this theory due to the fact that he did not act at all to prevent grounding. Navigators in general report that safety has a significantly lower effect on their navigation in simulator than in a real situation on board a vessel (Øvergård et al., 2005).

Further research should strive to conduct a similar research with experienced navigators to compare results with this study which used nautical students.

Conclusion

This study has examined whether a PPP presented and inserted in the vessel's ECDIS prior commencing the pilotage enhances the bridge team's situation awareness and the safety of the voyage. The result of this study revealed that providing a bridge team with a shared PPP before the pilotage commences leads to better navigation, more speedy recovery in case of navigational errors and higher navigational safety.

References

Accident Investigation Board Norway (2010a). Federal Kivalina - IMO no. 9205885 Grounding at Årsundøya, Norway, 6 OCTOBER 2008. (http://www.aibn.no/Sjofart/Rapporter/2010-01-eng)

Accident Investigation Board Norway & Bahamas Maritime Authority Marine Accident Report (2010b). Report on Marine Accident Crete Cement – IMO no. 9037161, Grounding at Aspond Island in the Oslo fjord, Norway, on 19. November 2008. (http://www.aibn.no/Sjofart/Rapporter/2010-04-eng)

Bryman, A. & Bell, E. (2011). Business Research Methods. Oxford University Press, USA.

Chart Appendix 1: http://kart.kystverket.no/, last checked 1. May 2016.

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences. 2nd edn. Hillsdale, New Jersey: L.

Cohen, J. (1992). A power primer. *Psychological bulletin*, 112(1), 155.

Cohen, J (1995). The earth is round (p< .05) Rejoiner. *American Psychologist*, 1103.

DeChurch, L.A. & Mesmer-Magnus, J.R. (2009). Information Sharing and Team Performance: A Meta-Analysis. *Journal of Applied Psychology*, Vol. 94, No. 2, 535-546

EfficienSea. Partners: Swedish Maritime Administration, Swedish Transport Agency, Chalmers University of Technology, SSPA Sweden, Norwegian Coastal Administration, Møre and Romsdal County, Runde Environmental Center, Finnish Transport Agency, Kymenlaakso University of Applied Science, Aalto University, Danish Maritime Authority, Estonian Maritime Administration, Maritime Office in Gdynia, National Institute of Telecommunications, Gdynia Maritime University, Maritime Institute in Gdansk, Maritime University of Szczecin. Web site: http://www.efficiensea.org/, last checked 1. May 2016.

Endsley, M.R. (1995). Toward a Theory of Situation Awareness in Dynamic Systems. *Human Factors* 37 (1): 32-64.

Endsley, M. R., & Jones, W. M. (2001). A model of inter- and intrateam situation awareness: Implications for design, training and measurement. In M. McNeese, E. Salas & M. Endsley (Eds.), *New trends in cooperative activities: Understanding system dynamics in complex environments* (pp. 46-67). Human Factors and Ergonomics Society.

Flin, R., O´Connor, R & Crichton, M. (2008) Safety at the sharp end: *A guide to non-technical skills*. Farnham, UK: Ashgate.

Greenhalgh, L., & Chapman, D. H. (1998). Negotiator relationships: Construct measurement, and demonstration of their impact on the process and outcomes of negotiation. Group Decision and Negotiation, 7, 465–489.

Hetherington, C., Flin, R. & Mearns, K. (2006) 'Safety in shipping: The human element, *Journal of Safety Research*, vol. 37, pp. 401-411.

Hollnagel, E. (1993). Requirements for dynamic modelling of man-machine interaction. *Nuclear engineering and design*, 144(2), 375-384.

IMO (1968). IMO Resolution A.159(ES.IV) Recommendation on Pilotage, p. 1. Adopted by IMO General Assembly 23rd session on 27 November 1968 (Agenda item 4). International Maritime Organization; London, UK.

IMO (1999). IMO Resolution A.893(21) Guidelines for Voyage Planning. Adopted by IMO Assembly 21st session on 25. November 1999. International Maritime Organization; London, UK.

IMO (2003). COLREG, Convention on the International Regulations for Prevention Collisions at Sea 1972. Consolidated edition 2003. International Maritime Organization; London, UK.

IMO (2009). MSC 85/26/Add.1, Annex 20, 1.1, p173. Report of the Maritime Safety Committee on its Eighty-fifth Session. International Maritime Organization; London, UK.

IMO (2014). International Safety Management Code – ISM Code. International Maritime Organization; London, UK.

Jenkins, D. P., Walker, G. H., Stanton, N. A. & Salmon, P. M. (2012).Distributed Situation Awareness: Theory, *Measurement and Application to Teamwork*. Ashgate Publishing Ltd.

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. *Frontiers in Psychology*.

Lee, J. D. (2004). Simulator fidelity: How low can you go? *Proceedings of the 48th Annual Meeting of the Human Factors and Ergonomics Society*, Santa Monica, CA.

