NAVIGATION

FOR

MASTERS

by the same author

An Introduction to Helicopter Operations at Sea
Marine Survival and Rescue Systems
Seamanship Techniques Vols I & II. (Combined)

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NAVIGATION FOR MASTERS

by

DAVID HOUSE

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Tel: 0171-251 5341
Fax: 0171-251 1296
International Tel. No. +44 171 251 5341
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NAVIGATION FOR MASTERS — The Book

This book is extremely timely. It addresses the age old practices of seamanship and navigation. But it brings readers, quite rightly, up to date with modern technical aspects of the profession that are now a routine part of sealife – satellite navigation and communication, GMDSS, helicopter operations – while not brushing aside older, still essential basics such as ocean currents and tidal prediction. "Navigation for Masters" follows in the finest tradition of Lecky, Nicholls and Danton.

Such books, written by practitioners of any science, are the lifeblood that encourages experienced professionals to expand their ability, and allows newcomers to look for early guidance. The author is active in promoting high standards in an industry that has always needed them because the sea is unforgiving of incompetence.

Although written before the Estonia casualty, the book is to be launched into the whirlpool of scrutiny and inspection of the industry that is following the loss of a passenger ferry and nearly a thousand souls. The bewilderment of the general public is as real as the frustration of professional seamen, that such a catastrophe could occur in this day and age, when the knowledge of how to prevent it is available.

This book will meet the need to make that knowledge accessible.

PREFACE TO FIRST EDITION

With the many innovations that have occurred in the practice of safe navigation, especially by way of increased equipment and extended communications, it is essential that Masters and Senior Marine Officers keep themselves abreast of new as well as tried and tested operations. This text will hopefully help towards greater awareness by mariners in specialised areas of navigation. The overall theme being directly related to the safety of life at sea and the safety of the ship in its lawful endeavours.

The marine industry can best serve the world community by continuing to self improve on its own operations. Pollution of the marine environment has regularly affected persons both ashore and afloat and if the cause can be placed at the door of either lack of training or poor navigation then that community may well be reluctant to forgive ... or forget. Mistakes in the past have often been fraught with human error and we cannot expect our fellow man to tolerate ignorance in our seamanlike activities.

David J. House.
1995

PREFACE TO SECOND EDITION

With increasing evidence of information technology changing all aspects of our day-to-day living it is not surprising that essential elements of navigation have also been considerably influenced. This edition endeavours to include an overview of some of the main changes occurring in the specific areas of electronics and the use of integrated bridge systems.

It would be a poor seaman who relies only on a primary position fixing system when a secondary system is also available. The visual fix should not be seen as obsolete neither should it be assumed that GPS, will always be there for the navigator. Instruments have a history of going 'off line', sometimes when the individual most needs them and the human faculties of eyes and ears of the lookout are not about to be traded for the safety of the vessel.

The text is compiled to introduce such developing areas as Electronic Chart Systems, Dynamic Positioning, and Differential Global Positioning Systems, to mention but three topics. Mariners and marine students should note it is not the authors intention to substitute theory for the practical usage of navigational instrumentation.

Good sailing,
David J. House.
1998.

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ABOUT THE AUTHOR

With this current publication of Navigation for Masters, David House is probably one of the most prolific marine authors of today. His sea-going history has been reflected within five marine publications since 1987, covering the wide aspects of general seamanship, marine safety and the ever growing use of helicopters within the maritime industry.

His early career provided wide experience of general cargo vessels, container ships, roll-on roll-off vessels, passenger liners, bulk and reefer cargoes together with periods aboard warships, in world wide trades. In 1982 he was influential in the development of the Fleetwood Offshore Survival Unit and this provided foundation for the writing of Marine Survival & Rescue Systems and the Introduction to Helicopter Operations at Sea.

He continues to lecture to senior marine students in all aspects of navigation and seamanship and his well illustrated books continue to remain in demand in most of the maritime nations. Marine training, especially youth training, has always been a major priority for him and it is anticipated that this most recent publication will reflect the need for safe navigation practice to be passed down to the next generation. There is a need for Masters both future and present to encourage our mariners in their endeavours. A need to develop power of command, and positive characteristics to ensure the safety of life at sea.

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INMARSAT — International Maritime Satellite Organization.

United States Coast Guard.

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ABBREVIATIONS & DEFINITIONS

ACSC	Australian Coastal Surveillance Centre.
ALL	Admiralty List of Lights.
ALRS	Admiralty List of Radio Signals.
ANTS	Automatic Navigation and Track keeping System. The name adopted by the Furuno Electric Company to describe its navigation system for use with integrated bridge design.
AMVER	Automated Mutual-assistance Vessel Rescue.
AR	Arrival Report.
ARCS	Admiralty Raster Chart Service — Upto 2500 electronic charts by the year end 1996. Together with an automatic updating system which reflects the Notice to Mariners system currently in use with paper charts.
	Admiralty Charts on CD-ROM.
ARPA	Automatic Radar Plotting Aids — A method of obtaining and displaying target data onto the radar screen. The advantage of ARPA is that multiple target information can automatically be acquired so relieving the observer of lengthy manual plotting techniques.
ATT	Admiralty Tide Tables.
AUSREP	Australian Ship Reporting System.
BBS	Bulletin Board System — A computer based information source operated for the general public by the United States Coast Guard Navigation Information Service.
C_b	Centre of Buoyancy.
CD	Compact Disc — At the time of publication the use of a compact disc as a means of establishing an acceptable chart correction system for Electronic Charts is highly probable.
CES	Coast Earth Station — term used with GMDSS communications.
Ch	Channel.
Changerep	Change Report.

CMG	Course made good.
CNIS	Channel Navigation Information Service.
Co	Course.
COG	Course over Ground a term generally employed, but used more so now with the advent of electronic chart systems.
COLREGS	Collision Regulations.
Comp	Complement.
Cos	Cosine.
Cot	Cotangent.
CPA	Closest Point of Approach. The term is used extensively when radar plotting.
CRS	Coast Radio Station.
CSP	Commencement of Search Pattern.
CSS	Co-ordinator Surface Search.
CW	Continuous Wave.
DEFREP	Defect Report.
Dep	Departure.
DF	Direction Finder — Radio bearing equipment. Included in the statutory navigation requirements for commercially operated vessels.
DGPS	Differential Global Positioning System. A highly accurate GPS fixing system which employs the known difference (error) between true position and the obtained GPS position. The error difference is then used to calibrate precise position information using the direct GPS signal and the differential data.
Dist	Distance.
D.Lat	Difference in Latitude.
D.Long	Difference in Longitude.
DMA	Defence Mapping Agency (US) — An American organisation which is responsible for broadcasting specialised and selective navigation information.
DMP	Difference in Meridional Parts.

DOD	Department of Defense (US).
DP	Dynamic Positioning — A position reference system employed to maintain station holding and heading.
DPO	Dynamic Positioning Officer — Watchkeeping officer designated as a DP controller.
DSC	Digital Selective Calling — A system which users digital codes which allows a radio station to communicate with another station or group of stations.
DSV	Diving Support Vessel.
EBM (EBI)	Electronic Bearing Marker as employed with marine radar.
EC	European Community.
ECDIS	Electronic Chart Display & Information Service. A complete electronic chart system and information Service coupled with an automatic chart updating procedure. Still in its development (1996) and can expect to be some years away from providing total world chart coverage. A vector based system with standards which are still under consideration by IMO & IHO. Mariners are warned that the system must be used with caution and at this present time it is not considered equivalent to a paper chart.
ECS	Electronic Chart System — several types are currently under manufacture but without an acceptable chart correction method. The ECDIS when fully developed would expect to gain world wide approval from such organisations as IMO.
ECTAB	Electronic Chart Table — optional accessory to the Kelvin Hughes Integrated Navigation System.
EGC	Enhanced Group Calling — a term used with GMDSS communications.
ENC	Defined as an Electronic Navigational Chart held in a machine-readable form.

EPIRB	Electronic Position Indicator Radio Beacon.
ETA	Estimated Time of Arrival.
ETD	Estimated Time of Departure.
Fin. Co.	Final Course.
GC	Great Circle.
GHA	Greenwich Hour Angle.
GHz	Gigahertz.
GMDSS	Global Maritime Distress & Safety System.
GMT	Greenwich Mean Time.
GPS	Global Positioning System — A satellite navigation method of fixing position either on land, at sea or in the air.
GRP	Glass Reinforced Plastic.
grt	Gross Registered Tonnage.
Hav	Haversine.
HDOP	Horizontal Dilution of Precision — an expression that reflects the continual movement of satellites and the effects on the crossing angles of the range circles of GPS navigation.
HMCG	Her Majesties Coast Guard.
HW	High Water.
ICS	International Chamber of Shipping.
IFR	Instrument Flying Rating.
IHO	International Hydrographic Organisation.
IMO	International Maritime Organisation.
INSPIRES	The Indian Ship Position & Information Reporting System.
Int. Co.	Initial Course.
kHz	Kilo Hertz.
L.A.T	Lowest Astronomical Tide.
Lat	Latitude.
LCD	Liquid Crystal Display — Electronic display screen widely used in various navigation instruments.

LHA	Local Hour Angle.
Long	Longitude.
LOP	Line of Position.
LUT	Local Users Terminal — Communication receiver terminal employed with GMDSS communications.
LW	Low Water.
MAREP	Marine Reporting System.
MERSAR	Merchant Vessel Search and Rescue Manual.
MHHW	Mean High High Water.
MHLW	Mean High Low Water.
MHW	Mean High Water.
MHWI	Mean High Water Interval.
MHz	Mega Hertz.
MLLW	Mean Low Low Water.
MLW	Mean Low Water.
'M' Notices	Merchant Shipping Notices.
MOB	Man Overboard — A control element fitted to most GPS units which allows the watch officer to obtain an immediate fix in an emergency. e.g. as in man overboard.
M.P's	Meridional Parts.
MSR	Mean Spring Range.
Nat.	Natural Logarithm.
NGS	National Geodetic Survey — A branch of the US National Ocean Service Administration. It is responsible for the supply of GPS orbit data via the NIS bulletin board.
NIS	Navigation Information Service — operated by the U.S.
NINUS	A Integrated Navigation System developed by Kelvin Hughes. NINAS for Nucleus Integrated Navigation System. Nucleus being a trade name for a sophisticated radar set.

NMA	Norwegian Mapping Agency — currently engaged in collaboration with the UK Hydrographic Office to produce a pilot service for an Electronic Navigational Chart.
NUC	Not Under Command.
OAB	Operational Advisory Broadcasts — A service provided by the USCG Navigation Information Service.
OOW	Officer of the Watch.
POSREP	Position Report.
PR	Position Report.
PRS (PR)	Position Reference System — employed with Dynamic Position operations.
RCC	Rescue Co-ordination Centre.
RNLI	Royal National Lifeboat Institution.
ROT	Rate of Turn.
ROV	Remotely Operated vehicle — employed as a diving/research vessel under water.
RPM	Revolutions per Minute.
R/T	Radio Telephone.
Rx	Receiver.
SA	Selective Availability — This is the option of the US Department of Defense to scramble GPS signals and alter positional accuracy of the GPS operation.
SAR	Search And Rescue.
SART	Search and Rescue Transponder — A radar activated transponder which provides positional indication on a radar display.
Sec	Secant.
S.E.S.	Ship Earth Station — term employed with GMDSS, communications.
Sin	Sine.
SMG	Speed made good.
SOG	Speed over Ground.

SP	Sailing Plan.
STOL	Short Take Off & Land.
Tan	Tangent.
TCPA	Time of Closest Point of Approach. A term used exclusively to radar plotting.
TRS	Tropical Revolving Storm.
T's & P's	Temporary & Preliminary Notices to Mariners.
TSS	Traffic Seperation Scheme.
UKC	Under Keel Clearance — that measurement obtained from the echo sounding machine.
UPS	Uninterrupted Power Supply — a means of continuous power guaranteed, over a limited period of time.
V/L	Vessel.
VDU	Visual Display Unit — used extensively with electronic data storage equipment.
VRM	Variable Range Marker. One of the range controls incorporated on a marine radar.
W/T	Wireless Telegraphy.
WGS	World Geodetic System, a datum reference.
WPT	Way Point. A term used when passage planning with an electronic chart. Usually defined as a point of course alteration, but not always so.
ZT	Zone Time.

LIST OF ILLUSTRATIONS

Chapter One

BRIDGE PROCEDURES

The Navigational Watch

It is in the interests of all persons at sea that the officer of the watch is accepted as the Master's representative and as such should carry the confidence of that Master to carry out relevant duties. It should be equally understood by that officer that the final responsibility of command rests with the Master and he should therefore not hesitate to call his superior in the event of any of the following: —

Calling the Master (by the OOW)

1. If restricted visibility is encountered or expected.
2. If traffic conditions or the movements of other ships are causing concern.
3. If difficulty is experienced in maintaining a course.
4. On failure to sight land, a navigation mark or to obtain soundings by the expected time.
5. If unexpectedly, land or a navigational mark is sighted or a change in soundings occurs.
6. On the breakdown of engines, steering gear or any essential navigational equipment.

7. If heavy weather is encountered, or if in doubt about the possibility of weather damage being expected.
8. If the ship meets any hazard to navigation such as ice, derelict or in receipt of a distress signal.
9. In any other emergency or situation in which he is in doubt.

Standing Orders

Many companies operate their ships under a comprehensive set of 'standing orders' or 'company instructions'. These tend to define and expand on the duties of individuals such as chief officers responsibilities, or the general duties of junior officers.

The Masters standing orders, are specifically for the well being of the ship to cover any eventuality to maintain the safety of the vessel. The standing orders would cover periods when the master might be temporarily indisposed, and be such to allow time for the Master to gain the 'con' of the vessel.

Standing orders are not designed to impose limitations on the duty officer, rather to increase responsibility, and provide positive direction in the Masters absence. They should be clearly understood by the officer of the watch (OOW) and the Master is obliged to satisfy himself that all his officers are aware of the content of the same. (Usually by OOW's reading and signing).

Bridge Procedures

Duties of the Officer of the Watch

He is primarily the Master's representative and as such is directly concerned with the safe navigation of the vessel. He should subsequently maintain an effective and efficient lookout from the bridge position, and ensure that the vessel complies with the "Regulations for the Prevention of Collision at Sea".

The officer of the watch will continue to be responsible for the ships well being, despite the presence of the Master on the

bridge, unless the Master specifically accepts the 'con' of the vessel. During the continuation of his duties the OOW will have the authority to use all navigation equipment including sound signal equipment, whenever he deems necessary, so as not to stand the vessel into danger. In a similar manner he will also be required to adjust the ships speed as and when this is required. Main engine status will be at the direct order of the OOW and he should be aware of any condition of readiness required by engine room personnel. He should also ensure that he is familiar with the stopping distance of the vessel, at various speeds, and the manoeuvring characteristics.

The officer of the watch should be positive in his decisions, and not hesitate to employ any of the above mentioned features. Neither should he hesitate to call additional watch keeping personnel, or his superiors should the need arise, at any time during the day or night time periods.

Watch Change Over

The relieving officer of the watch should ensure that:—

1. The members of the watch are fully capable of performing their duties, and not impaired by, drugs, alcohol, or sickness.
2. His vision has adjusted to the prevailing conditions.
3. He is satisfied with any 'standing orders' or specific, 'night orders' left by the ships Master.
4. The position of the vessel, the course and speed, and where appropriate, the draught of the ship are correct.
5. He is familiar with predicted tides and currents, weather reports, visibility state and their subsequent effect on navigation.
6. The navigational situation regarding the performance of gyroscopic and magnetic compasses together with any errors is in order.
7. All essential navigation equipment is performing in a correct manner.

