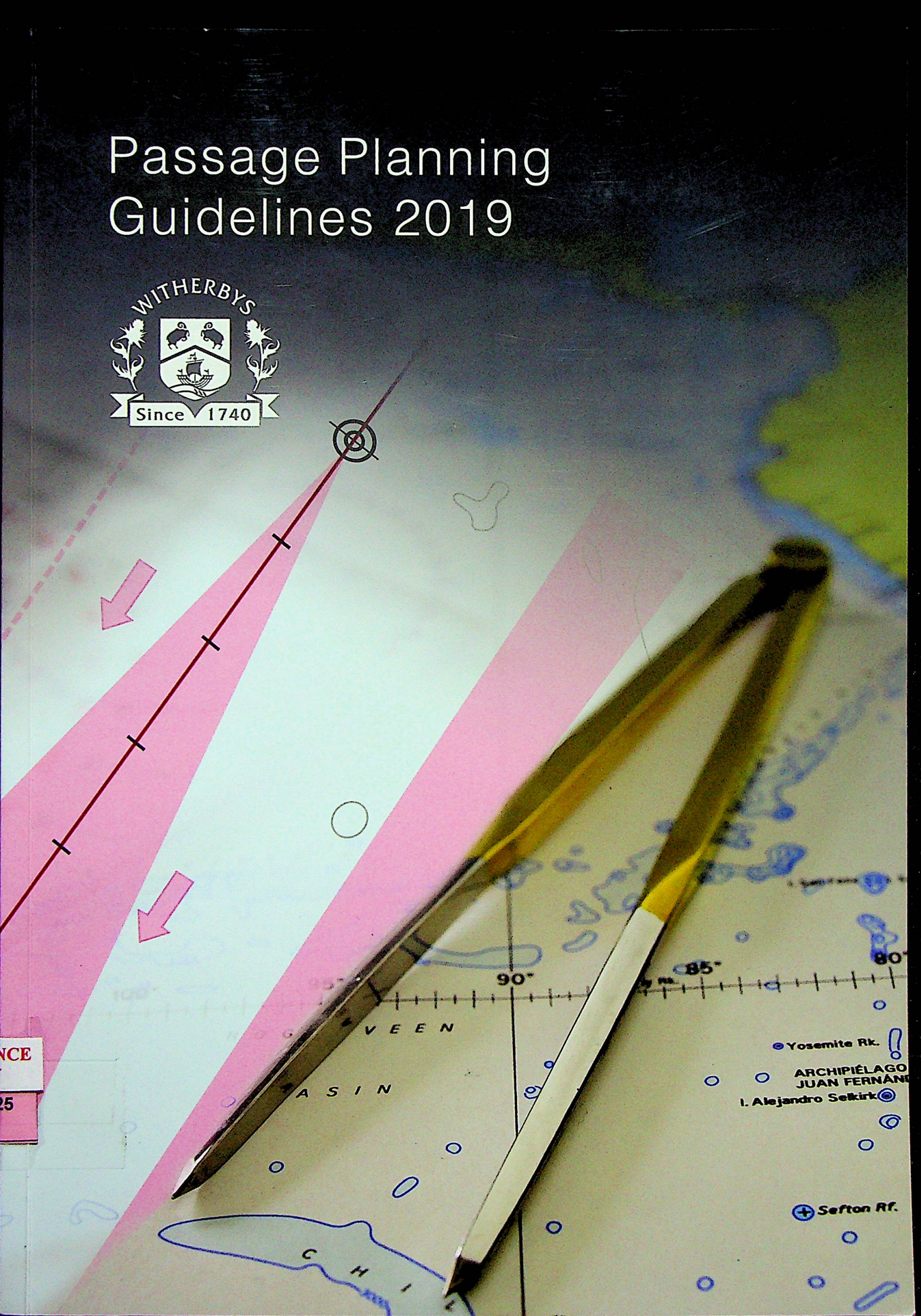
Passage Planning Guidelines 2019



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Contents

Abbreviations

ADC	Admiralty Digital Catalogue
AIO	Admiralty Information Overlay
ALRS	Admiralty List of Radio Signals
APC	Appropriate Portfolio of Paper Charts
APEM	Appraisal, Planning, Execution, Monitoring
ASL	Archipelagic Sea Lanes
ATT	Admiralty Tide Tables
CATZOC	Category of Zone of Confidence in Data
CIR	Cross Index Range
COLREGS	International Regulations for Preventing Collisions at Sea
DW	Deep Water Route
ECA	Emission Control Area
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
ENC	Electronic Navigational Chart
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
GC	Great Circle
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HAT	Highest Astronomical Tide
HO	Hydrographic Office
HoT	Height of Tide
HW	High Water
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IHO	International Hydrographic Organization
IMO	International Maritime Organization
IRTC	Internationally Recommended Transit Corridor
LAT	Lowest Astronomical Tide
LW	Low Water
MARPOL	International Convention for the Prevention of Pollution from Ships
MHWS	Mean High Water Springs
MOS	Margin of Safety
MSL	Mean Sea Level
NATO	North Atlantic Treaty Organization
NM	Notice to Mariners
NO	Navigating Officer
NOAA	National Oceanic and Atmospheric Administration
NP	Nautical Publication
OOW	Officer of the Watch
PI	Parallel Index
PL	Presentation Library
PMN	Primary Means of Navigation
PSSA	Particularly Sensitive Sea Area
RCDS	Raster Chart Display System
RL	Rhumb Line
RNC	Raster Navigational Chart
SA	Scheme Administrator

SECA	Sulphur Emission Control Area
SENC	System Electronic Navigational Chart
SMS	Safety Management System
SOG	Speed Over the Ground
SOLAS	International Convention for the Safety of Life at Sea
STCW	International Convention on Standards of Training, Certification and Watchkeeping
T&Ps	Temporary and Preliminary Notices
TRS	Tropical Revolving Storm
TSS	Traffic Separation Scheme
UKC	Under Keel Clearance
UKHO	United Kingdom Hydrographic Office
USCG	United States Coast Guard
VRM	Variable Range Marker
VTS	Vessel Traffic Service
XTD	Cross Track Distance
XTE	Cross Track Error
XTL	Cross Track Limit

Note that the following terms may be used synonymously. Review of the chart will show the style that the navigator has adopted:

XTD	**Cross Track Distance**
XTE	**Cross Track Error**

CHAPTER 1
Introduction

1 Effective Passage Planning

Passage planning is a process that requires skill and meticulous research. It is not something that should be taken lightly as it carries responsibility and the consequences of getting it wrong are serious. A passage planner must be conscientious and seek to produce a comprehensive and detailed 'berth to berth' plan based on a full appraisal, taking into account all possibilities and eventualities, while reducing navigational risk. An effective passage plan, whether it is completed using paper charts or ECDIS, must:

- Clearly define a safe navigational route from berth to berth
- be comprehensive and detailed, reduce navigational risk and include contingency options
- take into account established safety margins and environmental protection requirements
- satisfy a rigorous checking process
- be easy to follow, allowing safe execution and monitoring of the plan
- be efficient.

1.1 The Requirement for a Comprehensive Passage Plan

The necessity to prepare and follow a passage plan is well established in shipping and is a requirement of SOLAS (Chapter V, Regulation 34), the STCW Code, a ship's SMS and IMO Resolution A.893(21) *'Guidelines for Voyage Planning'*.

1.1.1 SOLAS Regulation 34

Regulation 34 of SOLAS Chapter V states the following with regard to *'safe navigation and avoidance of dangerous situations'*:

> *1 Prior to proceeding to sea, the master shall ensure that the intended voyage has been planned using the appropriate nautical charts and nautical publications for the area concerned, taking into account the guidelines and recommendations developed by the Organization* (ie IMO Resolution A.893(21)).
>
> *2 The voyage plan shall identify a route which:*
>
> *.1 takes into account any relevant ships' routeing systems;*
> *.2 ensures sufficient sea room for the safe passage of the ship throughout the voyage;*
> *.3 anticipates all known navigational hazards and adverse weather conditions; and*
> *.4 takes into account the marine environmental protection measures that apply, and avoids, as far as possible, actions and activities which could cause damage to the environment.*
>
> *34-1 The owner, the charterer, the company operating the ship as defined in regulation IX/1, or any other person shall not prevent or restrict the master of the ship from taking or executing any decision which, in the master's professional judgement, is necessary for safety of life at sea and protection of the marine environment.*

1.1.2 STCW Code

The general principles of passage planning are contained within STCW A-II/1 (operational) and A-II/2 (management) levels. Section A-VIII/2 of the STCW Code covers *Watchkeeping Arrangements and Principles to be Observed*, Part 2 of which relates to *Voyage Planning*:

> *General Requirements*
>
> *3 The intended voyage shall be planned in advance, taking into consideration all pertinent information, and any course laid down shall be checked before the voyage commences.*
>
> *4 The chief engineer officer shall, in consultation with the master, determine in advance the needs of the intended voyage, taking into consideration the requirements for fuel, water, lubricants, chemicals, expendable and other spare parts, tools, supplies and any other requirements.*
>
> *Planning prior to each voyage*
>
> *5 Prior to each voyage, the master of every ship shall ensure that the intended route from the port of departure to the first port of call is planned using adequate and appropriate charts and other nautical publications necessary for the intended voyage, containing accurate, complete and up-to-date information regarding those navigational limitations and hazards which are of a permanent or predictable nature and which are relevant to the safe navigation of the ship.*

1.1.3 Safety Management System

Ships undertake different voyages depending on their size and trade. Decisions affecting the route are further influenced by requirements, such as:

- Owner's or charterer's requirements
- coastal States' requirements, eg for ships carrying hazardous cargoes
- environmental considerations, eg emission control areas (ECAs).

Clause 7 (*Shipboard operations*) of the ISM Code requires the company to establish procedures, plans and instructions for key shipboard operations, which will include passage planning.

The ship's safety management system (SMS) should be read in conjunction with the Master's standing orders and his instructions for the particular voyage to ensure an efficient passage planning process.

1.1.4 IMO Resolution A.893(21)

The requirements of SOLAS, Chapter V, Regulation 34 are further emphasised within IMO Resolution A.893(21), *'Guidelines for Voyage Planning'*, which contains the following guidance:

> *1.1 The development of a plan for voyage or passage, as well as the close and continuous monitoring of the vessel's progress and position during the execution of such a plan, are of essential importance for safety of life at sea, safety and efficiency of navigation and protection of the marine environment.*
>
> *1.2 The need for voyage and passage planning applies to all vessels. There are several factors that may impede the safe navigation of all vessels and additional factors that may impede the navigation of large vessels or vessels carrying hazardous cargoes. These factors will need to be taken into account in the preparation of the plan and in the subsequent monitoring of the execution of the plan.*

1.3 Voyage and passage planning includes appraisal, i.e. gathering all information relevant to the contemplated voyage or passage; detailed planning of the whole voyage or passage from berth to berth, including those areas necessitating the presence of a pilot; execution of the plan; and the monitoring of the progress of the vessel in the implementation of the plan.

Passage planning requires a systematic approach to ensure that all relevant factors are considered. The 'four stages of planning' (set out in 1.3 above) are appraisal, planning, execution and monitoring (APEM).

1.2 The Four Stages of Planning

The four stages of planning apply regardless of whether a passage plan is prepared for completion on paper charts or on ECDIS:

- **Appraisal** – this stage comprises the gathering of all available information, from all relevant sources, concerning the contemplated voyage from berth to berth. It should include an appraisal report to the Master before proceeding to the planning stage.
- **Planning** – having made the fullest possible appraisal, this stage comprises the construction of the entire route from berth to berth, together with supporting information.

The appraisal and planning stages are completed prior to sailing and provide a framework for the gathering, presentation and subsequent detailed planning. The execution and monitoring stages are completed during the passage.

- **Execution** – final adjustments to the passage plan prior to departure are made by the Officer of the Watch (OOW), using the charts and supporting navigational information provided by the navigator.
- **Monitoring** – this stage ensures the voyage is conducted in accordance with the plan from departure to arrival, monitoring the ship's progress and adjusting the plan if required on passage.

Analysis (debrief) is a recommended fifth stage in the process where, on completion of a passage, the plan and its effectiveness in completing the voyage are reviewed. This provides an opportunity to discuss what was done well, what could have been done better and whether anything needs to be amended to improve future voyages. For example, could additional PIs have been of value to watchkeepers or were conspicuous marks not appropriate for radar use (poor return)?

1.3 Responsibility

Passage planning is a skill that is developed with experience and it requires good judgment. In all cases, planning must be supported by comprehensive research and appropriate calculations.

Although the ultimate responsibility for a passage plan will always remain with the Master, it is customary on most ships for the Master to delegate the initial preparation of the passage plan to the navigator. A detailed passage plan should be submitted for the Master's assessment and approval prior to the commencement of any voyage.

It is quite possible that there may be more than one option for the passage plan between the same two ports, so the navigator should present the Master with an assessment of the advantages and disadvantages to allow a decision to be made. Should the plan require modification or the final destination needs to be changed, to avoid severe weather for example, an updated version of the plan should be prepared for the Master's approval.

1.4 Key to Symbols

The following symbols are used throughout this publication to draw attention to important information:

!	Relates to cautionary information when passage planning on paper charts.
!	Relates to cautionary information when passage planning on ECDIS.
PL 4	Highlights important changes that came into force with edition 4.0.0 of the IHO ECDIS Presentation Library (PL) on 1st September 2017.
	Refers to common factors and considerations that need to be taken into account, regardless of whether passage planning on paper charts or ECDIS.

CHAPTER 2

Appraisal

2 Gathering Information

A number of items need to be considered before any passage plan is prepared, regardless of whether planning is on paper charts or on an ECDIS. Research from appropriate references, charts and nautical publications must be undertaken and it will be necessary to:

- Identify suitable routes after determining all areas of danger and likely environmental conditions
- gather supporting details from the reference materials
- undertake an appraisal study
- brief the Master
- select the preferred route.

This stage is called 'appraisal' and it comprises two steps:

- Preliminary research
- appraisal report.

Information gathered during this stage will be derived from a number of different sources, some of which will be factual and some drawn from the collective experience of others. Some of the data may require subjective evaluation as to its reliability, such as the age and quality of survey data used to compile the charts or CATZOC. This chapter provides guidance on the preliminary calculations and checks that must be completed prior to commencing the 'planning' stage.

2.1 Carriage Requirements for Charts and Nautical Publications

To complete the necessary research during the appraisal phase, the navigator will need access to the relevant charts and nautical publications. SOLAS Chapter V, Regulation 19 outlines the chart and publication carriage requirements:

2 Shipborne navigational equipment and systems

2.1 All ships, irrespective of size, shall have:

2.1.4 nautical charts and nautical publications to plan and display the ship's route for the intended voyage and to plot and monitor positions throughout the voyage. An electronic chart display and information system (ECDIS) is also accepted as meeting the chart carriage requirements of this subparagraph.

All navigators should consult the carriage requirements for charts and nautical publications for their flag State. For example, the United Kingdom Maritime and Coastguard Agency's (MCA) guidance as to the carriage requirements is as follows:

Charts

4.) The charts or ECDIS referred to in Regulation 19.2.1.4 must be of such a scale and contain sufficient detail as clearly to show:

i) all navigational marks which may be used by a ship when navigating the waters which are covered by the chart;

ii) all known dangers affecting those waters; and

iii) information concerning any ships' routeing and ship reporting measures applicable to those waters.

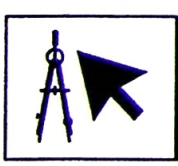
All charts and publications must be of the latest obtainable edition and be kept up to date from the latest relevant obtainable notices to mariners and radio navigational warnings.

Publications

5.) The following publications are considered to satisfy the requirements of Regulation 19.2.1.4

International Code of Signals (IMO)
IAMSAR Manual Vol. III
Mariners' Handbook (UKHO)
Merchant Shipping Notices, Marine Guidance Notes and Marine Information Notes (MCA)
Notices to Mariners (UKHO)
Notices to Mariners – Annual Summary (UKHO)
Lists of Radio Signals (UKHO)
Lists of Lights (UKHO)
Sailing Directions (UKHO)
Nautical Almanac
Navigational Tables
Tide Tables
Tidal Stream Atlases
Operating and Maintenance Instructions for Navigational Aids carried by the Ship.

Although an ECDIS provides efficiencies in the practical plotting of routes, it does not automatically perform or provide many of the chart selections, calculations and background reading that are required prior to commencing the planning stage. For example, the navigator should ensure that harbour scale ENCs are available for the passage plan (scale 5) and that information such as canal dimensions or tidal information is available.



The basis for the chosen passage plan must be supported by calculations and research. This detail should be recorded in a workbook, along with reference to the supporting information from relevant publications and the navigator's supporting notes and justification for a particular plan.

2.2 Preliminary Research

Preliminary research is based upon the anticipated requirements for the forthcoming voyage.

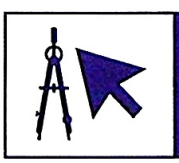
The navigator must be allowed adequate time to conduct the necessary research. If insufficient information on the voyage criteria has been provided, the navigator should seek the Master's guidance.

In establishing whether or not the intended passage is achievable, the following constraining factors should be among those considered:

- Destination
  - suitability, eg berth dimensions, clearances, etc
  - distance
  - time
  - tidal data
  - speed and range of the ship
- weather and environmental constraints
- availability of charts and nautical publications.

The aim is to identify all areas of navigational danger along with any restrictions or hazards associated with the passage, including logistical factors and support facilities. If early study reveals that the destination is unsuitable for the ship or the intended passage is unachievable or hazardous, planning time has been saved. This research should draw upon up-to-date publications issued in printed or digital format by competent hydrographic or navigation authorities.

Some ECDIS planning software can integrate with tide, current and weather databases to provide specific tools that may aid in the preliminary research process. Information is also available to the navigator from the relevant electronic navigational chart (ENC) using the 'cursor pick' function or by reviewing chart notes from any installed raster navigational charts (RNC). However, the cursor pick method can be time consuming and may not yield information in sufficient detail. Therefore, it is not a substitute for the use of updated publications and warnings issued in paper or digital format by a competent authority.



Within any passage there will be distinct sections, ie pilotage waters, port approaches, coastal transits and, possibly, ocean transits. Each section requires different levels of information, which the navigator will need to organise into a logical order to enable the Master to have a proper understanding of the options.

2.2.1 Preliminary Research – Destination

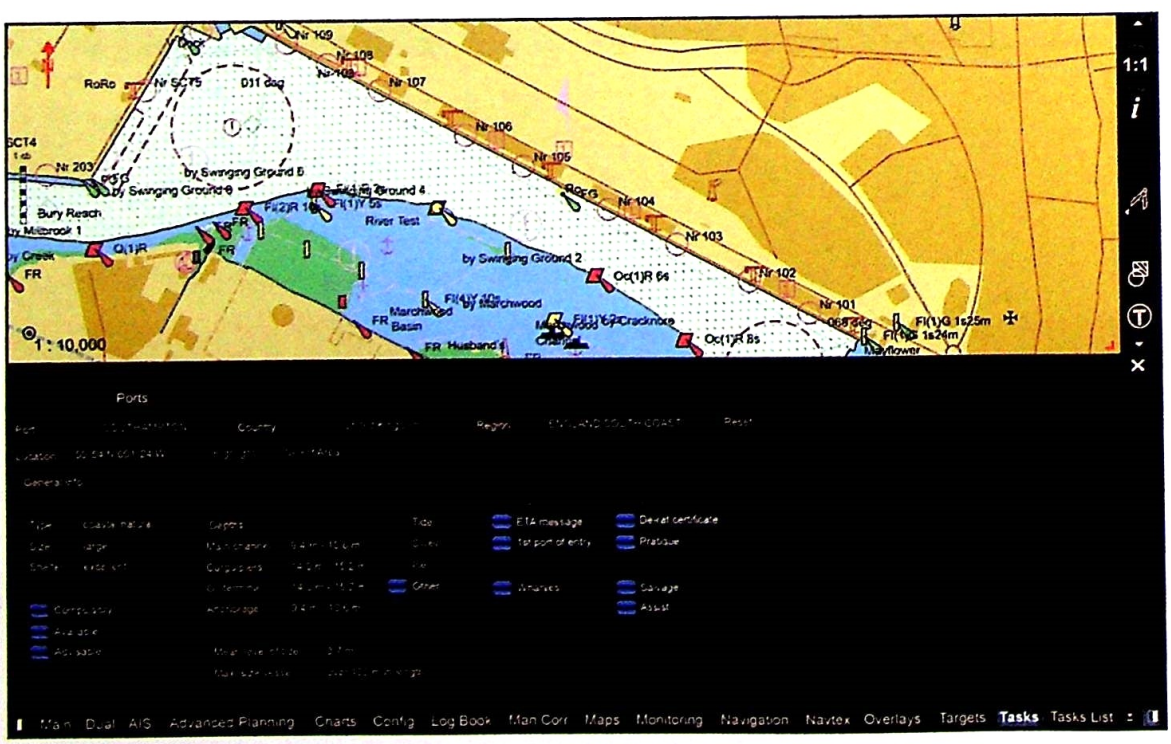
Determine the correct destination, including the berth (if known).

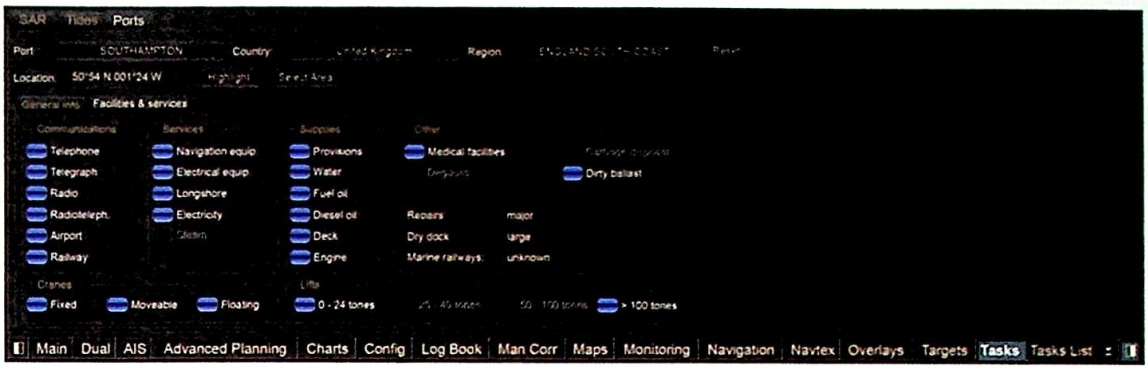
2.2.1.1 Suitability

The suitability of the ship for the destination must be considered by taking into account constraining factors, such as:

- Ship
  - competent and well rested crew
  - condition and state
  - draught (including air draught)
  - serviceability and state of equipment
  - manoeuvring data
  - operational limitations
  - restrictions and limitations
  - stability considerations
- cargo
  - any special characteristics (particularly if hazardous/dangerous)
  - distribution, stowage and securing on board
- port
  - correct name, latitude and longitude
  - available port information (including local notices to mariners)
  - restrictions and limitations
  - minimum charted depths and tidal information
  - overhead clearances
  - meteorological and climatological information
  - length of berths
  - availability and adequacy of tugs
  - availability of shore-based emergency response arrangements and equipment
- up-to-date certificates and documents concerning the ship, its equipment, crew, passengers or cargo.

Consultation with the 'Manoeuvring Data' and the relevant *'Sailing Directions'* will help to determine whether any of the above factors will affect the ship's ability to enter port at the chosen destination.





Figures 1 and 2: Some ECDIS manufacturers provide port databases that contain information such as restrictions, facilities and services. *(Courtesy of Transas)*

Figure 3: Cursor pick may reveal additional relevant planning information. *(Courtesy of Transas)*

2.2.1.2 Distance

The distances involved in the passage should be calculated, including the total distance berth to berth and the distance between pilot stations (or recognised point of arrival). Where appropriate, a comparison between rhumb line (RL) and great circle (GC) distances should be undertaken to establish the shortest route. There are several ways to determine distance and these include:

- Official charts
- 'Sailings Formula' – whether calculated or tabulated
- 'Distance Tables' such as the *'Admiralty Distance Tables'* – these can be used to obtain the shortest distance between listed ports (see Figures 4 and 5).

WEST APPROACHES TO THE BRITISH ISLES – TABLE 1b

Note. Small italic figures refer to the notes at the beginning of this table.
Names in capitals indicate that places are also in adjacent tables.
* Indicates that the place is also in the Link Tables.

PLACE	Fort William	Foyle, Lough	GALWAY	Holyhead	*INISHTEARAGHT (5'W of)	INISHTEARAGHT (5'N of)	Kyle of Lochalsh	Larne	Liverpool	*LONGSHIPS (3'W of)	LUNDY (10'W of)	Mallaig	Milford Haven	Mull of Kintyre (5½' SW of)	Oban	*OUESSANT, ÎLE d' (10'W of)	Padstow	*PENTLAND SKERRIES (2½' W of)	Portmadoc	Portree	Preston	Rosslare	SHANNON, RIVER	SLIGO	*SEIN, RAZ de (2'S of Pte du Raz)
Fort William																									
Foyle, Lough	117																								
GALWAY	343	256																							
Holyhead	247 44	153 24	395 34																						
*INISHTEARAGHT (5'W of)	373	286	94	301 30																					
INISHTEARAGHT (5'N of)	109	20	236	169 25	265																				
Kyle of Lochalsh	95	135	349	266 46	378	122																			
Larne	146 44	53 23	305	102	335 30	69 25	167 46																		
Liverpool	267 21 44	173 21 25	425 21 25	53	357 30	189 21 25	286 21 46	124 23 W 21																	
*LONGSHIPS (3'W of)	441 44	347 24	326	205 6	232	363 25	461 46	296	262 6																
LUNDY (10'W of)	375 44	281 6 24	349	140 6	255	297 6 25	395 6 46	231 6	195 6	90															
Mallaig	77	117	330	248 46	360	104	21	149 46	268 21 46	442 46	376 6 46														
Milford Haven	351 6 44	257 6 24	332	114 6	238	272 6 25	370 6 46	206 6	171 6	100	28	351 6 46													
Mull of Kintyre (5½' SW of)	125 44	33 25	285 25	122	314 25	49 25	144 46	24	142 21	317	251 6	126 46	226 6												
Oban	35	92	317	221 44	347	84	77	122 44	241 21 44	416 44	350 6 44	58	325 6 44	99 44											
*OUESSANT, ÎLE d' (10'W of)	540 44	445 24	400	303 6	306	461 25	559 45	394	360 6	98	188	540 46	198	415	514 44										
Padstow	411 6 44	317 6 24	346	174 6	252	333 6 25	430 6 46	266 6	231 6	47	50	412 6 46	67	286 6	385 6 44	145									
*PENTLAND SKERRIES (2½' W of)	266 50	298 53	492 53	434 53	522 53	280 53	159 53	335 53	454 21 53	628 53	562 6 53	207 53	538 6 53	312 53	247 50	726 53	598 6 53								
Portmadoc	312 44	218 24	388 30	70 7	294	234 25	331 46	167	127	189 6	122 6	313 46	97 6	187	266 44	287 6	157 6	499 53							
Portree	149 50	187 53	380 53	323 53	409 53	169 53	21	224 53	343 53	517 53	451 6 53	93 53	427 6 53	201 53	130 50	615 53	487 6 53	150	388 53						
Preston	262 21 44	168 21 25	420 21 25	60	363 30	184 21 25	281 21 46	119 21	12	268 6	201 6	263 21 46	177 6	137 21	236 21 46	366 6	237 6	449 21 53	133	338 21 53					
Rosslare	315 14 44	221 14 24	307 30	92	213	237 14 24	335 14 46	170 14	146 18	134	82 6	316 14 46	57 6	191 14	290 14 44	233	114	502 14 53	88	391 14 53	152 18				
SHANNON, RIVER	358	271	66	351 30	50	250	363	320 25	407 30	282	300	345	288	299	332	357	302	506 53	344	394 53	413 30	263			
SLIGO	213	127	161	275 25	191	107	220	176 25	296 21 25	423 29	404 6 41	202	379 6 41	155 26	187	497	439 30	369 53	341 25	257 53	291 21 25	344 13 18 24	176		
*SEIN, RAZ de (2'S of Pte du Raz)	574 1 44	480 1 24	438	338 1 6	344	496 1 25	593 1 46	429 1	395 1 6	133	223 1	575 1 44	232 1	449 1	548 1 44	38	180 1	761 1 53	322 1 6	650 1 53	401 1 6	267 1	394	535	

Figure 4: Example from *'Admiralty Distance Tables'* of a passage between Milford Haven and Liverpool. The distance shown is for a passage to the east of Grassholm Island, where Note 6 applies (see Figure 5). Red boxes have been added to highlight relevant information. (UKHO, *NP350(1) – 'Admiralty Distance Tables, Atlantic Ocean, Vol 1'*) *(Courtesy of UKHO)*

WEST APPROACHES TO THE BRITISH ISLES — TABLE 1b

The Minches. Where routes pass through the Minches, the mean of the distances by the N-bound and S-bound recommended tracks have been used.

Menai Strait, Sound of Islay and Kyle of Lochalsh. No routes, except those to Port Dinorwic, Port Askaig and Kyle of Lochalsh, have been used which pass through these straits. If a distance is required by way of one of the straits, it may be obtained by working it through the tabulated place which lies in the strait.

Caledonian Canal. Fort William to Moray Firth (North Sea Table (1d)) through Caledonian Canal is 68 miles.

Notes:

1 W of Île d'Ouessant.
2 W of Isles of Scilly.
3 E of Isles of Scilly.
4 N of Lundy.
5 S of Lundy.
6 E of Grassholm.
7 W of Bardsey Island.
8 W of The Smalls.
9 E of Anglesey.

