

**TURUN YLIOPISTON
MERENKULKUALAN KOULUTUS- JA TUTKIMUSKESKUKSEN JULKAISUJA**

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EFFECTIVENESS OF PILOTAGE

Jouni Lappalainen

Vappu Kunnaala

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Ulla Tapaninen



FINNPILOT



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FOREWORD

The economic perspective has dominated the Finnish discussion on pilotage in recent years. Less attention has been paid to the role of pilotage in maritime safety and traffic fluency. Pilotage is safety work and enables risk management in seafaring from both safety and the traffic flow standpoints. The economic perspectives of Finnish pilotage have been adequately explored in various earlier surveys, but the basic task itself has not been extensively studied. Without an independent study of the essence of pilotage, it is not possible to discuss the effects of the pilotage on increased safety and better flow of traffic. Finnpiilot Pilotage Ltd (later Finnpiilot) wants to encourage active dialogue on pilotage and its significance with all actors in the maritime field, and so Finnpiilot considered it very important to clarify the various factors that could be measured in pilotage.

The pilotage effectiveness study is the first step towards facilitating measurement based discussion of pilotage in Finland. In this study the whole pilotage process is described in more detail than ever before. The process description has enabled the identifying of measurable issues in different stages of the process. These meters will open the importance of the pilot's work to those not thoroughly familiarised with pilotage, thus awareness on the effect of the pilotage comes to a wider knowledge and at the same time greater understanding on what is paid for in a pilotage due.

Based on this study it can be concluded that pilotage has been studied little even globally, and examples of measuring the effectiveness of pilotage are scarce around the world. It can, however, be shown that there are measurable issues in the pilotage, and through them it is possible to evaluate the effectiveness of the pilotage. This study provides an excellent foundation for Finnpiilot in developing our own work and I hope this is the start of a completely new way of approaching pilotage in Finland and internationally.

The pilotage effectiveness studies have been carried out by M.Sc. (Engineering) Piia Nygren, M.Sc. (Admin.) Vappu Kunnaala and M.Sc. (Agric.) Jouni Lappalainen, supported by Professor Ulla Tapaninen. The research has been done at the Maritime Logistics Research department of the Centre for Maritime Studies of the University of Turku, which operates as part of the Maritime research centre "Merikotka" in Kotka.

The Finnpiilot Pilotage Ltd and the Centre of Maritime Studies of the University of Turku give their best thanks to the research management team as well as to the pilots who participated in the interviews.

Helsinki, 14th October 2011

Kari Kosonen
Pilotage Director
Finnpiilot Pilotage Ltd.

ABSTRACT

The objective of the pilotage effectiveness study was to come up with a process description of the pilotage procedure, to design performance indicators based on this process description, to be used by Finn pilot, and to work out a preliminary plan for the implementation of the indicators within the Finn pilot organisation.

The theoretical aspects of pilotage as well as the guidelines and standards used were determined through a literature review. Based on the literature review, a process flow model with the following phases was created: the planning of pilotage, the start of pilotage, the act of pilotage, the end of pilotage and the closing of pilotage.

The model based on the literature review was tested through interviews and observation of pilotage. At the same time an e-mail survey directed at foreign pilotage organisations, which included a questionnaire concerning their standards and management systems, operations procedures, measurement tools and their attitude to the passage planning, was conducted. The main issues in the observations and interviews were the passage plan and the bridge team co-operation. The phases of the pilotage process model emerged in both the pilotage activities and the interviews whereas bridge team co-operation was relatively marginal. Most of the pilotage organisations, who responded to the query, also use some standard-based management system. All organisations who answered the survey use some sort of a pilotage process model. According to the query, the main measuring tools for pilotage are statistical information concerning pilotage and the organisations, the customer feedback surveys, and financial results. Attitudes towards passage planning were mostly positive among the organisations.

A workshop with pilotage experts was arranged where the process model constructed on the basis of the literature review was tuned to match practical pilotage. In the workshop it was determined that certain phases and the corresponding tasks, through which pilotage can be described as a process, were identifiable in all pilotage. The result of the workshop was a complemented process model, which separates incoming and outgoing traffic, as well as the fairway pilotage and harbour pilotage from each other. Additionally indicators divided according to the data gathering method were defined. Data concerning safety and traffic flow is gathered in the form of customer feedback. The pilot's own perceptions of the pilotage process are gathered through self-assessment. The measurement data which is connected to the phases of the pilotage process is generated e.g. by gathering statistics of the success of the pilot dispatches, the accuracy of the pilotage and the incidents that occurred during the pilotage, near misses, deviations and accidents. The measurement data is collected via the PilotWeb at the closing of the pilotage.

A separate project and a project group with pilots also participating will be established for the deployment of the performance indicators. The phases of the project are: the definition phase, the implementation phase and the deployment phase. The purpose of the definition phase is to prepare questions for ship commanders concerning the customer feedback questionnaire and also to work out the self-assessment queries and the queries concerning the process indicators.

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1 INTRODUCTION

Finland's coastal waters are shallow and broken, which is why carrying on ship traffic is challenging. On the other hand in our country there statistically happen less ship traffic accidents than in the rest of the world. Effective and functional pilotage plays a key role in avoiding accidents. At this time there are no pilotage effectiveness indicators other than the number of accidents and the pilot's arrival on time on board.

The purpose of this study is to create a basis for measuring the effectiveness of the pilotage by describing the pilotage procedures as a process and to design individual indicators by using the process model, literature and pilotage organisations of other countries.

1.1 Changes in Pilotage in the 2000s

The Finland's pilotage organisation has been subject to significant changes during the 2000s.

2004 was the first year of the Public Pilotage Enterprise (Luotsausliikelaitos) as an independent company. The pilotage services were until then produced according to the law by the Finnish Maritime Administration (FMA) (Asetus Merenkulkulaitoksesta (1249/1997), § 1.1). The rights and responsibilities belonging to the FMA were transferred to Luotsausliikelaitos to the extent it was expressly agreed (Laki Luotsausliikelaitoksesta (938/2003) § 6.1), and FMA took the role of the authority responsible of the pilotage procedures. The change into a separate, independent state-owned enterprise was justified by increased service production efficiency and transparency, and by differentiating commercial activities from administrative tasks (HE 38/2003 vp). The negative opinion of the European Union Commission against the Finnish state-owned business enterprise system eventually led to the situation that Luotsausliikelaitos was incorporated 1.1.2011 including (HE 130/2010 vp; Laki Luotsausliikelaitoksen muuttamisesta osakeyhtiöksi (1008/2010)).

A private company began to offer competing pilotage services in Rauma in August 2007. The beginning of competition started a process of legal actions, which led to changes in the pilotage law. The amended provision expressed explicitly, that pilotage shall not be offered or carried on by any other instance than the pilotage company expressed in the Pilotage Act (Pilotage Act (940/2003) amendment (1050/2010) 4.1. §).

In addition to large revolutions Finnpiilot went in the 2000s also through minor changes:

- During 2006 a separate pilot dispatching service and a pilotage ERP system (PilotWeb) were built, and they were taken into use in early 2007 (Finnpiilot, 2007). With these reforms Luotsausliikelaitos took over the entire pilotage process (Finnpiilot, 2006).

- Since July 1st 2011 it has been possible to pass the line pilot degree and get the pilotage exemption certificate in Finnish and Swedish and also in the English language.
- In the spring of 2007, the renovation of the operational areas was started. The operative unit was divided into seven pilotage regions and for every region there were established a task for a regional supervisor (Finnpilot, 2007). For further development of the pilotage services the regions were re-arranged in the autumn of 2009 by decreasing the amount of regions to six. The changes focused on the pilotage regions on the Gulf of Bothnia (Finnpilot, 2009).
- The recession of the late 2000s was reflected on the amount of pilotage tasks and on the operating profit in 2008 (Finnpilot, 2008). The next year the recession hit even harder, traffic volumes decreased and the year was unprofitable for Luotsausliikelaitos. Thus personnel reductions and layoffs were necessary (Finnpilot, 2009).

Despite the great changes in the pilotage organisation and its model, the actual pilotage activity has stayed quite unchanged in the 2000s. Incorporation did not alter the activity significantly, and the changes were mainly administrative. Likewise, the ensuring of a monopoly position did not change the past practice, but it nevertheless confirmed the position of the pilotage company as the sole provider of pilotage services, so that new ambiguity of situations would not arise.

1.2 Objectives of the Study

The objectives of the 'Effectiveness of pilotage' project were to develop a description of the pilotage process flow, and design by using the process description indicators for Finnpiilot to monitor the effectiveness of the pilotage, and to work out a preliminary plan of implementing the measuring set in the Finnpiilot organisation.

1.3 Research Methodology and Study Structure

The study was carried out in four stages. The first stage was a literature research where pilotage was examined against the former surveys. By investigating the literature, it was determined how pilotage is described in the theory point of view, what kind of guidelines and standards are used for pilotage, and what kind of impact pilotage has on maritime safety and how this effectiveness has previously been measured. In the study of literature a model was created for describing the pilotage process. As sources for literature study pilotage organisation of other countries were used, as well as associations of the pilotage branches, IMO's documents and scientific literature and reports concerning the pilotage.

In the second stage of the study the model was tested by interviews and through observations of pilotage activities. As a backbone for the interviews a preliminary process

description was used alongside the sc. 'good pilotage practices'. At the same time with the interviews and observations an email query was made directed to the foreign pilotage organisations, aimed to find out the process descriptions and indicators they used and their attitudes to passage planning.

A workshop with experts was carried out in the third stage of the study, in which the process model was adapted to the current situation of practical acts of pilotage. In addition, the workshop came up with ideas for indicators based on the process model.

In the fourth stage the results were documented and an implementing plan of the indicator set was worked out for the Finnpilot organisation.

2 LITERATURE RESERACH

Literature research was designed to investigate how the pilotage is described in the literature as well as what kind of guidelines and standards are used in pilotage. The aim of the literature study was to create a model for describing the pilotage process. This chapter discusses previous studies concerning pilotage, standards and recommendations.

2.1 Scientific Studies

The literature research carried out in the first stage of the study showed that pilotage has not been researched much neither in Finland nor abroad. The most important studies are related to such marine accidents, where the pilot has been on board the accident ship. In these studies such common factors, which had at least contributed in the accident (Norros et al. 2006; Nuutinen & Norros, 2009; Filor, 2008; Drouin, 2008; Drouin & Robin, 2009) were found. These factors or deficiencies were:

1. At the time of the act of pilotage no proper passage plan was used or it was only in the pilot's head (Norros et al. 2006; Drouin & Robin, 2009).
2. Communication between the commander and the pilot was inadequate (Norros et al.2006; Drouin & Robin, 2009).
3. Pilotage was carried out without using modern navigation technology in the best possible way (Norros et al., 2006).

According to Drouin & Robin (2009), a passage plan is missing in most of the acts of pilotage. Even when the pilot has a passage plan, it is not discussed with the vessel's bridge staff, or it is considered not being worth following. In many cases, the pilot had not followed the passage plan, and accordingly the officers had not intervened, or noticed a deviation from the passage plan (Drouin & Robin, 2009). Due to the lack of a passage plan the ship's bridge crew would not in practice have had a proper opportunity to monitor the act of pilotage (Norros et al., 2006).

Drouin and Robin (2009) describe the traditional way of pilotage as "one-man-show", where the pilot is working alone, giving the ship's helmsman steering commands, which are based on a memory-based passage plan residing in the pilot's head. It is also typical that the pilot does not indicate his/her intentions in advance so that, for example, the commander of the vessel could assess the appropriateness of the steering commands. A passive personal role of the ship's bridge crew is also included in the traditional pilotage practice where they were not aware of the passage plan and the pilot's intentions and therefore do little to try to ensure the safe navigation of the vessel (Drouin & Robin, 2009). Norros et al. (2006) call this a pilot-centred individual performance, which in the traditional pilotage practice also means that each of the pilot has distinctive ways to carry out the act of pilotage and each pilot has his/her own plans for the passage (also Drouin & Robin, 2009).

Both Filor (2008) and Drouin & Robin (2009) consider problematic for the pilots and as well for ship officers that the above-described systemic deficiencies have in connection with the event of investigated accidents lead to e.g. pilots been placed to criminal liability. Drouin and Robin (2009) see the pilots and ship officers as victims of the traditional/current pilotage practice/system, when they have been accused in case of an accident. In their opinion especially the legal praxis in the United States has gone in the wrong direction in the criminalization of seafarers. In addition Drouin and Robin (2009) see that the traditional pilotage practice unreasonably burdens the pilots when they have to bear the majority of the workload and the actual responsibility for the safe navigation of the vessel.

The following changes lie under the above-described systemic problems: the size of the vessels has grown, the technology has become more complex, and the traffic volumes have increased. Due to these changes better organized and more consistent methods are required from seafaring in general and especially from the pilotage. Team work is needed in pilotage, because a single person is no longer able to control the more complicated entirety. Human errors have also no space anymore as the ship speeds have increased, and the fairways gotten narrower in relation to the growth of the vessels. That is why better anticipation of various situations is needed, which requires the bridge staff monitoring more closely the procedures carried out by others (Marine Board of the National Research Council, 1994).

Previous studies have shown that the traditional pilot-centred pilotage with its by heart learned passage plans no longer serves the needs of today as the traffic volumes and vessel sizes increase. However, the need for pilots or the quality of their work has not been questioned. Pilotage is still seen essential to ensure the safety of seafaring on challenging fairways. Studies have shown that having a pilot on board reduces the risk of an accident. It is considered a problem that the prevailing shipping practices do not adequately support the pilot's work. According to the studies, pilotage should take more advantage of passage plans made in advance, better co-operation with the bridge and modern navigation instruments (Norros et al., 2006).

2.2 Instructions, Standards and Management Systems Concerning Pilotage

The literature survey brought out a number of literary sources related to the operational requirements and skills required from the pilots. The Marine Board of the National Research Council (1994) has described extensively the pilotage procedures, contents of the pilot's tasks, and how pilotage operations should be developed in the United States. International organisations (IMO, and EMPA) have issued recommendations and requirements which should be taken into account and met in pilotage (e.g. the IMO, 2004, Empa, 1998, IALA, 2007). In addition EMPA (1997) has defined at a general level the requirements for the pilot's skills and training.