8. Respective traffic and other vessels movements will not endanger the vessel.
9. Clarity in advance of any navigational hazards that might be anticipated are duly noted.
10. The effects of heel, trim or squat will not effect the under-water keel clearance of the vessel.

Officer of the Watch — Being Relieved

Many ships Masters and shipping companies are quite specific regarding instructions and guidance towards the duties of ships officers. However, one area is often overlooked and this involves a watch officer who is being relieved. As with any change over of watch personnel, this is a critical period not only for the officer taking up the watch, but also for the officer who is duly handing on the responsibility.

Relief of the watch should not be carried out while an ongoing manoeuvre is being exercised or where detailed navigational operations are being activated. Any relief of the watch which coincides with a bridge operation should be deferred until the activity is complete.

The watch officer should not attempt to hand the watch over, if he has reason to believe that an officer taking the watch has a disability, for what ever reason. If the watch officer is in any doubt as to the capabilities of his relief he should always inform the Master and remain on station until relieved by the Master, or his designated representative. The correct details and timings of reliefs should be noted in the log book.

Once so relieved, the officer leaving his bridge station should complete log books and administration duties after his watch period is complete. Many shipping companies would also expect that officer to carry out 'ships rounds' on departure from the bridge to ensure that no potential hazards such as fire or security breach is present on board the vessel.

Bridge Procedure: Anchoring and Anchor Watch

1. The officer of the watch should advise the Master of the probable anchoring time together with an ETA for that time when engine status will go to 'stand-by'.
2. The engine room should be advised well in advance of the potential time of 'stand-by'.
3. An anchor plan should be prepared.
4. Speed should be reduced in plenty of time prior to the approach to the anchorage site.
5. Anchors should be made ready for letting go or walking back, together with the respective day or night anchor signals.
6. Account should be taken of the strength and direction of: wind, tide and currents.
7. Account should be made for adequate sea room, especially if other vessels are anchored at the same anchorage.
8. Anchor party should be standing by in ample time prior to the use of anchors and cables.
9. Anchor watches should be set to provide security.
10. The anchored position for the vessel should be ascertained by visual anchor bearings and verified by alternative means at regular intervals.
11. The position of the anchor should be recorded together with the amount of cable paid out.
12. A radio VHF listening watch should be maintained.
13. The weather should be monitored closely, and any changes should be communicated to the Master.
14. Engine room should be informed of the status of the vessel. (Main engines should not be rung-off when the vessel is at anchor, status should be one of immediate readiness and to this end the telegraph should be left at 'stop' engines, not 'finished with engines')
15. A deck watch should be maintained to ensure ships security, especially in certain regions where anchored vessels are considered, 'soft targets' for pirates.

The anchor plan should be comprehensive and include a detailed chart assessment and relevant inspection of appropriate publications, i.e. sailing directions.

It would be anticipated that the Master and the anchoring officer, would obtain details regarding depth of water and holding ground at the required position of anchoring. Any rise and fall in the tide should also be noted and account taken for this in the amount of cable that is initially paid out.

Close inspection should be made for underwater obstructions or hazards such as undersea pipelines or cables. Surface obstructions may also give rise for concern when taking into account swinging room of the vessel.

Bridge Emergencies – OOW Actions

Main Engine Failure

In the event of a main engine failure emergency services will be activated, although a short delay must be anticipated in the majority of ships before these become operational. The Master should be informed at the earliest possible time of the reason and kept updated with regard to state of repairs.

With regard to the ship handling possibilities following loss of power immediate actions by the officer of the watch could be extremely beneficial, depending on the ships position, geography and of course the prevailing weather at the time. It may be possible to maximise the use of 'Headreach' that the vessel will carry prior to the ship stopping in the water. Alternatively the use of anchors if navigating in appropriate depths may also be a prudent action. Deep water anchoring may become a viable option to prevent drift towards a lee shore for instance.

In any event 'not under command' signals/lights should be displayed and depending on circumstances an 'urgency signal' may also be a necessity. Without doubt the Master will call for an assessment of the situation regarding state of repairs and

future actions will depend greatly on what can and cannot be carried out by way of repairs. The use of a 'tug' may become a consideration.

A position should be placed on the chart and the rate of drift established. This may not be an easy task for watch officers who could well be left without instruments and out of sight of visual targets.

Steering Gear Failure

If steering gear fails, the OOW should immediately engage alternative emergency steering gear. The engine room should be informed and the Master informed of the situation. The watch officer should exhibit 'Not Under Command' signals/lights and if appropriate sound signals "D" or "U" to warn other shipping of the vessels predicament.

In the event of emergency and auxiliary steering systems being lost, the vessel would most certainly be stopped. In this situation a navigation warning and/or report may become necessary, depending on ships position, e.g. TSS, English Channel.

Compass Failure

If the ships gyroscopic compass became unreliable this would normally be noticed instantly by the 'off course alarm' being activated. The officer of the watch would engage manual steering and adopt steering by use of the magnetic compass.

The Master would be informed and an inspection of the gyro compass by either the navigation officer or the electrical officer would be an expected line of action.

The loss of the gyroscopic compass could well have a detrimental effect on other navigational instruments, such as radars which may be 'gyro-stabilised' and automatic steering, off course alarms etc.

Associated Shipboard Emergencies – Bridge Reactions

Bridge Informed of Fire

The officer of the watch will immediately raise the alarm and emergency stations would expect to be manned. The engine room would be placed on 'stand-by' status and the Master would be informed of all known details including the location of fire.

The OOW would be expected to carry out specific duties, dependent on the type of vessel involved:

1. Automatic closure of all fire doors can often be activated from the bridge. If this can be done it should be.
2. Ventilation and/or cargo fans are also sometimes controlled from the bridge or from a localised station. These should be shut down as soon as possible.
3. In all cases the course of the ship should be altered in conjunction with the wind, to reduced forced draft within the confines of the vessel.
4. The ships position should be plotted and made available to the communications officer prior to transmission of an 'urgency signal'.
5. The bridge watch and the monitoring of other traffic should be continued throughout and if appropriate, 'deck lighting' may be switched on.
6. N.U.C. lights/shapes would be displayed.

Bridge Informed of Flooding

Although unusual in its own right, the possibility of underwater damage and subsequent flooding is always present in the marine environment. However, it is more common following a collision incident. In many cases the emergency alarm may have already been sounded for an associated incident, but in the event no alarm has been activated, watch officers should immediately activate the 'general alarm signal'.

Additional actions will include: —

1. Closing of all watertight doors.
2. Inform the Master and update on the situation.
3. Engine room informed and respective pumps activated.
4. Position of vessel charted and made available for radio dispatch by communications officer.
5. Following damage assessment an 'urgency' or 'distress' signal may become necessary.
6. N.U.C. signals may be appropriate.

Man Overboard

In any incident where a man is overside the immediate tendency is for the ship to return to the datum position by one of the several manoeuvres considered appropriate, i.e. Williamson turn, single delayed turn, elliptical turn or short round. Usually initiated when the man is seen to fall, and the subsequent alarm raised simultaneously.

With any situation where the vessel is turned through 180° while at full sea speed, there is bound to be a subsequent decrease in the overall speed. In some cases the watch officer could expect a reduction of up to about 30% depending on sea state and weather conditions. The time factor to complete the turn will vary but it could be assumed that the OOW, would place main engines on a stand-by status and subsequently reduce approach speed to suit rescue boat launch and/or recovery, during the interim period.

In the event that the casualty is not found the MERSAR manual recommends that a sector search pattern is employed. However, the time factor for the man in the water is critical and any search pattern should reflect a small track space 'leg length'. If the speed of the vessel is also considered while the search is ongoing (probably about 3 knots) then the reason for short leg lengths is directly related to the well being of the casualty. When conducting a sector search, Masters may

well consider leg length in time as opposed to distance, e.g. 10 minutes away from datum at any one time.

Bridge Procedure

From the onset of the incident masters should ensure that the bridge is placed on alert operational status and the following actions take place: —

Assuming the alarm has been sounded, the helm has been applied to clear the propeller from the casualty, that engine room has been placed on stand-by and the bridge wing lifebuoy has been released.

1. Con of ship to be maintained and manoeuvre completed.
2. Manual steering to be engaged.
3. Datum position plotted and relevant search pattern laid on the chart.
4. Ships position to be monitored continually.
5. Lookouts strategically posted high and forward.
6. Communications established with coast radio station. Urgency message and/or distress, if required.
7. Local signals made to inform other shipping in the area: 'O' flag displayed and sounded on whistle.
8. Rescue boat turned out and made ready for immediate launch.
9. Hospital made ready to treat for shock and hypothermia.
10. Obtain updated weather report.

Standing Orders Example

1. For a vessel passing through an area of expected 'ice concentration'.

   (a) Call the Master as per company 'standing orders' or if in any doubt or other emergency situation.
   (b) A continuous lookout is to be maintained by the OOW and two lookout personnel from:

   (i) The forecastle head.
   (ii) Crows nest (or other appropriate high point). 'Monkey Island'.
   (c) Radar should be continually monitored at peak performance (Radar alone should not be solely relied upon).
   (d) Weather conditions should be monitored throughout watches.
   (e) Call the Master in the event of restricted visibility below 3 miles, and place the engines on stand-by.
   (f) Call the Master if any ice fragments or ice concentrations are sighted.
   (g) On sighting ice the vessels course should be altered to pass well clear of any danger zone.
   (h) A description and position of any ice sightings should be noted and the Master informed, immediately.

2. For a vessel navigating under a pilots advice.

   (a) The officer of the watch is and will remain the Masters representative throughout any period of pilotage.
   (b) The OOW should call the Master if in any doubt or if he requires verification on any aspect of the vessels safe navigation.
   (c) The OOW will at no time leave the bridge while under pilotage conditions unless relieved by the Master or his designated representative.
   (d) The Master should be kept informed of all communication check points and reporting stations.
   (e) Manual steering will be maintained throughout all pilotage periods.
   (f) An effective lookout will be maintained throughout the pilotage.
   (g) The vessel should be allowed to proceed at a safe speed throughout pilotage waters.
   (h) The OOW will monitor the vessel's position, communications and the weather conditions throughout and not stand the vessel into danger.

3. For Navigation in Restricted Visibility.

(a) Reduce the vessels speed in accordance with the Regulations for the Prevention of Collision at Sea, and appropriate to the prevailing conditions.
(b) Radar(s) should be operational and systematic plotting of all targets commenced.
(c) The Master should be informed of the state of visibility as soon as deterioration is expected or as soon as possible after reduced visibility is encountered.
(d) The prescribed fog signals will be sounded in accord with the regulations.
(e) Manual steering should be engaged.
(f) Engine room must be informed as to the state of visibility and manoeuvring speed maintained until conditions have improved.
(g) VHF, listening watch maintained.
(h) Lookouts will be posted in addition to the normal watch.
(i) Navigation lights will be switched on throughout any period of impaired visibility.
(j) Water tight doors should be closed.
(k) A contingency plan should be considered where appropriate, i.e. Anchoring.
(l) Echo sounder should be employed where appropriate.

Additionally: —

The position of the vessel should be monitored closely, if this is possible.

Watchkeeping staff should be increased in numbers when a continuous radar watch or specific duties require the need of double watch keepers.

NAVIGATION IN FOG

Every mariner is ever wary of reduced visibility conditions and the associated dangers of 'fog'. Obviously certain geographic

areas are well known for poor visibility in certain seasons and these are well publicised in the climatic chartlets within the 'Mariners' Handbook'. However, the realisation that fog could be, and is, encountered virtually anywhere world wide, is of concern to all at sea.

There are several different types of fog which may be encountered within the marine environment:

Fog and Mist
Fog is of greater intensity than mist. Although both contain visible quantities of water vapour, fog most certainly impedes navigation. Usual occurrence is when winds are light, the temperature is low and the barometer is high.

Sea Fog
This is normally formed by a warm wind passing over relatively colder water. This causes moisture in the air to be condensed and turn to visible water vapour. It is often low lying and would obscure most targets to the naked eye. Large, high freeboard vessels may have masts and upper superstructure projecting above the fog bank.
Alternatively, a cold wind which passes over warmer water, may cause the relatively warm moisture rising from the surface to be chilled, and a fog bank of considerable height could be formed. Sea fog may also be encountered where warm and cold ocean currents join.

Coast Fog
Often caused by cold air moving into an area after a period of warm weather. Alternatively, a warm air current after a cold spell.

Haze
Numerous dry particles suspended in the atmosphere. Particles are invisible to the naked eye but when encountered they may collectively reduce visibility up to about 1 kilometre.

Visible detection of vessels at night will be influenced by the prevailing conditions. Navigation lights will suffer from some

dispersion effects from fog. White lights may appear with a reddish effect in fog. Red rays have greater penetration than green rays and hence red lights could expect to be seen before green lights. Clear glass will absorb less light than a red glass and consequently a white light will be seen further than a red light. (By the same reasoning a red light will be seen further than a green light)

The quality of air can also be expected to influence the detection ranges of ships' lights. If the atmosphere is heavy in moisture content and/or dust particles their presence will cause light rays to be:

— reflected and scattered by dust particles
— refracted by moisture particles

Navigation Precautions

Proximity of Heavy Weather/Storm Conditions

Every Master on receiving a heavy weather report will attempt to re-route and avoid the storm vicinity, if at all possible. On the basis that avoidance is not possible then early deck preparations by way of securing would be in the interests of good seamanship.

With regard to the navigation of the vessel, all departments should be informed of impending heavy weather, and in particular the engine room should be advised of a time to go to 'stand-by' status. The communications officer should obtain updates on current weather reports while the navigator would be expected to plot and project the storms position and track.

It is prudent action to reduce speed in plenty of time to avoid structural stress on the vessel. Heavy rolling can be relieved by an alteration of course while the adjustment of speed will reduce pounding effects. If progress is effected to such an extent that the vessel would sustain damage to either the hull or to cargo the only remaining options would be to either 'heave to' or

turn and run before the wind for the lee of any available land mass.

The option of 'heaving to' will delay the vessel for an indefinite period. However, the vessel is less likely to sustain damage to herself or cargo. The ships head should be set to a heading relative to the wind at which experience will show the vessel to ride easy. As the wind backs or veers the heading would need to be adjusted. Reduce revolutions in order to maintain steerage while the ship is in this position.

The alternative option of seeking the 'lee of the land' is widely used in coastal regions and of course is not readily available to vessels in open sea conditions. Where high cliff shorelines or coastal mountain ranges are present Masters would be well advised to run for the 'lee of the land'. Fuel consumption could be increased and the time factor may effect sensitive cargoes. These would have to be judged against possible ship/cargo damage.

The mariner should be aware of all the above as being viable options if directly involved with heavy weather. Far better though, is not to get involved in the first place. The obvious options prior to departure should involve seeking out the most detailed weather information and if appropriate taking advantage of Metrouting Systems (Ref. Chapter 5).

N.B. Nautical literature expands the possibility of going to anchor in bad weather, as being an alternative. The author agrees with this only when combined with the 'lee of the land' option, as mentioned above. It is clear that the depth of water or the geography, will not always suit the use of anchors.

The dangers of a wind change, with anchors down, and being caught on a lee shore, is an experience that Masters could well do without. In general the author would suggest that most mariners would prefer open sea conditions to being handicapped by several tonnes of anchors and cables limiting a vessels movement.

DEPARTMENT OF TRANSPORT MERCHANT SHIPPING NOTICE NO. M.1263

NAVIGATIONAL WATCHKEEPING: KEEPING A LOOK-OUT

Notice to Shipowners. Ship Operators, Masters, Deck Officers and Seamen

1. The Department has received reports that some ships are navigating during the hours of darkness without a look-out posted in addition to the officer of the watch.