Figure 5: Note 6 relates to the passage between Milford Haven and Liverpool. The red box has been added to highlight relevant information. (UKHO, *NP350(1) – 'Admiralty Distance Tables, Atlantic Ocean, Vol 1'*)

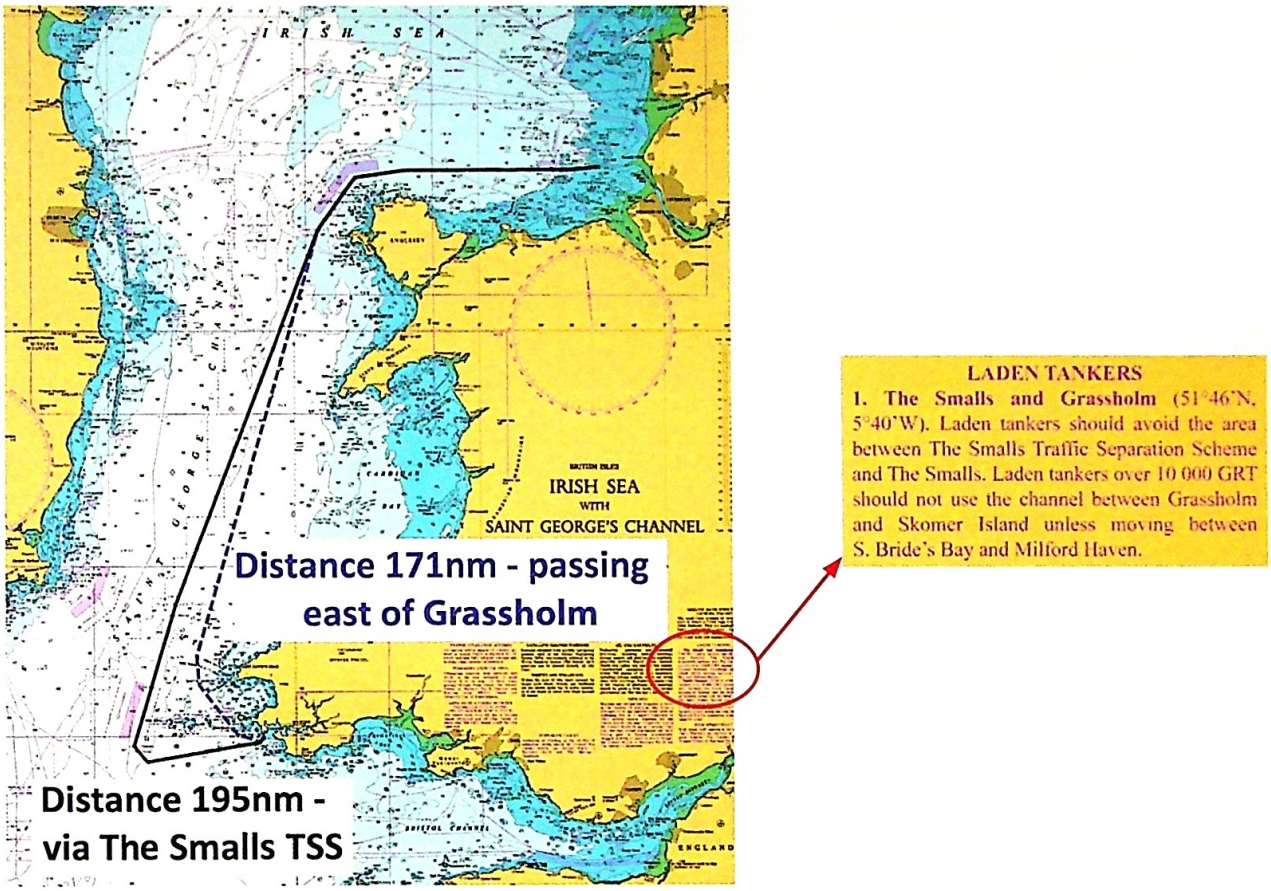


Figure 6: Chart showing the route listed in the *'Admiralty Distance Tables'* between Milford Haven and Liverpool (blue pecked line) passing east of Grassholm Island (that is not suitable for laden tankers over 10,000 GRT) and a longer route via The Smalls TSS.
Source: British Admiralty Chart 1121 *(Courtesy of UKHO)*

Distances obtained from distance tables provide the shortest distance between listed ports taking into account the normal navigational constraints, such as headlands or offshore hazards for coastal passages (see Figure 6) and GC distances for ocean passages. Any accompanying notes should always be consulted. However, the distance tables do not take into account ocean currents and prevailing weather conditions, nor do they always route via traffic separation schemes (TSS). Therefore, distances from the *'Admiralty Distance Tables'* should be used in conjunction with advice from the relevant *'Sailing Directions'* or *'Ocean Passages for the World'*. Distance tables can be integrated with some types of ECDIS software (see Figure 7), although ECDIS will automatically calculate the actual distance of any route plotted. Note that distances given in *'Ocean Passages for the World'* are to the nearest 5 miles for passages of less than 1,000 nautical miles (nm) and to the nearest 10 miles for passages over 1,000 nm.

When undertaking ocean passages, consideration must always be given to the advantages (or otherwise) of selecting a GC instead of an RL route. The difference in distance between RL and GC routes will be most significant on passages in a predominantly easterly or westerly direction at higher latitudes (see Tables 1 and 2).

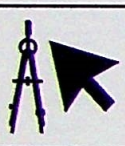
Latitude	RL Distance (nm)	GC Distance (nm)	Difference (nm)	Difference (%)	Difference of Longitudes
30°	3,000	2,965	35	1.17%	67°
	4,000	3,914	86	2.15%	87°
	5,000	4,818	182	3.64%	105°
45°	3,000	2,899	101	3.37%	80°
	4,000	3,748	252	6.30%	104°
	5,000	4,476	524	10.48%	127°
60°	3,000	2,705	295	9.83%	109°
	4,000	3,285	715	17.88%	142°
	5,000	3,585	1415	28.30%	175°

Table 1: Comparison of RL and GC distances at various latitudes.

Passage		RL Distance (nm)	GC Distance (nm)	Difference (nm)	Difference (%)	Difference (Longitudes)
Location A	Location B					
Land's End	New York	2,925	2,832	93	3.18%	68°
San Francisco	Tokyo	4,769	4,523	246	5.16%	98°
Wellington	Valparaiso	5,429	5,014	415	7.64%	116°
River Plate	Cape Town	3,726	3,630	96	2.58%	74°
Durban	Perth	4,368	4,244	124	2.84%	84°
Strait of Gibraltar	New York	3,242	3,161	81	2.50%	68°
San Francisco	Wellington	5,860	5,849	11	0.19%	63°
Land's End	River Plate	5,777	5,765	12	0.21%	51°

Table 2: Comparison of RL and GC distances for various trans-ocean passages.

When referring to a geographical index, be aware that a number of different ports share the same name and care should be taken to ensure that the correct port is selected. Publications such as Norie's *'Nautical Tables'* or the *'Ports of the World'* contain a list of ports with their corresponding latitude and longitude. It should also be noted that the latitude and longitude of a port listed in *'Admiralty Distance Tables'* is normally that for the pilot station or anchorages given in *'Admiralty Sailing Directions'*. This could result in significant differences to the overall distance berth to berth.



Regardless of the method used to determine distance, it is recommended that any distance calculation is cross-checked by another method.

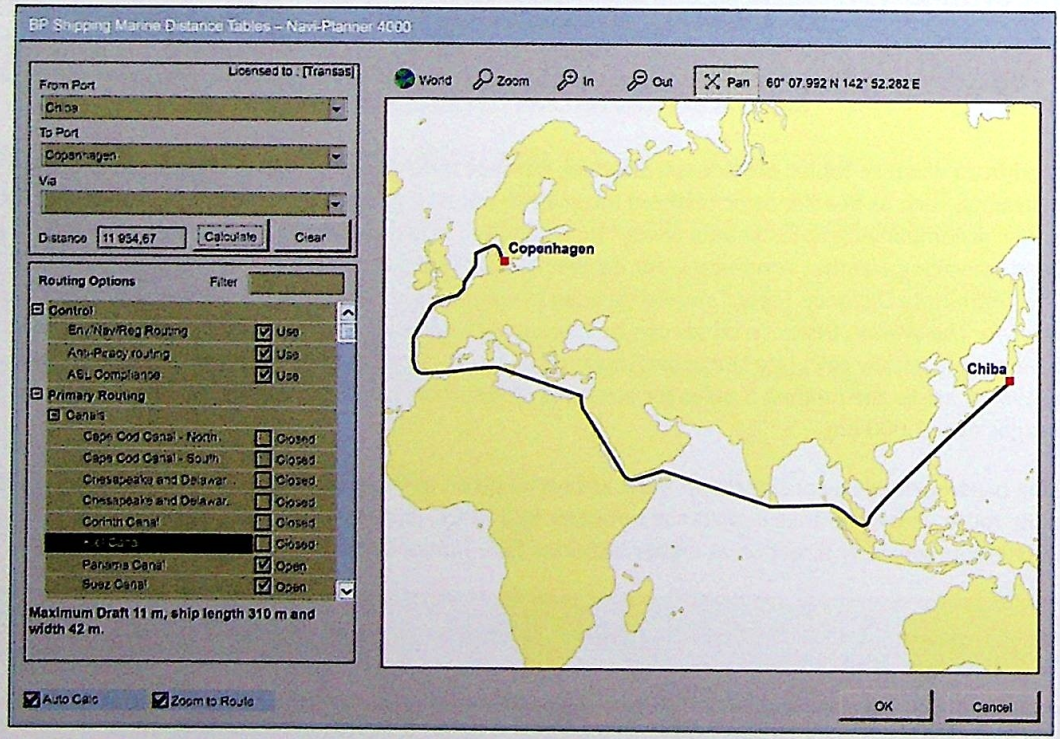
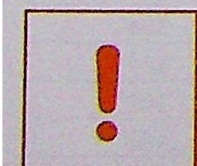


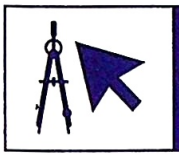
Figure 7: Example of distance table integration with ECDIS planning software that allows the automatic generation of routes. *(Courtesy of Transas)*



At this stage in the planning process, a high level overview of the route may be carried out. However, the final route can only be confirmed at the end of the appraisal stage. When using ECDIS to perform a high level overview, take care to select the base display mode before zooming out to prevent system overload on some models of ECDIS.

2.2.1.3 Time

The total amount of time available to complete the passage must be calculated to confirm that it is below the maximum speed of the ship and, preferably, at an economical speed. Some allowance for delays should be made, especially when the overall passage speed is close to the ship's maximum. For passages through several time zones, it is common practice to convert all times to a single time zone (such as UTC) to avoid any ambiguity. Details of the local (legal) time, including the periods of daylight saving time, are listed in the *'Admiralty List of Radio Signals, Vol 2'*.



When passage planning across multiple time zones, take great care to calculate the ETA at the pilot station/arrival waypoint to ensure you arrive at the correct local time. One method of ensuring this is to calculate ETA in both local time and UTC for each waypoint.

2.2.1.4 Tidal Data

Tidal conditions at the departure and destination ports should be determined in case it is necessary to achieve certain tidal windows that may constrain the timing of departure and arrival. This will depend on the required minimum under keel clearance (UKC), overhead vertical and horizontal clearances, strength of tidal stream or current and any port regulations. Consulting *'Tide Tables'*, *'Tidal Stream Atlases'* and relevant *'Sailing Directions'* will help to determine this. The following are considerations with regard to the ship conducting the passage:

- Tidal constraints
  - times and heights of tide (HoT) at high water (HW) and low water (LW), plus the % springs rates (see Figure 8). Note that % springs calculations are an aid and are not precise calculations because tide is not always linear. Electronic tide tables and tidal window calculators should be used with care
    - charted depths and HoT from the *'Tide Tables'* are referenced to the local datum of soundings (see Figure 9)
  - required UKC, taking into account the vessel's draught, an allowance for squat, a safety margin and the predicted HoT (see Figure 10)
  - overhead clearances
    - vertical clearances are normally referenced to the highest astronomical tide (HAT), listed in *'Admiralty Tide Tables'*, Table V, Part 1 for Standard Ports and Part 2 for Secondary Ports (see Figure 9)
  - times and strengths of tidal stream or currents (see Figure 13)
- port regulations and restrictions
  - draught/UKC permissible in fairways and harbours
  - restrictions with regard to sailing times
  - availability of pilot and tugs.

$$\text{\% Springs Rate} = \frac{(\textit{Tidal Range of the Day} - \textit{Mean Neaps tidal range})}{(\textit{Mean Spring tidal range} - \textit{Mean Neaps tidal range})} \times 100$$

For example, Mean Spring tidal range = 4.7 m, Mean Neaps tidal range = 1.8 m and Tidal Range of the Day = 3.7 m

$$\text{\% Springs Rate} = \frac{(3.7\text{ m} - 1.8\text{ m})}{(4.7\text{ m} - 1.8\text{ m})} = \frac{(1.9\text{ m})}{(2.9\text{ m})} \times 100$$

$$= 65\%$$

Figure 8: Calculation of % springs rate, to aid interpolation between the predicted spring and neap strength of tidal streams.

The relationships between the various tidal levels are shown in Figure 9.

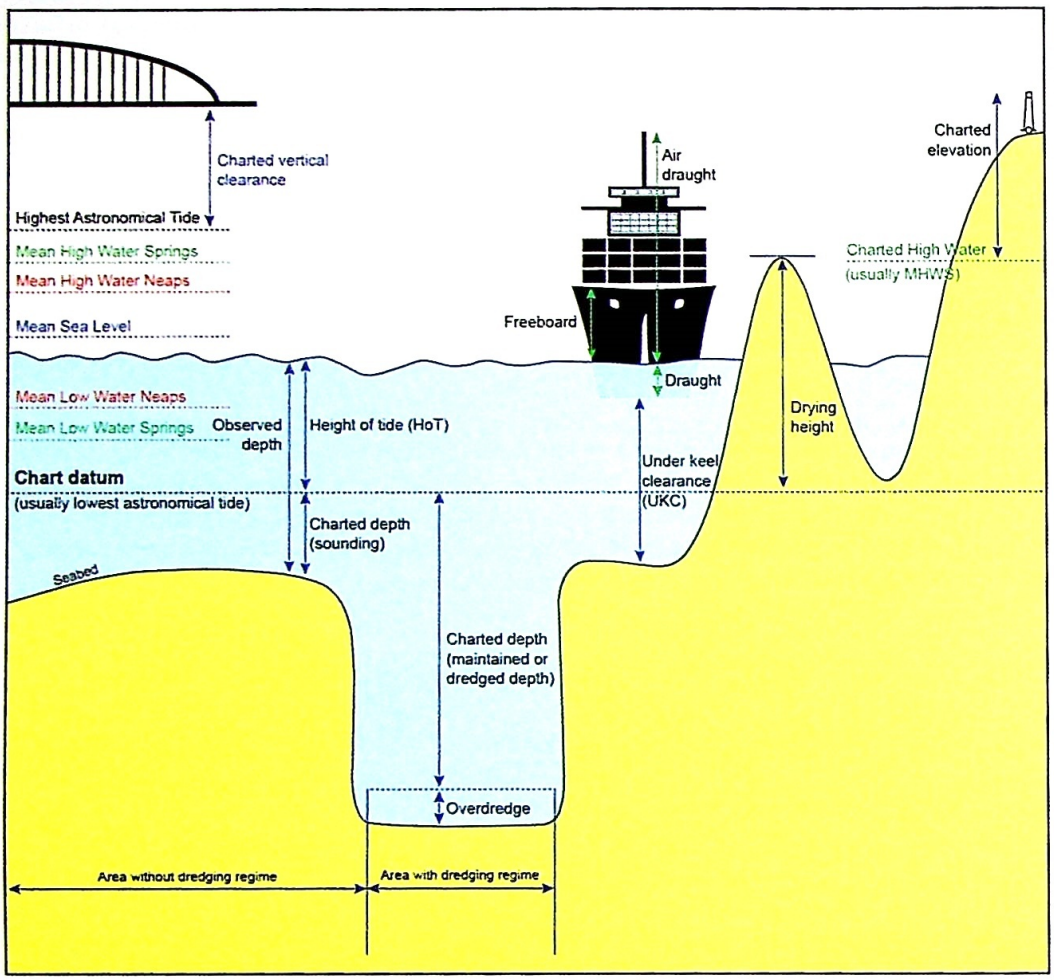
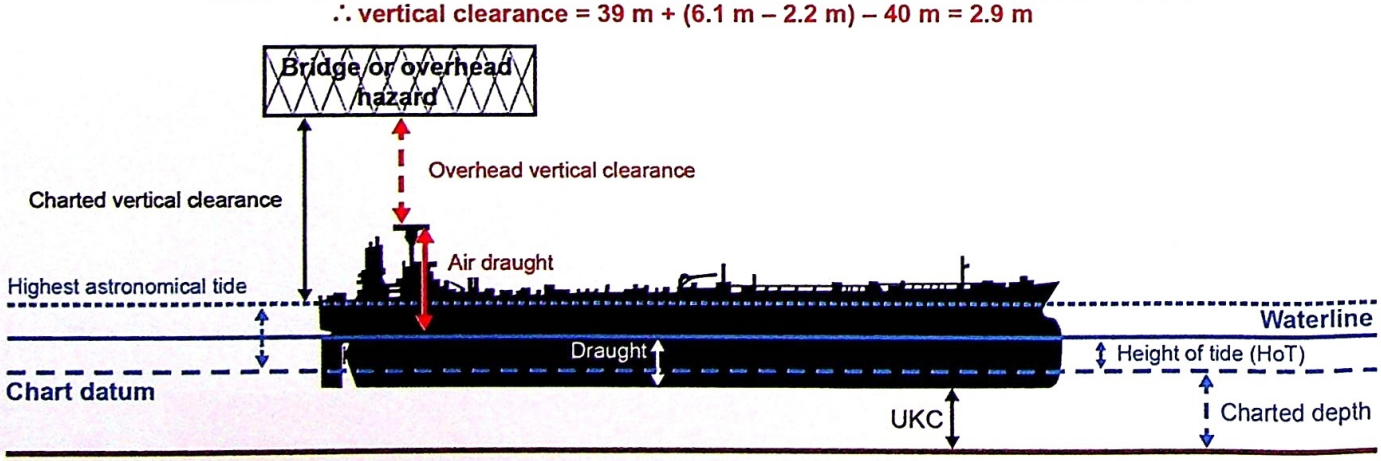


Figure 9: Standardised depth terminology. (UKHO, *NP100 – 'The Mariner's Handbook'*)
(Courtesy of UKHO)

The limits of safe water when leaving or entering a harbour should be calculated using the formula in Figure 10. This will allow the depth value for the 'no-go line' (limiting danger line) to be calculated prior to drawing courses on a paper chart, or the 'safety depth' value that will be used prior to constructing a route in ECDIS.

Overhead clearance = (charted vertical clearance + (HAT – HoT)) – air draught
eg air draught = 40 m, charted vertical clearance = 39 m, HAT = 6.1 m, HoT = 2.2 m
∴ vertical clearance = 39 m + (6.1 m – 2.2 m) – 40 m = 2.9 m



No-go line/Safety depth = (draught + squat + minimum UKC) – HoT
eg draught = 10.5 m, squat = 1.5 m, minimum UKC = 2 m, HoT = 4.3 m
∴ No-go line/Safety depth = (10.5 m + 1.5 m + 2 m) – 4.3 m = 9.7 m

Figure 10: The calculation of the no-go line, or safety depth, is used to define safe navigable water.

From the example calculation in Figure 10, charted depths of 9.7 m or less should be clearly marked on the chart as being unnavigable and unsafe. If a no-go line of 9.7 m prevents the ship from safely navigating for the HoT used in the calculation, the navigator should determine the times of the tidal window when the HoT will allow safe navigation, for the minimum UKC and/or overhead vertical clearances, within the port and its approaches. The minimum UKC and overhead vertical clearance should be agreed with the Master from the outset. To determine the minimum HoT to ensure sufficient UKC is maintained over a shallow water area, the calculation in Figure 11 should be made:

Minimum HoT required = (draught + squat + minimum UKC) – minimum charted depth

For example, draught = 10.5 m, squat = 1.5 m, minimum UKC = 2 m and minimum charted depth is 8.2 m

Minimum HoT required = (10.5 m + 1.5 m + 2 m) – 8.2 m
= 5.8 m

Figure 11: Minimum HoT calculation to ensure sufficient UKC.

To find the maximum HoT to safely pass under a bridge or cable, the calculation in Figure 12 should be made:

Maximum HoT = (charted vertical clearance + HAT) – (vertical clearance required + air draught)

For example, air draught = 30 m, charted vertical clearance = 29 m, HAT = 5.3, minimum required clearance = 2.0 m

Maximum HoT = (29 m + 5.3 m) – (2 m + 30 m) = 34.3 – 32 m
= 2.3 m

Figure 12: Maximum HoT calculation to pass safely under a bridge or cable.

Although horizontal datum within ENCs is standardised to WGS 84, vertical and sounding datums may differ between chart producers. For example, many European ENC producers use mean sea level (MSL) for vertical and sounding datum, while others use mean high water springs (MHWS) for vertical datum or lowest astronomical tide (LAT) for sounding datum. Where datums are not standardised, values will equate to those used on the equivalent paper chart or source data.

Tidal calculation software is widely available as an alternative to traditional paper tide tables and tidal atlases.

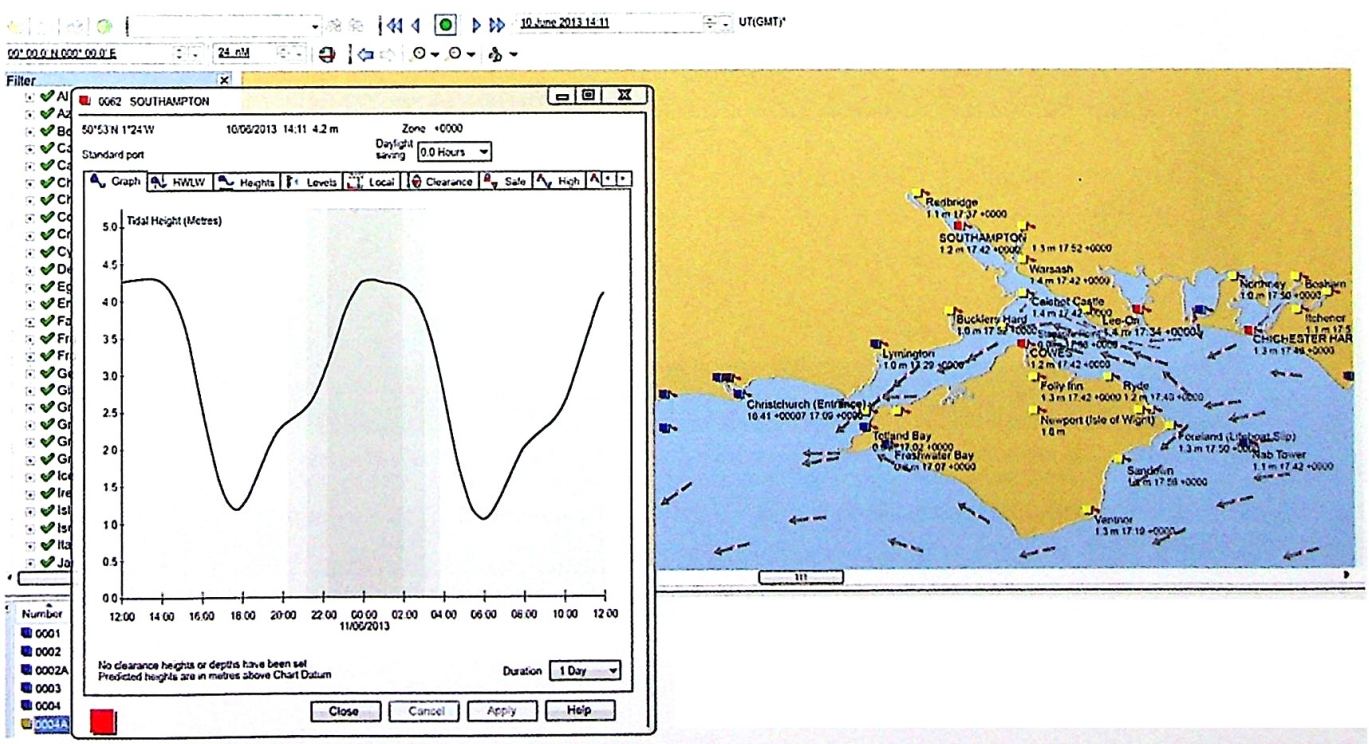


Figure 13: Official tidal databases such as '*Admiralty TotalTide (ATT)*' can be used as a standalone application or integrated with ECDIS to assist with HoT and tidal stream predictions or for calculating times of astronomical events. *(Courtesy of UKHO)*

Figure 14: An example of ATT integrated with ECDIS. *(Courtesy of OSI)*

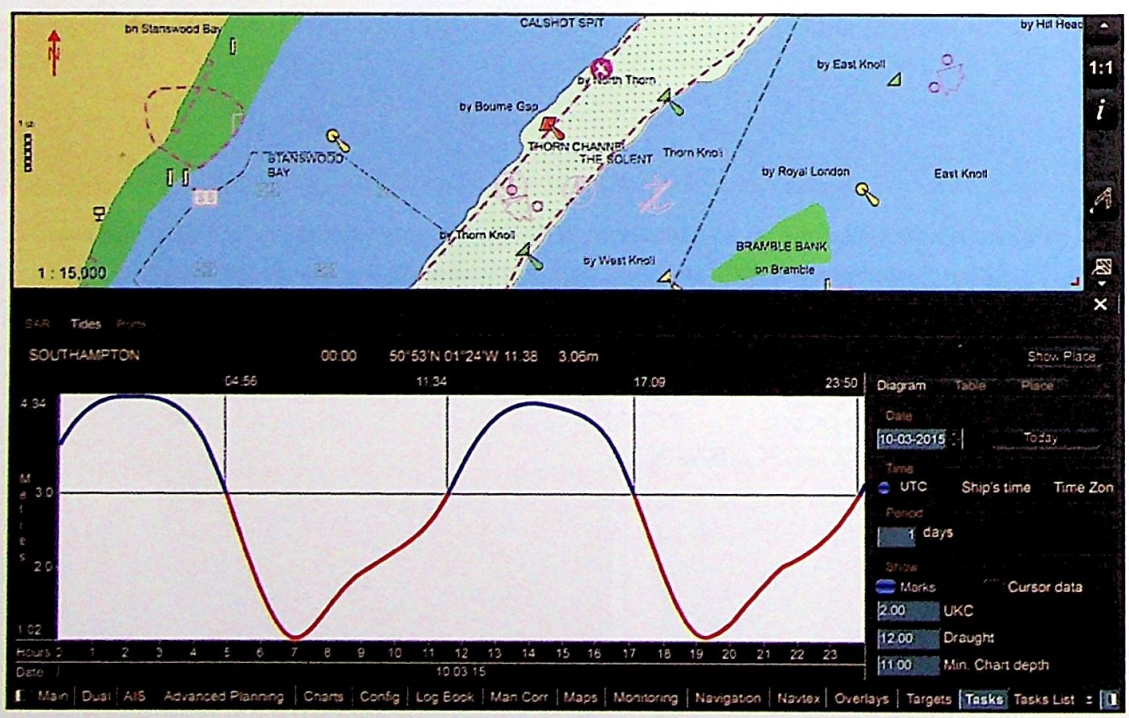


Figure 15: An example of a tidal database provided by the ECDIS manufacturer. *(Courtesy of Transas)*

The calculations resulting from this research should identify relevant tidal windows and provide an estimated time of departure (ETD) and arrival (ETA).

2.2.1.5 Speed and Endurance

The overall speed required to achieve the ETA can now be calculated. Consider whether any of the following will affect the calculated overall speed:

- Speed constraints
  - economical speed and maximum speed
  - environmental conditions
  - limits and restrictions
  - machinery limitations and defects
- endurance constraints
  - bunker capacity
  - fuel economy
  - minimum reserve of fuel
  - bunker availability
  - stability/loadline considerations
  - stores and spare parts
  - provisions and fresh water
  - manning considerations.

To conduct the majority of a passage at an economical speed, it may be necessary to proceed for a short period at a higher speed. If using ECDIS, the ETA to the final waypoint will update as the voyage progresses, enabling the speed to be adjusted accordingly. Alternatively, the formula shown in Figure 16 can be used to calculate the time necessary to proceed at higher speed to reduce to an economical speed for the remainder of the passage.

$$t = \frac{D - HT}{O - H}$$

Where:

t = time required to proceed at higher speed
D = distance (nm) from start of passage to point of arrival
T = time (hours) from start of passage to required ETA at point of arrival
O = higher speed (kts) to be used
H = economical speed (kts)

For example: The navigator is planning a passage for a ship with an economical speed of 10 kts and a maximum speed of 16 kts. There are 42 hours to complete the passage of 500 nm between departure and arrival points. The average speed required overall is therefore: 500 nm/42 hrs = 11.9 kts.

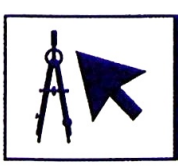
Therefore, the length of time to proceed at a higher speed (16 kts) in order to reduce to the economical speed (10 kts) for the latter part of the passage is:

$$t = \frac{500 - (10 \times 42)}{16 - 10} = \frac{500 - (420)}{6} = \frac{80}{6} = 13.33 \text{ or } 13 \text{ hrs } 20 \text{ mins}$$

Speed	Time	Distance travelled
16 kts	13 hrs 20 mins	213.33 nm
10 kts	28 hrs 40 mins	286.67 nm
Total:	**42 hrs**	**500 nm**

The navigator should then compare the fuel consumption figures to see whether initially increasing the speed to complete the majority of the passage at an economical speed will achieve an overall saving in fuel compared to proceeding at 11.9 kts for the entire passage.

Figure 16: Calculation to determine the time remaining at a higher speed, prior to reducing to a lower speed for the latter part of a voyage, while maintaining the required ETA.



If by this stage the voyage criteria are assessed to be unachievable, the Master should be advised at the earliest opportunity.