Lee, S. & Crockett, M.S. (1994). Effect of assertiveness training on levels of stress and assertiveness experienced by nurses in Taiwan, Republic of China. *Issues Ment Health Nurs.* 1994 Jul-Aug;15(4):419-32.

Martinsen, T.J.S. (2013). Characteristics of Critical Incidents in Dynamic Positioning. Vestfold University College.

Ministry of Transport and Communications (2015). Norwegian Pilotage Act, Entry into force on 1 January 2015.

Nazir, S., Sorensen, L.J., Kjell Ivar Øvergård, K.I. & Manca, D. (2015). Impact of training methods on Distributed Situation Awareness of industrial operators. *Safety Science 73 136–145.*

Nielsen, A.R. (2015). Assessing Navigational Teamwork Through Relevance and Situational Correctness of Communication. Department of Psychology, University of Oslo.

NCA (2016a). The Pilotage Act, Norwegian Costal Administration. Web site - http://www.kystverket.no/en/EN_Maritime-Services/Pilot-Services/The-Pilotage-Act/, last checked 1. May 2016.

NCA (2016b). Compulsory Pilotage, Norwegian Costal Administration. Web site - http://www.kystverket.no/en/EN_Maritime-Services/Pilot-Services/Compulsory-pilotage/, last checked 1. May 2016.

Saner, L.D., Bolstad, C.A., Gonzalez, C. & Cuevas, H.M., (2010). Predicting Shared Situation Awareness in Teams: A Case of Differential SA Requirements. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting 2010*, 54: 314.

Schittekatte, M., & Van Hiel, A. (1996). Effects of partially shared information and awareness of unshared information on information sampling. Small Group Research, 27, 431–449.

Sea Traffic Management (STM). Partners: Swedish Maritime Administration, Norwegian Costal Administration, Danish Maritime Authority, Italian Ministry of Transport, Valencia Port Authorities, Valencia Port Foundation, Swedish Meteorological and Hydrological Institute (SMHI), Danish Meteorological Institute, Chalmers University of Technology, University of Catalonia, Novia University of Applied Sciences, Viktoria Institute, TRANSAS, SSPA, SASEMAR, Rheinmetall, Fraunhofer, CIMNE and Carnival Corporation. Web site - http://stmvalidation.eu/, last checked 1. May 2016.

SESAME Straits. Partners: The Norwegian Coastal Administration (NCA), Kongsberg Norcontrol IT (KNC), Kongsberg Seatex (KSX), Kongsberg Maritime (KM), Navtor, University College of Southeast Norway (USN), The Research Council of Norway (RCN). Web site: http://straits-stms.com/, last checked 1. May 2016.

Singleton W.T. (1989). The Mind at Work. Cambridge University Press, Cambridge.

Sorensen, L.J., Stanton, N.A. (2012). Y is best: How Distributed Situational Awareness is mediated by organisational structure and correlated with task success. *Elsevier Safety Science*, (http://dx.doi.org/10.1016/j.ssci.2012.05.026).

Sorensen, L.J., Øvergård, K.J. & Martinsen, T.J.S. (2014). Understanding Human Decision Making During Critical Incidents in Dynamic Position. Vestfold University College.

Stasser, G. & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. *Journal of Personality and Social Psychology*, 48, 1467-1478.

Stasser, G. & Titus, W. (1987). Effects of information load and percentage of shared information on the dissemination of unshared information during group discussion. *Journal of Personality and Social Psychology*, 53, 81-93.

Stanton, N.A., Salmon, P.M., Rafferty, L.A., Walker, G.H., Baber, C. & Jenkins, D.P. (2013). Human factors methods: a practical guide for engineering and design. *Ashgate Publishing, Ltd.*

Øvergård, K. I., Bjørkli, C. A., Hoff, T. & Dahlman, J. (2005). Comparison of Trajectory Variation and Speed for Real and Simulator-based High-Speed Navigation. In B. Veiersted, K. I. Fostervold, and K. S. Gould (eds.). Proceedings of the 37th Annual Conference of the Nordic Ergonomic Society, *Ergonomics as a tool in future development and value creation*. (pp 275-279). Oslo, Norway: Nordic Ergonomics Society.

Øvergård, K. I., Bjørkli, C. A., Hoff, T. & Røed, B.K. (2010). Control strategies used by experienced marine navigators: observation of verbal conversations during navigation training. *Cogn Tech Work 12:163–179*.

Øvergård, K.I., Nielsen, A.R., Nazir, S & Sorensen, L.J. (2015). Assessing navigational teamwork through the situational correctness and relevance of communication. *Procedia Manufacturing,* 3, 2589 – 2596.

Øvergård, K. I., Sorensen, L. J., Hontvedt, M., Smit, P. N. & Nazir, S. (In Press). Maritime Bridge Crew Training. In M. Lenée & M. Young (eds.). *Simulators for Human Factors Research* (pp. xx-xx). Ashgate.