Finland has not worked out neither specific, detailed and promissory instructions for the pilots nor standards-like recommendations. In Finland, the pilotage is legislated by law (Pilotage Act 940/2003 and amendment 1050/2010) and decree (Government Decree on

Pilotage 246/2011). The Pilotage Act determines e.g. what pilotage means, compulsory pilotage and exemptions and the pilot's responsibilities and the moment the act of pilotage starts and ends. Pilotage Decree specifies e.g. the compulsory pilotage and the requirements for granting a pilot license. Of the contents of the acts of pilotage the Act and the Decree does not tell much of anything.

At a national level, the most accurate descriptions set out for the operational requirements of the pilotage activities and for contents of training as a pilot were found from British sources. Britain has drawn up a national standard concerning the pilot's operations, and a training program based on this standard: the National Occupational Standard for Marine Pilots, NOS (Port Skills and Safety, 2000a) and the Syllabus for Marine Pilot Training (Port Skills and Safety, 2000b).

The ISPO standard i.e. an international standard for pilot organisations (International Standard for Maritime Pilot Organizations) was developed in collaboration between the Dutch pilots, Lloyds Register and EMPA (the European Maritime Pilots Association) (ISPO, 2010). According to ISPO the pilotage organisation shall create a management system that includes safety and quality management as well as the necessary processes to implement them, the accident situation procedures, communication procedures, drawing up the accident and deviation reports, the procedures concerning the pilots' qualifications and certification and the procedures for the evaluation and measuring of the operations. These procedures, their descriptions and connections between the procedures must be documented in the organisation's safety and quality manual (ISPO, 2009).

Quality management systems complying with the ISO 9000 are not designed specifically for pilotage organisations. Thus, it is not as detailed as for example the ISPO. ISO 9000 quality management systems represent an international view of good quality management practices. ISO 9000 consists of standards and guidelines related to the quality management system, and of standards which support and are in connection with the system. ISO 9001:2008 is the standard that defines the general requirements for a quality management system. ISO 9001 is suitable for all organisations, regardless of their line of activities, size or position either as a private or public organisation. The organisation may receive a certificate of compliance. Certification is not mandatory (ISO, 2011). According to ISO 9001 the main requirement is that the organisation defines, documents, implements and maintains a quality management system. The organisation shall also continue to improve the efficiency of the system as required by the standard (ISO 9001:2008).

IMO i.e. the International Maritime Organisation has announced a resolution A.960 (23) (Recommendations on Training and Certification and the Operational Procedures for Maritime Pilots Other Than Deep-Sea Pilots) (IMO, 2004), which provides recommendations to the pilots' training and qualifications. The underlying idea is that the pilots have an important role in ensuring maritime safety and marine environmental protection. Resolution of the IMO gives instructions e.g. on how the pilotage authorities should assess the qualification of the pilots and what the pilots should demonstrate to obtain a license for pilotage. The resolution also provides recommendations for operational processes in pilotage. The IMO has also adopted a resolution A.893 (21) for

guidance concerning voyage planning (IMO, 2000). According to it the passage plan is necessary for all vessels, and it must cover the whole passage from berth to berth, including the areas where pilotage is compulsory. Although the resolution has not been directly targeted to the pilots, its instructions can be taken into account when the pilotage passage plan is made. So IMO in its decision suggests that the instructions for making a passage plan shall be notified, e.g. especially by the pilots.

The ISM (International Management Code for the Safe Operation of Ships and for Pollution Prevention) code i.e. the international safety management code was created to set the standard for ship safety and marine pollution prevention. The ISM Code requires that companies define for themselves their own safety and environmental protection policy. Companies need to create operational models that ensure safe working on board, protection of the environment and operational models for reporting accidents, dangerous occurrences and deviations, to identify, describe emergency situations and respond to them, and to enable the internal audits and administrative inspections (ISM, 2002).

Self assessment is a continuous improvement process, which is typically used as part of the organisation's overall quality management (TQM, Total Quality Management) or as an independent strategic management tool (Tari, 2008). Self assessment is designed to identify the organisation's current state, which gives the basis for defining the strengths and objects of the development (Keto & Malinen, 2007). The self assessment methodologies have been widely taken into use in industry, service business, and also in the public administration (Tari, 2008). Also there has been published quite a lot of scientific studies about the self assessment (Samuelsson & Nilsson, 2002; Costa & Lorente, 2011). In the maritime branch, the self-assessment has been applied mainly in the tanker shipping companies. The TMSA (Tanker Management and Self Assessment) guidelines written out by the international oil companies' marine forum are used in more than 1,200 tanker shipping companies (OCIMF, 2010).

Generally, as the context for the self assessment, the quality criteria based on the TQM-philosophy is used, such as the EFQM Excellence Model (EFQM, European Foundation for Quality Management) or the U.S. National Quality Award (Malcolm Baldrige National Quality Award). Some companies have developed their own specialized self-assessment criteria (Samuelsson & Nilsson, 2002). In according to the EFQM Excellence Model (EFQM), an excellent organisation is managed through structured and strategically aligned processes (EFQM, 2011a). The EFQM Model is divided into nine areas of assessment. The first five of these, namely, leadership, human resources, strategy, partnerships and resources, and processes reflect what the organisation is for and how it operates. The following four evaluation areas, i.e. personnel results, customer results, society results and performance results describe the results the organisation has achieved (EFQM, 2011b). The EFQM Model is neither a norm nor a standard and is therefore not a direct indication of what the organisation should do. There are, however, a number of recognition systems based on the EFQM Model, which provide valuable feedback about the organisation's activities and enable benchmarking with other organisations (EFQM, 2011c).

2.3 Good Pilotage Practice and the Pilotage Process

Previous studies and the research of the pilotage standards and recommendations brought up the cornerstones of a good pilotage practice which consists of: a passage plan, the bridge co-operation and the use of modern navigation technology.

2.3.1 Passage Plan

The ground of the act of pilotage is based on a passage plan (Marine Board and the National Research Council, 1994; Drouin, 2008). A passage plan devised in advance is to anticipate the phases of pilotage so that unwanted incidents do not occur (Drouin, 2008; Drouin & Robin, 2009).

At the international level, the regulations of using a passage plan are included in the IMO STCW convention inspected in 1995 (Norros et al., 2006). The passage plan is required so that the vessel must have a plan for an itinerary for the sea voyage from the port of departure to the port of arrival. In according to Norros et al. (2006), new in the 1995 STCW Convention was the requirements to describe the passage plan details, such as the turning points of the passage and the shallow water areas. The STCW-95 came into force in Finland in 1997 as Decree 54. According to Norros et al. (2006), the STCW-95 does not provide a direct practical guideline to draw up a passage plan. According to the criteria described in the recommendation, the seafarer should be able to compose a reliable passage based on radar-based navigation and ROT steering to carry out the act of pilotage. STCW, according to Norros et al., is a crucial step forward compared to previous regulations. However, IMO Resolution (IMO, 2000) contains more detailed instructions for a passage plan devised on board.

In the pilotage point of view, however, must be noted that the STCW-95 and the IMO Resolution (IMO, 2000) concerning the contents of the passage plan seem to require a passage plan specifically from the ship's crew, but not directly from the pilot (Port Philip Sea Pilot, 2011a). Instead, the EMPA (1998) sees that it is specifically the pilot's responsibility to prepare a passage plan suitable for local conditions. Similarly, the Finnish Pilotage Act assumes that the pilot is responsible for devising and presenting a passage plan on-board. According to the Pilotage Act, the pilot must present to the commander of the piloted vessel a passage plan based on real-time map material, and also other necessary information concerning the safe passage for the ship, and monitor such operations of steering and handling of the vessel related to maritime traffic safety, and environmental protection. This requirement of the passage plan was added to the Pilotage Act in 2010 (Amendment 645/2010 to the Pilotage Act).

Although both the international regulations and in Finland the Pilotage Act require a passage plan there has not been devised adequate instructions to draw up a passage plan. Norros et al. (2006) consider this very problematic. According to them the responsibility for planning the passage has been delegated from top down. Norros et al. believe that the instruction given is hampered by fear, that the responsibility is transferred to those who gave the instructions. Also Drouin and Robin (2009) consider the situation prob-

lematic, in particular in the pilots' point of view, who in the current situation will have to bear an unfair share of personal responsibility for the content of the passage plans.

The British national standard for the pilot's activities include a more detailed description of the requirements concerning the passage planning (Port Skills and Safety, 2000a). The British Standard describes precisely the responsibilities of the pilot of making the passage plan. Also, according to the ISPO standard, the pilotage organisation has to make a passage plan. The plan should be discussed between the commander and the pilot after the pilot has gotten aboard, and before the navigation starts and all changes should be agreed upon with the pilot and the bridge crew (ISPO, 2009).

According to Drouin and Robin (2009), the importance of the passage plan cannot be overstated. Without a proper passage plan there can be no consensus between the pilot and the bridge staff and the latter has no opportunity to call into question any of the pilot's erroneous instructions and react to potential hazards. Without a proper passage plan the responsibilities and roles between the pilot and the bridge staff are not defined and applied in the way they were meant to.

According to Drouin and Robin (2009), the responsibility of devising the passage plan for the act of pilotage belongs to the organisation carrying out the pilotage activities and to the pilotage authority. The organisation carrying out pilotage activities should publish official passage plans for such areas where pilotage is compulsory. Passage plans must be made available to the ship commanders to facilitate monitoring of the pilotage and the pilot's activities. The standard passage is planned with taken into consideration that every act of pilotage is unique and requires paying attention to the weather conditions as well as to the characteristics of the vessel and the fairway. Despite this, the standard passage plans offer a safe starting point for planning the pilotage in the form of the sc. best practice. Passage plans should be comprehensive but not, however, too complicated, so that all parties are able to adopt the plan quickly enough. Similarly, there must be a possibility to make changes to the passage plans flexibly (Drouin & Robin, 2009).

The Australian pilotage companies Port Phillip Sea Pilot, Brisbane Marine Pilots Pty Ltd and Fremantle Pilots have developed in their own use quality systems, which are based on pre-prepared and from the Internet downloadable passage plans (Filor, 2008). From the pilotage companies and the ports point of view the pre-prepared and standard passage plans reduce significantly the potential risk of a maritime accident in their areas of operation and responsibility (Port Phillip Sea Pilot, 2011a).

The significance and benefits of the passage plans are multilateral in relation to successful pilotage tasks. With the help of the passage plan the pilots and the staff of the bridge have a possibility to create a common mental model, with which it is easier to predict the activities and procedures of both parties (Port Phillip Sea Pilot, 2011a; also Drouin & Robin, 2009). A passage plan facilitates communication with the pilot and the bridge staff and also reduces potential misunderstandings, which can derive from language problems or cultural differences (Port Phillip Sea Pilot, 2011a). Port Phillip Sea Pilots emphasises, however, that the passages defined in the passage plan are ideal passages and that is possible that these ideal passages plans must be overruled if the circum-

stances so require. If a situation requires a deviation from the passage plan, the pilot must discuss the expected change of the passage plan and the sequences of the change with the ship's commander (Port Phillip Sea Pilot, 2011b).

2.3.2 The Bridge Cooperation

In addition to the passage plan, a basic prerequisite for a successful act of pilotage is an efficient communication and information exchange between the pilot, the commander and the bridge staff, which in practice means a functional bridge co-operation. According to the IMO's resolution the pilot and the commander must exchange, in the beginning of the pilotage, necessary information about the navigation, local circumstances and regulations and the ship's features. According to the IMO's resolution the exchange of information and the communication must during the entire period of the act of pilotage be continuous and uninterrupted. The exchange of information and communication are equally the responsibility of the pilot and the ship's bridge crew (IMO, 2004).

EMPA's (1998) philosophy considering the co-operation during the act of pilotage is based on the pilot's initiative to provide necessary information for the ship's safe navigation. EMPA's "best-practice" defines precisely that the exchange of information is the responsibility of the pilot. On the other hand EMPA's (1997; Charter on Pilotage, chapter 1.8) charter on pilotage describes the relations of the pilot, the commander and the bridge personnel as follows: the pilot, the commander and the watch keeping officer, must work together to navigate the ship safely through the most dangerous sea crossing legs. At this point, the EMPA (1998) makes the commander responsible for giving the necessary information to the pilot about the characteristics of the ship and the cargo.

The Finnish Pilotage Act determines the bridge co-operation concerning the pilot so, that the pilot must in the start of pilotage present the passage plan and the necessary information and instructions for ensuring safe navigation of the ship (Amendment 645/2010 to the Pilotage Act).

The IMO (2004) Resolution stipulates that an organisation operating in the pilotage branch shall establish specific procedures for information exchange and practices related to it, so that the current regulations and the best practices for each of the pilotage areas are taken into consideration in the standard procedures.

The importance of a well-functioning co-operation on the bridge is, that by coordination and communication means the plans and intentions are made clear, so that one party is able to ensure enough in advance that the operations of the other are appropriate and safe (Norros & Hukki, 1998).

According to Drouin & Robin (2009), the effective bridge co-operation should be based on the standard passage plans. Before the beginning of the act pilotage the passage plan should be informed and the pilot and the ship's bridge crew should achieve consensus on the passage plan to be used. During the pilotage procedure the bridge co-operation is concretised in following the passage plan and in monitoring the operations based on the

passage plan (Drouin & Robin, 2009). As an example of functional bridge co-operation based on the passage plan Drouin (2008) uses the standard procedures (Standard Operating Procedures, SOP) contained in the quality system of an Australian company Australian Brisbane Maritime Pilots. Bridge co-operation starts when the pilot after boarding the ship asks to see the ship's itinerary, which is compared with the pilot's standard passage plan. The act of pilotage is started only when the standard passage plan and the ship's itinerary are adapted (Take over the con). During the act of pilotage the pilot must inform in advance the passage changes ahead, and the watch keeping officer must confirm (OOW Confirmation), all the manoeuvring commands given by the pilot before they are actually carried out. For example, the course changes are reported and confirmed seven cable lengths prior to the turning point (Drouin, 2008).