2. This practice is contrary to the requirements of the International Standards of Training, Certification and Watchkeeping Convention 1978, to which the United Kingdom is a party. The watchkeeping requirements of this Convention are applied to sea-going UK ships (other than fishing vessels and pleasure craft) by means of the Merchant Shipping (Certification and Watchkeeping) Regulations 1982. Paragraph 6 of Schedule 1 to these Regulations requires a look-out to be posted in addition to the officer of the watch during the hours of darkness. A look-out should also be posted at any other time during restricted visibility or when the prevailing circumstances indicate such action is desirable in the interests of safety. The contents of this paragraph are reproduced in the Appendix to this Notice.

3. The master of a ship who contravenes any of the watchkeeping requirements specified in the Certification and Watchkeeping Regulations or the requirement to keep a look-out in accordance with Rule 5 of the Prevention of Collisions Regulations is guilty of an offence and liable on Conviction to a penalty.

Department of Transport
Marine Directorate
London WC1V 6LP
December 1986

APPENDIX

EXTRACT FROM SCHEDULE I TO THE MERCHANT SHIPPING (CERTIFICATION AND WATCHKEEPING) REGULATIONS 1982

6. Look-out

In addition to maintaining a proper look-out for the purpose of fully appraising the situation and the risk of collision, stranding and other dangers to navigation, the duties of the look-out shall include the detection of ships or aircraft in distress, shipwrecked persons, wrecks and debris. In maintaining look-out the following shall he observed:

(a) the look-out must be able to give full attention to the keeping of a proper look-out and no other duties shall be undertaken or assigned which could interfere with that task;

(b) the duties of the look-out and helmsman are separate and the helmsman shall not be considered to be the look-out while steering, except in small ships where an unobstructed all round view is provided at the steering position and there is no impairment of night vision or other impediment to the keeping of a proper look-out. The officer in charge of the watch may be the sole look-out in daylight provided that on each such occasion:

(i) the situation has been carefully assessed and it has been established without doubt that it is safe to do so;

(ii) full account has been taken of all relevant factors including, but not limited to:
state of weather
visibility
traffic density
proximity of danger to navigation
the attention necessary when navigating in or near traffic separation schemes;

(iii) assistance is immediately available to be summoned to the bridge when any change in the situation so requires.

Watchkeeping and Special Traffic

Specialist Craft to be Given a Wide Berth

(Ref: to the Regulations for the Prevention of Collision at Sea)

Masters and watch officers are advised that certain types of vessels and marine activities warrant being given a wide berth. Recognition of these specialist activities is generally not a major problem for the experienced watch keeper, however, the action taken to avoid them is often observed to be inadequate depending on the circumstances and could also involve the vessel in either another close quarters situation or bring the vessel into areas of additional navigational hazards.

Special attention should be given to the following types of craft and their associated activities:

Surveying Ships

As defined by Rule 3(g) ii, will exhibit restricted in ability to manoeuvre lights and shapes described in Rule 27(b). These

vessels may also show the signal 'IR' signifying that they are engaged in submarine survey work or other underwater operations. Vessels are advised to keep clear at slow speed.

The clearance on these vessels is established by the direction in Rule 16, however, the nature of the activity could well involve the towing of instruments at an undefined distance astern. An example of this may be experienced with vessels engaged in seismic surveys where cables up to 2 miles long may be being towed. These cables could very well be submerged with the end being marked by a tail buoy and/or radar reflector.

Survey Craft.

Navigational warnings normally accompany such operations, especially in areas of heavy traffic or in known shipping lanes. Use of VHF may also be restricted by these survey craft which

tends to make acceptable communications difficult. Use of international code and light communication can therefore be considered as viable alternatives.

Depending on the actual operation that the vessel is engaged in, could well dictate the level of manoeuvrability, stopping distance, and turning capability that is available to the craft. Action by the give way vessel should therefore take these facts into consideration when taking avoiding action. These vessels by the very nature of their employment could well be encountered in any region, often with no previous warning. Early action, which must be substantial, is strongly recommended in order to pass an absolute minimum of 2 miles clear of the operational craft.

Additionally, some activities may involve the use of 'air' or 'gas' explosions in the proximity of operations and small launch or boat activity may be featured. Watch officers should maintain an effective and all round lookout and brief lookouts accordingly.

Mine Clearance Vessels

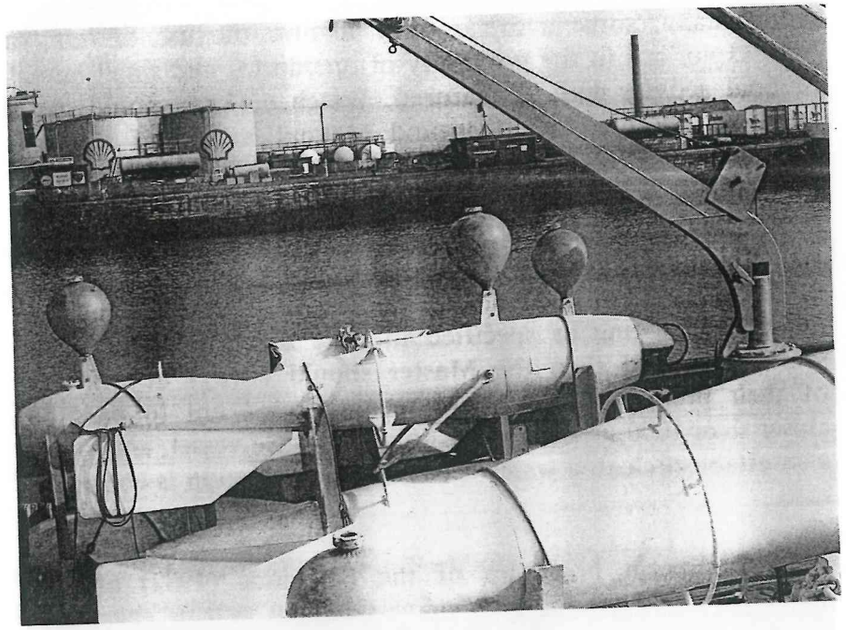
As defined by Rule 3(g)v, is classed as being within the category of being restricted in ability to manoeuvre. The day signal and night signal being as specified in Rule 27(f). If these vessels are encountered then the Master should always be informed of their presence. Vessels are recommended not to pass any closer than 1000 metres of the mine clearance vessel, and should also establish cleared water areas where navigation is considered safe.

With the recent hostilities of the Falklands (1982) and the Gulf War (1991) these types of vessels may well be engaged in actual operations of clearing live mines. In which case communications with the minehunter to obtain known limits of danger zones and to obtain the current situation regarding navigable waters is essential.

Whether the vessel is engaged in exercise or in actual mine clearance will not alter the recommended clearance of 1000

metres. The circumstances and conditions could well dictate that the vessels who encounter these warships may have to alter their intended tracks considerably, in the light of known hazards to be in the area.

The activities of mine clearance operations can be varied depending on the types of mines being cleared. Small boats could well be within the operational area and in the general vicinity and watch officers are advised to maintain effective and all round lookout by all available means. Boats may display flag 'A' or a rigid replica of the same and the speed of through vessels should be adjusted to take account of the use of divers below the surface. If at night morse 'A' may be flashed to approaching vessels.



Surface floats used for mine clearance activities.

Mine clearance vessels are often constructed in wood or glass-reinforced plastic (GRP). It is unlikely that they would not be detected by radar, but the echo return, depending on the aspect of the vessel, could very well be diminished. Overall size of

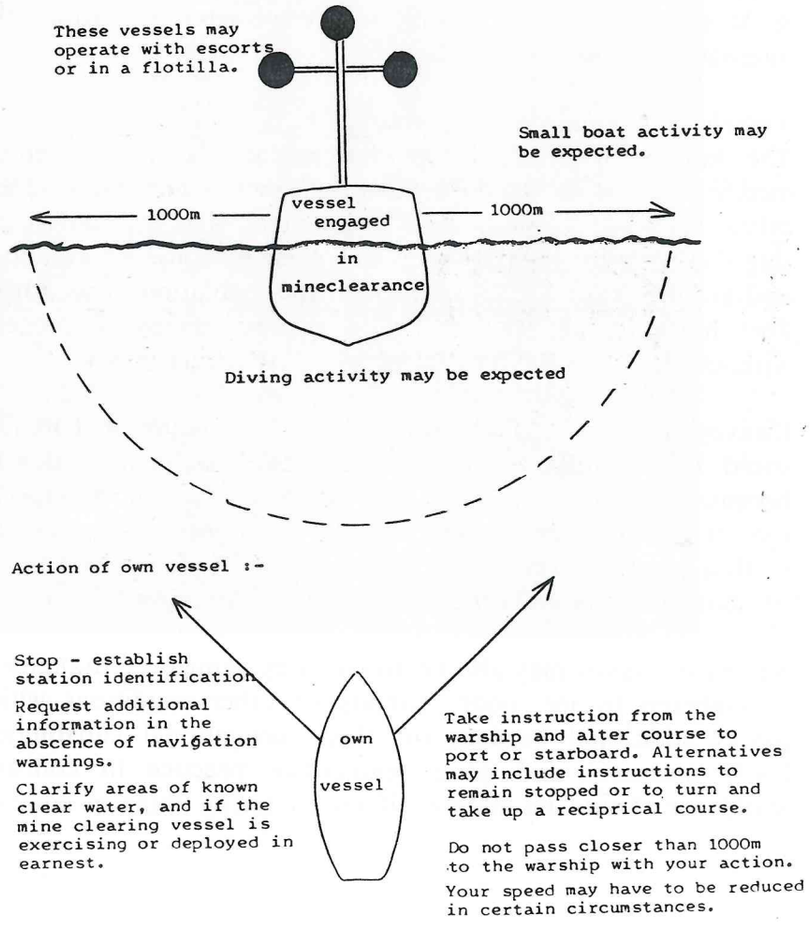
the target is approximately 50 metres in length, of about 400 tonnes displacement. Speeds average 15 knots when not actively engaged.

As with many warships, they may not be working alone. Joint operations or working with escorts is not unusual. Helicopter activity may also be present in and around the area of operation.

Mine Clearance — Situation

Day signal : Three black balls in place of three all round green lights.

Night signal : All round green lights displayed in a triangle in addition to the lights of a power driven vessel.



Vessels Undergoing Trials

New tonnage or vessels which have received structural alterations may be encountered undergoing trials for 'turning circles' or 'speed' capabilities. In many cases they will be in a 'light' condition of loading, which can render them high out of the water. This overall condition could effect the disposition of navigation lights visible to an approaching vessel. Also they may make abrupt sharp angled turns 180° or more for no apparent reason. A wide berth to these vessels is recommended so as not to interfere with their course runs or impede their trials.

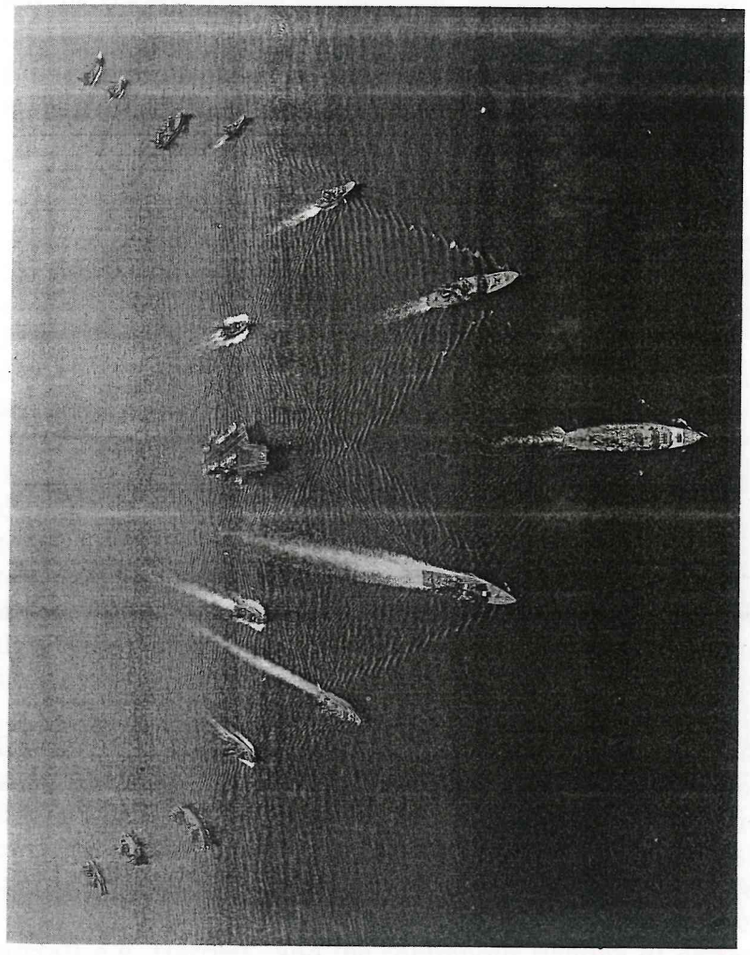
Vessels so engaged are normally encountered in open waters clear of navigational obstructions, or in waters which are in close proximity to ship building centres, e.g. Belfast/Harland & Wolf — Irish Sea region. These vessels may show the international code signal 'SM'

Vessels in Formation or Convoy

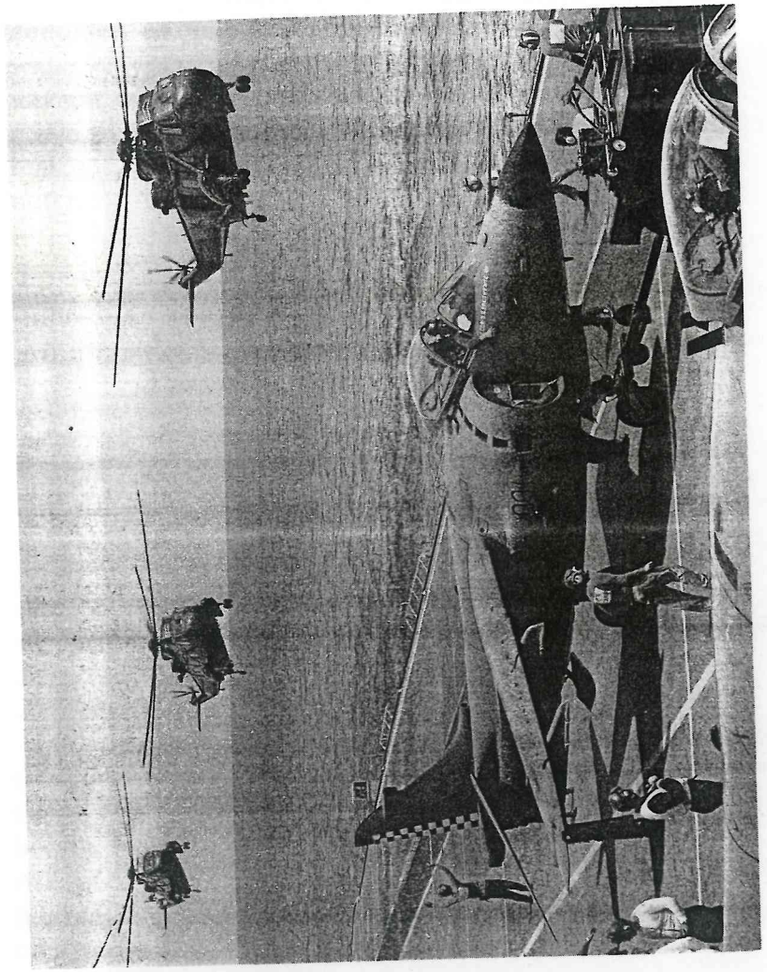
The dangers of a single ship approaching a convoy of either merchant ships or warships should be noted and early action taken to avoid close quarter encounters. General advice to single ships is for them to keep well clear of convoy formations and avoid passing ahead or through the formation. This advice does however, not give the right of the convoy to proceed without regard to the movement of approaching vessels.