Øvergård, K.I., Sorensen, L.J., Nazir, S. and Martinsen, T.J.S. (2015). Critical incidents during dynamic positioning: operators' situation awareness and decision-making in maritime operations. *Theoretical Issues in Ergonomics Science, 2015 Vol. 16, No. 4,* 366-387, Taylor and Francis.

Appendix 1

Abbreviations

AIBN – Accident Investigation Board Norway
AIS – Automatic Identification System
COLREG - International Regulations for Preventing Collisions at Sea ("Rules of the Road")
CPA – Closest Point of Approach
DSA – Distributed Situation Awareness
EBL – Electronic Bearing Line
ECDIS – Electronic Chart Display and Information System
ENC – Electronic Navigational Chart
EU – European Union
GPS – Global Positioning System
IMO – International Maritime Organization
KGJS – Kristian Gerhard Jebsen Skipsrederi
KN – Knot (1 kn = 1.852 km/h, 0.514 m/s)
MSC – Maritime Safety Committee (IMO)
NCA – Norwegian Costal Administration
NM – Nautical Mile (1 nm = 1852 meter)
NSD – Norsk samfunnsvitenskapelig datatjeneste (Norwegian Social Science Data Service)
OOW – Officer Of the Watch
PEC – Pilot Exemption Certificate
PPP – Pilot Passage Plan
ROT – Rate Of Turn
SESAME Straits – Secure, Efficient, and Safe maritime traffic Management in the Straits of Malacca and Singapore
STM – Sea Traffic Management
SA – Situation Awareness
SD – Standard Deviation
USN/HSN – University College of Southeast Norway/Høgskolen i Sørøst-Norge
VRM – Variable Range Marker
WOP – Wheel Over Point
WOL – Wheel Over Line
WP – Way Point

Appendix 2

Measured Result from the Exercise

Result simulator exercise – Group 1

Group 1 – Day 1							
Captain	**Route exchange**	**Age**	**Gender (M/F)**	**Class (year)**	**Time Realizing (seconds)**	**Time Action (seconds)**	**Grounding (Y/N)**
1	No	22	M	3	55	69	N
2	No	28	M	2	46	97	N
3	No	25	M	2	33	87	Y
4	No	24	M	2	14	25	N
5	No	46	M	2	20	38	N
6	No	23	M	2	37	80	Y
7	No	23	M	2	28	75	N
8	No	24	M	2	22	32	N
9	No	22	M	3	45	63	N
10	No	24	M	2	76	123	Y
Mean		**26.1**		**2.2**	**37.6**	**68.9**	

Result simulator exercise – Group 2

Group 2 – Day 2							
Captain	**Route exchange**	**Age**	**Gender (M/F)**	**Class (year)**	**Time Realizing (seconds)**	**Time Action (seconds)**	**Grounding (Y/N)**
11	Yes	23	M	3	0	0	N
12	Yes	23	M	2	0	5	N
13	Yes	48	M	2	5	20	N
14	Yes	22	F	2	26	35	N
15	Yes	22	M	3	26	57	N
16	Yes	22	M	3	21	73	N
17	Yes	23	M	3	0	20	N
18	Yes	23	M	3	0	0	N
19	Yes	29	M	3	0	0	N
20	Yes	26	F	2	22	36	N
Mean		**26.1**		**2.6**	**10.0**	**24.6**	

Appendix 3

Questionnaire to the participants after the exercise

1. How did you experience the communication between you and the pilot?

Response from participants without the route

- *Almost no communication.*
- *I was a bit hesitating due to the setting. Didn't I have the role of the captain. I should have been more authoritarian on the bridge.*
- *Almost non-existing*
- *Mostly commands, not much more. Pilot more occupied with his mobile phone.*
- *The pilot was laid-back and not present.*
- *Poor. Next to no communication.*
- *Low, the pilot was too busy with his cellphone.*
- *We had short time to prepare. Feel that the communication was poor. He did not say much about the voyage, but just said the new courses.*
- *Poor. The pilots focus was on other things.*
- *Very quiet. Have to inform about time to turn and what the next course is.*

Response from participants with the route

- *Good in the beginning. Evaporates eventually.*
- *Since everything went pretty fast and we skipped a good introduction, the communication became simple and to a bare minimum – course changes.*
- *The pilot was not communicating much, but gave me the information I needed until he became inattentive.*
- *Not much communication. Just a hand shake and a "hello", followed by course orders and when they should be conducted.*
- *Poor.*
- *Poor. He had "full" control. Not open for deviating from his "plan".*
- *Bad. He didn't seem interested.*
- *Poor.*