The NOS standard in the UK, which includes the requirements for the pilots' activities, gives guidelines for the bridge co-operation in its several main chapters. The fourth main chapter of the standard deals specifically the co-operation between the pilot and the bridge crew. According to the main chapter the co-operation includes the necessary exchange of information, the bridge team, skills evaluation and the pilot's duty to integrate as part of the bridge team. In addition, the bridge co-operation is emphasized during problems and hazardous incidents, when the pilot's role and responsibility is to assist the commander to resolve the situation. For this purpose the organisation carrying on pilotage should in advance prepare contingency plans for typical situations on each pilotage area (Port Skills and Safety, 2000a).

2.3.3 Use of Modern Navigation Technology

According to Norros et al. (2006), the way of pilotage should renew itself into such a combination of navigation and collaboration, where technology is exploited in the navigation-, coordination- and communication tasks. Also Drouin (2008) sees the modern navigation technology necessary for the implementation of a new way of pilotage. According to him, for the making of the passage plans and exchanging and modifying the information they contain, modern navigation technology is needed - like the electronic chart systems (ECDIS), which includes in addition to the chart data also information about the planned passage in full detail. According to Drouin, by using the ECDIS systems the pilot's passage plan and the ship's own passage plan can be compared with each other, and if necessary, the ship's passage plan can be easily modified as required by the situation. Thus the modern navigation systems would provide the technical platform for the use of the passage plans and through that a way to a more effective bridge co-operation. Norros et al. (2006) have stated the following: "*the offering of the technically oriented way of navigation in developing a new way of pilotage would be that it could open up more opportunities for co-operation and shared decision-making, because the object of the operations is objectified into tools and plans.*"

Norros et al. (2006) define the integrated navigation as a bridge technology, in which the navigation equipment forms one entity, where the system itself monitors the functioning of the subsystems e.g. by informing on the accuracy of the position determination. Integration also connects the bridge work as a comprehensive navigation and steer-

ing activity. Navigation devices are organised into an integral part of the bridge co-operation. The use of an integrated navigation system in pilotage requires according to Norros et al. (2006) that the organisation carrying out pilotage has standardised passage plans, so that there has been set uniform traffic rules and ways of trafficking for the fairways. By using integrated navigation the passage plans and requirements of the authorities for the fairways can be represented. When the way of sailing on the fairway has been explicitly agreed upon, the technology can support the pilotage, so that the sailing lines and curves have been programmed the same way in all the ships operating in the fairway.

Norros et al. (2006) study found that the integrated bridge would create a good foundation for the development of the pilotage, so that it could meet the current pilotage requirements. By using technology it is possible to create better opportunities for a more detailed planning, to anticipate the situations and to monitor the pilot's work.

According to Norros et al. (2006) since the bridge equipment renewal is slow, should resources also be allocated to the development of technologies carried by the pilots. Also Drouin (2008) sees that portable pilot workstations could benefit especially those vessels which do not yet have integrated navigation systems. In Canada, Pacific Pilotage Authority (2009) has decided to equip all pilots with Portable Piloting Units (PPU).

2.3.4 Pilotage Process

By applying process thinking, pilotage can be described as a chain of actions that incorporates predictions and preparations, the ending of pilotage and retrospective evaluation in addition to the actual act of pilotage.

Pilotage legislation only gives a crude definition of the phases of pilotage. According to pilotage legislation, pilotage begins when the ship takes off and in case of arriving ships ends after mooring. Otherwise pilotage begins after the pilot has boarded and begun the act of pilotage and ends after the pilot has handed over the pilotage to another pilot or completed the pilotage (Pilotage Act 940/2003).

In the list below, the pilotage process is described based mainly on the British NOS standard (Port Skills and Safety, 2000a). It is possible to identify the following steps in pilotage (see also Figure 2.1):

1. Planning an act of pilotage
2. Embarking
3. Take over the con ("Handshake")
4. Act of pilotage (Transiting the pilotage district)
5. End of pilotage
6. Disembarking
7. Closing of pilotage

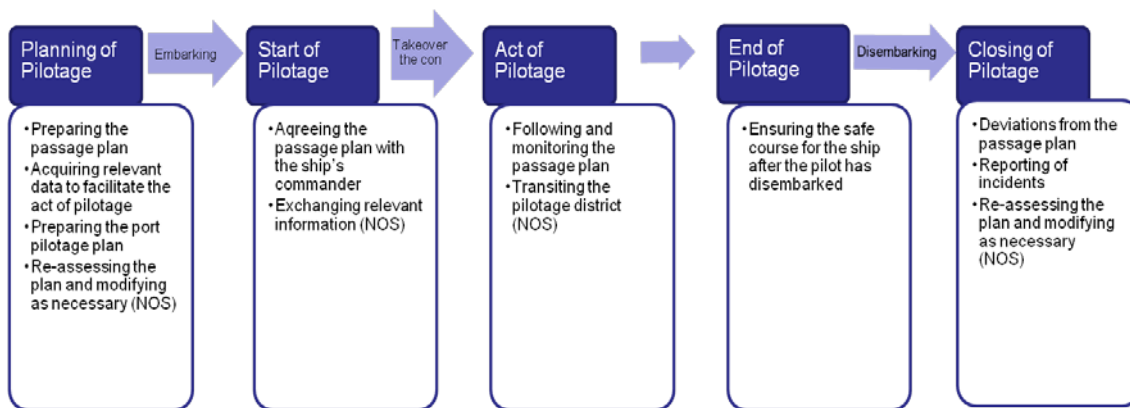


Figure 2.1. Preliminary pilotage process chart

The passage plan is present in all the phases of the pilotage process. **The pilotage process model is determined by the passage plan.** The process phases are described based on the passage plan by determining the operations upon the passage plan or by how the passage plan is used during different phases of the process. In terms of the process model a passage plan provides the necessary **platform** for the exchange of information at different stages of the process and as the process progresses. Process-related information exchange is based on the information provided by the passage plan, or is directed towards adapting the passage plan to meet the needs of each pilotage. The passage plan is a **practical work instruction** for the pilot as well as for the bridge staff to facilitate successful pilotage. The different roles involved in the process are also determined by the passage plan. The roles determine who is responsible for which task during different phases of the process.

2.4 Summary

Based on the literature review, it can be concluded that pilotage has had little study, both in Finland and abroad. The most important studies are related to marine accidents where the pilot has been on board during an accident. The results and conclusions of the previous studies were very similar. Both the Finnish and the foreign studies saw that the traditional individual-centred pilotage with its rote learned passage plans no longer serve modern needs as traffic volume and ship size keep increasing. (eg. Marine Board & National Research Council, 1998; Norros et al., 2006; Drouin & Robin, 2009). The common conclusion is also that pilotage should be based on, and it should take better advantage of pre-prepared passage plans, more efficient cooperation between the pilot and the bridge staff, and modern navigation instruments as a basis for better bridge cooperation. Additionally different standards and recommendations facilitated the outlining of a preliminary pilotage process model that describes pilotage in phases starting with planning and finishing with closing. The process model constructed based on literature review was utilised as a basis for the interviews and observations. Literature review was also used as a basis for an e-mail survey directed at foreign pilotage organisations.

3 E-MAIL SURVEY

3.1 Survey Background

In an e-mail survey conducted in connection with the study, foreign pilotage organisations were questioned on their operation. The organisations were questioned on their standards and management systems, standard operating procedures, measurement tools and their attitudes towards the use of passage plans.

During July 2011 the survey was sent to 54 pilotage organisations in Australia, Canada, and in western and northern Europe. Also included were all the ISPO members. In all 13 responses from eight different countries were received. Responding pilotage organisations ranged from small one person businesses to large organisations and from government managed to private enterprises. Following is a list of responding pilotage organisations sorted by country:

1. Denmark: Danish Pilot Service PS, DanPilot, Limfjordpilot ApS
2. Norway: Kystverket
3. Canada: The Fraser River Pilots, The British Columbia Coast Pilots Ltd
4. Germany: Lotsenbrüderschaft Elbe, Hafenlotsenbrüderschaft Hamburg
5. Australia: Brisbane Marine Pilots Pty Ltd
6. Belgium: Brabo Havenloodsen en Bootlieden cvba, Loodswezen
7. Bulgaria: Varna Pilot Station Ltd
8. Scotland: Association of Forth Pilots.

The participants were asked the following questions:

1. *Does your organisation use or comply any international standards or management systems, such as ISPO (International Standard for maritime Pilot Organisations) or ISO 9000 and ISO 14000?*
2. *What kind of special indicators or measurements your organisation uses to monitor the quality, safety and environmental efficiency of the pilotage process? Please, give some examples of the indicators or measurements, target values and achieved values; measuring periods and how do you gather the data required for the measurement.*
3. *Does your organisation apply some sort of standard operating procedures and how are these procedures generated?*
4. *What is your organisation's view on passage planning? Has your organisation prepared standard passage plans? If so, how are these passage plans utilised during pilotage?*

The following subchapters deal with the organisations' answers to the first and to the last two questions. Firstly the standards and management systems used by the organisations are listed. Secondly the respondents' views on passage plans are viewed. Lastly

the standard operating procedures are contemplated. The answers of the foreign pilotage organisations concerning measurements used are dealt with later on in chapter 6.

3.2 Management Systems in Use

The following table (table 3.1) is a breakdown of different standards and management systems in use by the various pilotage organisations. The information in the table is gathered from organisations that took part in the survey, and from organisations to which the survey was sent but did not take part and had the information available on their websites. In all the study went through information from 60 pilotage organisations.

Table 3.1. Management standards in use by pilotage organisations

System/standard	IMO and/or ISM code	ISO	ISPO	Other	None
The number that use the particular system	4	12 (4 survey participants)	7 (3 survey participants)	1	3
Additional information and variations on the standards	One instance of ISM code based self developed Pilot Safety Management System. Others follow IMO A960.	One instance of ISO 9000 compliant system that has not been certified and is not subject to outside audits		Only EFQM (European Foundation for Quality Management)	Single instance of observing national law, making standards unnecessary.
Overlap with other standards or systems		Two also use ISPO. One is applying for ISPO accreditation.	Two also follow the ISO standard.	Considering adopting ISPO standard as an alternative.	One has goal of ISPO by 30.3.2012.

ISPO members among the respondents are the Association of Forth Pilots, Scotland and Brabo Havenloodsen en Bootlieden cvba, Belgium that also uses ISO 9001 and Varna Pilot Station Ltd, Bulgaria that also uses ISO 9001 and has the goal of ISO 14001. In the view of Varna Pilot Station Ltd the ISPO should adopt some of the key elements of the ISO 14001 environmental management system and not just concentrate on the quality management. Two of the respondents (Australian Brisbane Marine Pilots Pty Ltd and the Danish DanPilot) are aiming for an ISPO accreditation within a few years. The ISPO website shows that other ISPO members are Trinidad & Tobago Pilots' Association and Region Amsterdam-IJmond Loodswezen, Region Nord Loodswezen and Region Rotterdam-Rijnmond from the Netherlands.

The following participant pilotage organisations use ISO 9001: Varna Pilot Station Ltd that also uses ISPO, Brabo Havenloodsen en Bootlieden cvba that also uses ISPO and Brisbane Marine Pilots Pty Ltd that also uses ISO 14001, AS/NZ 4801 and is applying for ISPO accreditation in 2011. The Norwegian Kystverket uses its own, the ISO 9000 compliant quality management system, which has not been certified and is not assessed by external audits. ISO 9000 compliant systems are in use in many other pilotage organisations. The following pilotage organisations mention the standards they use on their website. Riga harbour, Latvia uses ISO 9001. The Estonian Eesti Loots AS uses ISO 9001. The Australian Port Phillip Sea Pilots uses ISO 9001, ISO 14001 and OHSAS 15001, Fremantle Pilots uses ISO 9002, Australian Reef Pilots Pty Ltd uses ISO 9002 and Torres Pilots uses ISO 9001. Polish Unipil Ltd in Gdynia uses ISO 9001. The Dutch Loodswezen Scheldemonden uses ISO 9001.

Only one participating organisation, the Danish Pilot Service PS used a self developed pilot safety management system based on the ISM code. Their aim is to reach the standards in use by the maritime sector they service.

Three of the participating organisations declared the use of IMO resolution A960 (23) compliant system. These three organisations were the German Lotsenbrüderschaft Elbe and the Canadian The Fraser River Pilots and The British Columbia Coast Pilots Ltd. In its response the latter considered the IMO resolution the only internationally recognized guideline, the IMO to be the only valid forum for pilotage management discussion on an international level, and the IMO the only international organisation with the necessary authority and know-how to set standards. According to them A.960 (23) is a result of years of deliberation by all the actors in the maritime sector. The resolution instructs governments and pilotage officials on the most important elements of pilotage management. According to The British Columbia Coast Pilots Ltd ISPO is a commercial product that conflicts both with this IMO resolution and with the basic principles of safe navigation. According to them, this basic principle is that that safe navigation is best ensured by regulated non-competitive pilotage practiced by independent professionals. Because of this, Canadian pilots do not support ISPO adoption. According to The British Columbia Coast Pilots Ltd ISO standards are followed in some Canadian pilotage organisations but that those standards have no practical involvement in pilotage or pilotage management in Canada.

Belgium's Loodswezen uses the EFQM Excellence Model as a tool to evaluate and develop their operation but is considering adopting ISPO.

Three participants use no management system. Danish Limfjordpilot ApS justified this by being a one person operation. German Hafenslotsenbrüderschaft Hamburg explained that the national regulations already guide and bind them to a sufficient degree. Additionally, their documentation and operation is evaluated regularly. Danish DanPilot also has no management system but they aim to fulfil ISPO requirements by 30.3.2012.