2.2.2 Preliminary Research – Weather and Environment

The weather, and any other environmental factors likely to affect the passage, should now be considered. It will be necessary to gather climatological, meteorological and oceanographic data to estimate the weather most statistically likely for the passage. Publications such as *'Routeing Charts'* and *'Sailing Directions'*, published by competent authorities, should be consulted for this purpose. If planning is taking place immediately prior to commencing a passage, an up-to-date weather forecast should be obtained. The following factors should be considered:

- Historic weather statistics (see Figure 17)
  - mean pressure
  - mean temperature
  - precipitation
  - visibility and probability of fog
  - wind strength (see Figures 18, 19 and 20)
  - hurricane, cyclone or typhoon seasons (see Figure 21)
  - wave height and direction (see Figure 22)
- load line limits
  - depicted on *'Routeing Charts'* for the major oceans, by month

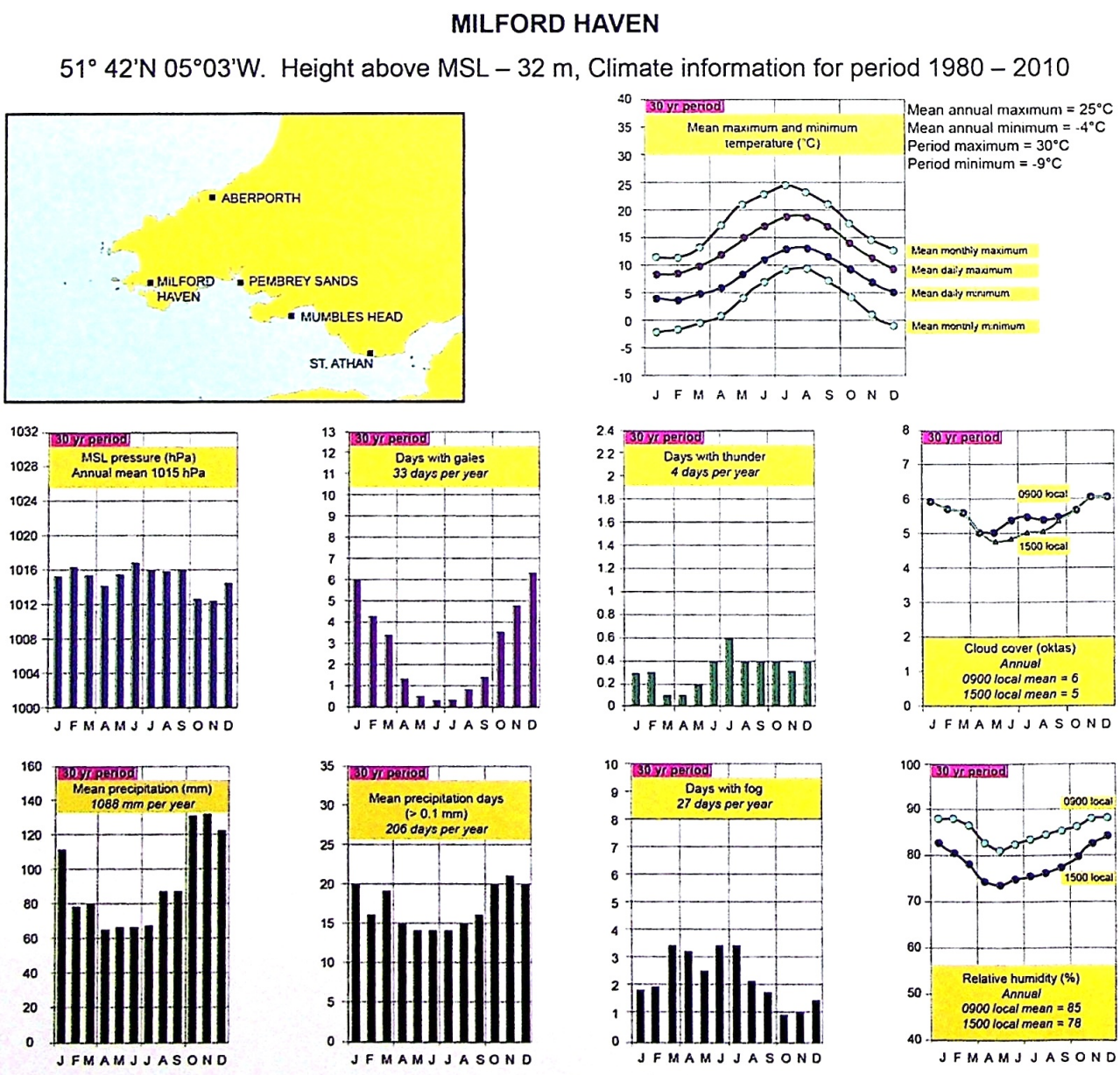
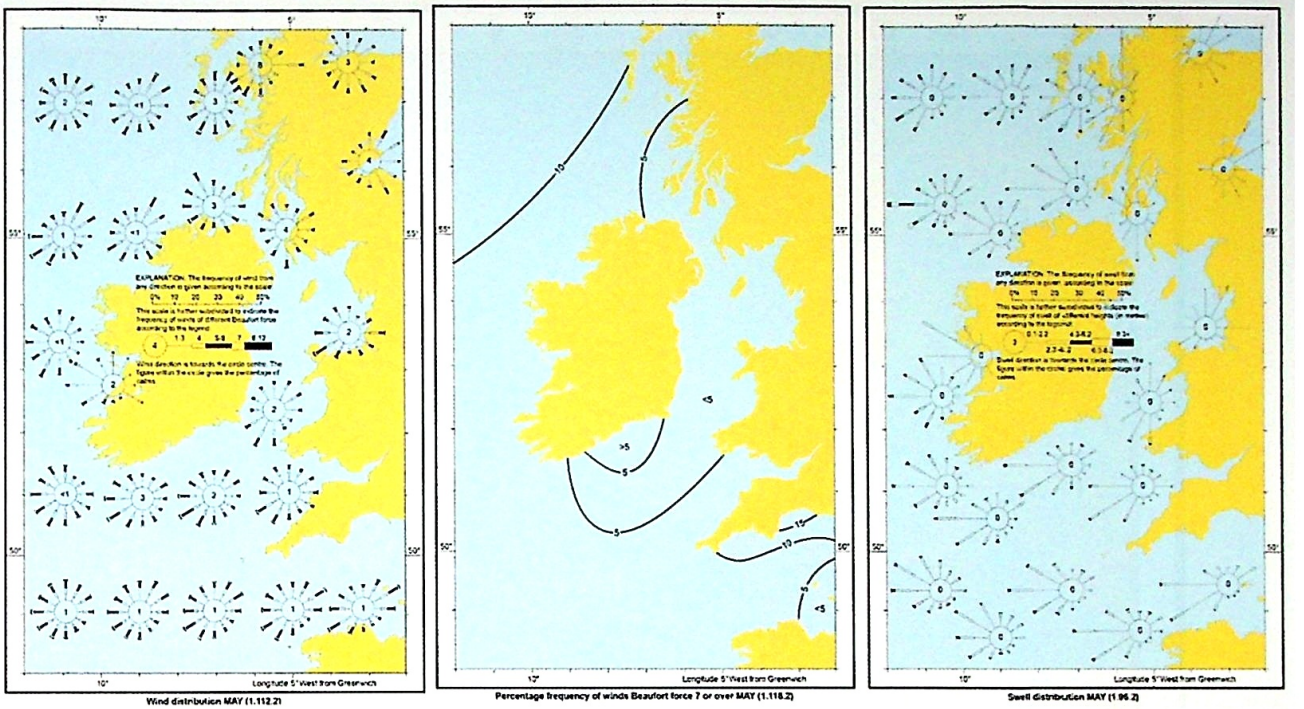


Figure 17: Historical climate information for Milford Haven.
(UKHO, *NP37 – 'Admiralty Sailing Directions, West Coasts of England and Wales'*) *(Courtesy of UKHO)*



Figures 18, 19 and 20: Wind direction, frequency of gales and swell distribution for the west coast of the UK in May.
(UKHO, *NP37 – 'Admiralty Sailing Directions, West Coasts of England and Wales'*) *(Courtesy of UKHO)*

Table C

Table showing principal areas affected and months in which tropical storms normally occur

Area & Local name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A	B
North Atlantic, West Indies region (hurricane)													10	5
North-East Pacific (hurricane)													15	7
North-West Pacific (typhoon)													25-30	15-20
North Indian Ocean Bay of Bengal (cyclone)													2-5	1-2
North Indian Ocean Arabian Sea (cyclone)													1-2	1
South Indian Ocean W of 80E (cyclone)													5-7	2
Australia W, NW, N coasts & Queensland coast (hurricane)													2-3	1
Fiji, Samoa, New Zealand (North Island) (hurricane)													7	2

Start/Finish of season Period of greatest activity Period affected when season early/late

Column A: Approximate average frequency of tropical storms each year
Column B: Approximate average frequency of tropical storms each year which develop Force 12 winds or stronger

Tropical Storm Table

Figure 21: Historical information relating to tropical storm frequency.
(UKHO, *NP136 – 'Ocean Passages for the World'*)
(Courtesy of UKHO)

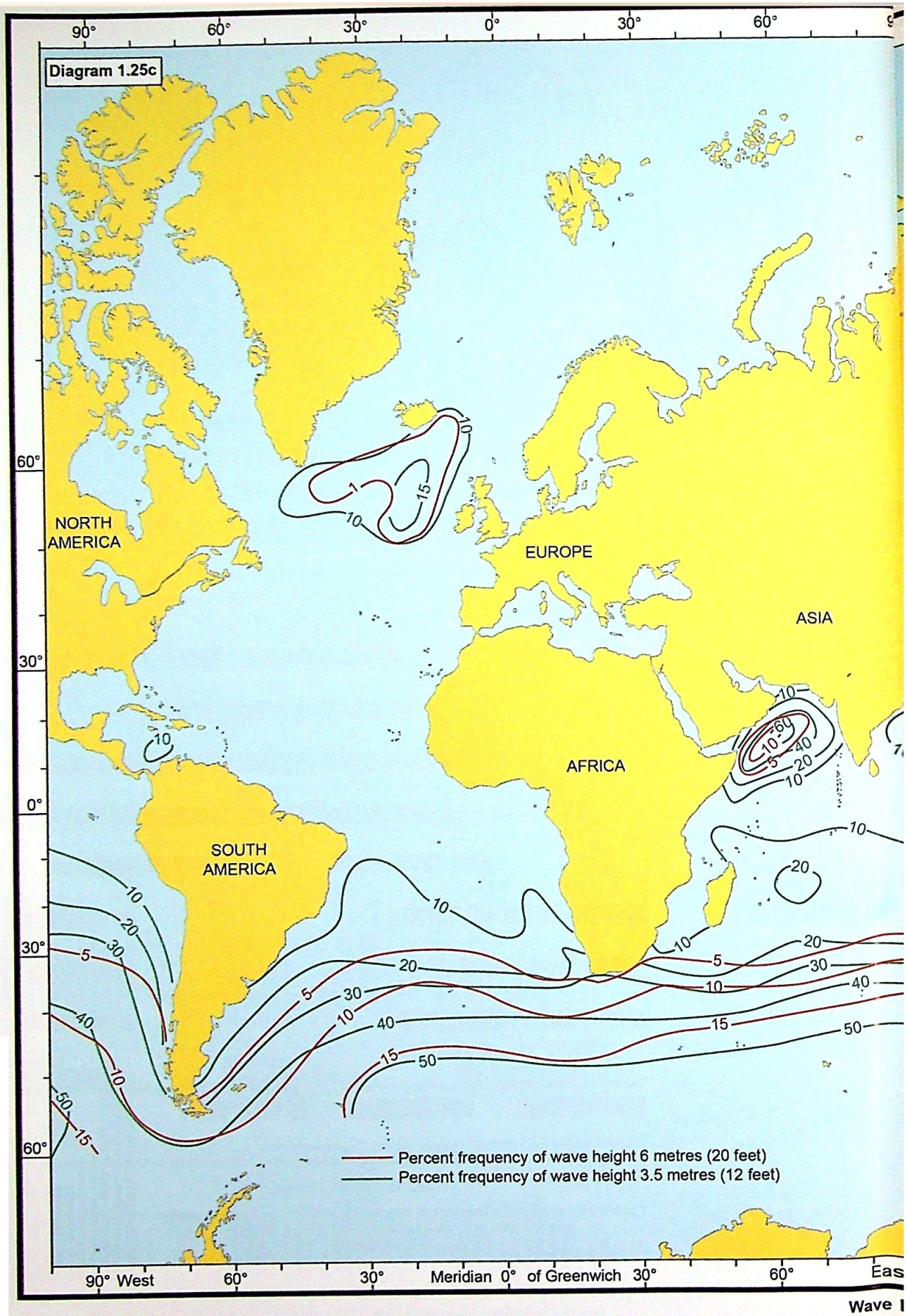
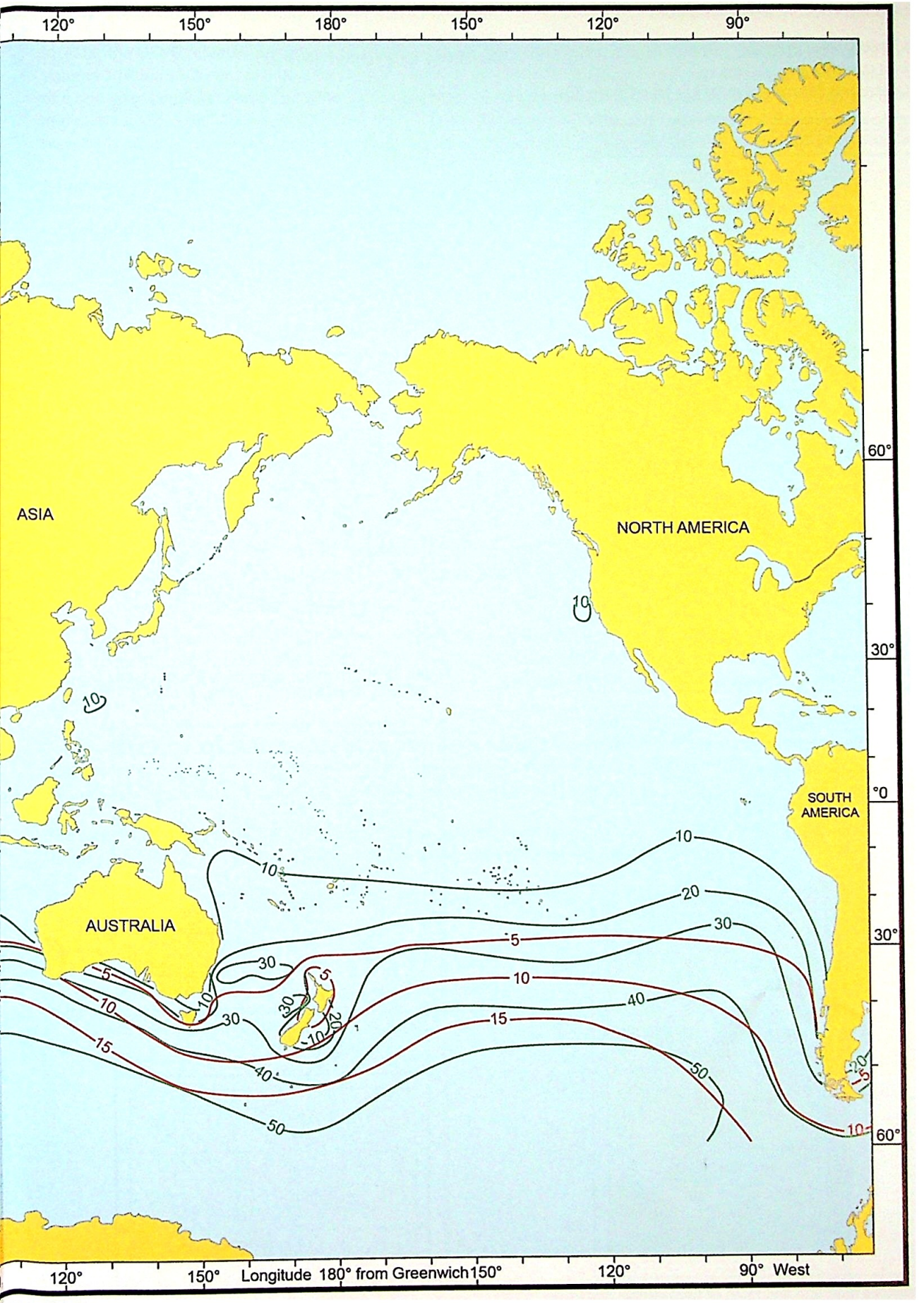


**Figure 22: Percentage frequency of wave heights for July. (UKHO, *NP136 – 'Ocean Passages for the World'*) *(Courtesy of UKH*


120°
150°
180°
150°
120°
90°
60°
30°
°0
30°
60°
ASIA
NORTH AMERICA
SOUTH AMERICA
AUSTRALIA
10
20
30
5
10
40
15
50
120°
150°
Longitude 180° from Greenwich
150°
120°
90° West

LY (1.25c)

- likely statistical environmental conditions
  - ice limits
  - ocean currents
  - tidal streams for coastal passages (see Figure 23).

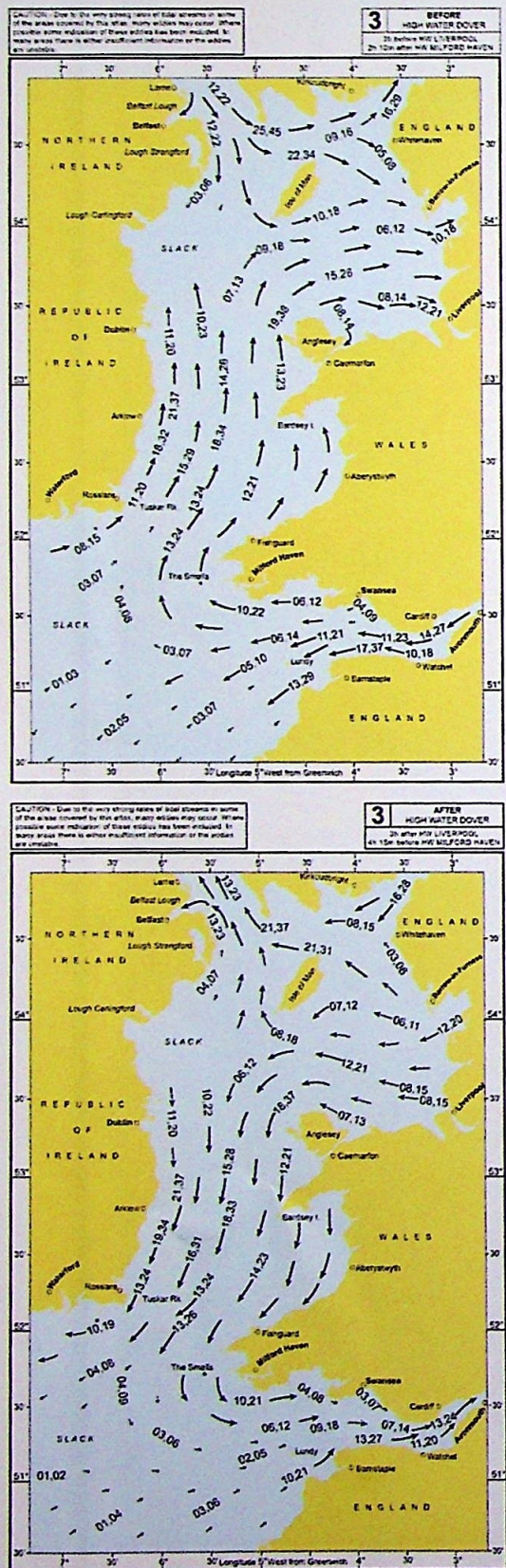


Figure 23: Predicted direction and rates of tidal stream shown in tidal stream atlas. (UKHO, *NP256 – 'Tidal Stream Atlas, Irish and Bristol Channel'*) *(Courtesy of UKHO)*

'Routeing Charts' provide information additional to that given in *'Ocean Passages for the World'* and *'Sailing Directions'* (see Figures 24 to 27).

Figure 24: North Atlantic Routeing Chart for July. (UKHO, Chart 5124(7)) *(Courtesy of UKHO)*

Figure 25: North Atlantic Routeing Chart for July. (UKHO, Chart 5124(7)) *(Courtesy of UKHO)*

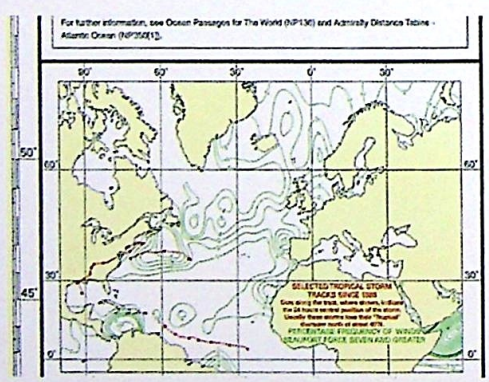


Figure 26: North Atlantic Routeing Chart for July showing tropical storm tracks and percentage frequency of winds greate than Force 7. (UKHO, Chart 5124(7)) *(Courtesy of UKHO)*

Figure 27: North Atlantic Routeing Chart for July showing percentage frequency of fog. (UKHO, Chart 5124(7)) *(Courtesy of UKHO)*

'Ocean Passages for the World' (OPTW/NP136)

In 2018, the UKHO released a significant update to *'Ocean Passages for the World'* (OPTW). The 2018 edition of NP136, Volume 1 (Atlantic Ocean) and Volume 2 (Indian and Pacific Oceans), was based on empirical research and depicts the results of a one-year sample of global (satellite and terrestrial) AIS data for worldwide bulk carrier, passenger ship, container ship and cargo ships' actual AIS tracks. The book removes any distinction between high-powered and low-powered ships, makes waypoints available in a format useful to ECDIS users and overlays ocean currents onto the route diagrams for the first time.

Admiralty OPTW (NP136, Vol 1/2) contains 'overview' information at the beginning of each geographical volume, which provides information on how to use each guide during the passage planning process. This overview section also provides information about each geographic area, regarding:

- Natural conditions
- climate
- winds, seasonality, TRS, depressions
- weather, waves and swell
- currents
- ice
- coral
- magnetic anomalies.

The overview section provides a broad description of global maritime weather patterns and other considerations relevant to ships crossing the ocean covered by that volume. The diagrams are similar to those found in *'Sailing Directions'*, but for ocean areas.

The subsequent sections of OPTW are organised by ocean region and detail the most frequently used routes between the most frequently used ports, identified by AIS analysis. Each section shows the routes in both a map/graphic diagram format and a tabular format. Each waypoint is named and the start and end of each route typically coincides with coastal routes detailed in *'Sailing Directions'*.

Each geographic section has a diagram at the start of the chapter showing each of the most frequently used ports, with the routes connecting them listed by name. The beginning of the section also lists cautionary notes particular to the region, naming hazards, currents and natural conditions that may be encountered there.

The routes given may be either 'port to port' or 'connector' routes. Connector routes span multiple sea areas. Routes may be Rhumb Line (RL), Great Circle (GC) or Composite GC and the distance of the route is listed.

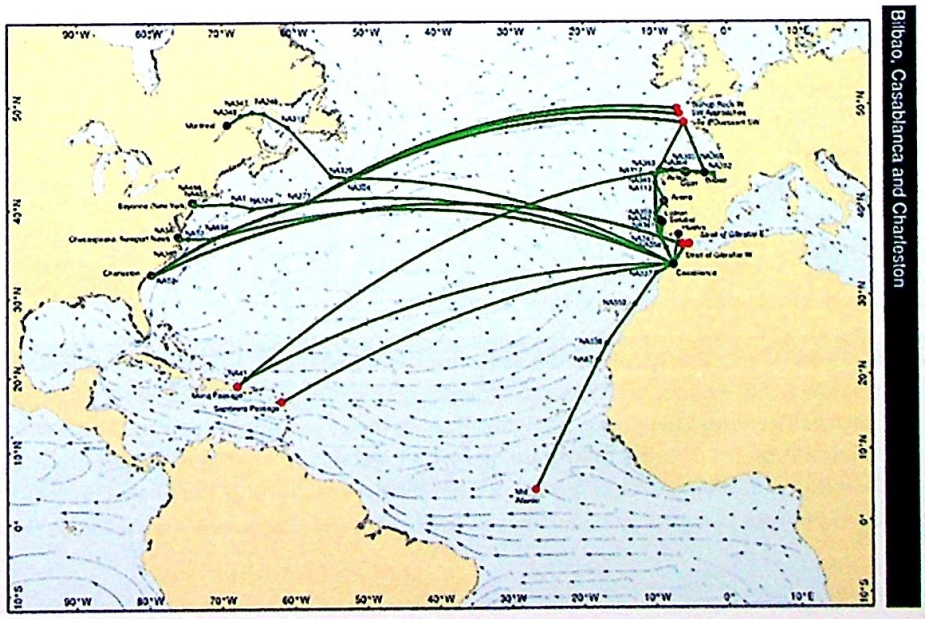


Figure 28: NP136, Vol 1, pg 43 – Screenshot from Admiralty Gateway eNP version, North Atlantic Connector Routes, UKHO 2018.

Port to Connector Routes

FROM	GP	TO	GP	LENGTH	FOR
Bilbao	43° 34'N 03° 11'W	Ile d'Ouessant SW	48° 24'N 06° 04'W	452	North Europe ports
Bilbao	43° 34'N 03° 11'W	Mona Passage	18° 41'N 67° 57'W	4371	Caribbean ports
Bilbao	43° 34'N 03° 11'W	Strait of Gibraltar E	36° 00'N 05° 24'W	1189	Mediterranean, Suez Canal and Indian Ocean ports
Bilbao	43° 34'N 03° 11'W	Strait of Gibraltar W	35° 57'N 06° 26'W	1189	Mediterranean, Suez Canal and Indian Ocean ports
Casablanca	33° 41'N 07° 34'W	Ile d'Ouessant SW	48° 24'N 06° 04'W	1266	North Europe ports
Casablanca	33° 41'N 07° 34'W	Antigua Channel	16° 34'N 61° 53'W	3482	Caribbean ports
Casablanca	33° 41'N 07° 34'W	Mid Atlantic	04° 26'N 26° 44'W	2230	South Atlantic ports
Casablanca	33° 41'N 07° 34'W	Mona Passage	18° 41'N 67° 57'W	3815	Caribbean ports
Casablanca	33° 41'N 07° 34'W	Strait of Gibraltar E	36° 00'N 05° 24'W	221	Mediterranean, Suez Canal and Indian Ocean ports
Charleston	32° 43'N 79° 47'W	Bishop Rock W	49° 41'N 07° 01'W	4667	North Europe ports
Charleston	32° 43'N 79° 47'W	Ile d'Ouessant SW	48° 24'N 06° 04'W	4698	North Europe ports
Charleston	32° 43'N 79° 47'W	SW Approaches	49° 11'N 06° 39'W	4678	North Europe ports
Charleston	32° 43'N 79° 47'W	Strait of Gibraltar E	36° 00'N 05° 24'W	4601	Mediterranean ports
Charleston	32° 43'N 79° 47'W	Strait of Gibraltar W	35° 57'N 06° 26'W	4601	Mediterranean ports

Waypoints

ID	NAME	GP	ID	NAME	GP
NA1	Great South Channel	40° 30'N 68° 42'W	NA341	Cape S. Vicente TSS	36° 40'N 09° 17'W
NA32	Chesapeake E	36° 48'N 74° 39'W	NA342	Cape Roca TSS	38° 39'N 09° 59'W
NA38	Cape Hatteras SE	35° 04'N 75° 01'W	NA345	Cape Finisterre TSS	43° 16'N 10° 00'W
NA41	Mona Passage NE	19° 43'N 66° 47'W	NA346	Detroit D'Honguedo	49° 20'N 64° 13'W
NA56	Chesapeake Bay SE	36° 47'N 75° 42'W	NA347	Mont-Louis N	49° 27'N 65° 47'W
NA59	Charleston	32° 37'N 79° 35'W	NA348	Saint-Felicite N	49° 08'N 67° 24'W

Figure 29: NP136, Vol 1, pg 44 – Screenshot from Admiralty Gateway eNP version, Corresponding waypoints, UKHO 2018.

The Ocean Connector Routes:

- Take account of the start or end of ocean TSSs
- do not account for coastal or inshore TSSs (port approaches)
- do not account for Load Line Zones
- do not account for hazards that may be shown on better scaled charts/ENCs
- make no distinction between high-powered/low-powered ships
- are described as 'Port to Port' or 'Port Connector' routes
- can be used in either direction.

The Ocean Connector Waypoints:

- Are all named
- are given a unique ID number
- are given to degrees and minutes accuracy (DD° MM').

The routes are shown graphically on map diagrams at an overview scale and the routes are overlaid on arrows depicting the magnitude and direction of the surface currents known to affect shipping. The currents shown are for the month of January and are intended to be used as a general guide only. Navigators using these waypoints, routes and current diagrams should use them as an initial approximation for a route, before doing further detailed planning using a more accurate current and tidal stream prediction. Admiralty *'Routeing Charts'* give more detailed predictions of the likely currents for each month, season and ocean region.

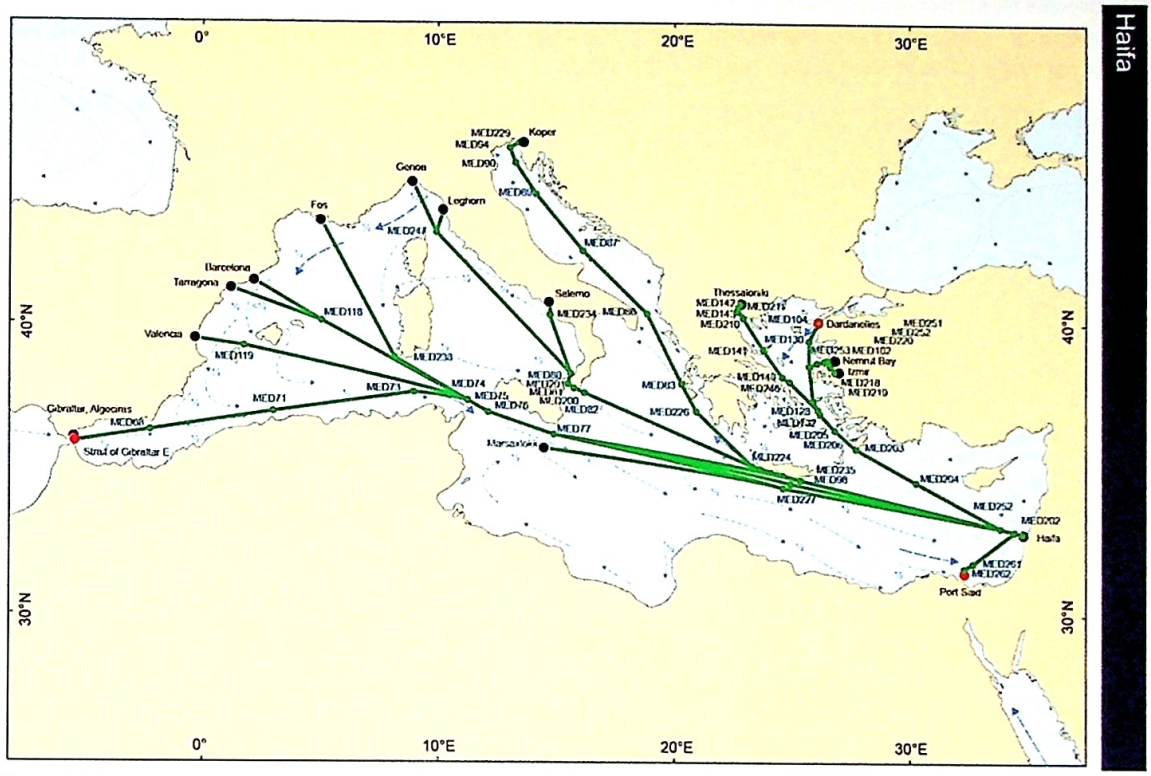


Figure 30: NP136, Vol 1, pg 108 – Screenshot from Admiralty Gateway eNP version, Port to Port Routes, UKHO 2018.

The table of ports in each section includes the 'UN Code for Trade and Transport Locations' (LOCODE) and 'UN Country Code' (CCODE) for each named port, to avoid misidentification between ports with the same name. Geographic Positions (GPs) are given for each waypoint in the format of DD° MM' and need to be adapted more precisely when plotting courses to steer on detailed charts/ENCs.