- *Very bad. No talking about the plan, only turn on pilot's orders.*

- *Moderate.*

2. When did you realize that something was wrong? (mark #1 in chart)

Response from participants without the route

- *When the red buoy was closing. Saw that the course was straight ahead towards the buoy and the grounding alarm on the ECDIS.*
- *When I was told to keep the course straight ahead to land. Was extra aware when I understood he was scrolling.*
- *We approached port side of the fairway on the next course. Observation by EBL.*
- *In the middle of the fairway. Did not receive any information about the turn.*
- *He started on the mobile phone (distracting element). We headed towards land when it was natural to turn north.*

Response from participants with the route

- *Yes. As soon as he took up the mobile phone.*
- *When I look at the ECDIS and see that we are passing a WP. Then I see the pilot fiddling with his mobile phone. Then I see we are passed the wheel over line and the pilot don't pay any attention, I understand that something is completely wrong.*
- *Became uncertain after passing first shallow ground buoy, got confirmation when the pilot confirmed that we should not head straight for the red buoy.*
- *When the pilot took up the mobile phone, sensed something was wrong.*
- *When the pilot took up the mobile phone.*
- *When we headed for the red buoy too long. The danger was unavailable 3 cables away.*
- *I realized something was wrong between WP 3 and 4.*
- *When I asked when the next turn should be executed.*
- *At WOP, and pilot not responding, occupied with iPhone.*

3. What in your opinion was wrong?

Response from participants without the route

- *The communication, and the pilot were not paying attention.*

- *The pilot was not focused on the voyage.*

- *My communication with the pilot was not as precise as it should have been. In the end it's my ship!*

- *The pilot was not really focused on the voyage and did not give any course changes on WP4.*

- *Course changes came when the turn was going to be executed, not in advance. The pilot did not pay attention forward.*

- *Communication. Believe that the pilot is paying attention and have control.*

- *My confidence in the pilot was too big. I thrusted him to know what to do and when.*

- *Missing a voyage plan.*

- *Unclear information, slow, unfocused, gets the course orders on the completely wrong point.*

- *The pilot was very quiet. Should have had a better communication with the officer of the watch.*

Response from participants with the route

- *The pilots focus on the mobile phone.*

- *If we had a better introduction the communication would probably be better as well. Then would I discovered the non-present pilot earlier and could perhaps give him a correction. I also felt dependent of the pilot's advices due to short manning of the bridge.*

- *The pilot did not give orders about the next course, was focused on the mobile.*

- *Kept the course too long, the pilot became unfocused with the mobile.*

- *Unfocused pilot.*

- *Communication. Securing of the position. Team work. And I trusted the pilot too much.*

- *Pilot was more interested in his cellphone than what was happening in front.*

- *When he didn't look up from the mobile phone / generally unattended. He knew the courses but not the turns.*

- *Lack of communication and focus.*

- *I did not get the next course within the time I could wish.*

4. **Did you decide to act on the situation? Explain why/why not.**
(If NO, go to question 8)

Response from participants without the route

- *Yes, the Captain is still responsible for the vessel.*
- *Yes, to prevent grounding.*
- *Acted but too late. Asked if the pilot was paying attention but did not tell him to put the phone down.*
- *Yes, I saw both visually and on the radar that there was enough space on starboard side to turn.*
- *I meant that we went too far before it was natural to change course. Observation by EBL.*
- *Yes, but too late. Because it took long time with the communication and we approached land.*
- *Yes, I did not want my ship to run aground.*
- *Reacted because the situation began to be dangerous. The pilot was unattended, and therefore I took over.*
- *Yes, turned starboard. Because the pilot was too slow. If I hadn't reacted we would have gone directly on the buoy.*
- *Did not react, but understood pretty early that something was wrong.*

Response from participants with the route

- *Took over the steering/command.*
- *Yes*
- *Yes (but got also confirmation from the pilot)*
- *Yes*
- *Yes, if not we would have grounded.*
- *Yes, I took command because he didn't know when to turn.*
- *Yes, because we were too far into the wrong side of the fairway.*
- *Trusted in my own situation awareness.*

- *Yes! I don't want to ground with the ship I'm responsible for.*

5. When did you decide to act? (mark #2 in chart)

Response from participants without the route

- *When I understood that we would go on the wrong side of the red post.*
- *When I saw that the EBL was on the port side of the fairway.*
- *Just before the red buoy.*

Response from participants with the route

- *Fagerstrand*
- *When I discovered we had passed WOP.*
- *Would most likely have steered away anyway at this point.*
- *When I still could steer away from the red buoy ahead.*
- *3 minutes from land (the island).*
- *When I was in the middle of the fairway.*
- *At WOP, visually confirmed. .*

6. What did you decide to do? Explain why.

Response from participants without the route

- *Asked the pilot if he was paying attention.*
- *Turned starboard towards open water.*
- *Took command and turned starboard. What followed was a zig zag run to regain control. Still no confrontation and clear message from the pilot.*
- *I took my own decision and turned starboard to 000˚*
- *Decided to turn. Told the pilot that we were on the port side of the fairway.*
- *Hard starboard.*
- *Hard starboard rudder. Because we came too close to the red buoy.*
- *Turn north to prevent grounding.*
- *Not waited on orders from the pilot. Had to do something drastic. Would have been*

dangerous if there had been traffic.