3.3 Answers Concerning Passage Plans

Australian Brisbane Marine Pilots Pty Ltd wrote the following on passage plans: *"In our view designing a passage plan is critical. The plan is agreed upon between the pilot and the bridge staff and this enables joint monitoring of the pilotage. Without a preliminary passage plan, efficient monitoring cannot exist and the pilotage is more susceptible to errors and their consequences. Our organisation makes use of standard passage plans that all pilot must use. Standard passage plans contain standard courses in certain areas, ship and navigation information, bridge staff responsibilities during pilotage and berth instructions. The plan is reviewed on board together with the ship's commander and bridge staff, adjusted when necessary and jointly approved. The bridge staff keeps the plan during pilotage to aid in monitoring. The passage plan can be used to clarify local traffic and planned velocities or to just generally clarify the situation. The passage plan is appended with information provided by the pilot, like anchorages and distances, that are available on paper and electronically. The pilot uses these to aid steering planning and communication with the bridge staff."*

The Belgian Loodswezen encourages pilots to use passage plans during training. They are given PPUs (Portable Pilot Unit), so that passage plans are easy to form. The PPUs also have some default passage plans.

In Brabo Havenloodsen en Bootlieden cvba creating passage plans is included in the statutes given to pilots and are used to provide piloted ships with all the necessary information. The information concerns passage, among other things, and also includes practices in potential problem situations (changes in the plans or technical difficulties on the ship, for example).

According to Danish pilot service PS passage plans are a good pilotage aid. They especially use passage plans on ships with deeper draft. The passage plan is used as an information sharing aid between the pilot and the ship's commander. The ship's commander is informed of the courses, speeds, weather reports, towboat count, mooring count, depth limits and other information in the passage plan.

DanPilot's ISPO standard compliant system, although it has not yet been certified, includes passage planning. All of the organisations pilots follow the same passage points during pilotage. These standard passage plans and their selection vary with ship size.

In the Association of Forth Pilots pilotage passage plan is based on the ship's harbour to harbour passage plan. Necessary modifications are made during the information exchange between the pilot and the commander.

According to The Fraser River Pilots in their organisation's pilotage area a passage plan cannot be made entirely in advance and so it cannot be delivered to the ship beforehand. The pilots in the area create an outline for a passage plan in advance and then adapt the plan to the current situation while on the bridge.

As a pilotage area Hamburg harbour is characterised by short distances and a large amount of manoeuvring. According to Hafenlotsenbrüderschaft Hamburg the passage plan is explained verbally to the ship's commander, after which it is respected. The plan is based on standard manoeuvres, traffic situation and the harbour traffic rules. Their organisation does not support the adoption of electronic or written passage plans.

In Norway passage plans are used in practice on most fairways. These plans have not been published or officially approved and they are discussed by the pilot after boarding. However Norway's Kystverket has begun trials where passage plans are sent to the ships in advance (before the pilot). This may become standard procedure but requires further testing.

In Limfjordpilot ApS, a one man business, passage plans are essential to pilotage but should, according to the respondent, only be used within reason. After boarding the pilot discusses the planned passage with the commander. In the organisations area the task is mainly just to follow premade channel passages. This is told to the ship's commander in the pre-pilotage communication.

Varna Pilot Station Ltd writes the following on the use of passage plans: *"None of our passage plans are final. Our passage plans don't necessarily get the pilot's approval. Designing a good, comprehensive and user friendly passage plan is difficult. Passage plans should be general, simple and easy to adjust. Otherwise the plan could face resistance from both the pilots and the ships. The practice in Varna Pilot Station Ltd has been to present written passage plans to the bridge staff. Due to negative feedback we have changed our practices so that information (like passage plans) is only shared if the time and place allows. All paperwork is filled out only after the pilot and the bridge staff thinks it safe. Even if the pilot only shares information orally, it is not considered to be breaking the rules or inadequate. In other words, the pilot presents the passage plan on the bridge orally or when the situation allows for in written form."*

Canadian The British Columbia Coast Pilots Ltd writes the following on the use of passage plans: *"The idea that passage plans would be standardised and sent to ships in advance (before the pilot) and then discussed between the pilot and the ship's commander has been topical for many years. The views of Canadian pilots mirror IMO in this matter: During the creation of the IMO A.960 (23) resolution, the concept of standardised passage plans and its potential was widely debated. In every step the idea was rejected as unpractical and unwise. Unlike in normal marine traffic, navigation in pilotage areas is in constant flux and demands flexibility, local knowledge and experience. Passage selection, velocity and the exact navigation manoeuvres depend on constantly changing conditions, such as traffic, weather, water level, currents and towboat availability. This information is often unavailable before the pilot boards the ship. Designing standard passage plans for widespread use is wrong because it is based on the assumption that pilotage always follows the same passages. Standardised passage plans have practically no value and can, in fact, compromise the safety of navigation because they create a working environment that promotes unsafe inflexibility and reluctance to adapt to changing circumstances. The correct place and time to discuss and reach an understanding on the passage is on the bridge between the pilot and the*

ship's commander as the pilot boards and then continuously during the passage. This is also described in IMO A.960 (23) Pilots have sometimes tried to provide additional information to interested ship, such as information on local pilotage regulations and local pilotage (maps, brochures) This is only done rarely and carefully on a case by case basis keeping in mind the aforementioned risks."

3.4 Responses Concerning Standard Processes

Australian Brisbane Marine Pilots Pty Ltd writes the following on standard operating procedures: *"Our organisation has created standard operating procedures to cover all the critical stages of pilotage and also the management side, such as pilot dispatching, resource management and financial processes. Examples of defined procedures and their content are ship meeting and passing, situations with limited visibility, communication with towboats, the reporting of risk situations and events, fatigue, qualification and training systems and pilot transit processes. These processes are supplemented by standards guidelines, checklists and methods for each phase. The harbour master regulates some actions, like the use of towboats and restrictions to ships passing each other or velocity in harbour's own process guidelines. Procedures and their components are altered, when necessary. This could be due to pilot or staff initiative, a risk situation or an abnormal event or it could be an answer to changes in operating regulations or requirements. The procedure system and its components are also evaluated regularly."* On its website Brisbane Marine Pilots Pty Ltd tells more of its own standard operating procedures. The goal of their standard operating procedures is minimizing risks. The standard operating procedures they use are constantly evaluated and improved. Reporting risk situations, workplace inspections and internal and external audits are all part of the continuous improvement of standard operating procedures (Brisbane Marine Pilots, 2011).

Belgium's Loodswezen's goal is to develop processes to include all functions related to pilotage. At the moment they have reached approximately 60% of their goal.

The Danish Pilot Service PS also uses standard procedures. These procedures are developed, monitored and removed from use if they turn out to be wrong and unusable in cooperation with the pilots within the organisation. Danish Pilot Service PS also works with third parties such as harbour officials, oil refineries and other pilotage organisations. Some procedures are mandatory for the organisation but for the most part they get to influence their development.

DanPilot aims to join ISPO and determining standard procedures is a part of ISPO. Even today they utilise standard procedures that are used in pilotage and which have mainly been developed in the field of logistics. Additionally, the pilotage authorities have set many standards for providers of pilotage services.

The response of Association of Forth Pilots to the question on standard procedures was that they use standard procedures agreed upon with harbour officials and they are included in the organisations safety and quality management manual. They also sent their

own written pilotage process model. In the model pilotage is divided into five phases, pre-boarding, boarding the vessel, pilot/master exchange of information, conducting the pilotage act, and finally completing the pilotage act and departing the vessel. Concerning the act of pilotage phase, the process model states that the agreed procedures must be maintained during the act of pilotage and any changes must be jointly agreed upon. The pilot must also ensure adequate bridge composition during pilotage. The pilot should not be required to act helmsman during the passage but if the pilot is steering then he must ensure that he is capable of simultaneously handling his main duties of navigation. The ship's commander must be on the bridge at the start of pilotage, so that the pilot can negotiate with him on, e.g., the passage plan. The ship's commander must be reachable during pilotage.

The Fraser River Pilots follows Canadian pilotage legislation and the pilotage authority's (Pacific Pilotage Authority) regulations. The organisation creates its own internal guidelines that are unique and made for that organisations pilotage area.

Hafenlotsenbrüderschaft Hamburg uses Börtordnung i.e rules of sequences of the pilots and services given to ships. These rules help in avoiding exhaustion and enable equal workload, free-time and treatment for all pilots in the organisation.

In Norway (Kystverket) standard procedures have been developed and implemented by the employed experts. Before implementation the procedures had to have been approved by management. Standard procedures have been integrated as a part of the quality management system.

For the Danish Limfjordpilot ApS the standard operating procedure is as follows: *"After boarding the ship we present the ship master with a written pre-pilotage information package. The package contains a simple passage plan, information on local regulations and on prevailing tides and currents."*

Varna Pilot Station Ltd has implemented all of the processes according to national and local (port) pilotage regulations. The organisation also takes into account the requirements of two existing international standards the ISPO and ISO 9001.

The British Columbia Coast Pilots Ltd discussed Canada's pilotage regulation system in their response. Canada's good safety and efficiency statistics are a result of an overarching system based on national pilotage legislation and regulations derived from it. The purpose of this system is to ensure that maritime traffic in areas with mandatory pilotage serve the public interest. To achieve this, the pilotage system is organised to allow pilots the use of their own expert judgement without being subject to economic pressures. At the same time, the system takes into consideration that all pilotage is individual and local, is based on local knowledge and takes into account the local sea area variations which can be very relevant. Due to this the demands and practices set by the system vary from one area to another. For example, the requirements for receiving a pilot licence vary according to the pilotage area.

3.5 Summary

Most of the participating pilotage organisations use a standard based quality or safety management system. Some have based their operating model on the ISM code. Four respondent organisations use an ISO 9001 standard based system. Three respondents base their system on the ISPO standard developed in collaboration by pilotage organisations.

Attitudes towards passage plans among the participating pilotage organisations were mostly positive. Ready-made passage plans are considered useful tools and guidelines when performing pilotage. Only one respondent did not consider ready-made passage plans useful and held that, due to their inflexibility, the use of passage plans could even be dangerous. In some ways, respondents' attitudes towards passage plans can be considered somewhat cautious and responses stressed that a ready-made plan shouldn't be trusted too far because conditions can change forcing a review of the passage plan.

Based on the questionnaire pilotage organisations present their passage plans in various ways. Some use a written or electronic passage plan (PPU) and some express passage choices orally on the bridge. Passage plan presentation can also vary depending on the situation, e.g., in a busy situation the plan is presented orally and the written plan is examined after the situation has calmed down. From the responses it is possible to conclude that a passage plan and agreeing upon it is considered an important element of bridge cooperation. A ready-made passage plan can also aid the creation of communication links.

An e-mail survey directed at pilotage organisations and a systematic review of pilotage organisation websites show that process thinking is starting to get a foothold within pilotage organisations. As a summary of the responses it is possible to note that all pilotage organisations participating in the survey use operating procedures of some kind. Some of the operating procedures are developed by the organisations themselves and some are derived from standards, management systems and national regulations. The procedures are not necessarily written down. A standard procedure could be an unwritten operational model or routine used during the act of pilotage.

4 INTERVIEWS AND OBSERVATIONS

This chapter presents the results of the interviews and observations. Observations were carried out during 6 passages in June and July 2011. The passages were carried out on Lake Saimaa, Kotka, Hamina, in the Archipelago Sea and in Helsinki. The majority of pilot interviews were also conducted in connection with these passages. Three separate pilot interviews were conducted. The preliminary pilotage process model based on the literature review was used as a framework for the interviews and observations. The main issues in the interviews and observations were the passage plan and the cooperation between the pilot and the commander and other bridge staff.

Chapter 4.1 describes how the different phases of the pilotage process were visible during passages and interviews. Chapter 4.2 describes how the characteristics of good pilotage were visible during passages and interviews. Chapter 4.3 deals with the role of the pilot in ensuring safety and fluent marine traffic flow.

4.1 Phases of Pilotage

4.1.1 Start of Pilotage

The start of pilotage precedes the act of pilotage. During the starting phase the pilot and the ship's commander exchanged information. After the start of pilotage came a transition to the act of pilotage. The transition was clearest on cruise ships, where the pilot taking over was clearly stated out loud. On other ships the transition was communicated more through the gestures and expressions of the pilot and the commander.

The passage plan was never gone through before the commencement of the act of pilotage. According to the pilots, this was due to the fact that all the piloted ships had passed through these passages before and the passages were familiar to them. The start phase, i.e., the handshake ceremony was very short and to the point on all ships except on the cruise ship. Typically as the pilot arrived on the bridge the ship's commander greeted the pilot and shook the pilot's hand. If necessary, possible passage changes were discussed briefly. The ship's properties, control devices or navigation equipment were not presented to the pilot.

On the cruise ship the handshake ceremony was more thorough. The pilot arrived on the bridge, where the commander received him. The commander relayed course and velocity and stated that the pilot had been on board before, and so a separate presentation of the ship's properties was not carried out. The first mate asked the pilot: "*Are you happy?*" the pilot answered that he was. Then the officer shouted: "*Pilot has the con!*" The commander and other officers echoed this. The pilot then began to give instructions on course and velocity.

Based on the interviews, the aforementioned short version is the common way to begin pilotage. According to pilots the longer handshake ceremony used on cruise ships can be too long. There's no time for long ceremonies when pilotage should already com-

mence with the ship approaching narrow entryways. Again, long ceremonies are seen as unnecessary when the pilot is familiar with the ship and its officers due to multiple previous visits.

When the pilot is familiar with the ship, the commander only needs to relay any changes to the ship. Draft is important information when deciding if the ship can be steered off the fairways in potential problem situation. On an unfamiliar ship the commander and the pilot must go through the information that effects ship's handling. These include propeller type, propeller direction of rotation, rudder type etc. According to one pilot the most important thing the pilot needs know is how to shift to manual steering should the need arise. The pilot will, if necessary, ask this separately.