Haifa

Port to Port Routes

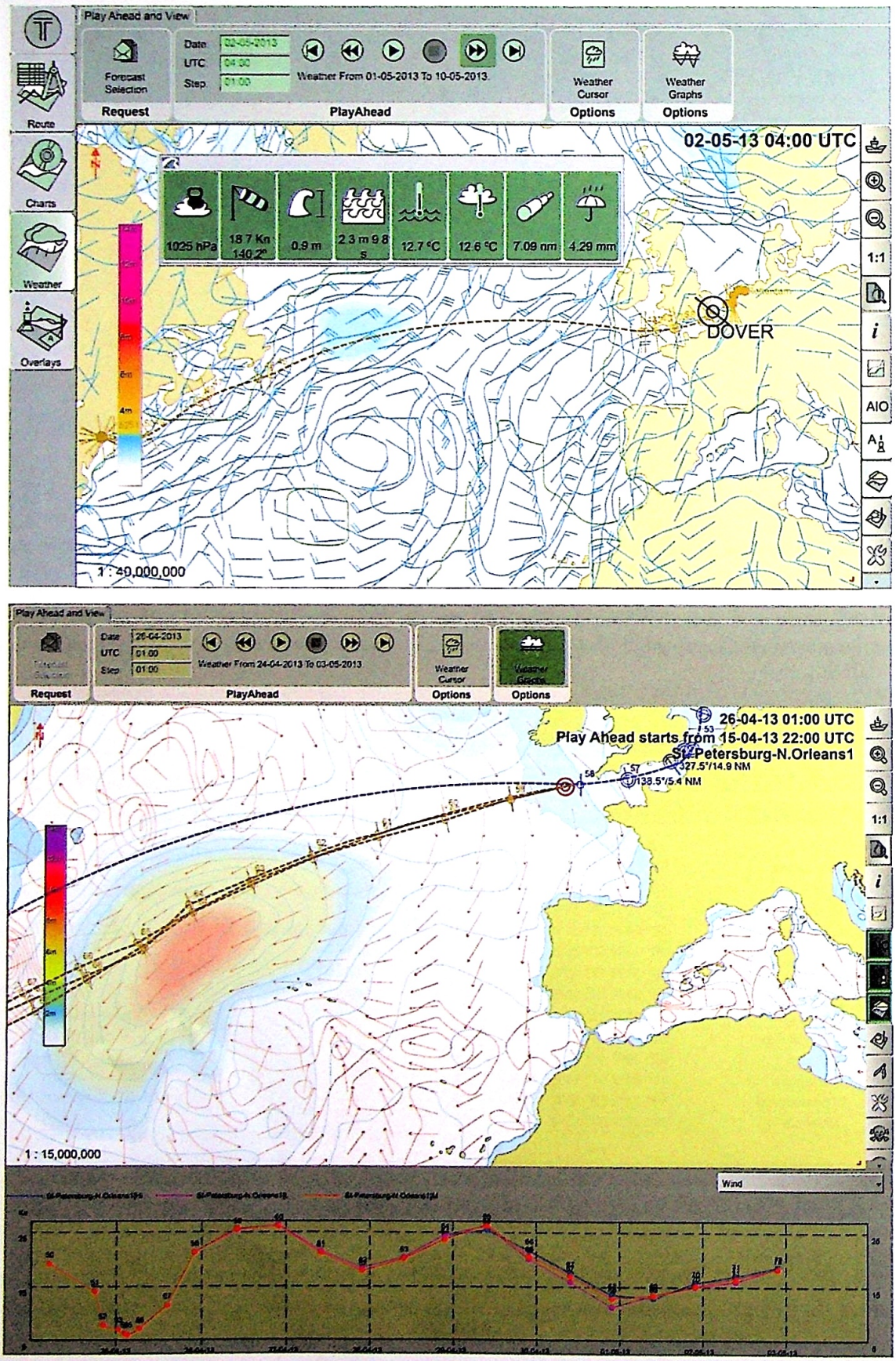
	NAME	GP	LOCODE	CCODE	LENGTH	FOR	NP
From	Haifa	32° 52'N 34° 58'E	HFA	IL			NP49
To	Barcelona	41° 18'N 02° 12'E	BCN	ES	2088		NP45
To	Fos	43° 11'N 05° 03'E	FOS	FR	2074		NP46
To	Genoa	44° 22'N 08° 57'E	GOA	IT	1893		NP46
To	Gibraltar, Algeciras	36° 08'N 05° 24'W	ALG	ES	2488		NP67
To	Izmir	38° 26'N 27° 05'E	IZM	TR	834		NP48
To	Koper	45° 34'N 13° 42'E	KOP	SI	1780		NP47
To	Leghorn	43° 31'N 10° 14'E	LIV	IT	1813		NP46
To	Marsaxlokk	35° 48'N 14° 34'E	MAR	MT	1244		NP45
To	Nemrut Bay	38° 46'N 26° 54'E	NEM	TR	810		NP48
To	Salerno	40° 38'N 14° 43'E	SAL	IT	1447		NP46
To	Tarragona	41° 04'N 01° 14'E	TAR	ES	2133		NP45
To	Thessaloniki	40° 37'N 22° 55'E	SKG	GR	968		NP48
To	Valencia	39° 25'N 00° 17'W	VLC	ES	2177		NP45

Port to Connector Routes

FROM	GP	TO	GP	LENGTH	FOR
Haifa	32° 52'N 34° 58'E	Dardanelles	40° 01'N 26° 09'E	855	Marmara Denizi and Black Sea ports
Haifa	32° 52'N 34° 58'E	Port Said	31° 24'N 32° 21'E	200	Suez Canal and Indian Ocean ports
Haifa	32° 52'N 34° 58'E	Strait of Gibraltar E	36° 00'N 05° 24'W	2488	North Europe and North Atlantic ports

Figure 31: NP136, Vol 1, pg 109 – Screenshot from Admiralty Gateway eNP version, Corresponding Port Waypoints and Port Codes, UKHO 2018.

In addition to the use of printed publications for assessment of weather and environmental information, some ECDIS can integrate with weather routeing services. Where this capability exists, it may be necessary to construct a route in ECDIS, although an approximate route is all that is required at this stage.



Figures 32 and 33: Some ECDIS passage planning software facilitates the simulation of likely weather conditions, allowing optimal routes that avoid certain weather patterns to be identified. *(Courtesy of Transas)*

It is also possible to use ECDIS to display chart products that can help ascertain the existence or extent of ice. This is particularly important when planning to use a GC route at high latitudes or when planning to travel through or near areas that are prone to ice formation (see Figures 34 and 35).

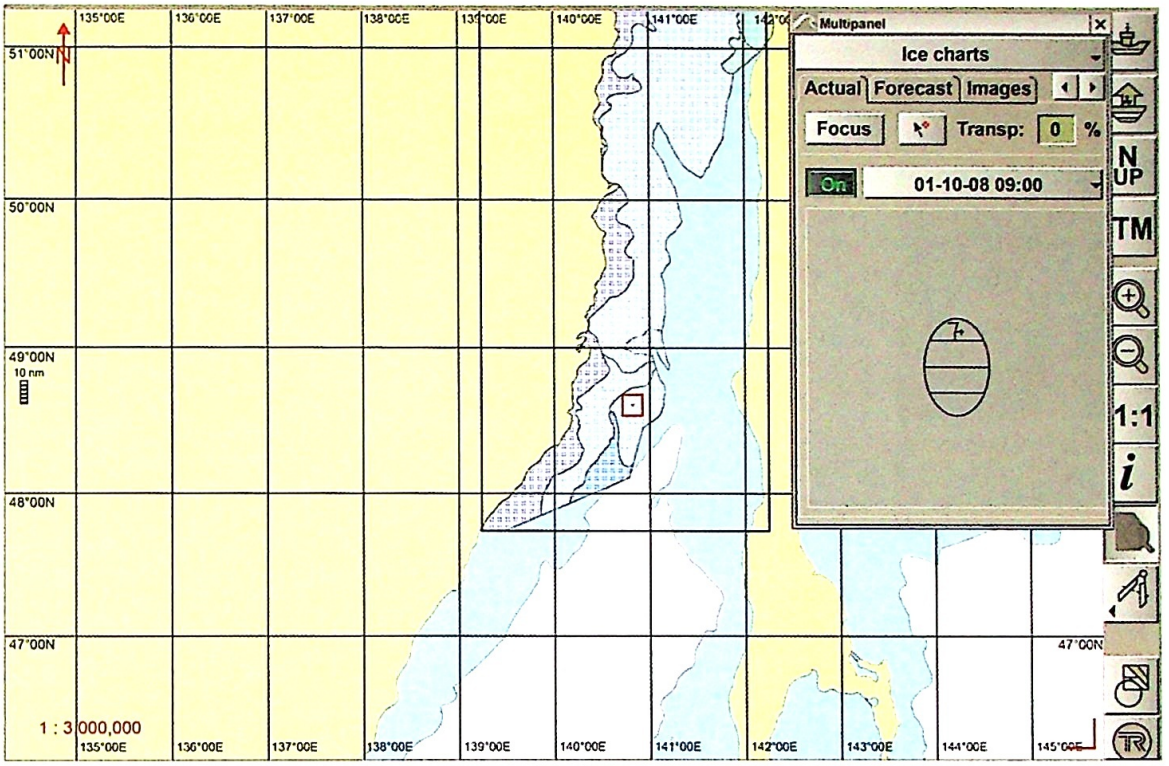


Figure 34: An example of an ice chart overlay. *(Courtesy of Transas)*

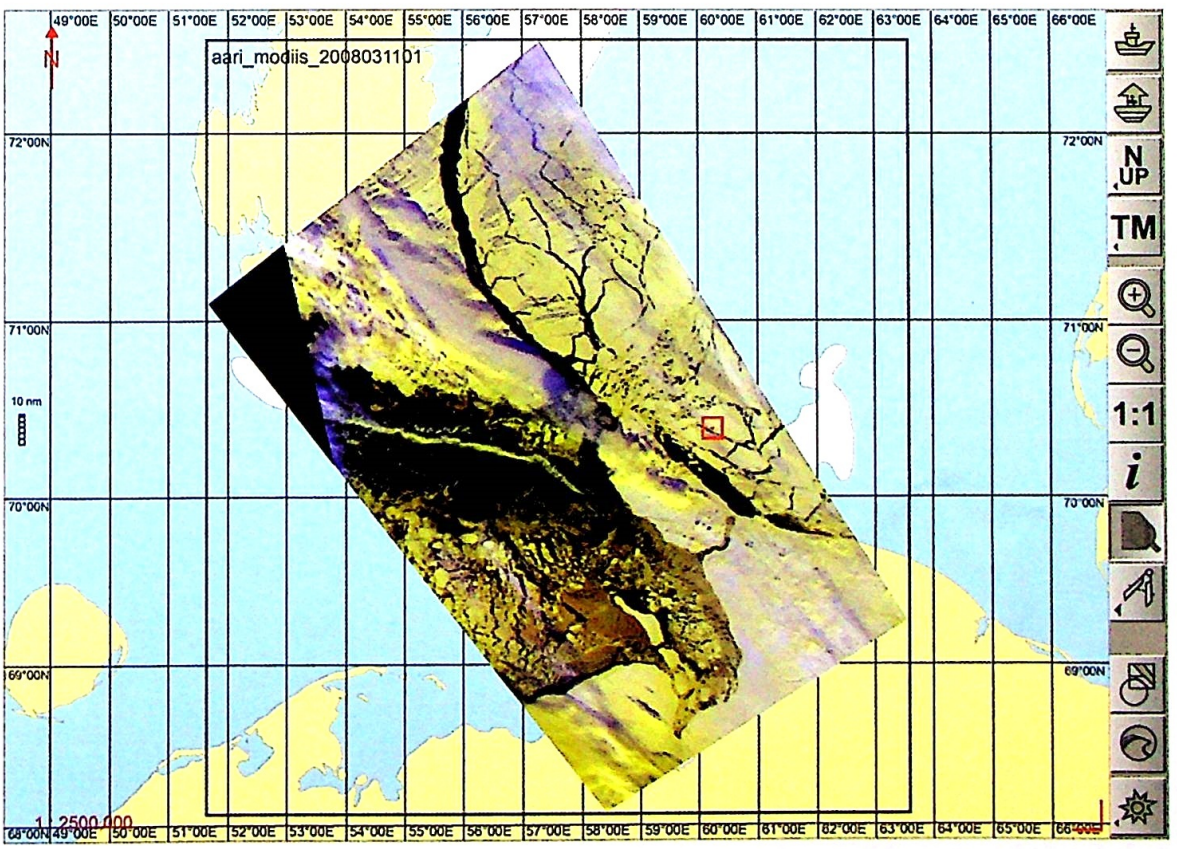
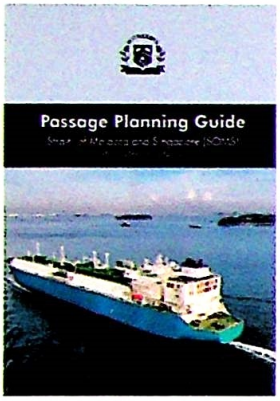


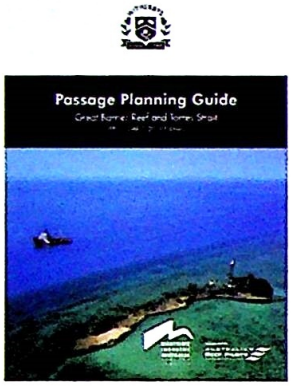
Figure 35: A satellite image that can be used to show ice formation relative to land mass.
(Courtesy of Transas)

2.2.3 Preliminary Research – Passage Planning Guides

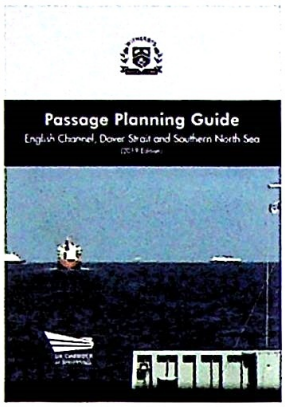
These Guides, produced by Witherbys, are updated on a two-year cycle to incorporate the latest guidance and practical advice for ships transiting the following regions:



Straits of Malacca and Singapore (SOMS)



Great Barrier Reef and Torres Strait (GBRTS)



English Channel, Dover Strait and Southern North Sea

Figure 36: Witherbys regional Passage Planning Guides.

The Guides bring together all the regional information required in the appraisal and planning stages and have been carefully compiled with the assistance of navigating officers, ship Masters, deep sea pilots, marine advisors, navigation superintendents and other appropriate organisations that have an interest in the respective regions.

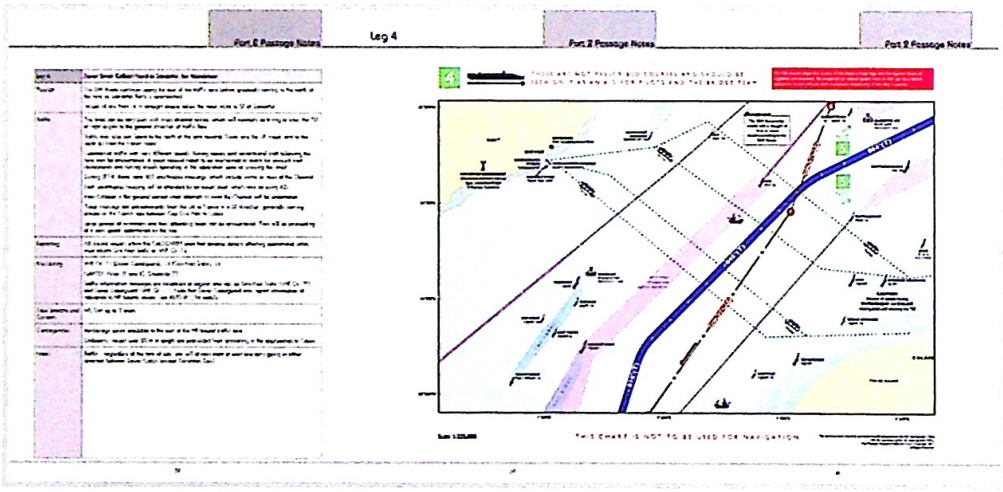


Figure 37: Extract from the English Channel, Dover Strait and Southern North Sea Passage Planning Guide.

The Guides include full-colour pull-out chartlets that accompany detailed passage information for each leg of the voyage, ensuring that they provide ongoing support and guidance during the complete voyage through the area.

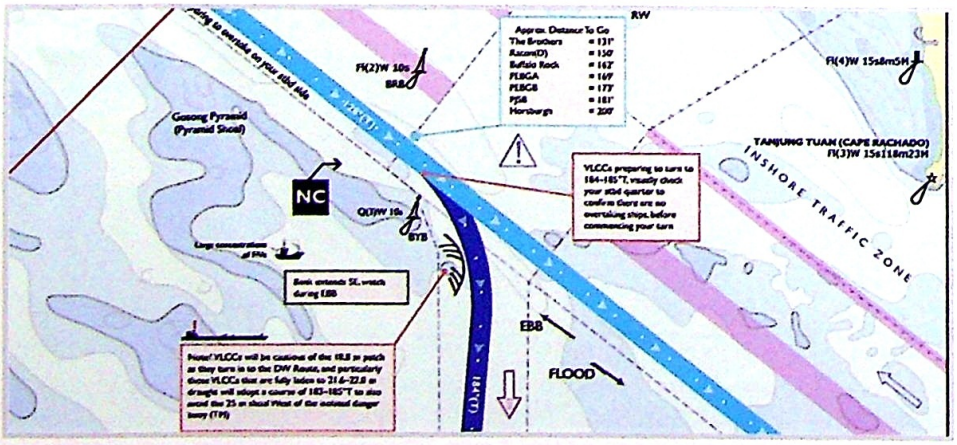


Figure 38: Extract from the Straits of Malacca and Singapore (SOMS) Passage Planning Guide.

Key information includes the main traffic and ferry routes through the region and details of local craft, such as tugs and tows, and where they are currently found as their routes change with reclamation works. Details of crossing traffic and likely times of day when they may be encountered are given, as are the areas where concentrations of fishing ships may be found along with times of day, tide, season and their typical behaviour with regard to through traffic.

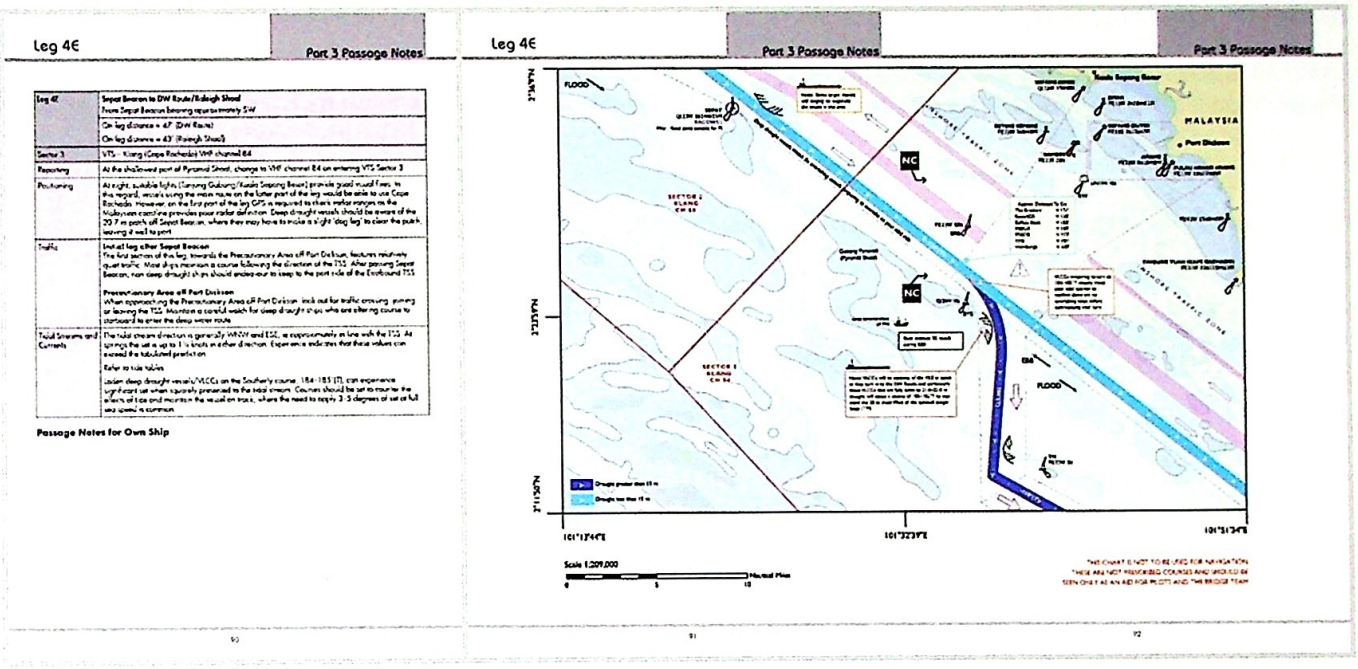


Figure 39: Extract from the Straits of Malacca and Singapore (SOMS) Passage Planning Guide.

General information on tidal streams is detailed, together with experience of how they behave in specific areas and their impact on ship manoeuvrability in those regions.

At constrained legs of the passage, details and particulars of UKC and the impact of any other environmental considerations on UKC, including their application to static and dynamic values of UKC, are taken into account.

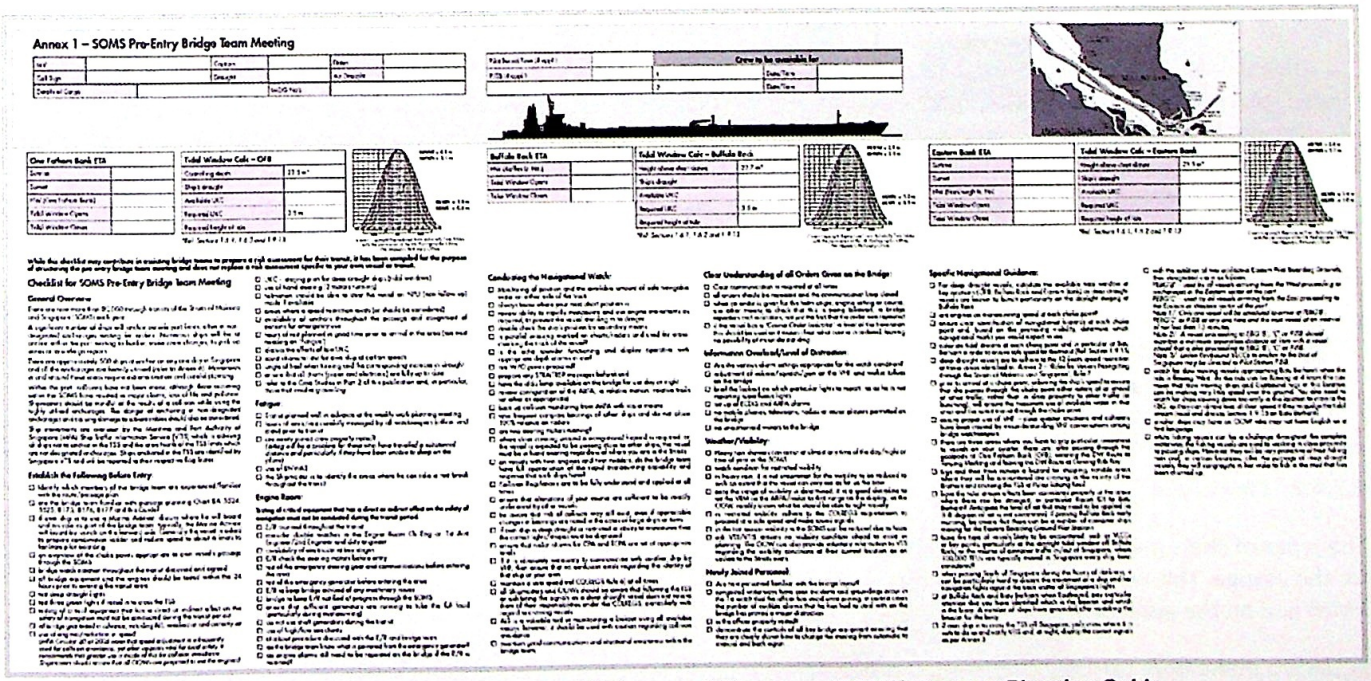


Figure 40: Extract from the Straits of Malacca and Singapore (SOMS) Passage Planning Guide.

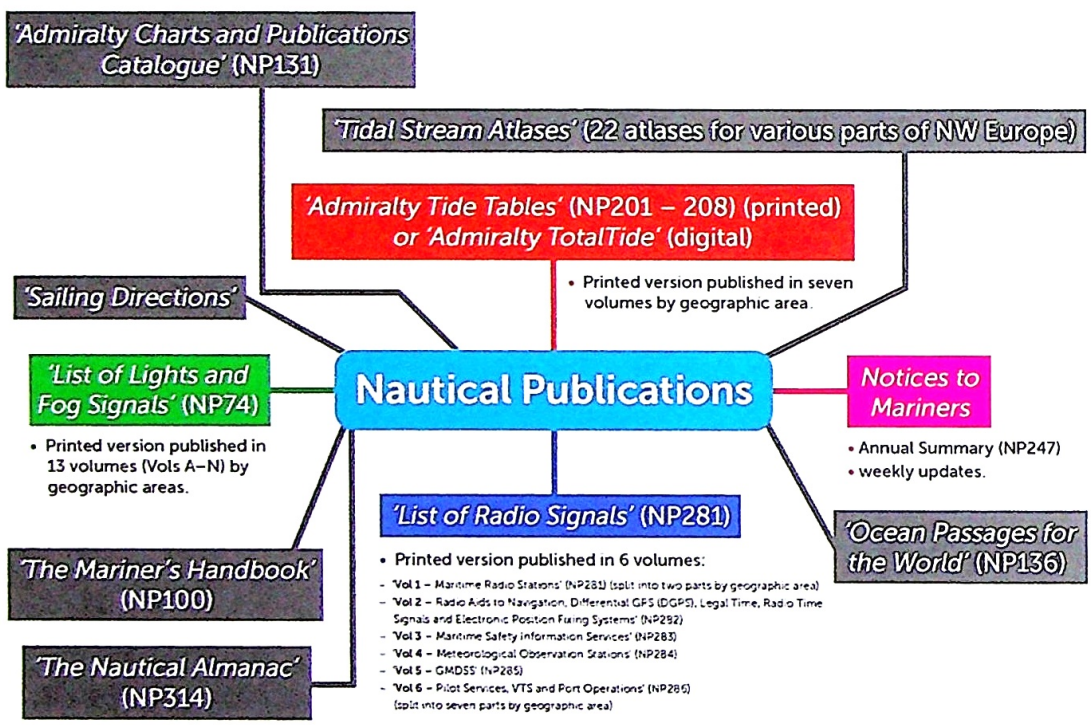
2.2.4 Preliminary Research – Nautical Publications, Charts, Update and Review

The likely routes should now start to present themselves. Section 2.1 outlined the charts and nautical publications that should be held on board, in accordance with guidance, to fulfil the SOLAS V, Regulation 19 carriage requirements. If the charts and nautical publications required for the voyage are not on board, they should be identified and sourced from an approved chart agent at the earliest opportunity.

Charts should be of an appropriate scale, up to date and assessed for content and quality. Where ECDIS is the primary means of navigation (PMN), it is also necessary to verify that ENCs are correctly installed and updated with the latest warnings.

2.2.4.1 Nautical Publications

Nautical publications are available in either paper or digital format and the following should be consulted when passage planning:



The navigator should identify the required nautical publications using chart management software or a paper method such as the *'Admiralty Charts and Publications Catalogue'*. These should be listed, then read, with the information extracted as appropriate for the voyage proposed.

Nautical publications require regular update. For paper publications, updates come from the Annual Summary of Notices to Mariners and Weekly Notices to Mariners. For digital publications, updates are available online or issued by email/update from the chart agents for the ship. Records of these updates should be maintained to provide evidence that the most up-to-date information is used when planning.

2.2.4.2 Chart Type

The types of chart (paper/ENC/RNC) used by the navigator depend on the primary means of navigation (PMN) to be used for the voyage. This will depend on both the approved method on the ship (whether the ship is certified to use ECDIS as the PMN) and on the availability of Electronic Navigational Charts (ENCs).

ECDIS is a mandatory carriage requirement under Regulation V/19.2.10 of SOLAS. It was subject to a phased entry into force programme that was completed in July 2018. A ship may use ECDIS to meet the compulsory chart carriage requirements for a voyage under SOLAS if ENCs are used and if certain additional conditions are met:

- ENC carriage must comply with SOLAS Regulation V/27 (the ENCs must be the latest available edition, kept up to date and correctly displayed according to the latest IHO standard)

- the installed ECDIS must be type approved (SOLAS Regulation V/18)
- the ECDIS must conform with the IMO performance standard (Resolution MSC.232(82))
- there must be adequate, independent backup arrangements in place (SOLAS Regulation V/19.2.1.5)
- the ECDIS operator must be duly certified.

In addition, each flag State has its own requirements for use of ECDIS as the primary means of navigation (PMN). Commonly referred to as 'paperless', ships using ECDIS as the PMN may still be required to have a full set of paper charts in use alongside their ECDIS or may be required only to have a reduced set of 'take me home' paper charts, or none at all. Usually, approval will also be based on an uninterruptible power supply (UPS) being available for the ECDIS.

Officers should be fully aware of what is required by their flag State Administration and of the types of chart in use on their ship.

The navigator must be aware that, even if ECDIS is approved as the PMN, where ENCs are not available for the voyage and even if RNCs are available, the ship will still need to use an appropriate and up-to-date portfolio of paper charts (APC) (for more information, see Figure 45).

2.2.4.3 Paper Chart Outfit

If paper charts are required, the navigator should identify and list the relevant charts for the passage from a chart catalogue issued by an official hydrographic authority, such as the UKHO. The *'Admiralty Charts and Publications Catalogue'* (NP131), also known as the *'Admiralty Chart Catalogue'*, lists all UKHO paper charts and shows their limits of coverage (see Figure 41). The *'Admiralty Digital Catalogue'* may also be used to select paper charts required for a route, which is similar to the mechanism used to select ENCs for a route (see Figures 48 and 49). These catalogues also contain lists of countries with other established hydrographic offices that publish charts of their own national waters. The selection of charts by the navigator should be comprehensive enough to cover the entire route, berth to berth, and include appropriate scales of charts for the phases of the voyage (pilotage, port approach, coastal and ocean passages).

With the list of charts required, the navigator should then prepare the charts for the voyage (usually known as the 'voyage folio'). Most ships that carry paper charts may already have the required charts as part of the 'chart outfit' on board. However, where paper charts are not present in the chart outfit, the navigator will need to order them from their approved chart agent. A list of charts should be kept and maintained by the navigator. In most cases, this is done with the chart management software on board (usually selected by the company/provided by the chart agent).

