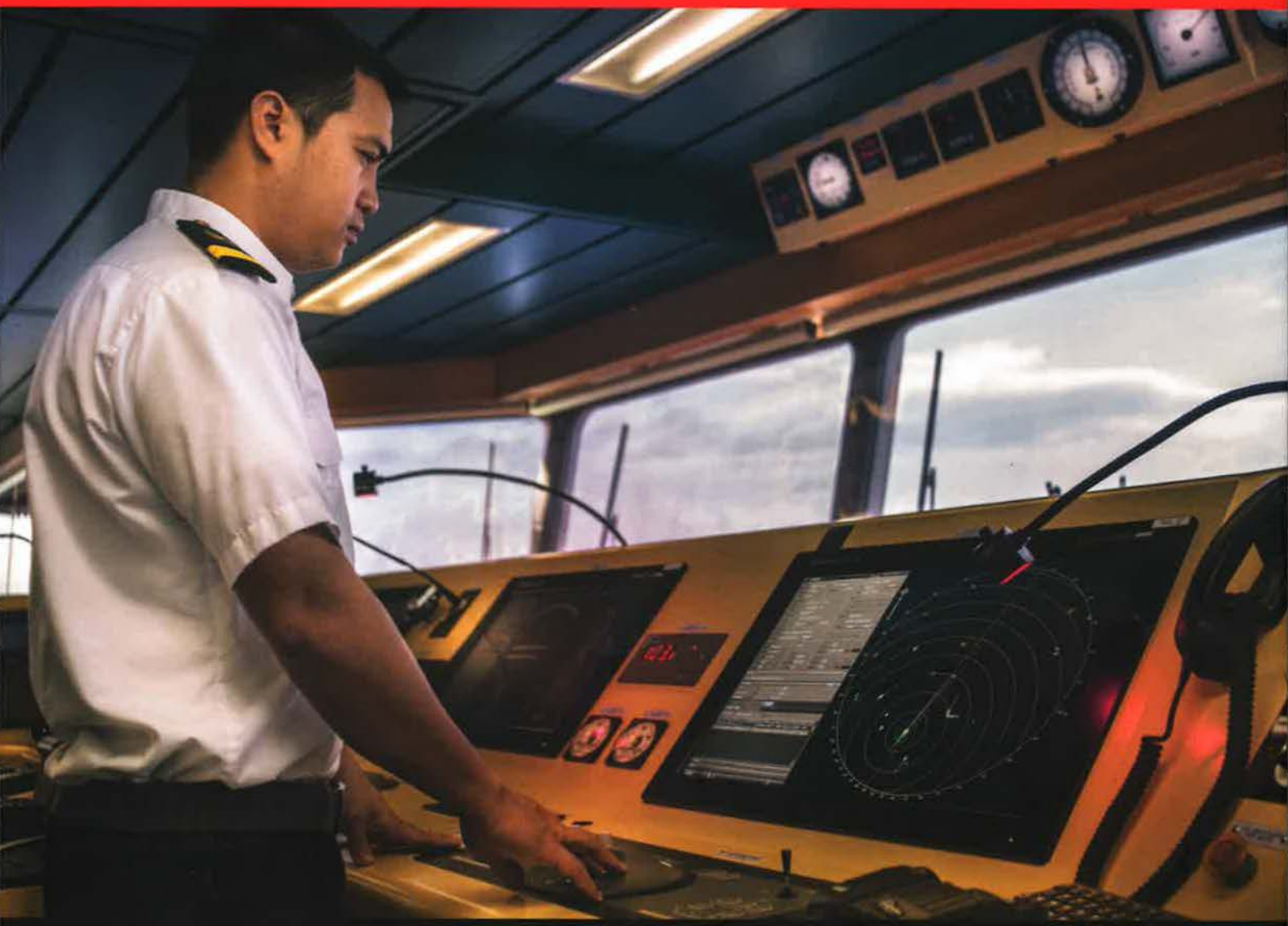
Bridge Procedures Guide

Sixth Edition



International Chamber of Shipping
Shaping the Future of Shipping

Bridge Procedures Guide

Sixth Edition

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Cover image: Officer looking at radar screen (Thierry Dosogne/Stone via Getty Images)

100 YEARS
Shaping the Future of Shipping

The International Chamber of Shipping (ICS) is the global trade association representing national shipowners' associations from Asia, the Americas and Europe and more than 80% of the world merchant fleet. Established in 1921, ICS is concerned with all aspects of maritime affairs particularly maritime safety, environmental protection, maritime law and employment affairs. ICS enjoys consultative status with the UN International Maritime Organization (IMO) and International Labour Organization (ILO).

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Sixth Edition

International Chamber of Shipping

Shaping the Future of Shipping

Foreword

Since it was first published in 1977, the International Chamber of Shipping (ICS) *Bridge Procedures Guide* has reflected current best navigational practice on commercial ships operating in all sectors and trades, and is generally acknowledged to be the principal industry advice on safe bridge procedures. It is also used as a reference publication by shipping companies, training institutions and accident investigators worldwide. But the target audience for the Guide remains, first and foremost, Masters and officers in charge of a navigational watch.

It is recommended that a copy is carried on board every ship, and this is a carriage requirement under national regulations. Keeping the *Bridge Procedures Guide* up to date and relevant is a major responsibility, and an important example of the work ICS undertakes on behalf of the international shipping industry. Technological and regulatory developments can contribute to making safe watchkeeping a complex and increasingly challenging task. An essential purpose of the Guide is therefore to provide clear guidance on best practice approaches to watchkeeping that make safe and effective use of modern technology.

This fully updated sixth edition continues to embrace internationally agreed standards and recommendations adopted by the International Maritime Organization (IMO). The Guide also includes extensive checklists for use by companies, Masters and those officers responsible for developing ship specific checklists for bridge procedures.

This sixth edition includes:

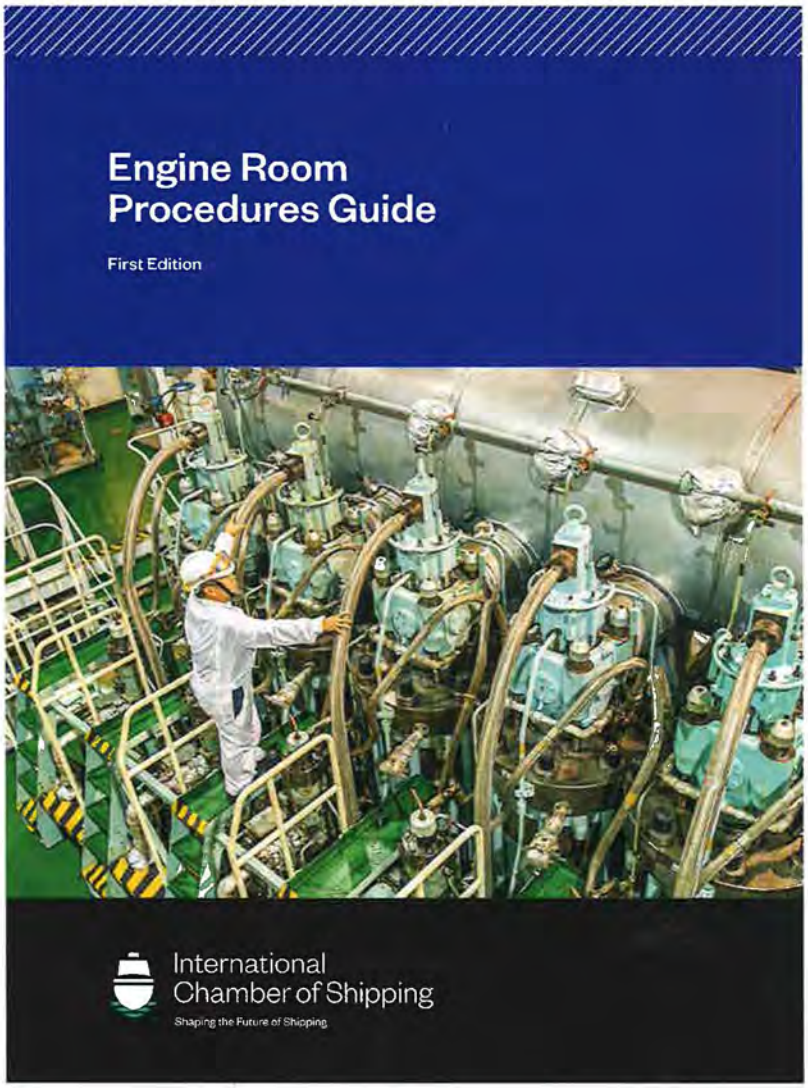
- Increased guidance on non-navigational procedures;
- New sections on the human element, Electronic Chart Display and Information System (ECDIS) safety settings, category zone of confidence (CATZOC), weather routeing, communications with the engine control room, cargo operations, risk assessments and permits to work, ship stability, ballast water management, errors associated with Global Navigation Satellite System (GNSS), and characteristics of radar;
- New checklist for rescue in enclosed spaces;
- More visual aids to improve understanding and support on board training; and
- Simplified language to reflect current best practice in writing guidelines and checklists.

Since the fifth edition was released in 2016, ICS has produced a companion volume in the *Engine Room Procedures Guide*. Together, these two publications highlight the importance of strong communication between the bridge and the engine room and it is recommended that both guides are held on board all merchant vessels.

ICS gratefully acknowledges the input of ICS Member national associations and in particular the members of the steering group for their support preparing this revised edition: Robert Merrylees (UK Chamber of Shipping), Captain Simon Pelletier (International Maritime Pilots' Association), John Dowds (Condor Ferries) and Nicholas Rich (Bernhard Schulte Shipmanagement).

Special thanks are also due to the Center for Simulator Maritime Training (CSMART) of Carnival Corporation for contributing ECDIS graphics and to StormGeo for the weather routeing map in chapter 3. Figure 5.4 was based on a photo of a container ship radar from Chris Sattleberger/Science Photo Library.

Comments on the Guide and suggestions for further improvement will be welcome and should be addressed to publications@ics-shipping.org.



The essential companion to the Bridge Procedures Guide

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Abbreviations

AGC	Anti-Grounding Cone
AIS	Automatic Identification System
AMVER	Automated Mutual-Assistance Vessel Rescue System
ARPA	Automatic radar plotting aid
ASOG	Activity Specific Operating Guidelines
ATA	Automatic tracking aid
AtoN	Aid to navigation
BAC	Blood alcohol level
BNWAS	Bridge navigational watch alarm system
BRM	Bridge resource management
BWMP	Ballast Water Management Plan
CATZOC	Category Zone of Confidence
CBT	Computer-based training
CES	Coast earth station
COG	Course over ground
COLREGS	International Regulations for Preventing Collisions at Sea
CPA	Closest point of approach
DGNSS	Differential Global Navigation Satellite System
DGPS	Differential Global Positioning System
DOP	Dilution of precision error
DP	Dynamic positioning
DPA	Designated Person Ashore
DPO	Dynamic Positioning Operator
DQI	Differential quality indicator
DR	Dead reckoning
DSC	Digital selective calling
DWT	Deadweight tonnage
EBL	Electronic bearing line
ECA	Emission Control Area

ECDIS	Electronic Chart Display and Information System
ECS	Electronic chart system
EGC	Enhanced group calling
ENC	Electronic navigational chart
EOOW	Engineer Officer of the Watch
EP	Estimated position
EPA	Electronic plotting aid
EPIRB	Emergency Position Indicating Radio Beacon
ETA	Estimated time of arrival
FMEA	Failure mode effect analysis
FPSO	Floating production, storage and offloading (vessel)
GM	Metacentric height
GMDSS	Global Maritime Distress and Safety System
GNSS	Global Navigation Satellite System
GOC	General Operator's Certificate
HDOP	Horizonal dilution of position
HF	High frequency
IAMSAR	International Aeronautical and Maritime Search and Rescue Manual
IBS	Integrated bridge system
ICAO	International Civil Aviation Organization
IHO	International Hydrographic Organization
ILO	International Labour Organization
IMO	International Maritime Organization
INS	Integrated navigation system
IS	Information service
ISM Code	International Safety Management Code
ITU	International Telecommunication Union
LOP	Lines of position
LRIT	Long range identification and tracking of ships
LSA	Life-saving appliance(s)
MARPOL	International Convention for the Prevention of Pollution from Ships
MCR	Maximum continuous rating
MF	Medium frequency

MIO	Marine information overlay
MLC	Maritime Labour Convention
MMSI	Maritime mobile service identity
MOB	Man Overboard
MPX	Master/pilot information exchange
MRU	Motion reference unit
MSI	Maritime safety information
NAS	Navigational assistance service
NM	Notice to Mariners
NUC	Not Under Command
OOW	Officer of the Watch
PAYS	Pay As You Sail
PEC	Pilotage exemption certificate
PRS	Position reference system
PSC	Port State Control
PSSA	Particularly Sensitive Sea Area
PWOM	Polar Water Operational Manual
RAIM	Receiver autonomous integrity monitoring
RCC	Rescue co-ordination centre
RCDS	Raster chart display system
RIO	Radar image overlay
RNC	Raster navigational chart
Rng/brg	Range/bearing
ROC	Restricted Operator's Certificate
ROT	Rate of turn
ROV	Remotely operated vehicle
RPM	Revolutions per minute
SA	Special Area
SAR	Search and Rescue
SART	Search and rescue transponder
SEEMP	Ship Energy Efficiency Management Plan
SENC	System electronic navigational chart
SES	Ship earth station

SMCP	Standard Marine Communication Phrases
SMG	Speed made good
SMPEP	Shipboard Marine Pollution Emergency Plan
SMS	Safety Management System
SOG	Speed over ground
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SSP	Ship Security Plan
STCW	International Convention (and Code) on Standards of Training, Certification and Watchkeeping for Seafarers
STW	Speed through water
SWL	Safe working load
TAGOS	Thrusters and generators operating strategy
TCPA	Time to closest point of approach
TMC	Transmitting magnetic compass
T&P	Temporary and Preliminary Notices to Mariners
TOS	Traffic organisation service
TSS	Traffic separation scheme
UKC	Under keel clearance
UMS	Unattended machinery space
UPS	Uninterruptible power supply
UTC	Co-ordinated Universal Time
VDR/S-VDR	Voyage data recorder/Simplified voyage data recorder
VHF	Very high frequency
VRM	Variable range marker
VTS	Vessel traffic services

Definitions

Airband	Radio frequencies used to communicate with aircraft.
Air draught	Vertical distance from the waterline to the highest point on the vessel.
AMVER	A worldwide voluntary system operated exclusively to support SAR and to make information available to all RCCs.
Bridge team	The personnel on the bridge engaged in the navigation of the vessel.
Category zone of confidence (CATZOC)	Symbols used to show varying levels of accuracy, coverage and survey reliability on an ENC.
Coast earth station (CES)	The maritime name for a shore-based station linking satellite communication with terrestrial communication networks.
Company	The owner of a ship or any organisation or person, e.g. a third party ship manager or charterer, who has assumed the responsibility for the operation of the ship from the shipowner and who, on assuming this responsibility, has agreed to take over all duties and responsibilities imposed by the ISM Code.
Co-ordinated Universal Time (UTC)	The global standard for time based on atomic and solar time measurements. UTC is interchangeable with Greenwich Mean Time (GMT) and time zone Z.
Cross track distance (XTD)	A specified limit for deviations from the planned track.
Cross track error (XTE)	The lateral distance between a planned track and the position of the ship.
Deep sea pilot	A pilot engaged in sea areas where there are specific dangers, high traffic density or other navigational hazards.
Differential Global Navigation Satellite System (DGNSS)	An augmented GNSS, including Differential Global Positioning System (DGPS), which provides increased accuracy and integrity.
Digital selective calling (DSC)	A technique using digital codes that enables a radio station to set up contact with, and transfer information to, another station or group of stations. DSC is available in VHF, MF and HF bands.
Draught	Vertical distance from the waterline to the keel.
Dynamic positioning (DP)	The ability of a ship to maintain a pre-set position and heading automatically by using its own propellers and thrusters.
Electronic chart system (ECS)	A system which is not an ECDIS, or an ECDIS which is using unofficial or private navigational charts.
Electronic navigational chart (ENC)	An official electronic vector chart for use on an ECDIS.

eLoran	Terrestrial navigation system derived from the Loran-C system.
Emission Control Area (ECA)	A sea area in which particular controls exist to minimise air emissions from ships.
Enhanced group calling (EGC)	A system for supplying MSI via satellite communications systems.
General Operator's Certificate (GOC)	A GMDSS radio operator's certificate for use on ships trading beyond GMDSS Sea Area A1.
Geodetic datum	A co-ordinate system, and a set of reference points, used to locate places on the surface of the Earth. WGS 84 is the geodetic datum used by GPS, ECDIS and ENCs.
Global Maritime Distress and Safety System (GMDSS)	A global system for providing distress and safety services to ships at sea using terrestrial and satellite communications.
Global Navigation Satellite System (GNSS)	A satellite-based system for providing position, navigation and time with global rather than regional coverage. GNSS in use include the Global Positioning System (United States), GLONASS (Russia), Galileo (Europe) and BeiDou (China).
International Aeronautical and Maritime Search and Rescue Manual (IAMSAR)	Published in three volumes jointly by ICAO and IMO.
International Civil Aviation Organization (ICAO)	United Nations organisation with responsibility for aviation regulation and standards in the aviation industry.
International Hydrographic Organization (IHO)	Intergovernmental organisation with responsibility for hydrographic standards.
International Maritime Organization (IMO)	United Nations organisation with responsibility for shipping regulation, including safety of life at sea, navigational safety, and the protection of the marine environment.
International Telecommunication Union (ITU)	United Nations body with responsibility for radio regulations.
Manoeuvring booklet	The ship's manoeuvring booklet should contain comprehensive details of the ship's manoeuvring characteristics and other relevant data.
Maritime mobile service identity (MMSI)	9-digit ITU identification number allocated to ships operating DSC or an SES.
Maritime safety information (MSI)	Navigational and meteorological warnings, forecasts and other urgent safety related messages broadcast to ships.
Meteorological areas (METEREAs)	21 geographical sea areas into which the world's oceans are divided. They are used to transmit meteorological warnings to ships and have the same boundaries as NAVAREAs.
Navigational areas (NAVAREA)	21 geographical sea areas into which the world's oceans are divided (NAVAREA 1-XXI). They are used to transmit long-range navigational and meteorological warnings to ships under the WWNWS. NAVAREAs have the same boundaries as METEREAs.

NAVTEX	A medium frequency direct printing service for broadcasting marine weather forecasts, navigational warnings, SAR alerts and other warnings and urgent information to ships in coastal waters under the WWNWS.
Notice to Mariners (NM)	A method used by hydrographic offices for routine distribution of official nautical chart and publication update information. Notices to Mariners may also be used by port authorities to distribute pertinent local navigation and safety information to ships.
Officer of the Watch (OOW)	The officer in charge of the navigational watch and the bridge team.
Particularly Sensitive Sea Area (PSSA)	An area that needs special protection through action by IMO because of its significance for recognised ecological, socio-economic or scientific attributes, and where these factors make it vulnerable to damage by international shipping activities.
Pick report	Also referred to as a chart query, cursor enquiry or selection of a chart symbol. This is used on an ENC to get more detailed information that may be considered necessary for safe navigation.
Pilotage exemption certificate (PEC)	In pilotage waters, an exemption certificate may be granted to a member of the bridge team, usually the Master, based on compliance with specific local criteria.
Pilotage waters	Waters where it is mandatory or recommended to take a pilot.
Polar waters	The extent of polar waters as defined in the International Code for Ships Operating in Polar Waters (Polar Code).
Raster navigational chart (RNC)	An official electronic image of a paper chart.
Rescue co-ordination centre (RCC)	A unit responsible for promoting the efficient organisation of SAR services and for co-ordinating the conduct of SAR operations in a SAR region.
Restricted Operator's Certificate (ROC)	A GMDSS radio operator's certificate for use on ships trading only in GMDSS Sea Area A1.
Safety Management System (SMS)	The system required by the ISM Code enabling personnel to apply the company's safety and environmental protection policy effectively.
SafetyNET	The international service for the broadcast and automatic reception of MSI via the Inmarsat EGC system.
Search and rescue transponder (SART)	A portable radar transponder or AIS transmitter for use in survival craft.
Ship earth station (SES)	A ship-based station which allows a ship to use satellite communications services.
Special Area (SA)	A sea area in which oceanographic and ecological conditions and sea traffic make the use of special mandatory methods for the prevention of sea pollution necessary.

Standard Marine Communication Phrases (SMCP)	English language phrases that have been developed to cover the most important safety related fields of communications.
System electronic navigational chart (SENC)	A database that comprises ENC data, ENC updates and other data added manually that is accessed by and displayed on ECDIS.
World Meteorological Organization (WMO)	United Nations organisation with responsibility to address interaction between oceans, the atmosphere and climate.
World-Wide Navigational Warning Service (WWNWS)	Set up by IMO in collaboration with IHO for the dissemination of navigational warnings to ships.
World-Wide Radio Navigation System (WWRNS)	Terrestrial and satellite radio-navigation systems that have been accepted by IMO as capable of providing adequate position information to an unlimited number of ships.

Chapter 1
Introduction

1 Introduction

1.1 Safe navigation

ICS attaches the greatest importance to safe navigation, so the ship is not exposed to unnecessary danger and can always be controlled within acceptable limits.

To achieve safe navigation, robust rules and procedures need to be in place. But if these procedures are to be effective, they must be complied with and supported by appropriate training and familiarisation.

Training in the principles of safe navigation and in navigational techniques provides the background knowledge. This can only be applied effectively through the correct use of equipment and by always following established procedures.

1.2 An effective bridge team

Effective bridge organisation is the starting point for a system that will promote, support and monitor best practice and so maximise the safety of navigation. Safe navigation always requires effective command, control, communication and management.

Bridge resource management (BRM) training is a mandatory requirement under the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) for officers in charge of the navigational watch (at operational level). The skills and benefits provided by BRM training need to be transferred into practice for it to have the desired effect on watchkeeping and safe navigation.

The root cause of many if not all maritime accidents lies in ship design, equipment design and performance, operational practices and training, all of which are human related activities. It follows that virtually all accidents may be attributed to human factors or human error. In navigational incidents, this may encourage accident investigations to focus on the immediate actions of the bridge team rather than other contributing human factors.

Working in isolation, rather than as an effective bridge team, creates the potential for a single point failure with the risk of an error going unnoticed or undetected. Mistakes cannot always be avoided, but good procedures and teamwork can create measures to detect these mistakes and mitigate their effects. Effective monitoring and cross-checking should be carried out to provide adequate barriers against accidents.

When considering the composition of the bridge team during different phases of a passage, the experience of individual team members should be carefully looked at to make sure that the team has appropriate skills and competencies. The watchkeeping schedule should be developed to provide enough qualified and experienced watchkeepers for each phase of the passage.

1.3 Passage planning

A comprehensive passage plan is essential to the safety of navigation. This should always include a thorough appraisal and planning process that complies with the ship's Safety Management System (SMS), as required by the International Safety Management (ISM) Code. The plan must be conducted from berth to berth.

The passage plan, including the intended route, should be checked by the officer responsible for navigation planning, and afterwards the Master should review and approve it. The Master should only approve the plan and associated route after any necessary amendments have been made. The other members of the bridge team should then be briefed on it to ensure they are fully familiarised prior to commencement of the voyage.

The checking and subsequent approval of the passage plan should include an assessment of measures to mitigate or avoid hazards using appropriate, up-to-date navigational charts and nautical publications together with any other relevant safety information.

1.4 Technology

Innovation and emerging technology have led to a steady increase in the number and applications of electronic systems designed to improve safety and the efficiency of navigation. Irrespective of these developments, the fundamental principles of navigation remain unchanged, and the bridge team should be aware of the dangers of over reliance on equipment or technology.

The introduction of new technology or equipment has sometimes been followed by unanticipated software anomalies that have caused inadequate performance. Masters and bridge teams should be aware of the possibility of these anomalies, how to identify them, their mitigating procedures and where to look for further advice.

Appropriate and structured familiarisation with navigational equipment, which is properly documented and recorded, is essential and should be included in the ship's SMS.

1.5 Pilotage

The passage plan will generally involve a pilotage phase, with the services of a pilot (or a bridge team member holding a pilotage exemption certificate (PEC)). The Master, the bridge team and the pilot, when embarked, should work together and co-operate for the safe navigation of the ship.

An effective Master/pilot information exchange (MPX) is essential to confirm that the Master, bridge team and pilot have appropriate levels of situational awareness and a common understanding before they start the pilotage, and this may show there is a need to amend the existing berth to berth passage plan.

The presence of a pilot does not relieve the Master or the bridge team of their duties and responsibilities for the safety of the ship.

Chapter 2
Effective bridge organisation

2 Effective bridge organisation

2.1 Overview

An effective bridge team should manage all the available resources and promote good communication and teamwork. This will allow it to plan and complete a berth to berth passage, in compliance with the International Regulations for Preventing Collisions at Sea (COLREGS) and the watchkeeping requirements of the STCW Convention. An effective bridge team will also be able to anticipate dangerous situations and respond to emergencies.

The information needed for effective bridge organisation should be included in the ship's SMS as a requirement of the ISM Code and should address:

- Safe manning levels;
- Safe conduct of navigation;
- Compliance with International Convention for the Prevention of Pollution from Ships (MARPOL) and minimising impact on the environment;
- Effective communication and teamwork;
- Effective training and familiarisation;
- Sound shipboard operational procedures; and
- Robust and practised emergency responses.

2.2 Bridge resource management (BRM) and the bridge team

2.2.1 Composition of the bridge team

The bridge team should have enough personnel to meet the operational requirements of the passage plan. When considering the composition of the bridge team and to make sure that the bridge is never left unattended at sea, the Master should address the following factors:

- Visibility, sea state and weather conditions;
- Traffic density;
- Activities taking place in the area in which the ship is navigating;
- Navigation in or near traffic separation schemes (TSSs) or other routeing measures;
- Navigation in or near fixed and mobile installations;
- Proximity to navigational hazards;
- Ship operating requirements, activities and anticipated manoeuvres;
- Ship's draught, the available depth of water and under keel clearance (UKC);
- Operational status of bridge equipment including alarm systems;
- Whether manual or automatic steering is anticipated;
- Any demands on the navigational watch as a result of exceptional circumstances; and
- Any other relevant standard, procedure or guidelines relating to watchkeeping arrangements or the activities of the ship.

2.2.2 Sole look-out

Under the STCW Code, the Officer of the Watch (OOW) may, in certain circumstances, be the sole look-out in daylight conditions. Clear guidance on the conduct of sole look-out should be included in the SMS (see section 4.4.2).

2.2.3 The bridge team

During sea passages, port approaches and pilotage, the bridge team should always work effectively to ensure the safety of the ship. This includes liaison between different navigational watches, the engine control room and other departments, as appropriate.

All personnel with bridge navigational watch or advisory duties will be part of the bridge team. The Master, other members of the bridge team and the pilot, when embarked, should work together and co-operate to ensure safe navigation.

2.2.4 The bridge team and the Master

The Master has the overriding authority and the responsibility to make decisions on board ships about safety and pollution prevention. This should be clearly stated in the SMS. The Master should not be constrained by the company or charterer from taking any decision necessary for the safety of navigation.

The bridge team should recognise and understand:

- The information that should be routinely reported to the Master;
- The need to keep the Master fully informed; and
- The circumstances under which the Master should be called (see section 4.6 and checklist C2.17).

It is important to consider carefully in which circumstances it may be appropriate for the Master, when on the bridge, to take control from the OOW. It is often preferable for the OOW to retain control with the Master providing oversight and guidance.

The presence of the Master on the bridge does not remove the responsibility for navigation from the OOW, and the OOW remains in control of the watch unless explicitly advised otherwise by the Master.

2.2.5 Bridge team leadership, resource management and teamwork

The performance of a bridge team relies on good leadership, teamwork, communication and management. This is clearly recognised under the STCW Convention and the requirement for BRM training for watchkeeping officers.

A bridge team that has a plan and is well briefed will work effectively and be able to develop and maintain good situational awareness. It should then be able to anticipate dangerous situations and recognise a sequence of errors that could lead to a problem. Actions can then be taken to break a chain of errors and avert an emergency (see section 4.8).

To identify and address chains of errors as soon as possible, it is vital to have an appropriate approach to raising safety concerns or doubts without any fear of reprisal or ridicule. 'Challenge and response' is a leadership approach that fosters effective communication and teamwork.

Figure 2.1: Challenge decisions if you see something unsafe. This figure is also available as a poster in Appendix D and can be downloaded for free from https://publications.ics-shipping.org

How 'challenge and response' works

Under the 'challenge and response' approach, bridge team members are encouraged to challenge operational decisions at all levels. A rating might have more experience than an officer on a particular ship and recognise that certain actions may not be the most operationally effective. Confirming the actions can help to avoid incidents and accidents.

Another example is where the OOW does not understand the action of a pilot, or if the action of the pilot deviates from the agreed plan. In such situations, a challenge should be made by the OOW so the pilot can either clarify the intended action or, if the intended action is indeed incorrect, amend or adjust the action to ensure the ship remains safe.

It should be made clear to all concerned that if a decision, proposed action or procedure is challenged for safety reasons, this is not a challenge to the authority of the people responsible for making it.

Providing that the immediate safety of the ship is not compromised, members of the bridge team should be encouraged to:

- Seek clarification on the actions of other bridge team members to better understand the decision making process; and
- Practise 'thinking aloud'. This can also help to develop junior officers by encouraging them to discuss their actions openly.

Thinking aloud is a technique which consists of speaking aloud while thinking through or describing actions as they are done. An example situation could be, "I am altering course to port by 20 degrees, to increase my CPA with the crossing vessel. I intend to pass astern of that vessel with a minimum CPA of two nautical miles".

Sharing a similar mental model helps the whole bridge team to understand the intended actions and how they will be carried out.

> Under no circumstances should a 'challenge and response' approach be considered as undermining the authority delegated to the OOW by the Master.

2.2.6 Bridge team human element

The bridge team should foster an environment where every member feels valued.

A mistake, so long as it is not intentional or caused by carelessness, should normally be treated as a learning opportunity. A 'just' culture should give personnel the confidence to admit any mistakes or 'near misses', and this leads to a safer working environment.

An atmosphere of responsible behaviour and trust is promoted by encouraging personnel to report information without fear of punishment, with the condition that unacceptable behaviour will not be tolerated.

2.2.7 Briefing and debriefing

Briefs and debriefs are useful tools to use before and after operations such as:

- Arrivals and departures;
- Approaches to challenging navigation areas;
- Emergency responses;
- Long pilotage; and
- Assisting other vessels.

The Master or a designated officer should brief the bridge team. A separate short brief can be prepared for the engine room personnel if relevant.

During a briefing session, all members of the team should be made aware of their duties and any special instructions or concerns for the operation.

During a debriefing session after the operation, all those involved should provide feedback about what went right and what could be improved in future.

2.2.8 The bridge team and internal communication

The bridge team is responsible for maintaining communications with the engine control room and all other operating areas.

It is essential that bridge and engine room personnel communicate regularly on matters such as:

- Machinery and propulsion status, including defects;
- Any existing or anticipated circumstances, including fuel changeover procedures and planned maintenance, that could affect machinery performance or the manoeuvrability of the ship;
- Any planned or anticipated speed changes; and
- Any environmental regulatory requirements (see section 4.21).

The bridge team is responsible for co-ordinating the activities of the whole ship on behalf of the Master. Good internal communications and a well briefed plan are essential, particularly during emergencies, as an effective response depends on good communication and co-ordinated actions by all personnel.

For more information on engine room procedures, see the ICS *Engine Room Procedures Guide*.

2.2.9 Bridge team duties

The term bridge team refers to all personnel with bridge watchkeeping or advisory duties.

Duties and responsibilities should be clearly assigned by the OOW, who should make sure that all members of the bridge team understand their duties. Figure 2.2 overleaf illustrates an example of a bridge team.

The presence of a pilot does not relieve the Master or the bridge team of their duties and responsibilities for ship safety and prevention of pollution. Guidance on effective pilotage and associated roles and responsibilities within the bridge team is set out in chapter 6.

Proactive reporting of events and actions allows the OOW to monitor the bridge team and detect potential deterioration in watchkeeping performance.

Bridge team performance is helped by a bridge environment which is free from distractions. To avoid disruption and distraction on the bridge:

- Limit unrestricted bridge access to those with operational bridge responsibilities;
- Strictly control the use of mobile phones and other personal electronic devices (see section 2.4); and
- Restrict internal and external communications to those related to the safe navigation of the ship (see section 2.5).

> The bridge should be free from distractions and all non-essential activity should be avoided.

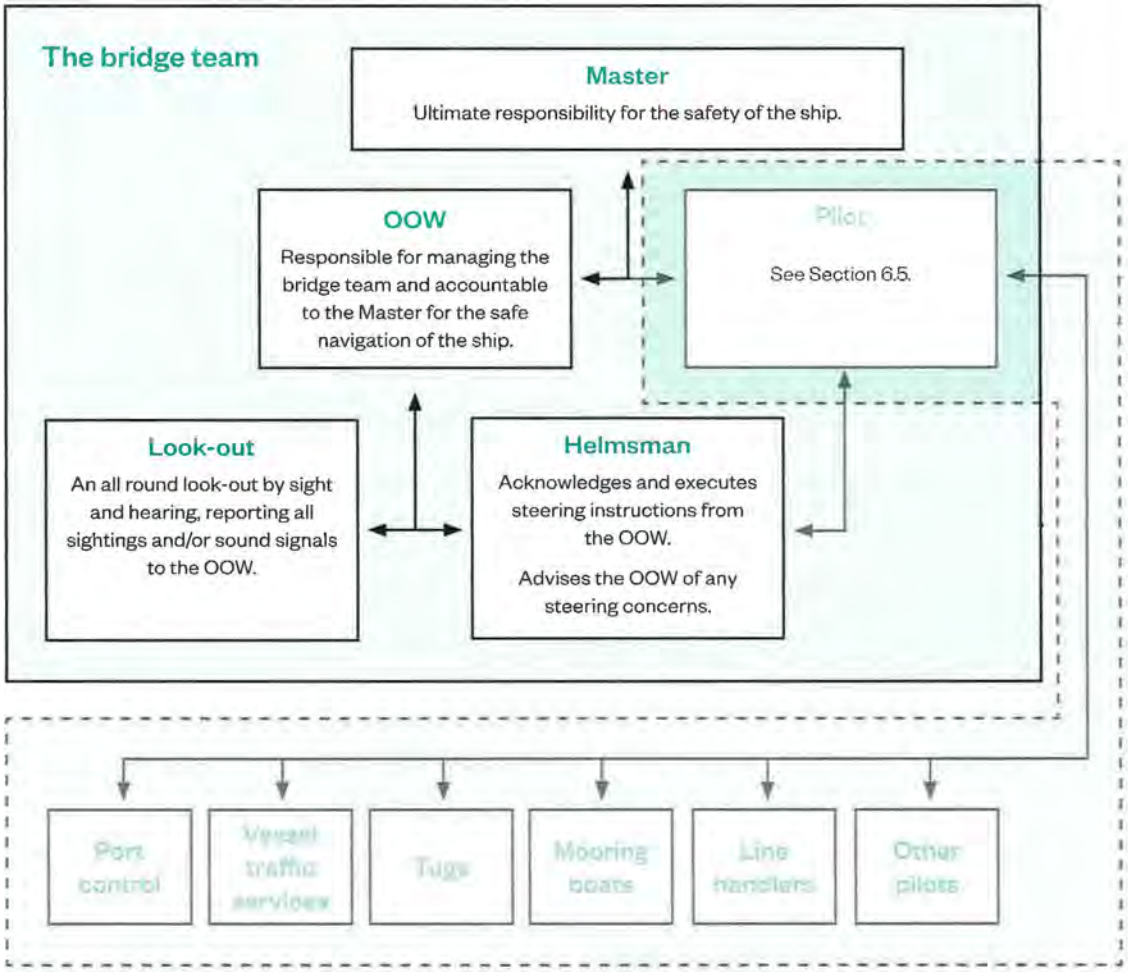


Figure 2.2: Example bridge team

2.2.10 New personnel and familiarisation

The ISM Code and the STCW Convention require the company to have in place a system for familiarising new personnel with ship equipment and procedures. The familiarisation procedures should be covered in the SMS and in written instructions that the company gives to the Master for whenever a new member of the bridge team is assigned to the ship.