4.1.2 Act of Pilotage

Methods varied in the observed acts of pilotage. In some acts of pilotage the pilot steered himself, in these cases the pilot steered the ship mainly using autopilot. In other acts of pilotage the pilot gave steering instructions, which were carried out by the helmsman manually steering or by the officer of the watch with autopilot.

During three of the observed acts of pilotage the pilot practically took care of steering for the whole duration of pilotage, except in one pilotage where the commander performed the port manoeuvres. In these cases the pilot set the course using autopilot. The commander or officer of the watch was to monitor the operation of the pilot and the ship's course. During three other acts of pilotage the pilots or in one case the ship's commander, who was completing a pilot exemption certificate, piloted by giving steering commands that the helmsman carried out by manual steering. When the ship's commander was conducting the act of pilotage the pilot's task was to monitor the commander's actions and the ship's passage.

Based on interviews, the most common pilotage practice is that the pilot steers the ship while the commander or an officer monitors. Sometimes the staff leaves the bridge, which is considered problematic.

Even though the observed acts of pilotage were evenly divided between the pilot steering and the crew steering, according to interviews the most common practice is that the pilot is responsible for manoeuvring either through autopilot or manual steering. According to pilots it is also very common that the pilot is responsible for pier and embarking manoeuvres. Experience has taught the pilots the importance of establishing who is responsible for steering or port manoeuvres so as to avoid confusion and resulting surprises.

4.1.3 End of Pilotage

During observation on incoming ships, pilotage ended with the pilot handing over control to the commander with the ship moored and the commander stating the ship posi-

tion. A separate closing ceremony was not used, instead the pilot informed the VTS centre that the ship was docked and gave an estimated departure time. Finally, the commander signed a receipt for the pilot. In acts of pilotage, where the commander took control the pilot had no further duties in the harbour area.

On outgoing ships the pilot informed the pilot station that the ship was approaching so the pilot boat could pick up the pilot. Then the pilot informed the commander on how and with what velocity to approach the pilot station and inquired whether the commander knew how to continue onward from there. On a ship, where the commander performed the act of pilotage there were no particular pilotage ending procedures. The ship's commander signed a receipt for the pilot after which an office escorted the pilot to the pilot port from where the pilot boarded to the pilot boat.

According to the interviews, when pilotage ends at a pilot station at sea, it is important to give clear instructions on how the ship can continue safely forward from the pilot station. Before the pilot leaves the bridge the pilot tells the ship's commander how he wants the ship to approach the pilot station for pilot drop-off. The pilot instructs the commander on ship velocity and course to make lee. The pilot also gives course instructions onwards from the pilot station by, for example, pointing out an appropriate course on the radar. According to one interviewed pilot this has to be done until one is certain that the ship's commander knows how to proceed onwards from the pilot station. In addition the pilot verifies whether there is oncoming traffic, and relays this information to the commander.

Even though in all of the inbound observation passages the ship's commander handled the pier manoeuvres, this is not always the case. Situations exist, where the ship's commander wants the pilot to bring the ship to berth due to being new on the ship and so feeling uncertain of his ability to do so. According to pilots, knowing who will bring the inbound ship to berth is extremely important. This must be agreed upon well in advance. Problems have arisen when the ship's commander has despite ignoring the pilot's suggestion of using tow boats to aid port entry, wanted the pilot to bring the ship to berth after all.

4.2 Good Pilotage Practice

4.2.1 Bridge Cooperation

In most of the observed acts of pilotage, there was no discussion on steering between the pilot and the bridge staff. Sometimes only an officer or the ship's commander was present on the bridge. On the cruise ship bridge cooperation was carried out almost "by the book". The bridge was half staffed with officers and crew. The pilot fulfilled his role by providing navigation instructions, which the first mate and the helmsman carried out.

The pilot encounters a wide range of situations on board. Any member of the crew from deck workers to officers can be willing to participate in pilotage, even by just doing obvious things like warning of other ships. Having multiple people take part in pilotage

creates security for the pilot. Sometimes when the pilot is in control the crew might have rest break or they could be doing paperwork. According to the interviewed pilots it's still rare to be completely alone on the bridge. From a safety point of view a low crew count is bothersome, since the crew is still responsible for monitoring.

Electronic map aids the commander in following the act of pilotage in cases with no clear bridge cooperation. Lack of communication on the bridge can, according to interviews, be a result of the pilots steering. And thus, the pilots do not even know how to give navigation instructions anymore. The pilot could communicate more by announcing his intentions out loud. Often though, no one is there to listen. Pilots give way to the ships' own customs on bridge cooperation.

4.2.2 Passage Plan

Passage plan information exchange didn't take place on any of observed passages due to the crew already being familiar with the passages in question. One piloted ship had the choice of four different passage options, out of which the commander chose the appropriate one. One piloted ship had the ship's own passage plan visible because it was on a paper map.

According to the interviews, ships usually already have passage plans in ECDIS systems. Pilots have to commit passages to memory, even though paper maps with turning points are carried. Passage plans are usually not went through because for the most part the passages are familiar to ships and their officers. Thus, the passage plan doesn't have to be reviewed separately on each passage. An oral passage plan would suffice for a routine passage familiar to both the pilot and the crew. Only if something unusual has happened or changes have been made is it necessary to review them with the ship's commander. Changes in conditions can demand negotiation on how to bring the ship to berth. With new visitors the passage plans are went through and the passages, choke points and tight turns reviewed. Additionally, the manner in which the ship is brought to berth is agreed upon.

That the passage plan is somewhat necessary, and that it could be constantly on display on the bridge map tables was not denied in the interviews. However, in practice the passage plan is rarely taken out. The maps are brought along to be used should the need arise. The maps contain passage plans with information on fairway locations for visual or radar based navigation.

Pilots come on board with passage plans drawn up in advance on paper maps, but these are almost never used. At the start of pilotage and during the voyage the passage might be shortly discussed with the ship's commander. But the ship's or the pilot's passage plan is not usually went through in any more detail. Pilots considered going through passage plans to be unnecessary, at least on ships that visited the same ports regularly.

4.2.3 Use of Modern Navigation Technology

In most of the observed acts of pilotage visibility was good enough that pilotage was based mainly on visual navigation. In less optimal weather conditions (light rain, fog) and at night, radar was also used in navigation. A pilot can manage using mainly radar. But ECDIS is also considered a useful tool.

According to pilots the most important navigation aid is the radar. Radar imaging is considered reliable in all circumstances. In practice, a pilot must commit passages to memory so that they can navigate passages using radar. Even though pilots don't really rely on ECDIS systems they believe that they can be of some use to the crew while monitoring. This came out during acts of pilotage where the ship's crew seemed to follow the ship's course through ECDIS systems.

4.3 The Role of the Pilot

According to the interviewed pilots, their most important task is to ensure maritime safety and after that to ensure fluent traffic flow.

A pilot's job is challenging in the autumn, in the dark and in the winter. Then the pilot is forced to work and stay focused all the time. When weather and visibility are good, the ship and technology are good and the crew is attentive and capable, work becomes much more pleasant. The pilot's role and importance become much more apparent according to weather, seasons, darkness, ice or fog. In such situations local knowledge becomes especially important.

Pilot's role on the ships came up in interviews when discussing line pilotage and pilotage exemption certificates. The ship commanders don't want to steer themselves and would rather use a pilot. A pilot also has significance in speeding up trade and processes. This becomes apparent when there's ice. Often it's also the pilot's role to calm down the ship's commander if the latter is stressed over a difficult situation.

The pilot's role is especially important in case of a weaker vessel (for example, an incomplete or old ship). It's also possible that the ship is still new to the crew and because of this the pilot is asked to steer even if the ship is unfamiliar to pilot too. Steering is not stressful to the pilot as long as the situation is clear and it is clear from the start that the pilot has the responsibility. It's more stressful if the responsibility for steering is a surprise, when the crew doesn't steer after all and turns over responsibility to the pilot in the middle of steering. Especially difficult are situations where there's no clear division of responsibility, but instead the crew partly steers and partly does something else.

4.4 Summary

The phases of the pilotage process model based on the literature review came into clear view during observations and in interviews. In all of the observed acts of pilotage it was

possible to recognise the start of pilotage (even if it was short), the act of pilotage and the end of pilotage.

During pilotage, based on both observations and interviews, communication as a part of bridge cooperation was quite sparse. The anticipation described in the literature did not express itself through, e.g., the pilot announcing future turns in advance. The pilots themselves were ready to communicate more. But pilots have to adapt their methods to the culture of each ship and communication is not considered meaningful when the ship's crew seems indifferent.

According to pilots, their most important task is to ensure safety and prevent accidents. The pilots also consider their work important in ensuring fluent traffic flow. Both safety and traffic flow are, in the opinion of the pilots, even more relevant in difficult weather and in winter.

5 PILOTAGE PROCESS

This chapter describes the pilotage process and its meters. The pilotage process model is based on the 17.8.2011 Finnpilot workshop, where the different phases of pilotage and their tasks were reviewed with pilots and Finnpilot management. The premise for designing a pilotage process was to describe pilotage as it exists in practise today. This being the case the goal of the workshop was not to describe how pilotage should be performed according to, e.g., literature. In the workshop the pilotage process was examined separately for inbound and outbound traffic.

5.1 Planning of Pilotage

Resource allocation is an integral part of the planning of pilotage. In resource allocation it is determined which pilot will handle which pilotage. During resource allocation it is ensured that there are enough pilots for the ships and that the pilots reach them in time. Pilotage resource allocation is very challenging. The ship situation is in constant flux. Their departure and arrival times change often. The possibility of anticipating ship schedules varies across different pilotage areas and different ships. On some cargo ships departure time can change multiple times in both directions. Pilot dispatch centre, chief pilots and pilots have to operate in constant state of readiness and exceptional flexibility.

In principle a single pilot does not take part in resource management. The pilot only needs to answer the phone and check from the PilotWeb for which ship he is about to pilot. Pilot dispatch centre wakes the pilot up an hour before the pilotage starts.

The pilot's tasks during planning are to check the ship's information, weather conditions, and traffic conditions, to arrange transportation to the ship, select a passage and determine a berth for inbound ships.

The aim is to find out ship information in advance, if the pilot is not already familiar with the ship. The amount of information available on ships in PilotWeb varies. Information can also be found on the internet or the pilot can ask other pilots for experiences on the ship if it has visited the area before. At the same time the pilot can ask if there are any ship specific problems that should be taken into account.

Weather conditions are determined by checking wind direction and strength, visibility and water level from a computer. It is also customary to look outside to perceive the prevailing weather. In winter the ice situation is checked from IceWeb. The information gathering can also be unconscious. For example, the weather can be judged by listening for the sound of rain while waking up.

The pilot must also arrange for transportation, the nature of which depends on whether the ship is inbound or outbound. In case of an outbound ship the pilot might have to check train schedules, for example. The harbour can also be reached by car, taxi or by

other means. If the pilot needs to be transported by pilot boat, the pilot boat driver must be woken up and called on site.

In practice actual passage planning doesn't come up during pilotage. A pilot has ready-made passage plans committed to memory and marked on paper maps. This being the case it is considered unnecessary to make separate passage plans for or to document single acts of pilotage. During the planning of pilotage, instead of passage planning the pilot performs passage selection, where the pilot decides in advance which passage to use during the pilotage. When leaving Hamina, for example, either the old 10m fairway or the new 12m fairway can be chosen.

Ship type, draft and berth all affect passage selection and can be checked from Pilot-Web. The weather also affects passage selection and the manner in which the ship will take off and how it will be brought to berth. Weather and ship type also affect the potential need for towboats. All of the necessary information cannot be gathered in advance each time. In those cases passage selection is performed on board the ship after the necessary information is available. Passage selection is partly unconscious and the choice is made automatically based on experience.

When choosing a passage the PilotWeb is checked for other traffic in the area during the pilotage. Additionally, the current traffic situation is checked for problems. It is determined whether towboats are needed for harbour manoeuvres and also whether they are available. The ship can also be contacted to inquire if they have perhaps already contacted the towboats.

In winter, the necessity and availability of ice breakers is determined. The harbour ice breaker is determined from the VTS centre or straight from the operating ice breaker (this communication is usually handled by the chief pilot). The need for an ice breaker depends on the ship type. In winter, some ships can get stuck in ice, unable to move on their own. The possibility for this might be clear from the ship's information. In such situations the pilot discusses whether or not to board the ship, in case it can't get moving. This too is personnel resource management.

In practice the scope and thoroughness of the tasks in the planning of a pilotage depends on the individual characteristics of the pilotage. With familiar ships there might be almost no preparation. Very often there is no time for preparation. The pilot might have to go straight from one ship to another at sea or in harbour. In situations like these it is thought that no actual preparation is done for the pilotage. Some preparation can still be made unconsciously. The information gathered and handled in the planning phase is not recorded. Just the gathering of information is enough for orientation for the pilotage.

5.2 Transit to Ship and Boarding

On an inbound ship the transit is done by pilot boat. Usually the pilot contacts the ship by VHF to sound out the ship's atmosphere. This contact is meant to facilitate future bridge cooperation. The pilot gives the ship instructions on slowing down and making

lee, so that the pilot can board safely. The practice on the archipelago sea is that the pilot contacts the ship already from the pilot station so that the VTS centre knows the pilot is awake.

Sometimes, e.g, when the ship's course is not optimal, pilots have to give navigation instructions to inbound ships even before boarding. Also in situations where weather conditions prevent the pilot from being picked up at the pilot station, instructions have to be given to the ship from the pilot boat. In such situations the ship is led past the pilot station to a more sheltered location.

In case of docked outbound ships the pilot is brought to the pier by a car. Pilots try to arrive on docked ships well in advance, 15-20 minutes before departure. This way there is good time for getting to know the ship and for information exchange.

5.3 Start of Pilotage

In the starting phase of pilotage ("handshake phase") the tasks performed on the bridge are passage selection, overview of the ship's information and deciding who will steer the ship through the fairways and who is responsible for port manoeuvres. The use of tow-boats, depending upon the ship and wind conditions, is agreed upon between the pilot and the ship's commander.

