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Aspects of Safe Port Entry for Ships

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ABSTRACT

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Entering port is one of the most crucial parts of a ships voyage. Confined coastal areas, heavy traffic and local conditions can cause challenges to the ship's crew, so safe actions are essential. Because of this there are multiple components in place to ensure no accidents occur. The IMO regulates ships operations, shipping companies have their own safety systems is place and national governments control their own sea territories, to name some examples. It is in the interests of many parties that ships deliver their cargo safely and no harm to environment, property or human life takes place.

This thesis looks at what is to be considered when a vessel is approaching port. The aim was to investigate and highlight the safest way of conducting the port entry while accounting for different factors effecting the operation. These factors were selected by the author based on their relevance to safe navigation and port entry.

The thesis was done for the ships deck crew and future officers to help them acknowledge what is happening before the ship is securely moored in port and how to implement a safe work culture. The work was written from a broad perspective looking at multiple different aspects and not focusing on just one. On the more theoretical side, the topics of hydrographic effects and bridge team management are evaluated. Research of practical knowledge about voyage planning, pilotage and communication are presented as well.

The research for this thesis was done by analysing relevant literature and online sources. A qualitative research method was used with a process of observation for gathering information.

With analysis of the research topic a conclusion can be draw that ships must pay careful attention to several different elements before and during port entry. Having multiple safeguards in place, and entities whose purpose is to make vessel traffic safer minimises the risk of accidents. The mindset of everyone working on board has a big impact on the safety culture and risk management. Vessels near shore have their movements and status are often closely monitored by reports and issued documents. The regulations by governments and IMO are the foundation for safety about all operations concerning ships.

Keywords: port entry, safety, pilotage

CONTENTS

LIST OF SYMBOLS AND TERMS

AIS – Automatic Identification System

COLREG – International Regulations for Preventing Collisions at Sea

ECDIS – Electronic Chart Display and Information System

FAL – Facilitation of International Maritime Traffic

HFO – Heavy Fuel Oil

IMO – International Maritime Organisation

ISGOTT – International Safety Guide for Oil Tankers and Terminals

MARPOL – The international Convention for the Prevention of Pollution from Ships

NOR – Notice of Readiness

OCIMF – Oil Companies International Maritime Forum

OOW – Officer of the Watch

SOLAS – Safety of Life at Sea

STCW – Standards of Training, Certification and Watchkeeping

VHF – Very High Frequency

VTS – Vessel Traffic Service

1 INTRODUCTION

Ships transporting cargo between ports has been the backbone of global trade and the maritime industry for an extremely long time. Humans have been trading with each other since long before the common era. And even during those prehistoric times the goods often were transported through waterways.
Nowadays global shipping is happening at a bigger scale then ever (UNCTAD, 2022). You can see the amount of cargo moved increasing, cargo ships getting larger and new types of innovation to make shipping even faster, more efficient, and greener. This means that to keep the elaborate logistics chains uninterrupted there should be no delays or problems. The cargo should keep moving regardless of the state of world. In this complex network of trade, ships are essential. Shown by how far most amount of cargo is transported by sea, compared to land and air.

For a ship to receive and load its cargo, it must come into port and stay moored during the cargo operations. During a ship's voyage the arrival and departure, to and from port are often the tasks that require the most care and expertise. The knowledge and experience of professional seafarers is essential for the whole worlds trade. Safely navigating the vessel to a berth is a small part of the logistics chain, but a very important one. The increasing size of ships makes it harder to maneuverer them inside port area and keeps this challenge of port approach highly relevant.

For the bystander ships sailing in and out of harbours might not look complex, but there is much more happening then what meets the eye. Channels and port approach areas are compact, which arises more risks. A large vessel not having open water around her to maneuverer in is challenging. In the worst case the result may be collision or grounding. These events usually mean damage to property, persons, or environment.

This topic was chosen to help the reader to better understand the complexities of a ship safely arriving to port and successfully berthing under any type of conditions. The thesis attempts to give knowledge on how the crew of a vessel should perform their duties, primarily focusing on the deck team. The tasks to be done before and during berthing are presented in detail. As well as different variables to be taken into consideration for planning and executing a safe berthing are analysed. Every port has their own unique characteristics as well as all ships, but the general guidelines for safe operation are universal, and those are topic this thesis highlights.

When mentioning port approach in this work it is used to describe the passage between a harbours pilot boarding area (or similar) and the ships designated berth. This may include rivers, lakes, channels, and locks. With mooring is meant the actions from preparing the mooring lines on deck to the vessel being secured to the quay and order to stop engines has been given.

The aim of this work is to advocate for the use of safe practises in shipping. Quite often onboard there are parts of the ships operation that could be done in a safer manner. The work highlights and guides towards actions that improve the safety. Information researched and presented aims to give advice on how a safe approach and berthing should be carried out, and what parts need attention. A ships operation should be as safe as possible for the crew, vessel, cargo, shore personnel and environment. I believe persons working in the maritime industry or persons interested in ship operations may benefit from this thesis research.

2 LEGISLATION

Vessels and marine traffic are subject to many international regulations. These are primarily created by the International Maritime Organization. The purpose of these regulations is to improve maritime safety and efficiency, as well as

control pollution from ships. (IMO. n.d.). SOLAS, MARPOL and STCW are considered to be three of the most important IMO conventions. The conventions most relevant to this thesis are COREGS and FAL. Since they are the most relevant ones to port entry.

IMO member governments enforce the codes and conventions by their own legislation. Accepting a convention is an agreement between IMO and the member nation to follow the details of the convention. Nations and their governments keep a register of vessels sailing under their flag and are responsible for inspecting the vessels. Ships must comply with their flag states legislation. In practice this often follows very closely with IMO codes and regulations. Rules and legislation apply to the crew and vessel at all times, thus there is no exemptions during port entry for example or exemptions dependent on the vessels location.

2.1 Finnish legislation

Finnish legislation states that the officer of the watch acts as the masters representative responsible for carrying out the vessel's safe navigation (Liikenneministeriön päätös aluksen miehityksestä, laivaväen pätevyydestä ja vahdinpidosta 1257/1997, Section 8). Officer of the watch keeps up the overall picture of the ship's status and location. The master of the ship is responsible for arranging the required safe watchkeeping.

According to Liikenneministeriön päätös aluksen miehityksestä, laivaväen pätevyydestä ja vahdinpidosta 1257/1997, Section 14-16 during restricted visibility and/or darkness the officer of the watch must pay special attention to the radar, COLREGS, safe speed and readiness for evasive manoeuvres. Notice to the master is often necessary per standing orders as well as having a lookout on the bridge. During hours of darkness the observing and displaying of correct navigational lights are emphasised. Ships are required to show the correct lights to display their status, so nearby vessels can identify them.

Near coastal areas and areas with high traffic intensity an up-to-date chart of a large enough scale should be used. The location is to be plotted between regular intervals using as multiple methods as reasonably possible.