A reasonable period should be allocated for familiarisation and a designated officer should be responsible for familiarising new personnel.

Familiarisation should be delivered one to one in a common language and a checklist should be used (see checklists C2.3 and C2.4). Familiarisation should cover all bridge equipment and procedures appropriate to the duties and responsibilities of individual members of the bridge team.

With computer-based systems, the equipment installed can vary greatly from one ship to another, even in the same fleet. Some equipment or systems such as Electronic Chart Display and Information Systems (ECDIS) are particularly complex. Some familiarisation with any one system may take place on shore before joining a ship, but familiarisation with the specific equipment installed on board will always be required.

Self-teaching manuals, videos or computer-based training (CBT) programmes can be used on board ship to aid familiarisation. These methods should complement rather than replace one to one familiarisation with equipment and procedures.

2.2.11 Hours of rest

The STCW Code states that watchkeepers, including the Master, are required to take mandatory minimum rest periods so that they will be fit for duty. In summary, the requirements are:

- Minimum of 77 hours rest in any seven day period;
- Minimum of 10 hours rest in any 24 hour period; and
- The 10 hour rest period should not be split into more than two periods, one of which should be at least six consecutive hours, with the interval between rest periods being not more than 14 hours.

To give some flexibility to ship operators, STCW contains provisions for exceptions that may be permitted by the flag State and should also be accepted by Port State Control (PSC). Evidence for these exceptions must be kept on board.

The International Labour Organization (ILO) Maritime Labour Convention (MLC, 2006) also sets out minimum rest periods and maximum work hours for all seafarers.[1] Compliance with the ILO MLC is subject to PSC but in practice the STCW requirements are slightly stricter and are those normally enforced by PSC.

2.2.12 Record keeping and schedules

Under the STCW Code (and the ILO MLC) individual seafarers' records of hours of rest must be kept to demonstrate compliance. Unless the flag State requires otherwise, these should follow the model formats agreed by IMO and ILO.[2] Individual rest hour records must be signed by the seafarer to whom they refer.

The STCW Code also requires companies to maintain a schedule of working arrangements, indicating the normal hours of work for different grades of seafarer, which should be posted on board ship in an easily accessible place.

Compliance with regulations and maintenance of exact records and work schedules is complex and a computer-based system for recording seafarers' rest hours is recommended.[3]

1 More information may be found in the ICS *Guidelines on the Application of the ILO Maritime Labour Convention.*

2 IMO/ILO Guidelines for the *Development of Tables of Seafarers' Shipboard Working Arrangements and Formats of Records of Seafarers' Hours of Work or Hours of Rest.*

3 ISF Watchkeeper is a computer program designed to help companies comply with the individual work/rest hour record requirements and with the preparation of compliant tables of shipboard working arrangements. Further details are available at www.isfwatchkeeper.com.

2.2.13 Drug and alcohol policies

The STCW Code includes requirements for the prevention of drug and alcohol abuse. Most flag States apply a limit of not greater than 0.05% blood alcohol level (BAC), or 0.25 mg/l alcohol in the breath, to seafarers performing safety, security or environmental protection duties. Some Administrations may apply more stringent limits.

The company should have a drug and alcohol policy, and bridge team members should always comply with it.

The Master should enforce the company drug and alcohol policy for visitors, including pilots, contractors and officials. If there is any concern about adherence to the policy, the Master (or chief officer if appropriate) should take immediate action to make sure the safety of the ship is not compromised.

2.2.14 Use of English

English is the language of international shipping. Communications, including with ratings, should be in English or in a defined language that is common to all bridge team members. Communications within the bridge team need to be clearly understood by every member. If English is not the working language of the ship, the company or Master should decide on and record an alternative working language in the ship's log book.

The STCW Code provides details on the adequate knowledge of written and spoken English, as shown in figure 2.3.

When navigating under pilotage, the same approach to communications within the bridge team should apply. The pilot should always be expected to explain instructions exchanged with other ships, pilot boats, tugs and vessel traffic services (VTS) to the Master and bridge team in English or a defined working language common to all personnel involved.

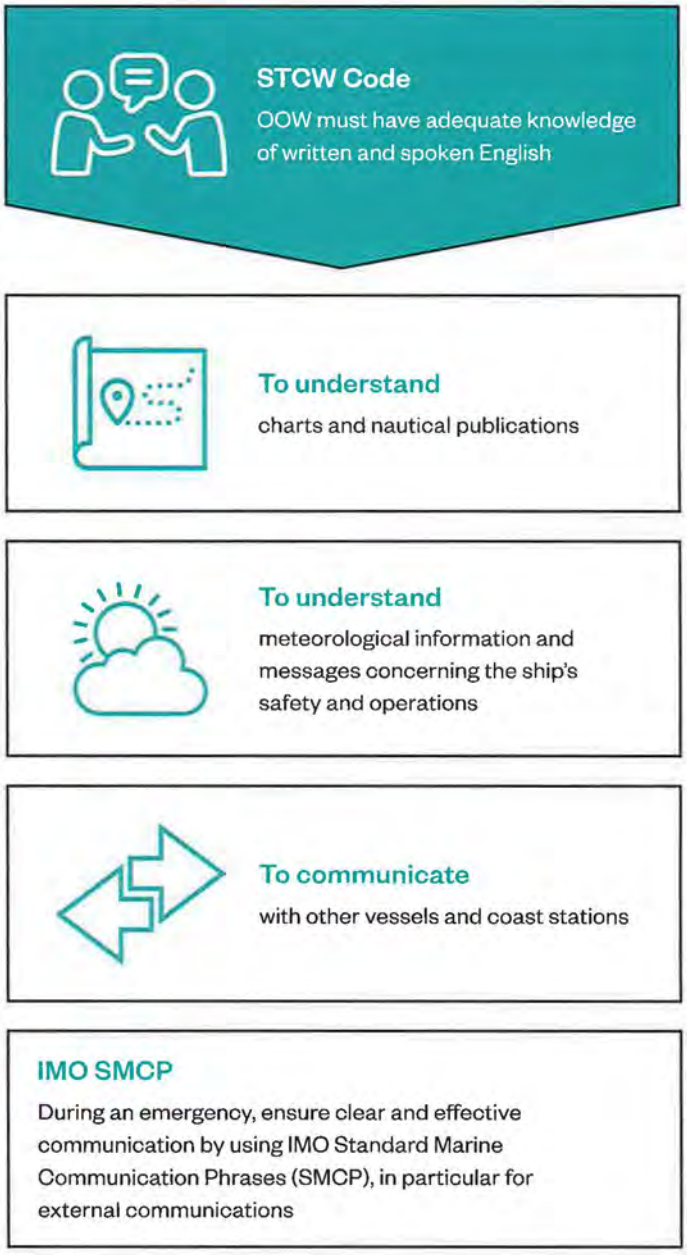


Figure 2.3: English knowledge as required by the STCW Code

2.3 Company policy and procedures

The ISM Code requires every company to have an SMS that covers instructions and procedures for the safe operation of ships and protection of the environment. It should include practical guidance on navigational safety including:

- Allocation of bridge watchkeeping duties and responsibilities;
- A procedure for when to call the Master to the bridge;
- Procedures for passage planning and navigation, including departures from the passage plan;
- Chart and nautical publication update and correction procedures;
- ECDIS procedures (including chart and software updates);
- Procedures to ensure that all essential navigation equipment and main and auxiliary machinery are tested, available and fully operational;
- Ship position reporting procedures;
- Accident and near miss reporting procedures;
- Recording of relevant events and voyage data recorder (VDR) policy;
- Use of bridge navigational watch alarm system (BNWAS) modes (automatic, on and off) and procedures for ensuring correct operation;
- Bridge access and distraction prevention procedures;
- Procedures for familiarisation and effective handover when crew changes take place;
- Training and drill requirements;
- A system for identifying particular training needs;
- Company contacts, including the Designated Person Ashore (DPA);
- Emergency procedures; and
- Any other information relevant to the safe operation of the ship.

The SMS should identify clear levels of authority and lines of communication between the Master, ship's officers, crew and the company.

2.3.1 Information distribution

IMO, flag States, other regulatory bodies and the shipping industry regularly publish new rules, guidance, best practice (including lessons learned from marine casualties) and information intended for ships. The company should have a clear procedure for forwarding relevant information to Masters and crews.

The company should:

- Assess the relevance of the information or new requirements to its fleet and operations;
- Implement the new requirements or best practice in the SMS, if appropriate; and
- Inform ships of the new requirements or recommendations and seek confirmation that they have been received and implemented.

The Master and bridge team should:

- Review and implement the new requirements or guidance as soon as practicable; and
- Inform the company of effective implementation, or any difficulties experienced when implementing new requirements or guidelines.

2.3.2 Orders

Master's standing orders

Lines of authority on board should follow those set out in the SMS and operational procedures manuals. The Master should explain particular requirements to the bridge team in the Master's standing orders. These orders should be drafted to support the SMS.

Company and Masters' standing orders should be read by all bridge team members on joining the ship, signed and dated. A copy of the orders should be available on the bridge for reference.

Bridge order book

In addition to the Master's standing orders, specific instructions will be needed. At least at daily intervals, the Master should write in the bridge order book what is expected of the OOW for that period. These orders should be signed by each OOW when taking over a watch, to confirm that they have read, understood and will comply with the orders.

The OOW should brief other members of the bridge team, as appropriate, on any particular activities or requirements for the forthcoming watch.

The Master may also issue night orders for periods when the Master is resting, and specific information about the current leg of the passage should be included in them.

These orders should not stop the OOW from calling the Master at any time when they consider it necessary.

2.4 Mobile phones and personal electronic devices

The company should have a written policy requiring that mobile phones or other personal electronic devices are only used on the bridge in circumstances approved by the Master.

While on some occasions the use of mobile phones or personal electronic devices may be permitted, the company policy should minimise the distraction caused by them by generally limiting their use to circumstances in which they are operationally necessary.

The policy should be read and understood by all bridge team members.

2.5 Bridge internet and email

Where internet and email services are available on the bridge, the company should have a policy to manage their use. To minimise distraction to the bridge team, access to internet and email use by bridge watchkeepers should generally be limited to circumstances where it is necessary for the safe navigation of the ship.

Internet access and email on the bridge should usually be restricted to:

- Updates for nautical charts and publications, licences and permits;
- Weather information;
- Navigational warnings; and
- Information relevant to the ship's operations and passage plan.

2.6 Emergency preparedness

The SMS should identify potential emergency shipboard situations and set out procedures to address them. The actions of the bridge team in the event of distress, damage, fire, pollution, personnel accidents, security and cargo emergencies should be included.

A programme of drills and exercises should be created to practise emergency actions and improve effective emergency responses by the bridge team. This should include practising the ship specific procedures for recovery of persons from the water.[4]

Procedures should be in place to support effective emergency response (see section 4.24) by ensuring that:

- Initial actions to establish control of an emergency are initiated;
- Communications between the bridge team and all personnel involved in an emergency are effective;
- If appropriate, the bridge team is able to set up and maintain communications with Search And Rescue (SAR) services, shore authorities, other vessels and/or aircraft; and
- Emergency responses are reviewed to make sure they continue to be effective.

All drills and exercises undertaken on board the ship should be recorded in line with company procedures. Mandatory emergency drills should be recorded as required by the flag State.

> During emergencies the bridge team remains responsible for the safety of navigation.

4 Advice can found in ICS *Recovery of Persons from the Water: Guidelines for the Development of Plans and Procedures.*

Chapter 3
Passage planning

3 Passage planning

3.1 Principles

The purpose of passage planning is to develop a comprehensive navigation plan for the safe conduct of the ship from berth to berth.[5]

The plan for the intended passage should identify a route that:

- Recognises hazards, and assesses associated risks and decision points;
- Ensures that sufficient sea room and depth of water is available;
- Includes appropriate position fixing opportunities and intervals;
- Complies with relevant reporting requirements and routeing measures for ships;
- Considers anticipated traffic and weather conditions;
- Takes into account any cargo care sensitivities; and
- Complies with all applicable environmental protection measures.

The four stages to achieving a safe passage plan are shown in figure 3.1.

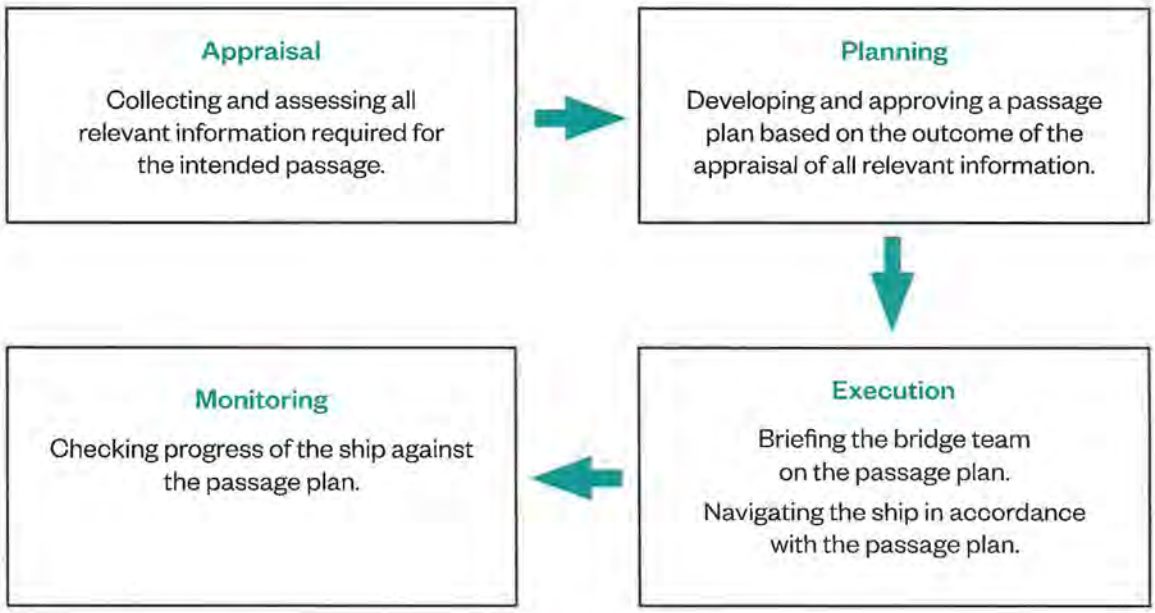


Figure 3.1: Four stages to achieving a safe passage plan

5 IMO Resolution A.893(21) *Guidelines for Voyage Planning*. Note that in this ICS *Bridge Procedures Guide* the term passage planning means the same as voyage planning.

3.2 Responsibility for passage planning

It is the responsibility of the Master to ensure that the passage plan provides the basis of safe navigation for the intended passage. This responsibility stands regardless of who prepares the plan.

> The Master should check and approve the passage plan before departure.

3.2.1 Company involvement

The SMS should include guidance for passage planning. If the company provides a standard passage plan for a voyage, this should be reviewed on board before departure and adjusted as appropriate for the particular voyage.

3.2.2 Passage planning constraints

A comprehensive passage plan should be prepared and approved before departure. However, it might be impractical to include all details at that stage, particularly those relating to arrival.

The plan should be finalised as soon as practicable, and the bridge team should be briefed on it at a suitable time.

3.3 Appraisal

The appraisal consists of gathering all information relevant to the proposed passage and reviewing it. The appraisal process allows risks to be identified and assessed to make sure that the proposed passage plan is safe. Some factors that should be considered during the appraisal of a passage plan are shown in figure 3.2.

Up-to-date official charts and nautical publications (electronic or paper) should be used with other relevant information to make a full assessment of the intended passage. This should include consultation with the chief engineer to ensure that enough appropriate fuel, water and lubricants are available, considering in particular environmental protection requirements, expected weather conditions and safety margins required by the company.

A passage plan appraisal checklist is included in this Guide as checklist C2.9.

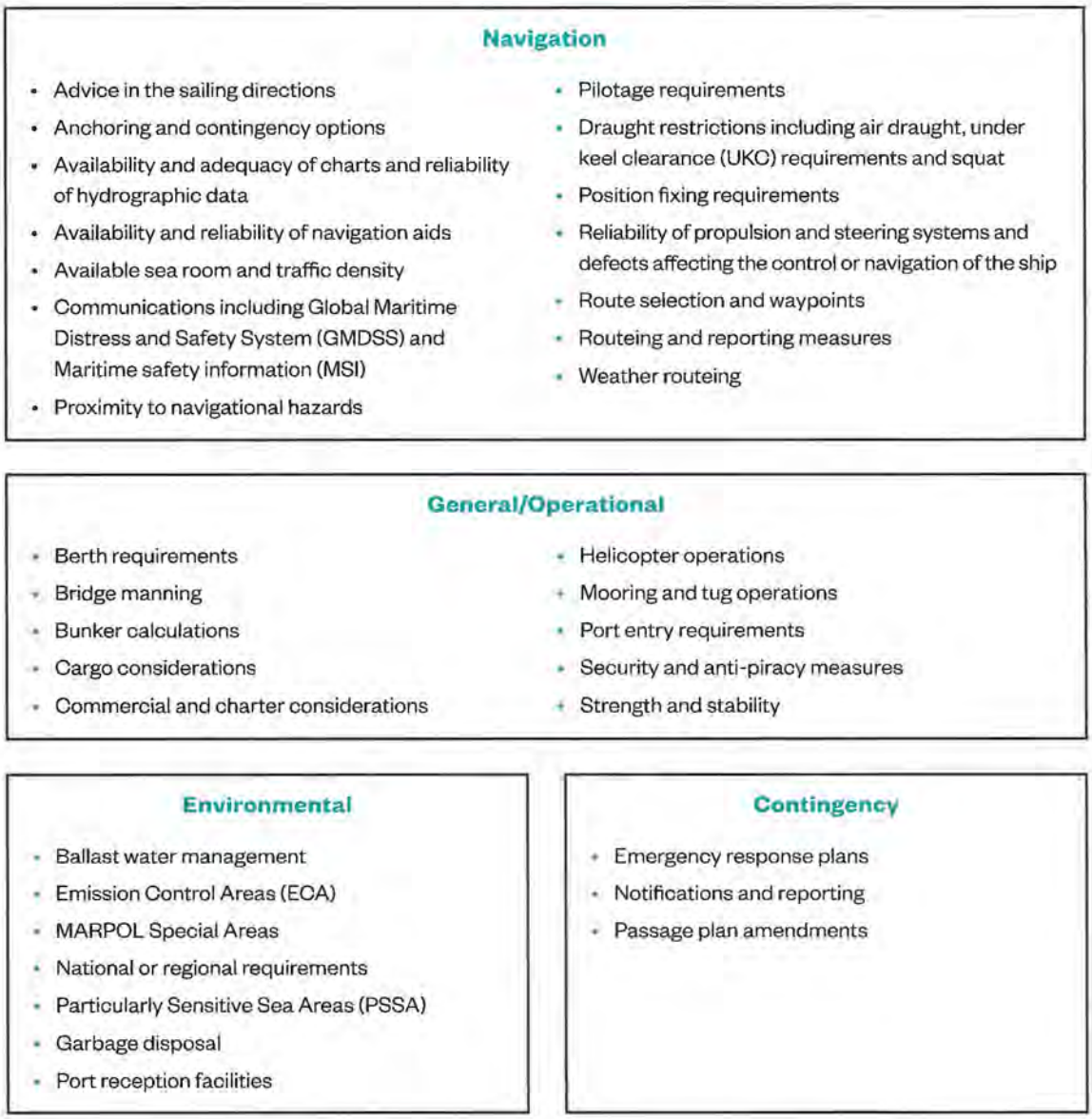


Figure 3.2: Factors to consider during an appraisal of the passage plan

3.3.1 Official charts

Only up-to-date official nautical charts should be used for passage appraisal and planning. Any other charts and publications needed for the intended passage should be identified, ordered and received before departure. In the case of electronic charts, sufficient permits/licences for the charts required for the intended route should be available before departure, or else the process for receiving them during the passage (dynamic licensing) should be clearly understood.

Factors that should be considered when appraising paper and electronic charts during passage planning are shown in figure 3.3 overleaf.

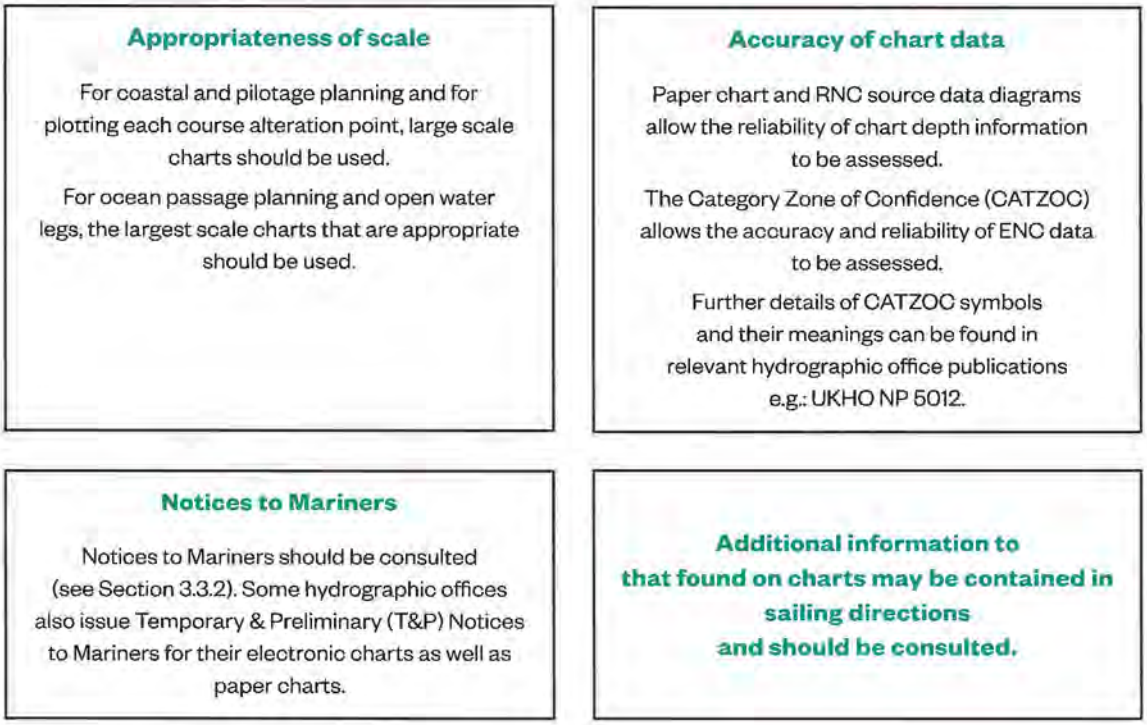


Figure 3.3: Factors to consider during an appraisal of paper and electronic charts

Electronic navigational charts (ENC), raster navigational charts (RNC) and paper charts are usually based on the same hydrographic survey data. This means that an ENC is not more accurate than an RNC or paper chart covering the same area.

Because of ECDIS screen resolution, its precision of charted objects may not be much different from that of paper charts (which has precision up to 15 metres).

When planning a passage on ECDIS, the OOW should:

- Be aware that the charted objects on an ENC are not more accurate or precisely plotted than charted objects on the corresponding RNC or paper chart; and
- Make sure that there is enough of a safety margin between charted hazards and the ship's intended route to allow for the accuracy and precision of charts.

3.3.2 Official nautical publications and other information

A full appraisal of the passage plan should include a review and consideration of other information that supplements navigational charts, including the sources of information shown in figure 3.4.

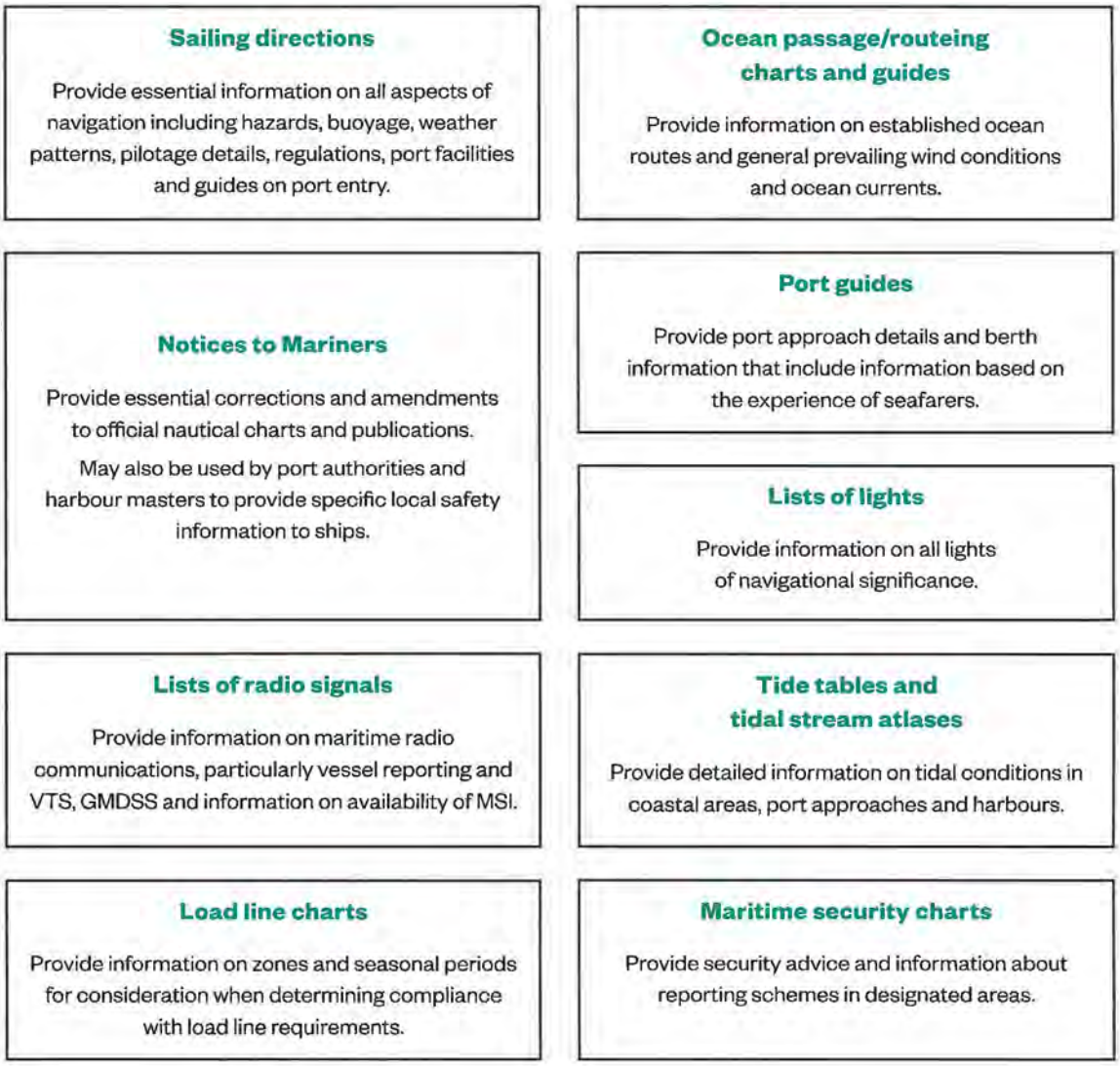


Figure 3.4: Additional information to review and consider during an appraisal of the passage plan

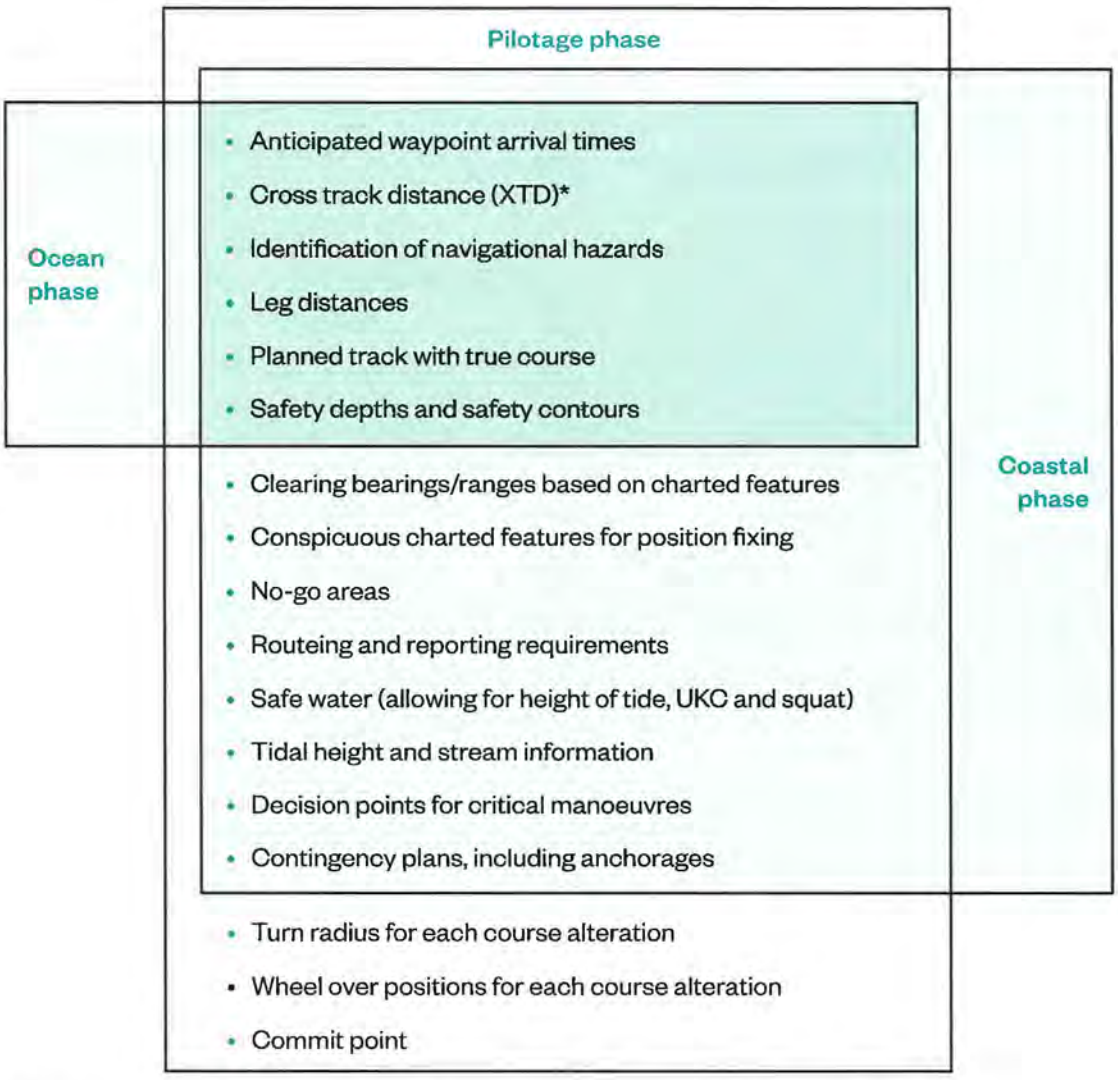
3.4 Planning

Following the appraisal of all charts, nautical publications and other information, a detailed passage plan should be prepared. This should cover the entire passage from berth to berth, including pilotage areas.

Planning for any section of a route should be undertaken using either electronic charts only or paper charts only rather than a mixture of chart types, unless the route includes areas where electronic charts are not available.

The choice of method will depend on whether the ship is certificated for full navigation by electronic means (paperless navigation).

Whether planning with paper charts or with ECDIS, the plotting of the route should follow established procedures that include the details shown in figure 3.5, where appropriate.



* To support route scanning on ECDIS, an XTD should be set up for all elements of the passage, including ocean passage elements. XTD information may not be required for plotting ocean routes on paper charts.

Figure 3.5: Information to show in route plotting

3.4.1 Passage planning in ocean waters

When planning ocean passages, consideration should be given to:

- Ocean routeing charts showing ocean currents, winds, ice limits and load lines;
- Load line charts showing zones and seasonal periods to assist in compliance with the IMO International Convention on Load Lines;
- Weather routeing services (see section 3.4.7); and
- The use of gnomonic projection charts for plotting great circle routes, as appropriate.

The following considerations may influence the selection of an ocean route:

- Ocean currents and their impact on ship speed and fuel consumption;
- Weather conditions including anticipated seasonal variations, e.g. heavy weather, tropical storms, ice and reduced visibility; and
- Environmental protection measures and associated requirements that may extend into an ocean route (see section 4.21).

Landfall targets need to be identified and the expected radar and visual ranges considered. For lights, this will include rising and dipping ranges and the arc/colours of sector lights.

3.4.2 Passage planning in coastal waters

Margins of safety in coastal or restricted waters are likely to be less than for ocean passages because of the available depth of water, proximity of land, coastal infrastructure, increased traffic density and other navigational hazards.

The following factors should be among those considered when planning a passage through coastal waters:

- The importance of passing charted and other features at a safe distance;
- Advice in the sailing directions;
- Available depth of water and tidal information contained in tide tables and tidal stream atlases;
- Availability of visual and radar fixing opportunities;
- Ship's routeing and reporting measures, as well as the availability of VTS;
- The reliability of the ship's propulsion and steering system; and
- Environmental protection measures and associated requirements, including fuel changeover procedures (see section 4.21).

In shallow water, allowance should be made for the increased draught and effects on steering caused by ship squat, which amplifies with increased ship speed.

3.4.3 Passage planning in pilotage waters

The passage planning for navigation in pilotage waters should contain more information to cover a pilotage phase, including when:

- The ship is navigating in a non-mandatory pilotage area and no pilot has been embarked;
- The ship is in pilotage waters and a pilot is embarked; or
- The ship is in pilotage waters and pilotage is being conducted by a ship's officer holding an appropriate and valid PEC.

The additional information that may be required to plan a pilotage phase, reflecting the fact that the ship is close to navigational hazards and needs to comply with local requirements, may include:

- Recommended routes and channel information;
- Procedures for pilotage including pilot boarding points and means of embarkation;
- Local conditions, rules and restrictions on navigation;
- Reporting and communications procedures;
- Details of the prospective berth, tugs and/or anchorages; and
- Contingency planning for unforeseen issues.

For more detailed guidance on pilotage, see chapter 6.

3.4.4 Passage planning using ECDIS

Depending on the ship's certification, ECDIS may be the primary tool for passage planning on board.

Effective use of route planning tools, voyage notes and action points contribute to a comprehensive passage plan.

When using ECDIS for passage planning, the following factors should be considered:

- Availability of and access to the required up-to-date ENCs and RNCs for the intended passage. This should include identification of areas where ECDIS may need to be in raster chart display system (RCDS) mode and where paper charts might therefore be required;
- If reusing a previous passage plan, the need to recheck the route to confirm that it remains safe and no changes are necessary;
- An appropriate large scale ENC or RNC should be used when planning a route;
- Making sure that any old or previous routes are removed from the display;
- The need to select chart symbols (pick report) on ENCs to get additional detailed safety and navigational information;
- Applying a maximum acceptable cross track distance (XTD) to each leg of a route. This should comply with any requirements in the SMS and be appropriate for the area;
- Calculating safety depths and safety contours and setting them up in line with the under keel clearance (UKC) requirements in the SMS;
- Setting estimated time of arrival (ETA) information manually or using route planning tools. If this is set incorrectly, it may affect tidal data and time dependent information for the route;

- Applying current and tidal data, if integrated with ECDIS and up to date, to the route; and
- Checking information about the vessel's characteristics and confirming it as correct. This includes details about draught (including any allowance for squat or additional safety margins), turn radius and vessel dimensions.