Every pilotage begins with a handshake between the ship's commander and the pilot. After which the starting phase tasks vary greatly depending on the ship, the ship commander's customs, prevailing conditions and especially the weather. One way or another these tasks are performed in all pilotages, but in practice the tasks are limited by depending on among other things how often the ship and the ship's commander have visited the area and how well the pilot knows the area. Internal demands set by the ship's commander and the ship-owner determine how thoroughly the different tasks are performed.

On inbound ships, pilotage usually begins immediately. As the pilot arrives on the bridge his first task is to ascertain the ship's exact position, direction, and velocity. The steering equipment, autopilot and how to switch to manual control are reviewed. As the pilot arrives he is handed a Pilot Card that contains essential information on the ship. It is usually set aside in this phase and returned to after the pilot has oriented himself with the situation and the ship is under control.

Very often the pilot has to begin the act of pilotage and often actually begins steering the ship *"on the same second he arrives on the bridge, since the ship could be headed full speed towards rocks."*

In most acts of pilotage steering is handed over to the pilot. This might happen orally, or merely through interpreting expressions and gestures. Sometimes the pilot just has to start steering, because the crew figuratively hands over the steering responsibility to the pilot as he arrives on the bridge. *"As the pilot arrives on the bridge you can almost hear*

the officers sigh, when they're able to hand over steering to the pilot." There are also situations where no one is really steering the ship. In these cases the pilot must quickly assess the situation and begin steering himself. These situations can arise from e.g. an interpretation error by the ship's commander. These are moments of great risk during pilotage.

Only after the pilot can be sure of the ship's safe passage, can a short discussion on passage selection or other information exchange with the commander be had and possibly a review of the Pilot Card.

Actual passage plans are went over on paper or electronic maps very rarely. It's more accurate to talk of passage selection where the pilot orally informs the ship's commander on the passage he plans to use. Usually the ship's commander accepts this. In some cases passage selection is not discussed at all. Often the ship's commander has used the passage before and the pilot is already familiar with the commander. In such situations discussion on the passage is considered unnecessary. If the pilot doesn't know the commander, then he asks whether the ship's commander is familiar with the area and has he visited the port before. In cases where the area is unfamiliar to the commander the passage plan can be reviewed more thoroughly. But even in these situations the review of the passage plan is left until after the pilotage has commenced and more "peaceful" part of the passage has been reached.

To confirm its data, the ship must have a Pilot Card. In most cases the Pilot Card is presented to the pilot in the initial phase of the pilotage task. However, at the time of the ship coming in, there is rarely time for inspecting the Pilot Card, thus it is often examined only later on. In the initial phase, the important issues to be clarified with the commander are the current draught of the vessel, which can vary upon the cargo situation on the ship. It is also important to find out in new vessels and vessels not familiar to the pilot, how the steering is to be transferred from autopilot to manual steering.

The initial activities described above almost always end with one of the deck officers asking the pilot if he should want some coffee. Coffee query is a standard routine in a pilotage task. The coffee query replaces in most pilotage situations the official pilot over-take (Take over the con). At this point the latest, the pilot has moved to the steering place designated to him and taken the control over the autopilot.

When the ship is leaving the port there is plenty of time for start-up activities. At this time the necessary information exchange between the commander and the pilot can be carried out in an adequate extent before the ropes of the vessel are unfastened. At first it is determined who is going to steer and in which phase. The ship's commander may want to make the port manoeuvres himself. Every time the issue is not agreed orally, but instead the pilot has to understand from the facial expressions or gestures, that he has to steer the ship. In most of the pilotage tasks the pilot only takes the wheel after the commander has gotten the ship off berth and it is steered to the actual fairway.

5.4 Act of Pilotage

In the actual piloting stage two differentiated tasks can be defined: the fairway pilotage and the port pilotage.

In the fairway pilotage there are in fact three different ways of pilotage. The first way, and the closest to the so-called good pilotage practice is, that the pilot gives the manoeuvre commands to the ship's helmsman, who carries them out manually or the mate who operates with autopilot. In addition, either the commander or the officer of the watch continuously monitors the steering commands issued by the pilot.

The second and most common way to practice the fairway pilotage is that the pilot himself is responsible for manoeuvring of the ship either with the autopilot, or more rarely by hand steering. In this case, the commander or the OOW monitors the pilot's work.

The third situation is that the commander is practicing for a pilotage exemption certificate and pilots the ship in either of the two ways described above. In this case it is the pilot's obligation to monitor the commander's pilotage procedures.

These options are not necessarily many times even discussed, but the pilot has to observe the situation and decide which action has to be done and when it is necessary to take the wheel.

During the pilotage the pilot is responsible for the external radio traffic and must keep in touch with e.g. the VTS centre, the port, bridges and other ships sailing on the area. In this way it is possible to react quickly to the changes in circumstances, e.g. changing traffic situations during the pilotage.

In the port pilotage the general rule is that the commander is responsible for the ship's manoeuvres and the pilot gives instructions. When the ship leaves the harbour the general rule is that the ships' commanders make the pier manoeuvres themselves after which they rather quickly give the steering wheel to the pilot. After this the pilot will continue the actual fairway steering and the commander switches to monitoring or gives the responsibility of the monitoring to one of the mates of the ship.

By arrival at the port basin it is well in advance tried to have an agreement on who shall steer the ship to the pier. During the port pilotage the pilot gives the commander instructions about the next procedure. An instruction may be e.g. how much one must slow down or when the vessel is in the right place at the pier. Although one approach would be agreed upon, the situation may change. It has e.g. been agreed upon, that the commander controls the ship's berth, but in a practical situation it becomes clear that the commander is incapable of doing it and the pilot has to intervene and take the wheel.

The right berthing place is confirmed well in advance during the act of pilotage. The pilot keeps in touch with possible tugs and port workers. Port men will aid the ship to moor exactly to the right point.

Sometimes in the port, the pilot acts as an intermediary between the port staff, and the ship. One example is the situation where the ship's commander does not consent longer to move the ship, even if the port staff advises that the ship should be moved a few meters back. In such situations, the pilot acts as a mediator and negotiator between the parties.

5.5 End of Pilotage

When the pilotage is ending at a location at sea, the pilot gives instructions on how the vessel can sail on safely from the pilotage point. Before getting off the bridge the pilot tells the commander how he wants the ship to approach the pilotage point for the pilot to get off board. The pilot gives instructions for the commander about the ship's speed and direction to make a proper leeward-turn. The pilot also gives instructions of the next course from the pilotage point onward by showing an appropriate course e.g. on radar.

The VTS centre is asked for the clearance of the other traffic. At the same time the centre is reported if the crew appears uncertain, so the VTS can take a more detailed follow-up of the vessel.

The pilotage ends at the port when the vessel is berthed in place (position) and the ropes are fastened. The VTS centre is informed, when the vessel is stationary. At the finishing handshakes the commander is requested to give the receipt for the pilotage fee. Often the pilots are asked to sign the ship's Pilot Card only at the end of the pilotage, although it should be gone through in the initiation phase of the act of pilotage. This may be due to the fact that there is not necessarily time for a go-through of the Pilot Card during the act of pilotage, or the fact that by this means one may be trying to "hide" the vessel's defects from the pilot. Prior to the end of the pilotage, the pilot also calls for a ride off the ship. This is done, depending on the situation, by boat or by car, i.e. in practice depending on whether the vessel was coming in or going out.

5.6 Closing of Pilotage

The pilotage task is closed in the PilotWeb by accepting the task as carried out completely. The ending time of the pilotage, the nautical miles sailed and the elapsed time of the pilotage are logged to the PilotWeb. If, during the pilotage task, there has been an accident or some other incident or an unexpected situation, that incident is informed in a separate deviation report in a separate system. At the end of the pilotage task the pilot also delivers a travel expense account.

5.7 Primary Stages of the Pilotage

The following figures show the main stages of the pilotage. The first figure (Figure 5.1) contains the main stages of the incoming traffic. The latter figure (Figure 5.2) describes the pilotage stages when leaving the port.

Incoming traffic

Planning of Pilotage	Start of Pilotage	Fairway Pilotage	Port Pilotage	End of Pilotage	Closing of Pilotage
<ul style="list-style-type: none"> •Pilotage resourcing •Ship data clearance •Inquiry of weather conditions •Inquiry of other traffic •Transport arrangements •Passage choice and inquiry of berth •Inquiries in need of tug or ice-breaking 	<ul style="list-style-type: none"> •Passage choice in cooperation with the ship's commander •Walkthrough of the ship data •Agreeing on who is responsible for the fairway steering and the port manoeuvres •Agreement on using tugs •After which the pilot's takeover 	<ul style="list-style-type: none"> •Alternatives: The pilot steers, the helmsman or the OOW steers and the pilot gives oral steering commands or a pilotage exemption certificate student carries out the pilotage and the pilot monitors •Keeping in contact on the VHF •Commander's takeover, if the commander is responsible for the port manoeuvres 	<ul style="list-style-type: none"> •Alternatives: The commander is responsible for the port manoeuvres; the pilot is responsible for the port manoeuvres •Keeping in contact on the VHF 	<ul style="list-style-type: none"> •Informing VTS that the vessel has berthed •Arranging the transport •Inquiry of receipt from the commander 	<ul style="list-style-type: none"> •To the PilotWeb •Incidents and deviations •Self-assessment about the act of pilotage •Travelling-expenses account

Figure 5.1. The pilotage process for the incoming traffic

Outgoing traffic

Planning of Pilotage	Start of Pilotage	Port Pilotage	Fairway Pilotage	End of Pilotage	Closing of Pilotage
<ul style="list-style-type: none"> •Pilotage resourcing •Ship data clearance •Inquiry of weather conditions •Inquiry of other traffic •Transport arrangements •Passage choice and inquiry of berth •Inquiries in need of tug or ice-breaking 	<ul style="list-style-type: none"> •Passage choice in cooperation with the ship's commander •Walkthrough of the ship data •Agreeing on who is responsible for the fairway steering and the port manoeuvres 	<ul style="list-style-type: none"> •Alternatives: The commander is responsible for the port manoeuvres; the pilot is responsible for the port manoeuvres •Keeping in contact on the VHF •Pilot's takeover 	<ul style="list-style-type: none"> •Alternatives: The pilot steers, the helmsman or the OOW steers and the pilot gives oral steering commands or a pilotage exemption certificate student carries out the pilotage and the pilot monitors •Keeping in contact on the VHF •Ends on the commander's takeover 	<ul style="list-style-type: none"> •Ensuring the safe sail for the ship •After which the takeover of the commander •Informing VTS that the pilot is disembarking, especially when elsewhere than at the pilotage site •Arranging the transport •Inquiry of receipt from the commander 	<ul style="list-style-type: none"> •To the PilotWeb •Incidents and deviations •Self-assessment about the act of pilotage •Travelling-expenses account

Figure 5.2. The pilotage process for the outgoing traffic

The main differences between inbound and outbound pilotage relate to the start of the pilotage on the bridge of the ship. The time to be used for initiation when the ship is inbound is very limited. For this reason the time given to the information exchange between the commander and the pilot that is vital to the safety of the voyage is very limited. At this point, it is necessary to concentrate only on the essential information, so the pilot can start a safe pilotage. It is very common that the information exchange, for example concerning the passage plan, is done a little later, in practice after the pilot has gotten the control of the ship.

Instead there is more time for processing the information, when the ship is outbound. But generally there is not very much time used for the information exchange. This is due to the fact that most commanders have visited the area several times before and they are familiar with the area already. Similarly, the pilots are familiar with the vessels already. On vessels that have visited less frequently and on ships the pilots are not familiar with, the issues are treated in a somewhat more precise way. Rarely, however, the passage plan is gone through in a very accurate way by using paper charts or an electronic map.

Another significant difference between the incoming and outgoing pilotage is the pilot's disembark when the vessel is outbound. When leaving the ship, the pilot must ensure a safe passage forward for the ship.

During the fairway pilotage, the main rule is that the pilot steers and the commander or OOW monitors. On the port area it is more common that the commander is responsible for steering and manoeuvring and the pilot gives instructions and keeps contact with external actors.

The most critical phases of the pilotage process are the moments when the pilot is embarking or disembarking. Even though the pilot manages to get on board fluently, he is at this point usually quite in a hurry to take possession of the ship and to ensure a safe passage deeper into the archipelago or to the coastal fairway.

The stage when the pilot takes over the main responsibility of pilotage, depends on who steers the ship and as well on other circumstances on board. When getting on board, the pilot very often has been obliged to take the control of the ship immediately after reaching the bridge, although the actual take-over should be done only after the decision of the passage and the information exchange. Similarly, there is variation in the inbound traffic, depending on whether the pilot steers the ship all the way to the pier or the ship's commander takes over when the ship arrives to the harbour area.

Generally, in outbound traffic the commander of the ship steers the ship away from the harbour area and after that the pilot takes over and begins steering the ship onward. Yet there are variations to this practice, as the pilots sometimes begin the steering already at the time of the port departure.

The workshop discussion also highlighted individual problems or problematic concerning pilotage. One of the problems aroused was, that the communication and cooperation on the bridge may not be sufficient. Creating process models and using ready-made process models may make it easier to take issues and questions under discussion and thus improve bridge communication.

5.8 Summary

The pilot's role as an advisor and the final responsibility staying with the ship's commander in all situations, require clarity in the pilotage events. In the centre are the issues, on which one can uniquely identify that the pilotage has started and ended i.e. the phase interfaces of the pilotage process.

The workshop consisting of the Finnpilot management team and the pilots went through, how the pilots carry out their work in practice. In the workshop, it was found that in all of the pilotage tasks a number of common phases are to be found, as well as the activities belonging to these phases, with which the pilotage can also be described as a process. On the other hand the workshop noticed that each pilotage task has its own special features, which bring variation to the process. This means that all the stages and tasks cannot always be performed in the same manner and in the same order. On each pilotage the changing factors, such as weather conditions, vessel characteristics, and other traffic must be taken into account, and one must carry out the tasks related to the different pilotage stages when it is appropriate and necessary according to the pilotage in question.