- *Asked first what was the next course, saw that you sailed on the wrong side of the buoy.*

Response from participants with the route

- *Took the decision to change course.*
- *Change course to the next course right away.*
- *Manually steering to starboard.*
- *Manually hard starboard, then steering 000˚.*
- *Take over the control.*
- *I took command and turned so we didn't crash.*
- *Took the turn to given course.*
- *Turned on planned course.*
- *Asked the pilot the reason for waiting with the turn, he became aware and agreed to the turn.*

7. **Did your action prevent grounding? Explain why/why not.**

Response from participants without the route

- *Yes, the pilot gave new order.*
- *Yes, because I took the commando myself and changed course. Not according to pilot's advice.*
- *Prevented grounding, but was not a clear leader and created a hazard.*
- *Yes*
- Yes. *We were heading straight towards land. Confined fairway, 15 knots.*
- *No, too late.*
- *Yes. Because I took action in time. But I should have been earlier.*
- *Because we turned in time.*
- *No, I steered clear just a second before.*
- *No, I should perhaps have communicated better with the pilot.*

Response from participants with the route

- *Yes.*

- *It was discovered early enough, so yes!*

- *Believe so…it was just in time, good maneuverability in the vessel.*

- *Yes. Took action before it went wrong.*

- *Yes.*

- *Yes, the heading was towards shore.*

- *Yes, because we stayed on the right side.*

- *Yes.*

- *Yes.*

8. What in your opinion would be helpful to preventing a critical situation or grounding in this case? (E.g. equipment, information or other resources)

Response from participants without the route

- *More information from the pilot.*
- *Thorough walk-through of the voyage plan. Good communication between the pilot and Captain.*
- *A pilot focused on his job. Clear communication and leadership on my end. Earlier information.*
- *Communication and navigation equipment.*
- *An attentive pilot, clear course orders before the turn. Information from the pilot about the route/fairway.*
- *Focus and good communication with the pilot. Would have been nice with position plots in the ECDIS.*
- *I've should have known exactly when to turn, and not relied on the pilot. The communication between me and the pilot should have been better before the exercise started.*
- *Communication in advance between the pilot and captain. Voyage plan, insert the route in the ECDIS. Both have agreed to the route/courses/dangers etc.*
- *Make sure communication not necessary, such as mobile phone, are used to a minimum. All captains should receive a map with recommended route from the pilot right away.*

- *Echo sounder. More on lookout.*

Response from participants with the route

- *Make sure the ships receive the passage plan in advance. And do not allow the pilot to bring private mobile phone during pilotage.*
- *More manning on the bridge. Alarm on WOP. Communication with the pilot.*
- *More details in the planned route (distance from the bow, PI). More continuous dialog between the pilot and OOW to verify that you are a jour in conjunction with WOL (common situation awareness). Talk about the beacons/buoys, land contours.*
- *Better communication and a "walk-through" of the route and certain turns. It had of course been assuring with a route that told you when to turn according to planned route.*
- *The captain's attitude towards the pilot.*
- *Could use parallel index – EBL/VRM – to conduct a more secure turn.*
- *No cellphone, and a longer brief.*
- *Make sure the pilot looks up when you ask him about something, like next turn or next course. Ask questions to the pilot.*
- *Proper planning. Even good pilots can make mistakes. Trust is good, control is better.*
- *Awareness, closed loop communication. A feeling that everybody on the bridge is responsible for safe navigation.*

Appendix 4

Hei alle første og andreklassinger på nautikk,

Vi har en masterstudent, Jahn Viggo Rønningen, som i forbindelse med sin masteroppgave i Maritime Management skal gjøre et forskningsprosjekt hvor interaksjon mellom los og skipets broteam er tema. I den forbindelse trenger han hjelp fra ca. 40 2. og 3. års nautikkstudenter med simulatorerfaring. Deltagere får beskjed om hva de skal gjøre og det er en enkel øvelse. Det er ikke behov for noen forberedelser eller erfaring utover den kunnskapen dere har gjennom nautikkstudiet.
Planen var å gjøre denne øvelsen før jul men ble utsatt grunnet for få påmeldte. Derfor prøver han igjen med to nye datoer i januar og håper det passer bedre for dere.
Følgende dager er satt av:

- Onsdag 13. januar 12:00 – 15:00
- Torsdag 28. januar 12:00 – 15:00

Det skal kjøres en simulatorøvelse i hovedsimulatoren «Horten» på Campus Vestfold hvor hver gruppe skal bestå av to studenter som tar rollen som henholdsvis kaptein og utkikk/rormann, mens en instruktør tar rollen som los. Øvelsen blir observert av masterstudenten, og evt andre ansatte, i tillegg til å bli filmet for senere analyse. Videoopptak og personopplysninger blir anonymisert og destruert etter masteroppgaven er levert.
Hver gruppe skal kjøre ett simulator-run etterfulgt av en kort papirbasert spørreundersøkelse. Målet er å kjøre 10 grupper hver av dagene. Anslagsvis bruker dere ca. 15 minutter pr. simulator-run.
Mer informasjon om gjennomføringen blir distribuert til deltagere i forkant av øvelsen.
Meld din interesse til jvr@rederi.no innen utgangen av **mandag 11. januar**.
Masterstudenten jobber i næringa og dette er en gylden mulighet for dere å vise at dere er interesserte i faget utover bare undervisningen og gi dere selv et godt rykte i næringen. Det er viktig for framtidige kadettplasser at vi på HSN har rykte på oss for å har engasjerte og positive studenter – og 15 minutter har ALLE tid til å sette av til dette… Og det er også en kjempefin mulighet til å se hvordan en masterstudent samler data til sin oppgave – dere skal jo alle gjøre det enten i år eller til neste år…

Appendix 5

Hei

Takk til alle som stiller opp på simulatorøvelsen i forbindelse men min masteroppgave. Som lovet sender jeg litt mer informasjon.

Formålet med øvelsen er å måle interaksjon mellom los og skipets navigatører basert på hvilken informasjon som blir formidlet på forhånd av et losoppdrag. For å simulere et virkelig losoppdrag og for at alle broteamene skal ha likt grunnlag før øvelsens start, vil deltagere i prosjektet får samme begrenset informasjon på forhånd. Det er ikke noe dere skal forberede dere på og det er ikke en test hvor dere blir målt på riktig eller gal handling.

Forholdet mellom los og skipets besetning:
Losen en lokal kjentmann og rådgiver som skal gi kapteinen råd på kurs og fart i lospliktig farvann. Losen har ikke et formelt ansvar for navigeringen og sikkerheten til skipet. Kapteinen har alltid ansvaret og kommandoen på sitt skip. I teorien gir losen råd til kapteinen, mens kapteinen gir ror- og maskinordre videre til sitt broteam. Dette er riktignok en teoretisk og tungvinn måte å utføre navigasjonen på men det beskriver ansvarsforholdet om bord under en losseilas.
Den virkelige og vanlige settingen er at losen gir kursordre direkte til rormann under manuell styring eller til vakthavende styrmann hvis skipet går på autopilot. Maskintelegrafen håndteres av vakthavende styrmann mens kapteinen overvåker seilasen. Kapteinen skal bryte inn og ta over navigeringen hvis han/hun er uenig losens utførelse av seilasen. Det er skipets broteam som fysisk utfører kursforandringer og håndterer maskintelegrafen. Losen kjenner ikke skipets broutstyr og feil håndtering kan resultere i uønskede hendelser.
Utkikkens rolle: Melde fra om alle skip og objekter/hindringer som kan være viktig for en sikker seilas.
Rormannens rolle: Utføre rorordre ved manuell styring.

Utførelsen av øvelsen i dette forskningsprosjektet:
Ut fra antall påmeldte til øvelse er jeg nødt til å redusere hvert broteam fra 2 til 1 deltager. Hver gruppe består derfor av 1 student som inntar rollen som kaptein. Rollen som rormann/utkikk utgår. En student tar rollen som los under hele øvelsen mens jeg kun skal observere og ikke delta aktivt. Losen gir kurs-/rorordre som kapteinen utfører samtidig som han/hun overvåker seilasen. Skipet er en liten bulkbåt på 97 meter og har en fart på ca. 14 knop. Øvelsen starter syd av øya Aspond som ligger ved Fagerstrand i Oslofjorden og skipet har Slemmestad som destinasjon i en nordgående rute. For skip på denne størrelsen er det to mulige ruter; en på vestsiden av Aspond der Color Line, DFDS, Stena Line og de større skipene går, og en på østsiden av øya inn mot Fagerstrand. Hvilken rute som velges er losens valg ut fra trafikken i området.

Umiddelbart etter øvelsen vil alle få utlevert et spørreskjema med 8 spørsmål som skal besvares og leveres inn til meg.

Estimert tid for simulatorøvelsen er ca. 15 minutter. I tillegg bruker dere 5-10 minutter på spørreskjemaet.

NB!! Det er veldig viktig at alle deltagere gjennomfører øvelsen på samme informasjonsgrunnlag, d.v.s. at de som har vært igjennom øvelsen ikke forteller de andre om hva som skjer. En lekkasje vil bare ødelegge målegrunnlaget og resultatet av forskningsprosjektet. Det er som nevnt ingen riktig eller gal handling i denne settingen.