Convoy formations if encountered are proceeding at a limited speed, usually relative to the slowest vessel in the formation or because of overall conditions, i.e. heavy ice concentration. The risk of collision within and between the vessels in the convoy is always present and would not be helped by close navigation of another single vessel approaching the formation.

Vessels in convoy may also be impaired by being deep draughted, encumbered by ice, poor visibility or other conditions which places additional burdens on their navigational capabilities. Early measures and good seamanlike practice in collision avoidance should be adopted if encountering ships in convoy.



Warships in formation — Conventional aircraft carrier with angled flight deck. Escorts widespread with aircraft photographic cover.



Launching & Recovery of aircraft — Fixed wing and rotary winged aircraft.

Vessels Engaged in the Launching or Recovery of Aircraft

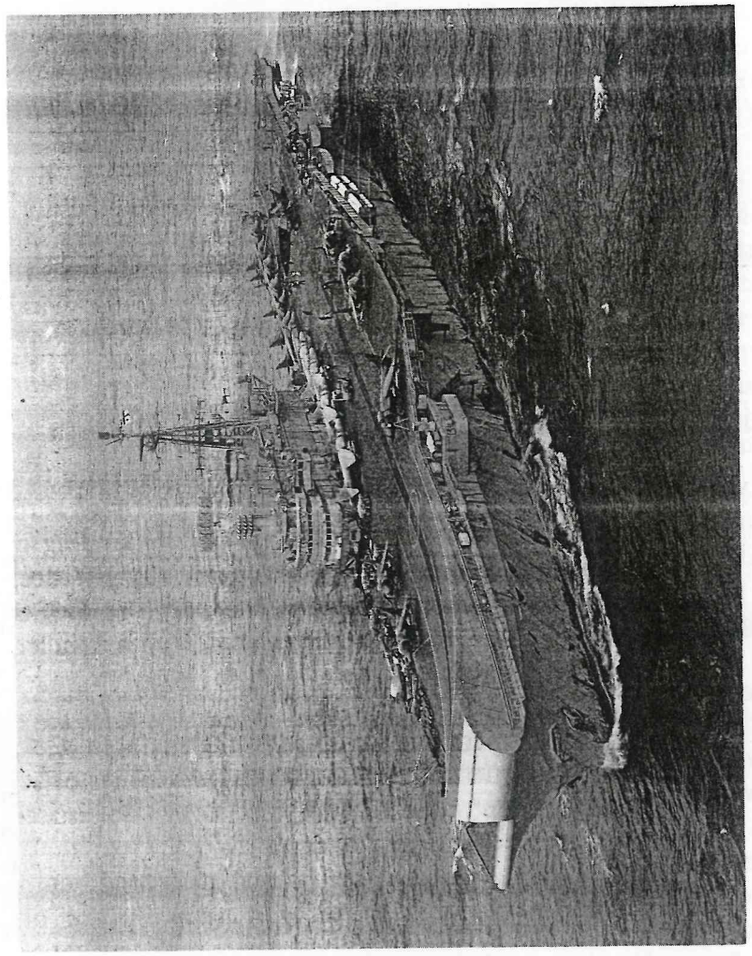
As defined by the regulations, Rule 3(g)iv. this class of vessel has in the past been predominantly warships. However, with the extensive offshore developments world wide and greater personal wealth, many types of the larger private yachts as well as offshore work boats are being fitted with helicopter facilities.

The increased use of the helicopter for pilotage transfer, or as an ambulance service within the marine environment continues to grow and will subsequently bring more types of vessels into this category. The courses set by these vessels when engaged with aircraft is often predetermined by the direction of the wind. Rotary winged aircraft as well as fixed winged, always take account of wind force and direction when engaged in marine activities.

The vessels should display the lights or shapes to indicate that they are restricted in their ability to manoeuvre but may additionally show extensive deck lighting at night during landing or take off periods. Some commercial vessels especially the deep draughted tanker or the larger passenger liner, by the fact of their size may require more sea room compared with a smaller, shallow draught inshore craft.

Conventional aircraft carriers and those with angled flight decks are well known to have their navigation lights sometimes offset from the fore and aft centreline of the ship. Other designated carriers are now fitted with through decks to facilitate short-take-off-and-land (STOL) or the 'ski jump' launching ramp. These carriers could well be engaged with vertical take off aircraft e.g. Harriers, and the continuous sighting of navigation lights may be impaired.

Large capital ships like aircraft carriers are usually escorted by one or more smaller faster moving ships, which are meant to provide a protective shield around the carrier. Helicopter and submarine activity could also be prominent in the area of the carrier. Support vessels may also be in attendance.



Conventional aircraft carrier at sea. NB "Ski Jump" launch ramp.

Ships meeting vessels engaged in aircraft operations should provide a wide berth to them and take substantial and early action so as not to encroach on their activities. Commercial vessels navigating to close to warships can expect to be monitored by either surface escorts or helicopters and maybe challenged.

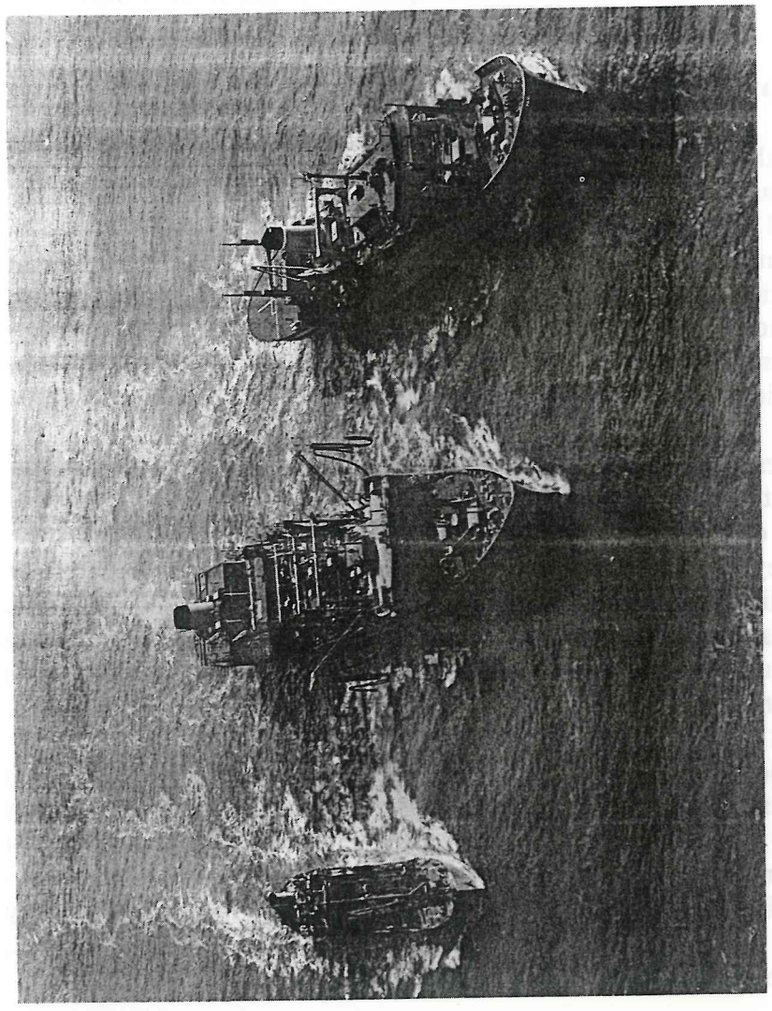
Hovercraft and Hydrofoils

High speed, 'air cushion craft or 'hydrofoil' craft have increased their numbers considerably in many areas of the globe and can be expected to be encountered at any time by ocean going commercial vessels. Although operating at high speeds, sometimes up to 80 knots they are extremely vulnerable to wind effects. The leeway that they experience may sometimes present a misleading picture to watch officers, giving a false indication of the actual direction of travel.

These vessels all comply with the Regulations for the Prevention of Collision at Sea, whether they are operating in the air cushion mode or only partly airborne or fully waterborne. They are also required to exhibit a yellow flashing light in addition to the normal lights shown by a power driven vessel. This light will operate at 120 or more flashes per minute. (it should not be confused with similar lights exhibited by some submarines).

Other vessels meeting these type of craft should be aware that their operation is accompanied by considerable noise levels and as a result sound signals made by either vessel may not be readily heard. Also, because of their construction, the disposition of navigation lights may not always be as specified by the regulations. The positioning of lights should be, however, as near as practical to what the regulations specify.

Popular areas of navigable waters where these vessels are regularly known to operate are as follows: English Channel British/French Ports, Florida Coast/Bahamas, Malta/Gozo Islands, Mediterranean Sea, Thames Estuary/European Continent.



Royal Fleet Auxiliary vessels engaged in replenishment at sea.

Ships Engaged in Replenishment at Sea

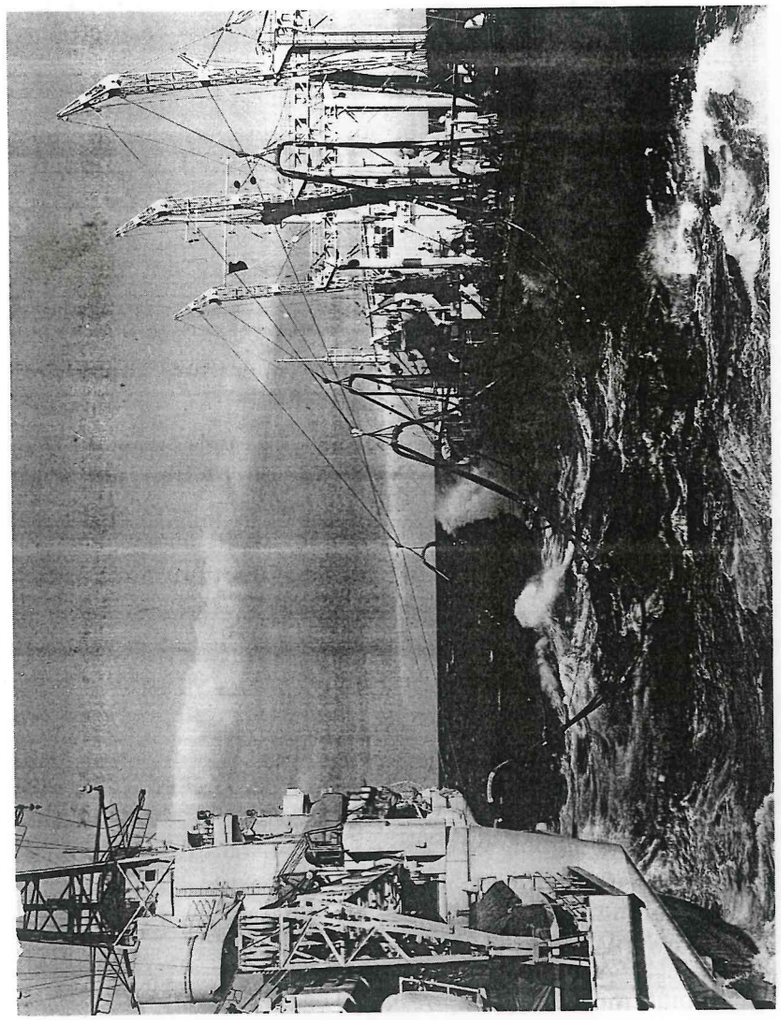
As defined by Rule 3(g) iii, vessels engaged in replenishment are usually warships being re-supplied by auxiliaries. The vessels will all show the lights and shapes as for vessels restricted in their ability to manoeuvre.

By the very nature of the operation the ships will be in close proximity to each other and will be interconnected by jackstays and possible hoses. They may appear as a single target on radar screens, depending on the aspect. Visually, one vessel may obscure the other and the two targets may not be easily discernible.

All other vessels which encounter this operation should be aware that high levels of ship handling and station holding are required by the participants. In any 'pacing' operation of this or other similar nature, the dangers of interaction are ever present. Consequently other traffic should keep well clear in accordance with Rule 18. Early action to avoid close quarters would reduce any possibility of causing disruption to such operations.

Submarine

Submarine activity may not always be readily apparent but on occasions can be noted by escorting vessel's showing the International Code signal 'NE 2' . All ships sighting this signal are advised to keep a sharp lookout and provide a wide berth to them. If submarines are sighted on the surface the navigation lights are placed well forward and low over the water and may present themselves in an unusual configuration. Stern lights of submarines are exceptionally low and may often be obscured by sea surface conditions, or spray. Additionally, some submarines are fitted with a 'yellow flashing light' flashing at the rate of 90 flashes per minute, (not to be confused with yellow lights on hovercraft). Certain submarines of various navies may carry similar distinctive lights:



Sea state observed between vessels engaged in replenishment.

Royal Navy Submarines	.....	Amber flashing light 90–150 per min.
Danish Submarines	.....	Blue flashing light 105 fl. per min.

These additional lights are meant to indicate to approaching vessels the need for extra caution.

Submarines may have cause or reason to use smoke candles or similar pyrotechnics as described in the Annual Summary of Notices to Mariners.

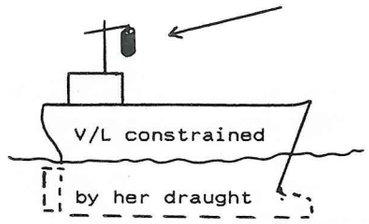
NB Special instructions effect mariners who encounter submarines in difficulty beneath the surface.

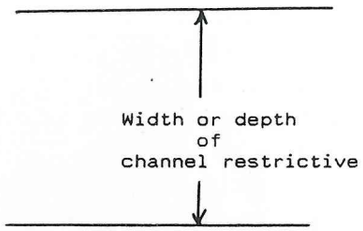
Vessels Constrained by their Draught

(in relation to the available depth and width of navigable water)

As defined by Rule 3(h) of the regulations will display the lights or shapes as described in Rule 23 and Rule 28. The attention of mariners is drawn to recent amendments to the regulations which directly effect the action by vessels meeting a ship which is constrained in this manner. Amendments which came into force in November 1989, concern Rule 8(f) which directs vessels in their actions when required not to impede the passage or safe passage of another vessel.

Night signal: 3 red lights in a vertical line.
Day signal: a black cylinder where it can best be seen.



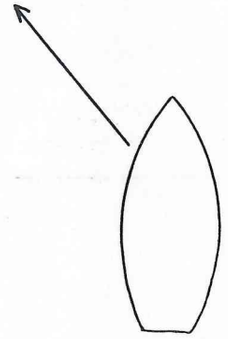


Action: Own vessel should avoiding impeding the vessel constrained by her draught.

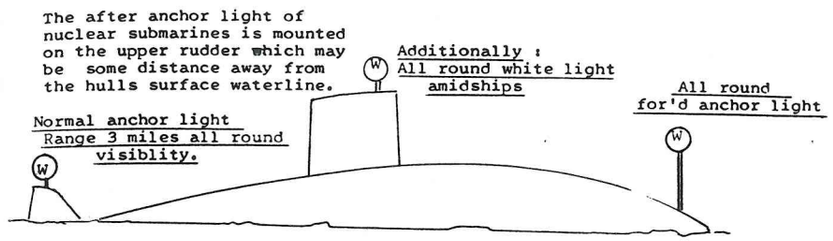
Reduce speed in ample time and allow the constrained vessel to pass ahead

NB The vessel constrained by her draught remains the give way vessel.