Importantly, the navigator must ensure that all navigation charts are corrected up to date. This applies both to new charts ordered and received on the ship and to existing charts. It is important to also check to see whether new editions have been issued. Chart corrections should be carried out weekly, as part of the routine of the navigator (usually the second officer). However, the navigator should still check each chart to ensure that they have been suitably updated, or replaced with a new edition, as it is possible previous updates may not have been applied.

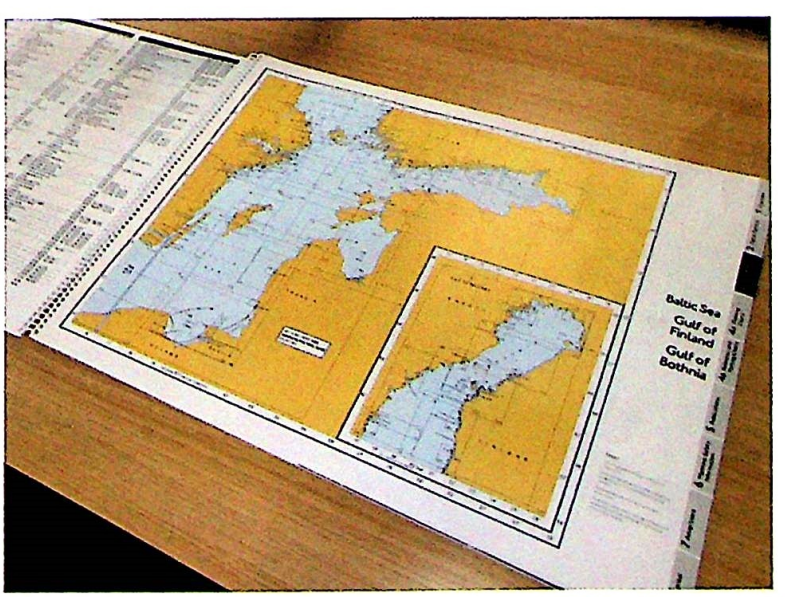


Figure 41: *'Admiralty Charts and Publications Catalogue'*, (NP131). *(Courtesy of UKHO)*

Charts must be kept up to date from:

- Weekly Notices to Mariners (NM)
- radio navigation warnings (see Figure 42 for NAVAREA regions).

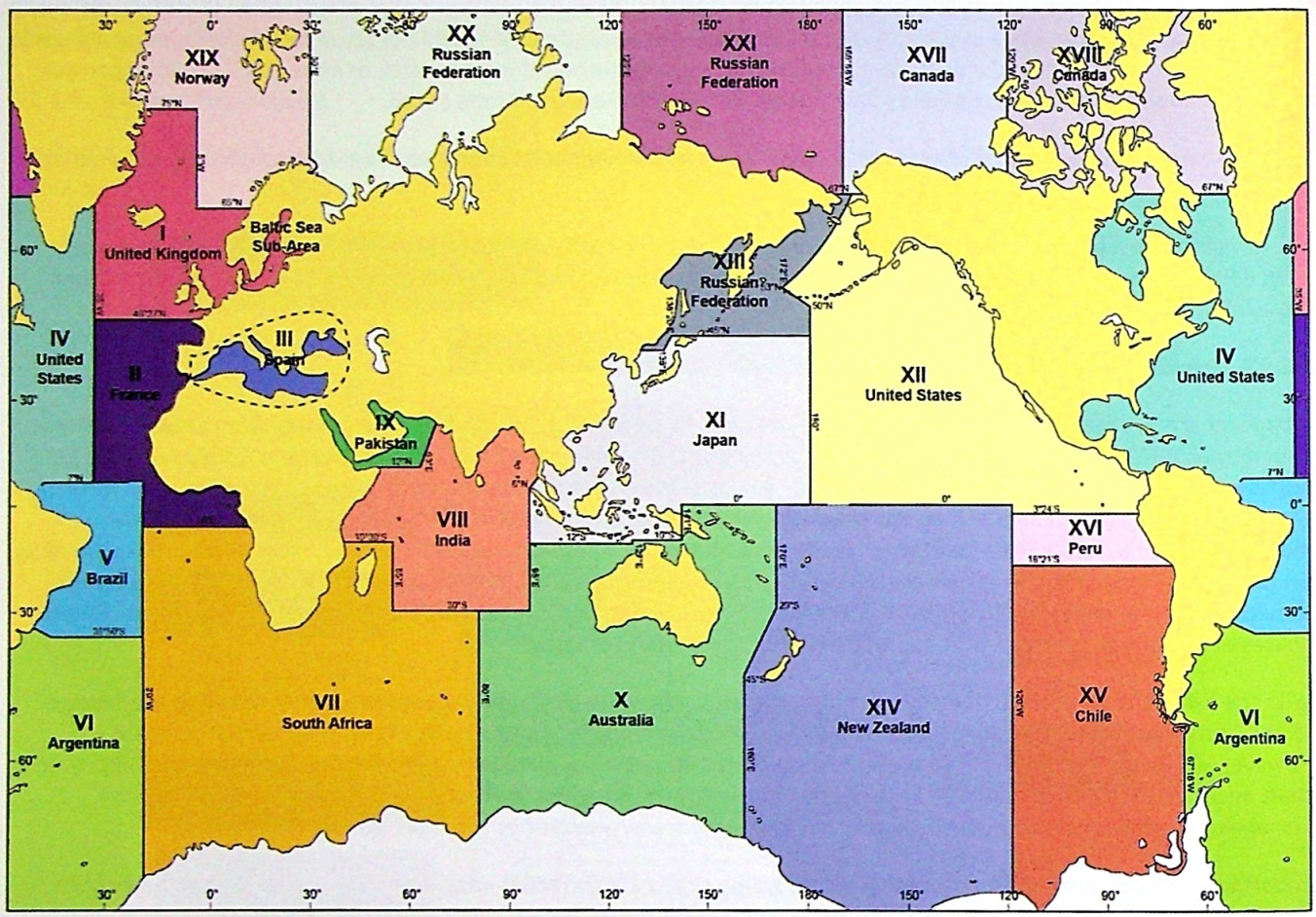
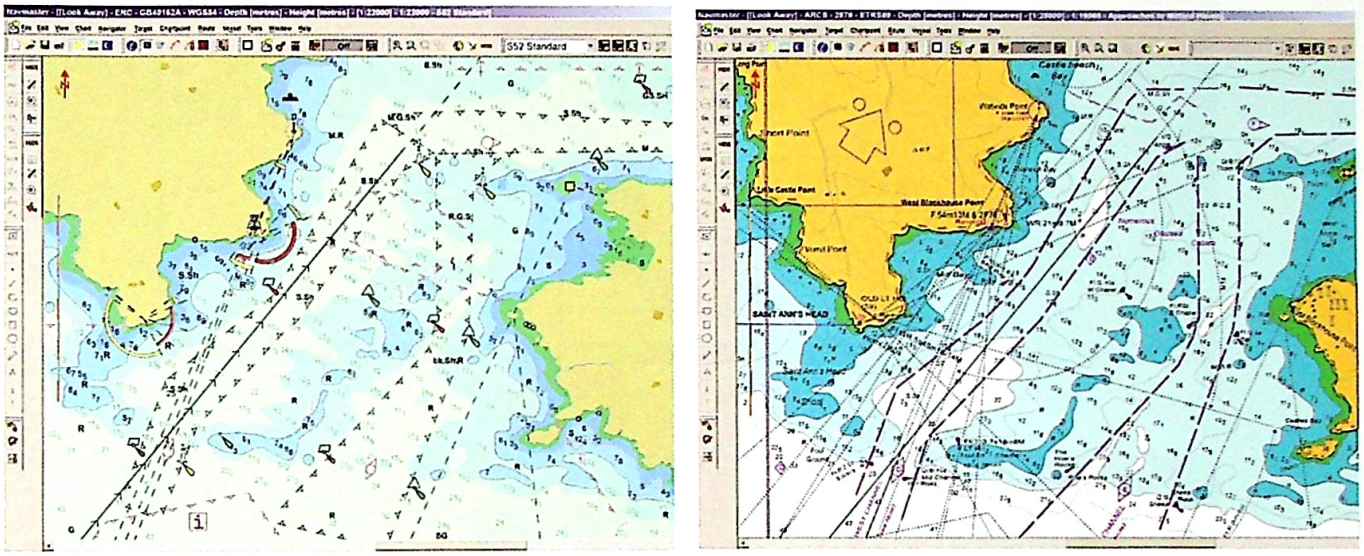


Figure 42: NAVAREA regions. (UKHO, *NP100 – 'The Mariner's Handbook'*) *(Courtesy of UKHO)*

2.2.4.4 ENC/RNC Portfolio

Where ECDIS is the PMN, it is important to ensure that all the relevant chart formats are installed. To meet SOLAS carriage requirements, electronic charts used in ECDIS must be official, meaning they must be issued by or on the authority of a government-authorised hydrographic office (HO), or other relevant government institution, and conform to IHO standards. ENCs and RNCs are the only official formats sanctioned by the IMO for use in ECDIS when it is used as the PMN. If there are insufficient ENCs of an appropriate scale to cover the entire route, RNCs may be used to fill any gaps in ENC coverage. However, due to the reduced safety features when using RNCs in ECDIS, flag States may require documented risk assessments to be conducted when using RNCs and an appropriate portfolio of paper charts (APC) may be prescribed.



Figures 43 and 44: Example of an ENC (left) and equivalent scale RNC (right) for the same area. *(Courtesy of PC Maritime)*

An RNC is a raster representation of a paper chart and, when used in ECDIS, the system is in raster chart display system (RCDS) mode. In RCDS mode, the ECDIS safety contour is not available and no alarms will be triggered when the ship crosses the safety contour value. Navigators should consider the use of mariner-added objects as well as the APC to mitigate the loss of this safety feature in ECDIS.

Figure 45 can be used to ascertain whether an electronic chart portfolio is SOLAS compliant. For example, the passage plan arrives at a port where an appropriate scale ENC (scale 5 or 6) is not available, and therefore an appropriate RNC and paper chart must be obtained.

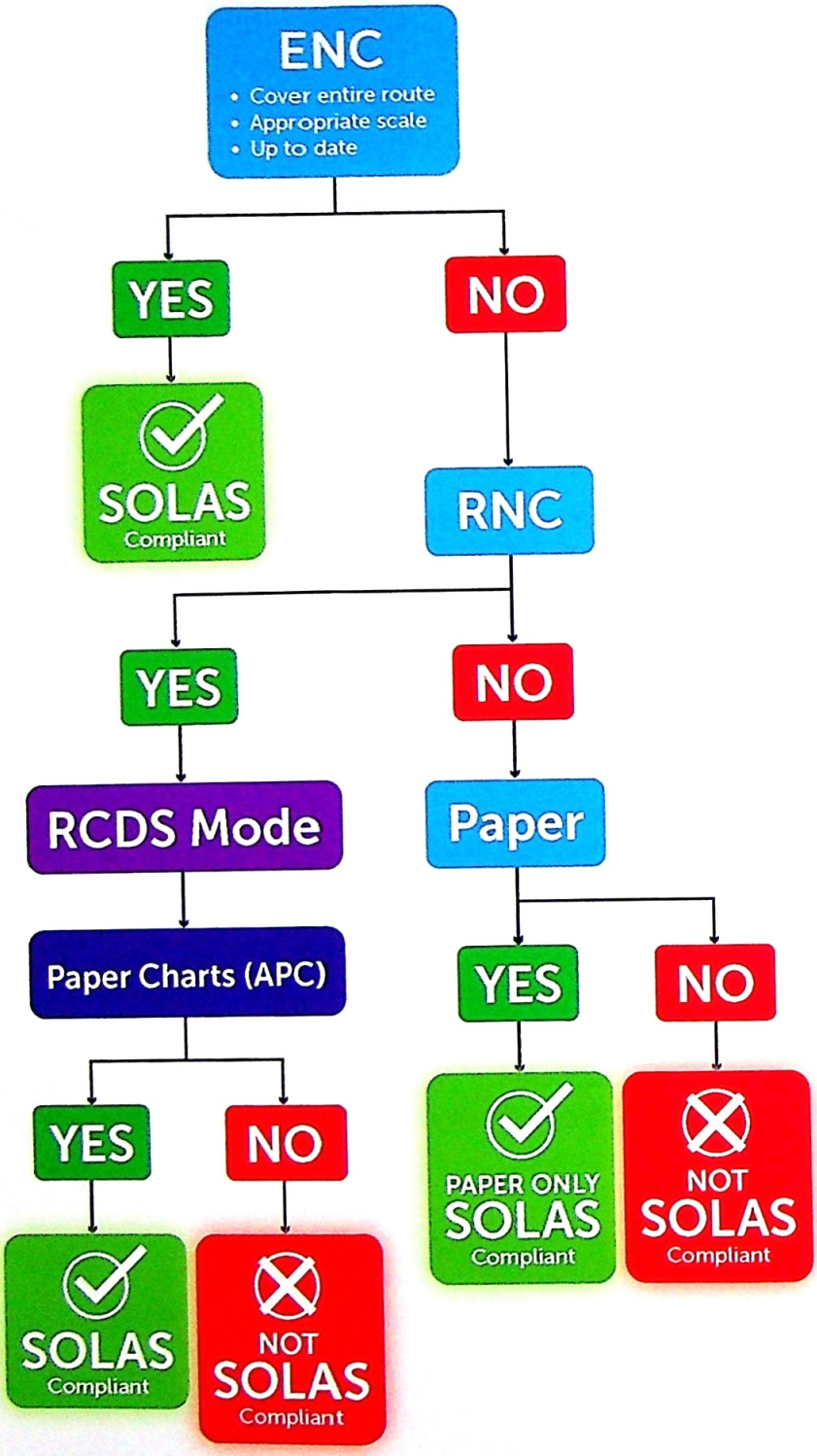


Figure 45: SOLAS chart compliance diagram.

The minimum requirements for carriage of charts (including the contents of any APC if required) will vary by flag State. The navigator should consult the relevant documentation for their flag State.

Figure 45 also illustrates when official data formats are permitted for use in ECDIS and shows when ships are permitted to use RNCs and official paper charts where ENC coverage at the appropriate scale does not exist.

Although unofficial chart data may be used in ECDIS as a supplementary aid to navigation, such data does not meet SOLAS chart carriage requirements when ECDIS is used as the PMN.

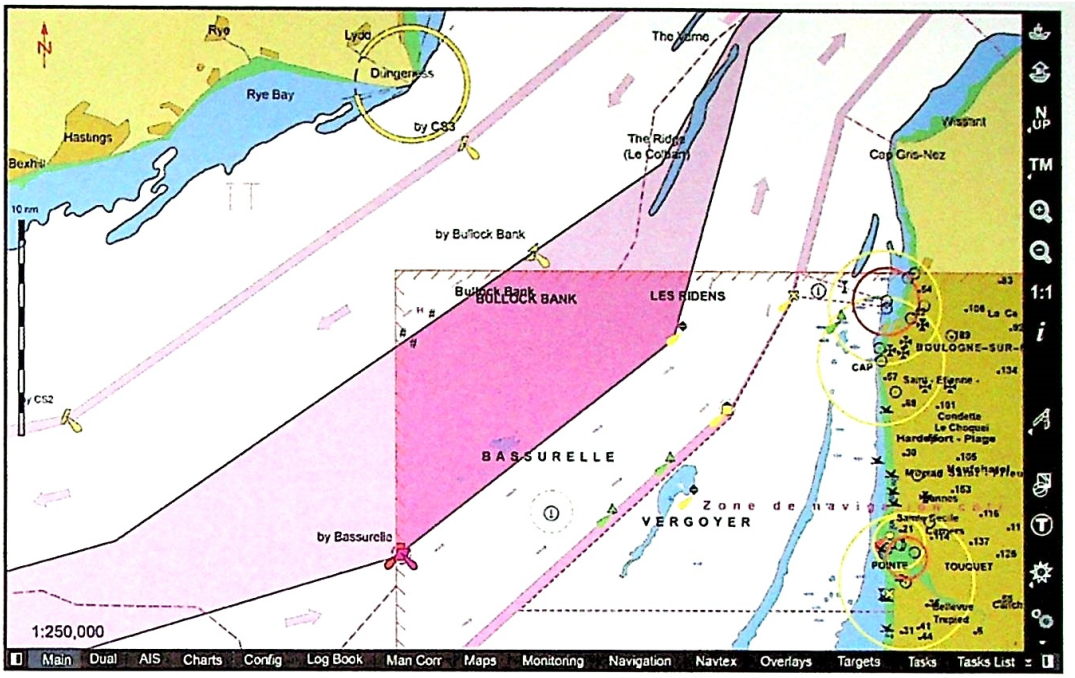


Figure 46: An example of unofficial Tx-97 data, produced to the S-57 standard, overlaid with an ENC. *(Courtesy of Transas)*

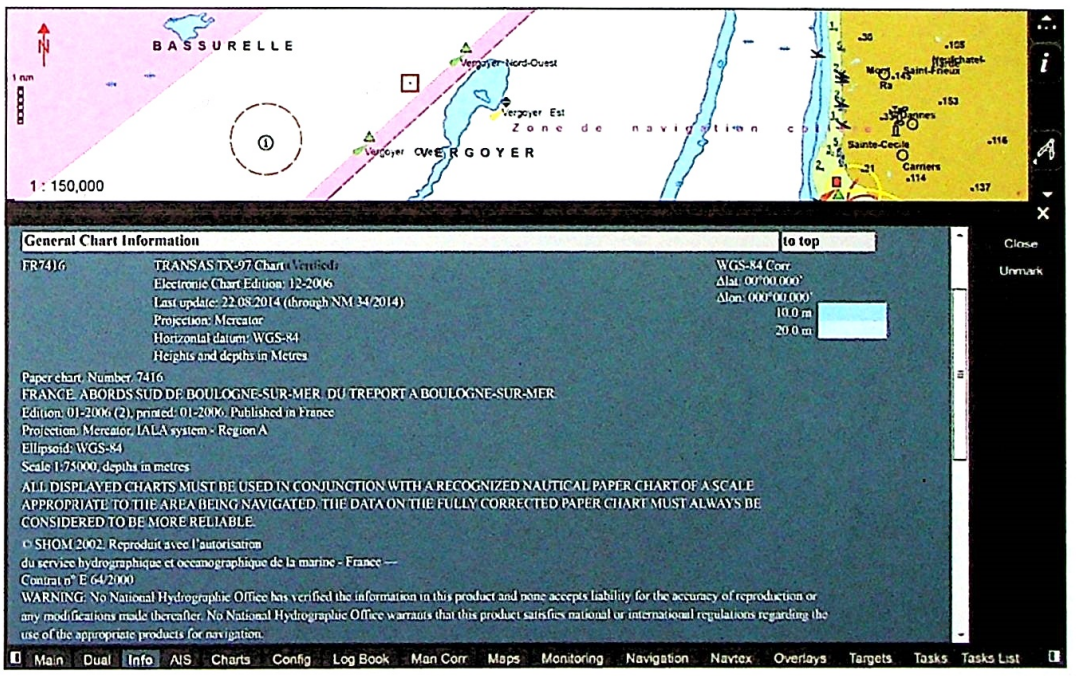
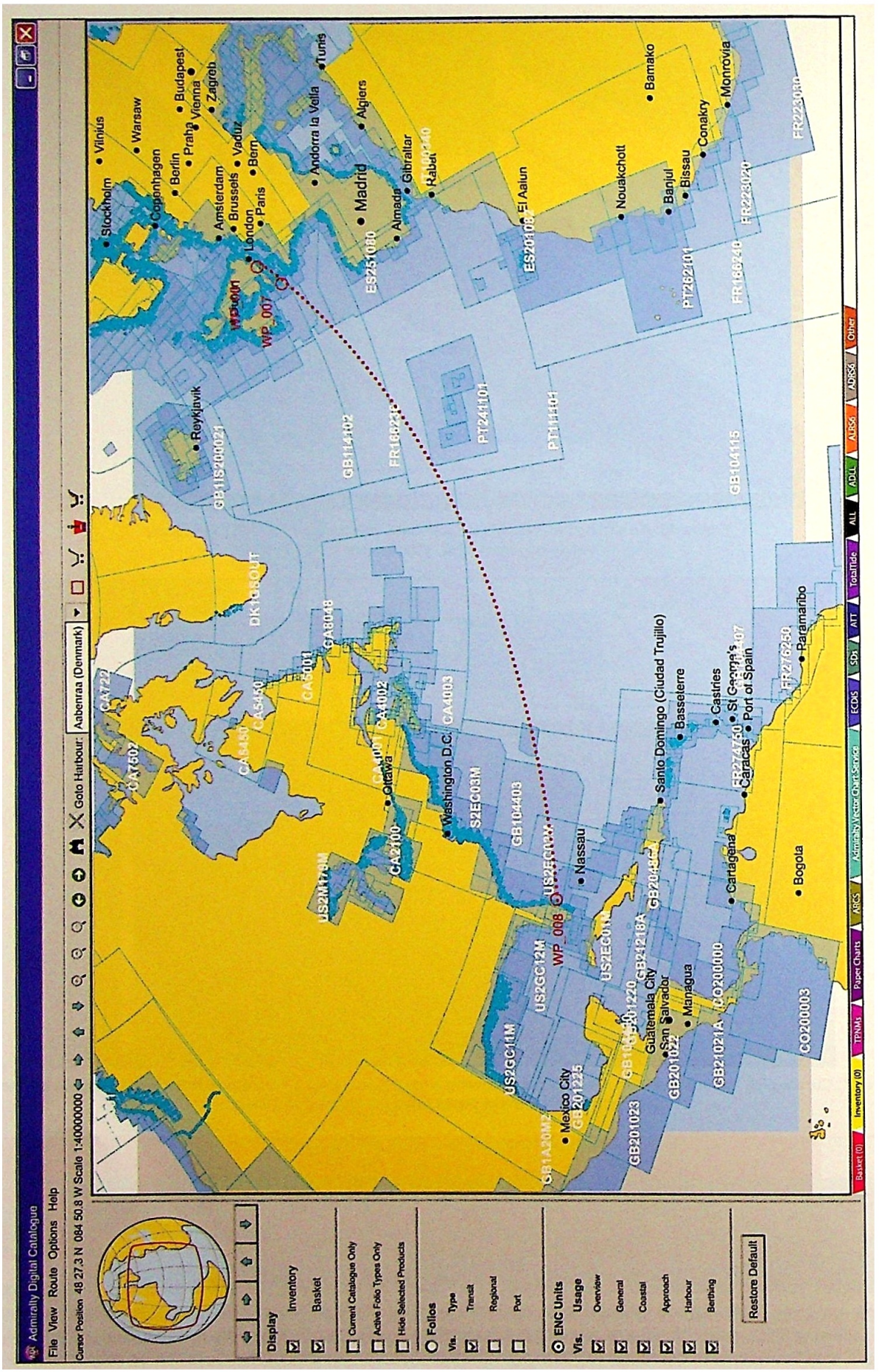
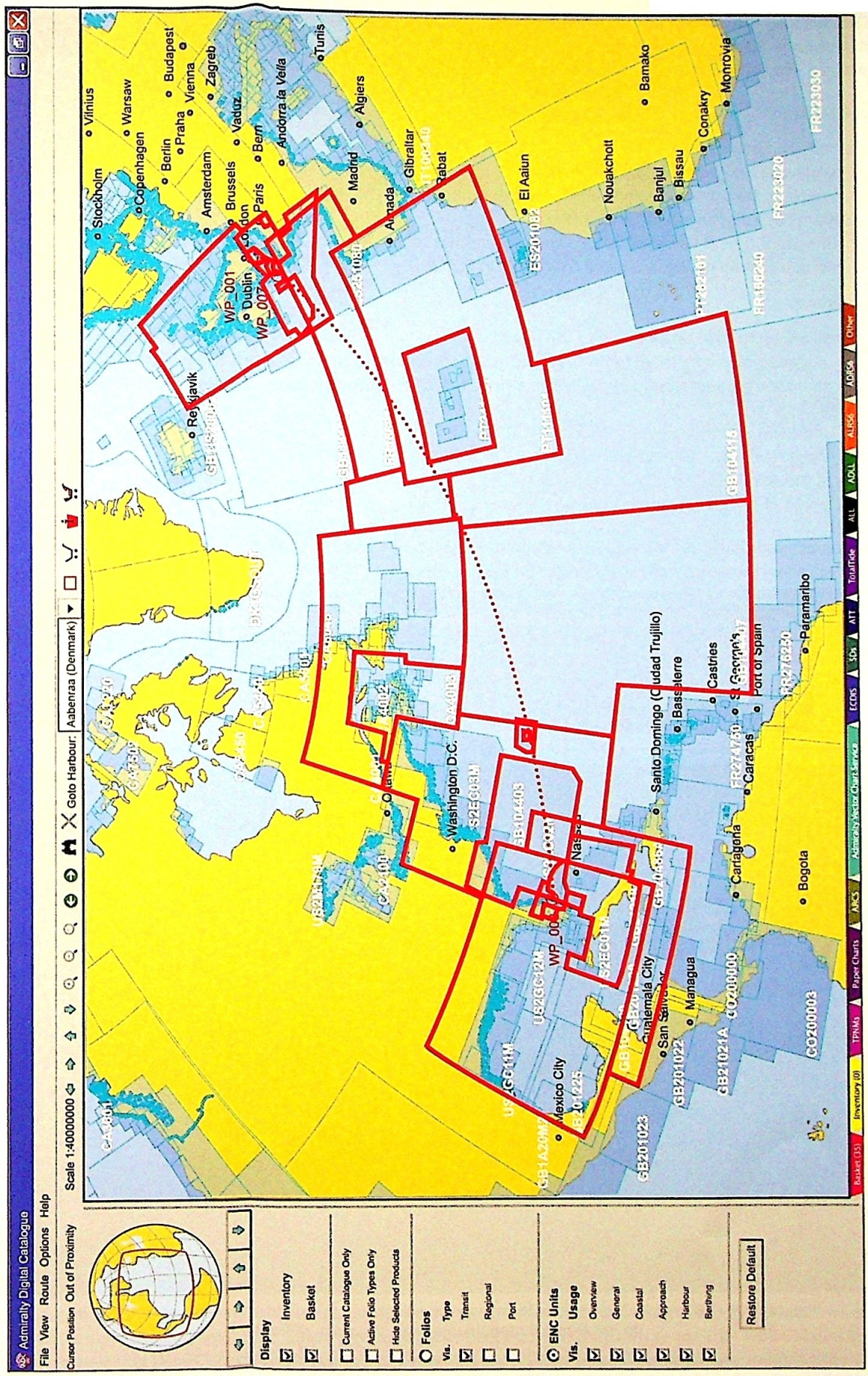


Figure 47: Cursor pick information from a Tx-97 chart showing associated warning message that such data should be used in conjunction with official paper charts. *(Courtesy of Transas)*

If an ECDIS is using unofficial chart data for navigation, the ECDIS is classified as an electronic chart system (ECS) only and cannot be used as the PMN.

Chart catalogues, such as the *'Admiralty Digital Catalogue'*, are useful for identifying the quantities and formats of charts required for any given route. Gaps in ENC coverage, or areas where insufficient ENCs of an appropriate scale exist, can be identified, allowing RNCs, paper charts and relevant publications to be sourced. In Figure 49, relevant charts are highlighted in red where they intersect with the route. Additionally, a 'buffer width' either side of the route can be added to cater for adjustment during the planning phase and to cover contingency. Where a route is required to be inserted, an approximation will be sufficient.


Admiralty Digital Catalogue
File View Route Options Help
Cursor Position 48 27.3 N 084 50.8 W Scale 1:40000000
Goto Harbour: Aabenraa (Denmark)
Display
Inventory
Basket
Current Catalogue Only
Active Folio Types Only
Hide Selected Products
Folios
Via.
Type
Transit
Regional
Port
ENC Units
Vis.
Usage
Overview
General
Coastal
Approach
Harbour
Berthing
Restore Default
Stockholm
Vilnius
Warsaw
Copenhagen
Berlin
Prahg
Budapest
Vienna
Zagreb
Amsterdam
Brussels
Vaduz
London
Paris
Bern
Andorra la Vella
Tunis
Reykjavik
Madrid
Algiers
Almada
Gibraltar
Rabat
El Aaiun
Nouakchott
Bamako
Banjul
Bissau
Conakry
Monrovia
Ottawa
Washington D.C.
Nassau
Mexico City
Guatemala City
San Salvador
Managua
Cartagena
Santo Domingo (Ciudad Trujillo)
Basseterre
Castries
Caracas
Port of Spain
Paramaribo
Bogola
WP_007
WP_008
Basket (0)
Inventory (0)
TPNMs
Paper Charts
ARCS
Admiralty Vector Chart Service
ECDIS
SDs
ATT
TotalTide
ALL
ADLL
AVCS
ADRS
Other



Figures 48 and 49: Products such as the *'Admiralty Digital Catalogue'* (available online from the UKHO) can be used to identify and purchase appropriate charts in a variety of formats, including paper charts. *(Courtesy of UKHO)*

2.2.4.5 ECDIS Chart Installation and Update

Once the necessary charts have been identified and sourced, they will need to be installed and updated in ECDIS prior to being reviewed. The following are considerations when installing and updating chart data:

- Chart installation
  - permits and licence
    - relevant ENC and RNC permits held
    - permits are up to date and valid for the duration of the voyage
  - relevant base discs are held on board
  - the length of time it takes to procure and receive chart data
  - the length of time it takes to install chart data in ECDIS
- chart updates
  - charts are up to date on all ECDIS to the latest:
    - notice to mariners (NM) (note that the IHO abbreviates this to NM and not NTM)
    - temporary and preliminary notices to mariners (T&Ps). Note that some T&Ps may need to be applied manually
    - local NM
    - radio navigational warnings (NAVAREAS)
  - the latest NM update is held on board
  - use of the Admiralty Information Overlay (AIO)
  - the length of time it takes to update chart data in ECDIS.

It must be appreciated that chart installation and update times can be considerable. Recording the time it takes to complete this process will allow more accurate estimates to be used in future.

Failure to renew chart subscriptions will result in a warning message whenever an expired cell is displayed, stating that the cell may be out of date and must not be used for primary navigation. In addition, it will not be possible to update expired cells with official updates until the subscription has been renewed and, until that time, the ship will be in direct contravention of the SOLAS Chapter V chart carriage requirements.