3 VOYAGE PLAN

3.1 Voyage plan introduction

Before a vessel sets sail from port an officer has prepared a voyage plan to the next destination. Voyage plan is an essential tool for the bridge team. The purpose of the plan is to acknowledge risks that may be present during the voyage and minimise them. A well-planned voyage is more likely to be a successful one.

On many ships a designated navigation officer is in charge of making the plan. The officer must have experience of nautical charts, route information and the tools he uses to create the plan. Most often on ships this is done by electronic chart display and information system. ECDIS for short. These systems have a tool for drawing a passage on the charts. It is required per IMO regulations for a ship to carry nautical charts that have the vessels route displayed. Before the route was drawn on paper charts, but since the year 2000 the route being on the electronic chart only is allowed IMO. (n.d.). And from the year 2009 onwards nearly every ship must have an ECDIS according to IMO SOLAS regulations. Before departure the plan must be reviewed and approved by the master. Like with the whole vessel the master carries the final responsibility for the plan and how it is carried out.

Basic principle of creating a voyage plan is to take the current location of the vessel and create a series of waypoints to the desired destination. A waypoint is a marked position on the chart that indicates an action. Usually, this action is a change in course, but it can also show a change in speed or pilot

embarkation location. Waypoints also help with following how the vessel is making way and if the schedule being maintained. The passages between waypoints are called legs of the voyage. For example, it could be decided that a certain leg is sailed at a lower speed to arrive at the right time and conserve fuel. With modern ECDIS systems distance and estimated time of arrival can be calculated and shown from the created voyage plan. The user is able to set any speed to the interface and the from the shown estimates it can be easily interpreted if the vessel is on schedule or if the speed needs to be increased or decreased. Described as speed of advance (SOA) in Nathaniel Bowditch's American Practical Navigator (Bowditch 2002, p.367).

The crew of course must know the details of their destination, like the country and ports name as well as when are they due to arrive to make the voyage plan and the proper preparations to ensure a smooth arrival. This includes for example documents the vessels master may have to issue for port officials and charterers.

If while underway the ship gets new orders regarding their destination a new plan must be made, and then the voyage may resume. The whole crew should be informed about significant changes to the plan.

3.2 Creating a voyage plan

The voyage plan can roughly be divided into two parts costal navigation and open sea navigation (Swift, 2004, p.20). This work focusing on port approach will pay more attention to costal navigation.

There are steps to drawing a voyage plan. The officer tasked with creating a voyage plan must know the point of departure and destination. Often when a new plan is made the ship is in port and the point of departure is just the vessels current position retrieved from GPS. When these basic pieces of information are known the drawing of the passage can begin. At this point the officer should already have a rough mental model on how the plan should look

like. Are there significant traffic areas, straits, archipelagos, or restrictions that need special attention?

Before the plan is being made it must be ensured all the required equipment, charts and publications are up to date and checked to be functioning. The values of safe distance to of costal passings, navigational hazards and set under keel clearance values should be discussed and agreed upon by the master and bridge team. There can be shipping company specific guidelines and values for voyage plans that the bridge team must follow when making the plan.

The route is drawn up by adding legs of the voyage by placing waypoints on the chart until the destination is reached. The plan must have enough information, so in case of doubt the officer on watch can retrieve info from the plan. One way of adding information to the plan can be done conveniently trough waypoints. Naming and adding descriptions to waypoints with close-by navigational aids, geographical features or even instructions when creating a voyage plan is helpful for executing the plan. Depending on the company rules, captain or officer making the plan sets no-go areas, wheel over points, point of no return and emergency routes and anchorages that are good additions to a route plan (Swift, 2004, p.27). Minimum under keel clearance is often stated on the company rules and should be followed in all voyage plans. The plan should always cover the route from berth to berth. This way it includes possible pilot embarkment, and the port approach is clearly routed and can be safely executed without hesitation.

3.3 Weather in voyage planning

Environmental factors are one of the most important things that must be taken into account while planning a passage. At the time of making the voyage plan the weather conditions at the arrival port during time of arrival may be unavailable and make planning harder. Forecasts don't always stay true and following them frequently during the voyage should be done, so precaution can be taken if necessary. Environmental factors must be assessed so the ship stays in safe

waters. Multiple different effects can make navigating in shallow and narrow ports more difficult. Most of these are weather related like wind, fog, and waves.

If a certain area is known for having strong gusts, it may be smart to draw the route somewhat further from coast with plenty of safe water to allow for greater margin of safety. Especially with a vessel that has a large windage area and is more prone to the effects of wind. When a ship is turning the point of which ships turning motion happens is called the pivot point. When making headway the point is between midships and the bow and with sternway it is between midships and the stern (House, 2018, p.36). Wind can change the location of the pivot point and have a significant effect on the steering properties of the vessel. If a vessel is sailing at a low speed the wind will have a larger effect, then with high speed. Maintaining a course at low speed and strong winds requires bigger rudder angles then at a higher speed. But in some areas like archipelagos sailing at a high speed may not be safe for the vessel's navigation. With no wind the pivot point changing location should not have a large effect on the manoeuvrability even at low speed.

Strong waves and wind both cause movement on the vessel in pitching and rolling for example. Unwanted movement on the hull affects steering in a negative way. Especially if there are strong waves from the stern or the ships side, and if the propeller of the vessel is above water level on occasion in high seas.

Visibility has a higher importance especially when approaching port compared to open sea since landmarks and navigational aids are used more in navigation. Hence restricted visibility also poses a challenge to port approach. In narrow channels for the pilots and officers not to see the coastline and breakwaters by eye makes the steering harder since they can be a valuable reference point. Thick fog can even block leading lines and lights. In situations like these the ships radar is the bridge team's best friend. The use of a sound signal and safe speed is advised.

Tides and currents should be considered in the voyage plan. In some cases, during the low tide, it may even be completely impossible for a ship to enter port if she is constrained by her draught. Admiralty Tide Tables are the standard for manually making tide height calculations concerning voyage plans. If a ship is coming into port with a strong high tide the current caused by the tide will make steering harder. In this case the current is coming from the stern of the ship that is making headway. To keep the vessel in control and the pivot point at the bow, the vessel must go faster than the current. Going against a current is not as complicated as current from the stern. In steering the bridge should just keep aware that the ship can move significantly in the current's direction even when manoeuvring.

In the wintertime cold regions of the world can have sea ice. For ships ice is an extra hazard to look out for. Not all crews have experience in ice navigation, so being well prepared is needed. When entering a region with ice knowing the local conditions is important. Weather services, VTS, pilots and icebreakers can provide ships with information. The close vicinity of large port areas are usually kept free from thick ice forming, but getting to the port may require navigating in ice or even the help of an icebreaker.

Entering ice should be done at the point where the consolidation of ice is lowest possible. Respecting the force of ice and working around and with it, is important. Finding the path of least resistance should be done and followed. Even if it is longer then steaming straight through the ice. Keeping the ship constantly moving is key to not getting surrounded and stuck in the ice (Canadian Coast Guard, 2022). Excessive speed must be avoided since hitting ice at too high speeds can cause structural damage. The ships turning circle will be increased due to the obstacle the ice creates for manoeuvring. Big manoeuvres in ice could be hard to execute, so taking smooth turns is often the best solution.