The passage plan should be saved, backed up and locked to prevent unauthorised editing.

ECDIS safety settings

Before departure, the OOW should make sure that the correct safety settings are entered into the ECDIS for the ship's static and dynamic data.

Contour lines

The ECDIS uses contours to display depths of water on the screen.

A contour is a line separating areas of minimum depths. For example, a 10-metre contour line separates waters with depths below and above 10 metres on either side. Contours are available in 5m intervals (5, 10, 15, 20 metres).

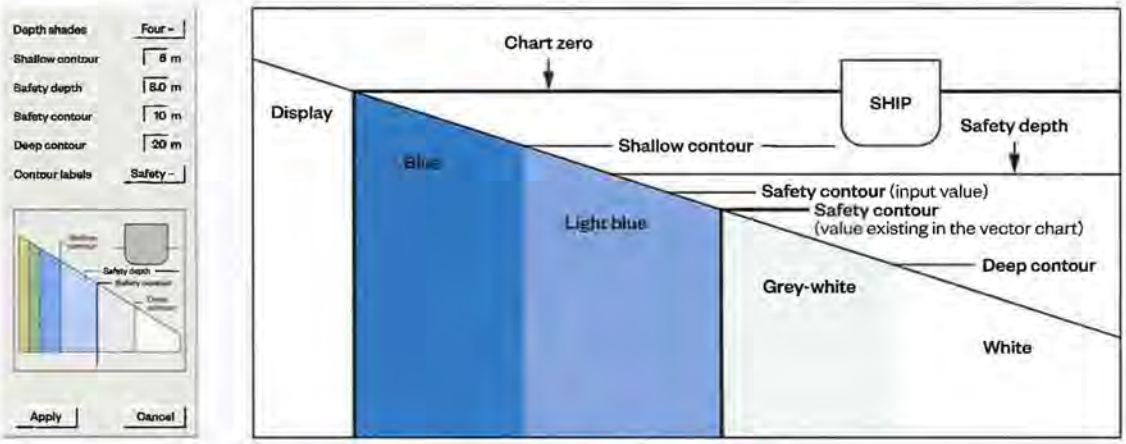


Figure 3.6: How contour lines indicate navigable waters

Shallow contour

The shallow contour value is needed to inform the ECDIS of the lowest depth of water that the ship can sail in. This is the value of water depth below which the ship will run aground.

The shallow contour value must be equal to or more than the lowest draught of the ship.

If the ship has a draught of 8m, the ECDIS will round up to the highest closest contour, i.e. 10m.

Safety contour

The safety contour displays the difference between unsafe water areas, isolated dangers and the triggering of anti-grounding alarms.

The safety contour is an outline that marks the division between safe and unsafe waters.

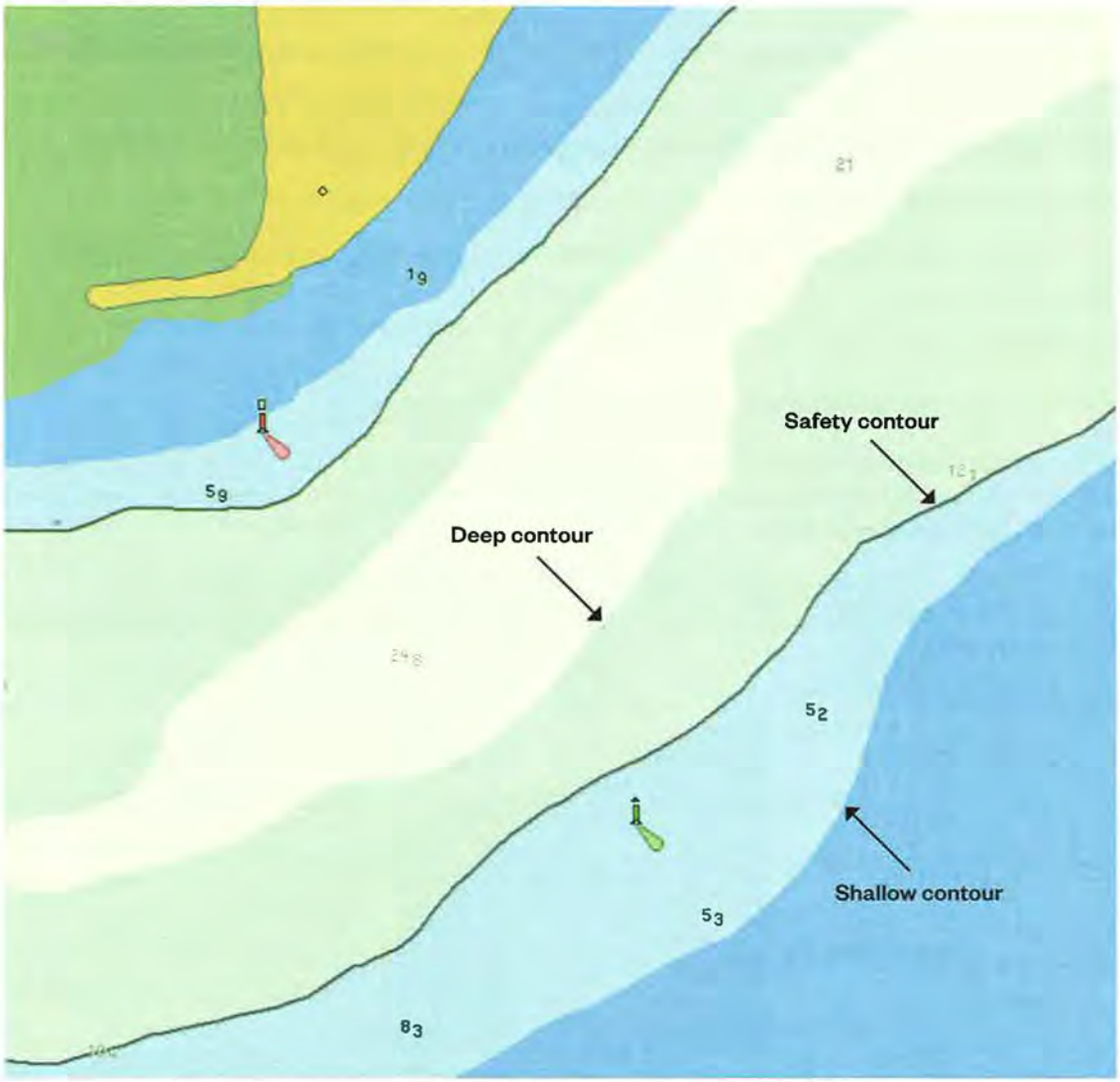


Figure 3.7: Contours on an ECDIS display

The blue colour in a traditional paper chart does not give a clear picture of water under the keel, as this depends on the ship's draught. With ECDIS, the officer can set the safety parameters according to the ship's own information.

The safety contour should be calculated before departure and entered into the ECDIS.

The OOW should consider:

- The ship' sailing draught and trim;
- Expected squat or allowance for squat;
- UKC as per the company SMS; and
- Expected height of tide.

If the ship crosses a safety contour, an alarm will be raised (audible and visual).

The ECDIS system has a tool to prewarn the OOW of the anticipated crossing of a safety contour within a specified time, as set by the user.

Based on the value of the safety contour set, the ECDIS displays the isolated danger symbol for underwater features and obstructions that may pose a danger to navigation.

Safety depth

By setting a safety depth, spot soundings are highlighted in grey (deep waters) or black (shallow waters) when compared with the safety depth value entered by the OOW. This outlines potentially safe and unsafe areas.

The safety depth differs from the safety contour as it will not trigger an alarm or indicate a different contour on the screen, but it will show isolated soundings outside the depths of the contour.

Deep contour

The deep contour can be used in different ways, depending on the ship's draught and the depths in the navigation area. It represents the area where the ship will encounter shallow water effects. For example, for a ship with a 10m draught this may be set to 30m.

3.4.5 Category zone of confidence (CATZOC)

In calculating the ship's safety depth it is also important to consider the category zone of confidence (CATZOC) values of the chart in use.

The CATZOC value highlights the accuracy of data presented on charts. With six categories, it informs the user about how far they can rely on the chart when planning a passage or conducting navigation.

Each ZOC value is described in figure 3.8.

ZOC	Position accuracy	Depth accuracy	
A1	±5m + 5% depth	= 0.50 +1%d	
		Depth (m)	Accuracy (m)
		10 30 100 1,000	±0.6 ±0.8 ±1.5 ±10.5
A2	±20m	= 1.00 + 2%d	
		Depth (m)	Accuracy (m)
		10 30 100 1,000	±1.2 ±1.6 ±3.0 ±21.0
B	±50m	= 1.00 + 2%d	
		Depth (m)	Accuracy (m)
		10 30 100 1,000	±1.2 ±1.6 ±3.0 ±21.0
C	±500m	= 2.00 + 5%d	
		Depth (m)	Accuracy (m)
		10 30 100 1,000	±2.5 ±3.5 ±7.0 ±52.0
D	Worse than ZOC C	Worse than ZOC C	
U	Unassessed – the quality of the bathymetric data has yet to be assessed		

Figure 3.8: CATZOC values (Source: UK Hydrographic Office)

When calculating the contours, the officer designated for passage planning should address several factors, including:

- Ship sailing draught;
- Anticipated squat (due to depth of water and ship speed);
- Company required UKC;
- Height of tide; and
- CATZOC of sailing area.

As an example, with the following values:

- Ship sailing draught of 10.0m;
- Anticipated squat of 0.7m at 10 knots;
- Height of tide 1.0m;
- Company required UKC of 10% of draught continuously; and
- CATZOC area A1.

> Safety contour = (10.0m draught + 0.7m squat + 1m UKC) – (Consideration of height of tide)
>
> Safety contour = 11.7m

In this example, the height of tide is not subtracted from the total, as an extra level of precaution. This would also allow the ship to sail in the specific area regardless of height of tide.

But if the ship sails in an area with a CATZOC value D, the quality and accuracy of the depths on the chart will be lower. The safety contour previously set to 11.7m for the CATZOC A1 area should then be increased to address this.

Companies should set out their minimum UKC and procedures for operating within different values of CATZOC in the SMS.

3.4.6 Finalising the passage plan

To avoid losing critical information, the passage plan should not be over detailed and it should be available in a format that can be easily understood by the bridge team.

When the officer planning the passage has completed the berth to berth passage plan, it should be checked and approved by the Master. These checks should include a careful inspection of navigational charts to make sure that the route is appropriate and safe.

When checking a route on ECDIS, it should be visually inspected at optimum scale (1:1) for the ENC or RNC in use. When a route is plotted on an ENC, the ECDIS route scanning function should be used as well as a visual inspection. For the route scanning function to be effective, the ECDIS should be correctly set up with safety depths and contours reflecting UKC requirements.

When the route scanning function is used, the officer should check each item that may be raised by the scan. If necessary, the officer should amend the route as required.

> A detailed review of the passage plan route should always be carried out in conjunction with an automated route scan when using ECDIS.

3.4.7 Weather routeing

Weather routeing allows the Master and the bridge team to follow a passage plan that avoids the worst weather in the interest of safety and fuel consumption efficiency.

Weather routeing predicts the movement of weather systems associated with poor conditions and rough seas. The most favourable route is then planned, taking these systems into consideration.

The main benefits of weather routeing are:

- Increased safety;
- Better conditions for cargo or passengers;
- Fuel and time savings; and
- Reduced costs overall.

Weather routeing is an aid to navigation and the Master should always consider routeing information as well as applying good seamanship.

The safety of the ship, its crew and its cargo or its passengers should always have priority over the ETA.

The bridge team should be familiar with dedicated software for weather routeing on board, if available.

Figure 3.9: Example weather route

3.4.8 Passage plan briefing

A briefing should be held to make sure that all bridge team members understand their role in executing the passage plan. The briefing should address the factors identified in checklist C2.9.

Before sailing, all of the bridge team should be appropriately briefed and should confirm their understanding of the passage plan.

3.4.9 Amendments to routes

Planning should be updated if the intended route is amended to reflect changing circumstances and conditions before or during a passage (see also section 4.15.4).

It is important to run a full route check on the ECDIS after amending the route.

3.4.10 Transferring positions

When transferring route and hazard information between paper charts, electronic charts and/or different Global Navigation Satellite Systems (GNSS), it is crucial to apply appropriate corrections as the geodetic datum used by different hydrographic offices, on different types of charts and equipment, may vary (see section 5.9).

Corrections may be needed when:

- Transferring positions between different GNSS systems;
- Transferring positions between GNSS systems and paper charts or RNCs; and
- Transferring positions between paper charts or RNCs and ENCs.

3.4.11 Maritime safety information (MSI)

Weather information (including gale warnings), NAVAREA warnings and coastal navigational warnings are broadcast by radiotelephony from coast radio stations and by NAVTEX. Long range weather warnings are broadcast via satellite communications systems, such as SafetyNET, along with NAVAREA navigational warnings as part of the World-Wide Navigational Warning Service (WWNWS).

Details of weather routeing services for ships and information for shipping such as limits of meteorological areas (METAREAs) are contained in lists of radio signals and in Volume D of the World Meteorological Organization (WMO) Publication No.9.

3.4.12 Planning an anchorage

Some of the factors to consider when planning to anchor are:

- The purpose of anchoring and its anticipated duration;
- Availability of appropriate space at the anchorage;
- Position fixing opportunities;
- Weather conditions and available shelter;
- Tidal height and stream for the duration of the anchorage;

- Prevailing weather conditions and anticipated forecast;
- Sea room and proximity of navigational hazards, including traffic;
- Depth of water and windlass capacity;
- Nature of seabed, depth and holding characteristics;
- Scope of anchor cable required/available and anticipated swinging circle;
- Port requirements;
- Security measures required by the Ship Security Plan (SSP)[6] and the latest industry best practices and guidance on responses to piracy and armed robbery at sea;
- Requirements for machinery availability;
- Availability of required services; and
- Watchkeeping arrangements to make sure that a proper look-out is kept. See also checklist C2.12.

6 For more guidance on SSPs, see the ICS *Maritime Security: A Comprehensive Guide for Shipowners, Seafarers and Administrations.*

3.4.13 Ships' routeing

Routeing measures for ships are designed for different purposes, as illustrated in figure 3.10.

Figure 3.10: Purpose of routeing schemes

Ships' routeing measures can be adopted internationally by IMO.

Measures are recommended or mandatory for all ships or for certain types of ship, or for ships carrying certain cargoes. Mandatory ships' routeing measures should always be used unless the ship has compelling safety reasons for not following them. Non-IMO adopted routeing measures may also exist and should be followed as best practice.

3.4.14 Ship reporting systems

Ship reporting systems allow coastal States to monitor ships navigating through their waters and are intended to contribute to the safety of life at sea, the efficiency of navigation and the prevention of pollution.

Routinely, ship reporting systems require information on the position, course, speed, persons on board, cargo and the ship's destination. In certain areas, information on defects affecting ship navigation equipment, propulsion or steering may also be requested by coastal authorities.

Where a ship reporting system has been adopted by IMO, the Master should comply with its requirements. Reporting may be required on entry and exit from an area covered by the system or when there has been a material change in the ship's condition. Masters may expect IMO adopted reporting systems to supply information that will assist the ship, if requested.

Ship reporting requirements will be referred to on charts with a note of any relevant provisions for their use, including details of their mandatory/recommended status. More details will be found in lists of radio signals.

Reporting areas may be difficult to identify on ECDIS, and pick reports may need to be used.

It may be useful to add a waypoint note for reporting, including the channel.

Automated ship reporting and monitoring

The Automatic Identification System (AIS) provides traffic reporting systems with the ability to monitor ships in real time. This has reduced the need for reports from vessels in certain areas, but Masters should continue to make reports as required by individual reporting systems.

Masters should make sure that the static, passage and dynamic data programmed into AIS equipment is accurate, to avoid the transmission of false data to reporting systems and other vessels.

This data should be entered before departure and updated as the passage progresses.

3.4.15 Vessel traffic services (VTS)

Vessel traffic services (VTS) monitor ship compliance with local regulations and optimise traffic management. VTS operate in:

- Areas where the volume of traffic and risk to navigation and the environment is high;
- In approaches to ports; and
- Other areas of confined water.

VTS reporting requirements are often marked on charts, with more details given in sailing directions and in lists of radio signals. The passage plan should include references to the specific radio frequencies that the ship should monitor to communicate with VTS. Masters should expect VTS to be able to provide:

- An information service (IS) which may include reports on the position, identity and intentions of other traffic, waterway conditions, weather, hazards or any other factors that may influence the ship's passage;
- A navigational assistance service (NAS) in difficult navigational or weather conditions or when a ship is suffering defects or deficiencies. The Master may request this service from the VTS; and
- A traffic organisation service (TOS) to set up and manage the priority of vessel movements, allocation of space, mandatory movement reporting, route information and speed limits or other appropriate measures.

3.5 Executing and monitoring the passage plan

The ship's passage should be continuously monitored to ensure that it is being carried out in line with the plan as checked and approved by the Master and as briefed to the bridge team.

More guidance on executing and monitoring the passage plan by the OOW can be found in chapter 4.

Chapter 4
Duties of the Officer of the Watch

4 Duties of the Officer of the Watch

4.1 Overview

The OOW is the Master's representative and is responsible for the safe navigation of the ship, in full compliance with the international regulations.

The presence of the Master on the bridge does not relieve the OOW of their responsibility for the safe navigation of the ship.

A decision by the Master to assume responsibility for the watch should be explicitly communicated to the OOW and the other members of the bridge team and fully understood by them.

The OOW should comply with the requirements of the SMS and the Master's standing, daily and night orders. Compliance ensures that the bridge team will follow agreed procedures in order to promote safety and mitigate risks when carrying out and monitoring the passage plan.

The primary duty of the OOW is to maintain a safe navigational watch at sea or at anchor. This will involve:

- Compliance with the company's navigational policies and requirements;
- Effective watch handovers;
- Management of the bridge team;
- Maintaining a proper look-out;
- Familiarity with the bridge layout and equipment;
- Familiarity with and implementation of bridge procedures;
- Maintaining situational awareness;
- Overall monitoring and surveillance of the ship;
- Execution of the passage plan;
- Navigation and control of the vessel;
- Collision avoidance in compliance with the COLREGS;
- Global Maritime Distress and Safety System (GMDSS) watchkeeping;
- Compliance with environmental requirements;
- Monitoring the performance of navigational equipment;
- Recording bridge activities;
- Management of emergency situations; and
- Security awareness.

4.2 Effective watch handover

An effective watch handover should take place to make sure that all important information is exchanged between the oncoming and off-going bridge team members (see checklist C2.16).

As the Master's representative, it is the OOW's responsibility to be satisfied that:

- The relieving OOW is fit for duty (see sections 2.2.9 and 2.2.11) and that during hours of darkness they have had enough time to allow for night vision adjustment; and
- The relieving officer has checked the ship's position and status.

During any watch handover the following information should be discussed and checked:

- The ship's current position and proximity to navigational hazards;
- The intended track (including any amendments to the passage plan), course and speed, and engine controls as appropriate;
- Machinery status with particular reference to defects that affect manoeuvrability;
- Steering mode and equipment status with particular reference to defects that affect manoeuvrability;
- The operational condition and alarm status of all navigational and safety equipment being used, or likely to be used, during the watch;
- Compass errors including last deviation and variation;
- The traffic situation including vessel reporting requirements completed or due;
- Weather conditions, navigational and other hazards likely to be encountered during the watch with reference to maritime safety information (MSI) received;
- Current stability situation including condition of draught, heel/list and trim;
- Any shallow water effects, including squat;
- Work going on around the ship which could affect the navigation, e.g. crew working on deck, engine room maintenance and cargo, ballasting or tank cleaning operations;
- The safety precautions for these operations, including active permits to work; and
- Any special instructions, particularly amendments to bridge orders.

> The watch handover should be deferred until after the completion of any action that is imminent, or that starts before the watch has been handed over.

4.3 Managing the bridge watch

The OOW is in charge of the bridge team, until properly relieved, in compliance with the SMS and Master's standing orders. This responsibility extends to ensuring that bridge watch manning levels are always kept at a safe level for the existing circumstances and conditions (see chapter 2 and checklist C2.2).

An OOW should always be on watch on the bridge at sea or at anchor.

All members of the bridge team including look-outs and any helmsmen should be fit for duty (see sections 2.2.9 and 2.2.11).

4.4 Maintaining a proper look-out

Maintaining an effective look-out is essential to the safe navigation of the ship. The OOW should make sure that a proper look-out by sight and hearing, as well as by all other available means, is always maintained. No other activity or duties should be allowed to interfere with this. While steering, a helmsman should not be considered to be the look-out, except on small ships with an unobstructed all round view from the steering position.

The OOW, supported by other members of the bridge team, should:

- Make a full appraisal of the risk of collision with other vessels;
- Identify navigational hazards, e.g. wrecks, floating objects, ice and uncharted hazards;
- Determine the risk of grounding or stranding;
- Detect and respond as appropriate to any significant change in the weather, visibility or sea state;
- Identify aids to navigation, including buoys and lights;
- Respond to persons, ships or aircraft in distress; and
- Identify threats to security, especially in areas with a known risk of piracy or armed robbery.

On ships with fully enclosed bridges, sound reception equipment should be continuously in operation and correctly adjusted to make sure that it is operating effectively. The SMS, the Master's standing orders and the on board procedures should address the need to maintain situational awareness, particularly when the characteristics of individual ship's bridges could isolate the bridge team from the outside environment.

> Electronic navigation aids including ECDIS, radar, automatic radar plotting aids (ARPA) and AIS are not substitutes for maintaining a proper look-out. The aids and the look-out should be used in combination to achieve a full appraisal of the situation.

4.4.1 Control of night vision

During the hours of darkness, it is essential that the bridge team has adequate night vision to maintain a proper look-out, and the environment should support this. Shipboard procedures should allow the vision of oncoming watchkeepers to adjust to ambient light conditions before taking over the watch.

Lighting used in the bridge and adjacent areas should be of low intensity and coloured red. Light from bridge equipment can impair night vision and should be controlled by using appropriate display settings. The use of blackout curtains will help to control light levels when it is not otherwise possible to exclude it.

The use of deck lighting during the hours of darkness should be carefully considered to avoid adversely affecting night vision, even if the lighting only affects a restricted sector of the horizon.

Externally facing accommodation windows should have suitable light exclusion curtains or deadlights that should be closed during the hours of darkness, along with all accommodation external doors, to avoid adversely affecting night vision.

It should be noted that even momentary exposure to bright light can temporarily destroy night vision and, during the subsequent readjustment period, the ability to maintain an effective look-out will be impaired. Consideration should be given to fitting cut-out switches to doors leading into the bridge so that adjacent light sources are temporarily switched off when doors are opened.

4.4.2 Sole look-out

Under the STCW Code, the OOW may, in certain circumstances when the Master has decided that it is safe to do so, be the sole look-out in daylight.

In making this decision, the Master should consider certain factors including:

- Weather conditions;
- Visibility;
- Traffic density;
- Proximity of dangers to navigation;
- Attention needed when navigating in or near a traffic separation scheme (TSS); and
- Defects affecting aids to navigation, propulsion or steering.

The Master should also be satisfied that:

- The OOW is fit for duty (see sections 2.2.9 and 2.2.11);
- The ability of the OOW to safely navigate the ship is not compromised by the volume of the anticipated workload;
- The OOW knows who will provide back-up assistance, in what circumstances back-up should be called and how to call it quickly; and
- Back-up personnel are aware of required response times and any limitations on their movements, and they can hear and respond to alarms or communication calls from the bridge.

> The OOW should not be the sole look-out during hours of darkness.

4.5 Bridge navigational watch alarm system (BNWAS)

The BNWAS should be in operation whenever the ship is at sea, including when the ship's heading or track control system is in use. The OOW should make sure that the BNWAS is operational and set correctly, in line with the SMS and the Master's standing orders (see section 5.6).

The operation of the BNWAS should be part of the departure checklist and a key, if supplied, should be kept with the Master when switched on.

4.6 Calling the Master

If there is any doubt about the safety of the ship or whenever there is any uncertainty, the OOW should immediately call the Master. Standard situations where the Master should be called are listed in checklist C2.17.

The presence of the Master on the bridge does not relieve the OOW of their responsibility for the watch, unless the Master has explicitly taken control. Any handover of responsibility must be fully understood and communicated. The OOW should remain on the bridge, continue to manage the bridge team and support the Master, unless instructed otherwise.

The Master should be called immediately if the OOW has any doubts about the safety of the ship or how to deal with the situation effectively.

4.7 Familiarity with bridge layout and equipment

The OOW should know the bridge layout and be familiar with the operation of all bridge equipment so that the ship can be safely navigated (see section 2.2.10). The OOW should:

- Understand the status, capabilities and limitations of all bridge equipment and its effective operation;
- Recognise and understand how to respond correctly to alarms and warnings; and
- Understand the status of the ship's engines and other appropriate machinery together with any restrictions or limitations on manoeuvrability.

4.8 Situational awareness

Situational awareness means appreciating what is happening around the ship. This includes knowing where the ship is, where it is planned to be, and whether any other vessel, event or conditions developing nearby could pose a risk to the ship's safety.

Situational awareness depends on:

- The bridge team's ability to use information effectively to assess a situation accurately;
- The bridge team's experience; and
- The absence of distractions.

Good situational awareness is essential for safe navigation and the protection of the environment.

The OOW should develop and maintain situational awareness of the area around the ship, the ship's activities, and the possible impact of external influences on the ship's safety. This will include awareness of requirements to protect marine wildlife and environmentally sensitive sea areas.

Situational awareness on the bridge will be aided by:

- A clear understanding of the passage plan;
- An effectively managed bridge team;
- A proper and continuous look-out by all available means;
- Familiarity with and understanding of bridge equipment and the information available from radar, AIS, ARPA and ECDIS;
- Using look-outs, ECDIS, radar and visual monitoring techniques to confirm the navigational safety of the ship;

- Continuous monitoring of the ship's position and proximity to navigational hazards by all means available;
- Using look-outs, radar and ARPA to monitor traffic; and
- Cross-checking information from different sources.

Care should be taken to ensure that the information available on electronic navigation equipment remains uncluttered and is relevant to the current situation.

> Over reliance on individual electronic systems for developing and maintaining situational awareness should be avoided.

4.9 Communication with the engine control room

Clear, concise and closed-loop communication between the bridge and the engine control room is vital for a ship to operate safely and efficiently, and without causing pollution.

In closed-loop communication, a person gives a message and gets an acknowledgment from the person who receives the message (Yes, Understood, Repeat message, etc.).

For more information on engine room procedures, see the ICS *Engine Room Procedures Guide.*

4.9.1 Situation reviews

The bridge and the engine control room should update each other on their operational status. For example, the bridge should give reasonable notice before the ship enters areas under restrictive environmental controls and should communicate information on any changes in the weather, the condition of traffic, visibility and any other relevant conditions.

Likewise, the engine control room should notify the bridge if an engine becomes unavailable or if any other system or equipment might affect the safe navigation of the ship. The engine control room should also provide an estimate of how long it will take to complete any work on the engine or main machinery.

There should be a procedure in place to inform the bridge of planned maintenance and to receive agreement from the bridge to release key equipment and systems. This is particularly important in the case of maintenance that will affect the firefighting systems on board.

4.9.2 Unattended machinery space (UMS) operation

The bridge should be informed by the Engineer Officer of the Watch (EOOW) when:

- Switching to unattended machinery space (UMS) operation;
- Personnel enter and exit unattended machinery spaces; and
- When the engine room is switched back to attended operation.

When the EOOW needs to enter the machinery space outside of normal working hours, e.g. for night rounds, they should:

- Inform the bridge on entering and exiting the machinery space;
- Say how long they intend to remain there; and
- Set up a method for confirming their safety (e.g. via regular agreed calls to the bridge).

4.9.3 Manoeuvring

Communication should always be available between the bridge and the engine control room during manoeuvring. This should include updates on manning levels, machinery availability and critical navigation phases that could affect the propulsion and steering machinery.

During critical operations, the talkback intercom system is the preferred method of communication with the engine control room, as it ensures that everybody in the engine room and on the bridge is aware of what is going on. The talkback intercom system also helps with automatic recording of voices. Bridge team members should be familiar with the use of all communication equipment on the bridge and the back-up communication equipment needed during a power shortage.

4.10 Monitoring shipboard operations

The OOW should maintain a high level of general awareness of the ship and its routine operations. This will include:

- Maintaining a general watch over the ship's decks;
- Monitoring, where possible, people working on deck and any cargo or cargo handling equipment;
- Monitoring machinery status;
- Considering weather and sea state when deciding whether activities are safe;
- Supervision and control of the ship's safety and environmental systems; and
- An understanding of the nature of work going on around the ship, including any active permits to work, and how the work could affect safety.

Whenever work is carried out in the vicinity of radar scanners, radio aerials or sound signalling apparatus, the OOW should be consulted and kept updated, and should isolate the equipment and/or post appropriate warning notices on the equipment controls.

Work that reduces the ship's fire integrity must be supervised from the bridge.

Under no circumstances should the OOW's other duties interfere with the safe navigation of the ship.

4.11 Cargo operations

The OOW should have a general overview of the cargo operations while the ship is at sea, at anchor or in port.

These operations could include:

- Loading or discharging cargo at a port or terminal;
- Working cargo, e.g. at an offshore installation;
- Embarking or disembarking passengers; and
- Monitoring the cargo on board (e.g. refrigerated cargo or livestock).

The OOW should be aware of ongoing operations and have an overview of:

- Cargo plan approval;
- Cargo stowage and security;
- Loading and discharge rates;
- Ballast/deballasting necessary; and
- Ship stability during operations.

The OOW should also be familiar with the company specific instructions included in the SMS.

4.12 Risk assessments and permits to work

4.12.1 Risk assessments

A key factor in safe shipboard operations and maintenance is risk assessment.

The risk assessment process identifies hazards present in an operation, analyses the level of risk, considers those in danger and evaluates whether hazards are adequately controlled, taking into account any measures already in place.

Risk assessments control work proactively by reducing the probability and consequences of unexpected events and ensuring compliance with the SMS and regulations. Used correctly by all involved, they minimise the risk of accidents and losses. A basic risk assessment matrix is shown in figure 4.1, but the company may use different terminology or include other stages in the process.

The steps in a risk assessment are:

1. Identify the current hazards;
2. Indicate who may be harmed and how;
3. Evaluate the risks and decide on precautions;
4. Record findings and apply precautions if necessary; and
5. Review the risk assessment.

Work should not proceed until the risk assessment demonstrates that the residual risk is acceptable.

4.12.2 Risk assessment matrix

When evaluating the risk, a risk level or factor should be identified by categorising the likelihood of harm and the potential severity. These two factors should then be plotted against each other in a risk matrix.

Ranking the results is key, as it can help decide which risks should be tackled first. But it is very important to avoid risk assessments becoming over complicated, for example by trying to introduce too many categories.

PROBABILITY OF OCCURRENCE	RISK RANKING			
	Negligible	Minor	Serious	Critical
Frequent	Low	Medium	High	High
Probable	Low	Medium	Medium	High
Remote	Low	Low	Medium	Medium
Improbable	Low	Low	Low	Low

Figure 4.1: Example risk matrix

To evaluate properly the likelihood of harm and the potential consequences, experience and expertise is necessary. If the risk assessment is not effective, it could create unnecessary controls or, worse, fail to identify necessary controls.

The development of risk assessments should involve those who are going to do the job as they should be in a good position to identify hazards and suggest what practical steps might control and reduce risks.

4.12.3 Permits to work

Based on the findings of the risk assessment, appropriate control measures should be put in place to protect those who may be affected.

Permits to work are formal records to confirm that control measures are in place when particular operations are carried out.

4.12.4 Permit to work systems

In many types of operation on board ships, the routine actions of one person may endanger another, or a series of actions need to be taken to ensure the safety of those engaged in an operation.

Before the work is done, it is necessary to identify the hazards and then to eliminate or control them effectively. The ultimate responsibility rests with the company to make sure this is done by the personnel on board in accordance with the SMS.

The permit to work system is an organised and predefined safety procedure. A permit to work does not in itself make the job safe but contributes to measures for safe working.

The ship's SMS should set out when permit to work systems should be used, and the format that the permit should take.

When using a permit to work, the following principles apply:

- The permit should be relevant and as accurate as possible. It should state the location and details of the work to be done, and the nature and results of any preliminary tests undertaken;
- The permit should describe the measures that have been undertaken to make the job safe and the safeguards that need to be in place during the operation;
- The permit should specify the period of its validity (which should not exceed 24 hours) and any time limits applicable to the work that it authorises;
- Only the work specified on the permit should be undertaken;
- Before signing the permit, the authorised officer should make sure that all the measures specified as essential have in fact been taken, or that relevant procedures are in place;
- The authorised officer retains responsibility for the work until they have either closed the permit or formally transferred it to another authorised officer;
- The competent person responsible for carrying out the specified work should countersign the permit to indicate their understanding of the safety precautions to be observed;
- On completion of the work, the competent person should notify the authorised officer and get the permit closed; and
- The competent person carrying out the specified work should not be the same person as the authorised officer.

Permits to work are normally required for the following categories of work:

- Entry into dangerous (enclosed) spaces;
- Any work requiring use of gas testing/equipment;
- Hot work;
- Working at height/over the side;
- Electrical work;
- Working on deck during adverse weather; and
- Work on lifts, lift trunks and machinery.

This list is not exhaustive. Permits to work with a similar but different format may be required and should be developed for other categories of work.

The bridge team must have an overview of all active permits on board so that they can react to an emergency in the most appropriate way.

4.13 Ship stability

The ship should always meet the required intact stability criteria, which are specific to ship types.

The OOW should know how different loading conditions affect the ship performance.

The OOW should have an overview of the ship's loading condition which includes stability information relevant to the voyage. This information may include:

- Draughts (forward, aft and midship) and related hogging or sagging;
- Ship trim (bow and propeller immersion);
- Bending moments and shear forces;
- Approximate ship's metacentric height (GM);
- Any list or heel that the ship is experiencing;
- Status of ballast tanks;
- Status of fresh water tanks; and
- Status of fuel oil tanks.

4.14 Navigation and control

It is important that the OOW follows the passage plan and monitors the progress of the ship.

The OOW should not hesitate to use helm, engines, or any other manoeuvring arrangements, including sound signalling apparatus, to comply with the COLREGS.

4.14.1 Manoeuvring information

The OOW should be familiar with the handling characteristics and stopping distances of the ship, and should also know how these characteristics are affected by the current and anticipated machinery status. Information on the manoeuvring characteristics should be recorded on the pilot card and on the wheelhouse poster (see checklists C1.2 and C1.3) and the ship's manoeuvring booklet.

It is important not only to record on the pilot card ship data such as draught, but also factors that could affect manoeuvrability. For example, it is useful to know that a ship tends to steer to port at full speed but to starboard at slow speed.

4.14.2 Use of propulsion

To control the main engines effectively, the OOW should understand the characteristics of the:

- Bridge control systems;
- Type of main engine(s); and
- Type of propeller(s) and/or thruster(s).

Changing speed could have implications for the operation of propulsion machinery, and the engine control room should be informed of any intended changes to ship speed.

4.14.3 Safe speed

The OOW is responsible for ensuring that the ship always proceeds at a safe speed. Factors to consider when deciding on a safe speed are listed in the COLREGS: Rule 6 and Rule 19.