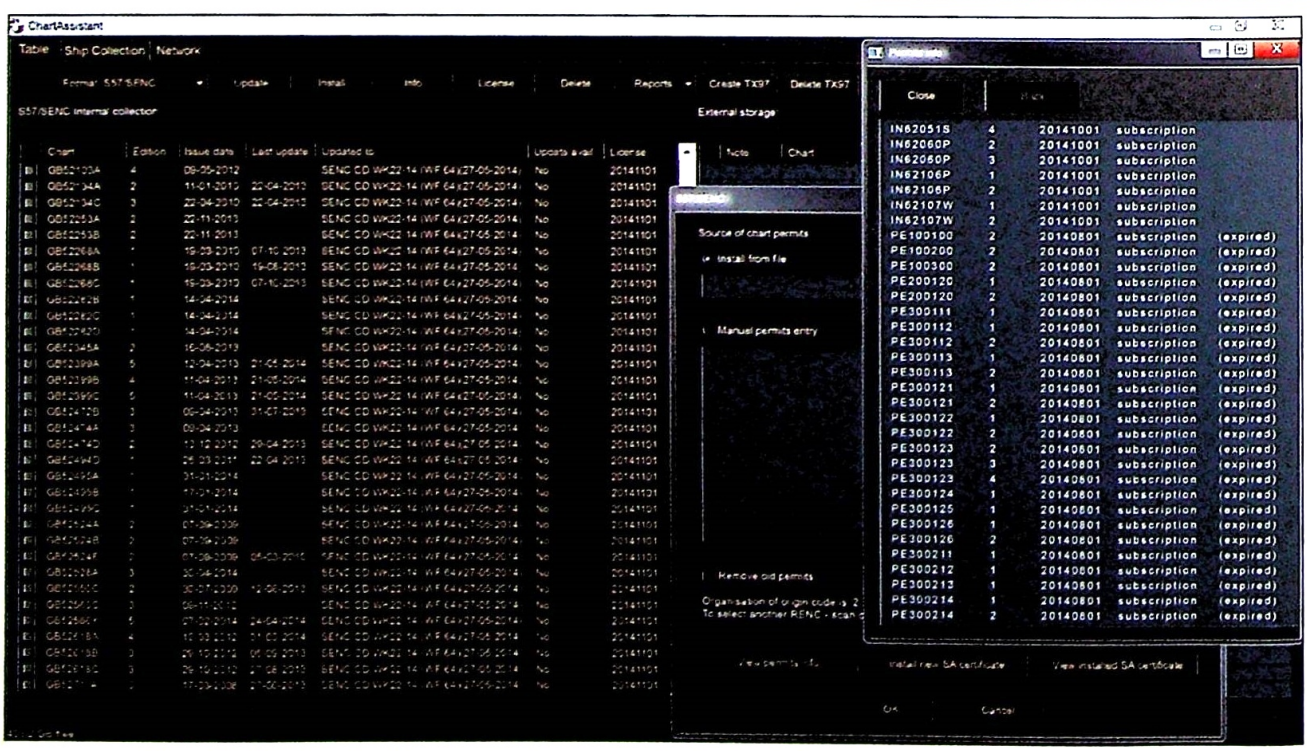
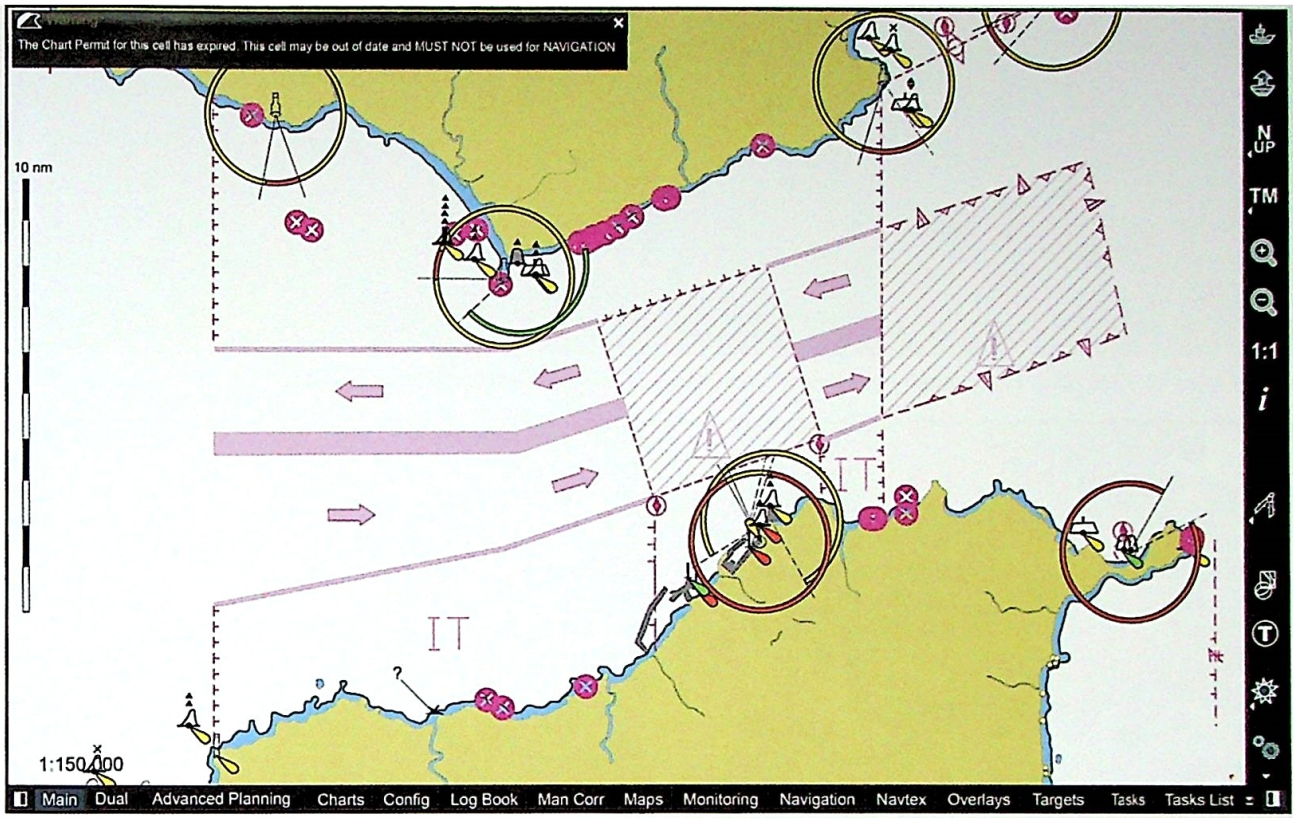
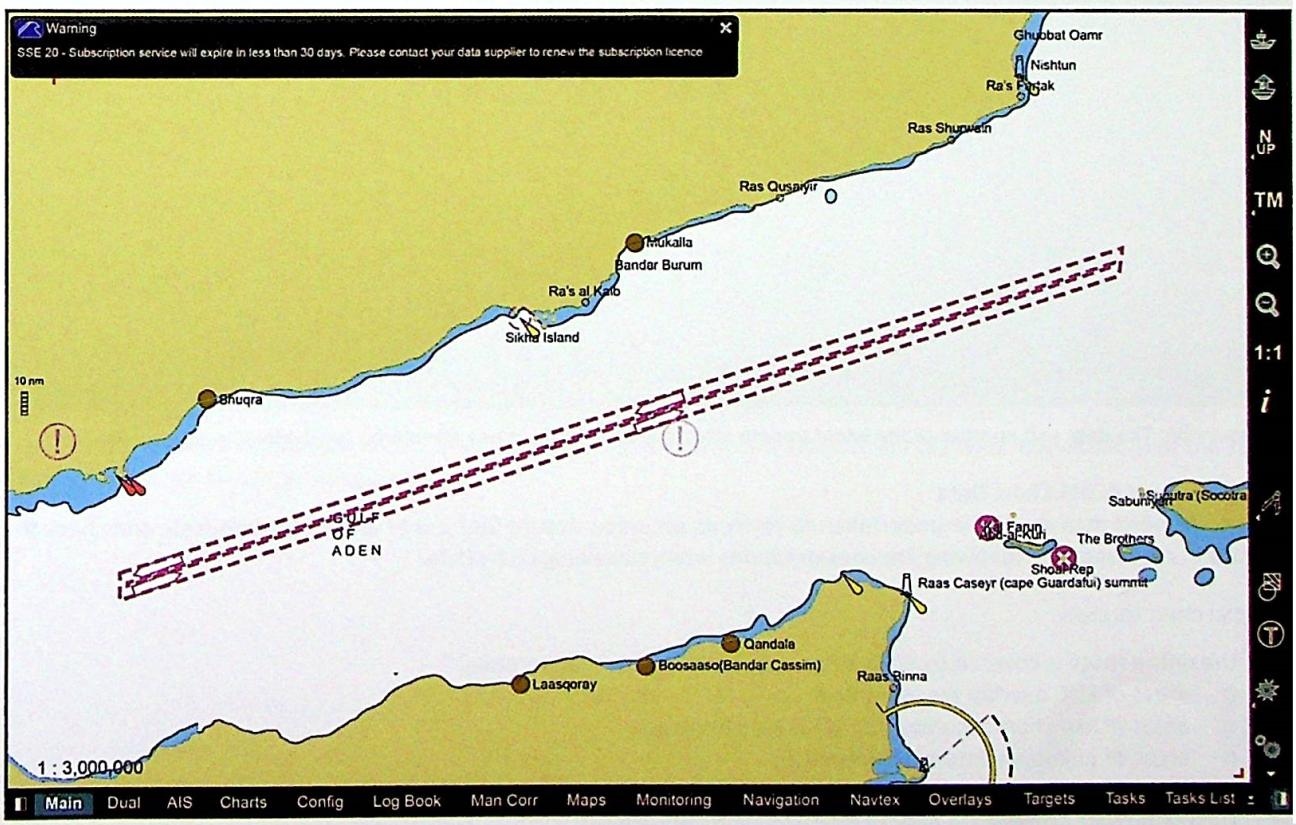


Figure 50: It is important to competently manage chart subscriptions and permits to ensure that they do not expire during the passage. *(Courtesy of Transas)*





Figures 51 and 52: Warning messages will be displayed if a chart permit has expired and 30 days before the subscription service is due to expire. These are displayed whenever an affected cell is loaded. *(Courtesy of Transas)*

Chart installation and updating can be a time-consuming process, particularly when installing encrypted data or when errors are encountered. When installing encrypted data from chart providers that are signatories to the IHO S-63 Data Protection Scheme, it is important that the ECDIS software and presentation library (PL) are up to date to ensure compatibility with the latest edition. It is also important to ensure that the correct scheme administrator (SA) and chart producer certificates are installed to facilitate chart installation. Sufficient knowledge of the process and the specific ECDIS in use is essential for successful chart installation.

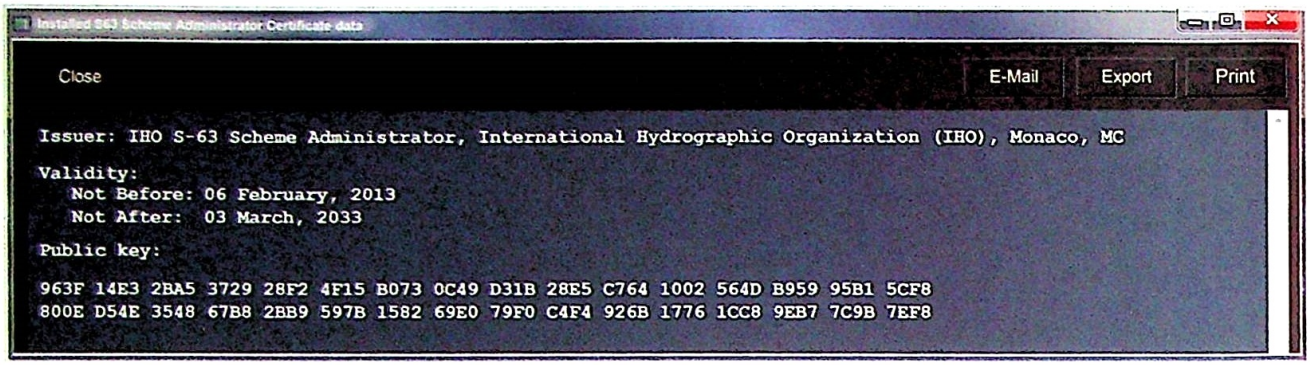


Figure 53: Encrypted ENCs require the correct SA and chart producer certificates to be installed. *(Courtesy of Transas)*

Figure 54: The date and number of the latest update affecting chart cells in use should be available. *(Courtesy of Transas)*

2.2.4.6 Review of ECDIS Chart Data

A review of installed data should be undertaken to verify its accuracy, ensure that it is of an appropriate scale and check there are no gaps in coverage. The following are considerations when reviewing chart data:

- Official chart formats
  - the entire route is covered by ENCs of an appropriate scale and accuracy
    - o areas of ENC overlap are identified
    - o areas of low chart accuracy (CATZOC) are identified
    - o areas of unknown datum are identified
    - o areas of poor GNSS coverage are identified
  - sufficient chart provision in case of deviation and contingency
  - where ECDIS supports RCDS mode
    - o the relevant flag State allows RCDS mode
    - o gaps in ENC coverage or scale are filled by appropriate scale RNCs
    - o an APC is available
    - o RCDS mode risk assessment is conducted
  - where ECDIS does not support RCDS mode
    - o gaps in ENC coverage are filled by appropriate scale paper charts.

When conducting the review, the navigator should have visibility of installed ENC data to assess whether better scale charts are available and to identify gaps in coverage (see Figure 48). This function may also be useful during route construction. The six available 'navigational purpose bands' are explained in Section 4.2.1 – New Route.

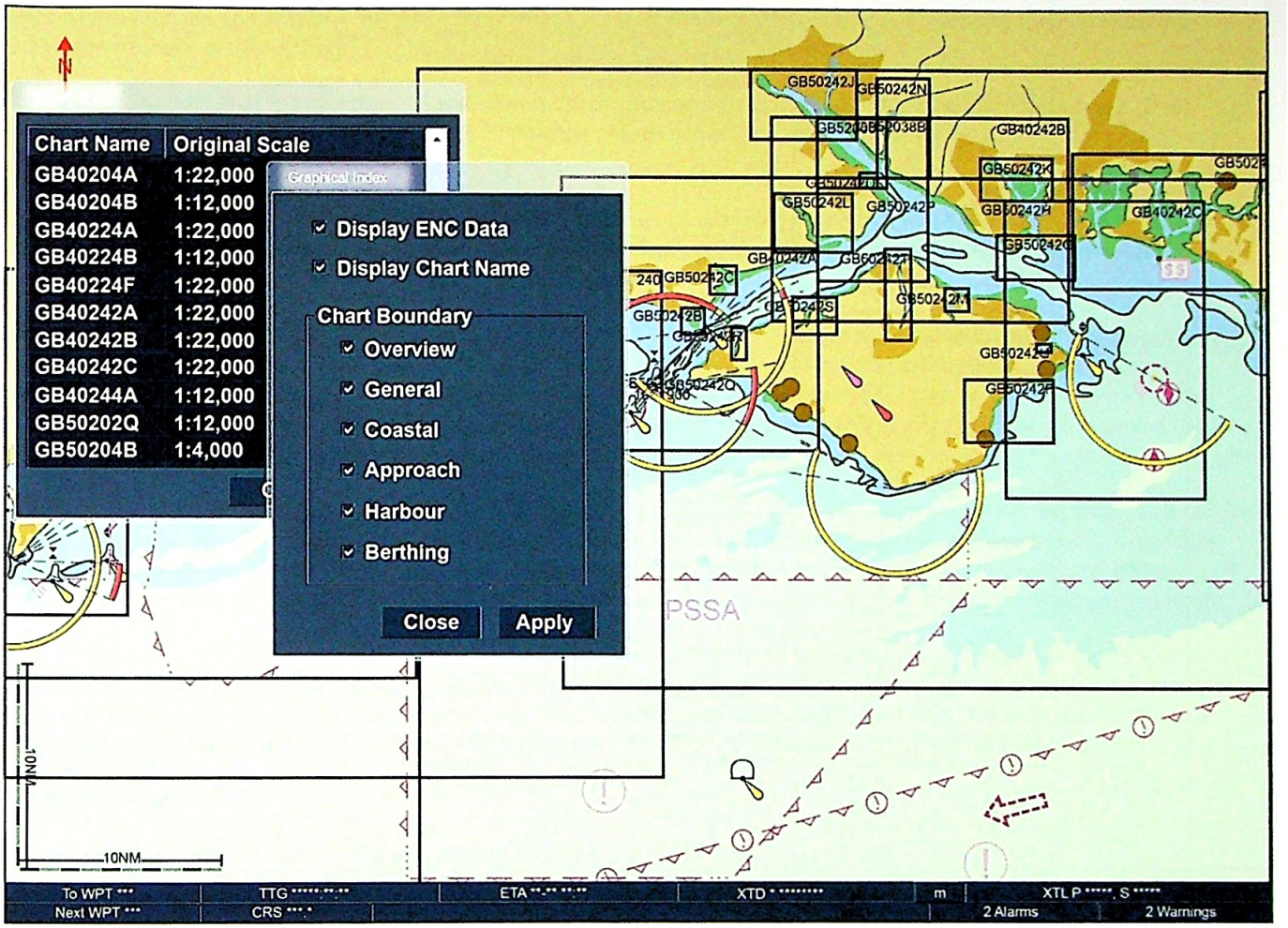


Figure 55: An example of a graphical index, classified by navigational purpose, of all installed ENC data. *(Courtesy of Japan Radio Company)*

When reviewing the accuracy of installed data, it should be noted that ENCs do not contain a source data diagram as depicted on paper charts. Instead, the quality of the ENC is displayed using 'category of zone of confidence in data' (CATZOC). The understanding of these symbols is critical to interpreting the accuracy of presented survey data. Explanations of the six CATZOC symbols are provided in Figure 56.

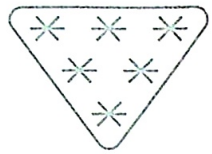
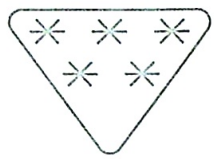
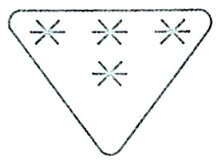
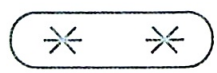
1	2	3		4	5	6
ZOC	Position Accuracy	Depth Accuracy		Seafloor Coverage	Typical Survey Characteristics	Symbol
A1	± 5 m	= 0.50 + 1%d		Full area search undertaken. All significant seafloor features detected and depths measured.	Controlled, systematic survey, high position and depth accuracy achieved using DGPS or a minimum three high quality lines of position (LOP) and a multibeam, channel or mechanical sweep system.	
		Depth (m)	Accuracy (m)			
		10 30 100 1000	± 0.6 ± 0.8 ± 1.5 ± 10.5			
A2	± 20 m	= 1.00 + 2%d		Full area search undertaken. All significant seafloor features detected and depths measured.	Controlled, systematic survey achieving position and depth accuracy less than ZOC A1 and using a modern survey echosounder and a sonar or mechanical sweep system.	
		Depth (m)	Accuracy (m)			
		10 30 100 1000	± 1.2 ± 1.6 ± 3.0 ± 21.0			
B	± 50 m	= 1.00 + 2%d		Full area search not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, systematic survey achieving similar depth but lesser position accuracies than ZOC A2, using a modern survey echosounder, but no sonar or mechanical sweep system.	
		Depth (m)	Accuracy (m)			
		10 30 100 1000	± 1.2 ± 1.6 ± 3.0 ± 21.0			
C	± 500 m	= 2.00 + 5%d		Full area search not achieved, depth anomalies may be expected.	Low accuracy survey or data collected on an opportunity basis such as soundings on passage.	
		Depth (m)	Accuracy (m)			
		10 30 100 1000	± 2.5 ± 3.5 ± 7.0 ± 52.0			
D	worse than ZOC C	Worse Than ZOC C		Full area search not achieved, large depth anomalies may be expected.	Poor quality data or data that cannot be quality assessed due to lack of information.	
U	Unassessed – The quality of the bathymetric data has yet to be assessed					

Figure 56: CATZOCs provide an indication of ENC accuracy. *(Courtesy of IHO)*

Despite advances in hydrographic technology, many ENCs are still derived from the source data of the equivalent paper chart and are no more accurate. Navigators must be mindful that there is always potential for error and the presence of undetected dangers. Therefore, it is recommended that, where possible, all work is manually checked by a second navigator. Safety margins should always be applied and extended whenever practical.

PL 4

The ECDIS operator must verify that ENC updates have been applied. It is necessary to perform spot checks of the ENC display and not simply accept a system message that an update has been applied. In most cases, NM and other warnings will also need to be applied manually. Many hydrographic offices do not include T&Ps in their weekly ENC updates and these may also need to be applied manually.

2.2.5 Passage Planning in Ice

Passage planning in ice regions will involve additional consideration to assess the presence of ice and its extent, as well as more attention to seasonal and weather routeing variations. As a general principle, the navigator should plan routes in open water where possible and only plan for the ship to enter ice when absolutely necessary. For example, there are specific circumstances, such as when there is significant freezing spray, that may require entering the ice.

The Polar Code states that the passage (voyage) plan must consider the potential hazards of the intended voyage. Ships operating in polar regions should ensure that each passage plan includes, as a minimum, the requirements for compliance with the voyage planning goal of the Code.

Additionally, passenger ships should follow the *'Guidelines on voyage planning for passenger ships operating in remote areas'* (IMO Resolution A.999(25)). Passenger ships should create contingency plans that include consideration for emergencies in the event of limited SAR and medical facilities in remote regions.

The passage plan will be subject to varying local and national restrictions that will, depending on the authority, potentially limit the ship from proceeding along a certain route, or require an alternative route to be taken. One such example is the Canadian Arctic Ice Regime Shipping System (AIRSS) calculation for ships outside the zone/date system. For an ice regime, an ice numeral (IN) is calculated. Ships using the system may only enter the proposed route through the ice regime if the ice numeral is equal to or greater than zero.

The Polar Operational Limit Assessment Risk Indexing System (POLARIS) may be of use during the planning stage, as it can be used to assess the risk of the voyage and provide support for decision making. POLARIS has been developed incorporating experience and best practices from Canada's Arctic Ice Regime Shipping System and the Russian Ice Certificate and is supplemented by pilot ice assistance as prescribed in the Rules of Navigation on the water area of the Northern Sea Route.

POLARIS can assist with risks posed to the ship by ice conditions relative to the ship's evaluation of the assigned ice class. It uses the WMO nomenclature and the ice class consistent with the ice class(es) referenced in the Polar Ship Certificate. This is represented through an index of risk values (RIVs), which are assigned to the ship based on its ice class. While the final decision will always be based on the judgment of the Master, POLARIS can be useful in assisting with that decision.

Appraisal Considerations

For ice regions, additional considerations during the appraisal stage include:

- Understanding that the location of the route could be affected by ice formation and/or ice movement that is unnavigable or threatens the safety of the ship. Standard information could be expanded with facsimile ice chartlets and/or ice reports. All sources of navigational data should be appraised, including any limitations in the hydrographic information available
- ascertaining the standard ice limits for both pack ice and icebergs and noting any seasonal changes. Prior to departure, the ship's charts must be updated in accordance with the weekly notices for the latest chart corrections. In certain areas, it may be necessary to obtain local/national charts and the corresponding corrections due to absence of international chart coverage or ENCs
- appraising regulatory and guidance sources related to ice operations and navigating in ice, including the company SMS, guidance from coastal States and the ship's Polar Water Operations Manual (PWOM)
- appraising historical, current and forecast weather and ice conditions. This includes satellite imagery and weather routeing services for ice regions. Predictions may not be available for some remote regions and, if available, information should be used with caution
- the availability and requirements for icebreaker support, including the estimated response time in remote regions
- areas where marine mammals are likely, as well as routeing schemes and any protected areas in the region (the Polar Code requires ships to minimise disturbances to marine mammals and local areas of cultural heritage/significance)
- search and rescue provision in the region, including the estimated response time in remote regions, as well as places of refuge that are available
- additional communication requirements for operating at high latitudes, including provision of satellite coverage/ subscriptions and VTS/reporting considerations
- the infrastructure available in the region, including nearest ports in the event of medical emergencies or nearest facilities to bunker/resupply the ship if the ship has become delayed due to the presence of ice.

Planning Considerations

Once all data has been gathered and appraised, the navigator should begin planning the intended voyage. This will involve creation of a charted route, with waypoints and courses that consider the general ice data available, as well as the ship's limitations. The passage plan should recognise any limitations imposed by certification, coastal States or Class, as well as any limitations imposed by insufficient navigation or communication equipment on board. The plan should consider the availability of nav aids, the availability and reliability of charts, SAR provision and infrastructure (all of which may be limited) in the intended region, especially in the Arctic and Antarctic. The ship should not plan to enter an area where it cannot safely navigate according to its requirements set by Class or national authority.

A passage plan for ice should consider pack ice and iceberg limits indicated on the navigational chart and other available material (some regions will have more information than others).

It is essential that the plan gives a suitable allowance for necessary deviation and course changes so as to allow the ship to adequately respond to the ice concentration and leads that may exist. The passage plan should be formulated to cover the passage from berth to berth, but it must be possible to adapt it to the changing conditions and allow sufficient opportunity to deviate for moving ice formations.

So far as possible, courses should be determined through areas of lowest ice concentrations and avoid environmental/cultural protected areas. Where course lines intersect with known ice limits, these limits should be marked on the charts or added as mariner's objects/notes on the ECDIS. This will allow the ship's Master to assess the need to upgrade watchkeeping duties before ice is encountered.

Ships using ECDIS to create the passage plan should conduct a thorough visual check of the entire route. ECDIS safety settings must be appropriately configured to ensure application of the correct safety depth, contour values and display settings. The look-ahead area, mariner added objects, function and safety settings can enhance safe navigation provided these are correctly configured at the passage planning stage. These can help to mitigate poor quality hydrographic data. The use of overlaid satellite imagery with visible ice concentrations is also beneficial.

Ice routeing services may exist in the ice region. Care should be taken with such information as it may not be fully comprehensive. Ice routeing services may be compulsory, voluntary or obtainable via commercial providers for a fee. They are based on factors such as:

- The geographic criteria
- the ship's specifications and capabilities
- seasonal meteorological patterns.

2.2.6 Preliminary Research – Other Considerations

The final stage of preliminary research is to consider any additional factors that may influence the route before actual planning can commence. As a minimum, the following should be given due consideration:

- Routeing
  - anchorage(s)
  - areas to be avoided
  - bridge manning at the different phases of the passage
  - canals
  - danger areas
  - day or night transit of critical points
  - deep water routes (DWs)
  - environmental protection
    - emission control areas (ECA)/sulphur emission control areas (SECA)
    - *'International Convention for the Prevention of Pollution from Ships'* (MARPOL)
    - marine environmental protection measures/particularly sensitive sea areas (PSSA)
  - ephemeral data
    - times of sunrise and sunset
    - times of morning and evening civil twilight
    - times of moonrise and moonset
  - IALA buoyage systems
  - military/naval weapon practice areas
  - nature of the seabed
    - coral
    - sandwaves
    - underwater volcanic activity
  - navigation methods
    - GNSS coverage (including any planned service outages)
    - conspicuous charted features for visual fixing
    - radar detection ranges, taking into account the nature of the coastline
    - the use of parallel index techniques
  - pilotage embarkation, disembarkation and exchange of information
  - piracy and criminal risk areas
    - use of internationally recommended transit corridor (IRTC) in the Gulf of Aden
  - precautionary areas
  - shipping lanes
  - survey data (see Figure 58 for paper charts, and Figure 59 for ENCs)
  - territorial waters
  - time zones and time zone changes
  - traffic density and likely concentrations of fishing vessels
  - traffic separation schemes (TSS)
  - vessel traffic services (VTS) and ship reporting systems
- delays
  - likelihood of a change in orders
  - operations such as gas freeing, purging, cargo grade change, ballast water exchange.

This list is not exhaustive and will depend upon the type of ship and geographic area through which the passage is planned. For example, piracy is a risk in several parts of the world and becomes a concern when transiting areas such as the Gulf of Aden, Malacca Straits, Indian Ocean and the Gulf of Guinea off West Africa. There are numerous sources of information available to aid the navigator, including the NATO Shipping Centre and P&I Club websites, some of which are available within ECDIS passage planning software (see Figure 60).