As with everything in cold winter conditions the berthing of a vessel should be expected to take more time then usual. The vessel must manoeuvre carefully to the berth, to avoid having ice between the ship and the berth. Washing ice away with the use of the propeller may be necessary. (Canadian Coast Guard, 2022) Ice trapped between the vessel and the berth could damage them both.

3.4 Vessel's particulars

Ships characteristics are a factor that must be considered in the voyage plan. They are the most important thing to know about when planning to enter a certain port. Draught being the common limitation for bigger ships. The characteristics include length overall, beam, draught (trim), air draught, length to beam ratio, windward surface, type of propeller, number of propellers, type and size of rudder, thrusters, engine power, type of vessel and its hull. All of these have an effect on how she handles. A large ship with just one fixed pitch propeller might need the assistance of tugs in narrow port areas and in harsh weather conditions. If the port you are sailing to won't allow ships your size, naturally you cannot sail there. This issue applies mostly to very large ships, but still must be kept in mind when making a voyage plan. The air draught of a vessel might cause a problem when sailing under bridges and/or other high structures that might interfere with the ship. Loading cranes in port could cause the same type if issue. Ships with especially high cargo on deck could hit a bridge and cause damage to the bridge, cargo, and the vessel. These things should be checked and addressed in the making of the voyage plan.

With the port approach well planned the crew can safely execute the arrival and berthing. Most often with assistance from a pilot. With the plan done berth to berth manoeuvring can be done with certainty inside the confined port area. Remembering to apply previously mentioned advice and having safety as a priority when making a voyage plan leads to an overall safer voyage.

4 VESSEL TRAFFIC SERVICE

Before a ship enters a port there are notices that must be made to different parties. Vessel traffic service also known as VTS should be contacted at a VTS reporting position, this is an area or position that can be seen from a nautical

chart. Usually, this reporting is done via VHF radio. Different areas of the world use different VHF channels and different frequencies. The vessel should beforehand find the correct channel for the area they are entering, and have a radio tuned to the cannel. Vessels should carry onboard a publication by the International Telecommunications Union called List of Coast Stations that contains the right channels and frequencies for coast stations. The book also contains the stations watch hours, frequencies, and the services they offer.

4.1 Purpose of vessel traffic service

The purpose of vessel traffic service is to improve the safety of navigation, especially in areas with high amounts of traffic and dangers to navigation. VTS centres keep an updated picture of vessels movements in their area and ensure a safe passage for everyone. If a ship notices a danger that poses a threat to vessels nearby, they should report it to VTS, so they have the information and can inform other vessels in the area. Operators at the VTS centre should notice if a danger of collision is arising and act to prevent it. Prevention of congestion at port fairways is also the responsibility of VTS personnel. Vessels receive information about inbound or outbound traffic that might be hard to notice by radar due to geographical features or the radars range. The centres can also help with navigation by proving useful information especially in challenging weather conditions. If operations affecting navigation are conducted in the harbour area, like dredging or maintenance of boys of lights, the VTS centre will inform the ship. The final authority for the vessel and its movement is on the master, including when sailing in VTS area. VTS cannot give orders to the ship, but it can provide useful assistance.

If the vessel is without a pilot, VTS could be interested in the masters or officers pilot exemption certificate number. As an example, in Finland's Saimaa VTS area the information given to VTS includes name of the vessel, name of reporting point, destination, intended route and if applicable length of tow (Fintraffic, 2023, p.5). Reporting is required when entering or leaving VTS area, before and after anchoring, after berthing and before leaving port or lock. A

VTS area can have multiple points where a vessel should report, especially if the port approach is long.

5 ARRIVAL DOCUMENTS

There are multiple documents a ship could have to issue when approaching or arriving at a port. Customs, immigration control, the harbour, charterer, agent, owner, or pilot might all require documents from the ship. The IMO's FAL convention decreases required declarations that contracting governments can require. The aim is to have uniformity and regulation, but remove insignificant regulation and unnecessary burden. (IMO, n.d.). The bigger goal is to prevent delays in global shipping due to paperwork. The convention has recommendations for document requirements and practises during the different stages of ships port call and the different areas of interest for the authorities. The convention includes standard documents for the following: IMO General Declaration, Cargo Declaration, Ship's Stores Declaration, Crew's Effects Declaration, Crew List, Passenger List, Dangerous Goods (IMO, n.d.). These standard lists are made to ease the workload for both the ship's crew and the customs and port authorities that require the information given by the ship to carry out their duties. Since 2019 it has been mandatory to exchange the information in electric format. The purpose of these documents is to regulate all ships, so the authorities know if someone is breaking the rules. Countries are interested in what and who are arriving in their ports to prevent illegal activity. The same applies to the crew and their effects. The crew's items must not contain any illegal items or exceed the limited amounts for restricted goods. The documents often have to be submitted 24 hours or 72 hours prior to arrival. Submitting the required documents well beforehand reduces the vessels turnaround time and saves money for the owner.

5.1 Dangerous goods documents

Shipping and handling of dangerous goods is especially regulated and more strictly followed in shipping. The IMO's International Maritime Dangerous Goods-code (IMDG) was created to protect crew's and environment as well as to ensure safe shipping of dangerous materials. There is more documentation to be done with dangerous goods. Safety and ease of transactions and operations are ensured by having international practises in place with checklists and cargo manifests. All ships carrying dangerous goods are required to have a document of compliance. It is meant to show the vessel is suitable and has the equipment for carrying dangerous goods. The document if issued by the vessels flag state administration. Usually, it is the chief officers responsibility to have all documentation concerning dangerous goods in order. It could lead to fines if inspectors find deficiencies in the paperwork.
Material safety data sheets for all dangerous goods must be carried onboard when under carriage. They contain detailed information about the material and have instructions for emergency situations. The material safety date sheets should be available to the whole crew, and the crew should be aware of the dangerous cargo onboard and its properties. It is the shipper's responsibility to supply dangerous goods manifest and material safety data sheet. (Shipsbusiness, n.d.)

5.2 Ships agent

The ships agent is a person ashore who handles many different things on behalf of the ship and acts as a link between the ship and the cargo recipient. The agent is a local person from the country who knows the language, customs, and culture. This makes it easier for them to handle and organise different services on behalf of the ship. These things can include creating and transporting documents to different authorities in the port. Letting the ship know the exact berth. Ordering a pilot for the arrival and departure. Ordering tugboats to assist the ship. Arranging shipments for spare parts, repairs, and provisions from shore side to the vessel. The stevedores may get information about the loading and unloading of the vessel from the agent. If there has been damage

to the cargo, the agent will assist the ship with documenting and taking further action (Charpentier, 2022). In the need for bunkering the agent can assist the ship with ordering it. Agent services are usually mostly related to the cargo documentation and to the freight and transport of cargo. They are handling activities between shipper and receivers of cargo. Once all the required documents have been delivered the ship can arrive at the port without unnecessary hassle and start their cargo operations with no delays.