The need to reduce speed should be anticipated to minimise the risk of damage by ship's wash and wake in shallow or confined waters, particularly to small craft and on the shoreline.

4.14.4 Steering control

The OOW should be familiar with the operation of all manual, automatic and back-up steering control systems on the bridge, as well as the means of control at the emergency steering position (see checklist C2.3). This will allow the OOW to select the most appropriate steering control system for the situation.

A helmsman should always be available and ready to take over steering control when automatic systems are unsuitable. Manual steering should be used whenever appropriate, including in:

- Areas of high traffic density;
- Conditions of restricted visibility;
- Situations when the ship is manoeuvring or under pilotage; and
- Any other potentially hazardous situations and particularly when an automatic steering system could provide insufficient control.

The changeover between automatic and manual steering should not affect or distract the attention of the bridge team from maintaining a proper look-out. The changeover should be:

- Completed in good time, before critical situations arise; and
- Under the supervision of the OOW.

Manual steering should be tested once per watch (see checklist C2.1).

> Changes between manual and automatic steering should be checked to confirm that the subsequent steering response is satisfactory.

4.14.5 Track control systems

Track control systems use position, course and speed information to keep a ship automatically on a planned track over the ground. Track control systems can be used to navigate between a series of waypoints with the OOW alerted before course alterations are made.

Use of a track control system does not relieve the OOW of the duty to make sure that the ship is safely on track or navigating within an authorised cross track distance (XTD). Track control systems do not alter course if there is a hazard ahead.

4.15 Monitoring the passage

Compliance with the passage plan should be closely monitored by the OOW:

- To check that the ship's position is maintained within an authorised XTD, including following alterations of course to avoid collision or following a planned course alteration;
- By fixing the ship's position at a frequency based on existing conditions and the proximity of navigational hazards;
- By cross-checking the ship's position using all appropriate means, including:
  - By visual and/or radar fixing techniques using ranges and bearing of charted objects;
  - By echo sounder to monitor charted depths and contours; and
  - By monitoring the integrity of information displayed on navigational equipment.

Monitoring should be undertaken using appropriately prepared electronic or paper charts. A mixture of chart types should where possible be avoided, but it is recognised that there will be occasions when both electronic and paper charts are in use. These transition periods should be kept as short as practicable and should be carefully managed to make sure that all appropriate navigation information is transferred.

4.15.1 Navigation in coastal or restricted waters

It is important that the bridge team fully understands the increased dangers of navigation in coastal or restricted waters, and the importance of creating and maintaining good situational awareness.

Procedures and the Master's orders should ensure that:

- Navigation is conducted on the most suitable large scale ENC, RNC or paper charts available;
- The position of the ship is fixed at frequent intervals by the most appropriate means and cross-checked;
- All relevant navigation marks are positively identified by the OOW;
- The OOW is aware of mandatory reporting requirements for routeing schemes;
- The OOW considers ship's draught and manoeuvring characteristics that may affect navigation in restricted waters;
- The OOW is aware of the squat characteristics for individual loading conditions and the effect of ship speed on squat. In shallow water, squat may have a critical effect on manoeuvrability and the ship's under keel clearance (UKC) and;
- The OOW is aware of bank effect and the impact this may have on the ship when transiting rivers or narrow channels.

4.15.2 Monitoring techniques

The following visual techniques should be used when monitoring the passage in coastal and pilotage waters or the safety of the ship at anchor:

- Azimuth bearings of charted objects to fix the position;
- Heading transits, which can provide a leading line along which a ship can safely steer;
- Beam transits, which can provide an additional check when altering course; and
- Clearing bearings, which can be used to check that a ship remains in a safe area.

When charted features visible by radar appear on the display, radar can be used for monitoring. The following techniques should be used for passage in coastal and pilotage waters, particularly in conditions of restricted visibility or at night:

- Parallel indexing, recommended to ensure the ship's track is maintained;
- Radar bearings; and
- Radar ranges.

Where ECDIS is integrated with radar, and a radar image overlay (RIO) feature is available (see section 5.11.3), the alignment of the radar picture with charted features can be used to further verify the ship's position. Any offset should be addressed immediately.

4.15.3 Monitoring a passage plan on ECDIS

ECDIS is an effective tool for monitoring a passage as long as the following checks are made before departure:

- The correct passage plan is loaded on both the primary and back-up ECDIS terminals;
- The safety settings, particularly depth safety contours, are set in compliance with the SMS and reflect the ship's current operational status including the actual draught. This will help to avoid inappropriate alarms; and
- Information from all sensors connected to the ECDIS is available and correct. Particular attention should be paid to the availability of information from the GNSS receiver, gyro compass and log and that back-up sensors are providing the correct inputs.

When using ECDIS to monitor the ship's passage, the OOW should consider:

- The capabilities and limitations of ENCs and RNCs (see section 5.12);
- The need to select individual chart symbols (pick reports) on ENCs to get more detailed safety and navigational information;
- The need to manage the amount of information displayed on an ECDIS terminal to avoid obscuring charted features and information, and the effects of information overload;
- The potential for positioning or related errors. Every opportunity should be taken to confirm the validity of a GNSS position with traditional fixing techniques. These fixes should, whenever possible, be plotted using electronic lines of position (LOP);
- Looking ahead or using an offset view can improve situational awareness;
- The display of relative or true vectors and the appropriate interpretation of them;
- The potential for software anomalies and their possible consequences. The bridge team should be familiar with the latest guidance on identification and use of mitigation measures for software anomalies (see sections 5.1.3 and 5.1.4); and
- Time settings are normally based on Co-ordinated Universal Time (UTC) and allowances are needed for local time.

The OOW should be aware that the charted detail on some ENCs/RNCs may not be as accurate as the GNSS position of the ship on ECDIS. Caution is needed when planning and navigating to make sure there is an adequate safety margin between charted hazards and the ship's intended route.

> Over reliance on ECDIS should be avoided, particularly if it prevents a proper look-out from being maintained.

4.15.4 Amending the passage plan

The OOW should execute the passage plan approved by the Master, but there may be situations that require an amendment to or deviation from it. Any deviation from the agreed passage plan may introduce new risks which will require assessment and possible mitigating action.

If a permanent amendment to the passage plan is needed, the relevant parts of the appraisal and planning process should be repeated. The Master should be informed as appropriate, after which they should check and approve the amendment and the bridge team should be briefed.

A revised passage plan may be required in the following circumstances:

- Weather routeing developments;
- Change of ship's orders/destination port; and
- SAR response.

For the ship to remain clear of hazards, deviations may be required, particularly to the planned course and/or speed, as well as to the course and/or speed that is needed to comply with the COLREGS.

Deviation from the planned route may be required in the following circumstances:

- Variations in weather conditions;
- Advice and information received from VTS;
- Navigational warnings; and
- Detected hazards.

Following a deviation, the ship should be returned to the planned route once it is safe to do so.

4.16 Compliance with the COLREGS

4.16.1 Lights, shapes and sound signals

The conduct of a ship's navigation should always comply with the COLREGS. This includes displaying the correct lights and shapes, and making the correct sound and light signals.

The OOW should be aware that other vessels may fail to display the correct lights or shapes or make the correct sound signals. Safe navigation will therefore require the use of all available means to determine whether a risk of collision exists, or to confirm the operational status of other vessels.

4.16.2 Risk of collision

The risk of collision can be determined at an early stage by plotting targets at longer ranges on radar. Taking regular bearings of approaching vessels within visual range will also determine whether a risk of collision exists. Plotting aids should always be used to track approaching vessels.

Particular care should be taken when approaching very large ships, ships engaged in towing or ships at close range. An appreciable bearing change may be apparent, but a risk of collision may still exist.

Careful monitoring of the situation should continue until the vessel is finally past and clear.

Particular care should be taken when navigating in or near an area of restricted visibility and the OOW should be aware of the obligations under Rule 19 of the COLREGS.

The OOW should use ECDIS and AIS to aid situational awareness but should not rely on either system for collision avoidance.

> Radar and ARPA are the primary electronic anti-collision aids for the OOW. The OOW should not rely on very high frequency (VHF) radio or AIS for collision avoidance.

4.16.3 Action to avoid collision

Early, substantial and positive action that is appropriate to the situation, seaman-like and readily apparent to other vessels should always be taken to avoid collision. Monitoring the effectiveness of an action should continue until the other vessel is finally past and clear.

4.17 Navigation under pilotage

For advice on pilotage, see chapter 6 and checklist C2.8.

4.18 Maintaining an anchor watch

An anchoring plan should be developed as a complement to, or as part of, the passage plan (see checklist C2.12). On anchoring, the initial duties of the OOW include:

- Plotting a fix of the anchor drop position and the position of the ship at anchor;
- Informing port authorities about the anchored position, as appropriate;
- Identifying the ship's swinging circle;
- Selecting landmarks and transits to monitor the ship's position;
- Monitoring the depth under keel and the tidal state;
- Monitoring the depth of water and windlass capacity;
- Confirming that the appropriate status is selected on AIS; and
- Making sure that appropriate lights and shapes are displayed (and, in restricted visibility, that sound signals are initiated) in accordance with the COLREGS and any local regulations.

At anchor, the duties of the OOW include:

- Keeping a proper look-out;
- Regularly plotting the ship's position (see section 4.15.2) and monitoring swinging pattern;
- Identifying potential hazards and risks of collision;
- Making sure that inspection rounds are carried out periodically;
- Maintaining ship security and access control;
- Monitoring weather conditions, tidal conditions and sea state, including updates to forecast conditions;
- Making sure that main engines and other machinery are in a readiness state appropriate to the conditions, in line with the Master's daily and standing orders;
- Monitoring traffic and other anchored vessels;
- Monitoring compliance with environmental protection requirements (see section 4.21); and
- Complying with any additional regional or local requirements.

The Master should be notified immediately if the ship drags its anchor, or if sea conditions or visibility deteriorate, or if there is any doubt about the ship's safety or security (see section 4.6 and checklist C2.17).

4.19 GMDSS watchkeeping

To send and receive distress, urgency and safety information, the OOW should hold a General Operator's Certificate (GOC) or Restricted Operator's Certificate (ROC), as appropriate, and should be familiar with the requirements and procedures for GMDSS watchkeeping. The OOW should make sure that:

- All GMDSS communications are under the control of an appropriately certified operator;
- Communication procedures and discipline are followed to avoid interference with other radio users; and
- Frequencies are used for their correct purpose.

GMDSS communications are ranked according to their importance for the safety of life at sea.

Figure 4.2: Priority of GMDSS communications

The International Telecommunication Union (ITU) publication *Manual for Use by the Maritime Mobile and Maritime Mobile-Satellite Services* contains extracts from the ITU Radio Regulations and sets out the maritime operational procedures to follow.

4.19.1 Radio watchkeeping

The OOW is responsible for ensuring compliance with the ship's radio watchkeeping requirements. In general, a radio watch should be kept on all frequencies to receive distress, urgency and safety messages appropriate to the sea area in which the ship is operating. Watchkeeping requirements are shown in figure 4.3 overleaf.

	Sea area			
	A1	A2	A3	A4
VHF Ch.16 (156.8 MHz)	X	X	X	X
VHF DSC Ch.70 (156.525 MHz)	X	X	X	X
MF DSC (2187.5 kHz)		X	X	X
HF DSC (8414.5 kHz)			X[2]	X
HF DSC (4207.5, 6312, 12577, 16804.5 kHz)			X[2,4]	X
NAVTEX (518 kHz)	X	X	X[3]	
Satellite (Ship earth station (SES))	X[1]	X[1]	X[2]	
HF Direct-Printing (1605-27500 kHz)			X[2]	X

Notes:

1. If fitted because the ship is operating exclusively in areas outside the range of a coast station broadcasting NAVTEX or high frequency (HF) direct-printing MSI service.
2. If fitted under SES or medium frequency (MF)/high frequency (HF) option permitted for Sea Area A3.
3. If in range of a coast station broadcasting NAVTEX.
4. At least one of these frequencies should be monitored based on the time of day and geographical location of the ship.

Figure 4.3: Radio watchkeeping requirements

4.19.2 Emergency communications

The OOW should be familiar with the procedures for sending distress, urgency and safety messages contained in the *International Aeronautical and Maritime Search and Rescue Manual Volume III* (IAMSAR Vol III Mobile facilities), Section 2 Distress alerts and messages. It is crucial to give the appropriate priority to alerts and messages sent by digital selective calling (DSC), radio-telephony and satellite communications.

It is also important for the OOW to make sure that:

- Alerts and messages are sent to ALL STATIONS;
- DSC alerts and messages are sent on appropriate frequencies;
- When the situation allows, DSC distress alerts are followed by a radio-telephony message;
- DSC urgency and safety alerts are followed by a radio-telephony message;
- Distress and urgency alerts are cancelled when the emergency is over; and
- During a distress a qualified operator is designated as being responsible for radio communications. (On a passenger ship, the operator should have no other duties during a distress.)

Every precaution should be taken to avoid sending false distress alerts.

4.19.3 Maritime safety information

A continuous MSI watch should always be kept at sea by all ships. To meet this requirement, NAVTEX should be used while the ship is in range of a coast station broadcasting NAVTEX. Beyond this range, a watch should be kept on the appropriate MF or HF frequencies or on the SES to receive MSI.

4.19.4 Routine and general communications

Routine and general communications are any DSC, radio-telephony or satellite communications which are not related to emergencies or safety. The frequencies used by coast stations, port stations and reporting systems can be found in lists of radio signals.

The OOW should make sure that routine and general communications do not interfere with emergency or safety communications.

4.19.5 GMDSS log keeping

A GMDSS radio log is kept to provide a record of all events connected with the radio communications facilities on board. As a minimum, the following should be recorded:

- A summary of communications relating to distress, urgency and safety. This includes any periods when a radio watch is discontinued and the reasons for doing so;
- The position of the ship at least daily;
- The identities of other stations with which the ship communicates, or tries to communicate;
- Records of any difficulties experienced with communications;
- Incidents involving unnecessary or inappropriate transmissions, with the identities of the stations concerned, if known; and
- Cancellation of any false alerts.

The requirements for the retention of radio logs are laid down by the flag State and in the ITU Radio Regulations and should be included in the SMS.

4.19.6 Communications equipment tests

Radio equipment should be tested in line with the SMS (including flag State requirements) and the manufacturers' maintenance and operation manuals. It is essential to avoid transmitting false distress/urgency alerts when testing GMDSS equipment.

Daily, weekly and monthly radio tests should be recorded in the GMDSS radio log and demonstrate continuous compliance with the functional requirements of the International Convention for the Safety of Life at Sea (SOLAS) and should include the tests listed in figure 4.4.

Daily	• Functioning of DSC facilities (VHF, MF and HF) using built-in test functions • Battery supplies to GMDSS equipment including charging condition
Weekly	• Functioning of DSC facilities by a test call with a coastal station (if in range, or at the earliest opportunity if out of range) • Reserve power supplies to GMDSS equipment other than batteries
Monthly	• Enhanced group calling (EGC) function • EPIRB function (using built-in test) and condition • Function (using built-in test) and condition of search and rescue transponder (SART) • Condition and security of batteries • Condition of aerials and insulators • Functioning test of survival craft two-way VHF equipment

Figure 4.4: Example of radio tests schedule

4.19.7 False distress alerts

The transmission of false alerts (distress or urgency) is a significant problem for the GMDSS. Every effort should be made to minimise the risk of sending them. Checklist C2.19 identifies the actions to be taken if a false distress alert is sent.

Ships should use any means available to inform the appropriate authorities that a false distress alert has been transmitted and that it should be cancelled. Records of any false alert and subsequent remedial actions should be kept on board.

If a false alert is reported and cancelled promptly, no action will be taken against the ship, unless repeated negligence occurs.

4.20 Long range identification and tracking (LRIT)

Cargo ships of 300 gross tonnage and upwards and all passenger ships engaged on international voyages must be fitted with a system to transmit automatically the following long range identification and tracking (LRIT) information:

- The identity of the ship;
- The position of the ship; and
- The date and time of position given.

LRIT is not part of the GMDSS but can contribute to effective SAR efforts.

4.21 Environmental compliance

Environmental compliance relies not only on the effective prevention of pollution incidents, but also on strict compliance with complex and diverse environmental standards.

MARPOL comprises six Annexes that address different types of ship's pollution and waste streams, and it defines Special Areas where stricter requirements apply.

The OOW should be familiar with the MARPOL Convention and any other company or national/regional requirements. National and regional restrictions may exist in:

- Particularly Sensitive Sea Areas (PSSA), as established by IMO;
- Marine Protected Areas (MPA), as established by a State or a group of States; and
- Emission Control Areas (ECA), as established by a State or a group of States.

Environmental requirements such as discharge restrictions or fuel changeover points should be addressed in the passage plan.

4.21.1 Pollution by oil or harmful substances

The OOW should know and understand the ship's Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) that should be applied in incidents involving oil and/or harmful substances.

4.21.2 Reporting obligations

A slick near the ship may indicate a potential pollution incident. Ships should report to the relevant authorities when an incident involving another vessel is observed or when an on board incident involves:

- A discharge or probable discharge of oil or noxious liquid substances above the permitted level for whatever reason, including when securing the safety of the ship or saving life; or
- A discharge or probable discharge of harmful substances in packaged form, including those in containers, portable tanks, vehicles and barges.

A report must also be made if the ship suffers damage, failure or a breakdown that affects its safety or impairs safe navigation, and results in a discharge or probable discharge into the sea of a harmful substance. Reports are not required for environmental compliance if there has simply been a breakdown or failure of machinery or equipment, but they may be required from a safety perspective.

4.21.3 Reporting points

The SOPEP/SMPEP will have an appendix with the list of agencies or officials of administrations designated to receive and process reports from ships.

If there is no local agency, or in case of delay in contacting a listed reporting point, it is important to contact the nearest coastal radio station, reporting station or rescue co-ordination centre (RCC) by the quickest available means.

4.21.4 Other sources of pollution

The OOW should be familiar with MARPOL requirements on the management and discharge of sewage, garbage and air pollutants. Discharge criteria are based on the ship's distance from the nearest land, with stricter criteria in Special Areas as defined in the MARPOL Annexes.

4.21.5 Energy efficiency

Energy efficiency reduces air emissions such as sulphur and greenhouse gases (GHG) including carbon dioxide (CO_2) and also helps to reduce fuel consumption.

As required by MARPOL Annex VI, the Ship Energy Efficiency Management Plan (SEEMP) must be developed by the company, with the objective of optimising the performance of the ship. The SEEMP should be followed by the engineering team, but it may also address operational measures relevant to the bridge team, e.g.:

- Improved voyage planning;
- Weather routeing;
- Just in time arrivals;
- Speed optimisation; and
- Optimised ship handling (optimum ballast; optimum use of autopilot systems).

4.21.6 Ballast water management

The International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) requires all ballast water operations to be carried out in line with the ship-specific Ballast Water Management Plan (BWMP).

Ships are required to conduct ballast water management in accordance with the implementation schedule detailed in regulation B-3 of the Convention. This will require, dependent on the date the ship was constructed, that ballast water is managed either in accordance with regulation D-1 (the Ballast Water Exchange Standard) or regulation D-2 (the Ballast Water Performance Standard). To comply with regulation D-2 and to meet the performance standard, ballast water will need to be treated using an approved ballast water management system. Ballast water operations must be recorded in the ballast water record book.

Depending on the company procedures as outlined in the SMS, ballast operations should be carried out by either the deck department or the engineering department.

In either case, before the operation can start, the deck officer in charge should issue specific instructions based on stability considerations.

On ships using ballast water management systems, the engineering department should confirm that the system is operational and within the specified limits.

The officer carrying out the ballast operation should:

- Record and promptly carry out or issue any instructions on ballasting and deballasting;
- Make sure the ship meets all relevant environmental restrictions when discharging treated/untreated ballast water overboard;

- Record in the official log book the date, time and position of both the start and completion of any ballast water overboard operations;
- Strictly follow any operational or safety procedures; and
- Maintain an overview of the stability conditions during the operation.

4.22 Periodic checks of navigational equipment

4.22.1 Operational checks

Operational checks on navigational equipment should be performed when preparing for sea and before port entry (see checklists C2.1, C2.6 and C2.7) and at any other time required by the SMS.

Before entering restricted or coastal waters, it is important also to check that there is full control of engine and steering functions.

4.22.2 Routine tests and checks

Daily tests and checks of bridge equipment consist of the following:

- Manual steering should be tested at least once per watch (see checklist C2.1);
- Gyro and magnetic compass errors should be checked and recorded at least once a watch, when possible;
- The synchronisation of all compass repeaters, including repeaters at the emergency steering position, should be regularly checked;
- To make sure that performance is adequate, information from electronic equipment should always be compared and checked against information from different independent sources; and
- All available positioning systems and sources (GNSS, DGNSS, satellite communications terminals with integrated GNSS and terrestrial radio-navigation aids) should be cross-checked.

The following checks should confirm that the equipment functions properly and communicates successfully with any other bridge system to which it is connected:

- Built-in test facilities should be checked frequently, including alarm self-test functions;
- Configuration settings should be checked and confirmed to be in line with the SMS and the passage plan; and
- Operational settings and alarms should be correctly set and checked on the equipment and/or the BNWAS.

4.22.3 Software anomalies

The OOW should be able to detect software anomalies (see sections 5.1.3 and 5.1.4) as they occur by:

- Carrying out regular performance checks;
- Carrying out regular cross-checks of information with other systems; and
- Following manufacturer and SMS instructions for equipment testing, maintenance and operation.

4.23 Recording bridge activities

Records of bridge activities should be kept by the OOW. The company should have a policy set out in the SMS for the maintenance of navigational records on paper and/or electronically (if approved by the flag State).

Information about position, course and speed should be recorded with enough detail to reconstruct a complete voyage if necessary:

- Paper and/or electronic records from course recorders, echo sounders and NAVTEX receivers should be kept, with a date and time if practicable; and
- VDR and ECDIS voyage records should be kept and download procedures should be understood and followed. Procedures for preserving this information should be covered in the SMS.

4.24 Emergency situations

4.24.1 Management

The bridge team should be aware that it could be requested to respond to an emergency on board or on another vessel which it is obliged to assist.

To manage emergency situations efficiently, the OOW should:

- Be fully familiar with the emergency checklists contained in this Guide (see Appendix C3) and similar checklists and procedures in the SMS;
- Know the initial action to take in response to emergency situations; and
- Know the general emergency alarm signals and actions to take on hearing or sounding an alarm.

The OOW should not hesitate to take immediate emergency action before the Master arrives on the bridge. Following the initial response, checklists such as those in Appendix C3 may be used to make sure that all the actions for an effective response to an emergency are taken.

An illustrated table describing the ship's life-saving appliances (LSA) should be kept on the bridge, as required by SOLAS.

4.24.2 Search and rescue

The OOW should be aware of the obligations relating to distress at sea and the instructions in IAMSAR Vol III relating to the alert, conduct and co-ordination of a distress response (see checklist C3.9).

Ships may be requested by an RCC to provide assistance. Ships able to help must proceed at their best speed towards the casualty. If a ship is responding to a distress alert, the co-ordinating RCC should be informed to help in its rescue planning. Any decision by a ship not to provide assistance should be justifiable, recorded in the log book by the Master, and the appropriate RCC should be informed.

A ship is only released from its obligation to assist when informed that help is no longer required by the vessel in distress, the appropriate RCC, or another vessel which has already given assistance.

Every passenger ship will have on board a plan for co-operation with appropriate SAR services for use in an emergency. The plan should be reviewed regularly and updated as required. These plans should also be available for PSC inspection.

Ship's personnel should be familiar with the international signals for indicating distress and for communicating with ships giving assistance and SAR units (including aircraft).

4.25 Danger reporting

Ships should broadcast danger messages as required by SOLAS. The OOW should send a danger message if the ship experiences or observes any of the following:

- Dangerous ice;
- A dangerous derelict or any other direct danger to navigation;
- A tropical cyclone;
- Sub-freezing air temperatures associated with gale force winds causing severe ice build-up on superstructures; or
- Winds of force 10 or above on the Beaufort scale for which no storm warning has been received.

All danger messages should be transmitted as safety messages and include the following basic information:

- The kind of ice, derelict or danger observed;
- The position of the ice, derelict or danger; and
- The UTC time and date when the danger was last observed.

4.26 Helicopter operations

On a ship likely to transfer personnel or stores by helicopter, even if only in emergency situations, watchkeeping officers should use and be familiar with the ICS *Guide to Helicopter/Ship Operations*.

4.27 Security awareness

Masters and watchkeeping officers should be familiar with:

- Guidance on measures to reduce security risks on ships provided by flag and coastal States;
- Responsibilities and procedures included in the Ship Security Plan (SSP) in response to changes in the security level; and
- Advice on reporting, identifying threats and appropriate ship protection measures as contained in the latest industry best practices and guidance on responses to piracy and armed robbery at sea.

Good situational awareness (see section 4.8) when navigating in a reporting area or designated risk area, or in an area where the security level has been raised, is essential for the prompt identification of threats and the effective protection of the ship.

For more information and context on maritime security, see the ICS *Maritime Security: A Comprehensive Guide for Shipowners, Seafarers and Administrations*. For guidance on preparing for and responding to rescues of migrants at sea, see the ICS *Large Scale Rescue Operations at Sea: Guidance on Ensuring the Safety and Security of Seafarers and Rescued Persons*.

Chapter 5
Operation and maintenance of bridge equipment

5 Operation and maintenance of bridge equipment

5.1 General

Masters and watchkeeping officers should be trained and competent in the use of the ship's navigation and bridge equipment, and be familiar with its operation (see section 2.2.10 and checklists C2.3 and C2.4). This should include understanding:

- The contents and use of operating manuals, in particular to configure safety critical features;
- How equipment and software updates are managed, and how to check whether updates have been applied;
- Procedures for identifying equipment failures and responding to them; and
- The capabilities and limitations of the systems and equipment.

This Guide is complementary to, and should be used in conjunction with, manufacturers' operating and maintenance manuals and specific user policies that should be included in the SMS.

Over reliance on automatic systems for navigation and collision avoidance may have severe consequences, including the risk of collision, grounding or pollution.

5.1.1 Carriage requirements

Masters and officers in charge of the navigational watch should be familiar with the relevant carriage requirements that apply to their ship.

5.1.2 Equipment performance

Periodic checks on equipment should be carried out and any defects reported to the Master. Defects should also be recorded in the log book and identified as appropriate on the pilot card (see checklist C1.2).

Regular preventive maintenance of all equipment should be carried out in line with shipboard maintenance procedures, making use of manufacturers' instructions and manuals.

5.1.3 Software anomalies

Computer systems are widely used to support navigation, communication and cargo management. To operate safely and efficiently, these systems rely on software that is both suitable and stable.

Deficiencies in the design or operation of software have sometimes led to compromised systems, with the safety of the ship potentially being at risk. These deficiencies are known as software anomalies.

To detect and deal with software anomalies appropriately:

- Shipboard familiarisation should provide the Master and watchkeeping officers with an understanding of the equipment's normal operating condition;
- Any deviation from the normal or anticipated operation of the software should be investigated to find the cause(s) and remedial measures should be applied in line with available guidance;
- New or previously unknown software anomalies should be reported to the equipment manufacturer; and
- Masters and watchkeeping officers should be familiar with the guidance available, including from equipment manufacturers, on how to identify, mitigate and report anomaly issues.

Masters and watchkeeping officers should be familiar with and practise procedures in the SMS to monitor the performance of shipboard equipment.

5.1.4 ECDIS anomalies

Historically, ECDIS operating anomalies have been identified and then addressed through software updates[7] (see section 5.13.3). ECDIS and ENC standards have been modernised and improved over the years and anomalies now occur less often. However, Masters and watchkeeping officers should be aware that such anomalies can still happen.

The ship's SMS should contain procedures to ensure that ECDIS data presentation and performance checks are done following a software update, ECDIS upgrade or whenever the Master or watchkeeping officers have concerns over the performance of the ECDIS on board.

ECDIS is a complex system and other anomalies may be identified. But OOWs may misinterpret information and/or set the system up incorrectly, which can also affect the safe and efficient operation of navigation and related systems. To avoid this problem, there should be effective generic ECDIS training and familiarisation with the specific ECDIS installed on board (see section 2.2.10).

5.1.5 Cyber security

The exchange of electronic data between ships and shore authorities, service providers, charterers and owners/operators has increased significantly over recent years. This exchange, which includes updates to navigational systems and software, exposes users to the possibility of unauthorised or malicious access, and this creates a risk to the safety and security of shipboard systems.

To make sure that safety and environmental protection are not compromised, and to protect commercial interests, it is important for seafarers to fully comply with company cyber security procedures. Company procedures should address industry guidelines and any regulatory cyber security requirements. Management of cyber security risks should be included in the SMS.

Additional information can also be found in the ICS, BIMCO, Witherbys *Cyber Security Workbook for Onboard Ship Use*.

5.2 Steering gear and automatic pilot

5.2.1 Operation and testing

The OOW should follow the SMS and manufacturer's requirements on operation and testing of the steering gear (see checklist C2.1) and in particular:

- In restricted waters or restricted visibility, a second steering gear power unit is in operation so that these units can operate simultaneously;
- The complete steering system is tested no more than 12 hours before departure; and
- When approaching heavy traffic, restricted waters or restricted visibility, automatic steering may be changed over to hand steering as appropriate and in good time.

7 IMO Circular MSC.1/Circ.1503/Rev.1 ECDIS – Guidance for Good Practice.

5.2.2 Steering control

Steering control of the ship usually consists of manual steering and an automatic pilot (autopilot) or other track control system. At each steering position there should be a gyro repeater and rudder angle indicator.

With an autopilot, a steering mode selector switch is also available to change between automatic and manual steering. A manual override control allows immediate manual control of the steering.

In an emergency, steering control may require the use of alternative power supplies, auxiliary steering gear or direct control of the steering gear in the steering compartment.

5.2.3 Autopilot – Heading control

Heading control will steer to maintain the ship's heading but, unlike automatic track-keeping, cannot compensate for the effects of wind and tidal-stream/current on the ship's course over ground (COG).

When the autopilot is engaged it is important that the OOW ensures the yaw and rudder options are set and adjusted as necessary to the appropriate settings, given the sea state and prevailing conditions, to ensure that fuel consumption efficiency is optimised by smoothing out large angle rudder movements used to maintain course.

5.2.4 Autopilot – Automatic track-keeping

Automatic track-keeping steers the ship towards a waypoint or to follow a route while remaining within a specified XTD. The ship will steer to maintain a COG that keeps the ship on track and moving towards the next waypoint.

An autopilot performs automatic track-keeping functions, and its alarm outputs should always be monitored closely by the OOW, who should check that the autopilot can alter course safely.

Whether the autopilot can follow a planned track closely will depend on the accuracy of the cross track error (XTE) information which is sent by the navigation system to the autopilot.

5.2.5 Off-course alarm

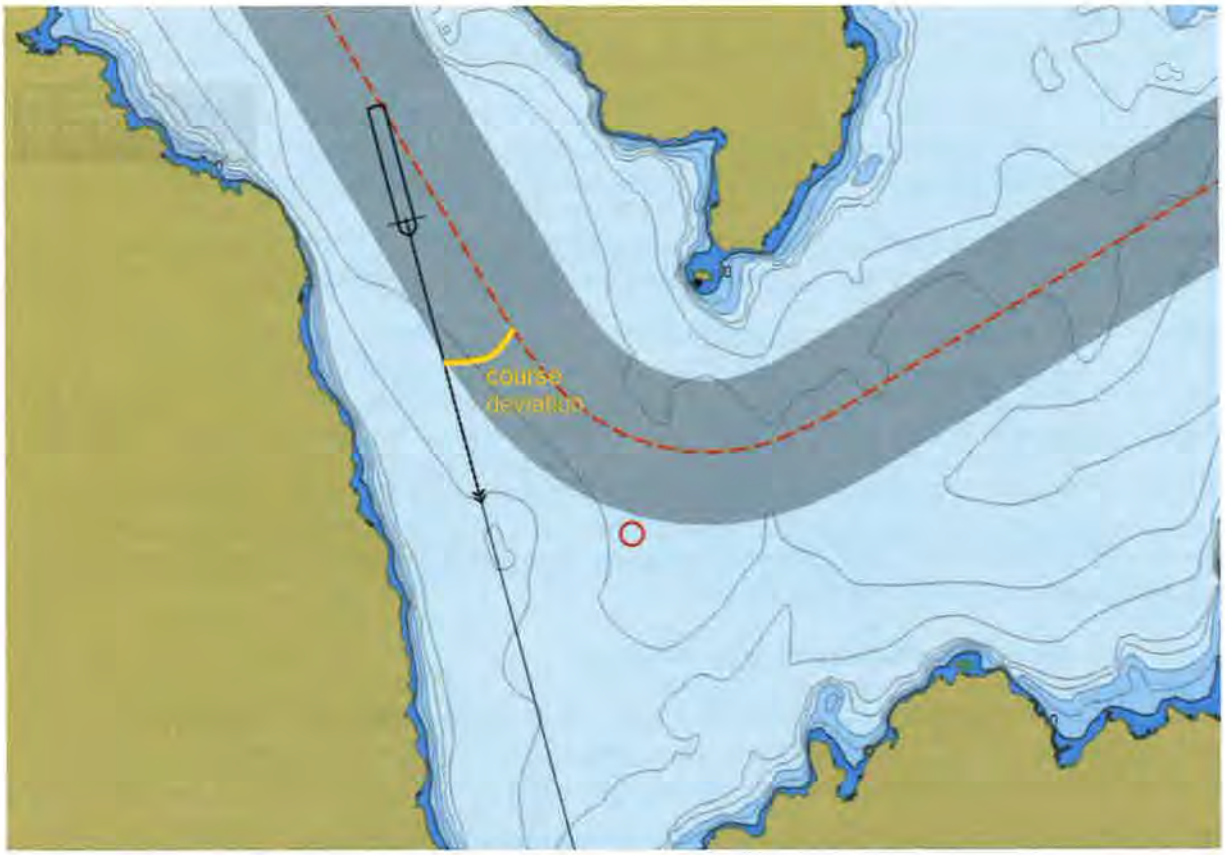


Figure 5.1: Off-course alarm on ECDIS display

The steering control system has an off-course alarm to warn the OOW when the ship deviates from its heading.

Examples of appropriate independent devices include:

- A magnetic off-course alarm independent of other bridge equipment and inputs; and
- A second gyro compass or transmitting heading device, as appropriate, with a heading comparison unit connected to both compasses.

The alarm should always be in use when the autopilot is in operation, and the alarm should also be integrated with the BNWAS.

The off-course alarm may not always sound when the ship deviates from its planned track. The ship may be moved off track by wind and tidal stream/currents even though the heading remains unchanged.

> The use of an autopilot and the off-course alarm does not relieve the OOW from frequently checking that the planned course is safe and being maintained.

5.2.6 Berthing systems

A range of highly accurate berthing systems are available that enable a precise approach to a berth. These systems usually apply to specific ship types or to particular locations, and may use laser, doppler or GNSS technology to measure the ship's movements accurately in relation to the berth or another vessel.

The bridge team should be aware of the types of system in use and their capabilities and limitations.

5.3 Compass systems

5.3.1 Magnetic compass

The magnetic compass is generally fitted above the navigating bridge on the centreline and has a periscope so that the compass can be read from the helmsman's position.

Where the magnetic compass is needed to provide heading outputs to other bridge systems, a transmitting magnetic compass (TMC) should be fitted. TMC outputs should be corrected for compass error and the TMC should be tested once a week.