Jeg har lagt ved dokumentet *Forespørsel om deltagelse i forskningsprosjekt.doc* til orientering. Dette er et samtykke mellom deltager og meg som arrangør av øvelsen om behandling av personopplysninger og videoopptak i etterkant av prosjektet. Før øvelsen starter skal dette samtykke underskrives av deltageren.

Se vedlagt *Tidsskjema.docx* for øvelsen. Møt opp i tide så er det større sannsynlighet for at vi blir ferdig til oppsatt tid.

Onsdag 13. januar 13:00 – 16:00
Torsdag 28. januar 12:20 – 15:20

PS. Alle som deltar får en *Dagens pastarett* i kantinen.

Kort om meg:
Bachelor i nautikk på Høgskolen i Vestfold 1996-1999.
Seilt i gradene fra kadett til overstyrmann på roro/conro skipene i linjefarta til Wilh. Wilhelmsen.
Jobbet hos Höegh Autoliners som bl.a. port captain og maritim inspektør.
Har vært ansatt som rådgiver i Norges Rederiforbund siden 2009.
Begynte på master i maritim management høsten 2012 som deltidsstudent i tillegg til full jobb i Rederiforbundet. Masteroppgaven skal leveres i mai 2016.

Appendix 6

Hei

Litt informasjon om bakgrunnen til øvelsen dere har vært med på.

Det har vært en del grunnstøtinger langs norskekysten med los om bord. Grunnene til uhellene har vært flere, men det viser seg at losen ikke er ufeilbar og skipets broteam er nødt til å være årvåken og følge med på seilasen hele tiden.

Eksempler på hendelser:
Under simulatorøvelsen brukte vi samme seilingsrute som Crete Cement som gikk på grunn ved øya Aspond. Havarikommisjonen konkluderte med at losen om bord sovnet ca. 90 sekunder rett før WP ved Aspond (første turnet under øvelsen) og gikk på grunn mens overstyrmannen var opptatt med å purre mannskapet til standby ankomst Slemmestad.
Om bord på Federal Kivalina var losen opptatt i telefon med havnen da de ikke gjennomførte ett turn og gikk på grunn ved Årsundøya i Møre og Romsdal. For spesielt interesserte, se rapportene under.

Crete Cement – Statens Havarikommisjons rapport:
http://www.aibn.no/Sjofart/Rapporter/2010-04

Federal Kivalina - Statens Havarikommisjons rapport:
http://www.aibn.no/Sjofart/Rapporter/2010-01

I forbindelse diverse uhell har flere rederier vært kritisk til hvordan losoppdrag gjennomføres i dag. Hver los har sin egen «loslekse» som er deres tilegnet erfaring om farvannet og deres måte å utføre seilasen på. Det er ikke noen informasjonsutveksling om losseilasen på forhånd før losen kommer om bord. I de fleste tilfeller vet ikke kapteinen nøyaktig hvor seilasen skal gå.
Ihht. IMO Res. A.893(21) er det krav om at alle skip skal ha en seilings plan fra kai-til-kai, det innebærer også losseilasen. I mange tilfeller blir det en kvalifisert gjetting av kapteinen hvor losen skal gå. Hvis skipet har lagt inn en rute i ECDIS som ikke stemmer overens med hvor losen faktisk går, blir ofte broteamet opptatt med å korrigere ruten i ECDIS i stedet for å følge med på seilasen.
Næringen mener at det er rom for forbedringer og forslaget er at losen skal sende sin seilingsplan til skipet i god tid før han/hun kommer om bord. Da har broteamet tid til å legge inn den riktige ruten i sine systemer og gjøre seg kjent med den på forhånd. Kystverket sentralt har sett dette som et positivt tiltak for å bedre sikkerheten ved losseilas og vi er i gang med prøveprosjekter der dette blir en del av en større informasjonsutveksling mellom VTS og skip. Losene er derimot ikke helt overbevist ennå for å si det mildt.

Øvelsen:
Alle dere har kjørt samme rute under samme forutsetninger bortsett fra en ting; gruppe 1 (onsdag 13. januar) skulle loses gjennom seilasen uten å få oppgitt ruten på forhånd, mens gruppe 2 (torsdag 28. januar) fikk ruten lagt inn i ECDIS og kunne dermed se hvor losen hadde intensjon om å gå.

I begge tilfeller skulle losen miste fokus på seilasen rett før WP4. Jeg registrerte hvor lang tid det tok før dere oppdaget at noe var galt med losen, tiden det tok før dere agerte og hva dere gjorde da dere skjønte at det kunne ende med grunnstøting. Målet med oppgaven er å bevise hypotesen om at de som får oppgitt ruten på forhånd oppdager evt. feil fra losens side mye tidligere, og kan effektivt forhindre potensielle farlige situasjoner, enn de som ikke får informasjonen på forhånd. Derfor måtte øvelsen vise at gruppe 2 oppdaget losens manglende tilstedeværelse tidligere enn gruppe 1. Jeg har ikke fått systematisert all informasjonen ennå, men kan bestemt si at resultatet var som forventet og ønsket.