5.3 Notice of readiness

Ships often issue a notice of readiness (NOR) when she ready for chartered service. NOR is an important document in legal disputes, especially voyage charter parties. It is issued when the ship is ready to commence cargo operations. It can be made when the ship has berthed, or in a port specified anchorage if the designated berth is unavailable. A notice of readiness is issued and signed by the master and contains information about the cargo, port, and charterer. Laytime starts when NOR is issued and it is in the charterers interests to complete the cargo operations during the laytime agreed in the carter party.

6 PILOTAGE

6.1 Introduction to pilotage

Coming into port area the master is most often the one who is doing the manoeuvring in the port. If the port requires a pilot onboard for entering, as most do. The ship must prepare for taking the pilot onboard. Often the ordering of a pilot must be done 24 hours before the pilotage starts, or ever earlier. In high traffic areas it may be less. The pilot's duty is to assist the ship's captain in conducting the passage between the pilot boarding location and the ships intended berth in a safe manner. There are also open sea pilotages in high traffic density areas such as the Danish straights and the English Channel for

example. Not all vessels are required to take a pilot in these areas. It depends on the company's instructions for their fleet, or the local governments demands. The ships factors considered in the Danish straights are dangerous cargo, her draught, radioactive materials and large amount of bunker oils (DanPilot, n.d.).

6.2 When are pilots required

The need to take on a pilot in certain ports is decided by the state of the port. In Finland the state controls the country wide pilotage organisation and chooses which fairways and ports have features that call for the need of pilotage. All persons working as a pilot have a master's certificate. In Finland the pilots are state officials (Piira & Haavisto, 2006, p.55). Their required skills for recruitment are decided by the state-owned pilotage company.

6.3 Cost of pilotage

Every time a ship has a pilot, they will have to pay for the pilot's services. The amount to be paid varies between countries and areas. The net tonnage of the ship and the distance of the pilotage in nautical miles determines the cost Finnpilot. (n.d.). Some masters and chief officers may obtain a pilot exemption certificate for certain fairways. This means they don't need to take a pilot onboard when the person who has the exemption is navigating the vessel to port. Vessels in liner traffic that call the same ports on a daily basis often have crew members with these exemption certificates. The owners or charterers are happy with captains that have the exemptions for multiple ports as this means they don't have to be paying for the pilotage fees every time the vessel arrives and departs the port. Shipping companies may help and pay for their ships masters to take the certificate examination to reduce costs in the long run (Hattunen, 2023).

6.4 Pilot embarkation

The pilot comes onboard the vessel by a pilot boat. The location where the pilot will embark the vessel is given by the pilotage authority. Usually, this location is the same that is marked on nautical charts with a pilot boarding position symbol for the associated port. The communication is done by VHF radio between the pilot station or the pilot boat. They often tell the ship to steer a certain course and speed. The pilot boat will come alongside the vessel when the pilot is ready to embark. The boarding arrangements for pilots have strict rules. The international maritime pilots' association have created recommendations for boarding and the IMO's SOLAS convention has requirements that must be followed during pilot boarding situations. These rules and requirements are in place for the pilot's safety during embarkation and disembarkation. The rules have many requirements for the pilot ladder that is lowered on the side of the ship's hull. They must be on the lee side of the vessel with the ship giving some shelter from the weather to the pilot and the pilot boat. This is to minimise excessive waves or wind to make the boarding easier and safer. When ordering the pilot, they will usually tell on which side the ladder should be. Only the pilot ladder can be used when the ships freeboard is nine meters or less. If more the ladder must be used together with an accommodation ladder. The pilot ladder must be made only for pilot operations and should not be used for anything else. The ladder must be in good shape and there can't be any alterations. The steps must be horizontal and equally spaced and there must be a spreader every nine steps at minimum. The four lowest steps should be made of rubber to improve their durability.

The area on the ship should be clearly marked as a pilot boarding station. Usually on ships this is between midships and stern. The boarding area should be clear of any hazards and well-lit during night-time. No loose ropes or other items should be on deck that could cause a tripping hazard. Steps, ladders, and hand poles must be firmly tied down or otherwise attached to their appropriate positions. A lifebuoy with a light must be at the station ready for use.

When getting ready to take a pilot onboard the deck crew of the vessel have designated duties in the operation. As always, the bridge must be appropriately manned. Officer of the watch on the bridge must be kept updated with the events of the pilot boarding. When the pilot boat is closing in a deck hand and an officer should be overseeing the operation on the ships side and possibly assisting the pilot at the boarding station. The officer is in contact with the bridge via radio and will escort the pilot to the wheelhouse once they are onboard. The task of collecting the pilot ladder back in place and possible closing the pilot door is the deckhand's responsibility.

Not complying with the required pilot boarding arrangements could lead to the pilot refusing to board the ship, and subsequently meaning the ship cannot enter port until needed corrections are made. An occurrence like this could be a major problem for the ship's schedule as well as a big detriment to the ship's and companies' reputation and would likely add costs due to delays.

The pilot's knowledge is used to improve safety of navigation. The vessels crew could be visiting their port of destination for the first time and not have knowledge of the area. With modern navigation equipment and up to date charts the pilot's local expertise is still a valuable asset. Pilots are trained to be experts on the port and its fairways. They know the local hazards and conditions.

6.5 Master pilot exchange

The master pilot information exchange is one of the most important procedures during the pilotage. The pilot should be informed or will often ask about the ship steering systems and characteristics. A pilot card on the bridge should have all the essential info about the ship a pilot may be interested in. The ships radars abilities and settings might be of interest to the pilot in assisting with the navigation. As with regular bridge work effective communication is very important. The working language used should be one that everyone related to steering and navigation understands. It is essential that the whole bridge crew

are on the same page and know what the plan is to get the vessel safely to berth. Master and the pilot go through the plan on how the vessel should be steered and what course to take (Simojoki, n.d.). Changes may be made to the original voyage plan if there is traffic, or the pilot advises for another approach. However, the final call depends on the master. If there are specific dangers to the vessel that may arise, the actions to take should be agreed beforehand. Often the pilot handles much of the radio traffic on behalf of the ship with port staff, VTS or with giving orders to tugs. Communicating in the local language can make the operations more straightforward. The pilot should still remember to translate critical information to the bridge team and keep the crew in the loop.

6.6 Control of the vessel during pilotage

The ships master can give complete control over to the pilot or they may choose to have it themselves. These things should be discussed on the bridge together with the pilot. The pilot should not start taking control and acting on their own before proposing it first to the master and having their approval. Some pilots may expect to take control and others are more happy giving suggestions to the master. Personal chemistries play a part in the bridge teams' ability to work together. In the end the master is always liable for the vessel. The master oversees that the pilot is fulfilling their duties correctly. Having a pilot onboard does not change the fact that the OOW must be attentive on the bridge an fulfil their duties. There should be a lookout and possibly a helmsman as well on the bridge if needed. These two tasks cannot be assigned to the same person. Usually, the master acts as the OOW handling the port approach and manoeuvring of the vessel alongside. The pilot is an asset to help with the crew's workload when they are onboard, and to ensure safety of the vessel, property, and environment.