Often, the pilotage phases overlap and mingle. E.g. it can be obligatory to give navigation instructions already from the pilot boat before the pilot has gotten on board, or the passage plan can be gone through only when the situation has calmed down a little after the pilot has entered the bridge. Often, the difficult conditions require that the pilot must have urgently started to perform the act of pilotage by checking the ship's position, course and speed and by giving the necessary steering commands, so that the possible hazardous situation can be avoided.

The main differences in pilotage are between the processes of the incoming and outgoing traffic. The first difference relates to the start of the pilotage on the bridge. When the vessel leaves the port the pilot usually arrives to the bridge early before the ship sails. In this case, the pilot and the commander have more time available for start-up tasks of the pilotage. On the other hand when the ship comes in, there is almost always, so to speak a situation immediately. The pilot must start giving the navigation instructions immediately upon entering the bridge, and sometimes there is need to begin giving instructions during the transport phase in the pilot boat on VHF radio.

Another key difference between the incoming and outgoing pilotage relates to the ending of the pilotage. In the incoming traffic the pilotage ends at the time the ship is brought to berth. As a rule, the commander is responsible for the ship's manoeuvres in the port area and during the berthing procedures. In this case, the pilot gives advice on applicable manoeuvres for the situation and keeps connection to the port staff and the tugs. By departure the ship leaves the pilot on board the pilot boat at the pilotage site. Before the pilot leaves the bridge he gives the commander instructions for a safe onward sailing course. In addition, the pilot gives instructions on how to disembark the pilot and reports of other possible traffic.

6 INDICATORS FOR PILOTAGE

Once an organisation has defined the processes that describe its activities, it is possible to determine how these processes and their results can be monitored and measured. Monitoring is usually possible, but the actual measuring may be impractical in some situations, or even impossible. Measuring, however, gives more objective information about the process and it is normally in practice a more effective evaluating tool than monitoring (ISO, 2008).

This chapter presents first those indicators the foreign pilotage organisations, who responded to the e-mail inquiry, declared to use. After that, the indicators worked out in Finnpiilot's workshop with the pilots and the Finnpiilot management, are discussed.

6.1 Indicators for Pilotage in Foreign Pilotage Organisations

In the e-mail survey for the foreign pilotage organisations the following question was asked: *What kind of special indicators or measurements your organization uses to monitor the quality, safety and environmental efficiency of the pilotage process? Please, give some examples of the indicators or measurements, target values and achieved values, measuring periods and how do you gather the data required for the measurement.*

A chart, based on the answers, showing the indicators in use was created (Figure 6.1):

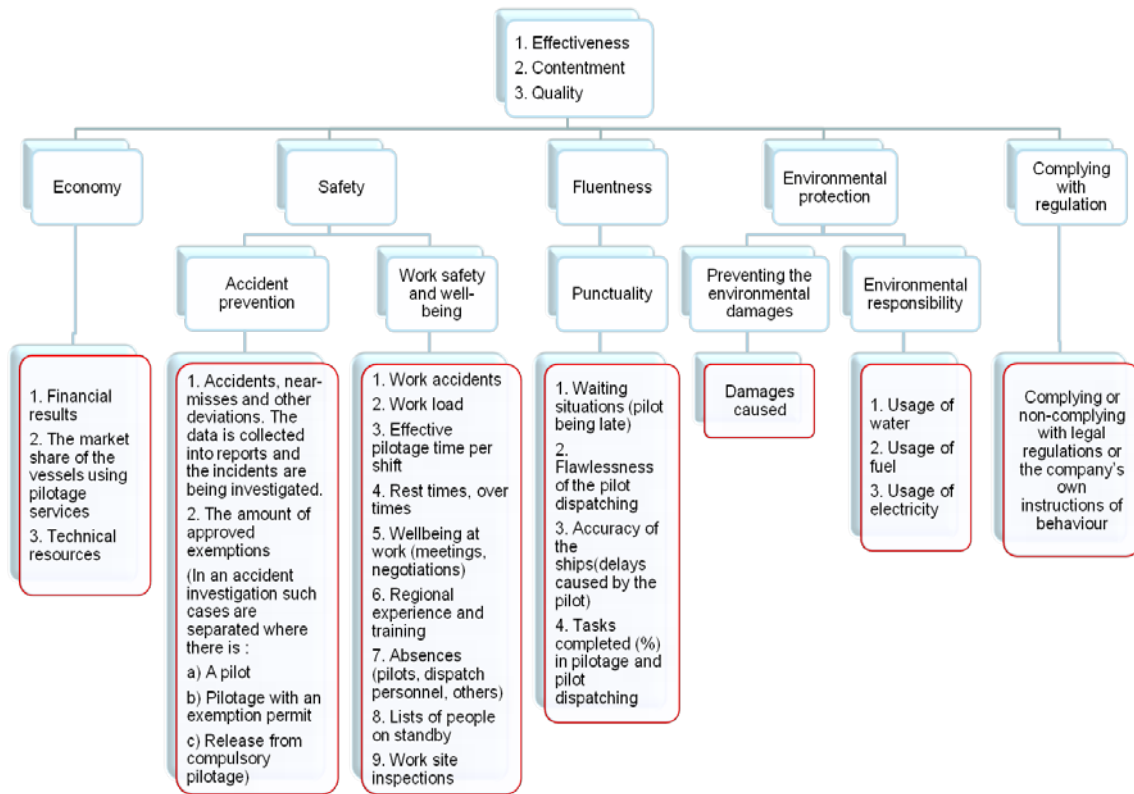


Figure 6.1. The indicators used in the pilotage organisations

Reporting and analysis of the accidents, near misses and deviations are the most commonly used indicators according to the survey. In some cases, the accident statistics will be read through on a regular basis at specified intervals. Accident statistics are also analysed and discussed in meetings and negotiations. Also the indicators concerning the pilots' work-related accidents, stress and job satisfaction were mentioned by several pilotage organisation respondents. The reports and statistics of the previously mentioned issues are also discussed in meetings and negotiations among the staff. The third most of responses on a specific measuring area gathered the precision measurement. The pilotage organisations measure the waiting times, the punctuality of the ships or the ships' delays due to the procedures of the pilot and the tasks fulfilled during the pilotage. Also the financial results are measured in more than one pilotage organisation. Other entries of the various indicators were single.

Some respondents gave additional information regarding to the customer surveys:

- The Association of Forth Pilots measures customer satisfaction annually.
- Also Brabo Havenloodsen en Bootlieden cvba measures customer satisfaction annually. The sections of the customer survey are satisfaction about the level of service, billing and administrative handling.
- DanPilot performs queries both on board (the commanders) during the pilotage and among the staff on shore every two years. The on-shore personnel are send a questionnaire to be filled in the Internet and the commanders are given on board a written form to be filled in.

- According to Varna Pilot Station Ltd, the quality management system must measure the customers' perceptions of whether the pilotage produced by the pilotage organisation meets the customers' needs. The customer satisfaction can be measured by data derived from e.g. satisfaction and opinion surveys, compliments, complaints, reclamations and reports from the shipping agents. Varna Pilot Station Ltd sends every year customer queries for different target groups, such as shipping agents, maritime administration, port authorities and the commanders and owners of the ships.
- The Belgian Loodswezen examines customer feedback (complaints). The rapidity and adequacy of the answers given back about the feedback are also evaluated in the organisation.

According to the survey responses of the foreign pilotage organisations, they mainly use statistical information gathered from the pilotage and inside the company, information gathered with customer feedback surveys and financial results. These are very typical measurement tools used in monitoring and measuring of operations.

The reporting and applied statistic of the accidents and deviations are considered an important measurement tool for assessing the quality and safety of the pilotage. Importance is given to the work safety and well-being, such as the work load of the pilots, sickness absence levels and overall job satisfaction. Customer satisfaction is also considered a good indicator because the customer satisfaction information is easy to gather and process and it can be obtained directly from various sources. The customer satisfaction is measured both among the staff on the vessels and those on shore.

6.2 Indicators Developed in the Workshop

6.2.1 Background

The indicators for the pilotage can be divided according to the basic tasks of the pilotage into safety, fluency and environmental protection. Many of the presented indicators measure the success of more than one basic task. The indicators can also be distinguished by their data collection method basis. Measurement data can be collected as customer feedback from third parties outside Finnpiilot organisation and from Finnpiilot's own staff as self-assessment. Third, the measurement data can be accumulated with the actual events of the pilotage task. In this chapter the indicators are presented according to their data collection method.

6.2.2 Indicators Related to Customer Feedback

Primarily the customer feedback can be collected from Finnpiilot's actual customers, i.e. the shipping companies and vessels (commanders and other officers). In addition, information resembling customer feedback may be collected from other organisations, operating in the maritime branch. These organisations include the VTS, agents, ports,

icebreakers and towing companies. Customer feedback can be gathered related to safety or traffic flow.

Customer feedback collection was raised as the primary indicator of the effectiveness of the pilotage. The customer feedback should be collected immediately from the people working with the pilots which in practice means the commanders and OOWs. A query is directed to the commanders and OOWs, in which they assess the fluency and safety of the pilotage as follows:

- Fluency
 - Did the voyage go quicker by using a pilot (especially in winter time)?
 - Was the visit to the port easier with the pilot?
 - Fluency can be evaluated on both a single ship's and the whole traffic's standpoint.
- Safety
 - Could the ship have moved safely in or out of the port without a pilot?
 - Did the pilot, according to the commander, do something dubious or unpredictable during pilotage?
 - Was the information exchange between the commander and the pilot successful?
 - Did the pilot give adequate information e.g. about the passage plan?

Alternative implementation methods for the query are: a questionnaire given in envelope to the commander, who returns it via an agent or by post, or an electronic query in the Internet, of which the pilot informs the commander or by an e-mail separately sent to the ship.

Traffic flow and safety issues can be asked from other organisations very much in the same way. For example, the VTS centre can be asked how the piloted vessels have been operating in the VTS centre's sphere of influence. Have they noticed problems concerning safety and especially such problems which might be caused by the pilot? Are there, in the VTS centre's point of view, differences between the pilots' activities, or differences between different pilotage areas? Similarly the VTS centre could be able to give information about the operation of ships sailing without a pilot with a pilotage exemption certificate etc. This could be used as a comparison in the measurements.

6.2.3 The Indicators Based on Self-assessment

Self-assessment can be applied to pilotage effectiveness so that after each pilotage task, the pilots evaluate the pilotage process through pre-defined questions in the PilotWeb. These questions would be:

- How has the pilot influenced in the pilotage (Did the pilot steer himself, did the pilot give the manoeuvre commands or did he monitor while a pilotage exemption certificate student was steering)?
- How important the pilot considers his own role ("There I only just dug my nose, no for need me there" cf. "Many times had they driven to stones without me")?

- Did the pilot prevent near misses?
- Was the information exchange between the commander and the pilot successful?

The pilot can assess the pilotage task also based on different themes. The co-operation on the bridge can be evaluated and measured statistically using the following indicators:

- The disagreements between the pilot and the commander should be marked as deviations.
- What information was given to the commander during pilotage?
- What information was received from the commander?
- What information should have been needed or wanted on the ship and was this information given or received?
- Foreign language skills and any possible problems related to them.

The utilisation of the passage plan can be evaluated using the following criteria:

- Was the passage plan presented in connection with the handshake at the start of the pilotage?
- Where there deviations from the passage plan during the voyage?
- Were there disagreements about the passage plan?

6.2.4 The Indicators Based on the Stages of the Pilotage Process

The indicators related to the fluency of the traffic can be presented separately according to the stages of the pilotage. In this case, it is measured whether the stages start at the right time and for how long each stage has taken (the duration of the actual pilotage).

The indicators for pilot transport and pilot dispatch:

- The success of the transports
 - Waiting times due to the transportations (min/h). These may be caused by, for example, that there was no free pilot boats, or their drivers.
- The success of the pilot dispatching
 - The deviations in the pilot dispatching process and its success, the pilot dispatch service quality, are the right pilots waked up etc., the feedback concerning the pilot dispatch (in-house or from outside the organisation).

Indicators concerning the traffic fluency:

- How accurately did the pilotage begin (starting time)
 - How often does the pilotage start on time (%)?
 - How often is the pilotage late of the promised time? All statistics for more than 5 minutes delay (nowadays the delay boundaries are 2 hours and 6 hours depending on the area).
 - The statistics/measuring are made concerning delays caused by the pilot. The time of the pilot dispatching call is compared to the time when the ship at last started to sail.

- How many (%) of the pilotages start late for reasons not depending on the pilot (lack of the port workers, problems in the port, the ship was not ready) i.e. the pilot was at the place in vain.
- How often (%) ships begin to sail ahead of time and how much ahead of time (min/h) it then began its sail.
- The availability of the service (pilots, drivers, equipment) and how often the pilotage task starts as soon as the pilotage order has come.
- How accurately did the pilotage end (time of the ending)
 - How big percentage (%) of the acts of pilotage ends later than was promised, for reasons depending on the pilot.
 - How big percentage (%) of the acts of pilotage ends later than was promised, for reasons not depending on the pilot but e.g. other traffic, release of a berth, tugs being late etc.
- Duration of the pilotage
 - Did the pilotage last the estimated time or was the estimated time exceeded. This is measured by comparing the amount of time elapsed from the starting time when the ship left the berth to the time the pilot left the ship or the ship reached another port (E.g. from Kotka to Hamina).
 - If the pilotage has lasted longer than usual, it can be assumed that something abnormal has occurred, even if it has not been noticed. Such a pilotage must then be analysed in more detail.

Indicators related to the process activities are:

- How many (%) of the fairway pilotages are managed so that the pilot steers.
- How many (%) of the port pilotages start/end with the pilot making the port manoeuvres.
- Has the act of pilotage started already in the pilot boat in a situation of a ship coming in, i.e. the pilotage starts at the wrong time (this is not a legitimate activity, but mandatory under the circumstances above).
- Has the pilot had to intervene in pilotage while monitoring the commander's pilotage procedures (for example, while exercising for the pilotage exemption certificate or manoeuvring in the port area).