Dette er selvfølgelig en teoretisk og akademisk øvelse, men resultatet viser at hypotesen stemmer og det kan brukes videre som argument (i det virkelige liv) for at losene bør sende seilingsinformasjon til skipet i god tid før losen kommer om bord.

Takk for at dere stilte opp!!

Mvh
Jahn Viggo

Appendix 7

Forespørsel om deltakelse i forskningsprosjektet

"Interaksjon og utveksling av informasjon mellom los og broteam"

Bakgrunn og formål

Formålet med forskningsprosjektet er å måle interaksjon mellom los og skipets navigatører basert på hvilken informasjon som blir formidlet på forhånd av et losoppdrag. Dette er en masterstudie ved fakultetet for teknologi og maritime fag ved Høgskolen i Buskerud og Vestfold, og gjennomføres ikke for ekstern oppdragsgiver.

Deltagere som er forespurt til å delta i prosjektet er utelukkende nautikkstudenter ved Høgskolen i Buskerud og Vestfold som har erfaring fra navigasjonssimulator.

Hva innebærer deltakelse i studien?

Hver deltager deltar i en simulatorøvelse på hovedsimulatoren «Horten» på Høgskolen i Buskerud og Vestfold. Hvert broteam består av to studenter som tar rollen som henholdsvis kaptein og utkikk/rormann, mens en instruktør tar rollen som los. Øvelsen blir observert av masterstudent Jahn Viggo Rønningen i tillegg til å bli filmet for senere analyse. Hvert broteam kjører en øvelse på simulatoren etterfulgt av en kort papirbasert spørreundersøkelse. Anslagsvis blir totalt tid pr. broteam ca. 30 minutter.

Deltagere i prosjektet får begrenset informasjon om øvelsen på forhånd. Dette er for å simulere et virkelig losoppdrag og for at alle broteamene har likt grunnlag før øvelsens start.

Hva skjer med informasjonen om deg?

Alle personopplysninger og videoopptak vil bli behandlet konfidensielt og lagret på brukernavn- og passordbeskyttet datamaskin. Kun masterstudent Jahn Viggo Rønningen og veileder Kjell Ivar Ødegård ved Høgskolen i Buskerud og Vestfold vil ha tilgang på denne informasjonen.

Deltagere i øvelsen vil ikke kunne gjenkjennes i masteroppgaven eller ved en publikasjon. Prosjektet skal etter planen avsluttes 13. mai 2015 og personopplysninger og videoopptak vil bli slettet når prosjektet avsluttes – senest 13. juni 2015.

Frivillig deltakelse
Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert.

Dersom du har spørsmål til studien, ta kontakt med Jahn Viggo Rønningen (mobil 96 22 34 44, epost: jvr@rederi.no) eller veileder Kjell Ivar Ødegård (mobil 98 64 82 33, epost: koe@hive.no).

Studien er meldt til Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste AS.

Samtykke til deltakelse i studien
Jeg har mottatt informasjon om studien, og er villig til å delta

----
(Signert av prosjektdeltaker, dato)

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

Harald Hårfagres gate 29
N-5007 Bergen
Norway
Tel: +47-55 58 21 17
Fax: +47-55 58 96 50
nsd@nsd.uib.no
www.nsd.uib.no
Org.nr. 985 321 884

Kjell Ivar Øvergård
Institutt for maritim teknologi, drift og innovasjon Høgskolen i Buskerud og Vestfold
Postboks 235
3603 KONGSBERG

Vår dato: 11.12.2015 Vår ref: 45714 / 3 / HJP Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 17.11.2015. Meldingen gjelder prosjektet:

45714	*Interaction and information exchange between pilot and bridge team*
Behandlingsansvarlig	*Høgskolen i Buskerud og Vestfold, ved institusjonens øverste leder*
Daglig ansvarlig	*Kjell Ivar Øvergård*
Student	*Jahn Viggo Rønningen*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 15.06.2016, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Katrine Utaaker Segadal

Hanne Johansen-Pekovic

Kontaktperson: Hanne Johansen-Pekovic tlf: 55 58 31 18
Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Avdelingskontorer / District Offices:
OSLO: NSD. Universitetet i Oslo, Postboks 1055 Blindern, 0316 Oslo. Tel: +47-22 85 52 11. nsd@uio.no
TRONDHEIM: NSD. Norges teknisk-naturvitenskapelige universitet, 7491 Trondheim. Tel: +47-73 59 19 07. kyrre.svarva@svt.ntnu.no
TROMSØ: NSD. SVF, Universitetet i Tromsø, 9037 Tromsø. Tel: +47-77 64 43 36. nsdmaa@sv.uit.no