7 NAVIGATION IN PORTS, CHANNELS AND RIVERS

7.1 Introduction to confined areas

Ports are manmade structures which means they are only the size that allows only for the essential operations and not much else. When building ports, the geography must be paid attention to, and it can sometimes limit the ports size. For example, moving whole islands out of the way is not the most practical thing to do. This means you just must work with what you have got and find the best way around that. Constructing port areas is not cheap and they can take a lot a resources and time. Often ports are not so excessively large that they would allow for ample space for vessels to manoeuvre inside. A more confined space means less room for error. Underwater obstacles and dredging aren't cheap to deal with either. The maintenance of a larger area will also come with a larger cost and require more workforce from the port. These are some of the factors that limit the sizes of ports.

Navigation and manoeuvring in confined areas such as rivers, channels and docks has more challenges than open sea. In these narrow spaces there are different types of features the crew must be aware of. How a vessel behaves, and handles depends on different factors. These factors are very different compared to deep open ocean and shallow channels. When approaching the port, the level of alertness should be higher on the bridge. Ships have multiple effects concerning interaction with other close-by vessels and the environment. The bridge must be aware of the interactions and how to prevent them from occurring or minimize their effects.

7.2 Channels and interaction between ships

For vessels sailing in narrow channels the risk for grounding or a collision is higher because there are banks of the channel on both sides and there may be structures and other ships making way that are to be avoided. The space for evasive manoeuvres is extremely limited. In these types is restricted

environments interactions between ships are most common. The interaction can occur during ships passing or overtaking. Even when passing a moored ship there can be effects.

When making headway there are different types of pressure zones around the ship's hull. These zones are created by the vessel moving through the water. The bow is pushing water away to the sides of the ship creating a positive pressure zone at the bow of the ship and low-pressure zones along the sides of the hull. (Baudu, 2018, p.) Water rushing back to its original position at the stern creates another high-pressure zone. In a passing situation where the ships are meeting head on at first the bows of the ships will repel each other. The effect will have more significance on the ship that is lighter in terms of tonnage and can lead to a dangerous situation if the vessel is gets too close to the side of a channel. After the bows have passed the lighter ship will be sucked into the large ship due to the different pressure zones. The low pressure of the larger ship attracting the high-pressure zone at the stern of the smaller ship. Especially the stern and side of the smaller ship will be sucked by these hydrodynamic forces. In the worst case this could lead to a collision between the vessels. Trying to overcorrect with the ships rudder or increasing speed when the ships is subject to these effects could make the situation even worse. The best way to minimise this interaction is for both ships to reduce speed beforehand and have as much water between them as possible. In especially narrow channels the other ship may even stop completely to let the other ship pass.

7.3 Overtaking in channels

When overtaking in a narrow channel the same effects caused by pressure are in place between ships. If a larger vessel overtakes a smaller one the stern of the smaller ship will be sucked by the larger ships side. Suction between ships hulls or the overtaking ship and the channels bank must be avoided. When the ships bows are side to side their repelling force should be anticipated and a small correction done by the overtaking vessels helm (House, 2018, p.739).

Making too sharp turns and using too large rudder angles are common mistakes. The turns should be controlled and done enough in advance for letting them take effect. For preventing strong interaction effects and accidents that may follow from poor overtaking reducing ships speed if the most effective. In narrow channels where the ships speed should be reasonable anyways reducing it further can prevent accident from happening and ensure a safe passage.

7.4 Moored vessels in channels

There may be places in channels when vessels are moored to wharfs at the side of a channel or moored in regular port areas. They could be conducting cargo operations or bunkering. In these situations, the same previously mentioned effects stay true, don't pass too close or at too high of a speed. The water moving around the ship's hull and propeller wash can affect the moored vessels lines and even loosen them. Both the lines getting loose or them even snapping under tension can happen. If the watch is not attentive there could be serious damage if the vessel gets loose from the quay. If there are bunkering operations taking place, there can be severe environmental damages from the bunkering connection getting torn. For the ship moored it's recommended to have more mooring lines then usual when mooring in a channel or next to a lane with frequent traffic to ensure that the vessel stays in place. It is not good seamanship practice to cause interaction like this between ships that endangers the other party.

7.5 Locks

Ports that are in areas with a strong tidal effect often have locks. Locks are a structure that connects two different pools of water that aren't always on the same level due to tidal effects. Ships can be transported up and down in the lock. For a ship to use a lock it must manoeuvre into the lock and stay moored while the water level in the lock changes. This requires for the lock to have linesmen ready and staff to close and open the lock gates and pump the water. Locks often have their own staff on call at the location. Some ports have a

closed off basin that the ships must enter through a lock. With the basing segregated from the sea the effect of tide won't influence the ships in the basin and they can conduct their cargo operations without having to worry about the tide. Locks in harbours are often located in rivers or river deltas. In large ports and busy canals, the locks can be big enough to take multiple ships at a time. Manoeuvring into them requires knowledge of the area and the ships characteristics. Steering the ship in a confined space with possibly traffic around and the rivers current affecting the ship can be very challenging. Strong wind and bad weather conditions could make the job even harder. The strength of the current caused by tide will vary depending on the time of day and the time of neap and spring tides. Before entering an area with tidal effects, the direction and strength of the current should be checked from nautical publications and charts. If the entering of a lock seems too risky due to extremely bad weather, it should be postponed. For big ships and ships with restricted handling abilities the use of tugs is usually required or may even be mandatory per port rules. Locks usually are in pilotage areas, so the pilot will be assisting the bridge team with their local expertise.

7.6 Bank effect

Sailing in narrow and shallow areas such as rivers and channels can cause challenges even with the absence of other vessels. Bank and squat effects can have strong forces that affect the ships manoeuvring. Bank effect occurs when the vessel is too close to a bank of a channel or there are similar circumstances. Water moving between the vessels side and the bank will have a negative pressure and the water starts moving faster towards the stern. The water rushing away is increased by the propulsion and causes the water pressure to drop and the rudder is no longer as responsive. Water escaping from between the stern and the bank causes a suction effect that draws the vessel to the bank (House, 2018, p.741). Overcorrecting with rudder in the early stages of bank effect could start the vessel to swing from one side to other in a channel, causing to experience and trying to correct bank effect constantly. Breaking out of this type of swinging is very hard.

7.7 Squat effect and shallow water

Shallow water has its own effects on ships. Having less water between the ships keel and the bottom can at high speeds create an effect called squat. When a vessel enters from deep water to shallow water there is less space under the ships keel. When moving forward the water flow in the small space under the ship increases in speed. The speed of the water flow is accelerated even further by the ship's propeller and the water pressure under the ship drops. A vacuumlike effect is generated and the vessel sees an increase in draught. The increase can be multiple tens of centimetres to even meters depending on the ships size, shape, and speed. Especially the stern of a vessel sinks following the squat effect and may be a threat to the vessel, as propulsion systems and rudders are generally located at the stern. This can lead to a grounding if the crew is not aware. When experiencing squat, the vessels propellor doesn't have as much water to move and manoeuvring is harder. Holding a steady course can be challenging. The characteristics of the area surrounding the vessel influence the squat's strength. In a channel there is limited water on all sides of the vessel compared to a shallow area with ample space on the sides of the ship. The effect won't be as strong with space on the sides of the ship.