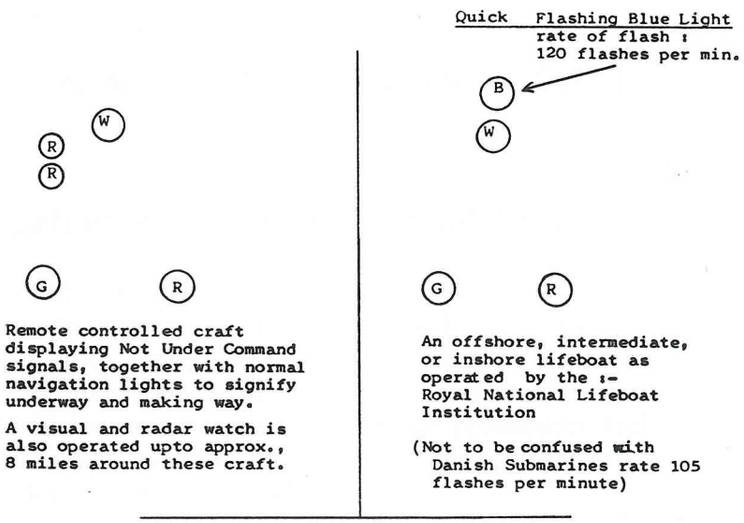
She may give way to your ship if the circumstances permit.



Special Navigation Light — Configurations



Submarine at anchor - on the surface (or moored to a buoy)



Remote controlled craft displaying Not Under Command signals, together with normal navigation lights to signify underway and making way.

A visual and radar watch is also operated upto approx., 8 miles around these craft.

An offshore, intermediate, or inshore lifeboat as operated by the :- Royal National Lifeboat Institution

(Not to be confused with Danish Submarines rate 105 flashes per minute)

Chapter Two

NAVIGATION IN PORT

Navigation in and Around Small Craft

There are numerous occasions when commercial deep sea vessels can expect to encounter small craft. Pilot launches, harbour craft, tugs, cargo barges to mention but a few. Apart from the dangers of interaction Masters and bridge officers should be aware of some basic bridge procedures and precautionary actions prior to engagement with smaller craft, in close proximity.

Approach Plan

Any engagement with small vessels should be planned and well thought out prior to the operations commencement. Full consideration should be given to the geography of the area of intended operation. It should preferably be clear of navigational hazards and in clear water, to allow a suitable course setting to present a favourable aspect to prevailing weather.

The under keel clearance should be noted for all stages of the engagement and any areas of limiting water depth should be clearly marked on the chart. Areas where the under keel

clearance may give cause for concern should be identified in relation to the early use of echo sounder and with relevant position fixing methods.

The plan should incorporate early timings for standard operations such as:

Manual steering change from automatic steering, engine room status prior to reduction of speed, preparation of anchors. Masters requirement on the bridge, lookouts posted etc.

Charting the Plan

All tracks and courses should be clearly identified on the chart with both the gyro and compass headings noted. Position monitoring points together with projected ETA's should also be charted.

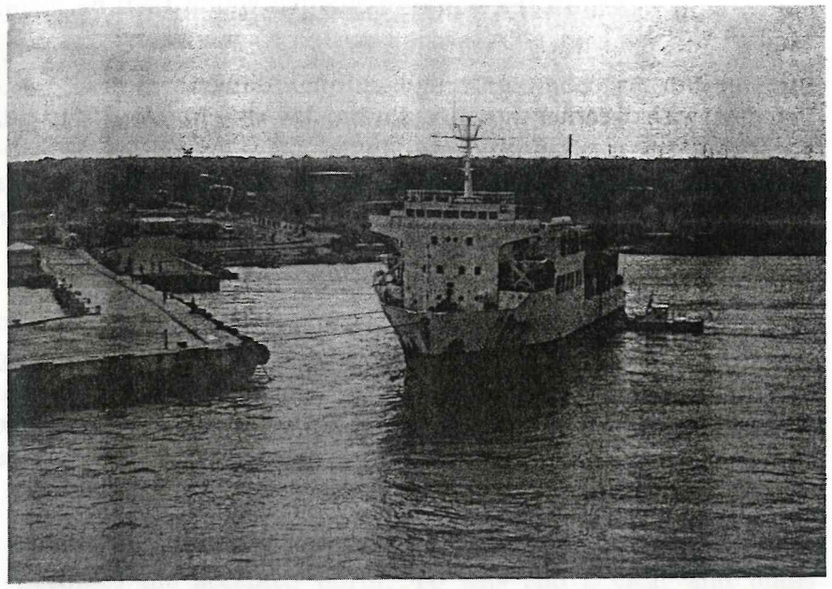
The use of clearing bearings, transits and sector lights can be particularly useful during small boat engagement and can provide simple checks for monitoring the safe navigation of the vessel. Radar conspicuous targets should be highlighted before the vessel enters the area of engagement.

Special attention being given to racon's and buoys carrying radar reflectors. Course alteration points with wheel over points should be identified and charted in accord with recommendations of relevant speeds. Special attention should be given to areas where course alterations or speed changes may be adversely effected by strong currents, etc. (e.g. eddies).

Shipboard Preparations

All flags and/or navigational day/night signals should be clearly indicated prior to the approach. It would be normal practice for early communications to be established by VHF either channel 16 or if known, the most suitable working channel.

Port & Harbour Operations



Berthing operation showing headlines ashore and use of small stern tug (pilot boat) pushing at the after end.

Mooring boat being employed to run "two" mooring ropes ashore (Pilot boat doubles up as mooring boat)

A listening watch on the working channel would then be maintained with relevant ETA's being passed to the target vessel.

Information regarding new navigational dangers in the area, together with weather updates should be sought from the approaching craft as appropriate. In the case of pilots, ladders should be rigged in ample time and in a position to suit the weather and the needs of pilot launches.

Instrument checks should be made and a safe speed established prior to engagement. Radars adjusted to a practical working range for the circumstances. Ships progress and all relevant operations should be noted in the log book especially the monitoring of the ships position at appropriate stages of the approach.

Operations

An early sighting of the target is always beneficial, but it should always be borne in mind that the most direct route to the rendezvous is not always the safest or prudent. Echo sounder should be running and the position monitored as often as the situation demands. A sharp lookout should be maintained for other traffic while at the same time maintaining visual contact with the target vessel once this has been established.

The direction of the wind should be ascertained immediately prior to engagement, with the view to adjusting the vessels head so as to provide a 'lee' for the smaller craft. Speed should be continually adjusted to allow the two vessels to close and maintain station on each other.

Officers of the watch and/or Masters should ensure that reductions of speed do not result in the vessel losing steerage way. Clear instructions to the bridge team, especially to the helmsman and lookouts to report anything untoward, should be clearly expressed.

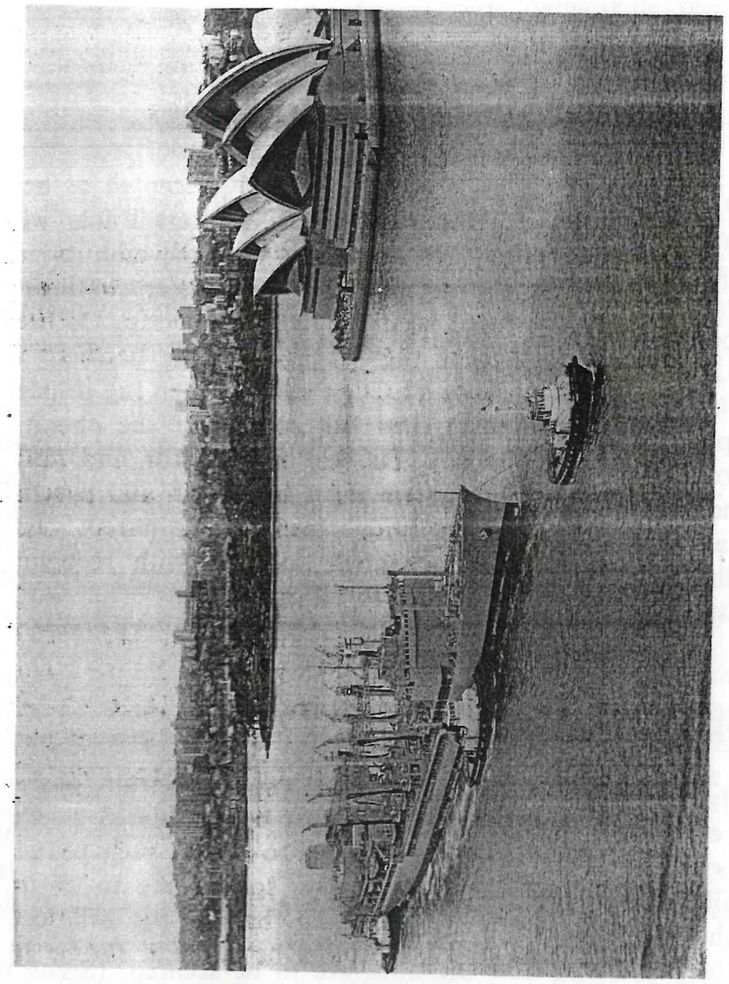
Internal and external communications, will without doubt play a major role in any operation of this nature. If precise records are maintained in the form of old log books, they can form a valuable directive for future operations and help to inform in similar activities at a later date.

Navigation and Manoeuvring with Tugs

The employment of tugs is always generally accepted as being a welcome addition by the majority of Masters/Pilots when engaged in manoeuvring. However, the welcome addition will only remain so while the tug and the Tug Master continue to respond to the navigational needs of the parent vessel. It is not unusual to see six or more tugs engaged in the berthing undocking of a large ULCC or VLCC. Provided each tug responds as part of an overall team then full control of the operation becomes the accepted norm. To this end a clear and understandable communication system must be known and practised by all Tug Masters and the bridge team of the parent vessel. Clear and identified VHF channels together with recognised whistle signals must be familiar to all operators.

Approaching Tugs/Rendezvous

Early communication with Tug Masters to ascertain position of rendezvous and projected ETA must be considered essential information. Prudent Masters would also obtain such practical details as to whether the ships towing springs are to be used or the tugs lines. The relative position that the tug will secure to the vessel and how the lines are to be secured. (Some tugs will secure by employing the eye only, others will require the wires figure '8' on the bitts. Other tugs may be engaged to push as opposed to securing). When approaching tugs a continuous lookout should be maintained and the operation of securing tugs should not be allowed to distract from essential watch keeping duties. The vessel should be in manual steering and all flags and/or respective navigation signals displayed.



Vessel engaged in manoeuvring (entering Sydney Harbour) employing three tugs.

The Master/Navigator should make an early chart assessment of the area of rendezvous. It should be clear of obstructions and without heavy traffic density. The prevailing direction of anticipated weather could be usefully displayed on the chart to provide indication for ships head and visually present the overall ship handling scenario to the bridge team. Current and tide must be considered prior to engagement of tugs.

Tug Engagement

Deck preparations by way of crew at deck stations, heaving lines and towing springs (if ship's lines) flaked and made ready to pass to tugs, should all be ready by the time the parent vessel makes visual contact with tugs. The engines should be on 'Stand By' and the vessel at manoeuvring speed.

One of the main areas of danger when securing tugs is through interaction. To this end the speed of the parent vessel must be adjusted well in advance to remove excessive risk of interaction between the two vessels as they close.

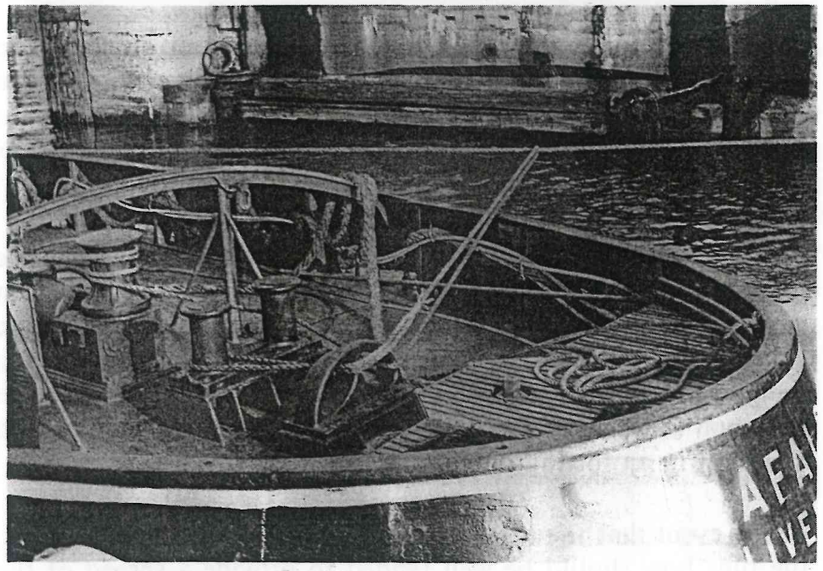
It is normal, for a tug's line to have a rope tail attached to the eye of the towing wire. This aids control of the wire when heaving up to secure and also when letting go. Once brought on board the parent vessel the rope tail should be kept clear of bitts when belaying the towing wire or placing the eye.

NB: The eye should not, under normal circumstances be placed over bitts as a means of securing. In the event of an emergency it is required to let go the wire, this cannot be achieved unless the tug eases back on the weight of the towing spring. Therefore, temporarily, control is in the hands of the tug, not the Master of the parent vessel. A most undesirable situation in any towing operation.

In the event that the tug is to be engaged in a pushing capacity, the tugs bow should be well fended to provide a spread of the load and avoid potential hull damage. Many tugs when pushing

Tugs & Towing Features

Docking Tug — Liverpool.
Note pudding fender over the bow specifically for pushing.



Tugs after deck with towline secured and 'Gob Rope' employed.

will use a bow steadying line to hold herself against the parent ship, but not in every case.

Deployment and Use of Tugs

The number of tugs employed and the designated function of each tug will depend on several factors: —

1. The type of vessel (or rig) being towed or pushed.
2. The weight of the towed vessel/craft.
3. The handling capability of the towed craft.
4. Relevant direction of currents/eddies.
5. Prevailing weather conditions.
6. Manned or unmanned tows could well reflect whether the tow is self-propelled or being moved in a 'cold' condition.
7. Anchor availability for stopping or emergency actions could well dictate the need for one or more tugs to be deployed for slowing or stopping the operation (usually astern).
8. The time of the towing operation. Length and duration must lie within the endurance and capabilities of tugs.

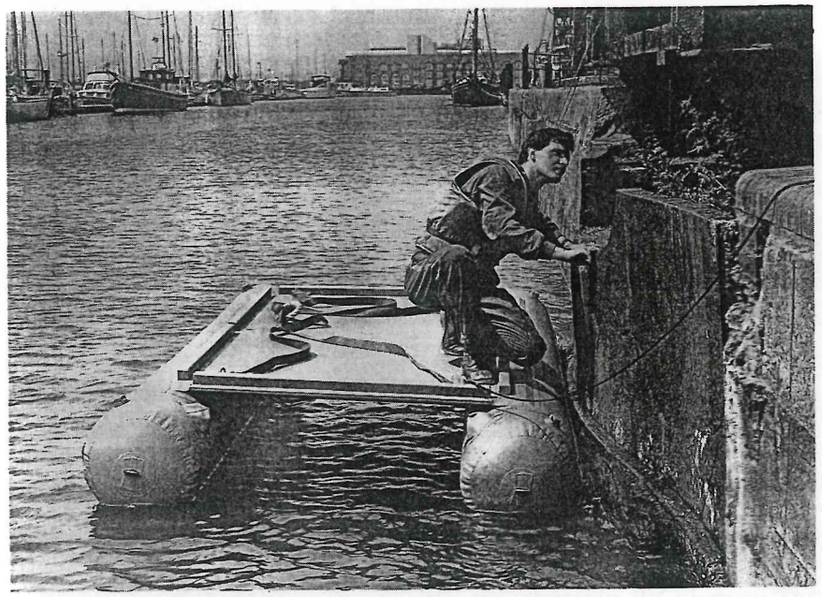
The attention of the mariner about to engage in a towing operation, or for mariners who can expect to encounter operational tugs, is drawn to 'M' 1406 — Safety of Towed Ships and Other Floating Objects.