A compass deviation card should be kept and be visible on the bridge, and the specific magnet positions should be shown on it. The deviation needs to be determined and the compass adjusted at intervals during the ship's life, particularly after any major steel conversion work has been done to the ship. Care should be taken when using the magnetic compass on ships that carry, or have recently carried, magnetic cargoes such as iron ore and steel.

Compass safe distances are specified on all electrical bridge equipment and give the minimum distances from the magnetic compass that equipment can be installed.

A TMC may have variation automatically applied, but this correction will not include deviation. When correcting TMC outputs for compass error, it is important to apply the correct values for variation and deviation.

The OOW should be aware of limitations to the performance of the magnetic compass in relation to proximity to the magnetic poles.

5.3.2 Gyro compass

The gyro compass should run continuously. If it stops for any reason, it should be restarted and then regularly checked. It can only be relied on again when it has 'settled' and the error is known.

Where the gyro has no direct speed log or position input, manual corrections should be made as required.

The gyro usually supports several repeaters including a required repeater at the emergency steering position. Gyro repeaters on the bridge should be checked against the main gyro at least once per watch and after significant manoeuvring. Other repeaters should be checked frequently.

Any anomalies should be corrected and the gyro repeaters resynchronised.

The OOW should be aware of gyro compass errors by reduced horizontal force in polar latitudes, such as +/- 70 degrees north or south.

5.3.3 GNSS compass

A GNSS compass provides an alternative to a gyro compass as a non-magnetic transmitting heading device able to give heading data to AIS, radar and automatic plotting aids. A GNSS compass or equivalent is required on ships navigating in polar waters at latitudes above 80 degrees.

5.3.4 Compass errors

Gyro and gyro repeater headings should be frequently checked to avoid any wandering from the correct heading going undetected.

Magnetic and gyro compass errors should be checked and recorded each watch, where possible, using either azimuth or transit bearings.

5.3.5 Rate of turn (ROT)

When ships are manoeuvring, particularly large ships where the distance between the bow and the pivot point of the ship is considerable, ROT indication gives feedback on how quickly the ship is turning. ROT measurement is used by automatic track-keeping systems when ships are to perform controlled turns.

5.4 Speed and distance log

Depending on their type, speed and distance measuring equipment will measure speed and distance travelled through the water or over the ground.

5.4.1 Speed measurement

Speed over the ground (SOG) is the speed of a vessel relative to the surface of the earth. Speed through the water (STW) is the speed of a vessel relative to the water in which it is navigating.

In general, STW is used for radar collision avoidance and SOG is used for navigation. Care should be taken if SOG is used for collision avoidance as there can be differences in the aspect of a target and its vector, particularly when there are strong cross tides (currents).

Speed made good (SMG) can be measured from two fixed points on a chart and is also calculated and transmitted by electronic position fixing systems.

5.4.2 Types of speed log

Electromagnetic and doppler logs can be either single-axis and measure speed in the fore and aft direction (longitudinal), or dual-axis and measure fore and aft (longitudinal) and also athwartships (transverse) movement. When connected to ROT data, dual-axis logs can also calculate the speed and direction of movement of the bow and stern.

5.4.3 Recording of distance travelled

Log distances should be recorded in the log book at the end of each watch. To make sure that the recorded speed and distance log equipment is accurate, it should be installed, maintained and calibrated in line with manufacturers' instructions.

The distance travelled can also be compared with data from the GNSS system and checked for anomalies.

5.5 Echo sounders

Cargo vessels of 300 gross tonnage and above and all passenger vessels are required to carry an echo sounder for measuring water depth. The echo sounder should have a minimum of two range scales: shallow (20m) and deep (200m).

The echo sounder should always be used when making a landfall and kept switched on in coastal and pilotage waters. If the echo sounder is fitted with a shallow water alarm, the alarm should be set to an appropriate safe depth to warn of approaching shallow water.

It is important to check that the units of soundings on the echo sounder are the same as those on the chart in use. When comparing echo and chart soundings, the ship's draught, any depth reading offset and the height of tide should be considered.

> The depth alarm on the echo sounder should not be set to a value lower than the ship's sailing draught.

5.6 Bridge navigational watch alarm system (BNWAS)

The BNWAS monitors bridge activity and OOW awareness and can detect operator disability that could lead to marine accidents. The system uses stages of visual and audible alarms to alert the bridge team. If for any reason the OOW does not or cannot respond, the Master and/or other appropriate personnel will be automatically alerted.

The BNWAS alert period should be sufficient so that alarms do not distract the OOW from watchkeeping duties.

The BNWAS is also a means for the OOW to call immediate assistance to the bridge.

> The BNWAS must be operational whenever the ship is underway and should also be used at anchor.

5.7 Navigation lights and signalling equipment

The OOW is responsible for making sure that the navigation lights, emergency navigation lights and signalling equipment are in working order and always ready for immediate use.

The condition of lights, flags and shapes should be checked at regular intervals.

Sound signalling equipment should be checked daily and maintained in an operational condition.

5.8 Voyage data recorder (VDR)

5.8.1 Overview

VDRs record and securely store information on the position, movement, physical status, command and control of a ship. VDR equipment allows accident investigators to review the circumstances leading up to an incident and helps to identify the cause(s).

VDRs also provide the company with information that can improve ship operation and management, and offer the owner/operator a comprehensive record of events during a given period.

A simplified VDR (S-VDR) is not required to store the same range of information as a VDR, but still records and securely stores information on the position, movement, physical status, command and control of a ship, for use by accident investigators and owners.

On ships where S-VDR is fitted, any information or data source listed as mandatory for a VDR should also be recorded by an S-VDR if appropriate interfaces are available.

5.8.2 VDR requirements

A VDR is required to maintain a sequential record of information, covering at least a 48 hour period, which as a minimum should include the items shown in figure 5.2.

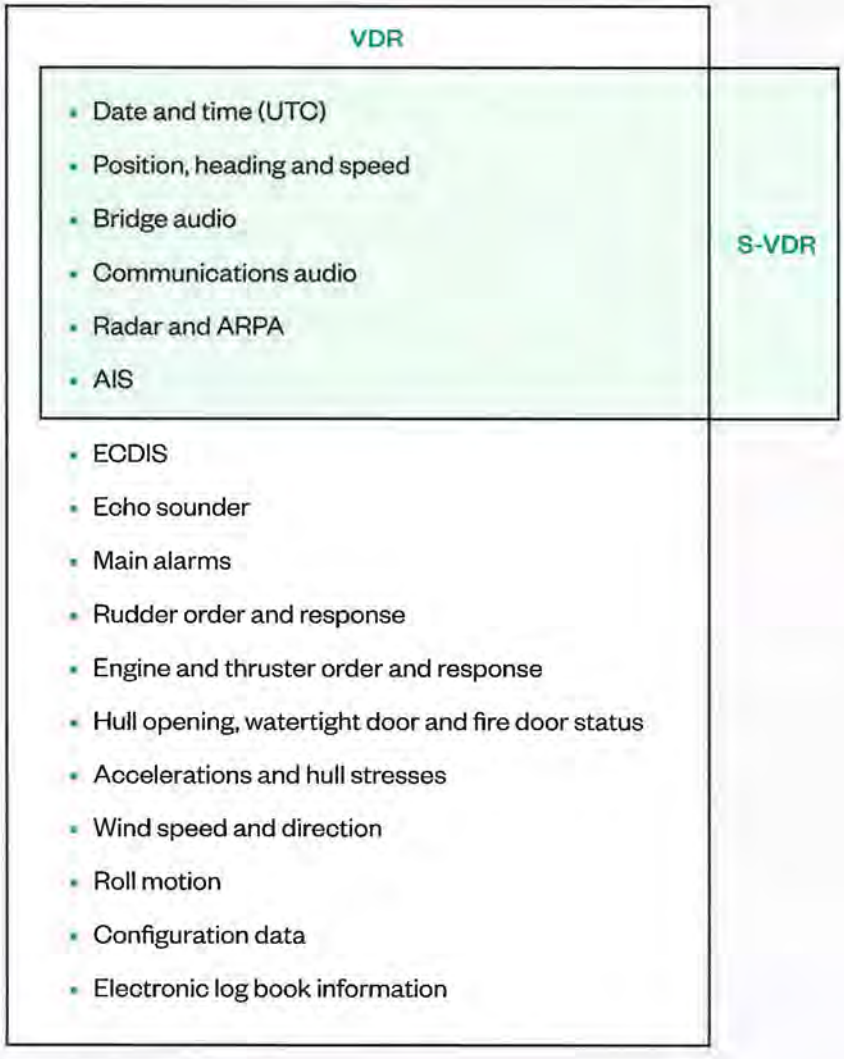


Figure 5.2: Data recorded in a VDR

5.8.3 Preserving records

Records should be kept for at least 30 days/720 hours on the VDR long term recording element, and at least 48 hours on its fixed and float-free recording element. After these periods have passed, older records on each of the recording elements may be overwritten with new data and will be lost. Watchkeeping officers should understand and be familiar with the procedures for preserving records as required by the SMS.

> VDR and S-VDR recordings provide important information for marine accident investigators. All watchkeeping officers should be familiar with the procedures to avoid overwriting these records.

5.8.4 VDR testing

The system includes functions to carry out a performance test at any time. Testing is required annually and should always be carried out after repair or maintenance work to the VDR or to any source that submits data to the VDR. This test may be done with the playback equipment and the user should make sure that all the required data items have been correctly recorded.

The VDR should be checked before departure to make sure that it is functioning and that there are no alarms or errors.

5.8.5 VDR playback

Company policy for the playback of VDR data should be set out in the SMS. VDR data playback may be used as a tool for analysing the performance of the bridge team.

5.9 Electronic position fixing systems

Electronic position fixing systems provide an automatic and continuous position update for ships fitted with a suitable single or multi-system receiver.

5.9.1 Global Navigation Satellite System (GNSS)

A GNSS is a satellite-based system that provides continuous worldwide position, time and speed (over ground) information. Two systems that give near global coverage are available to ships:

- Global Positioning System (GPS) operated by the United States; and
- Global Navigation Satellite System (GLONASS) operated by the Russian Federation.

Other satellite systems recognised as components of the World-Wide Radio Navigation System (WWRNS) are:

- BeiDou Navigation Satellite System (BDS) operated by China; and
- Galileo Global Satellite Navigation System (Galileo) operated by the EU.

5.9.2 Differential GNSS

GNSS generally have a base accuracy in the order of 15-25 metres. Differential GNSS receivers offer greater navigational accuracy by applying corrections received from ground-based reference stations.

5.9.3 GNSS associated errors and alarms

The OOW should be familiar with the GNSS system used on board.

The GNSS system should indicate its current operating status and any associated alarms or errors.

Some common errors are:

- Dilution of precision error (DOP): This error occurs when fewer satellites are available to the ship. It is common when sailing in areas with high mountains such as Alaska or Norway.
- Receiver autonomous integrity monitoring (RAIM): This error relates to the quality of data being sent to the GNSS receiver. If the system detects a drop in quality, it will alert the user.
- GNSS jamming or spoofing: This can happen in an area of increased military presence. The OOW may notice a position jump on ECDIS or, when cross-checking position, the GNSS position may be unreliable.
- Multi path error: Similar to the DOP error. The GNSS receiver may be blocked or receiving a double signal. This could be due to interference by structures, mountains, etc.

5.9.4 GNSS receivers

As stand-alone equipment or as part of an integrated system, GNSS receivers provide:

- Position (including service quality information and geodetic datum corrections);
- Course and speed over ground; and
- Route storage and XTD monitoring. By entering the passage plan into the GNSS receiver, the OOW has an independent method of monitoring the passage.

5.9.5 Geodetic datum

A GNSS calculates positions referenced to a particular global geodetic datum, but this may not be the same as the geodetic datum of the chart in use, and the position could therefore be plotted in the wrong place.

Where the difference or datum shift is known, a 'satellite-derived positions' note on the chart provides the offset to apply to the position before it is plotted.

Many GNSS receivers have internal facilities to transform positions between different geodetic datums, eliminating the need to apply datum offsets manually.

5.9.6 Chart accuracy and precision

ENC, RNC and paper charts are based on hydrographic surveys that are conducted using the best position-fixing technology available. Although a ship navigating with GNSS may know its position with an accuracy better than 10 metres, positions of hazards and other objects on the seabed may only be known with an accuracy of 20 metres or less.

Due to the screen resolution of ECDIS, the precision of charted objects on ECDIS may not be substantially different from that of paper charts (i.e. precision up to 15 metres).

5.10 Automatic identification system (AIS)

5.10.1 AIS overview

AIS is a maritime mobile system broadcasting on VHF band which can automatically exchange static, dynamic and voyage data on a ship-to-ship and ship-to-shore basis. Information transmitted by AIS is shown in figure 5.3.

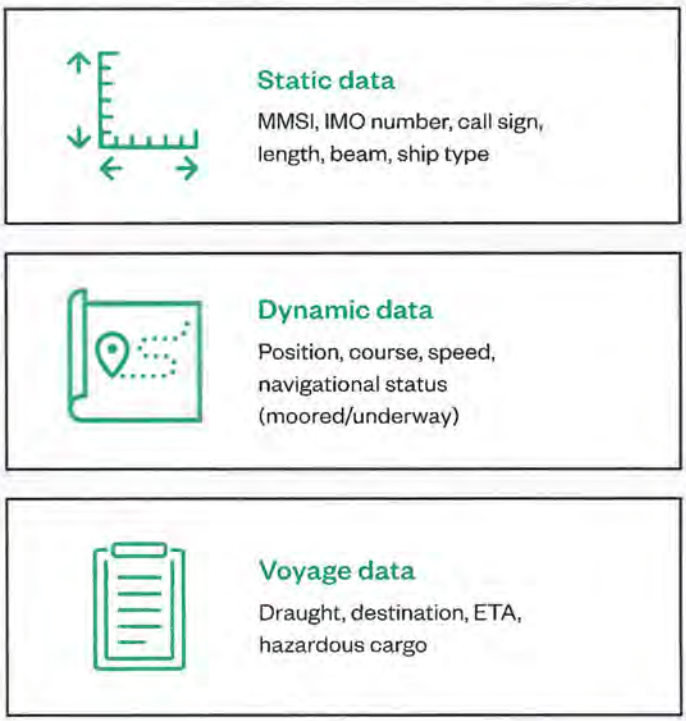


Figure 5.3: AIS information transmitted by a VHF broadcast system

Not all vessels carry AIS and watchkeeping officers should be aware that other ships, in particular leisure craft, fishing boats and warships, might not be displayed on AIS. A vessel's AIS may also be switched off based on the Master's professional judgement.

It is important to operate the AIS correctly and watchkeepers should be familiar with the equipment, including how to check that all information transmitted by AIS is both accurate and updated. Poor quality broadcast data can significantly reduce the potential value of this system.

AIS is an aid to navigation and should not be relied upon solely for collision avoidance.

5.10.2 AIS aids to navigation (AtoN)

AIS is increasingly used to provide extra information to ships, for example with Aids to Navigation (AtoN). AIS AtoN can provide:

- Type and name of AtoN;
- Position of AtoN;
- AtoN status, e.g. an indication of a buoy light failure or a buoy being out of position; and
- Other safety related information, e.g. tide or wind conditions.

Physical AIS aids to navigation

Physical AIS AtoN are actual aids to navigation that are fitted with AIS transponders. Examples include navigational buoys and lighthouses.

Virtual AIS aids to navigation

Virtual AIS AtoN do not physically exist but are transmitted by a coastal authority and are generally designed for temporary applications, e.g. the immediate marking of a wreck, identifying a hazard to navigation or defining an area. Virtual AtoN are likely to become more common, for example in areas where it is difficult to set up fixed AtoN.

Virtual AIS AtoN are not marked on charts unless a temporary Notice to Mariners (NM) has been issued.

5.10.3 Satellite AIS (SAT-AIS)

This system uses satellites to detect AIS signals, and allows the AIS to transmit beyond coastal areas. SAT-AIS technology is available and several States are currently developing SAT-AIS systems.

5.10.4 AIS and SAR

Some SAR devices including the Emergency Position Indicating Radio Beacon (AIS-EPIRB), the Man Overboard device (AIS-MOB) and the AIS-SART can use AIS to send distress alerts. Watchkeeping officers should know how these are displayed on AIS or on an ECDIS integrated with AIS.

5.11 Radar and radar plotting aids

Watchkeepers should understand the differences between X-Band (3cm) and S-Band (10cm) radars including their characteristics and the impact of different weather conditions on their performance.

The OOW should be familiar with the capabilities and limitations of the radar plotting aid integrated with the radar and the inter-switching arrangements to change radar displays between X-Band and S-Band transceivers.

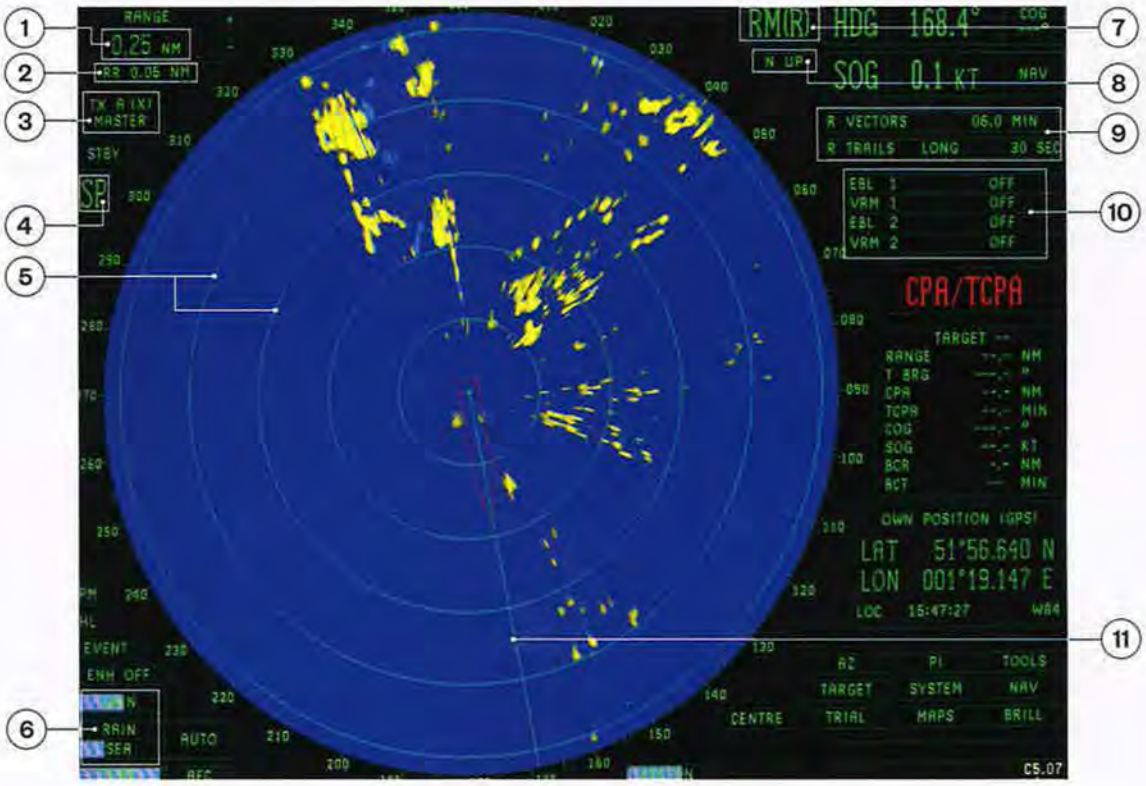
5.11.1 Characteristics of radar

The OOW should be familiar with the type of radar used on board the ship and its limitations.

This includes the correct use of:

- Gain, rain and sea clutter options to improve presentation in different conditions;
- North up, head up, course up options for orientation of display;

- Range scales;
- Variable range markers (VRMs);
- Electronic bearing lines (EBLs);
- Range rings;
- Pulse length used by the radar;
- Offsetting the radar display; and
- Performance monitoring and expected results (see manufacturers' guidelines).



1. Range scale
2. Range ring interval
3. X- or S-band radar transmission
4. Pulse length
5. Range rings
6. Clutter controls
7. Motion orientation – relative/true
8. Orientation
9. Vector and trail lengths
10. Electronic bearing lines and variable range markers
11. Vessel heading marker

Figure 5.4: Container ship radar screen

5.11.2 Safe use of radar

Unless switched off, usually for safety reasons, radar should be kept running and fully operational when the ship is at sea or at anchor. Radar is the main electronic collision avoidance tool for bridge watchkeepers and supports effective passage plan monitoring, but over reliance on radar that detracts from maintaining a proper look-out by sight and by hearing should be avoided.

When using radar, the OOW should keep in mind the following points:

- The quality of the radar picture should be checked regularly. This may be automatic when using a performance monitor;
- A heading marker that is not correctly aligned can give misleading information in potential collision situations. Heading marker alignment should be checked periodically against both the gyro heading and the fore and aft line of the ship;
- Small vessels, ice and other floating objects, e.g. containers, may not be detected by the radar;
- Echoes may be obscured by sea or rain clutter. Detection can be improved through careful use of the sensitivity and clutter controls;
- Masts or other structural features may cause shadow or blind sectors on the display. The OOW and look-out should check these blind sectors regularly, particularly astern;
- Clear weather gives an opportunity for watchkeepers to check radar target detection performance; and
- Parallel indexing techniques should be practised regularly during coastal navigation.

5.11.3 Detection of targets

The choice of radar range should be based on factors including visibility, traffic density, proximity of navigational hazards and speed of own ship.

As well as monitoring targets at the radar range appropriate to the prevailing conditions, regular checks should be made at both shorter and longer ranges to develop and maintain situational awareness. At shorter ranges, small targets are more easily detected. Regular scanning at longer ranges gives advanced warning of land and approaching vessels, particularly high speed craft. This is an important factor in determining safe speed.

5.11.4 Radar image overlay (RIO)

When a RIO is applied to an electronic chart using ECDIS, it is crucial to maintain a correct orientation, heading alignment and scale. The OOW can check these factors by confirming that the radar image correlates with charted features.

The OOW should adjust the colour and transparency of RIO to make sure that radar contacts can be viewed clearly on ECDIS without obscuring charted features. The use of RIO is not a substitute for maintaining an anti-collision plot on a separate radar/ARPA display.

5.11.5 Radar and collision avoidance

Accuracy of heading and speed inputs

To identify a target's closest point of approach (CPA) and whether there is a risk of collision, radar requires an accurate input of own ship's heading and speed through the water.

Yawing or inaccuracies in speed or heading inputs reduce the accuracy of target vectors. Particularly in head on situations with strong currents, the vectors may indicate that a target is passing clear when in fact a risk of collision exists.

Plotting periods

Multiple observations are required to determine a target's course, speed and CPA. A single observation is not enough. The accuracy of a target vector will be reduced if there is a change in the ship's own course and speed or in the target vessel's course and speed. A change in the target's course or speed during the plotting period may not be immediately detected.

The estimation of the target's course and speed and risk of collision is only valid up to the time of the last observation, so the situation should be kept closely under review.

Changing target bearing

It should not be assumed that, because the relative bearing of a target is changing, there is no risk of collision. Although an alteration of course and/or speed may alter the relative bearing, the risk of collision can still exist, especially at close quarters.

5.11.6 Radar plotting aids

A plotting aid function is available on radars, which provides an automatic tool for the systematic plotting of detected objects as required by the COLREGS. On smaller ships, it may simply be an automatic tracking aid (ATA) or an electronic plotting aid (EPA) function. ARPA are required on vessels of 10,000 gross tonnage and above.

ARPA offers several automated collision avoidance features, including the ability to conduct a trial manoeuvre before initiating actions, but over reliance on ARPA is dangerous. The OOW should:

- Understand the types of errors that are possible and recognise the operational warnings that may appear on the display;
- Understand the limitations of ARPA;
- Treat the apparent precision on a digital display with caution when the anticipated CPA is approaching the minimum point that is considered safe, particularly when approaching at close range or when large vessels are involved; and
- Regularly test and check the ARPA functions and accuracy using the built-in self-test facilities.

5.11.7 Heading and speed inputs

To process information correctly, it is essential to provide accurate speed and heading data to the ARPA.

For collision avoidance purposes, speed and heading inputs should be sea stabilised (water track) to provide the ARPA with speed and course through the water. It may be hazardous to use ARPA in a ground stabilised (bottom tracked) mode for assessing risk of collision where there are strong currents or tides.

To determine a target's CPA and whether there is a risk of collision, it is necessary to have an accurate input of own ship's heading and speed through the water.

5.11.8 Automatic radar target acquisition

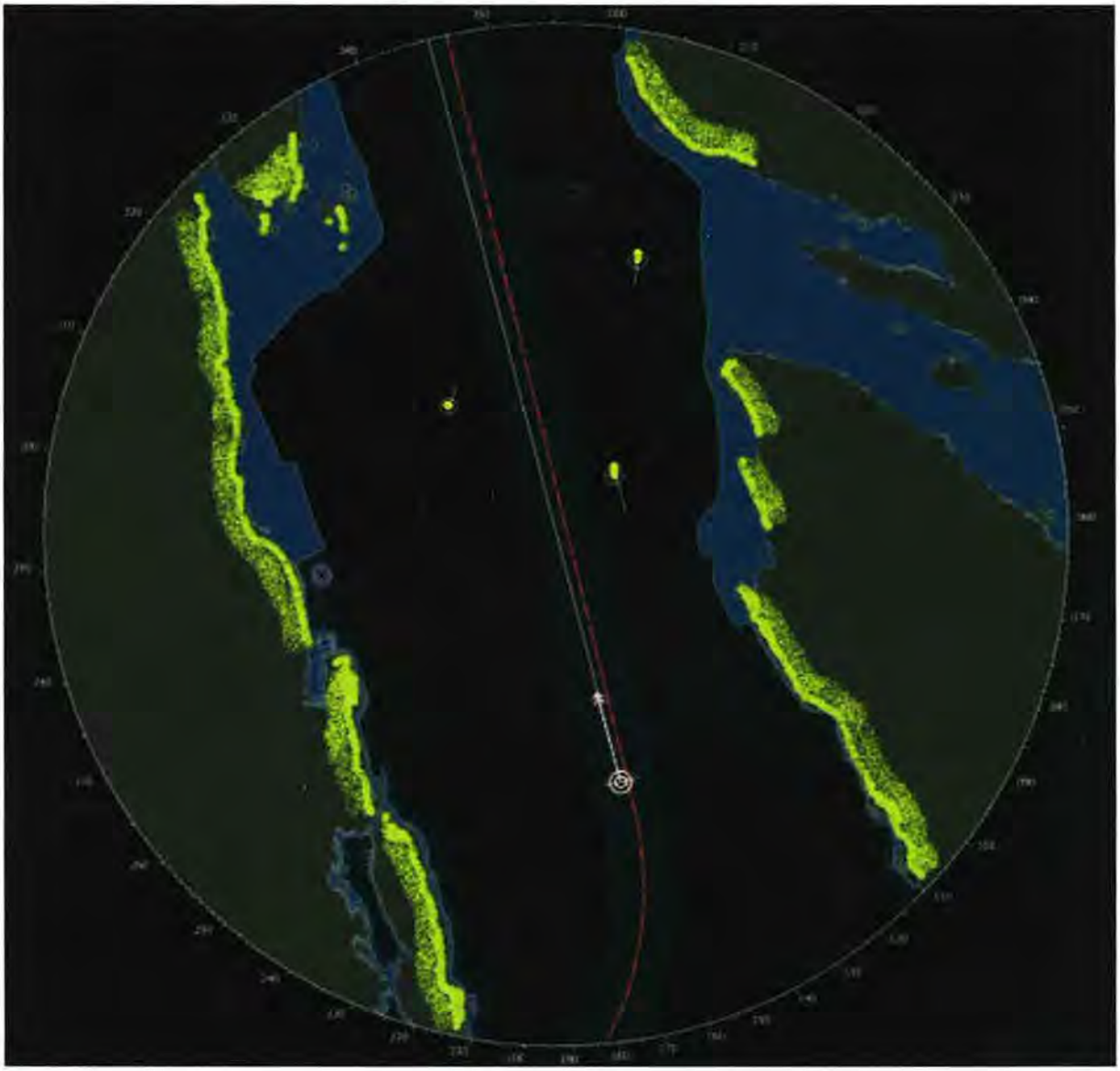


Figure 5.5: Automatic radar target acquisition on ECDIS

Guard zones can be set up on ARPA, and targets that enter guard zones are automatically acquired and processed by ARPA. The OOW can specify the size and position of guard zones to manage the number of targets acquired.

Automated acquisition features should be used with caution as hidden targets may not be detected. Automatic acquisition cannot provide the OOW with complete situational awareness and it is not a substitute for keeping a proper look-out, regular inspection of the radar image or manual acquisition of targets of interest or concern, that should begin as early as possible.

5.11.9 AIS targets on ARPA

Radar/ARPA systems can display AIS target information next to or merged with ARPA information if they are connected to the AIS transponder. The ARPA display should clearly indicate whether target information comes from ARPA or AIS.

> AIS information, particularly CPA and time to closest approach (TCPA), should not be relied on for collision avoidance.

5.11.10 Radar and navigation

Particularly when navigating in or near restricted visibility, radar provides a valuable tool to fix the ship's position and to cross reference GNSS positions.

The OOW should check:

- Overall performance of the radar and adjust settings as appropriate;
- Heading line alignment;
- Accuracy of the VRM(s), EBL(s) and fixed range rings; and
- If in use, that parallel index lines are correctly set.

Parallel indexing

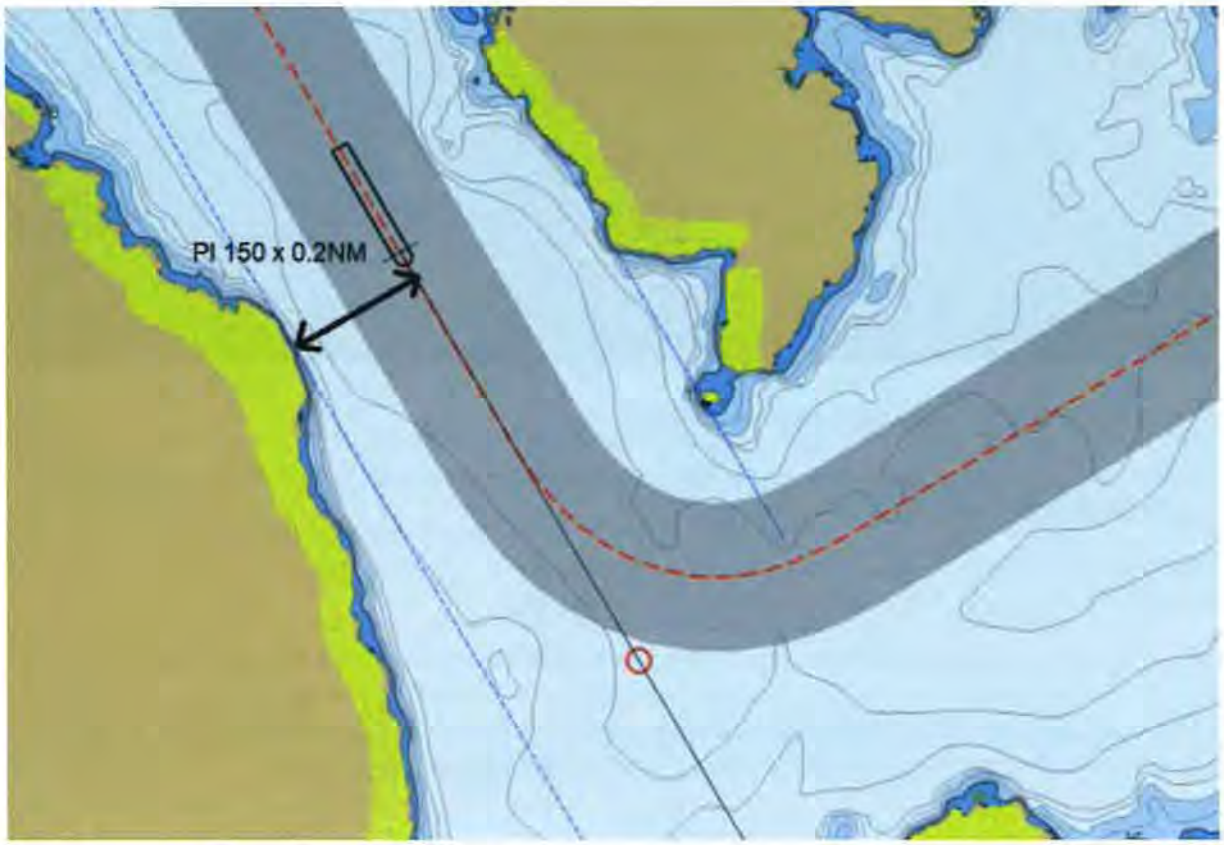


Figure 5.6: Parallel indexing on ECDIS

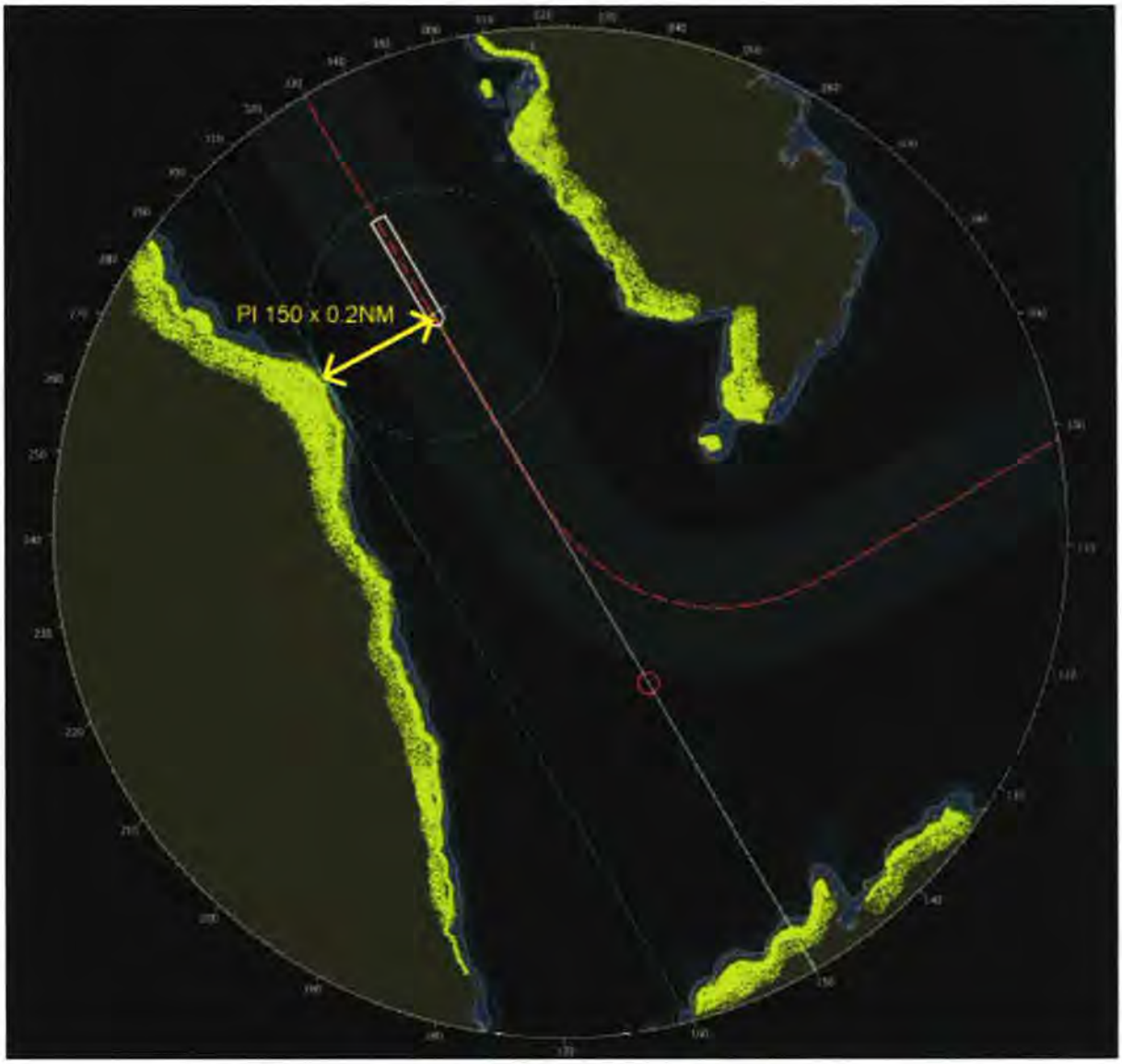


Figure 5.7: Parallel indexing radar on ECDIS

Parallel indexing is a technique for assessing the distance at which the ship will pass a fixed object (e.g. a headland) on a particular course.