You can identify squat onboard from different signs. The speed of the vessel will decrease. The waves created by the vessel are larges as it pushes more water when sailing deeper. A change in the vessels trim. Engine load is unstable. Stopping distance and turn radius increase. (House, 2018, p.58) The ship's crew must be prepared to reduce to a lower speed when entering shallow water areas as ports, rivers, and channels. The reduction of speed is the primary action to minimise the squat effect. During route planning shallow areas and port approaches should receive special attention to predict if the vessel may encounter conditions that can require a change in speed or more personnel on the bridge for example. Following the safe water depth can be done together from the chart, echo sounder and tide tables.

Making a sharp turn is shallow water might increase a ships draught even more then the squat effect. Most ships have a box shape underwater hull. So, when

turning the vessel, she heels or creates list to the opposite side of the turn. This is due to the centrifugal force acting on the ship during turning and the waters resistance. Picturing the vessels hull as a floating box shape that has a list to one side will cause the “corner” of the box to hit the bottom. Different water pressure zones around the hull make handling during a turn harder in shallow water. The increase in turning circles is an attribute the bridge team should be prepared for when manoeuvring in confined shallow areas. This is result of the decreased space for the water to move under the ship’s hull.

8 CHECKLISTS

Many shipping companies require their ships to use checklists onboard. They are a very useful tool for when forgetting something important could be a threat to safety. The lists primary focus is to improve the vessels safety and help the crew or responsible crewmember to remember to do their tasks thoroughly. Checklists promote a strong safety culture onboard while still keeping up with efficient and fast operation of the vessel. The checklists consist of different items to be checked or tasks or notices to be done relating to the vessel’s seaworthiness. Depending on the vessel and the company the list may be divided to different categories such as: communication, navigation, pilot, engine room, technical systems, and the crew. Arrival and departure have their own checklists. Master pilot information exchange and the pilotage itself have their own checklists. They can consist of navigation equipment available to the pilot, the planned route, and the ship’s details.

Checklists might not be completed in one go. There can be items that are checked in a certain location or time. For example, reporting to VTS when arriving or calling the pilot for an ETA. Some of the events may need to be written in the ship’s logbook as well. It’s good to have the arrival checklist already printed out and ready on the bridge shortly after departure. With the help of the checklist, it is easy to follow what has been done and what is still left. Having

a good ready template for different checklists means you don't have to create the list from scratch every time you need it. Completing the list should be done with care and the things must be really inspected and not just marked as checked. The officer completing the list can be held responsible for completing a part of the list and the master in responsible for the whole checklist. The person completing the list assures they have done the checks by signing the list or parts of it. If there are deficiencies or problems with the items in the list the master should be informed, and the problems must be addressed and fixed.

9 COMMUNICATION & BRIDGE TEAM MANAGEMENT

Clear and efficient communication onboard is very important for safety. An error in a communication chain or a misunderstanding can have disastrous consequences. Daily routine exchanges of information are common when working onboard ships. During change of watches a handover exchange is necessary to ensure the next person taking over knows what to expect and to look out for. Efficient communication doesn't always mean talking for a long time with high detail but getting the essential information to the other party clearly in a way they understand it. Messages in critical situations should be clearly heard, straight to the point and leave no room for misinterpretation. And if there is a misunderstanding it should be cleared up by asking. The IMO's standard maritime communication phrases are the industry standard. They are taught to mariners according to STCW and knowledge of the phrases is required from officers. But in daily operation common English is mostly used.

9.1 Working as a bridge team

When working together on the bridge keeping everyone necessary in the loop, with open communication benefits the whole bridge team. With a teamwork atmosphere everyone is welcome to give input and challenge the decisions.

This can lead to productive debate and discussion. If a voyage has areas that require higher workload than normal a briefing is a good way to inform everyone involved about what is expected and what to look out for. The atmosphere and how the crew gets along can have a very big impact on teamwork. A tense environment between crew members is reproductive to working together and carrying out ship operations. (Swift, 2004, p.4) Sometimes between the higher and lower-level crew members there may even be a level of intimidation if a very strict personal hierarchy is present on the ship. In the worst case this may lead to crucial information being left untold or ignored. Different cultures and leadership styles play a big part in working as productive team on the bridge. The crew knowing each other and having worked together for a while usually improves morale and cooperation.

When approaching port, the bridge is coordinating with many different places to ensure the port entry goes as intended. They may be in contact with VTS, tugs, engine room, mooring stations and each other including the pilot on the bridge. The bridge team should consist of multiple different persons when entering a port and there should be communication between them as well. The master and pilot may discuss the made voyage plan, ships handling characteristics or the pilots' intentions. Lookout will inform the OOW about navigational dangers and helmsman will repeat helm orders. All these examples of communication are necessary to maintaining a safe port entry. Too much talking on the bridge or machinery alarms during critical manoeuvring may be distracting to the crew or pilot. Therefore, usually only the persons with duties on the bridge are there during port entry and mooring. Some ships may even have rules that entering the bridge is prohibited for crew that doesn't work there to prevent distractions.

9.2 Different cultures and nationalities

Often on ships the crew consists of multiple different nationalities representing different cultures. Not everyone speaks the same native language or has the same level on fluency in the English language. A language barrier could make

communication sometimes challenging. With different cultures there may be different styles of communication. Some phrases or jokes may not translate or be understood well. English being the primary language in shipping means it should also be the working language on a vessel unless otherwise stated by the master or company (Simojoki, n.d.). By IMO's requirements all ships officers must be fluent enough in English to communicate with other ships and costal stations. Understanding notices about dangers to navigation on VHF radio is essential. Technical systems and charts written in English must also be understood by officers.

9.3 Closed loop communication

Closed-loop communication is the best way of communicating when it's important that the receiver heard the message correctly. This is especially useful when talking via radio. The radio can have static and distort voices that makes hearing harder, or the other party may be in a noisy environment that makes hearing harder. Closed loop means the receiver of a message repeats the message to the sender. This way they sender can be sure the message has been received correctly. If the receiver didn't read the message correctly and repeats the wrong thing, the sender can correct them. Compared to if they wouldn't respond with anything.

10 BRIDGE MANNING

The bridge is the ships command centre. Most operations are coordinated from the bridge and the ships safe navigation is monitored there. Fixing the ships position and ensuring the voyage plan is followed is done on the bridge. It is also where most outbound communication from the ship to other organisations is done. Steering the ship happens on the bridge and the necessary equipment to assist with navigation is located on the bridge. When overtaking, steering clear of other ships or manoeuvring officers are making decisions on the

bridge. Modern bridges also have tools to help with monitoring many different aspects of the ship such as cargo spaces and fire alarms.