The Dangers of Interaction

Stand by vessels hold station in close proximity to Offshore oil/gas installations. While support vessels have to move within the radius of crane jibs to allow cargoes to be discharged.
The more modern vessels are fitted with 'dynamic positioning' also, the majority have rotatable thrusters or bow/stern thrusters to assist ship handling. However, the risk of contact and landing with the installation is a real one and watch officers need to be aware in all weathers, in this station holding capacity.
Prudent use and deployment of fenders on working boats can be beneficial in avoiding minor contact damage.

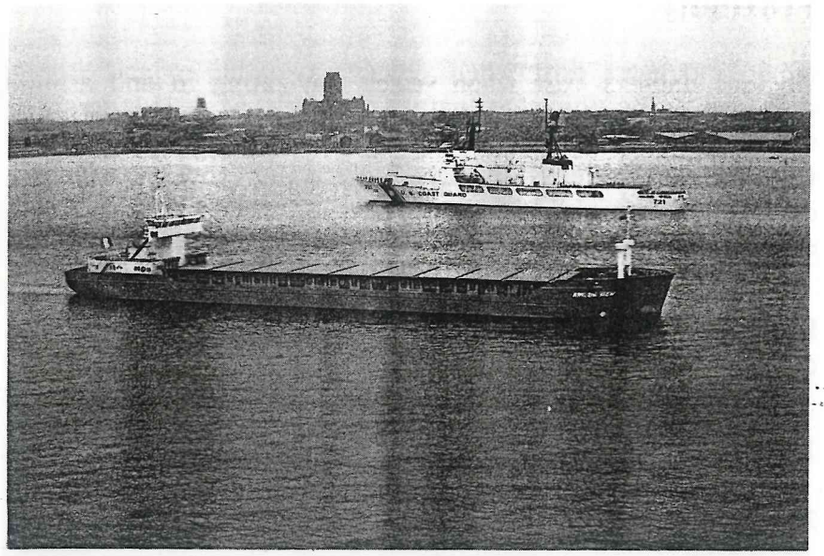
CLOSE QUARTERS — Areas of Interaction & Potential Hazard.

Harbour entrances, dock walls and moored shipping.

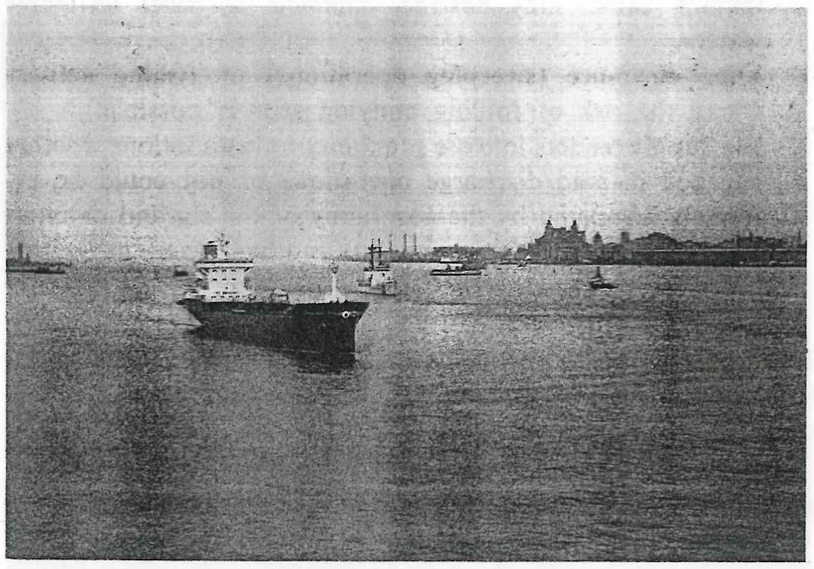


Maintenance punt for overside working in and around docks and harbours, jetties and water side installations.

Interaction Examples & Inshore Congestion



Passing coastal traffic.



Congested inshore waters.

Restricted in Ability to Manoeuvre – Navigation Proximity

Obvious dangers exist when vessels navigating in and around craft which by the very nature of their work restrict their manoeuvrability. Not only is the task of interaction often present with the target vessel but also interaction could occur with overside gear or with the activity in which the restricted craft is engaged.

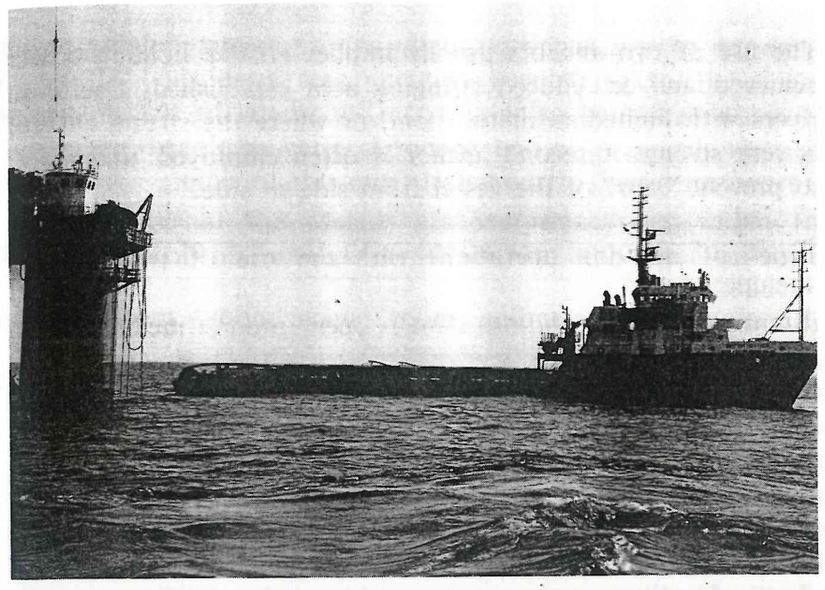
Examples of potential hazards could be experienced with close quarter situations with the following types of vessels:

1. Dredgers, especially suction pipe dredgers, where interaction could cause the pipe to break.
2. Towing operations where risk of collision may exist with the vessel being towed. While at the same time having no risk of collision with the towing vessel.
3. Survey vessels engaged in underwater operations where extending cables may obstruct channels or other navigable waters.
4. Mine clearance (sweeping operations) or fishing activity where the risk of fouling outlying gear is possible.
5. Rig supply tenders in close proximity to installations whether engaged in load/discharge operations or not could be extremely hampered by the geography of the rig and or interaction from another source, i.e another vessel navigating too close.

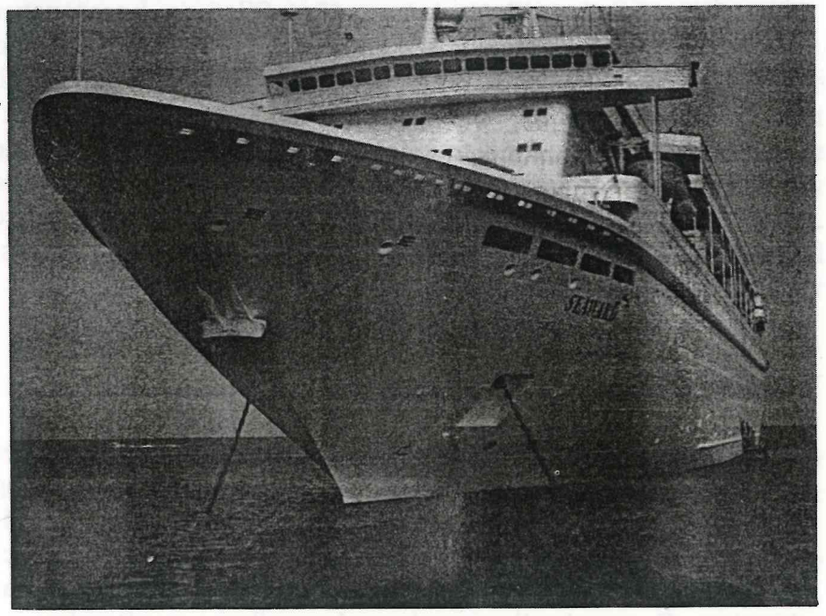
The need for extreme caution at reduced speed by associated traffic cannot be over emphasised when circumstances cause such situations to be encountered.

Main concerns for watch officers are the direction of swing of a vessel when moored to 'two' anchors. The possibility of a foul hawse, where crossed cables occur is a potential hazard and astute watch keeping is essential. Directional changes in tidal

MOORING & ANCHOR USE



Supply vessel and rig proximity.



Cruise liner moored with two anchors.

streams, and the rise and fall of tide heights could influence the ships movement and create the foul hawse.

The use of two anchors usually implies greater holding power achieved and/or reduced swinging area established. Useful in rivers with limited swinging room, or where the stream current is very strong. A second anchor is often employed 'underfoot' to prevent "yaw" of the vessel from side to side.

Types of mooring operations with the use of two anchors include:
Running moor, standing moor, open moor, mediterranean moor.
(For details of these operations readers should refer to Seamanship Techniques Volumes I & II by the same author.)

PILOTS AND PILOTAGE

Introduction

With few exceptions the presence of a Pilot on board never relieves the Master or members of his crew of their duties and obligations regarding the safe navigation of the vessel. The 'bridge team' principle, where all relevant parties are interlinked within a communication loop must include the marine pilot as a key member. Full exchange of information from the onset of picking up the pilot and a continuous flow of positive assistance between and towards all bridge team contributors, should be the order of the day.

Master/Pilot Relationship

With the arrival of the marine pilot aboard a vessel, the Master would normally be expected to receive documentation reflecting the pilots licence and/or the pilotage authority. The recognition and acceptance of the pilots credentials and the respect and reputation of the pilotage authority is assessed initially at this time. On regular liner trades, where pilots are often known

personally to the Master the task of pilot assessment is obviously made with increased peace of mind.

As with any relationship, mutual respect is two ways. The pilot will require an equal level of respect from the Master as well as the ships criteria (see panel). In the majority of cases the pilot is a professional mariner and his competency is attested to by the pilotage authority that issue the licence to practice. In the case of the Master his competency lies within the possession of his masters certificate, so both meet on equal terms.

Open and frank discussion between Master/Pilot regarding manoeuvres of berthing or other navigational aspects would be expected. There is however, a danger of excessive fraternisation and it must be remembered that final decisions and the necessary 'power of command' remain with the Master. In the past shipping companies retained 'company pilots' but this practice is not as prevalent as it used to be. This Master/Company Pilot relationship was one that could, if allowed too, easily develop to a point of distraction for the pilot and the Master, away from the task in hand.

Masters who are engaged on world wide trades can expect to experience varying degrees of competence in the pilots that board their vessels. It must therefore be assumed that at some time in the future Masters will encounter a pilot that they may consider inadequate for maintaining the safety of the vessel. In this case the level of competence may well not be revealed until the pilotage is underway. The options at this stage for the Master would appear to be as follows:—

1. Master relieves the pilot and takes on the pilotage duty.
2. Master relieves the pilot and requests another pilot.
3. Master relieves the pilot and holds the ships position, either stopped or at anchor until a relief pilot is available.

Should this unlikely situation develop a statement should be entered into the ships log book and evidence and witness statements obtained where relevant.

Navigational Procedure – Embarking/Disembarking Marine Pilots

In any operation which involves the embarkation or the disembarkation of a 'marine pilot', it is essential that early and effective communications are established from the onset. If the inbound vessel requires the services of a marine pilot ample notice should be given to the pilotage station/authority, by the ships agents or direct from the Master of the vessel. Relevant call signs and frequencies being found for respective stations in the Admiralty List of Radio Signals.

A provisional ETA once passed to the pilot station, can always be revised up or down as the ships progress can more accurately be projected with the closing range. Once contact is established by radio, additional information will be sort by the pilot station, to enable the planning of an appropriate coastal route.

Such information could include: —

1. Draught of vessel when at pilot roads.
2. Manoeuvring speed of vessel.
3. Size of vessel, with respect to:
   (a) length overall (for berthing)
   (b) mast height (for bridges)
   (c) beam width (for locks)
   (d) navigation equipment
   (e) manoeuvring aids.
4. Requirements for tugs, linesmen, docking pilot, mooring boats, etc.
5. Nature of cargo.

Masters Requirements

Initially the Master will be concerned with accepting the 'con' of the vessel and creating a safe environment for the ship and in so doing provide the pilot with a safe embarkation scenario. When pilots join vessels either from pilot launches or from

helicopters the Masters main concern, must always be for the overall safety of the vessel, by way of operational sea room, clearance from other traffic and the nearness of associated navigational dangers. Duty officers can all to easily be concerned for the safe embarkation of the pilot, which is essential, but can often lose sight of other priority navigational duties.

The Master would normally gain information local to his needs from communication prior to approaching the station. This information would include a local weather situation, so that the ship can be steered to create a lee for a boat, or a heading for a helicopter delivery. Working details would also include which side the pilot would require the boarding ladder and at what height fixed above the waterline, in the case of a surface craft engagement.

Master/Pilot – Questionnaire

Once the pilot has boarded and the Master accepts his advice an exchange of information would normally be made between the two men. The purpose of the exchange is to make the pilot familiar with the manoeuvring characteristics of the ship and to update the Master with any relevant or new dangers and clarify the ships movements. Typical questions that might be asked by the Master of the pilot are as follows:

1. Are there any navigational warnings, effecting the ships proposed track/route?
2. With the ships present draught and the pilots local knowledge where are the particular areas of shallow water that the vessel might encounter with a reduced underkeel clearance?
3. What tide or current features could be expected to effect the vessels ETA?
4. Have any changes in port regulations occurred regarding communications or navigational operations?
5. Will the present or projected weather conditions cause problems on route or in berthing?
6. Will 'tugs' be employed on route or for docking operations and if so, at what positions are tugs to be made fast?

7. Which berth is to be used and which side?
8. Is there any specialised traffic known to be engaged on route towards the berth e.g. dredging operations?
9. Will the pilot change or will a 'docking pilot' be used?
10. Assuming no traffic congestion, at what points on route are speed reductions planned and what would subsequently be the vessels ETA at destination?

With all ship handling operations there are bound to be specific needs required for individual ships and specified operations. An example of this would be if a vessel is to take tugs. Would ships lines be employed or the tugs lines used. If tugs are being employed will they be secured or employed for pushing. If secured at what respective points and how will they be secured etc. Some operations may or may not make use of anchors and some ships may require a stern discharge as opposed to a port/starboard, load/discharge, so each situation must be judged on its own merits.

The above questions are meant as a general guideline which could well effect the majority of vessels when engaging a marine pilot.

Example of information that would be relevant to a marine pilot on boarding a vessel for the first time.
It is normal practice to have such information on permanent display on the bridge.

TO BE FILED WITH END PAPERS (iii)

GENERAL SPECIFICATIONS S.S./M.V......

International Call Sign .....
Built (yard)..... ..... at .....
In service .....
Construction number .....
Official number ..... (where stamped.....)
Registration number..... (where stamped.....)
Place of registration .... 19.....
Power .... ship at ..... r.p.m.
Service speed..... ..... ship at ..... r.p.m.
Classification .....
Equipment number.....

DIMENSIONS

	Feet	Inches	Metres
Length —overall			
—between perpendiculars			
Breadth—overall			
—moulded breadth			
Depth —moulded depth			

TONNAGES

Mark	Freeboard	Draft	Deadweight	Displacement
TF				
F				
T				
S				
W				

Displacement light ship =..... when draft forward =.....
aft =.....

TPI light ship =..... laden ship =.....

Freeboard allowance =.....

CAPACITY ACCORDING TO TONNAGE CERTIFICATE

Tonnage Certificate	Gross Register Tons	m³	Net Register Tons	m³	Date of Issue
International					
Suez Canal					
Panama Canal					

TO BE FILED WITH END PAPERS (iv)

DISTANCES

	Feet	Metres
Bridge — bow		
Bridge — stern		
Manifold — bow		
Manifold — stern		
Manifold — railing		
Manifold — side		

TOTAL HEIGHT FROM KEEL

	Feet	Metres
Fore mast		
Main mast		
Radar mast		
Aerial mast		
Funnel		

GROUND TACKLE

Anchor weight — Port = ... tons.
— Starboard = ... tons.
— Spare = ... tons.