An index line is drawn parallel to the planned ground track that touches the edge of the radar echo of a fixed object, at a range equal to the desired passing distance.

This technique can be used in both relative motion and sea stabilised true motion. In relative motion the static object will move along the parallel index line, with a direction and speed reciprocal to that of the ship's ground track. In sea stabilised true motion, the variable range marker (VRM) will move along the parallel index as the ship moves towards the static object.

Charts on radar

Radars may have the ability to display ENCs that can improve situational awareness.

Electronic mapping functions

Electronic mapping functions are available on some radars for displaying maps, navigation lines and routes, but should be used with caution as these could be inaccurate.

Maps can be drawn to include chart features, e.g. buoys, channel limits, separation zones and anchorages, using different lines and symbols. Once completed, maps can be stored in the radar's memory.

Any map or passage plan should be geographically referenced so that it will appear on the radar with a correct orientation and location relative to the ship's position.

Errors in the ship's position used by the radar or any errors in the accuracy of the maps or poor radar ground stabilisation can cause map interpretation problems.

5.11.11 Search and rescue transponder (SART)

A SART is a self-contained emergency device that uses either radar or AIS technologies. A radar-SART will indicate a distress situation by creating a series of 12 dots on X-band radar display. To achieve stable reception of a radar-SART, interference rejection should be switched off. An AIS-SART is detected by AIS (see section 5.10.4) but will not appear on radar.

5.12 Charts and nautical publications

5.12.1 Carriage of charts and nautical publications

All ships must carry adequate and up-to-date official nautical charts, sailing directions, lists of lights and radio signals, NMs, tide tables and all other nautical publications necessary to appraise, plan, execute and monitor a passage.

A chart and publication management system can help to maintain charts and publications efficiently. It should record the charts, publications and licences/permits carried, and when the charts and other publications were last corrected.

5.12.2 Official charts and nautical publications

Official nautical charts can be either in paper or electronic format, and official nautical publications may also be available in digital as well as paper form.

For a nautical chart or publication to be considered as official, it must be produced or approved by an authorised hydrographic office or relevant government institution in accordance with International Hydrographic Organization (IHO) resolutions and recommendations.

Only up-to-date official charts and publications should be used for the appraisal, planning, execution and monitoring of a passage plan.

5.12.3 Electronic charts

Users of electronic charts should be aware that:

- ENC and RNC are official charts produced by a hydrographic office; and
- All other commercially available alternatives are unofficial or private charts.

Only a type-approved ECDIS with an appropriate back-up operating with up-to-date official electronic charts meets the safe navigation requirements of SOLAS (see Appendix B of this Guide).

Electronic navigational charts

ENCs are official vector charts that store hydrographic information in a database rather than as a picture. An ECDIS uses the database to create system electronic navigational charts (SENC) and displays charts without interruption. Using a database allows watchkeeping officers to select which charted features are displayed and add information to the chart manually.

The advantages of ENCs over RNCs and paper charts are shown in figure 5.8.

Raster navigational charts

RNCs are official charts that are exact copies of paper charts and are produced by digitally scanning an original paper chart. It is not possible to change how information is displayed on an RNC and so there is no risk of hiding charted information.

Feature	ENC	RNC
Geodetic datum	WGS 84, compatible with GPS without correction	Geodetic datum and projections may differ between RNCs
Zoom	Zooms in to different display scales, retain size and shape of text and symbols	Zooming in can result in loss of clarity and image definition
Alarms	An automated audible and visual alarm is triggered when an anti-grounding code, safety zone or look ahead feature crosses a hazard	No automatic visual and audible alarms. Requires a manually created object or line
Symbols	Selects chart symbols to get additional safety and navigation information	Pixellates if zoomed in
Display	Selects feature sets relevant to the navigational situation. The standard display provides a minimum amount of information for safe navigation	Individual display of charts. Transition may not be seamless
Updates	With digital information provided by hydrographic offices. Eliminates sources of errors	

Figure 5.8: Comparison of ENC and RNC

Watchkeepers should be aware of the effects of over and under zooming of charts. With over zooming, the chart is displayed at a scale larger than the scale used when created. This is normally indicated by a warning and vertical lines displayed on the chart affected.

With under zooming, the chart is displayed at a scale smaller than the scale used when it was created. This is normally indicated by a warning only.

> If an ENC is over or under zoomed, some charted information required for safe navigation may not be displayed.

Chart licences and permits

Companies, Masters and watchkeeping officers should be aware that access to ENCs and RNCs is controlled by licences/permits. To view a particular ENC or RNC a valid licence/permit needs to be loaded onto each ECDIS.

Licences and permits are available from the hydrographic office that produced the ENC or RNC. Licensing arrangements usually include:

- Pre-pay licensing based on intended use. Normally licences and permits are specific to a ship and typically allow a chart to be viewed for a period of 3, 6 or 12 months on that ship; or
- Dynamic or pay as you sail (PAYS) licensing based on actual passage. Ships have access to all charts for planning purposes but only pay for charts that they use during navigation.

Licences and permits should be managed using the ship's chart management system.

5.13 Electronic Chart Display and Information System (ECDIS)

5.13.1 Overview

Electronic Chart Display and Information Systems (ECDIS) may operate as a stand-alone terminal or as part of an integrated bridge system (IBS). Only a type-approved ECDIS operating with up-to-date ENCs and with appropriate back-up may be used to meet the chart carriage requirement under SOLAS.

ECDIS can display large amounts of information which, unless carefully managed, can overload and potentially confuse watchkeepers. It is important to recognise that displaying all the available information is not always needed, and that essential navigational information may be hidden or obscured on a cluttered display. General guidance for the level of information displayed in different navigation scenarios should be provided in the SMS.

Other systems, including the use of type-approved ECDIS with unofficial or private charts, are categorised as electronic chart systems (ECS).

> ECDIS is an aid to safe navigation. But ECDIS alone does not conduct safe navigation or relieve the Master or OOW of their responsibilities for conducting safe navigation.

5.13.2 Chart updates

Procedures for updating ENCs and RNCs on ECDIS should be included in the SMS. Chart updates should be controlled and monitored using the on board chart management system.

Cyber security procedures must be followed.

5.13.3 ECDIS software updates

As with any computer-based system requiring periodic updates, ECDIS manufacturers may release updates to the software that runs the system.

Appropriate procedures are necessary to install system software updates correctly. Failure to follow these procedures has sometimes resulted in an ECDIS malfunction, non-availability of the system and subsequent delay to the ship. Unless there are exceptional circumstances, system software updates should be carried out when a ship is in port or not immediately dependent on ECDIS. Software system updates should be done in strict compliance with the manufacturers' instructions and guidelines, by suitably qualified personnel.

5.13.4 Back-up requirements

To provide a resilient on board navigation system, IMO carriage requirements state that, in addition to a type-approved ECDIS, the overall system should include an adequate independent back-up (see Appendix B of this Guide) that provides:

- Independent facilities allowing the functions of the ECDIS to be safely taken over, so that a system failure does not result in a critical situation; and
- A means to provide for safe navigation for the remaining part of the voyage in case of ECDIS failure.

Options that could potentially meet these requirements include:

- A second type-approved ECDIS connected to an independent power supply and separate GNSS receiver;
- An appropriate up-to-date folio of official paper charts for the intended voyage; or
- A type-approved chart-radar. A chart-radar is a type of radar display with an integrated navigation function capable of displaying ENCs in compliance with IHO standards, which can be used for route planning and monitoring in a similar way to an ECDIS.

Normal and alternative/emergency power supplies should be available to each ECDIS and back-up system. The OOW should know how to switch between power supplies.

5.14 Integrated bridge systems (IBS) and integrated navigation systems (INS)

An IBS is a combination of systems that are interconnected to allow centralised access to sensor information and control of passage planning, execution and monitoring functions.

An integrated navigation system (INS) may be a part of an IBS or a stand-alone system. It is designed to improve the safety of navigation by integrating route monitoring, collision avoidance and navigation control.

Both IBS and INS use multi-function workstations that integrate some or all of the systems and equipment covered in this chapter, including the systems in figure 5.9.

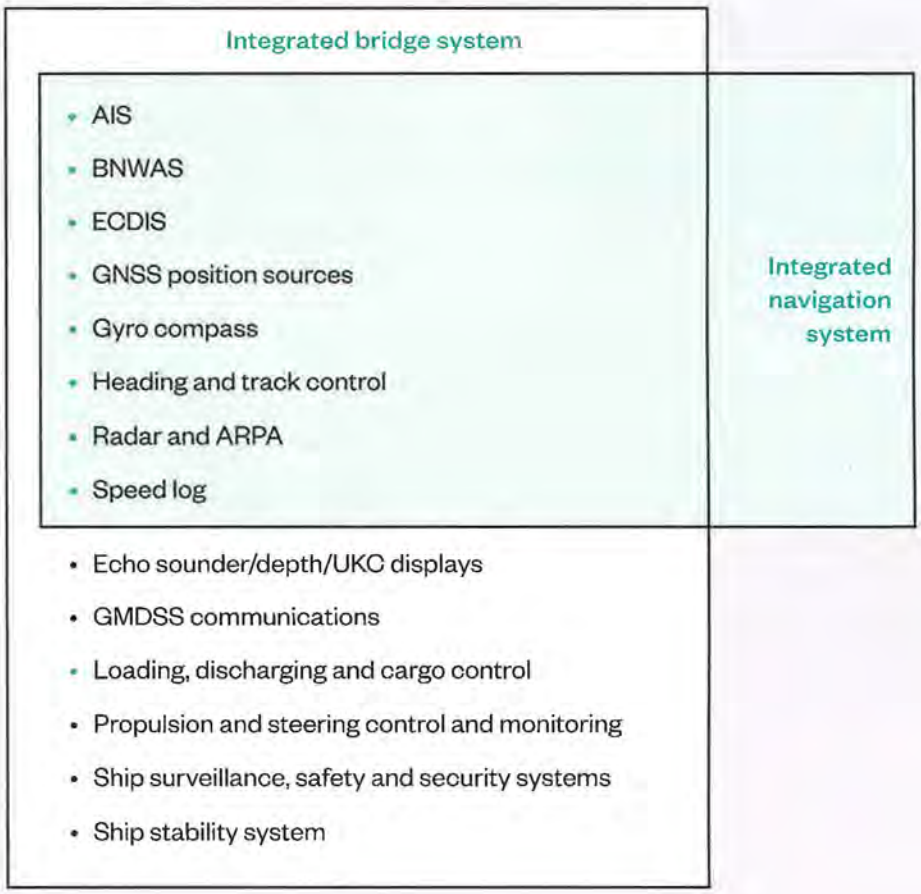


Figure 5.9: Systems integrated into an IBS and INS

IBS and INS should be robust enough for the failure of any one part of the system not to result in the failure of the whole system. Several factors should be considered in deciding how far bridge functions can be automated on account of the IBS and INS design, e.g. the design of the bridge, the type and compatibility of equipment fitted and the layout of displays and user interfaces.

5.15 GMDSS communications

Ships equipped with GMDSS should be able to:

- Transmit ship-to-shore distress alerts by two independent means; and
- Receive shore-to-ship alerts (usually relayed by an RCC).

Ships with GMDSS should also be able to transmit and receive:

- Ship-to-ship alerts;
- SAR co-ordinating communications;
- On-scene communications;
- Locating signals;
- MSI;
- Routine or general communications to and from shore; and
- Bridge-to-bridge communications.

5.15.1 GMDSS equipment

Carriage requirements for GMDSS equipment by all ships, and ships operating in Sea Areas A1, A2, A3 and A4, are set out in SOLAS. All SOLAS ships should have at least the equipment shown in figure 5.10. Ships sailing beyond the range of a VHF DSC coast station (beyond Sea Area A1) should have an MF DSC transmitter and watch receiver. If sailing beyond MF DSC range (beyond Sea Area A2), a ship should have either an HF DSC or an SES.

DSC is used for calling and replying, and for transmitting, acknowledging and relaying distress alerts. It allows a specific station maritime mobile service identity (MMSI) to be contacted and informed that the calling station wishes to communicate with it, and to indicate how to reply or which station to listen to for subsequent distress traffic. Calls can also be addressed to ALL SHIPS or ALL STATIONS.

SOLAS ships should have at least the following equipment

VHF radio installation

For continuous watch and communications with DSC and VHF DSC Channel 70 and voice communications on VHF Channels 6, 13 and 16

NAVTEX receiver

For the reception of MSI

Two portable VHF radios

For use in survival craft

Search and rescue transponder (SART)

Either radar SART or AIS-SART

Emergency Position Indicating Radio Beacon – EPIRB (406 MHz)

For passenger ships only

Ability to communicate on Airband frequencies with commercial aircraft for SAR purposes

Ship earth station (SES) capable of receiving MSI (EGC receiver)

Unless the ship operates exclusively within range of NAVTEX broadcasts or operates exclusively outside GMDSS satellite provider coverage

Figure 5.10: Mandatory GMDSS equipment on SOLAS ships

Chapter 6
Pilotage

6 Pilotage

This chapter on pilotage should be read in conjunction with the guidance on effective bridge team organisation in chapter 2 and on passage planning in chapter 3 of this Guide.

6.1 Overview

Effective co-ordination between the Master, other members of the bridge team and the pilot is a prerequisite for safe pilotage.

Pilots possess specialist local knowledge and have ship handling and tug management skills to assist the bridge team during the most critical and potentially hazardous phases of a voyage.

Efficient pilotage allows the ship to navigate safely and is based on principles shown in figure 6.1 overleaf.

As appropriate, ship's personnel, shore-based ship management and pilots should be trained in, be familiar with and practise bridge resource management (BRM) (see section 2.2 of this Guide).

If a ship's officer holds a valid PEC issued by the responsible authority, it may not be necessary to engage a pilot when the ship is in pilotage waters. In certain circumstances, remote pilotage services may be provided by a shore-based pilot.

> The presence of a pilot does not relieve the Master or the bridge team from their duties and responsibilities for the safe conduct of the ship.

6.2 Preparation for pilotage

6.2.1 The passage plan

The passage plan contains information related to navigation in pilotage waters (see section 3.4.3).

The Master should be prepared to accept any necessary amendments to the passage plan when the pilot boards, after an appropriate discussion. Any agreed changes to the passage plan should also be communicated to the OOW.

The appraisal and planning process is not a substitute for a full Master/pilot information exchange (MPX) (see checklist C1.1) covering the most up-to-date information available when the pilot embarks.

Port authorities may require specific information in advance of arrival. The Master should be prepared to provide:

- Any of the ship particulars in checklists C1.1 and C1.2;
- Declarations about cargo, stores, crew, passengers and dangerous goods; and
- Arrival intentions, including arrangements for cargo discharge and bunkering.

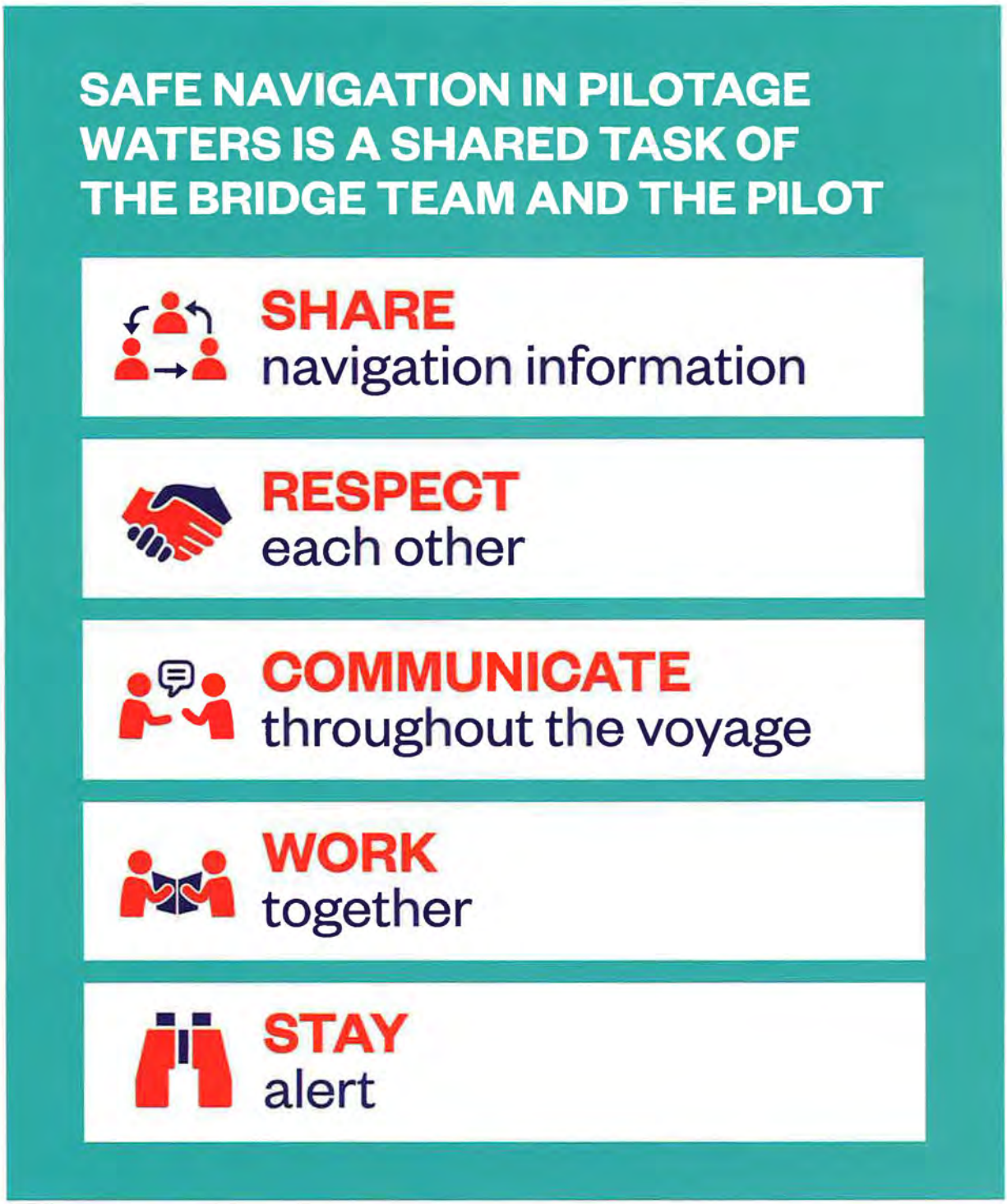


Figure 6.1: Safe navigation in pilotage waters is a shared task of the bridge team and the pilot. Based on the 'Commit to Safe Navigation' poster by the International Maritime Pilots' Association–Marine Accident Investigators' International Forum (IMPA–MAIIF). This figure is also available as a poster in Appendix D and can be downloaded for free from https://publications.ics-shipping.org

6.2.2 The ship and bridge team

As well as the full berth to berth passage plan (see section 3.4.3) the following preparations for pilotage should take place:

- The bridge team should be briefed on the pilotage and the duties of those involved;
- The pilot card (see checklist C1.2) should be completed; and
- Communications should be set up with the pilot, port VTS and port authorities as appropriate.

6.2.3 The pilot

The Master should expect the pilot(s) to be qualified, certified, experienced in the intended pilotage and adequately rested and alert. The Master has a right to request a replacement pilot if they consider it necessary.

Masters should be aware that a pilot may refuse to conduct a pilotage if they believe that the ship may be a danger to the safety of navigation or to the environment. If a pilotage is refused, the pilot may have to report the reason to the appropriate authority for further action.

The Master should also understand that the pilot should report, without delay, to the appropriate authority:

- Any circumstance that may affect the safety of navigation or compromise the prevention of pollution;
- Any accident or near miss that may have occurred during the pilotage; and
- Any irregularities with navigational lights, shapes and signals on board.

6.2.4 The pilot card

The pilot card should be updated to include all the details of the current ship condition and all the relevant information for the passage and port. It is important to record every defect that may affect the ship's manoeuvrability or pilotage and to provide the pilot with clear details about those defects.

The pilot card format should be based on the IMO standard format (see checklist C1.2).

6.3 Safe pilot boarding

6.3.1 Pilot boarding time

To allow enough time for a comprehensive MPX, the ship should be ready to embark the pilot at the agreed time. Any delays in embarkation may reduce the time needed for a detailed exchange of information and for making amendments to the passage plan, if necessary.

6.3.2 Embarking the pilot

The Master should make sure that a properly maintained means of pilot embarkation and disembarkation is ready and positioned, rigged, checked and manned in accordance with SOLAS regulation V/23 (see checklist C1.4) and, where applicable, local requirements. If the pilot is to embark by helicopter, the ICS *Guide to Helicopter/Ship Operations* should be consulted.

The pilot should:

- Use appropriate personal protective equipment; and
- Liaise with the Master so that the ship is positioned and manoeuvred to permit safe boarding. The pilot may be expected to check that boarding equipment appears properly rigged and manned.

6.4 Master/pilot information exchange (MPX)

The pilot and the Master should exchange information about the pilot's intentions, the ship's characteristics and operational factors as soon as possible after the pilot has boarded.

For an effective and clear exchange of information, the MPX checklist should be used (see checklist C1.1). It should cover:

- Presentation of a completed standard pilot card (see checklist C1.2);
- The passage plan and the circumstances when it may be necessary to deviate from the plan. Changes to the plan should be agreed and changes to individual bridge team responsibilities made before pilotage begins;
- Updates on local conditions such as weather, depth of water, tides and tidal streams;
- An update on traffic conditions;
- Ship's dimensions and manoeuvring information in the form of the wheelhouse poster (see checklist C1.3). A manoeuvring booklet containing more detailed information should also be available on the bridge;
- Any unusual ship handling characteristics and machinery, navigational equipment and crew limitations that could affect the safe conduct of pilotage and berthing;
- Information on berthing arrangements including the use, characteristics and number of tugs, mooring boats, mooring arrangements and other external facilities;
- Contingency plans identifying possible abort points if there should be a malfunction or a shipboard emergency; and
- Formal confirmation of the working language.

> All defects that might affect the manoeuvrability of the ship or the pilotage should be reported to the pilot.

In some circumstances, a debriefing with the pilot after pilotage may help to identify how the bridge team could improve the conduct of future pilotage operations.

6.4.1 Extra pilots

If more than one pilot is required or supernumerary pilots board:

- All pilots should be involved in the MPX; and
- Each pilot's role and responsibility, including duty periods, should be understood by the entire bridge team.

6.5 Duties and responsibilities

The Master has ultimate responsibility for the safety of the ship and prevention of pollution. The bridge team is not relieved of its responsibility for safe navigation following the embarkation of the pilot. Figure 6.2 illustrates how a bridge team and pilot can co-operate and work together.

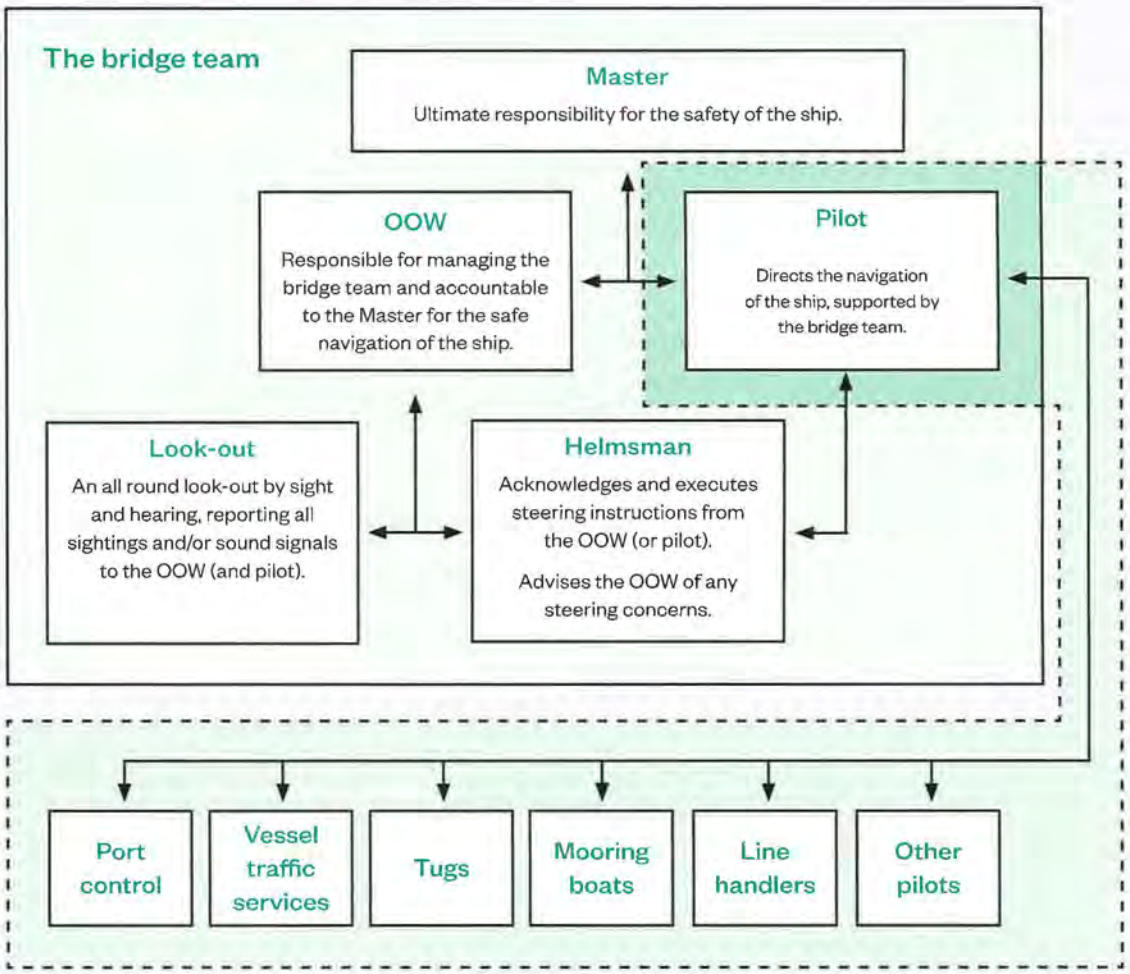


Figure 6.2: Example of bridge team/pilot co-operation

The pilot should communicate expert local knowledge, information and advice to the bridge team in English or another agreed working language. Pilots should in turn be supported by shipboard personnel in their execution of safe navigation.

The bridge team, including the pilot, should always clearly understand whether the Master, pilot or OOW has control of the steering and propulsion.

6.5.1 Bridge team responsibilities

The bridge team should consist of enough personnel to allow for the following:

- Operating navigation equipment and providing assistance and advice to the pilot;
- Monitoring the actions of the pilot and other members of the bridge team;
- Monitoring ship progress against the passage plan by track monitoring and regular fixing of the ship position, particularly after each course alteration;
- Monitoring UKC;
- Checking verbal orders from the pilot and confirming that they are carried out correctly;
- Monitoring the ROT, rudder angle and revolutions per minute (RPM) indicators when helm and engine orders are given;
- Identifying misunderstandings and seeking clarifications immediately if in any doubt; and
- Advising the Master if there is any doubt about the ship's safety.

6.5.2 Pilot's responsibilities

Throughout the pilotage and berthing the pilot should:

- Use the agreed working language and if necessary the IMO Standard Marine Communication Phrases (SMCP) when directing or communicating with the bridge team;
- Understand the roles and responsibilities of each bridge team member;
- Use the information given during the MPX about manoeuvring characteristics;
- Respond to information, advice and questions from the bridge team;
- Inform the bridge team of any failures or deficiencies, such as the unavailability of tugs, in good time;
- Inform the bridge team of pilotage progress and any anticipated need to deviate from the passage plan; and
- Inform the bridge team of any handover between pilots.

6.6 Manoeuvring

6.6.1 Mooring operations

The pilot and the Master should discuss and agree how and when the pilot may directly operate the controls for key equipment (e.g. the main engine, helm and thrusters). The pilot may not be familiar with the propulsion system on board or its characteristics and methods of operation, and if there is any doubt, the Master or OOW should control these systems.

During mooring operations, the pilot should co-ordinate the work of the bridge team, tugs, mooring boats and linesmen and explain their intentions and actions.

To support the pilot, the Master and bridge team should:

- Make sure that the pilot's directions are conveyed to the mooring stations and are correctly executed;
- Make sure that the mooring stations provide feedback; and
- Inform the pilot once directions have been carried out, or where an omission has occurred or if a potential problem exists.

6.6.2 Use of tugs and mooring boats

The number of tugs, how they will operate (on a line or alongside), their capabilities and their limitations should form part of the MPX and be understood by the bridge team. It is important that the size and power of tugs is appropriate for the size of the ship.

Communications between the pilot, tugs and mooring boats should be monitored and checked, and the pilot should keep the bridge team informed about the orders given to tugs and mooring boats, particularly if not in English or the working language of the ship. Any concerns should be reported to the Master and pilot.

Tugs and mooring boats should not be endangered by the actions of the ship, especially when making fast or letting go.

The bridge team should understand the effects of interaction between ships, tugs and/or mooring boats and fixed structures.

6.7 Preparing the outbound passage plan

After berthing, the outbound passage plan may be discussed with the pilot to support the appraisal and planning stages of the passage plan. A complete MPX should still take place before departure.

6.8 Pilotage exemption certificates (PECs)

Where pilotage is compulsory, a ship should engage a pilot unless an officer on board holds a PEC issued by the pilotage authority for the specific port or pilotage area.

A PEC holder should act as the pilot and take on the duties and responsibilities of a pilot while providing local information and advice to the Master and other members of the bridge team.

The presence of a PEC holder on board does not prevent the Master from requesting a pilot if necessary.

6.9 Deep sea pilots

Deep sea pilotage is a service provided for navigation in confined and busy waters. In certain areas, IMO Resolutions strongly advise using deep sea pilots, and companies and Masters should give due consideration to these recommendations. They should have a rationale and justification for not embarking deep sea pilots in areas where they are recommended.

Appendices

Appendix A
Dynamic positioning (DP)

A1 General

The guidance in this Appendix focuses on the interface between dynamic positioning (DP) systems and bridge procedures. It should be considered as a supplement to detailed DP procedure manuals, checklists and training requirements for personnel operating DP vessels.

A2 Operational planning on DP ships

In addition to their conventional berth to berth passage, many vessels operate and sail in areas where different forms of hazard exist, for example in offshore oil fields and wind farms. The berth to berth plan should reflect the guidance in chapters 3 and 6 and address operational planning in a worksite environment.

A detailed operational plan covering the approach and other phases of the intended operation should be available before the ship arrives at the operational area or worksite and before entering the 500m zone. If the ship is using DP mode, allowance should be made in the operational plan for the capabilities and limitations of the DP system and its peripheral equipment.

When developing the operational plan, Activity Specific Operating Guidelines (ASOG) and Thrusters and Generators Operating Strategy (TAGOS) should be consulted, and the following factors should be considered:

- Guidance from the ship's operational procedures manuals on, for example, the capability plots, failure mode effect analysis (FMEA) and instructions or guidance from the ship's owners or managers, or from the agency responsible for operations on the worksite area;
- Manufacturers' guidelines and procedures;
- Any conditions that may require changes to the operational planning;
- Location of hazards in the worksite area, and depth of water on and around the worksite;
- Whether ship manoeuvrability is impaired by any aspect of the operation;
- Expected weather, visibility, sea state and currents;
- Availability of ship power, including after worst case failure;
- Level of ship redundancy and the redundancy requirements of the operation;
- Availability of position reference, including contingency and back-up references;
- Any restrictions that might be imposed by the field operator on the placing or manoeuvring of underwater hardware;
- Proximity of other vessels at any stage of the operation that could have an impact on the manoeuvrability of own ship or the integrity of its position references; and
- Ability of own ship to react to changes in weather, power or operational status.

All of the above form part of a formal risk assessment that will cover all aspects of the operation.

Contingency planning is an essential part of any DP operation as these are often conducted close to other vessels or fixed structures. Anchored installations pose unique problems because of the subsurface anchor lines.

Contingency plans must cover:

- Safe escape routes and actions to be taken in unforeseen circumstances;
- Worst case failure;
- Catastrophic DP system failure; or
- Any significant degradation of any ship's systems.

A3 Navigation in DP mode

During DP operations, the DP operator (DPO) should be aware of nearby vessels or fixed structures that might present a collision hazard. This is especially important as vessels engaged in DP operations are often constrained in their ability to manoeuvre. The appropriate lights and other signals required by the COLREGS should be displayed.

The DPO is responsible for the continuous monitoring of the ship's position and of the status of the various position reference systems (PRS) that provide positional data. If data from more than one PRS is being automatically pooled or combined, the DPO should know the relative weightings applied to individual PRS.

Operations with DP capable vessels often involve positioning relative to a moving target, for example when a shuttle tanker conducts tandem loading operations from a floating production, storage and offloading (FPSO) vessel. In these cases, the DPO should be aware of the target's motion characteristics. Appropriate position references should be available, including both absolute references, e.g. Differential Global Navigation Satellite System (DGNSS) and relative references with position data referenced to the moving target.

In other operations involving DP capable vessels, divers, remotely operated vehicles (ROVs), pipelines, cables and other underwater equipment should be deployed individually or as part of a combined operation. The DPO should know the limitations imposed on manoeuvring and the hazards presented by equipment or operations of this type.

A4 Controlling speed and direction in DP mode

The DPO is responsible for monitoring all equipment that controls the position and heading of the ship in DP mode. DP relies on a complex computer-controlled system that integrates functions relating to the power plant, propulsion systems, motion and environmental sensors, and position and heading references.

DP systems employ complex mathematical modelling techniques to provide adaptive positioning control and this modelling process takes time to set up in the system. Before starting operations where the precise positioning of the ship is a critical factor, the DPO should make sure that enough time has been allowed for the model to become established. 30 minutes is the usual standard for 'settling or model building' time.

Effective control of a ship in DP mode depends on the efficient operation of propulsion units, propellers and thrusters. The DPO should continually check that propulsion commands are matched by feedback values from all thrust units.

The DPO should also remain constantly aware of the demands on the power plant and make sure that enough power is available for the effective control of the ship, with an appropriate power reserve. Similarly, individual propulsion units (propellers and thrusters) should be monitored continuously. DP Class 2 vessels are required to have a power management system for monitoring and performing actions such as power limiting, load sharing and breaker control.

If environmental conditions deteriorate, the DPO should continue to monitor how precisely the ship position and heading are maintained. If position and/or heading excursions are outside acceptable limits, the DPO should consider stopping operations until conditions become more favourable.

Attention must also be given to the various systems and sub-systems that allow the DP control system to operate, e.g. the fuel system, air compressors, fresh and seawater cooling systems, etc. The DPO should know the details of all single point failures.