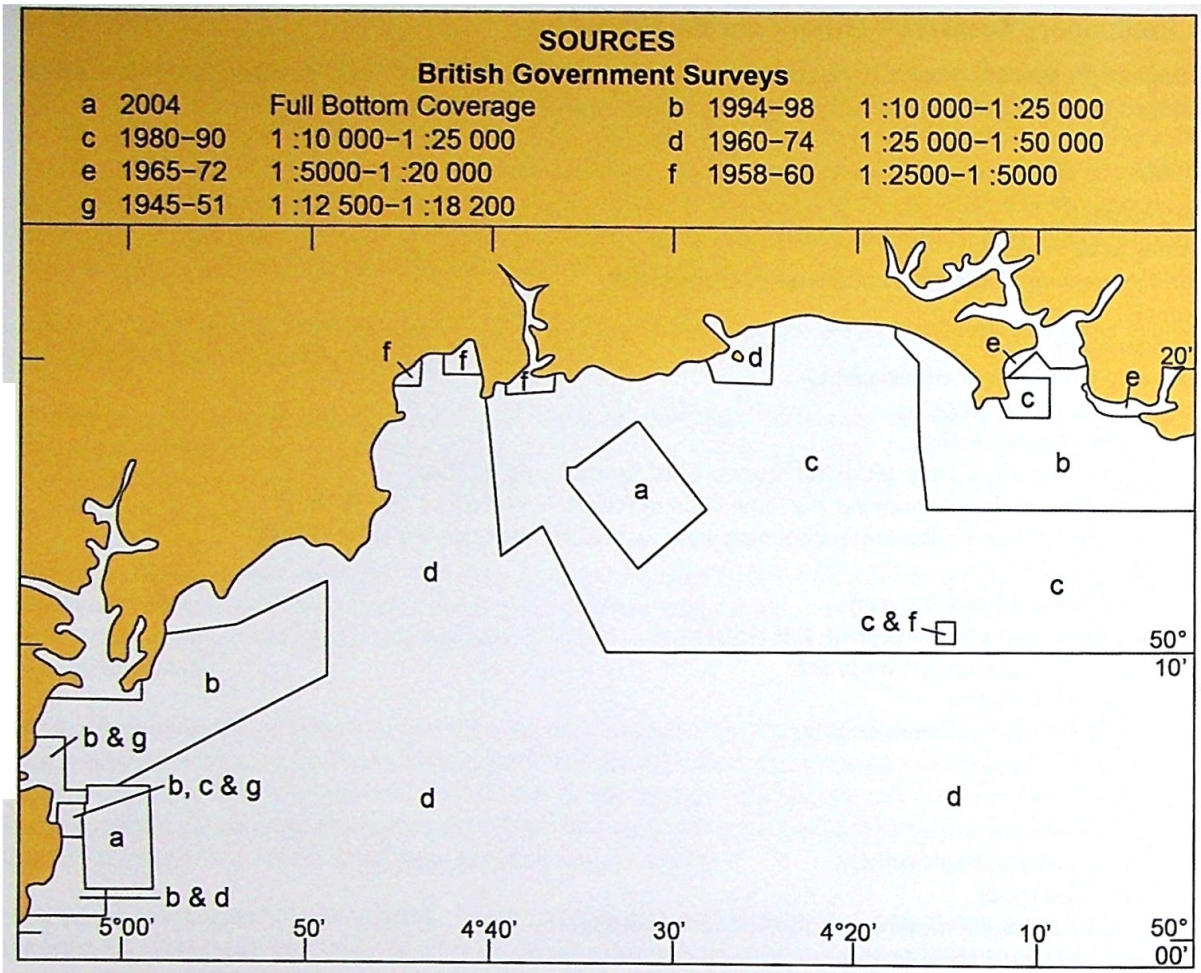


Figure 57: Example of a Source Data Diagram, as found on most Admiralty paper charts. *(Courtesy of UKHO)*

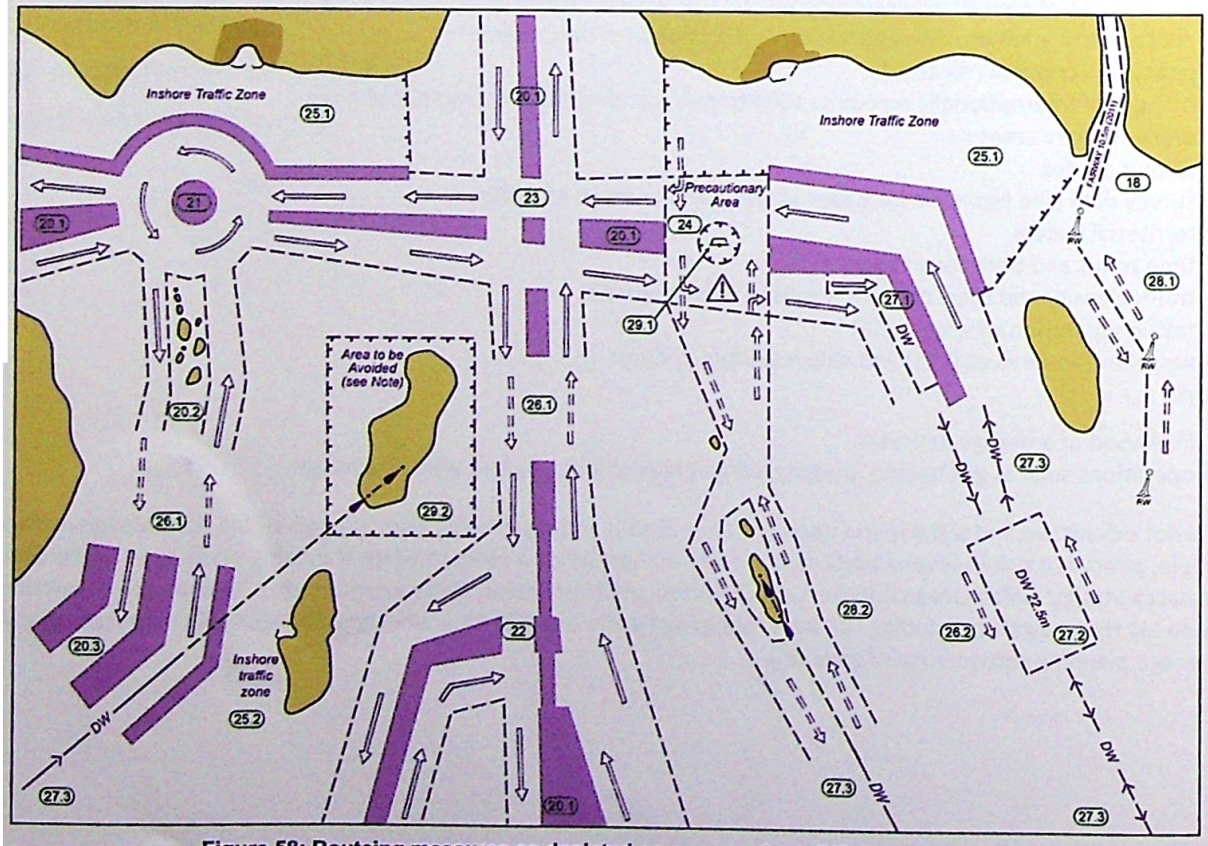


Figure 58: Routeing measures as depicted on a paper chart. (US Chart 1, NOAA)

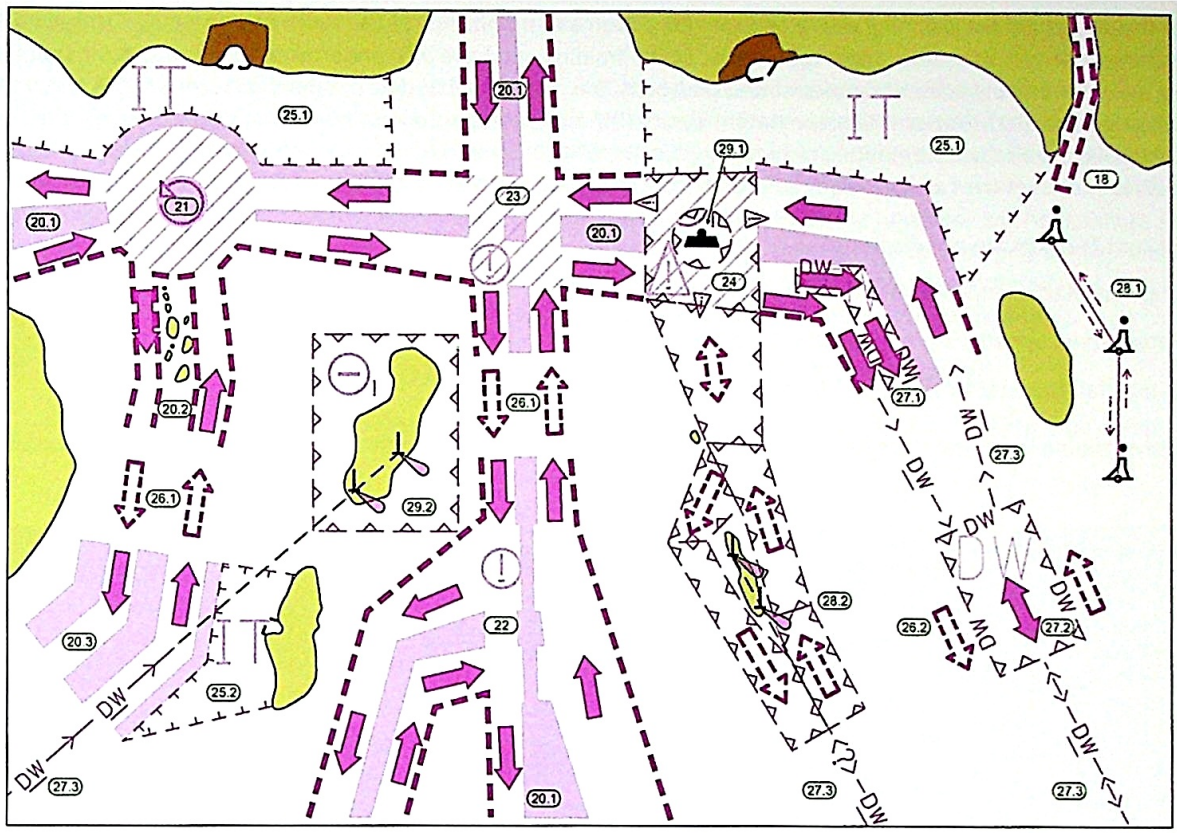


Figure 59: Routeing measures as depicted on an ENC. (US Chart 1, NOAA)

= Attempted Attack = Boarded = Fired upon = Hijacked = Suspicious vessel

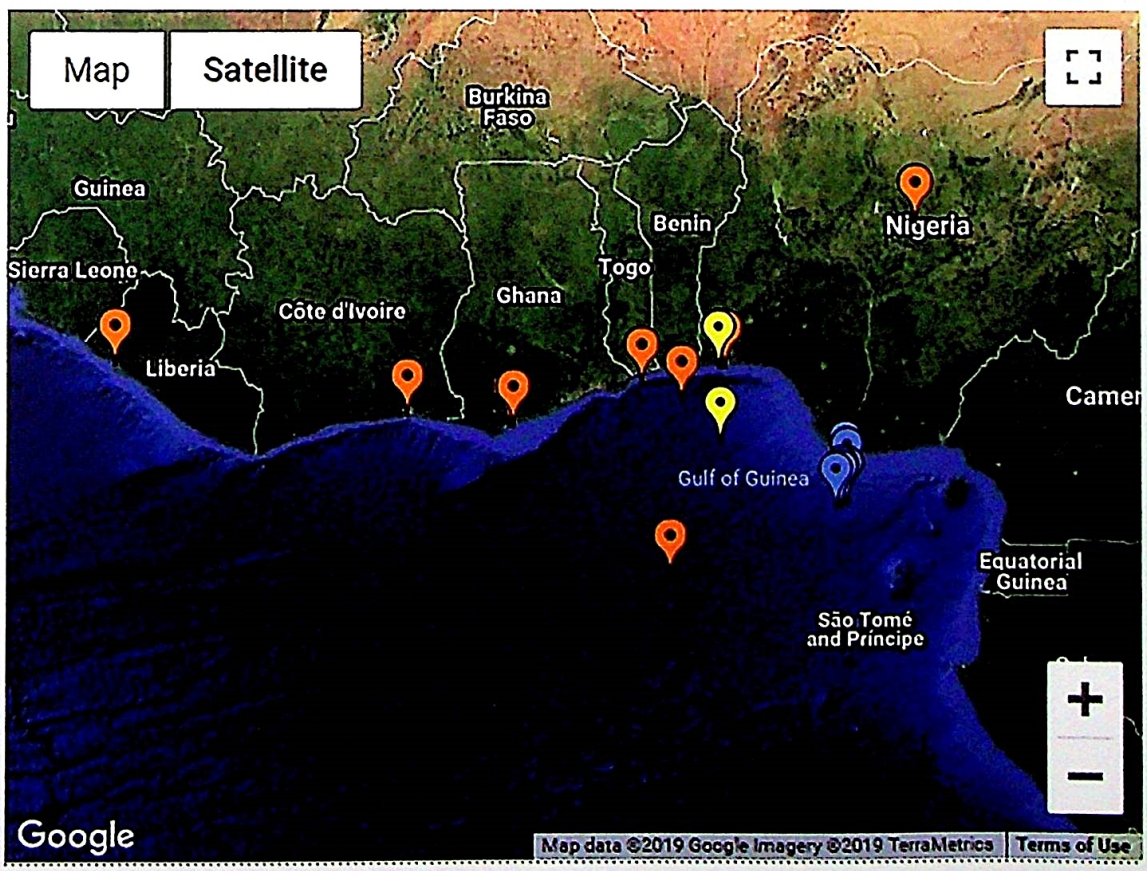


Figure 60: IMB Piracy & Armed Robbery Map, accessed 15/03/2019 at https://www.icc-ccs.org/index.php/piracy-reporting-centre/live-piracy-map

Critical to the success of the planning phase and safe execution and monitoring of the route using an ECDIS is that all operators have received adequate, approved generic ECDIS training and have also undertaken the type specific training necessary to operate the specific equipment fitted on board. It is also essential that the manufacturer's ECDIS software works fully in accordance with the latest IHO presentation library (PL) and data protection standards, as only then will the ECDIS be capable of displaying all the information contained within the ENC. Failure to update the software may mean the ECDIS fitted on board does not meet the carriage requirements set out in SOLAS and may result in the following equipment shortfalls:

- Significant features are not displayed
- appropriate alarms and indications may not be activated
- the latest chart updates are not displayed, eg new TSS, offshore wind farms or bridges
- ENCs may fail to install or load.

The navigator should know the state of the software update, although this information should also be available within the system.

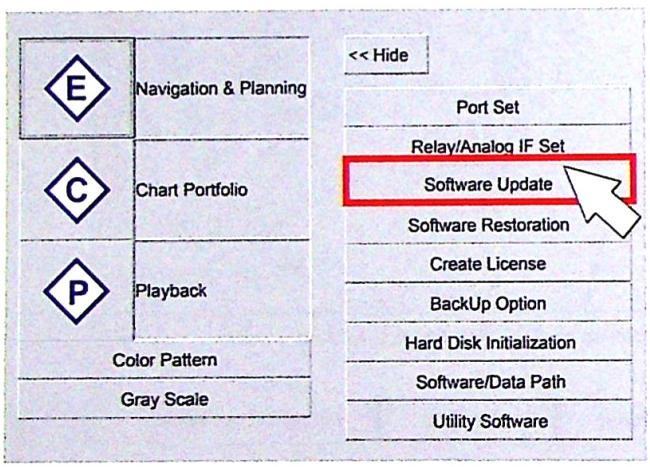


Figure 61: Manufacturers will normally provide instructions on how to perform the update. *(Courtesy of Japan Radio Company)*

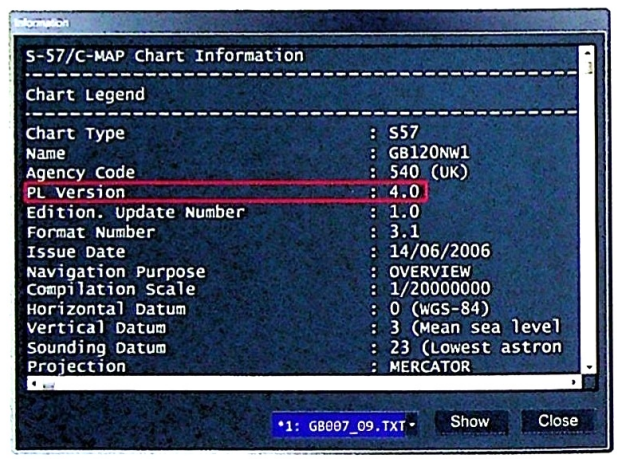


Figure 62: The version number of the PL installed should be readily available to the operator. Here, it is stated in the chart legend within the pick report. *(Courtesy of Japan Radio Company)*

Known anomalies within an ECDIS are usually rectified by the manufacturer with software patches. It is, therefore, important that the latest patch is installed in ECDIS and that the most recent IMO guidance on ECDIS anomalies has been read. In addition, any anomalies encountered during use should be fed back to the appropriate authority.

All potential hazards and dangers identified during the appraisal should be noted for reference during the planning phase.

2.3 Appraisal Report

Once a thorough appraisal of the intended voyage has been completed, and relevant information documented, the navigator should be ready to brief the ship's Master about the passage in order to gain approval prior to the detailed planning. This briefing will also provide a convenient opportunity for the Master to make any inputs with regard to the intended plan. The navigator should present the various route options on a suitable chart, as well as all relevant information obtained during the research. A standard briefing pro forma (see Annex A for an example) prepared by the navigator will help ensure the brief is presented in a logical and concise manner, ensuring the key points of the passage are covered and highlighting areas where the Master's decision is required before the outline plan is agreed and the detailed planning commences. The use of a passage graph will also help to ensure that key positions and timings are available at the brief (see Figure 63).

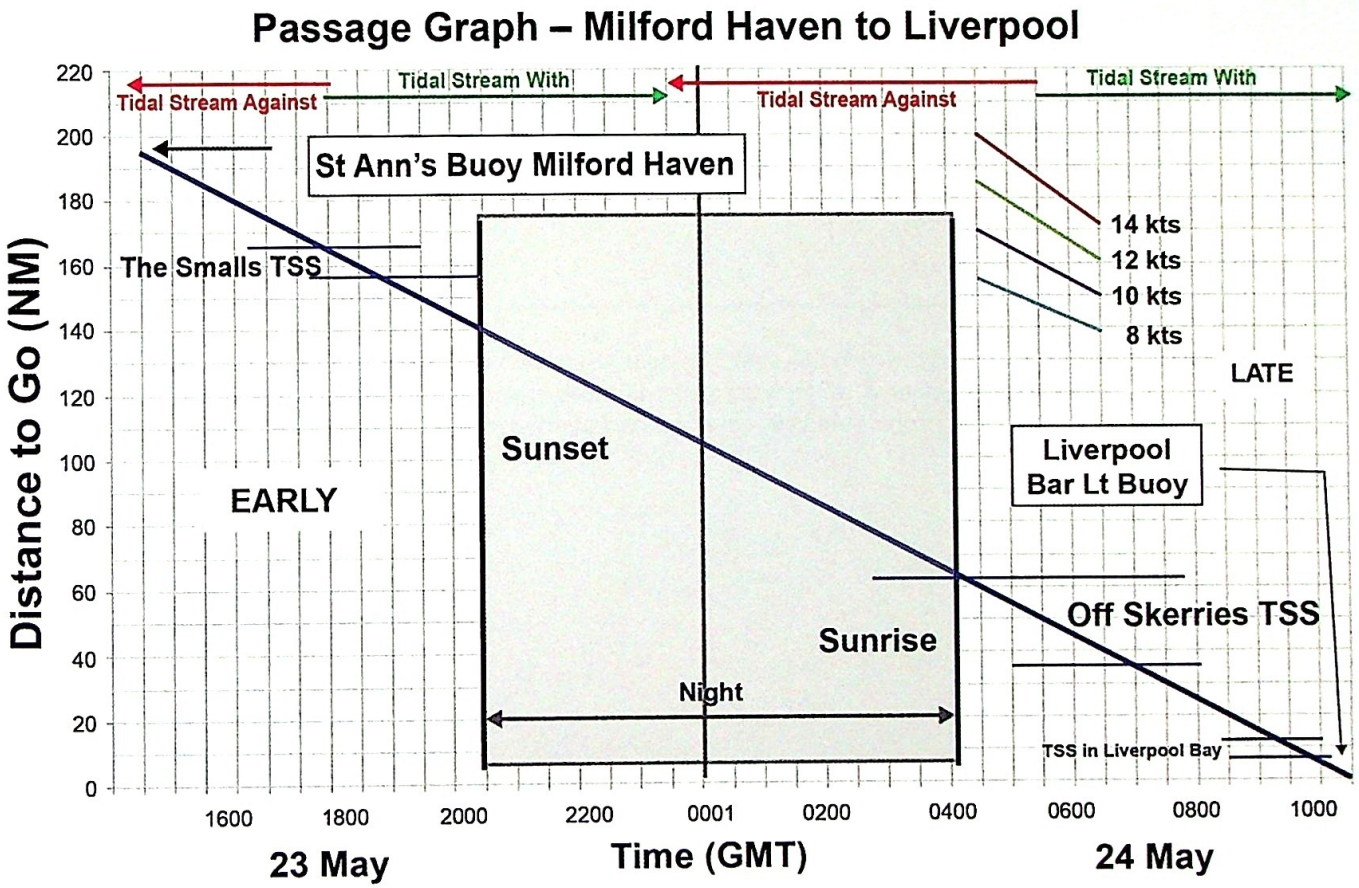


Figure 63: Example of a passage graph.

No two passages are the same. Even when the proposed route between two ports has been undertaken before, there will be changes that need to be considered before deciding on the detailed plan. Each and every voyage should be regarded as a separate undertaking, requiring the same methodical approach and research before any detailed planning can commence.

In particular, when using ECDIS with a reverse waypoints option, a full review of the passage plan must be undertaken to ensure the planned route remains safe for the updated voyage conditions and follows the correct flow of traffic.

CHAPTER 3

Passage Planning on Paper Charts

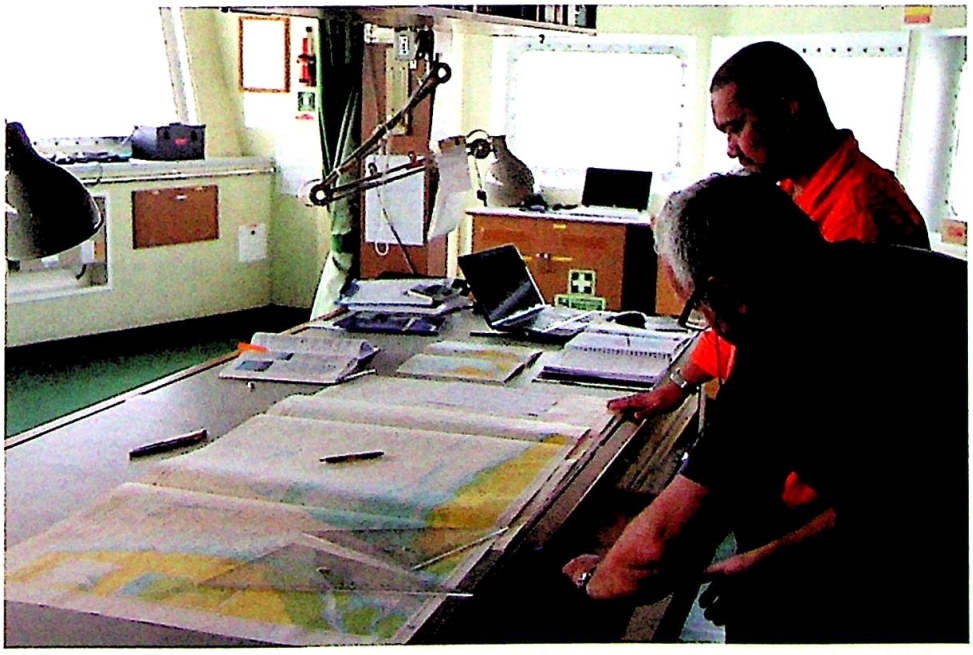
3 Planning

Having briefed the Master on the details collected at the appraisal stage and received approval to commence the detailed planning, the navigator can start to prepare charts and supporting information to enable the safe execution and monitoring of the passage. The passage plan should be from berth to berth, and may include some or all of the following separate phases:

- Pilotage
- port arrival and departure
- coastal passage
- ocean passage.

3.1 Voyage Overview

Once the Master has selected the route to be followed, the navigator can plot the route and add supporting information and detail on appropriately scaled charts that will be used by navigators during the monitoring stage of the passage. The level of detail to be added to the charts will depend on which of the passage stages the chart will be used for.



3.2 Chart Preparation

Prior to plotting the track, the navigator should prepare the paper charts to be used during the monitoring stage using the information gathered during the appraisal stage. The navigator should:

- Identify and mark off shallow water and navigation hazards to ensure the track is plotted in safe water
- identify and check the depth of wrecks charted along the intended route to confirm as dangerous or non-dangerous
- identify and highlight any areas of lower accuracy survey data
  - refer to the source data diagram on the chart (see Figure 64)

Date	Survey method
Before 1935	Lead line or wire drag survey
1935 to 1972	Echo sounder survey
Post 1972	Side scan sonar

(Note that hydrographic surveys prior to the 1980s did not use DGPS. Therefore, even side scan sonar data gathered before the 1980s may have poor positional accuracy.)

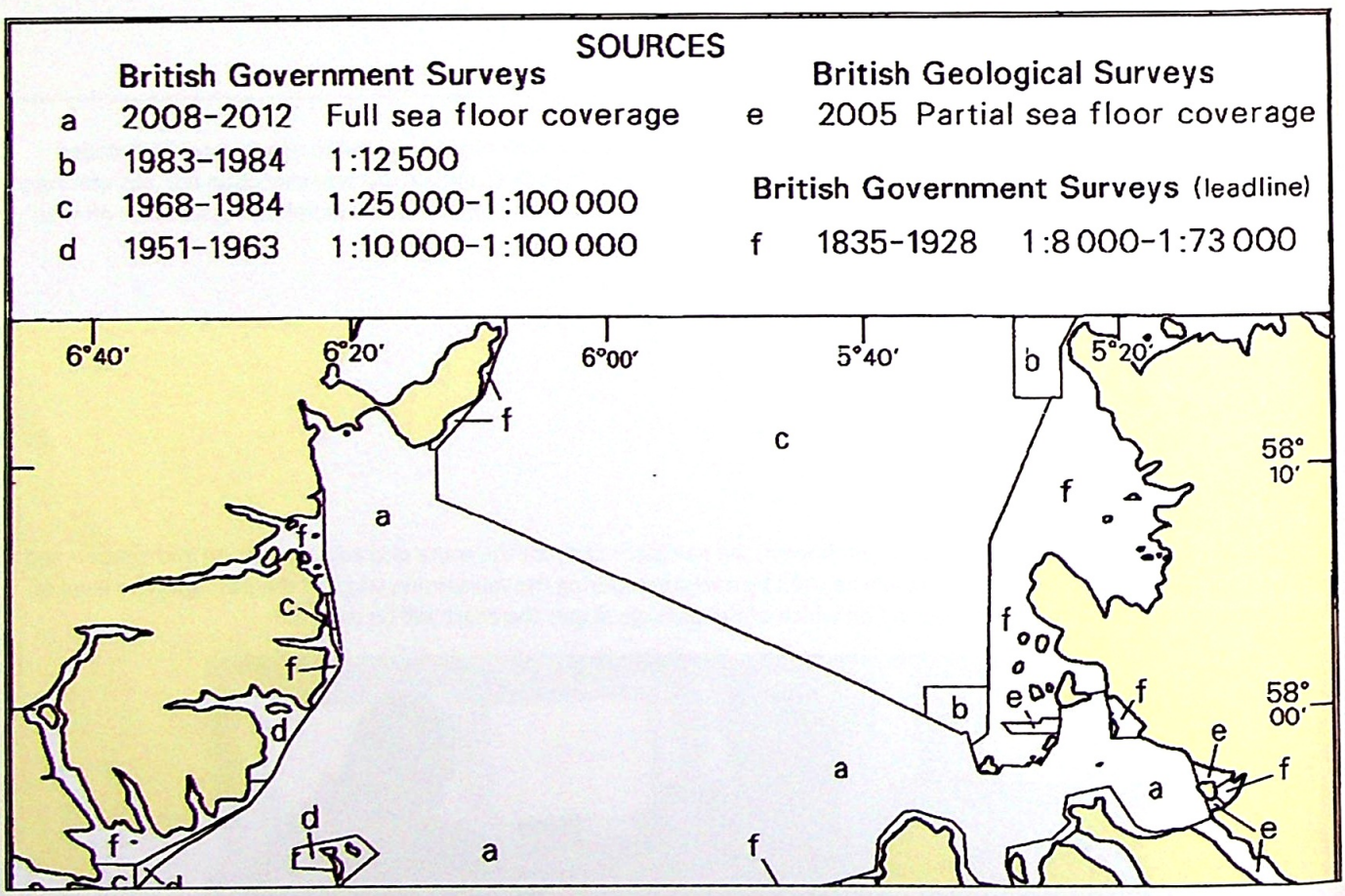


Figure 64: Example source data diagram showing survey data within the limits of the chart.
Source: British Admiralty Chart 1794 *(Courtesy of UKHO)*

- highlight areas of possible seabed changes, where the charted depth may have changed significantly since the last survey due to, for example:
  - sandwaves
  - coral growth
  - volcanic activity
- identify areas of dense shipping traffic and potential areas of convergence

- identify and highlight conspicuous charted features (and annotate, when known, a description of their appearance) that are suitable for:
  - visual and/or radar fixing
  - parallel indexing (measure the distance and mark the PIs on the chart)
- annotate the chart with tidal data
  - time(s) of high water at relevant standard port(s) (see Figure 65)
  - direction and strength of tidal streams at tidal diamonds (see Figure 65)

23 May - 0656 / 1913 GMT Tidal Streams referred to HW at MILFORD HAVEN 51°43′·93

Hours	Geographical Position	A 51°40′·23 N 5 11·08 W			B 51°39′·90 N 5 10·53 W			C 51°41′·13 N 5 08·86 W			D 51°41′·83 N 5 05·56 W			E 51°41′·83 N 5 04·36 W			F 51°41′·93 N 5 01·76 W			
	Directions of streams (degrees)	Rates at spring tides (knots)	Rates at neap tides (knots)																	
Before High Water 6		127	2.1	0.9	118	1.8	0.8		0.0	0.0	003	0.3	0.2	310	0.4	0.2	100	0.1	0.0	−6
Before High Water 5		122	2.0	0.9	122	1.6	0.7	013	0.3	0.1	060	0.6	0.3	073	0.4	0.2	097	0.7	0.3	−5
Before High Water 4		074	0.8	0.3	083	0.9	0.4	023	0.8	0.4	086	1.2	0.6	085	1.0	0.5	095	1.0	0.4	−4
Before High Water 3		003	0.6	0.3	009	0.6	0.2	027	1.1	0.5	088	1.7	0.8	089	1.5	0.7	095	1.1	0.5	−3
Before High Water 2		322	1.1	0.5	321	0.6	0.2	023	1.0	0.5	087	1.5	0.7	097	1.3	0.6	097	1.4	0.6	−2
Before High Water 1		310	1.3	0.6	300	0.8	0.3	017	0.7	0.3	084	0.9	0.4	098	1.1	0.5	102	0.9	0.4	−1
High Water		300	1.6	0.7	292	1.4	0.6	354	0.3	0.1	017	0.1	0.0	083	0.3	0.2	100	0.1	0.0	0
After High Water 1		296	1.8	0.8	292	1.5	0.6	214	0.5	0.2	266	0.4	0.2	294	0.4	0.2	285	1.1	0.5	+1
After High Water 2		288	1.5	0.6	288	0.3	0.6	207	0.9	0.4	260	1.2	0.5	272	1.0	0.5	280	1.2	0.5	+2
After High Water 3		264	0.6	0.3	273	0.8	0.3	207	1.1	0.5	260	1.7	0.8	263	1.1	0.5	278	1.1	0.5	+3
After High Water 4		131	0.9	0.4	156	0.5	0.2	200	1.1	0.5	261	1.4	0.7	257	1.3	0.6	276	0.9	0.4	+4
After High Water 5		128	2.4	1.0	121	1.8	0.8	187	0.6	0.3	265	1.0	0.5	263	1.2	0.6	270	0.5	0.2	+5
After High Water 6		126	2.3	1.0	115	1.9	0.8	120	0.1	0.1	317	0.6	0.3	278	0.7	0.3	258	0.2	0.1	+6