The IMO's STCW's and SOLAS defines the rules for safe manning of the bridge. The manning level is a key factor for safety. Most marine accidents are caused by human error. Training of bridge work aims to prevent errors from occurring. Effective bridge work requires knowledge of the ship and its systems. It is required to always have an officer on the bridge while sailing. During every phase of a voyage there should be a competent watchkeeper monitoring and ensuring the safety of the navigation. Having good situational awareness is an essential skill for an OOW. The officer should know what is happening around the ship and have a picture on how the current situation may develop. On ships, if a threat is foreseen acting should be done as soon as possible and not at last minute because of ships relatively slow turning and stopping times, especially with big vessels. Basic awareness can be mostly had with just visual and hearing lookout on the bridge. When you add monitoring the ships digital navigation and safety systems to accompany the lookout, good awareness is built. The officer must know what details and information to look for when building a picture of the situation. As needed the level on manning may be increased. This is often the case during approaching port when there are confined fairways, archipelagos and more traffic or other dangers that could pose a threat to navigation. In open seas during clear weather having many persons on the bridge is not as necessary. The bridge team consists of everyone working on the bridge, this can include a pilot during pilotage. The team's duty is to work effectively to ensure the vessels safety and respond to unexpected events. Every member must know their role in the bridge team and what is their responsibility. To ensure everyone knows the plan having a briefing beforehand could help getting the team on the same page.

Leadership of the bridge is required to coordinate actions and control the vessel. The leader is usually the OOW. If there is an officer, pilot, and the master on the bridge it should be clear to everyone on the bridge who has the control. Good leadership is not only assigning tasks to the crew, but also supporting them and letting the develop their skills in a fitting environment. Example of a

typical bridge team during arrival could be master, officer, pilot, lookout, helmsman (Swift, 2004, p.50). The reason for having multiple people on the bridge is to have redundancy. If one person happens miss or forget something others can bring attention to it. Communication between members is essential for a functioning bridge team. Anyone should bring up concerns or questions about the situation at hand. Good communication helps keep up the team's situational awareness.

11 PREPARING FOR ARRIVAL

11.1 Navigation in traffic

Port areas typically have quite a lot of traffic around them. Especially big ports facilitating international traffic. All nearby vessels such as in- and outbound traffic, ships at anchor, fishing vessels and pleasure crafts need to be accounted for by the OOW when underway. The area should be evaluated before entering and checked can the voyage plan be executed with the current traffic situation. With many different vessels close the risk of collision is higher. Bad weather and a confined space for evasive manoeuvres could make the situation even more difficult. In the worst case, when an evasive manoeuvre is needed in a confined and shallow port approach or archipelago, it could lead to grounding when avoiding a collision. Which is a choice the master or officer might have to make.

Pilots working together with VTS often handle who enters first if the port entrance is congested. The position in queue usually depends on when the ship got their pilot onboard and how long they have been waiting.
Sailing in areas with high amounts of traffic the best way to avoid collisions is to keep a safe distance and speed. Knowing the COLREG's is of course required form officers, but excellent knowledge of them is vital when there is a large amount of traffic. Some ships may try to take shortcuts by pressuring

others to give way when they are not required to. The OOW should contact them via radio and state they have the right of way if the situation requires it. Because if some people try to take exemptions and not follow the rules it can lead to just more confusion and dangerous situations. Fishing vessels can be an annoyance in separation schemes and fairways, but they often are not engaged in fishing very near ports, caution should still be taken when nearby. Also pleasure crafts may use the same fairway and port as commercial vessels, so being prepared for them when approaching is advised. They are often smaller and could be made of material that doesn't reflect radar waves back as well. This makes spotting them by radar much harder than large commercial vessels, especially if the radar is not appropriately tuned. The pleasure craft skippers might not have as much knowledge of regulations or how to behave near large vessels in confined waters. This can mean they are unpredictable or could take dangerous action.

During dark hours and restricted visibility paying close attention to the lights of navigational aids and other vessels is important. Fairways and ports have marks with light signals near them to make entry during night-time easier. Visually observing and then crosschecking from a nautical chart is a good way of ensuring position. The task can be made more difficult by lights from near-by population centres or very heavy traffic. Ships with high amounts of deck and side lighting can make it harder to notice the ships navigational lights. Also knowing the differences between the different navigation lights is required from deck crew. The purpose of a lookout is emphasized during dark hours and restricted visibility. Their duty is to inform the OOW if they notice something abnormal or a danger to the navigation. Knowledge of the different light groups of navigational marks is key. In doubt they can be seen from charts for each light. Binoculars are a great tool for observing lights, and every ship has them on the bridge.

11.2 Ships status and systems

The ship's crew should always know the state of their vessel. During port entry the state may affect how the ship handles. Manoeuvring with a vessel in full load is different than an empty vessel or a vessel in ballast. Turning radius and stopping distance increase with a loaded ship. If the ship is fitted with stabilizers or other protruding items from the hull, they should be retracted to ensure they don't cause problems is shallow water or hit the quay during berthing. If a pilot is assisting with the passage, they must be well informed about the vessels condition, so they know what to expect and can assist safely.
Good practise on ships is when sailing in areas where a technical system malfunction could cause a high level of danger there is a backup system in place. When approaching port, the arrival checklist may have points for starting backup systems. Steering gear pumps that move the rudder or rudders via hydraulic pressure are very important system that should have a backup in place. If a pump fails the rudder can only be used with emergency steering from the engine room, which may take too much time in a critical situation. So having one spare pump running will ensure steering capabilities if one fails. Depending on the ships characteristics the rudder can also be more responsive with shorter time required for the rudder to move when turning the wheel, with two pumps running the handling is improved.

Manoeuvring in port is made easier if the vessel is fitted with a bow thruster. But before use of the bow thruster the bridge must talk with the engine room to start a standby auxiliary engine to create enough power for the electrical motor running the thruster. Running the thruster without adequate power available from generators could cause an overload and blackout on the ships electrical system. Before the thruster is needed in manoeuvring its operation should be tested beforehand to ensure it is ready for use. Finding out the thruster is faulty when relying on it for berthing in windy weather can be an unpleasant surprise.

Shipping companies are taking steps to reduce the emissions of their vessels to keep up with modern day requirements from the public and maritime

authorities. Many companies and ships want to improve their image and appear environmentally friendly when at port. Fuel changeovers are the solution to less visible air pollution in coastal areas or areas with emission control restrictions such as ports. The changeover must be done with both bridge and engine room being aware since lowering the engines load may be required during the procedure. Ships emissions must comply with the limits set in MARPOL convention. Changing the fuel from the typical heavy fuel oil to diesel reduces the amount of thick black smoke from the ships funnel almost entirely. The operation appears climate friendly when the public sees the ship in port but the switchover back to the more sulphur rich and cheaper HFO can happen at open sea. There is still lots of work to be done with ship fuels being more climate friendly and still attractive to ship owners who care about costs.