Chain weight — per length = ... tons
— 22 lengths = ... tons

Chain diameter = ...

Total weight 2 anchors plus 22 chain lengths = ... tons.

DANGERS WHEN EMBARKING/DISEMBARKING PILOTS

Danger	*Action*
High freeboard vessels.	Combine use of pilot ladder with accommodation ladder. *Or* Use pilot hoist.
Rough sea conditions.	Create a lee for pilot transfer and adjust vessels speed. *Or* Anchor and wait for improved conditions.
A sudden change in the wind direction.	Alter the vessels course to meet and account for change.
Twisting ladder when engaged in pilot transfer.	Stand by personnel to correct and rig man ropes provide additional support. *Or* Ladder rigged with anti-twist battens (spreaders).
Incorrect ladder rigging.	Rigging inspected by a responsible officer. Lifebuoy, lights, rescue line, adequate manpower available. Safe access to deck provided.

Restricted waters with additional traffic.	Gain sea room and adjust ETA.
Fast operations. (Sometimes necessary)	Plan approach in detail, reduce speed early and brief crew.
Interaction/pilot boat capsize or man overboard.	Vigilance at all times. Parent vessel prepared. Pilot boat itself provides best means of rescue boat. Alternatively use ships rescue boat.
Visible contact lost during manoeuvre under freeboard or around stern. Poor visibility.	Post lookouts and brief them. Maximise use of bridge wings.

Air to Surface — Transfer of Marine Pilots

With the ever growing use of helicopters in the marine environment, transfers of marine pilots to ships by rotary winged aircraft is becoming a regular occurrence. Masters should observe the recommendations enumerated by the ICS Guide to Helicopter Operations.

It should also be noted that when vessels engage with aircraft the following navigational aspects should be observed.

1. Display correct signals for vessel engaged with aircraft: red/white/red all round lights by night or ball, diamond ball, by day.
2. Steer towards a recognised rendezvous point to conserve aircraft fuel.
3. Display a wind indicator to show relative wind direction.
4. Ensure that the position of engagement is clear of navigational hazards and sea room is adequate.
5. Brief 'bridge team' inclusive of lookouts and helmsman, regarding safety of operations.
6. Ensure main engines are on stand by and vessel can readily manoeuvre.
7. Display identity signal flags to aid recognition.
8. Transmit homing signal if requested by helicopter Pilot.

9. Establish early communications with aircraft.
10. Alter course to pilots request, to suit position of engagement. Ref. Annual summary suggests that the ships course should be such as to present the wind on the port bow, when hoist operations are scheduled for the port side. Alternative courses respective of the wind direction are suggested if the operation is to take place in the after part of the vessel, e.g. Starboard quarter.
11. Maintain an efficient bridge watch while on route and while engagement takes place.
12. Do not transmit on radio during hoist operations.
13. Enter statements of activity into log books.

Relevant Seamanship Aspects

Ensure that all decks are clean and clear of loose objects. High rigging such as aerials or stays should be clear for the helicopters approach and all fire fighting/safety precautions observed.

Chapter Three

PASSAGE PLANNING

The safe navigation of the vessel has historically always been the responsibility of the Master. However, it is customary for the Master to delegate navigational duties to his officers and in particular to identify an individual who acts as the 'navigation officer'. The principle of passage planning generally falls into his/her expected duties whether for ocean passage or coastal passage.

The expected standards of passage planning are not new but the procedures have become more formalised over recent years and generally conform to principles published by the Department of Trade in: A Guide to the Planning and Conduct of Sea Passages. These principles expand on 4 essential areas of activity required to achieve a safe passage between ports:

Namely
1. Appraisal
2. Planning
3. Execution
4. Monitoring

By necessity these individual operations must follow on from each other to achieve the objective.

Once completed, the plan is for use by the 'bridge team', and to this end it should be presented as a complete product, to the Master, by the navigation officer. This is not to say that the plan is rigid in its guidelines. On the contrary, any passage plan must retain operational flexibility to take account of the unexpected. The plan in its entirety must therefore cover the period from when the vessel departs her berth to her arrival at her new berth. The saying 'berth to berth' is appropriate, but contingency plans, where applicable should be included.

The practical construction of a passage plan becomes that personal composition of the navigator and can be effectively achieved by alternative methods. The Department of Trade's Guide contains a recommended check list and any method employed should incorporate all these features. Many navigators complete the objective by means of:

1. Use of a data notebook.
2. Tabular presentation.
3. Chart — passage plan — check list.

The following is offered as a possible approach to ensure that the four principles of passage planning are comprehensively covered.

1. The Navigators Data Notebook

No one can pre-empt passage conditions or anticipate ETA's prior to the event. Certain aspects must, by the nature of the beast, be carried out on route or when an arrival time is realised.

Such items that might usefully be employed towards the plan which the navigator could be expected to hold are:

- Times of sunset/sunrise at landfall positions, fairways or harbours.
- Tidal data for rivers, harbours, locks etc.
- Rising and dipping ranges of navigational lights, prominent to the plan.

- Port signals for destination.
- Frequencies for radio beacons intended for use on route.
- Call signs/VHF channels for respective coast radio stations on passage.
- Departure draughts and expected arrival draughts of the vessel.
- Detail of clocks advancing or being turned back as longitude is changed.
- Special hazards and prominent features of the overall plan.
- Details on contingency plans for unusual occurrences, such as (a) no pilot available, (b) poor visibility in congested areas, (c) engine or gear failure in areas of reduced sea room.

2. The Tabular Presentation

The use of a 'table' related directly to the 'passage plan' can be the ideal check for the navigator. It can provide a running update on the distance and subsequently deliver a continually revised ETA. The basic table entries would be comparable with the 'charted legs' of the passage and this in itself ensures an additional check against the measured distance.
Table presentations can be as detailed as the conditions of the passage dictate but should include the following example entries:

- All 'alter course', positions, with the specified courses and distances between them. Courses being in degrees 'true'.
- Distances 'to go' and the respective steaming time for each 'leg' of the passage is useful in providing an update to the ETA as the passage proceeds.

Additionally, some presentations may show 'primary' and 'secondary' position fixing methods and frequency of their use. Engine status may also be shown for appropriate periods in the passage together with under keel clearances when necessary.

Examples of a basic table with a more detailed alternative are shown overleaf.

LIVERPOOL TO HALIFAX (Canada) *Route North about Ireland (Great Circle)*

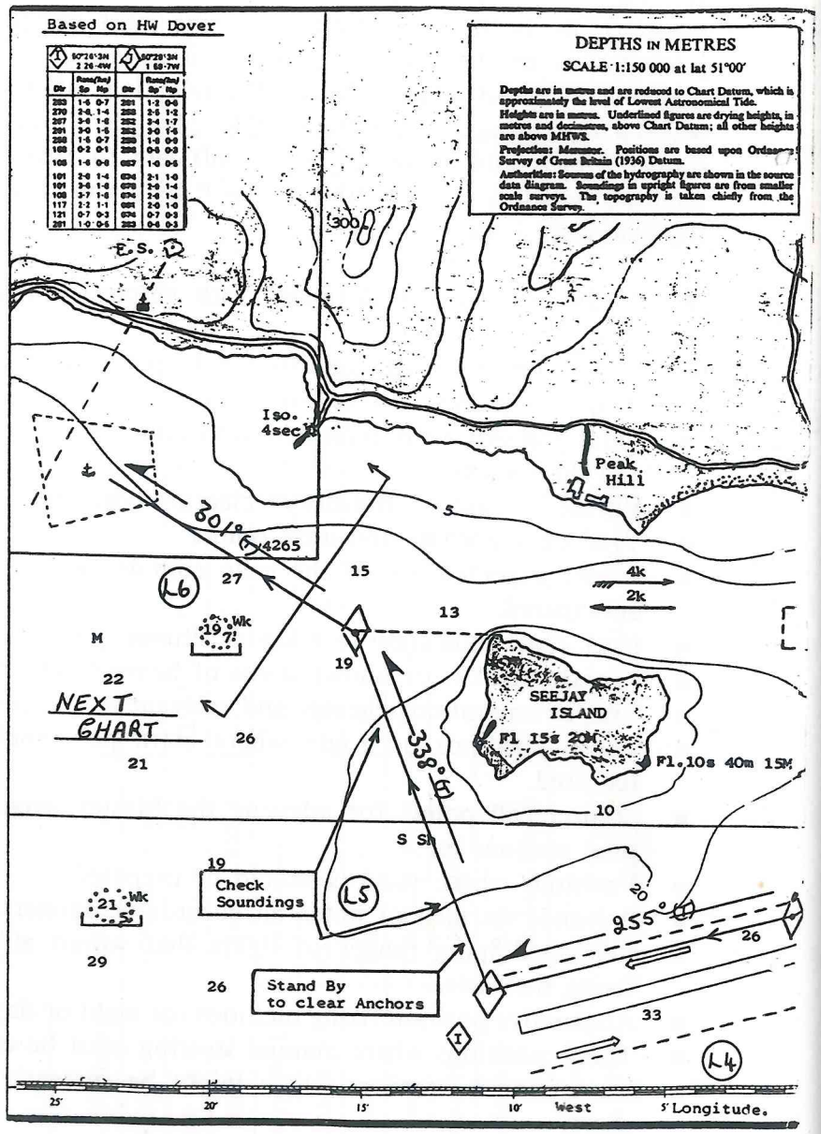
From Name	*To*	*Bearing × Distance*	*Tr. Course*	*Steam Time at 15.0kts*	*Distance*	*Dist to Go*
Berth (Pilotage)	Bar Pilot Stat'n	—	Various to Masters Orders	0.5 hrs	6.5	2436
Bar Station	Chicken Rk.Lt.	054° × 5.0'	295°	4.3 hrs	64.0	2372
Chicken Rk.Lt.	Mew Island Lt.	256° × 4.5'	341°	3.0 hrs	45.0	2327
Mew Island Lt.	Altacarry Hd. Lt.	225° × 8.8'	333°	3.0 hrs	45.0	2282
Altacarry Hd.Lt.	Inishtrahull Lt.	180° × 4.0'	277°	2.9 hrs	44.0	2238
Inishtrahull Lt.	Cape Race	000° × 12.0'	269° Int.Co.	118.6 hrs	1780.0	458
Cape Race	Egg Island	000° × 9.4'	254°	28.7 hrs	430.0	28
Egg Island	Chebucto Head	270° × 3.0'	270°	1.8 hrs	27.0	1
Chebucto Hd.	Pilot Station	—	315°	0.1 hrs	1.0	0
Pilots Station	Berth* (To be advised)	—	Various to Masters Orders	1.0 hrs	*	
Total Distance					2442.5'	
Steaming Time	(excluding Halifax Pilot)				162.8 hrs = 6 days 18.8 hrs	
					Provisional ETA = XXXXXX	

Clocks to be retarded 4 hours from BST.

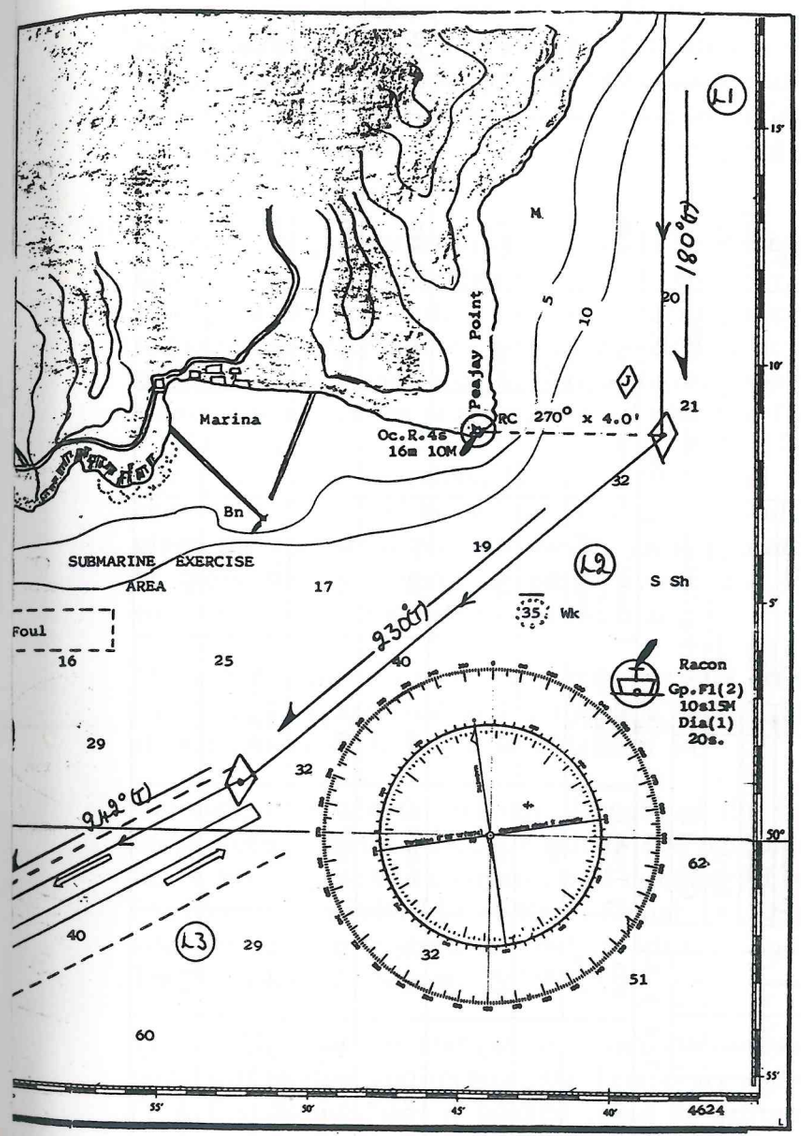
3. Passage Plan – Chart – Check List

Without doubt the completed chart, which illustrates the proposed route, is the most central and the most essential visual presentation of the 'passage plan'. It is required to carry all items that could effect the safe navigation of the vessel, without obscuring relevant detail. The plan should reflect continuity which will allow all watch officers to take over the navigational duties and to this end will be required to indicate the following items:

- Course tracks and distances with respective margins of safety.
- Radar conspicuous targets should be prominent.
- Projected ETA's at alter course positions.
- Tidal streams with indicated maximum/minimum rates and directions.
- Visible landmarks, transits or clearing bearings.
- VHF calling/communication points.
- Where expected use of the echo sounder would be anticipated.
- Next chart indication to allow positional transfer.
- Crossing traffic or known areas of heavy traffic density.
- Traffic separation schemes and relevant references.
- Those positions on route where extra personnel may be required.
- Station call points for advising the Master, engine room, pilot stations etc.
- Positions where anchors should be prepared.
- Advance warning of potential hazards or dangers.
- Raising/dipping ranges of lights that would aid position fixing methods.
- Alternative position fixing methods for night or day passage.
- Those positions where manual steering must be engaged.
- Navigational warnings which might be currently effecting chart.
- Navigational radio aids and their accuracy within charted area.
- Highlight 'NO GO AREAS'.



Passage planning example



PASSAGE PLANNING FORMAT Arrive / Depart / Transit Date Sheet No.,

Bridge Manning						
Master			✓	✓	✓	✓
Pilot						
OOW (1)	✓	✓	✓	✓	✓	✓
OOW (2)						✓
Helmsman		✓	✓	✓	✓	✓
Lookout	✓	✓	✓	✓	✓	✓
Legs	1.	2.	3.	4.	5.	6.