The workshop also discussed separately the deviations and near misses and the indicators associated to them. At the whole Finnpiilot organisation level there are some 100 deviation reports made in a year. As a rule, there is always a specific concrete damage involved in the deviation, which comes into light in a way or another, or one has encountered a possible (big) hazardous situation. The number of reported occurrences was considered to be too low compared to the actual practical pilotage. Deviation reports can be considered useful both by substance and statistics, and a visible indicator of the quality of work, which can also be used in the external communication. In the workshop participants' opinion, the deviations should be specified in more detail. The deviation reports should have an accurate definition/classification/encoding concerning the character of the deviation. The deviations would be classified to primary classes and further to sub-classes e.g. as follows: primary class 5: Port Operations, Sub-Class 5.1 the port workers were not at the site in time to fasten or unfasten the ship. In this case a mark is set in the corresponding sub-class check box in the PilotWeb. The issues of the devia-

tions could be pilot's activities, activities of the crew, and deviations due to the procedures of a third party and other deviations e.g. technical problems or broken seamarks. Also all other exceptional situations should be written down and recorded for the statistics. An example of an exceptional situation is taking a course along a fairway rarely used, such as the coastal path. Using the coastal path is an exception, because the usual passage is then not used.

A significantly exceptional situation occurs, when the pilot aborts the pilotage of the ship if the circumstances so demand. The pilot has the right to abort the pilotage or order another pilot to help. The possibility to refuse or abort the pilotage or to call a second pilot reduces the risk of accidents, because if the commander could decide, risks might be taken, and the ship steered e.g. in a dense fog. The reasons, occurrences of the abortion of the pilotage and the calling for a second pilot should be recorded for statistics, and if possible also the data whether these activities have enhanced safety and decreased the risk of accidents. The abortion of the pilotage has been used especially on the Saimaa area.

6.2.5 Indicators Related to Wellbeing at Work

The discussion on the pilots' well-being at work emerged through the workload-related factors. The general work load factors in the pilots' job are the ports, the ships' personnel, the ships' defects, the agents' inquiries, lack of communication, the VTS, which burdens with other traffic, icebreakers, language and other circumstances. By using a systematic reporting and statistics method, it is possible to get into the company's knowledge the essential improvement areas concerning the work.

Some issues, like e.g. possible fatigue, concerning the pilot himself are also connected to wellbeing at work. The pilots' workload can be measured by comparing it to the time used for pilotage and to the time that there would be available for the pilotage. *"You have to observe both the resting time and the working time; otherwise the statistics and the evaluation do not work!"*

As one concrete indicator it was mentioned, whether the pilot was given a meal on the ship. This would be necessary for a pilotage lasting more than four hours.

6.3 Usability of the Indicators

As some kind of a problem in measuring the pilotage, it was found out, that there is not very much information flowing in about the actual act of pilotage procedure. E.g. in the process flow charts, made by the work groups in the workshop, there were described only the coffee drinking sessions. Although the amount of pilotage is large, the acts of pilotage are often quite poor in events. During the act of pilotage, the practices and routines formed in a long run are in use. Many of the current standard routines are used even unconsciously. The workshop discussion felt that a routine act of pilotage that is poor in events works well even without a management system. It was felt also that the

little routine issues may be difficult to get on paper i.e. as part of the process. A management system would, however, give help and answers in non-routine situations.

The effectiveness of the pilotage should be able to be measured also by Euro-based indicators. This is not necessarily achieved by measuring only the stages of the process. Instead, it was seen that the measuring is important for the development of the organisation's activities. Measuring the impact of the effectiveness in Euros could provide information about how much money has been saved by using a pilot (e.g. traffic flow in the winter). Effectiveness may be concretised through savings in time by measuring i.e. assessing how much the pilot accelerated the journey of the vessel.

There is a need for further discussion on where and how the measurement data is used in the future. Alternatives include e.g. the development of the organisation's own operations or external communications. Also the reduction of risks caused by the external operators may be a measurement objective. A practical example: deviations from the passage plans on the same fairway due to the sailboats happen 300 times a year, or in 90% of the pilotage. This would mean that when closing the pilotage in PilotWeb these exceptions should always be marked as deviations, so that when analysing the deviation statistics afterwards, the frequency of the problem is detected and the authority responsible for the maritime safety can be informed for corrective activities. As a result, e.g. changes to the fairway are made, or the sailing competitions may be prohibited on the fairway, which reduces the risk of accidents.

By measuring in parallel the same issues with different data collection methods such as customer feedback and self-assessment, reliable and comprehensive information can be produced. The objective for processing and disseminating the measurement results in the organisation depends on the goal to be achieved. Do you want to increase safety, for example? Which indicators should be developed for this purpose? Or do you wish to improve the public image and which indicators should be used for that? E.g., a well-implemented self-assessment and process description would also help to sell the service forward. The objective of the measuring and the choice of the final indicators must yet be decided.

When designing the indicators it should be noted that it is difficult to verify, and compile statistics on what has not happened. There are, however, situations where it can be stated directly, that an accident would have happened if the pilot had not acted in a certain way. (Or alternatively there are situations, where it can be said that the accident occurred because the pilot had acted in a certain way.). It is, however, the pilot's duty to carry out an "uneventful" pilotage. When creating indicators for the development of the pilotage, i.e. when evaluating the pilot's load, the assessment can be difficult, if the ship's crew has not done anything else than cooked coffee, and thus one can evaluate only the activities of the pilot. In this case, there is no way to evaluate how the crew would have managed without a pilot.

The workshop discussed various types of measurement methods and how the related basic data collection should be organised and how the information obtained should be treated. The data related to deviations, accidents and near misses are to be processed

statistically and collected via the PilotWeb. At this point, the occurrences happened during the pilotage are recorded to the PilotWeb on closing of the pilotage. Statistical analysis can be made of the collected material by using the classifications. Also on the closing of the pilotage the information on self-assessment of the pilot can be gathered to the PilotWeb using the check-box principle. The idea here is, that to all of the pilotage tasks there is sent a few ready-made self-assessment questions, to which the pilot responds according to his own qualitative criteria. The self-assessment should not require too much time though, especially in case it is done separately after each pilotage.

The basic principle of reporting the deviations is that the pilotage carried out (i.e. the pilotage process) is compared to the ideal pilotage (the standard pilotage process), when the deviations to be recorded for statistics are found. The accident pyramid theory can thus be applied to the pilotage when evaluating the effectiveness of the pilotage through processes and their measurement. The basic formula of the accident pyramid theory is as follows: define the ideal process - measure the deviations from the ideal process - calculate the accidents (risks/probabilities). The idea there is, that the more often there happen deviations (including small and insignificant) from the ideal process, the greater probability there is for major accidents. Thus, limiting the deviations during pilotage i.e. by approaching the ideal pilotage process the risk of accidents is reduced. The theory is not applicable quite this directly to practice, but in assessing the probabilities of accidents, it also provides valuable guidance for pilotage.

7 SUMMARY

The objectives of the effectiveness of the pilotage project were to develop a description of the pilotage process flow, design, on the basis of the process description, indicators to be used by Finnpiilot to monitor the effectiveness of the pilotage, and to develop a preliminary plan for the deployment of the indicators in the Finnpiilot organisation.

7.1 Creating the Process Description

The first task of the project was to carry out a literature review. Based on the literature review, a preliminary model for the flow of the pilotage process was created. This model was further exploited in the next step, where the pilots were interviewed and the actual pilotage process was observed on six actual pilotage trips. During the interviews on the observed pilotage trips it was to find out how the pilotage is performed in practice, and where the current practices differ from the process model designed on the basis of literature. The following figure describes the process model at a general level (figure 7.1).



Figure 7.1. Pilotage process model

The pilotage process was gone through in a workshop held in August. As a result of the workshop a complemented process model was created, in which the pilotage of the incoming and outgoing traffic are separated. Similarly, the model separates the fairway pilotage and the port pilotage from each other.

7.2 Designing the Indicators

A classification based on the basic activities of the pilotage was created including individual indicators which are: customer satisfaction, quality, safety and maintenance support performance. During the study it was examined through an e-mail questionnaire and by a systematic Internet search what kind of indicators there are in use in the foreign pilotage organisations at this time. Furthermore, in the August workshop, indicators based on the process flow chart were defined and divided according to their way of data collection. The designed indicators have a structure of three primary classes: indicators to be collected as customer feedback, indicators based on self-assessment and indicators based on the pilotage process stages. The indicators relating to safety and traffic fluency is collected in customer feedback form. Data concerning the pilot's own views about the flow of communication between the pilot and the bridge crew, the effect of the pilotage to the safety of the trip and how the passage plan was exploited in the pilotage, is gathered through self-assessment. Data related to the pilotage process stages is accumulated e.g. from the success of the pilot dispatching, the transports of the

pilots, the accuracy of the pilotage and the incidents, near misses, deviations and accidents during the pilotage task.

Planning of Pilotage	Start of Pilotage	Fairway Pilotage	Port Pilotage	End of Pilotage
<ul style="list-style-type: none"> • Process indicators • The pilot dispatching and transportation: <ul style="list-style-type: none"> • Deviations in the pilot dispatching service • Self-assessment indicators • The passage plan: <ul style="list-style-type: none"> • Was the passage plan prepared in advance? 	<ul style="list-style-type: none"> • Process indicators • The pilot dispatching and transportation: <ul style="list-style-type: none"> • Delays due to the transportations (min/h). • Deviations in the pilot dispatching service • Fluentness: <ul style="list-style-type: none"> • Accuracy of the pilotage starting time • Ways of operations: <ul style="list-style-type: none"> • Has the act of pilotage begun already from the boat? • Self-assessment indicators • Bridge cooperation: <ul style="list-style-type: none"> • What information was given to the commander during the act of pilotage? • Did the pilot get enough information from the ship's commander? • The passage plan: <ul style="list-style-type: none"> • Was the passage plan presented before the act of pilotage? • Customer satisfaction: <ul style="list-style-type: none"> • Did the pilot provide sufficient information of e.g. the planned passage plan? 	<ul style="list-style-type: none"> • Process indicators • Fluentness: <ul style="list-style-type: none"> • Pilotage duration • Ways of operations: <ul style="list-style-type: none"> • How great deal (%) of the fairway pilotage is carried out so, that the pilot steers? • Has the pilot been obliged to intervene in the act of pilotage when monitoring the steering of the commander? • Self-assessment indicators • The effectiveness of the pilot: <ul style="list-style-type: none"> • How has the pilot effected to the pilotage? • How important does the pilot consider his/her role? • Did the pilot prevent near-miss situations? • Was the information exchange successful between the pilot and the commander? • The passage plan: <ul style="list-style-type: none"> • Deviations from the passage plan during the trip • Disagreements concerning the passage plan? • Customer satisfaction: <ul style="list-style-type: none"> • Did the voyage go quicker by using the pilot? • Was the information exchange successful between the pilot and the commander? • Did the pilot provide sufficient information of e.g. the planned passage plan? 	<ul style="list-style-type: none"> • Process indicators • Fluentness: <ul style="list-style-type: none"> • Pilotage duration • Ways of operations: <ul style="list-style-type: none"> • What percentage of port pilotage begins/ends so that the pilot carries out the port manoeuvres? • Has the pilot been obliged to intervene in the act of pilotage when monitoring the steering of the commander? • Self-assessment indicators • The effectiveness of the pilot: <ul style="list-style-type: none"> • How has the pilot effected to the pilotage? • How important does the pilot consider his/her role? • Did the pilot prevent near-miss situations? • Was the information exchange successful between the pilot and the commander? • Customer satisfaction: <ul style="list-style-type: none"> • Was the port visit easier by using a pilot? • Could the ship have sailed safely to the port or off the port without a pilot? 	<ul style="list-style-type: none"> • Process indicators • Fluentness: <ul style="list-style-type: none"> • The accuracy of ending the pilotage • Customer satisfaction: <ul style="list-style-type: none"> • Presenting the query

Figure 7.2. The pilotage process indicators divided by the stages of the process

In the figure above (Figure 7.2) the indicators are divided into the process stages (planning of pilotage, start of pilotage, fairway pilotage, port pilotage and end of pilotage). Off the chart was left the closing of pilotage stage having no specific indicators, but during which a self-assessment is being carried out. Customer feedback is collected both pilotage-wise from the ship commanders and through a yearly customer feedback survey via the shipping companies and the shipping agents. Measurement data based on self-assessment is collected in the PilotWeb, where the necessary self-assessment questions are added, and to which the pilot is responsible to answer. Also the indicators related to the process stages and process activities are gathered via the PilotWeb. The data

related to the punctuality of the pilotage is formed in the system through time stamps connected to various events. Also the questions concerning incidents and deviations are added to the PilotWeb. Further on the pilot will mark, using the check-in-the box principle, what kind of incidents, deviations, accidents or near miss situations there had occurred during the pilotage.

7.3 Initialization

A separate project shall be established in Finnpiilot for the deployment of the pilotage effectiveness indicators. The stages of the project are the definition phase, the implementation phase and the initialization phase. A project team including pilots is established for the project.

The work in the definition phase is divided into following activities:

1. Writing out the questions for the ship commanders concerning the customer feedback survey.
2. Writing out the questions for the self-assessment query.
3. Writing out the questions related to the process event indicators.

In the project's implementation phase separate sections for customer satisfaction, self-assessment and process indicators are added to the pilot order view of the PilotWeb. The PilotWeb functionality is changed so that the pilot has to, when accepting the pilotage, also answer the questions concerning the self-assessment and the process flow. The answers are given in a specific form either in numeral values or multi-choice check marks. The possible need for an additional data field is to be considered. Alternatively, the current deviation form of the PilotWeb might open, if the pilot sees it necessary to give additional information.

The customer satisfaction data collection is implemented in the PilotWeb, so that this information can be added to the pilotage event afterwards. The pilot can thus accept the pilotage before the customer feedback data is entered. The customer feedback data from the commanders can be entered to the system as office work.

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