A5 Operation and maintenance of DP systems

As DP is a vessel function rather than a specific piece of equipment, it can be described as an integration of various components such as PRS, gyro compasses, motion and environmental sensors, computers, propulsion systems and the ship power plant. DP systems are controlled by an operator station, usually located on the bridge, while the controlling computer may be in another compartment on the ship.

Before starting DP operations, or transferring to DP control from conventional navigation, all systems should be carefully checked and tested. A pre-DP checklist is normally provided for this purpose. This checklist should be modified as and when needed and should reflect the principles of the DP system as described in the failure mode effects analysis (FMEA).

When transferring from conventional navigational control to DP control, the DPO should check that control of all propulsion units and thrusters is effective, i.e. that all units are being correctly commanded by the DP system. This is normally done in a 'manual' DP mode, with position and heading of the ship controlled by a joystick on the DP panel.

In automatic DP mode, the DPO should set warning and alarm limits to appropriate values, to give indications of heading or position excursions. Many DP vessels have a full system redundancy. Multiple gyro compasses, wind sensors, PRS and computers contribute to the level of redundancy.

The DPO should monitor and compare input data from duplicated sensors, and the system should give warnings and alarms against data discrepancies. If the system features triple modular redundancy with triplicated sensors, a 'voting' capability will allow automatic detection of an errant sensor and automatic rejection of an incorrect sensor and its data.

All PRSs have inherent limits to their levels of reliability and accuracy and it is essential to deploy more than one PRS with data pooling to provide a 'best fit' position using at least two different principles of operation. Deploying at least three PRS is recommended, based on different principles of operation, when possible. This will allow the computer to 'vote out' an unstable position reference system.

The DPO should avoid common mode failure scenarios resulting from the deployment of PRS of the same type. Typical position reference systems include:

- DGNSS;
- Microwave range/bearing systems;
- Hydro-acoustic systems;
- Taut wire systems; and
- Laser-based systems.

Appendix B
ECDIS carriage requirements

The table below is designed to help companies, Masters and watchkeeping officers to decide how the SOLAS chart carriage requirement could be applied on board.

Electronic chart and equipment status				
Are official ENCs available for the area of operation?	YES	NO	YES	NO
What digital charts are being used in the Electronic Chart Display and Information System (ECDIS) by the mariner?	ENC (Coverage to an appropriate scale for navigation)	RNC (Coverage to an appropriate scale for navigation)	RNC (Coverage to an appropriate scale for navigation)	Unofficial/ private charts[6]
How is the ECDIS operating?	As ECDIS	As ECDIS in RCDS mode	As ECDIS in RCDS mode	As ECS
What back-up system is required?	Independent ECDIS or other back-up solution required[7]	Independent ECDIS or other back-up solution required[7]	Not required[3]	Not required[3]
What are the requirements for the carriage of official paper charts?	Not required[1] (Except if back-up is a folio of official paper charts[7])	An 'appropriate' folio of up-to-date paper charts to be used with the ECDIS in RCDS mode[2]	Up-to-date official paper charts required for safe navigation areas where ENCs are not available	All up-to-date official paper charts required for safe navigation for the intended voyage
Does ECDIS fulfil chart carriage requirements?	YES[1]	YES[1]	NO[4]	NO[5]

OR

Notes:

1. Some flag States may require specific documentation to allow this.
2. Flag State defines the meaning of 'appropriate'.
3. Back-up system is only required if ECDIS is intended to meet chart carriage requirements.
4. For ECDIS to fulfil carriage requirements vessels should use ENCs where these are available. 'Availability' refers to the absolute availability of charts from hydrographic offices and not just those available on board the ship.
5. Paper charts (not ECDIS) should remain the primary means of navigation.
6. If private charts are used in an ECDIS, the system is regarded as operating as an electronic chart system (ECS). An ECS does not meet IMO chart carriage requirements.
7. Flag State specific requirements should be complied with. Commonly used back-up methods are:
   a. A second ECDIS, connected to an independent power supply and a separate Global Navigation Satellite System (GNSS) position input;
   b. Up-to-date paper nautical charts suitable for the intended voyage; and/or
   c. A type-approved chart-radar.

Appendix C Checklists

C1 Pilotage

The checklists in section C1 provide a guide to creating appropriate company and/or on board checklists that suit the particular needs of the ship.

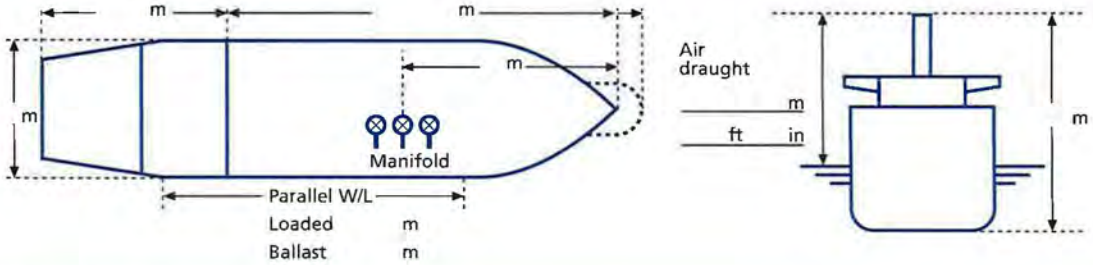
C1.1 Master/pilot information exchange (MPX)

SHIP IDENTITY		
Name:	Call sign:	Flag:
Agent:	Year built:	IMO number:
Cargo:	Ship type:	Last port:
ADDITIONAL SHIP'S CONTACT INFORMATION		
Telephone:	Email:	Other:
PILOT BOARDING INSTRUCTIONS		
ETA at pilot station:	Pilot ETA at boarding station:	Approach course and speed:
Embarkation side:	Requested boarding arrangements:	
SHIP PARTICULARS		
Refer to the ship particulars in the pilot card (checklist C2)		
ANCHORS (length of cable available)		
Refer to the ship particulars in the pilot card (checklist C2)		
MANOEUVRING DETAILS AT CURRENT CONDITION		
Refer to the steering information in the pilot card (checklist C2)		
MAIN ENGINE DETAILS		
Refer to the main engine information in the pilot card (checklist C2)		

BERTH AND TUG DETAILS		
Intended berth and berthing plan:		
Side alongside:	Estimated transit time to berth:	Tug rendezvous position:
Number of tugs:	Tug arrangements:	Total bollard pull:
WEATHER AND SEA CONDITIONS (at boarding station and at berth)		
Tidal information (heights and times):		
Expected currents:		
Weather forecast:		
PASSAGE PLAN		
REGULATIONS (VTS reporting, anchor/look-out attendance, maximum allowable draught)		
OTHER IMPORTANT DETAILS (including navigation hazards, ship movements, berthing restrictions, manoeuvring peculiarities)		

C1.2 Pilot card

SHIP PARTICULARS		
Name:		Call sign:
Displacement:	DWT:	Year built:
Length:	Beam:	Bulbous bow:
Draught fwd:	Draught aft:	Draught amidships:
Air draught:	Port anchor: shackles	Stbd anchor: shackles
		1 shackle = 27.4m/15 fathoms



MAIN ENGINE			
Type:	Max power: kW		Max power: HP
	RPM/pitch	Loaded speed (kts)	Ballast speed (kts)
Full ahead:			
Half ahead:			
Slow ahead:			
Dead slow ahead:			
Dead slow astern:			
Slow astern:			
Half astern:			
Full astern:		% Full ahead power	

Engine critical RPM:	Maximum number of consecutive engine starts:	Time from full ahead to full astern:
Time limit astern:	Minimum steering speed:	
STEERING		
Number of propellers:	Direction of turn:	Propeller arrangement:
Time from hard-over to hard-over:	Rudder angle for neutral effects:	
Thrusters (positions and power):	Steering characteristics/rudder type:	
EQUIPMENT CHECKED AND READY FOR USE		
Anchors:		Cleared away: YES/NO
Compasses:		
Compass error:		
Speed log:		Doppler: YES/NO Speed: Water/Ground Axis: Single/Dual
Echo sounder:		
GNSS:		Type:
ECDIS:		
X-Band radar:		ARPA: YES/NO
S-Band radar:		ARPA: YES/NO
VHF (including handheld):		
Steering gear:		Number of power units in use:
Engine telegraphs:		
Rudder/rpm/rot indicators:		
Mooring winches and lines:		
Navigation lights:		
Whistles:		
EQUIPMENT OPERATIONAL DEFECTS		
OTHER IMPORTANT DETAILS (e.g. ship windage area, position of the Automatic Identification System (AIS) antenna, safe working load (SWL) of bollards)		

Reference: IMO Resolution A.601(15) Provision and Display of Manoeuvring Information On Board Ships

Master's signature: ..... Date: .....

C1.3 Wheelhouse poster

Ship's name..... Call sign.....Gross tonnage.....Net tonnage.....

Max. displacement.....tonnes, and Deadweight.....tonnes, and Block coefficient.....at summer full load draught

Draught at which the manoeuvring data were obtained

Loaded	Ballast
Trial/Estimated	Trial/Estimated
___m forward	___m forward
___m aft	___m aft

STEERING PARTICULARS

Type of rudder(s) _____
Maximum rudder angle _____°
Time hard-over to hard-over
with one power unit _____s
with two power units _____s
Minimum speed to maintain
course propeller stopped _____knots
Rudder angle for neutral effect _____°

ANCHOR CHAIN

	No. of shackles	Max. rate of heaving (min/shackle)
Port		
Starboard		
Stern		

(1 shackle = _____m/_____fathoms)

PROPULSION PARTICULARS

Type of engine _____ ___kW (___HP) Type of propeller _____

Engine order	Rpm/pitch setting	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed			
Full ahead			
Half ahead			
Slow ahead			
Dead slow ahead			
Dead slow astern		Critical revolutions ___rpm Minimum rpm ___ ___knots	
Slow astern		Time limit astern ___rpm Time limit at min. rev ___rpm	
Half astern		Emergency full ahead to full astern ___s Stop to full astern ___s	
Full astern		Astern power ___% ahead Max. no. of consecutive starts ___	

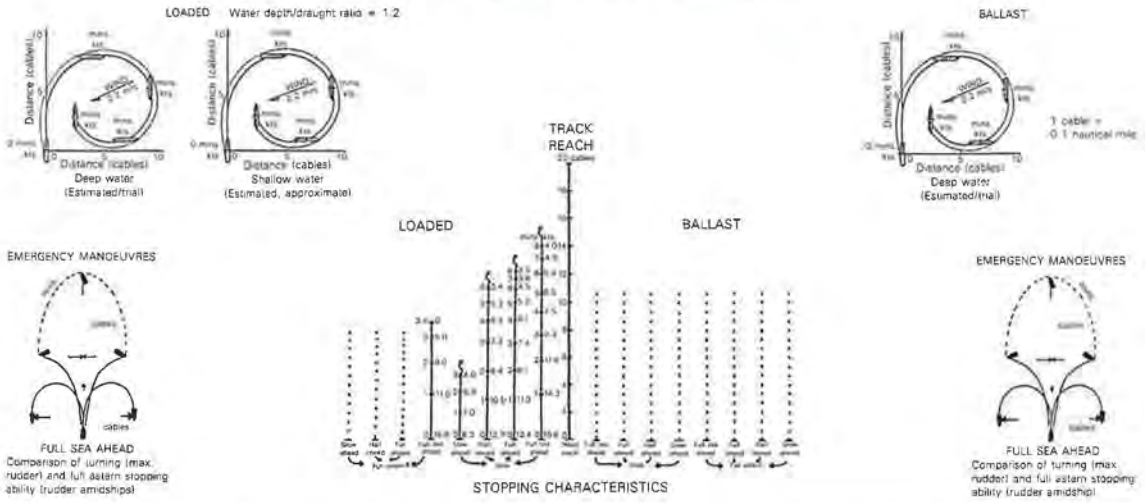
THRUSTER EFFECT at trial conditions

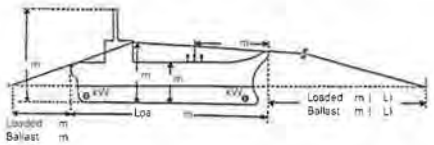
Thruster	kW (HP)	Time delay for full thrust	Turning rate at zero speed	Time delay to reverse full thrust	Not effective above speed
Bow		s	°/min	min s	knots
Stern		s	°/min	min s	knots
Combined		s	°/min	min s	knots

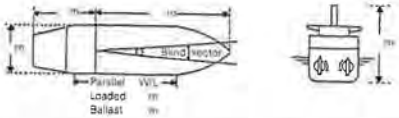
DRAUGHT INCREASE (LOADED)

Estimated Squat Effect: Under keel clearance	Ship's speed (knots)	Max. bow squat estimated (m)	Heel Effect: Heel angle (degree)	Draught increase (m)
			2	
m			4	
			8	
			12	
m			16	

TURNING CIRCLES AT MAX. RUDDER ANGLE







MAN OVERBOARD RESCUE MANOEUVRE

SEQUENCE OF ACTIONS TO BE TAKEN
- TO CAST A LIFEBUOY
- TO GIVE THE HELM ORDER
- TO SOUND THE ALARM
- TO KEEP THE LOOK-OUT

Insert a recommended turn

PERFORMANCE MAY DIFFER FROM THIS RECORD DUE TO ENVIRONMENTAL, HULL AND LOADING CONDITIONS

Reference: IMO Resolution A.601(15) Provision and Display of Manoeuvring Information On Board Ships

REQUIRED BOARDING ARRANGEMENTS FOR PILOT

IMO INTERNATIONAL MARITIME ORGANIZATION

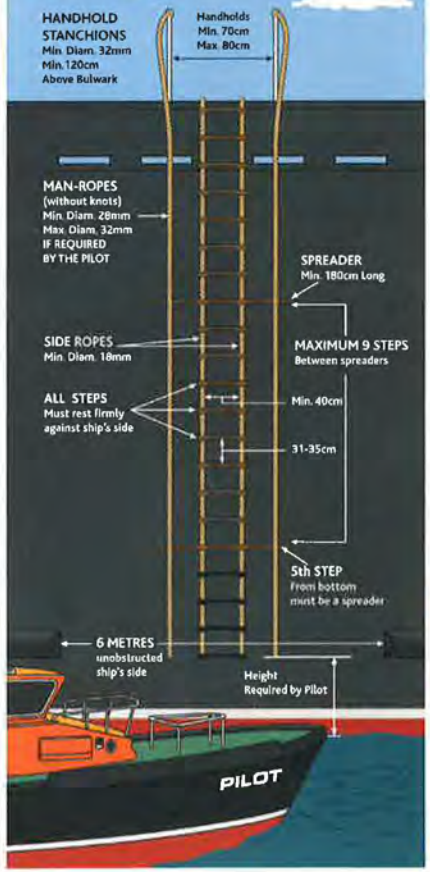
In accordance with SOLAS Regulation V/23 & IMO Resolution A.1045(27)

INTERNATIONAL MARITIME PILOTS' ASSOCIATION

H.Q.S. "Wellington" Temple Stairs, Victoria Embankment, London WC2R 2PN Tel: +44 (0)20 7240 3973 Fax: +44 (0)20 7210 3518 Email: office@impahq.org

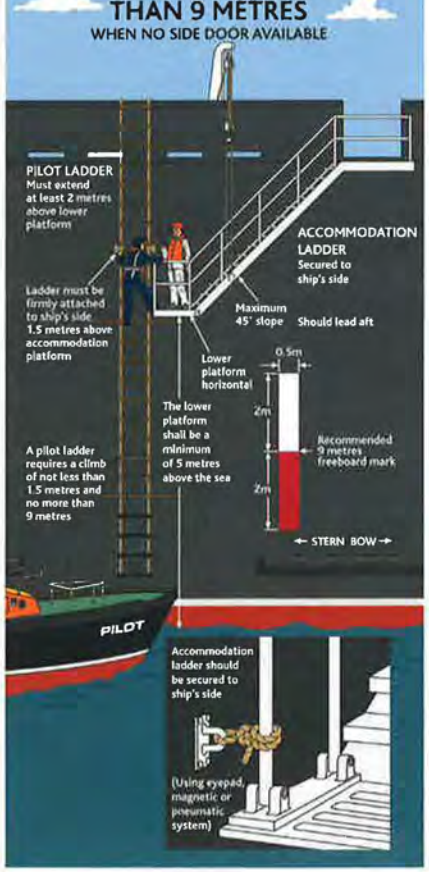
This document and all IMO Pilot-related documents are available for download at: http://www.impahq.org

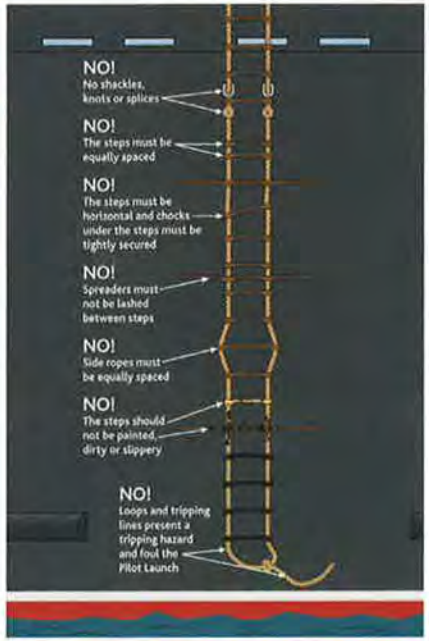
RIGGING FOR FREEBOARDS OF 9 METRES OR LESS

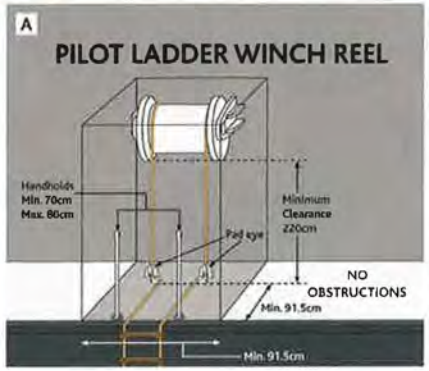


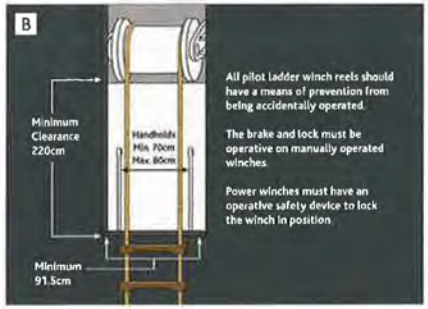
COMBINATION ARRANGEMENT FOR SHIPS WITH A FREEBOARD OF MORE THAN 9 METRES

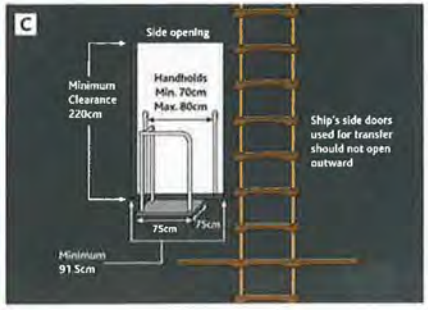
WHEN NO SIDE DOOR AVAILABLE











C2 Bridge

The checklists in section C2 provide a guide to creating appropriate company and/or on board checklists that suit the particular needs of the ship.

Signature blocks are included on some checklists where it is considered appropriate to confirm that the actions have been completed.

C2.1 Steering gear test routines

These routines should be carried out at any time, as required, and if there is doubt as to the performance of the steering gear. Checks of steering equipment may also be required by coastal States prior to entry into their waters.

	Status	Date last checked	Checked by	Remarks
Every watch/after prolonged use of autopilot				
Rudder response to manual steering checked and confirmed from all bridge positions using each steering gear power unit singly and together	☐ Yes			
Before entering coastal or congested waters				
Communications between bridge and steering gear compartment checked	☐ Yes			
Rudder response to manual steering checked and confirmed from all bridge positions using each steering gear power unit singly and together	☐ Yes			
Before departure (no more than 12 hours before departure)				
Communications between bridge and steering gear compartment checked	☐ Yes			
Correct operation of the following tested and confirmed:				
• Main steering gear*	☐ Yes			
• Auxiliary steering gear	☐ Yes			
• Remote steering gear control systems	☐ Yes			
• Steering positions on the bridge	☐ Yes			
• Emergency power supply	☐ Yes			
• All rudder angle indicator repeaters show the correct rudder position	☐ Yes			
• Remote steering gear control system power failure alarms	☐ Yes			

• Steering gear power unit failure alarms	☐ Yes			
• Automatic isolating arrangements and other automatic equipment	☐ Yes			
Emergency steering drills				
Emergency steering drills should take place at least every three months and should include direct control from within the steering gear compartment, the communications procedure with the bridge and, where applicable, the operation of alternative power supplies				

* Checks and tests

- Confirm that the full rudder movement matches the required capabilities of the steering gear;
- Check the timing of rudder movement from hard-over to hard-over, using each steering gear power unit singly and together, to make sure it is consistent with previous tests; and
- Visually inspect the steering gear and linkages for leaks or damage.

Changeover procedures

The regular testing of manual steering should be an opportunity for all bridge team members to practise procedures for changing over between different steering modes, as appropriate. Typically, these will include:

- Automatic track-keeping to automatic heading control;
- Automatic heading control to hand steering;
- Hand steering to non-follow-up; and
- Hand steering to emergency steering.

C2.2 Example of a bridge manning matrix

This example of a bridge manning matrix planning tool was developed for a specific ship. It is therefore not suitable for manning levels on all ships and should be adapted.

	Conditions		Master	OOW	Look-out	Helmsman	Pilot	Engine	Helm
Entering and leaving port	All	All	👤	👤	👤	👤	👤	M	H
Restricted waters	All	Clear weather		👤	👤	Option		U	Option
		Restricted visibility	👤	👤	👤	👤		M	H
Coastal waters	All	Clear weather		👤	👤			U	A
		Restricted visibility	Option	👤	👤	👤		Option	H
Ocean waters	Daylight	Clear weather		👤	Option			U	A
		Restricted visibility		👤	👤	Option		U	Option
	Darkness	Clear weather		👤	👤			U	A
		Restricted visibility		👤	👤	Option		U	Option
At anchor	Day	All		👤	Option			U	
	Night	All		👤	👤			U	

Key:	Engine	Helm
Manned	M	
Unmanned	U	
Hand steering		H
Auto		A

C2.3 Familiarisation with bridge equipment

Compass and heading devices	Tick
Location and operation of the standard magnetic compass and azimuth mirror	
Date of last compass swing	
Location of deviation card and compass error log	
Location and operation of magnetic off-course alarm	
Location and operation of the TMC control unit	
Location and operation of gyro compass, repeaters and azimuth mirrors	
Gyro compass error	
Location and operation of off-course alarm	
Radar and radar plotting aids	**Tick**
Location and operation of radar(s) including operation performance monitors	
Operation of ARPA (or other plotting aids)	
Echo sounder	**Tick**
Location and operation of echo sounding devices	
Location of echo sounder repeaters	
Location of echo sounder spares and spare recording paper (if not digital unit)	
Speed and distance logs	**Tick**
Location and operation of speed logs	
Location and operation of speed log repeaters	
Global Maritime Distress and Safety System (GMDSS) including maritime safety information (MSI)	**Tick**
Location and operation of GMDSS station, isolation of aerials, location of batteries/back-up power	
Location and operation of VHF/MF/HF equipment including digital selective calling (DSC)	
Location and operation of ship earth station (SES)	
Location and operation of NAVTEX receiver	
Location and operation of weather fax receiver and any weather routeing program	
Location of spare paper for weather fax receiver	

Location of the GMDSS log	
Location and operation of Emergency Position Indicating Radio Beacon (EPIRB)	
Position fixing systems	**Tick**
Location and operation of GNSS	
Location and operation of terrestrial radio-navigation systems	
Location of antenna(s)	
General bridge equipment	**Tick**
Location and operation of the chronometer, master clocks system and stopwatch	
Location of compass error log	
Location of binoculars	
Location of sextant(s)	
Location of log books	
Location and operation of bridge windscreen wipers and clear view screens including water wash	
Internal communications	**Tick**
Location and operation of internal communications	
Location and operation of emergency internal communications	
Propulsion and steering	**Tick**
Location of manoeuvring characteristics information and data	
Location and operation of engine telegraph	
Location and use of engine movement recorder	
Location and operation of thruster controls	
Operation of steering, steering changeover and emergency steering systems	
Location and use of rate of turn (ROT) indicator	
Orders and logs	**Tick**
Location and content of the SMS and Master's standing orders	
Location of Master's daily/night orders	
Location and content of instructions for unmanned spaces	

Passage planning and monitoring	Tick
Location of passage plan for proposed/current passage	
Location of charts for proposed/current passage	
Completion of ECDIS familiarisation (see checklist C2.4)	
Location of navigational publications, light lists, radio signals, digital and/or hard copies	
Location and operation of chart management system	
Location of navigation warnings and weather information	
Location of Notices to Mariners (NMs), digital and/or hard copies	
Automatic Identification System (AIS)	**Tick**
Location and operation of AIS	
Alarm systems	**Tick**
Location and operation of BNWAS	
Voyage recording	**Tick**
Location and operation of VDR or S-VDR	
Recovery/saving data procedure from VDR or S-VDR	
Location and operation of bridge audio recording system	
Location and operation of the course recorder	
Location of spare recording paper for course recorder, and other spares (if electro mechanical)	
Location of LRIT equipment	
Location of bridge procedures manual, SMS and ship specific procedures	
Navigation lights, shapes and signalling equipment	**Tick**
Location and operation of navigation and signal light controls and alarm panel	
Location of bridge operated deck lighting	
Location of spare bulbs for navigation lights and equipment	
Location and operation of daylight signalling lamp	
Location of mains sockets and batteries	
Understand the recharging procedure for back-up battery supplies	

Location of flags, shapes and manual sound signalling apparatus	
Location and operation of sound signalling panel	
Emergency equipment and security	**Tick**
Location of muster point information	
Location of spare lifejackets	
Location of man overboard lifebuoys and methods of release	
Location and operation of fire detection and alarm panel	
Location of fire and general alarm activation points	
Location of emergency fan stop	
Location of watertight door remote controls	
Location of emergency fire pump(s) stop/start	
Location of counter-piracy equipment	
Other	**Tick**

Bridge team member: ..... Date: .....

Master's signature: ..... Date: .....

The above points are recommendations only. It is essential that the checklist is amended to reflect the bridge equipment installed on board.

C2.4 ECDIS familiarisation

Initial preparation	Tick
Identify whether the vessel is approved to use ECDIS for navigation	
Identify whether there are company procedures for the use of ECDIS and ensure that these are followed	
Identify whether any passwords are needed for the management of the system and, if so, get the details	
Identify how one to one familiarisation is supported, e.g. by a CBT package and/or a built-in mode	
Identify the primary ECDIS equipment and the facilities for back-up (if the back-up is a second ECDIS of a different type to the primary installation, this familiarisation checklist should be completed for both systems)	
Understand the procedures in event of ECDIS failure	
Identify the location of user manuals for ECDIS and its back-up	
Identify the location of base and update media	
Understand the procedures for getting additional chart permits	
Understand the position fixing systems that feed the ECDIS. Decide on the method of switching between sources, e.g. primary and secondary position fixing systems	
Identify what other systems supply ECDIS, such as speed logs, GNSS, gyro compass, radar/ARPA (acquired targets, radar picture overlay), AIS and echo sounder. For each one, identify the reference framework, e.g. ground, water or ship stabilised	
Identify where to find maintenance records related to the ECDIS and service reports, non-conformity reports and inspection, validation reports	
Identify the power supply modes and their specifications such as uninterruptible power supply (UPS) duration	
Basic operation	**Tick**
Identify how to switch the ECDIS on and off	
Identify the function(s), position and general operation of the physical controls and switches, including cursor control, and the access and selection of menu items	
Understand how to access the main menu and select menu options	
Identify the methods for setting day/night viewing modes, brightness, contrast and colour correction	
Identify how to switch between traditional and simplified symbols	

Identify how to put equipment in route monitoring mode and route planning mode	
Identify the methods for scrolling and zooming charts, including the current scale of displayed charts and setting the display to a particular scale	
Identify how to select the display base and standard display	
Identify how to display other information from ENCs, including the display of All Other Information	
Identify how to check that information concerning own ship, e.g. dimensions, is correct	
Identify how to select the safety contour and safety depth	
Identify how to select two or four colour contour mode	
Identify how to select deep and shallow area display options	
Identify how to set all other safety parameters	
Identify how alarms and other alerts are given by the ECDIS and understand the procedure needed to acknowledge them	
Electronic charts	**Tick**
Identify how to access the chart directory and to identify whether charts are ENCs, RNCs or unofficial (private)	
Identify how to select a chart for display on the screen	
Identify how to load new chart licence keys	
Identify how to load base data	
Identify how to check the update status of loaded charts	
Identify how to update charts using the normal cumulative update procedures	
Identify how to apply non-cumulative or electronically transmitted updates	
Find out how to apply manual updates	
Navigation tools and functions	**Tick**
Identify how to display the legend of general information	
Identify how to select information about an object using a pick report/chart query	
Identify how category zone of confidence (CATZOC) information can be displayed	
Identify how to access the presentation library	
Identify what marine information overlays (MIOs) are available and how to access them	

Identify the single operator action needed to remove MIOs from the display	
Identify the single operator action needed to set the standard display setting	
Identify how to view, add, edit and delete NMs	
Identify how to access all navigational elements and parameters, such as past track, vectors, position lines (LOP) and anti-grounding cone (AGC)	
Identify the facilities provided for the measurement of range and bearing (e.g. EBLs and VRMs) and how they are to be used	
Identify the method(s) used for inserting parallel index lines	
Identify what other navigational tools are available and how to access them	
Identify how to change to using the ECDIS back-up system	
Identify the procedure for identifying and reacting to sensor/GNSS failure	
Identify how to switch chart text (text for charted objects) on and off	
Route planning	**Tick**
Identify how to load existing routes and enable for editing	
Identify how to initiate a new route plan	
Identify how to initiate and plan alternate routes	
Identify how to save route plan	
Identify how to add, delete and graphically adjust the position of waypoints	
Identify how to add, edit and delete critical points	
Identify how to display time varying objects relevant for the timing of the planned voyage	
Identify all the features available for planning routes, such as use of straight and curved segments, wheel over positions, turn radius, and inserting pilotage aids	
Identify the ship's procedures for displaying MSI, Temporary and Preliminary (T&P) notices and other relevant notes into the passage plan	
Identify how to use the facilities for checking the planned route	
Identify how to load the planned route and alternatives into the back-up system	
If RCDS mode is available, identify how to use it where ENCs are not available and as appropriate	

Route monitoring	Tick
Identify how to load a pre-planned route	
Identify how to select the primary or an alternative route, and how to distinguish between them on the display	
Identify the single operator action that selects the charted display of own ship's position	
Identify the available display orientation modes, and how to switch between them (e.g. north up, head up or course up)	
Identify the available display motion modes and how to select them and change the parameters, such as the position of own ship on the display when relative motion is selected	
If radar or AIS targets can be displayed on the ECDIS, identify what target vector modes are available and how to switch between and differentiate them	
Identify how to create time labels along the ship's track	
Become familiar with the route monitoring display, including the display of position, heading, course, speed and time	
Identify how to set the length of own ship's vector and intermediate time marks	
Identify how to display radar and AIS MIOs, if available	
Identify how to use the ECDIS as the input to a track-keeping autopilot. (This will require reference to the autopilot handbook)	
Identify how to input lines of position (LOP) to form the reference for an estimated position (EP)	
Identify how to configure the ECDIS to use the above reference for subsequent EP	
Identify how to switch to dead reckoning (DR) mode and to identify when the ECDIS is in DR mode	
Identify how to use the review facilities of the voyage recorder (if appropriate and not essential knowledge before sailing)	

Bridge team member: ..... Date: .....

Master's signature: ..... Date: .....

C2.5 ECDIS setup

Action	Status	Remarks
Primary position fixing system set up correctly. Prove the ECDIS is correct by entering a manual fix into the system	☐ Yes	
System time configured correctly	☐ Yes	
ECDIS setup is replicated on all ECDIS units	☐ Yes	
Navigation tools configured correctly	☐ Yes	
Safety depth and safety contour settings configured correctly	☐ Yes	
System units configured correctly	☐ Yes	
All relevant overlays loaded	☐ Yes	
Area alerts configured correctly (if system in use allows alarm configuration)	☐ Yes	
Docking mode configured correctly	☐ Yes	
Navigation alarms configured correctly, including safety frame/anti-grounding cone	☐ Yes	
Route alarms configured correctly	☐ Yes	
Targets configured correctly	☐ Yes	
Preferred radar selected	☐ Yes	
Ship data set up correctly	☐ Yes	
Audible alarm working correctly	☐ Yes	
Chart motion, chart orientation, screen layout, colour palette and additional ENC settings configured correctly	☐ Yes	
Correct display setting available for execution of navigation in line with ECDIS check off cards for pilotage and confined waters, and coastal navigation and open ocean	☐ Yes	
Correct route loaded for route monitoring	☐ Yes	
Correct waypoint and route monitoring information displayed	☐ Yes	

Time and date: .....

OOW signature: .....

The above points are recommendations only. It is essential that the checklist is amended to reflect the appropriate manufacturer's operating manuals and company procedures.

C2.6 Preparations for departure

Passage plan	Status	Remarks
Berth to berth passage plan for the intended passage prepared and available on the bridge with the route plotted on up-to-date and appropriate scale charts (official paper or electronic)	☐ Yes	
Passage plan checked and approved by the Master	☐ Yes	
Passage plan briefed to the bridge team	☐ Yes	
Route displayed on ECDIS and/or other electronic navigation aids, as appropriate	☐ Yes	
Up-to-date charts and nautical publications available	☐ Yes	
Latest NMs (week number)	☐ Yes	
Equipment checks (tested and ready for use)	**Status**	**Remarks**
AIS (voyage data updated and correct)	☐ Yes	
Anchors, cables and winches	☐ Yes	
Ancillary bridge equipment (e.g. binoculars)	☐ Yes	
BNWAS	☐ Yes	
Clocks synchronised with engine room	☐ Yes	
Controllable pitch propeller controls and indicators	☐ Yes	
Course and engine movement recorder/bridge movement book	☐ Yes	
Deck power	☐ Yes	
ECDIS and/or other electronic navigation aids	☐ Yes	
Echo sounder	☐ Yes	
Electronic position fixing systems	☐ Yes	
Emergency engine stops	☐ Yes	
Engine(s)/propulsion (ahead and astern)	☐ Yes	
GMDSS communications and GMDSS log	☐ Yes	
Gyro/magnetic compass and repeaters, including repeater in steering gear area	☐ Yes	
Internal communications (particularly bridge to engine room/bridge to mooring stations)	☐ Yes	
LRIT	☐ Yes	
Navigation lights, shapes and sound signals	☐ Yes	

Radar(s) and ARPA	☐ Yes	
RPM and ROT indicators	☐ Yes	
Signalling equipment including flags, search lights and signal lamps	☐ Yes	
Speed and distance log	☐ Yes	
Stabilisers	☐ Yes	
Steering gear (checklist C2.1)	☐ Yes	
Thrusters	☐ Yes	
VDR/S-VDR	☐ Yes	
Port and pilotage	**Status**	**Remarks**
Master/pilot information exchange checklist completed (checklist C1.1)	☐ Yes	
Pilot card prepared (checklist C1.2)	☐ Yes	
Pilot boarding time confirmed	☐ Yes	
Pilot boarding arrangements ready for disembarkation of the pilot (checklist C1.4)	☐ Yes	
Port and VTS channels monitored	☐ Yes	
Port, VTS and pilot informed of any special requirements	☐ Yes	
Preparations for pilotage complete (checklist C2.8)	☐ Yes	
Securing for sea	**Status**	**Remarks**
Cargo and cargo handling equipment secure	☐ Yes	
Cargo/passenger details available	☐ Yes	
Hull openings secure and watertight	☐ Yes	
Stability and draught information available	☐ Yes	
Watertight doors closed	☐ Yes	
Before sailing	**Status**	**Remarks**
All crew on board	☐ Yes	
Anchors cleared away	☐ Yes	
Bridge team fit for duty	☐ Yes	
Engine room ready	☐ Yes	
Mooring stations manned and ready	☐ Yes	
MSI checked and communicated to bridge team	☐ Yes	

Pressure on fire main	☐ Yes	
Stowaway/security search completed	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

Time and date: .....