VHF Channels	
Port Control	12
Pilots	—
Tugs	—
Berth	—
CRS. (1)	16

High Waters	
Place	Dover
Time	1320
Place	—
Time	—
Springs / Neaps	

Critical Depths	
Anchorage approach	
Draught	*7.0m*
Sunrise	*0605*
Sunset	*1956*

Arr/Dep Weather	
Wind	W × 5
Sea	mod.
Vis.	good
Precip	nil
Outlook	fair

Remarks
Arrival Anchorage

Pass Leg Ref.,	Positions	ETA/ Track Time	Track (T)	Tr/offset Tide/L'way	Course Gyro Mag/Comp	Distance	Engine Status	Ground Speed	U.K.C.	Pos'n Fix mthds	Remarks
L1.	Peajay Pt. 270° × 4.0'	1hr 12'	180°	nil	180° G.	12 +	Full	10kts	OK	Rad. Lt/ves.	Tide J
L2.	Lat. 50° 1'.2N Lg. 01° 52.3W	1hr 11'	230°	nil	230° G.	11.7	Full	10kts	OK	Visuals Lt/ves. Peajay/ Pt.	—
L3.	Seejay Isle East Lt. 315° × 4.6'	0hr 36'	242°	nil	242° G.	6.2	Full	10kts	OK	Vis/Rad Seejay Isle.	
L4.	Lat. 49° 56'.6N Lg. 02° 10'.8W	0hr 40'	255°	nil	255° G.	6.7	Full	10kts	OK	Vis/Rad Seejay lights.	
L5.	Lat. 58° 04' N Lg. 02° 15.4W	0hr 48'	338°	L'way 3° W'ly wind	335° G.	8.0	SBE Man/Spd	10kts	OK	Visuals Seejay-Nth.Hd. W.Lt.	Echo Sound.
L6.	Anchorage	Est. 1hr 00'	301°	nil	301° G.	6.1	½ Ahd. Slow. Dd. Slow	5 kts	3m	Visual Transit	6 shackles cable

Passage Plan – Appraisal

This is that operation carried out by the navigation officer which gathers together all relevant information that benefit the future stages of the passage plan. Obviously certain items of information will require regular updating as the plan develops and becomes operational, e.g. weather reports or navigational warnings.

Much of the Navigators information can be short and obtained from the official publications (see list). However, other items may be contained within the ships internal papers, as with manoeuvring information. While ships equipment may also be another valuable source of additional information, i.e. Navtex transmissions and the prognostic charts obtained from same.

Local knowledge of pilots, harbour control and other experienced officers should be welcomed whenever available in compiling the completed plan. However, local information should be cross checked against a second source and its reliability confirmed prior to its use within the plan.

Many Navigators, in order to avoid oversight often employ a 'check list' for appraisal and if this is a method being used it should contain such topical investigation on:—

Currents, tides and the relevant draught of the ship with the under keel clearance (UKC) in mind. The navigational use of lights, beacons etc and comparison of Admiralty List of Lights. (ALL) and Admiralty List of Radio Signals (ALRS). Particular attention should be given to 'routing schemes' and the use of Traffic Separation Schemes, (TSS).

The weekly notice to mariners is a valuable source of navigational information and includes the Temporary and Preliminary (T & P's) Notices that if ignored could be detrimental to the safety of any ship. A chart inspection would reveal the required charts and their availability. Navigators should check the correctness and ensure the Ps and Ts, are entered if appropriate. Missing charts will of course require to be ordered, from an approved chart supplier.

Summary

Navigation officers are advised that in planning a passage, especially into unfamiliar waters, that they will benefit considerably by asking questions. Nobody, especially a prudent Master, expects everyone to know all the answers, all of the time. Where questions and/or problems arise do not avoid the issue. People are more often as not pleased to be asked to assist with problems.

Passage Plan — Main Points for Masters Appraisal

When considering a navigators passage plan for approval the Master should take note of the following areas of concern:

- That the largest scale charts have been employed.
- That all charts used are corrected up to date.
- Ensure that all navigation warnings have been received and where applicable applied to the plan.
- Ensure that relevant publications are on board and correct for the forthcoming voyage.
- Estimated draughts are correct for different stages of the passage and that adequate under keel clearance is available throughout the passage.
- That the chosen route has taken account of the climatological information for the areas associated weather patterns.
- Consider the route for traffic flow and the volume of traffic which can expect to be encountered.
- Ensure adequate coverage of position fixing methods, including the range and viable use of radio aids.
- Take note of all pilotage positions or positions of high interest with regard to potential marine hazards.
- Compare recommended route with sailing directions and routes advised by Ocean Passages for the World.
- Assess with care all landfall positions for shallows, currents and other possible dangers.
- Compare the qualities and capabilities of the vessel to ensure that manoeuvring characteristics, bunker capacity and speed capability will allow safe completion of the voyage.
- That loadline regulations are not infringed.

When making up a plan for a voyage, some navigators will lack experience, especially if it is their first attempt. Both Masters and navigators are advised that the prime concern is for the safety of the vessel, 'throughout' the voyage. With this in mind navigators should not hesitate to seek advice even when an individual has ample experience. Neither should Masters seek to chastise a young officer for an obvious error of judgment in recommending a chosen route.

Passage Plan — Planning

The operation of actually constructing the 'plan' must include 'pilotage water' and cover the total period, from 'berth to berth. One of the main functions of the plan is to highlight where the ship should NOT GO and in the construction and build up, this objective should not be lost by the Master or his navigation officer. To this end the charts employed should be of the largest scale available and should show:

1. The intended tracks, with margins for error. Clearly identified with their respective three figure, numerical notation in a 'true heading'. Tracks should be clear of 'hazards' and laid off at a safe distance and advance warning of all dangers should be readily visible to another watch keeper. When charting the intended track for the vessel, due regard should be made to the possibility of engine failure or steering gear malfunction.
2. Radar conspicuous targets — such as RAMARKS or RACONS, or buoys carrying radar reflectors, which could be gainfully employed in position fixing should be well indicated.
3. Maximum use of 'transit marks' and clearing bearings should be included in the plan. Where radar is employed, clearing ranges may be used to distinct advantage.
4. Key elements of the plan — must take into account;
   (a) A safe speed throughout the passage, bearing in mind the ships draught and the possibility of 'squat' and reduction in under keel clearance.
   (b) Critical areas where minimum under keel clearance can be maintained taking into account the state of tide.

(c) Those alteration points, where because of the ships turning circle a wheel over position must be planned to be appropriate to the ships speed and to any tidal effects present.
(d) The reliability and the necessity for accurate position fixing methods, both of a primary and secondary nature.
(e) Planned contingency action in the event of deviation from the plan becoming necessary.

Summary

The plan should flow easily between focal points and highlight hazards and dangers on route. It should not be over complicated with irrelevant material but reflect the essential detail for junior watch officers, pilots and the Master to allow them clear understanding and visible continuity.

Passage Plan – Execution

The execution of any passage plan is the formulation of the tactics which are intended to carry the plan through. Consideration should therefore be given to the following specific topics:

The reliability of ships equipment, specifically the navigation equipment. Its condition and limitations together with its degree of accuracy. Account should also be given to the level of expertise of ships officers and whether they are familiar with that ships type of equipment.

The projection of ETA's towards critical points to allow a more detailed assessment of tide heights and flow. Underkeel clearance (UKC) being a main consideration for the plans execution. By advancing the ETA, while on passage the possibility of anticipating difficulties can often resolve problems before they arrive.

Meteorological conditions will be continually changing while the vessel is on passage. In order to maintain optimum passage

time heavy seas and areas of reduced visibility need to be avoided, if at all possible. Historically and at certain seasons, specific areas are prone to 'fog' or 'bad-weather' conditions. If transit of these areas can be avoided or co-ordinated to coincide with daylight or similar suitable time, the overall safety aspects of the passage can be raised.

Day-time or night-time passage, especially when negotiating dangers or narrows can often be achieved at a favourable time by early realisation and making an appropriate speed adjustment. Speed adjustments can of course be an increase in speed as well as a decrease in speed. However, if an increase in speed is employed, then the conditions should be appropriate and the contents of Rule 6, of the Regulations for the Prevention of Collision at Sea, noted.

It should also be borne in mind that position fixing methods during the day and during the night may well differ, e.g. the use of unlit headlands for visual bearings is not possible at night.

Traffic conditions, notably at navigational focal points like traffic separation schemes, or prominent geographic points should also be considered in light of the projected ETA of the vessel. Speed adjustment again can be a prudent action to arrive at focal points at an appropriate time.

Summary

It has already been stated that no plan is rigid and by its nature, it must be flexible to suit changing conditions. The inclusion of contingency alternatives in many cases will prove to be that item which is not used. However, the plan that doesn't contain the contingency options is very often the one that turns out to need it most. In anticipation of navigational problems where additional personnel may be required to back up routine watch keeping duties. Masters should have suitable manpower routines available to handle all emergencies.

Passage Plan – Monitoring

The construction of the finished passage plan and the instigation of the plan in the execution phase are commendable in their own right. However, the Master of any vessel is posed with the question, 'How does he know that the plan is being complied with, accurately'. The answer to the question is revealed by the progress of the vessel being monitored and visual confirmation that the plan is being drawn to a conclusion.

The monitoring of the vessels movements must therefore be 'close and continuous'. If and when problems are foreseen, or anticipated the Master of the vessel should be informed to allow flexibility in the plan to accommodate possible deviations safely. Monitoring of shipboard equipment is common to monitoring the safe movement of the vessel and therefore to ensure continuity of safe navigational practice, recommended checks on navigation equipment should be made at the following times:

1. Prior to sailing and departure from the berth.
2. Prior to entering known hazardous areas or areas of specific dangers.
3. At regular and frequent intervals during passage time.

Reference is made to navigators and watch keepers to consult the 'Bridge Procedures Guide'.

Position fixing:— All the navigational equipment of a vessel is at the disposal of watch keepers and should be used to maximum advantage whenever possible. However, the principles of efficient watch keeping should not be lost in the hi-tech world of satellite systems. Visual bearings are still considered the most accurate and reliable means of fixing the ships position, provided fixes are based on three position lines. Bearing in mind that the use of Decca Navigator, Radar, Omega, Loran or other instrument systems are liable to instrument error, or operator error. This is not to say that they should not be used. On the contrary, instruments may be the only method of position fixing available, as with a vessel in poor visibility.

Navigators should use alternate position fixing methods to avoid a possible continuous operator/observer error. Full use should also be made of the echo sounder when practical, to provide corresponding data checks on obtained fixes.

The frequency of fixing the vessels position will depend on the geography and the circumstances prevailing. Obviously certain areas of navigation for the vessel will require more position checks than others and the frequency of charting fixes will be dictated by the prevailing conditions.

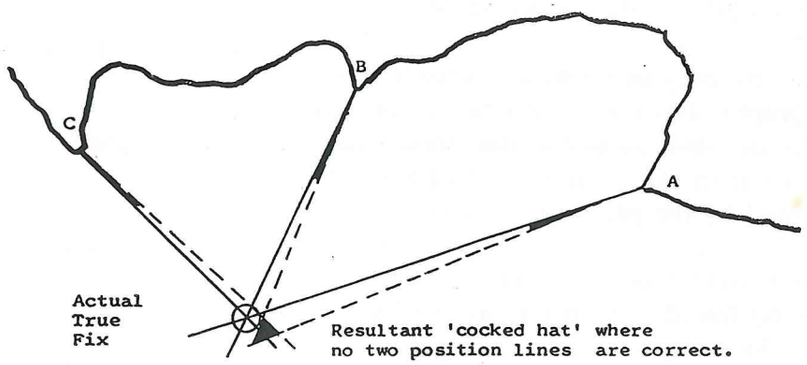
Buoys should not be used for fixing the vessels position but may be found to be useful as checks when fixed objects are not available. Transits and clearing bearings can also be gainfully employed in providing margins of safety for the vessel. The use of parallel indexing has grown over the years and has proved itself to be a reliable and effective method of monitoring the ships progress.

Summary

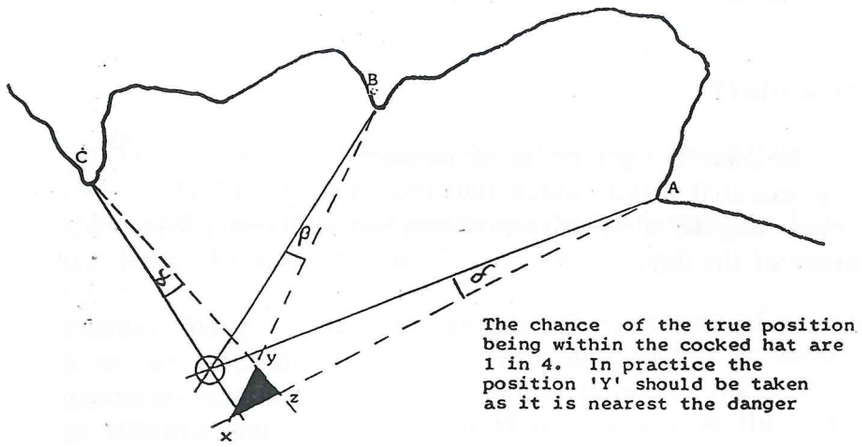
To complete the principles of passage planning, monitoring is that essential action which illustrates the safe progress of the vessel. Regular alternative position fixing methods must be the order of the day.

Errors in Position Fixing

Example 1 Fixed error on compass or regular observer error: —



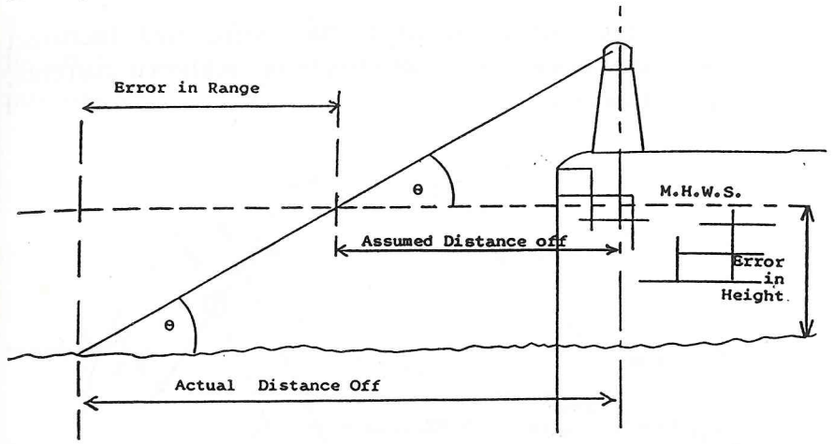
Example 2 Variable errors in bearings: —



NB: If the variable error on bearing 'A' passed through 'Z' then an incorrect but perfect plot is obtained. Random/variable errors because of:

(1) Observational error.
(2) Changes in compass error for different bearings (i.e. compass card not steady).

Example 3 Error in distance by vertical angle



Inaccuracy in this method of fixing is due to:

1. Errors in the measured angle θ.
2. Errors in the height above sea level being employed.
3. Plotting and computing the error.

Example figures illustrate error in range. (Use of distance by vertical angle tables employed, found in Norrie's Nautical Tables).

Assume a vessel observes a lighthouse 13 metres high and obtains a vertical angle of 0° 24' when at the time of high water. If the range of tide is 10 metres and the same vertical angle is observed at low water time, what would be the two ranges?

HW (Assumed MHWS)		*LW* (Tide 10m)	
Object	13.0m.	Object	23.0m
Vert. Sex't Angle	0° 24'	Vert. Sex't Angle	0° 24'
Range by table	1.0 n.mile	Range by table	1.75 n.miles

If the state of the tide is not taken into account the error in this example would therefore fall anywhere between 1.0 nautical mile and 1.75 nautical miles.

Range of error 0.75 n.mile.

Height above sea level, caused by draught or trim of the vessel could also effect the result in a similar manner.