11.3 Bridge device settings

Having redundancy in ECDIS and radar systems is good, in case of a malfunction in one of them. Especially on bigger ships it is common to have two or more separated systems that aren't connected. But smaller vessels could have a hard time if one of their systems fails. Loss of a navigational system could lead to a complicated situation in a challenging location. Official IMO ECDIS requirements state that the system must have a backup power source if there is a blackout onboard, to ensure the functioning of the system. Radar issues especially during night-time, when the dependency on navigating by radar is at its highest can create a difficult situation on the bridge as well. In a case like this the master must be immediately informed and the situation assessed with them.

Having the radar and chart display using a large enough scale during port entry is essential. This is because when using a small-scale chart, navigational aids, chart datums and marks for hazards may be lost. Very near ports the distance you can look ahead is not as long as open sea, so the need to look very far ahead is not as relevant. So by having a more detailed and zoomed-in radar screen and chart display is appropriate and gathering information from them is easier. Smaller targets are also easier to spot when the radar is zoomed-in

and tuned correctly. If the ship is fitted with both X-band and S-band radars, using the X-band during port approaches is the better option. As the shorter 3cm wavelength gives a sharper and more responsive image on short ranges. The denser wavelength compared to a 10cm S-band radar is better as the less dense wave could “jump” over a target and not show them on the radar screen. Setting and tuning the right settings for the bridge equipment is the officer’s responsibility when they take over the watch. They must assess the ongoing situation, environment and conditions when applying and tuning the settings that they see fit for the situation.

12 TUGS

Tugboats are vessels designed to assist other larger vessels with their manoeuvring in confined spaces, difficult conditions or on special occasions. They usually push or pull the vessels via a towline or by making contact with their hull. Large ships often must take tugs to assist them when approaching and berthing in port. Their manoeuvring abilities can be more limited than smaller more agile ships. In some ports having a tug accompany a vessel is mandatory. The tugs main goal is to assist the ship manoeuvre and turn safely in port. So, improving safety is at the centre of this operation. Preventing possible damages to vessels, port infrastructure and environment is mitigated by the use of tugs. (Standard Club, 2021, p.18)

12.1 Preparing for tugs

When planning the use of tugs there are different factors to take into consideration. The first question being are tugs necessary and if they are how many are needed. On what part of the vessel the tugboat will attach should be decided beforehand. Knowing the environment where the tugs are used. For example, if the space is very confined using two tugs may be needed instead of one. The draught, tides and traffic should be assessed when planning working

with tugs. Sometimes masters may take a tug to assist if the port is unknown to them. Often the pilot is very good resource for knowledge on the details about the port's layout and local conditions. If the ships intended berth is hard to access assistance could be required.

The characteristics of the vessel being assisted by the tug are essential is the operation. If the vessel is very large with poor manoeuvring capabilities the use of multiple tugs may be necessary. But even large vessels such as modern cruise ships can have very good manoeuvring, especially when fitted with azi-pod propulsion units (or similar) and multiple thrusters. Ships fitted with multiple thrusters can give the crew a false sense of confidence of the vessels handling capabilities. Thrusters are designed to make ships less reliant on tugs, but there are situations where ships might need tugs even when fitted with powerful thrusters. (Standard Club, 2021, p.23) Everyone can make misjudgements, even the crew that should be familiar with their vessel's capabilities in different weather conditions. With smaller ships they might only take tugs when the port requires them, or in bad weather. Working with tugs in ports always happens at low speeds. Too high speed makes the tug less affective and may even lead to the tug capsizing if very poorly executed.

The weather conditions at the time of entering the port usually are one of the most common reasons for vessels to have a tug. High waves and strong wind make the handling of a vessel harder, and when safe water is restricted, it is better to take the extra cost of a tug then risk damaging your ship. Vessels with a large windage area are especially vulnerable for the forces of strong winds.

The vessel owners might encourage the masters to use as little tugs as possible to save on operating costs. Safety can unfortunately sometimes be overlooked in the maritime industry when it may increase costs. This puts the masters in a difficult position where they must try to make the best possible decision for all sides. Safety should always come first, as the master is responsible for the crews and the vessels safety. Some shipping companies have a practise where the company office must approve the number and use of tugs before the operation. Obviously, they might not have the same local information and details as the crew which makes the assessing difficult. The master must

be experienced and use all the information they have about the conditions when planning the use of tugboats.

When two ships are operating in conjunction good communication between them is required. From the vessel being assisted it may be the master or the pilot who is giving orders to the tugs. The master of the vessel using tugboats is always in command of the operation and is liable for the damages if they occur, unless there is proof of the tugs liability. For ships officers it is good to know basic characteristics of tugboats and how they can be used to assist the vessel. The communication between the vessels happens with VHF radio on a working channel. The communications should be established and tested before engaging in towing.

12.2 Cautions with tugs

Working with and attaching towlines can be extremely dangerous if done incorrectly. The lines must be secured to bitts that can take the amount of force/pull generated by the tug. Care must be taken when handling the line(s), a sudden tension on the line caused by either of the vessel's movements could harm the deck crew. Holding the line in place with a foot when heaving it onboard or having a hand between the bitt and the line when securing it should never be done. Snapback effect during tug operations is one of the most dangerous things that could happen. It is when there is so much tension and force on the line that it snaps and is sent flying in both directions. Accidents where the line has hit a crewmember have even led to deaths. Standing away from the line when there is strong tension on it is advised and you should not be in the snapback zone. There are multiple types and configurations of tow lines. One of the most common configurations is to have a steel cable with a nylon rope part intertwined in the line that acts as a breaking point if the force on the line is at a dangerous level.

When a ship has tugs accompanying her the master must be aware of their own ships wake and other forces created that may affect the tugboat. As

mentioned in the chapter 7.2 the pressure zones around a moving vessel affect others around it. This also applies to tugboats. Tug being ahead of a larger vessel can have difficulties staying straight ahead of a vessels high pressure zone if the towline is short. Astern a tug might experience a suction force caused by the other ships propellor if it is very close. A too short towline can make pulling for the tug harder as the pull force is counteracted by the tugs own propellor stream acting on the other vessels hull, pushing it backwards. But often the interaction effects aren't a problem because the operations are carried out at such low speeds.

13 CONCLUSION

With analysis of the research material, one could conclude that vessels have quite many things to remember and to look-out for when preparing for a port call. Thankfully with competent crew and good preparation it is something they can overcome reasonably well, as shown by constantly operating shipping industry. The deck department has many tools that are meant to ease their workload and ensure safe operation. Use of them is highly recommended since they are not meant to be just accessories. When available using the pilots knowledge could be helpful to the bridge team when approaching port. But it must always be remembered that ultimately the master of the ship has full responsibility of everything onboard. Having good communication with multiple different parties is essential as well as having good management of the available resources. The ships crew also must know their vessels handling and condition. The local weather conditions and information about the port are key to good planning. Following all applying local and universal conventions and rules is of course required. They are in place to ensure safety of persons, property, and environment. A thoroughly planned approach is more likely to succeed safely and efficiently then a poorly planned one. Following good seamanship practices will often grant good results.

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