OOW signature: .....

The above points are recommendations only. It is essential that the checklist is amended to reflect the appropriate operating manuals and company procedures.

C2.7 Preparations for arrival

Passage plan	Status	Remarks
Pre-arrival documentation complete and sent	☐ Yes	
Passage plan updated with additional information received since departure	☐ Yes	
Updated passage plan checked and approved by the Master	☐ Yes	
Updated passage plan briefed to the bridge team	☐ Yes	
Updated passage plan available on the bridge with the route plotted on up-to-date and appropriate scale charts (official paper or electronic)	☐ Yes	
Updated route displayed on ECDIS and/or other electronic navigation aids, as appropriate	☐ Yes	
Is cargo/ballast rearrangement required?	☐ Yes	
Equipment checks (tested and ready for use)	**Status**	**Remarks**
Clocks synchronised with engine room	☐ Yes	
Controllable pitch propeller controls and indicators	☐ Yes	
Deck power	☐ Yes	
ECDIS and/or other electronic navigation aids	☐ Yes	
Echo sounder	☐ Yes	
Electronic position fixing systems	☐ Yes	
Emergency engine stops	☐ Yes	
Engine(s)/propulsion (ahead and astern)	☐ Yes	
Gyro/magnetic compass and repeaters, including repeater in steering gear area	☐ Yes	
Internal communications (particularly bridge to engine room/bridge to mooring stations)	☐ Yes	
Navigation lights, shapes and sound signals	☐ Yes	
RPM and ROT indicators	☐ Yes	
Signalling equipment including flags, search lights and signal lamps	☐ Yes	
Steering gear (checklist C2.1)	☐ Yes	
Thrusters	☐ Yes	
Before arrival	**Status**	**Remarks**
Anchors cleared and ready for use	☐ Yes	

Any stabilisers housed	☐ Yes	
Bridge team ready	☐ Yes	
Cargo/passenger details available	☐ Yes	
Engine room ready	☐ Yes	
Ship ready for manoeuvring	☐ Yes	
If available, use more than one steering gear power unit	☐ Yes	
Manual steering engaged	☐ Yes	
Mooring stations manned and ready	☐ Yes	
Pressure on fire main	☐ Yes	
Stability and draught information verified and available	☐ Yes	
Watertight doors closed	☐ Yes	
Port and pilotage requirements	**Status**	**Remarks**
Master/pilot information exchange (MPX) checklist completed (checklist C1.1)	☐ Yes	
Pilot card prepared (checklist C1.2)	☐ Yes	
Pilot boarding time confirmed	☐ Yes	
Pilot boarding arrangements ready for disembarkation of the pilot (checklist C1.4)	☐ Yes	
Port and VTS channels monitored	☐ Yes	
Port, VTS and pilot informed of any special requirements	☐ Yes	
Preparations for pilotage complete (checklist C2.8)	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

Time and date: .....

OOW signature: .....

The above points are recommendations only. It is essential that the checklist is amended to reflect the appropriate operating manuals and company procedures.

C2.8 Pilotage

Action	Status	Remarks
Appropriate scale charts available with route plotted	☐ Yes	
Appropriate flags and navigation lights or shapes displayed	☐ Yes	
Bridge appropriately manned to:		
• Maintain a proper look-out	☐ Yes	
• Monitor the progress of the ship and navigational safety	☐ Yes	
• Monitor communications between pilot, shore, tugs and mooring craft	☐ Yes	
• Carry out orders and instructions given by the Master and pilot	☐ Yes	
Bridge watch and crew standby arrangements	☐ Yes	
ECDIS terminals are set up correctly for navigation in pilotage waters with route displayed (checklist C2.5)	☐ Yes	
Engine room and mooring stations regularly updated on pilotage progress	☐ Yes	
MPX completed and passage plan agreed by the Master (checklist C1.1)	☐ Yes	
Pilot briefed on the pilot card (checklist C1.2) and wheelhouse poster (checklist C1.3) concerning manoeuvring characteristics	☐ Yes	
Mooring stations informed of berthing arrangements	☐ Yes	
Pilot informed of any propulsion or steering gear defects or limitations	☐ Yes	
Pilot informed of ship's heading, speed, engine setting and draught on arrival on the bridge	☐ Yes	
Pilot informed of the location of life-saving appliances provided for their use	☐ Yes	
Preparation for departure (checklist C2.6) or arrival (checklist C2.7) checks complete	☐ Yes	
Working language agreed	☐ Yes	

Other	Status	Remarks
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C2.9 Passage planning

Factors to consider when developing a passage plan and associated route

Appraisal	Tick
Adequacy and reliability of aids to navigation	
Adequacy and reliability of charts and hydrographic data	
Appropriate scale charts for ocean, coastal, harbour and berthing phases	
Guides to port entry	
List of lights	
Local area warnings	
NAVAREA navigational warnings	
New charts and licences ordered as appropriate	
Notices to Mariners	
Planning charts	
List of radio signals	
Routeing and load line charts	
Sailing directions and pilot books	
Tide tables and tidal stream atlases	
Passage requirements	**Tick**
Anchoring locations	
Any special ship operational requirements for the passage	
Bunker calculations	
Cargo and any special stowage/carriage restrictions	
Communications/GMDSS watchkeeping considerations	
Draught restrictions including air draught and under keel clearance (UKC) requirements	
Helicopter operations	
Load line requirements	
Log book requirements	
Passage reporting requirements	
Passage speed and ETA calculations	
Position fixing intervals	

Reliability of propulsion and steering systems or any known defects affecting navigation or control of vessel	
Routeing and reporting measures	
Safety contours	
Safety depths	
Security concerns	
Ship-to-ship transfers	
Squat	
Strength and stability	
Watch schedules	
Environmental considerations	**Tick**
Ballast water	
Emission Control Area (ECA) limits and fuel changeover procedures	
MARPOL Special Areas, PSSAs, or national and regional requirements	
Notifications/advice to crew on board	
Weather/conditions	**Tick**
Abnormal waves	
Currents and tides	
Heavy weather	
Ice	
Swell	
Tropical storms	
Visibility	
Weather routeing	
Winds	
Contingencies	**Tick**
Emergency anchorages	
Commit points	
Emergency response plans	
Notifications and reporting	
Plan amendments	

Other	Tick

Officer responsible – passage plan completed and checked.

Signature: ..... Date: .....

Master – passage plan checked and approved.

Signature: ..... Date: .....

Officer responsible – approved passage plan briefed to the bridge team.

Signature: ..... Date: .....

C2.10 Navigation in coastal waters

Action	Status	Remarks
Appropriate scale charts available with route plotted	☐ Yes	
Bridge manning appropriate to maintain a proper look-out	☐ Yes	
ECDIS terminals set up correctly for navigation in coastal waters with route displayed	☐ Yes	
Echo sounder checked	☐ Yes	
Effects of weather and currents for the area understood	☐ Yes	
Engines ready for immediate use	☐ Yes	
Gyro/magnetic compass errors checked	☐ Yes	
Helmsman is available at immediate notice	☐ Yes	
Manual steering checked and ready for use (checklist C2.1). Use more than one steering gear power unit, as appropriate	☐ Yes	
Measures taken to comply with environmental requirements and applicable pollution regulations	☐ Yes	
MSI is monitored and plotted as appropriate	☐ Yes	
Position of the ship is fixed regularly and cross referenced at appropriate intervals	☐ Yes	
Proximity to shallow water and the effect of squat monitored	☐ Yes	
Radar performance and radar heading line marker alignment checked	☐ Yes	
Ship security procedures understood and followed	☐ Yes	
Traffic conditions in the area understood	☐ Yes	
Vessel reporting requirements understood and followed	☐ Yes	
Vessel routeing requirements understood and followed	☐ Yes	
Weather monitored, particularly in areas prone to restricted visibility	☐ Yes	

Other	Status	Remarks
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C2.11 Navigation in ocean waters

Action	Status	Remarks
Appropriate scale charts available with route plotted	☐ Yes	
All measures taken to comply with environmental requirements and applicable pollution prevention regulations	☐ Yes	
ECDIS terminals correctly set up for navigation in ocean waters with route displayed (checklist C2.5)	☐ Yes	
Bridge manning appropriate for maintaining a proper look-out	☐ Yes	
Ship's position confirmed at appropriate intervals	☐ Yes	
Changes in weather monitored and regular barometer observations made	☐ Yes	
NAVAREA navigational warning broadcasts and other long range weather reports monitored	☐ Yes	
Participation in area reporting systems (e.g. Automated Mutual-Assistance Vessel Rescue System (AMVER)) as appropriate	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C2.12 Anchoring and anchor watch

Anchoring appraisal and planning	Status	Remarks
Anchoring plan checked and approved by the Master	☐ Yes	
Anchoring position identified that addresses the:		
• Availability of appropriate space at the anchorage	☐ Yes	
• Proximity of navigational hazards including traffic	☐ Yes	
• Scope of anchor cable required/available	☐ Yes	
• Suitable seabed type and holding conditions	☐ Yes	
• Tidal height checked to confirm that sufficient water is available for the duration of the anchorage	☐ Yes	
• Tidal stream checked with particular reference to effect on slow speed manoeuvring	☐ Yes	
• Weather conditions and available shelter	☐ Yes	
Anchors, cables and winches checked and ready for use	☐ Yes	
Engine room and anchor party informed of the time of anchoring	☐ Yes	
Intended anchor position of the ship reported to the port authority	☐ Yes	
Lights, shapes and sound signalling apparatus checked and ready for use	☐ Yes	
Ship ready for manoeuvring	☐ Yes	
Security measures required by the Ship Security Plan (SSP)	☐ Yes	
While at anchor the OOW should:	**Status**	**Remarks**
Check at sufficiently frequent intervals whether the ship is remaining securely at anchor by taking bearings of fixed navigational marks or readily identifiable shore objects	☐ Yes	
Identify and plot the ship's position on the appropriate chart as soon as practicable	☐ Yes	
Monitor swinging pattern	☐ Yes	
Ensure that inspection rounds of the ship are made periodically	☐ Yes	

Ensure that a proper look-out is kept	☐ Yes	
Ensure that the ship exhibits the appropriate lights and shapes and that appropriate sound signals are made in accordance with all applicable regulations	☐ Yes	
Ensure that the state of readiness of the main engines and other machinery is in accordance with the Master's instructions	☐ Yes	
Ensure that vessel access control precautions are maintained	☐ Yes	
If visibility deteriorates, call the Master	☐ Yes	
Modify AIS status	☐ Yes	
Call the Master and undertake all necessary measures if the ship drags anchor	☐ Yes	
Observe meteorological and tidal conditions and the sea state	☐ Yes	
Take measures to protect the environment from pollution by the ship and comply with applicable pollution prevention regulations	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C2.13 Restricted visibility

Action	Status	Remarks
Master informed of reduced visibility as required in Master's standing orders and the SMS	☐ Yes	
Engine room informed	☐ Yes	
Bridge manning levels increased, as necessary (checklist C2.2)	☐ Yes	
Look-outs posted	☐ Yes	
Hand steering selected	☐ Yes	
Engines ready for immediate manoeuvre	☐ Yes	
All watertight doors and openings closed	☐ Yes	
Equipment preparations	**Status**	**Remarks**
AIS	☐ Yes	
Echo sounder	☐ Yes	
Fog signalling apparatus	☐ Yes	
Navigation lights	☐ Yes	
Radar, ARPA or other plotting aids	☐ Yes	
VHF	☐ Yes	
Compliance with COLREGS regulations	**Status**	**Remarks**
Rule 19 – Conduct of vessels in restricted visibility	☐ Yes	
Rule 35 – Sound signals in restricted visibility	☐ Yes	
Rule 5 – Look-out	☐ Yes	
Rule 6 – Safe speed	☐ Yes	
Contingency planning	**Status**	**Remarks**
Consider the possibility of anchoring the ship if in doubt and ship in a suitable depth of water	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C2.14 Heavy weather/tropical storm areas

Action	Status	Remarks
Master informed of the weather conditions	☐ Yes	
Engine room informed of the weather conditions	☐ Yes	
Crew informed of the need to avoid upper deck areas made dangerous by weather	☐ Yes	
Safety lines/hand ropes rigged where necessary	☐ Yes	
Ship course and speed adjusted as necessary to ease ship/avoid worst of motion	☐ Yes	
Ship manoeuvred to minimise risk of broaching, pooping and/or synchronous rolling	☐ Yes	
Weather reports monitored	☐ Yes	
Weather reports made to appropriate authorities. In the case of tropical storms, danger messages in accordance with SOLAS	☐ Yes	
Secure and/or check securing:		
• All weather deck openings (doors/hatches)	☐ Yes	
• Anchors and winches	☐ Yes	
• Hatch covers, vents and any other openings to cargo holds	☐ Yes	
• Cargo (as appropriate)	☐ Yes	
• Loose or movable objects in cabins and accommodation	☐ Yes	
• Loose or movable objects on deck	☐ Yes	
• Loose or movable objects in the engine room	☐ Yes	
• Loose or movable objects in the galley	☐ Yes	
• Loose or movable objects in the storerooms	☐ Yes	
• All ports and deadlights closed	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C2.15 Navigation in ice*

Action	Status	Remarks
Master informed of the proximity to ice	☐ Yes	
Additional look-outs posted if appropriate	☐ Yes	
Engine room informed of the proximity to ice	☐ Yes	
Crew informed of the proximity to ice	☐ Yes	
All watertight doors closed	☐ Yes	
Speed reduced as appropriate in the conditions	☐ Yes	
Hand steering engaged if appropriate	☐ Yes	
Frequency of sounding tanks and bilges increased	☐ Yes	
Ice advisory service broadcasts monitored	☐ Yes	
Danger messages transmitted in accordance with SOLAS	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

* Preparations for navigation in ice for ships operating in polar waters should be in line with the ship's Polar Water Operational Manual (PWOM).

C2.16 Change of watch at sea

Action	Status	Remarks
Enough time allowed for night vision to adjust	☐ Yes	
Master's orders understood	☐ Yes	
GMDSS log up to date	☐ Yes	
Deck log up to date	☐ Yes	
Position, course and speed	☐ Yes	
Passage plan progress and time to next alter course	☐ Yes	
Passage plan look-ahead including hazards for the watch	☐ Yes	
Draught, air draught and UKC	☐ Yes	
Effect of heel, trim, water density and squat	☐ Yes	
Current traffic conditions	☐ Yes	
Maritime safety information:		
• Weather	☐ Yes	
• Navigational warnings	☐ Yes	
Status of navigation and bridge equipment:		
• AIS	☐ Yes	
• Autopilot	☐ Yes	
• BNWAS	☐ Yes	
• Course and engine movement recorder	☐ Yes	
• ECDIS	☐ Yes	
• Echo sounder	☐ Yes	
• GNSS	☐ Yes	
• Gyro and magnetic compass	☐ Yes	
• Navigation lights, shapes and signals	☐ Yes	
• Radar and ARPA	☐ Yes	
• VDR/S-VDR	☐ Yes	
Status of communications equipment:		
• EPIRB	☐ Yes	
• NAVTEX	☐ Yes	

• SES	☐ Yes	
• VHF/MF/HF	☐ Yes	
Status of propulsion and steering equipment:		
• Engine room watch	☐ Yes	
• Hand steering tested	☐ Yes	
• Main engines and generators	☐ Yes	
• Steering system	☐ Yes	
Status of watertight doors	☐ Yes	
Status of fire zones	☐ Yes	
Any special work in progress	☐ Yes	

C2.17 Calling the Master

If the Master needs to be called, particularly where there is concern about the safety of the ship, this should be done early enough to allow the Master enough time to understand and respond effectively to the situation.

Failing to call the Master promptly can lead to an increased level of risk of:

- Collision;
- Grounding;
- Safety of life;
- Damage to the environment;
- Ship delays;
- Cargo leaks or spills;
- Property damage;
- Commercial losses; or
- Reputation losses due to delays or damage.

Occasions to call the Master	Status	Remarks
As required by the SMS, Master's standing orders and daily orders, including:		
• When restricted visibility is encountered or expected	☐ Yes	
• When traffic conditions, density or the movements of other vessels are causing concern	☐ Yes	
• When a distress alert has been received or a distress signal has been sighted	☐ Yes	
• When difficulties in maintaining course are experienced	☐ Yes	
• When there is significant difference between the latest observed position and the expected position of the ship	☐ Yes	
• In case of failure to sight land, identify a navigation mark or get soundings by the expected time	☐ Yes	
• When there is unexpected sighting of land or a navigation mark or unexpected change in soundings	☐ Yes	
• When amendments to the passage plan require immediate approval	☐ Yes	
• When there is a breakdown of the engines, propulsion machinery remote control, steering gear or any essential navigational equipment, alarm or indicator	☐ Yes	

• When communications or GMDSS radio equipment malfunctions	☐ Yes	
• In heavy weather, if any doubt about the possibility of weather damage	☐ Yes	
• When the ship meets hazards to navigation, e.g. ice or a derelict vessel	☐ Yes	
• When there are concerns about the ship's security	☐ Yes	
• In any emergency situation	☐ Yes	
• In any cases when the situation is beyond the experience of the OOW or if there is any doubt about the safety of the ship, or ability to comply with regulatory requirements	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C2.18 Pre-operational dynamic positioning

This checklist should complement the detailed DP procedures and checklists required for personnel operating DP vessels.

Item	Status					Remarks
Computers	A	Running		Online		
	B	Running		Online		
	A/B Difference messages					
Thrusters	1	Running		Enabled		
	2	Running		Enabled		
	3	Running		Enabled		
	4	Running		Enabled		
	5	Running		Enabled		
	6	Running		Enabled		
Power and generators	1	Running		Standby		
	2	Running		Standby		
	3	Running		Standby		
	4	Running		Standby		
Bus tie switch	Open/closed					
Equipment class		Consequence analysis enabled				
Control gain	Low/medium/high					Customised/relaxed
Alternative rate of turn (ROT) point	Number selected:			Position:		
Wind sensors	1/2	Available		Selected		Gyro differences checked
Gyros	1	Running		Selected		Repeater checked Gyro alarms checked
	2	Running		Selected		
	3	Running		Selected		
Motion Reference Unit (MRU)	1			MRU differences checked		
	2					
Printer	Running			Paper OK		Outstanding messages checked

Position reference system (PRS)	**Differential Global Positioning System (DGPS)**	1	Running		Diff available		IMCA differential quality indicator (DQI) factor
			Horizonal dilution of position (HDOP)		AOD (Sec)		
	DGPS	2	Running		Diff available		IMCA DQI Factor
			HDOP		AOD (sec)		
	Taut wires	Port			Deployed		Water depth: m
		Stbd			Deployed		Water depth: m
	Fan beam	Deployed			Range/ bearing (Rng/Brg):		Reflector location
	HPR	1	Running		Pole up/ down		Transponder deployed
		2	Running		Pole up/ down		Transponder deployed
Communications		VHF:	Working channels:			Tested	
		UHF:	Channels:			Tested	
		Internal				Tested	
		Talkback				Tested	
Weather forecast		Time received:					
Signals displayed							
30 minute setting time complete							
Maximum continuous rating (MCR) checklist complete							
Tasks agreed							
Permit to work		Reference number:			Expiry time:		

OOW/DPO Signature: ..... Date: .....

C2.19 False distress alerts

False alert sent on VHF digital selective calling (DSC)	Status	Remarks
VHF DSC reset immediately	☐ Yes	
Alert on VHF DSC Channel 70 cancelled	☐ Yes	
Broadcast message transmitted to ALL STATIONS on VHF Channel 16 giving the ship's name, call sign and maritime mobile service identity (MMSI) and cancelling the false distress alert	☐ Yes	
Details of the false alert and actions to cancel the alert recorded	☐ Yes	
False alert sent on MF DSC	**Status**	**Remarks**
MF DSC reset immediately	☐ Yes	
Alert cancelled on MF DSC 2187.5 kHz	☐ Yes	
Broadcast message transmitted to ALL STATIONS on 2182 kHz giving the ship's name, call sign and MMSI and cancelling the false distress alert	☐ Yes	
Record details of the false alert and actions to cancel the alert	☐ Yes	
False alert sent on HF DSC	**Status**	**Remarks**
HF DSC reset immediately	☐ Yes	
Alert cancelled on the HF DSC distress frequencies on which it was sent:		
• 4207.5 kHz	☐ Yes	
• 6312 kHz	☐ Yes	
• 8414.5 kHz	☐ Yes	
• 12577 kHz	☐ Yes	
• 16804.5 kHz	☐ Yes	
Broadcast message transmitted to ALL STATIONS giving the ship's name, call sign and MMSI, and cancelling the false alert on each of the radio-telephony distress frequencies in the bands on which the HF DSC was sent:		
• 4125 kHz	☐ Yes	
• 6215 kHz	☐ Yes	
• 8291 kHz	☐ Yes	
• 12290 kHz	☐ Yes	
• 16420 kHz	☐ Yes	

Details of the false alert and actions to cancel the alert recorded	☐ Yes	
False alert sent via SES	**Status**	**Remarks**
Distress priority message sent to cancel the distress alert to the appropriate rescue co-ordination centre (RCC) via coast earth station (CES) through which the false distress alert was sent	☐ Yes	
Details of the false alert and actions to cancel the alert recorded	☐ Yes	
False alert sent on EPIRB	**Status**	**Remarks**
EPIRB reset immediately	☐ Yes	
Nearest coast station or an appropriate CES or RCC contacted and distress alert cancelled	☐ Yes	
Details of the false alert and actions to cancel the alert recorded	☐ Yes	

C3 Emergencies

The checklists in section C3 provide a guide to creating appropriate company and/or on board checklists that suit the particular needs of the ship.

Emergency drills and on board training should include scenarios with incidents as addressed in these emergency checklists. During the drills and training, the use of emergency checklists should be encouraged to make sure personnel respond effectively to emergencies.

In any emergency there are several actions that require almost immediate attention. The following emergency checklists indicate essential actions, but factors including the design of a particular bridge or the layout of its equipment may mean that some of the identified actions need to be carried out in a different order.

Raising the alarm, taking immediate action to safeguard the ship and crew and calling the Master are essential actions that should take priority over others.

C3.1 Main engine failure

Action	Status	Remarks
Master called	☐ Yes	
Immediate action taken to keep ship away from danger	☐ Yes	
Position of vessels in the vicinity checked	☐ Yes	
Navigational hazards checked	☐ Yes	
Not Under Command (NUC) lights, shapes and sound signals activated, as appropriate	☐ Yes	
Autopilot disengaged	☐ Yes	
Anchoring prepared if water depth and conditions are appropriate	☐ Yes	
AIS status modified	☐ Yes	
VTS or port authority informed, as appropriate	☐ Yes	
SAFETY or URGENCY message broadcast, if appropriate	☐ Yes	
Bridge informed of the situation and status, including expected time of restarting the engine	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	
Other	**Status**	**Remarks**
Watertight doors closed, if applicable	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C3.2 Steering failure

Action	Status	Remarks
Master called	☐ Yes	
Autopilot disengaged	☐ Yes	
Alternate or emergency steering engaged	☐ Yes	
Appropriate manoeuvres made/engine(s) stopped	☐ Yes	
Engine room informed of steering failure	☐ Yes	
Way off ship taken, if safe to do so	☐ Yes	
Not Under Command (NUC) lights, shapes and sound signals activated, as appropriate	☐ Yes	
Position of vessels in the vicinity checked	☐ Yes	
Engine prepared for manoeuvre	☐ Yes	
Navigational hazards checked	☐ Yes	
Anchoring prepared if water depth and conditions are appropriate	☐ Yes	
AIS status modified	☐ Yes	
VTS or port authority informed, as appropriate	☐ Yes	
SAFETY or URGENCY message broadcast, if appropriate	☐ Yes	
Bridge informed of the situation and status of repairs	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	
Other	**Status**	**Remarks**
Full steering gear tested before restarting passage	☐ Yes	
Watertight doors closed, if applicable	☐ Yes	
	☐ Yes	
	☐ Yes	

C3.3 Total electrical power failure (blackout)

Action	Status	Remarks
Master called	☐ Yes	
Immediate action taken to keep the ship away from danger	☐ Yes	
Not Under Command (NUC) lights, shapes and sound signals activated, as appropriate	☐ Yes	
Engine room/duty engineer contacted	☐ Yes	
Emergency power supplies selected for bridge and navigational equipment	☐ Yes	
Position of vessels in the vicinity checked	☐ Yes	
Navigational hazards checked	☐ Yes	
Anchoring prepared if water depth and conditions are appropriate	☐ Yes	
VTS or port authority informed, as appropriate	☐ Yes	
AIS status modified	☐ Yes	
Bridge informed of the situation and status of repairs	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	
Other	**Status**	**Remarks**
Manual steering engaged, if necessary	☐ Yes	
Ship's drift pattern from weather and tide determined	☐ Yes	
Watertight doors closed, if applicable	☐ Yes	
	☐ Yes	

C3.4 Collision

Action	Status	Remarks
Master called	☐ Yes	
General emergency alarm sounded	☐ Yes	
Engine room notified	☐ Yes	
Appropriate manoeuvres made/engine(s) stopped until the situation has been assessed	☐ Yes	
Watertight doors and automatic fire doors closed	☐ Yes	
Crew mustered at damage control stations	☐ Yes	
Any passengers mustered	☐ Yes	
Damage control procedures conducted*	☐ Yes	
URGENCY or DISTRESS message broadcast, if appropriate	☐ Yes	
All tanks, bilges, void spaces and cofferdams sounded regularly	☐ Yes	
Ship checked for spills/pollution, internal and over the side	☐ Yes	
VTS or port authority informed, as appropriate	☐ Yes	
Company emergency response team notified	☐ Yes	
Deck lighting switched on	☐ Yes	
Assistance to other vessel offered	☐ Yes	
VDR records preserved	☐ Yes	
ECDIS records preserved	☐ Yes	
Stability checked, with shore assistance (emergency response services) if available	☐ Yes	
Disengagement from the other ship prepared and planned as appropriate	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	
Other	**Status**	**Remarks**
Ship's position confirmed	☐ Yes	
Proximity of navigational hazards established and traffic situation checked	☐ Yes	
Ship emergency response service contacted	☐ Yes	
Tug assistance or salvage considered	☐ Yes	

* Actions required should be in line with ship specific damage control procedures.

C3.5 Stranding or grounding

Action	Status	Remarks
Master called	☐ Yes	
General emergency alarm sounded	☐ Yes	
Engine room notified	☐ Yes	
Watertight doors and automatic fire doors closed	☐ Yes	
Appropriate manoeuvres made/engine(s) stopped until the situation is assessed	☐ Yes	
Switch made to high cooling water intakes	☐ Yes	
Use of anchors considered	☐ Yes	
Aground lights or shapes exhibited and sound signals made, as appropriate	☐ Yes	
VTS or port authority informed, as appropriate	☐ Yes	
Company emergency response team notified	☐ Yes	
Deck lighting switched on	☐ Yes	
AIS status modified	☐ Yes	
Crew mustered to damage control stations	☐ Yes	
Damage control procedures conducted*	☐ Yes	
All tanks, bilges, void spaces and cofferdams sounded regularly	☐ Yes	
Ship checked for spills/pollution, internal and over the side	☐ Yes	
Nature of the sea bed assessed	☐ Yes	
Tides and currents assessed	☐ Yes	
Weather conditions and forecasts assessed	☐ Yes	
Soundings taken around ship	☐ Yes	
Location of deep water in relation to the ship determined	☐ Yes	
Option to reduce draught considered	☐ Yes	
Option to take on additional ballast to prevent unwanted movement and damage considered	☐ Yes	
Stability checked, with shore assistance (emergency response services) if available	☐ Yes	
Refloating prepared and planned as appropriate	☐ Yes	

URGENCY or DISTRESS message broadcast, if appropriate	☐ Yes	
VDR records preserved	☐ Yes	
ECDIS records preserved	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	

* Actions required should be in line with ship specific damage control procedures.

C3.6 Man Overboard (MOB)

Action	Status	Remarks
Lifebuoy with light and smoke signal released on side that person has fallen overboard	☐ Yes	
Look-out assigned to indicate the position of the person in the water	☐ Yes	
GNSS MOB marker activated	☐ Yes	
MOB position marked on ECDIS	☐ Yes	
Hand steering engaged	☐ Yes	
Engines ready for manoeuvring	☐ Yes	
Immediate manoeuvring action taken to preserve safety of person in water	☐ Yes	
General emergency alarm sounded, including three long blasts on ship's whistle	☐ Yes	
Master called	☐ Yes	
Extra look-outs posted	☐ Yes	
Recovery manoeuvre started	☐ Yes	
Preparations made for recovery of persons from the water*	☐ Yes	
DISTRESS message broadcast, if appropriate	☐ Yes	
Role of on-scene co-ordinator assumed	☐ Yes	
Signal flag OSCAR hoisted	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	
Other	**Status**	**Remarks**
Proximity of navigational hazards established and traffic situation checked	☐ Yes	

* Actions required should be in line with the ship specific plan for recovery of persons from the water.

C3.7 Fire

Action	Status	Remarks
Master called	☐ Yes	
General emergency alarm sounded	☐ Yes	
Ventilation system shut down	☐ Yes	
Crew mustered to fire control stations	☐ Yes	
Fire control procedures conducted*	☐ Yes	
Proximity of navigational hazards, including traffic, assessed and ship manoeuvred as appropriate	☐ Yes	
In case of fire in:		
• Engine room – Checklist C3.1 completed as appropriate	☐ Yes	
• Steering gear compartment – Checklist C3.2 completed as appropriate	☐ Yes	
• Generator compartments – Checklist C3.3 completed as appropriate	☐ Yes	
URGENCY or DISTRESS message broadcast, if appropriate	☐ Yes	
VTS or port authority informed, as appropriate	☐ Yes	
Company emergency response team notified	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	
Other	**Status**	**Remarks**
Smoke-wind effect reduced (course/speed)	☐ Yes	
Fire screen doors and watertight doors closed	☐ Yes	
	☐ Yes	
	☐ Yes	

* Actions required should be in line with ship specific fire control procedures.

C3.8 Flooding/hull failure

Action	Status	Remarks
Master called	☐ Yes	
General emergency alarm sounded	☐ Yes	
Engine(s) stopped until the situation is assessed	☐ Yes	
Autopilot disengaged	☐ Yes	
All watertight doors closed	☐ Yes	
Crew mustered to damage control stations	☐ Yes	
Damage control procedures conducted*	☐ Yes	
In case of flood in:		
• Engine room – checklist C3.1 completed as appropriate	☐ Yes	
• Steering gear compartment – checklist C3.2 completed as appropriate	☐ Yes	
• Generator compartments – checklist C3.3 completed as appropriate	☐ Yes	
All tanks, bilges, void spaces and cofferdams sounded regularly	☐ Yes	
Ship checked for spills/pollution, internal and over the side	☐ Yes	
URGENCY or DISTRESS message broadcast, if appropriate	☐ Yes	
VTS or port authority informed, as appropriate	☐ Yes	
Company emergency response team notified	☐ Yes	
Stability checked, with shore assistance (emergency response services) if available	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

* Actions required should be in line with ship specific damage control procedures.

C3.9 Search and Rescue (SAR) and receiving distress alerts

Action	Status	Remarks
Contents of distress alert and/or message recorded	☐ Yes	
Master called	☐ Yes	
Communications established with the RCC and/or on-scene co-ordinator and other SAR units as appropriate	☐ Yes	
Radio watch maintained	☐ Yes	
X-Band radar and AIS for SART signals monitored as appropriate	☐ Yes	
IAMSAR Manual Volume III and industry guidance on rescue procedures consulted	☐ Yes	
Extra look-outs posted	☐ Yes	
Distress situation monitored	☐ Yes	
Preparations made for recovery of persons from the water*	☐ Yes	
Log/record of events and decisions maintained	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

* Actions required should be in line with the ship specific plan for recovery of persons from the water.

C3.10 Abandoning ship

Action	Status	Remarks
DISTRESS message broadcast on authority of the Master	☐ Yes	
Crew instructed to don lifejackets and immersion suits as appropriate	☐ Yes	
Crew mustered at lifeboat stations	☐ Yes	
Survival craft prepared for launch	☐ Yes	
EPIRB, SART and SOLAS radios collected and prepared	☐ Yes	
Survival craft embarked and launched	☐ Yes	
Survival craft remain close to ship and in contact with each other	☐ Yes	
EPRIB and SART activated	☐ Yes	
Other	**Status**	**Remarks**
	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

C3.11 Rescue in enclosed spaces

Action	Status	Remarks
Master called	☐ Yes	
Exact location, nature of incident and number of people confirmed	☐ Yes	
Rescue team and medical team mustered	☐ Yes	
General emergency alarm sounded	☐ Yes	
Area restricted	☐ Yes	
Personal protective equipment required for entry checked and used	☐ Yes	
Rescue equipment checked and confirmed ready for use	☐ Yes	
Atmosphere tested	☐ Yes	
Situation prior to entry evaluated to ensure safety of those performing rescue	☐ Yes	
Rescue performed*	☐ Yes	
Casualty recovered, area secured and rescue completed	☐ Yes	
Additional care given by medical officer	☐ Yes	
Other	**Status**	**Remarks**
All equipment used for the response is available and ready for use	☐ Yes	
	☐ Yes	
	☐ Yes	
	☐ Yes	

* Actions required should be in line with the ship specific plan for rescue of persons in enclosed spaces.

Appendix D
Posters

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D1 Challenge decisions poster

D2 Safe navigation in pilotage waters poster

SAFE NAVIGATION IN PILOTAGE WATERS IS A SHARED TASK OF THE BRIDGE TEAM AND THE PILOT

SHARE navigation information

RESPECT each other

COMMUNICATE throughout the voyage

WORK together

STAY alert

International Chamber of Shipping
Shaping the Future of Shipping

From the **ICS Bridge Procedures Guide, Sixth Edition**

Based on International Maritime Pilots' Association–Marine Accident Investigators' International Forum (IMPA–MAIIF)

Appendix E
Recommended industry publications

Cyber Security Workbook for Onboard Ship Use (ICS/BIMCO/Witherbys)

Drug Trafficking and Drug Abuse On Board Ship (ICS/Witherbys)

Engine Room Procedures Guide (ICS)

Guide to Helicopter/Ship Operations (ICS)

Guidelines on the Application of the ILO Maritime Labour Convention (ICS)

Guidelines on the Application of the IMO International Safety Management (ISM) Code (ICS)

Guidelines on the IMO STCW Convention and Code (ICS)

International Safety Guide for Oil Tankers and Terminals (ISGOTT) (ICS/OCIMF)

Maritime Security: A Comprehensive Guide for Shipowners, Seafarers and Administrations (ICS)

On Board Training Record Book for Officers in Charge of a Navigational Watch (Deck Cadets) (ICS)

On Board Training Record Book for Ratings Forming Part of a Navigational Watch and Ratings Qualifying As Able Seafarer Deck (ICS)

Ship to Ship Transfer Guide for Petroleum, Chemicals and Liquefied Gases (ICS/CDI/OCIMF/SIGTTO)

Tanker Safety Guide (Chemicals) (ICS)

Tanker Safety Guide (Liquefied Gas) (ICS)

ISF Watchkeeper Work and Rest Hour Software (ICS/IT Energy)

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