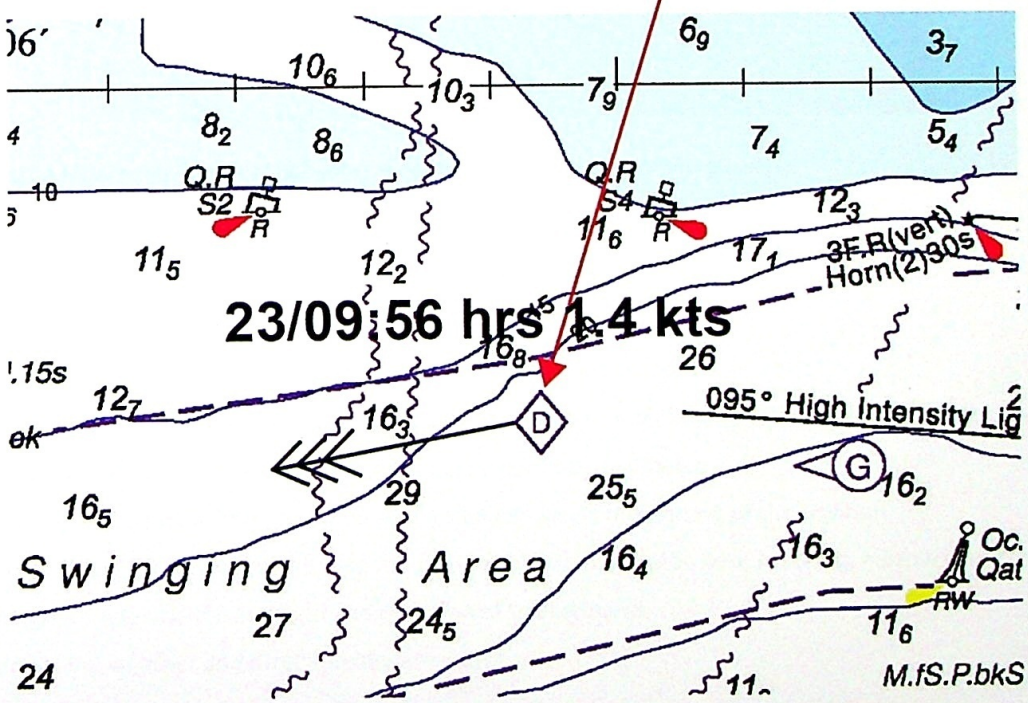


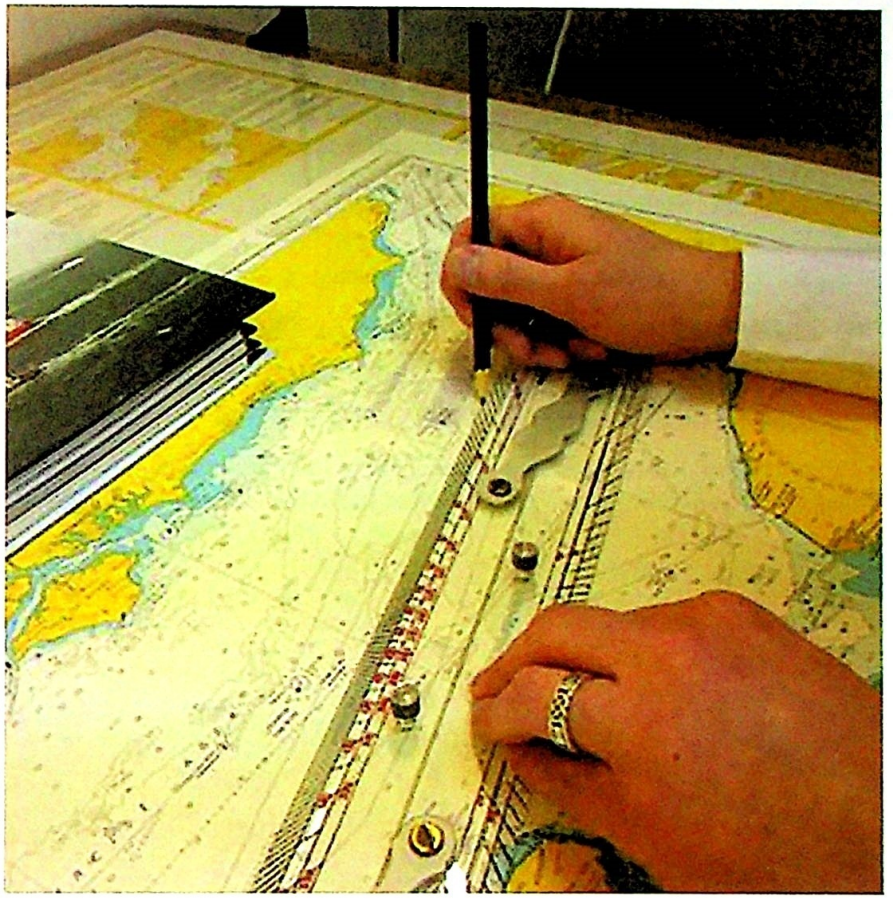
Figure 65: Time of HW at standard port, annotated beside the tidal data table and tidal strength and direction, annotated for a tidal diamond (predicted strength interpolated between predicted spring and neap strength for the calculated % springs rate). The red circles and arrow have been added to highlight relevant information. Source: British Admiralty Chart 3274 *(Courtesy of UKHO)*

- highlight areas of meteorological concern
  - tropical revolving storms (TRS) anticipated and forecasted
  - likelihood of fog
  - ice limits and type of ice, depending on ship Classification
  - monsoons, depending on the region and time of year

- highlight marine environmental/MARPOL restrictions
  - garbage discharge
  - sewage discharge
  - discharge of oil or oily water residues
  - ballast water exchange
  - local and special area requirements
  - compliance with emission control area (ECA)/sulphur emission control area (SECA) regulations
  - tank cleaning at sea/availability of shore discharge facilities
- security restrictions
  - war zones/politically sensitive areas
  - areas of known piracy/armed robbery
  - drug trafficking
  - naval/military exercise area.

Once these initial chart preparations have been completed, the navigator can plot courses for the various phases of the passage.

3.3 Plotting Courses



When plotting the courses to steer, the following are common to all phases of the passage:

- Course lines should be plotted on the most appropriate scale charts for each leg
- course lines should avoid all navigational hazards (rocks, wrecks, shoals, etc)
- the true course direction should be shown using 360° notation
- manoeuvring characteristics should be used to show the wheel over position
- any areas where the UKC may decrease, due to the effects of squat or heel when turning, should be identified
- adequate overhead clearance under bridges and cables should be maintained
- head or stern marks (leading lights) should be used to enable visual monitoring of the position
- compliance with the COLREGS (conforming to the general direction of traffic flow, routeing, narrow channels)
- analysis of height of tide and the strength and direction of tidal streams
- analysis of prevailing weather and direction of wave travel
- analysis of any expected heavy weather and swell
- courses should be adjusted to avoid beam seas
- visibility (to give a wider margin from navigational hazards).

3.4 Speed

The speed along each leg of the passage should be planned to ensure a timely arrival at the destination. The appraisal stage will have determined the overall speed required, but detailed planning may have to take account of:

- The need to meet a tidal window at the departure and/or destination port or at navigationally critical sections along the route, due to minimum UKC requirements, vertical overhead clearances or to avoid strong tidal streams
- speed restrictions due to:
  - port regulations
  - the need to avoid a decrease in UKC due to turning and/or squat in areas of shallow water
- adjusting speed as per the charterer's requirements or as required by weather and other restrictions
- expected speed made good due to the effects of tidal stream or current
- the need for day or night-time transit of some areas, either for navigational or security reasons
- spare time to allow for unexpected delays. The use of a virtual ETA, a short distance before the planned point of arrival (such as a pilot boarding place), will allow for final adjustment of speed to meet the required ETA
- fuel economy considerations
- the speed characteristics of the ship.

Figure 66: High Speed Craft, 2016.

3.5 Pilotage

3.5.1 Pilotage Chart Preparation

During the pilotage stage, the ship will be passing in close proximity to shallow water and navigational hazards. The navigator should prepare the best scale charts available with sufficient detail to ensure the ship can follow the intended scale, continuously monitor its position and be kept in safe water at all times. These preparations include:

- Marking off shoals (pencil danger area) at or shallower than the calculated depth of the no-go line for the time of transiting pilotage waters
  - the lowest predicted HoT for the period of the transit should be used in the calculation (see Chapter 2, Figure 9)
- description of prominent marks, structures or features
  - text or photographs in sailing directions (see Figure 67) or the description of light structures from the lists of lights (see Figure 68) and similar publications are useful sources for this detail

Principal marks
8.78
1 **Landmarks:**
Crosby Beacon (red ball over diamond topmark, 22 m in height) (53°31′·36N 3°04′·69W).
North Inner Mark (diamond topmark) (53°29′·78N 3°03′·63W).
Port Radar Station (white, 25 m in height) (53°27′·95N 3°02′·44W), conspicuous from most directions. Six wind turbines are situated along the dock wall SE of the Radar Station.
Rock Lighthouse (white granite tower) (53°26′·66N 3°02′·54W), disused.

Figure 67: Example of description of marks from *'Sailing Directions'. (NP37 – 'West Coasts of England and Wales Pilot')* *(Courtesy of UKHO)*

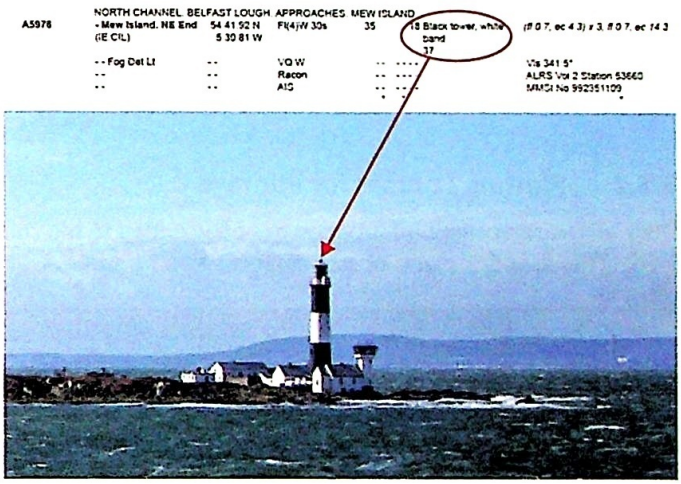


Figure 68: *'List of Lights'* description of lighthouse structure. *(Photograph courtesy of David Goddard)*

- clearing bearings to provide visual means of ensuring the ship remains in safe water
  - based upon prominent charted objects or marks
  - a brief notation on the chart describing the marks will assist with their identification during the monitoring phase
- displaying the predicted strength and direction of tidal stream or current (see Figure 69)
  - tidal data sources include
    - o tidal diamonds printed on the chart
    - o tidal stream atlases
    - o digital prediction software, such as *'Admiralty TotalTide'*
    - o local sources of tidal data and local nav warnings of tidal surges
- highlighting radio reporting points and annotating the charts with details of the VHF channel and station to call.

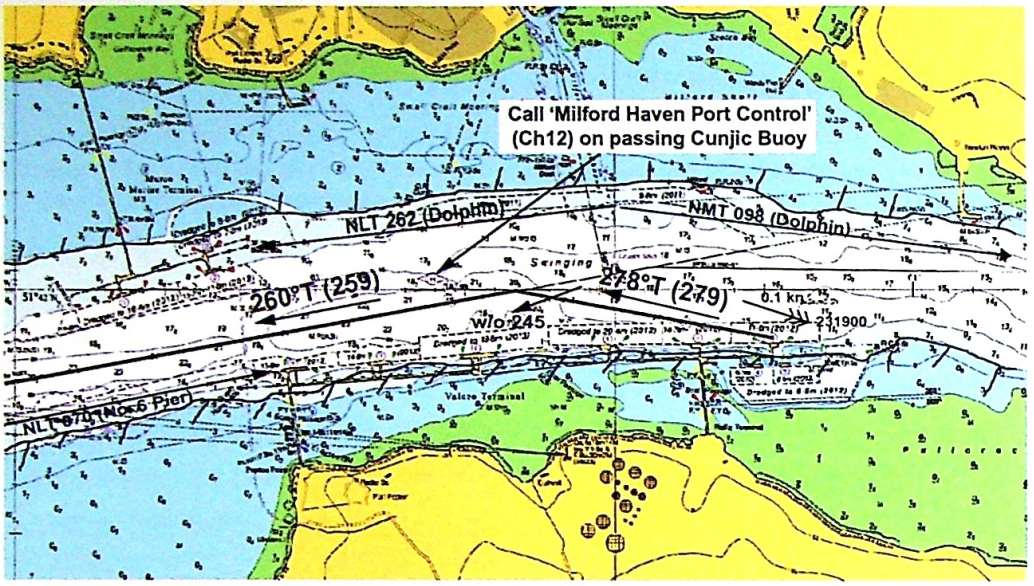


Figure 69: Example of detail for a pilotage phase chart. Source: British Admiralty Chart 3274
(Courtesy of UKHO)

3.5.2 Plotting Courses for Pilotage

Once all the safety limit information has been added to the chart, the recommended courses to steer can be plotted using leading marks, head marks or stern marks, as appropriate.

> **!** **Where recommended courses to steer are printed on charts or described in sailing directions, they should be used with caution as there is the possibility of meeting other ships following a reciprocal course. If possible, it is prudent to have one PI prepared for following the recommended course to steer and a second PI prepared for a course to starboard of the recommended course.**

Distances marked along the courses to the ship's berth during entry into port will help monitor the progress and any necessary adjustments of speed.

If intending to use parallel indexing (PI) techniques, the cross index ranges (CIR) for the track, margin of safety and wheel over lines should be drawn on the chart to ensure these are correctly positioned on the radar display. See Annex D for further details.

3.6 Port Approaches

When approaching port, it is likely that there will be an increased frequency of risk of collision situations. In these areas, there are greater numbers of ships proceeding at slow speeds and with reduced manoeuvrability, combined with ships at anchor or berthed at offshore terminals or moorings.

The chart should be prepared in a similar manner as for the pilotage phase. The scale of the chart is likely to be smaller and, to avoid clutter, annotated detail should be limited to the key marks and points that the ship expects to pass near.

To assist with planning in the vicinity of port approaches, the UK Hydrographic Office publishes *'Port Approach Guides'*, which are planning diagrams (British Admiralty 8000 chart series) that contain information from several different sources, such as *'Sailing Directions'*, *'Tide Tables'* and the *'Admiralty List of Radio Signals'*. Consideration should be given to following the recommended routes printed on the port approach charts or described in the *'Sailing Directions'*.

The courses for both arrival and departure should take into account the position of pilot boarding places, follow the general traffic pattern in the area, avoiding concentrations of traffic wherever possible, and allow a safe margin from anchorages or offshore terminals/moorings where large ships may be berthed. The use of suitable head or stern marks and PIs will help with monitoring the ship's position in relation to the planned course.

If a pilot is to be embarked or disembarked at a pilot boarding station, the navigator should prepare an approach that allows sufficient room for the ship to adjust her course and speed to provide a lee for the pilot transfer.

3.7 Coastal and Ocean Passages

Once clear of the port and in open water, the passage plan should be monitored by the OOW using the passage charts prepared by the navigator.

3.7.1 Passage Charts

The scale of the charts should be sufficiently detailed to allow the navigator to identify any navigational hazards and plot a course that avoids them by an adequate margin of safety. Navigational charts should depict all known dangers, TSSs and aids to navigation in sufficient detail for coastal passages. More detailed charts should be prepared if passing close to navigational hazards.

Charts intended for ocean passages are typically at a scale of 1:3,500,000, but better scale charts, if available, should be reviewed and prepared if conducting a passage in the vicinity of offshore hazards, eg seamounts, pinnacles of rock, etc.

The navigator should prepare the coastal and ocean passage charts with annotations of all relevant information (see Section 3.2 – Chart Preparation).

3.7.2 Distances to Clear Hazards

The passage plan should identify the nearest danger at every point along the route. Tracks should be plotted at a safe distance from hazards to navigation. The definition of a safe distance must be decided on a case-by-case basis and may require a documented risk assessment. One definition of a safe distance is determined by the passage speed and the method of position fixing available, such that the navigator should be able to plot two position fixes in the time taken to reach the nearest hazard.

3.7.3 Courses for Coastal and Ocean Passages

The navigator should annotate the course on coastal and ocean passage charts with:

- True course to steer for each leg and the distance to run
- distances (at regular intervals) to run to the point of arrival
- ETAs at:
  - waypoints
  - predicted positions of making landfall
  - regular intervals along legs
- highlighted radio reporting points, annotated with details of the VHF channel and station to call (refer to *'Admiralty List of Radio Signals (ALRS)'*, Vol 6).

3.7.4 Courses to Steer in Traffic Separation Schemes (TSSs)

TSSs adopted by the IMO are set out in the latest edition of the IMO publication *'Ships' Routeing'* and in the Annual Summary of Notices to Mariners. Rule 10 of the COLREGS applies to the conduct of all ships in and near TSSs that have been adopted by the IMO.

When following a TSS traffic lane, where there is likely to be a heavy density of traffic crossing the TSS, consider positioning the course to the left of the centre of the lane. This will allow additional sea room when manoeuvring to starboard as the give-way ship in a crossing situation, rather than leaving the starboard limit of the traffic lane (see Figure 70).

When crossing a TSS, ships should plan to do so on a heading that is as nearly as practicable at right angles to the direction of traffic flow. This minimises the time a crossing ship is in the lane, regardless of the tidal stream, and allows ships crossing or following a lane to assess the situation as a crossing encounter and take action in accordance with the COLREGS. Unless permitted by the COLREGS, ships should remain clear of TSS inshore traffic zones.

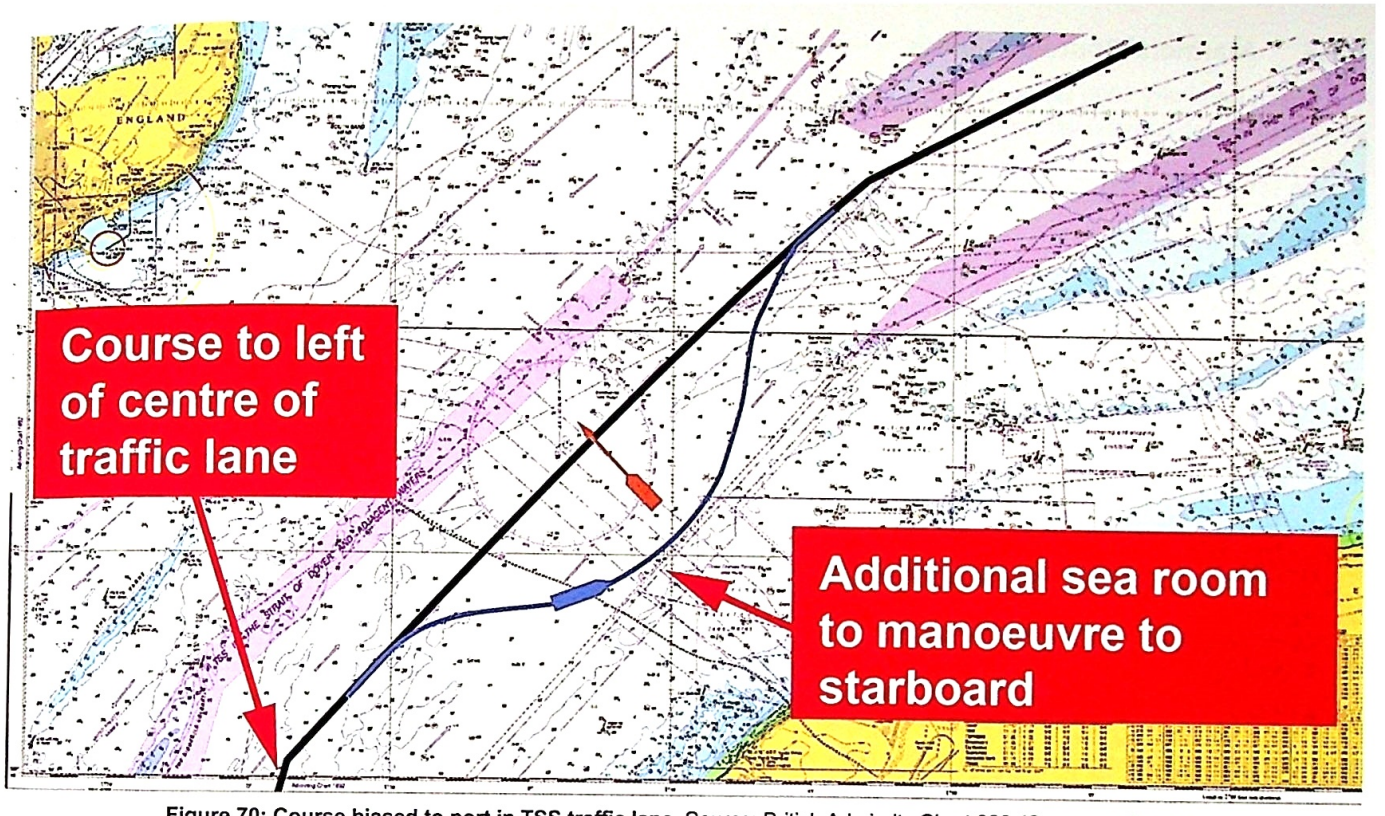


Figure 70: Course biased to port in TSS traffic lane. Source: British Admiralty Chart 323 *(Courtesy of UKHO)*

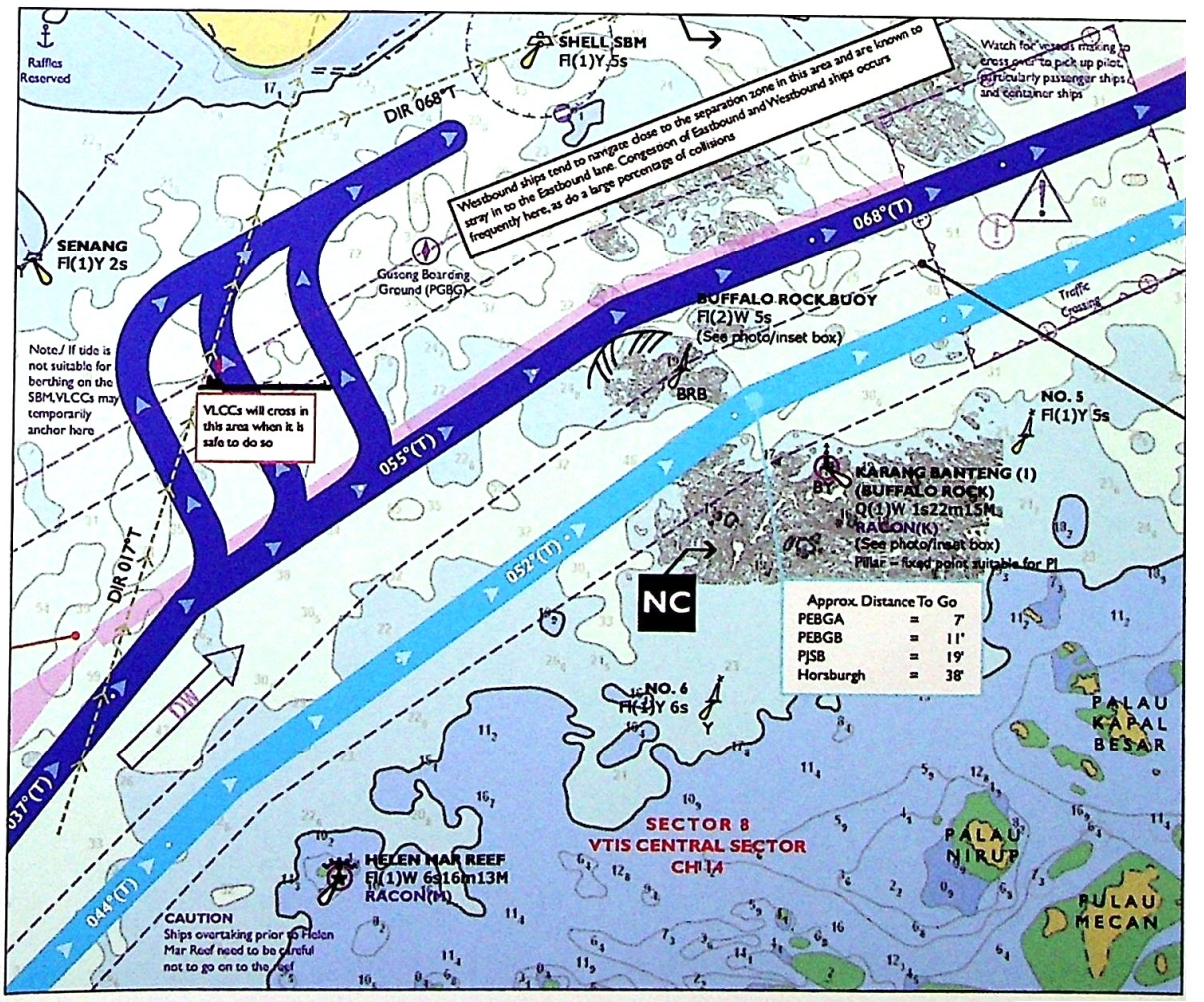


Figure 71: Area for crossing the TSS south of Singapore, for ships bound for the 'Shell' tanker mooring buoy. Source: Witherby Publishing

3.7.5 Mariners' Routeing Guides

The British Admiralty 5000 series of Mariners' Routeing Guides are charts specifically designed to assist with planning passages through constrained waterways. These include:

- BA 5500 English Channel and Southern North Sea
- BA 5501 Gulf of Suez
- BA 5503 Baltic Sea
- BA 5504 Approaches to the Panama Canal
- BA 5506 Turkish Straits – Strait of Istanbul and Southern Approaches
- BA 5507 Turkish Straits – Strait of Çanakkale and Approaches
- JP 5510 Tokyo Wan
- JP 5511 Ise Wan
- JP 5512 Seto Naikai
- BA 5520 Gulf of Mexico
- BA 5521 Irish Sea
- BA 5522 West Coast of Scotland and Pentland Firth
- BA 5523 Adriatic Sea and Stretto di Messina
- BA 5524 Singapore Strait
- BA 5525 Malacca Strait.

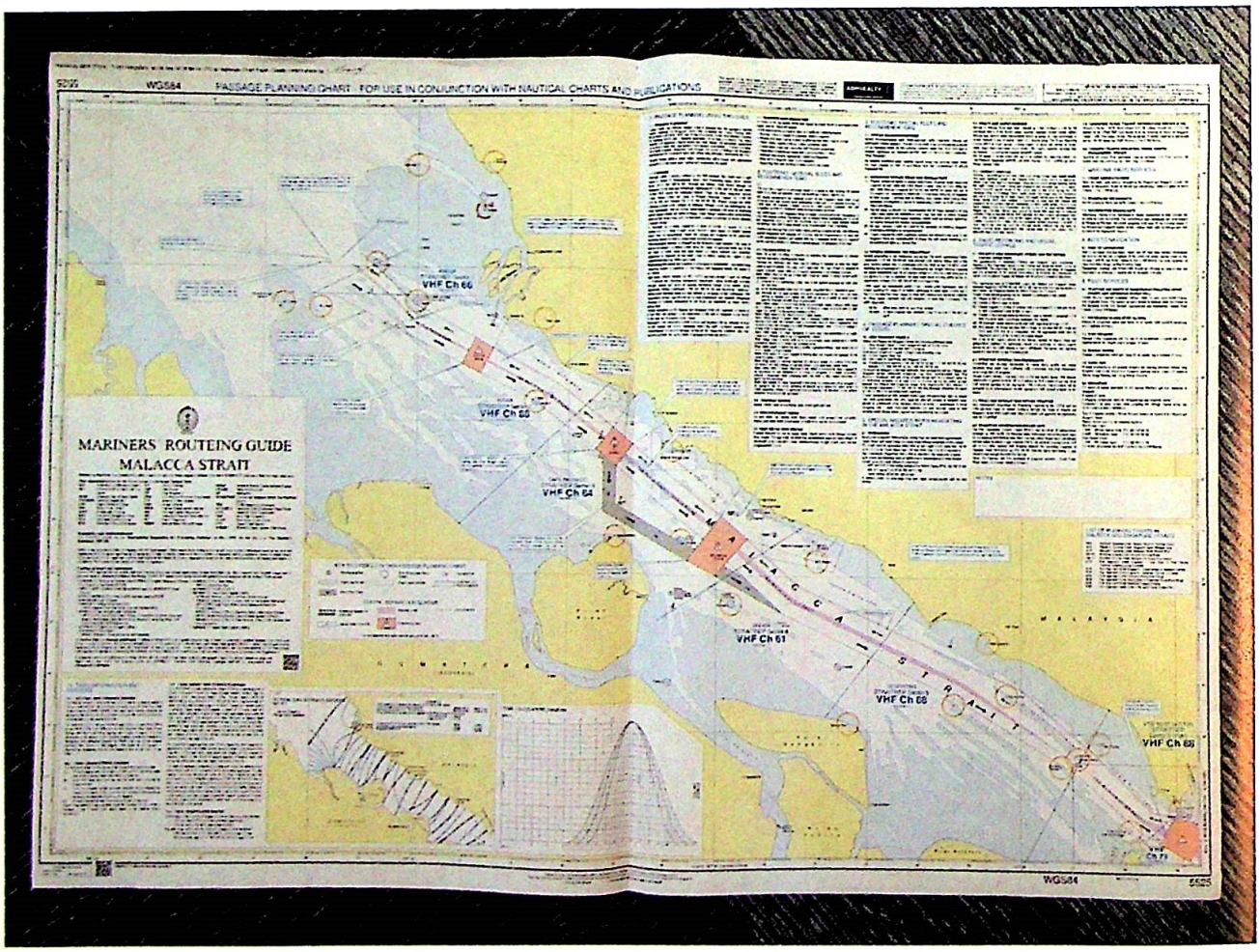


Figure 72: Chart 5525, Malacca Strait Routeing Guide. *(Courtesy of UKHO)*

Further information can also be found in the following Witherby Publishing Guides:

- *'Passage Planning Guide – English Channel, Dover Strait and Southern North Sea'*
- *'Passage Planning Guide – Straits of Malacca and Singapore (SOMS)'*
- *'Passage Planning Guide – Great Barrier Reef and Torres Strait'.*

3.7.6 Planning a Canal Transit

A canal transit plan should be developed that contains all the relevant route information, requirements, logistics and alternative courses. The date and time of the transit should be booked early to avoid delays. The local regulations issued by the canal authority should be checked to ensure the ship is compliant and that required equipment, facilities and documentation are prepared and available.

3.7.7 Courses for Ocean Passage

The options for an ocean passage route should have been considered during the appraisal stage and presented at the appraisal report for the Master's decision on which route to follow. If intending to follow a GC or composite GC route, a series of RLs between waypoints that describe the GC must be drawn.

The distance between the waypoints for RL legs along a GC may be determined either by drawing legs of a standard length (ie 200 nm legs) or a difference in longitude (ie every 5° of longitude). Once the RL segments of the GC route have been determined (see Figures 73 and 74), they should be transferred to appropriate scale charts for the passage.

The navigator should ensure that any dangers are highlighted in the same manner as for a coastal passage and that the course clears them by a safe distance, taking into account the availability and accuracy of the navigation methods to be used during the monitoring stage.

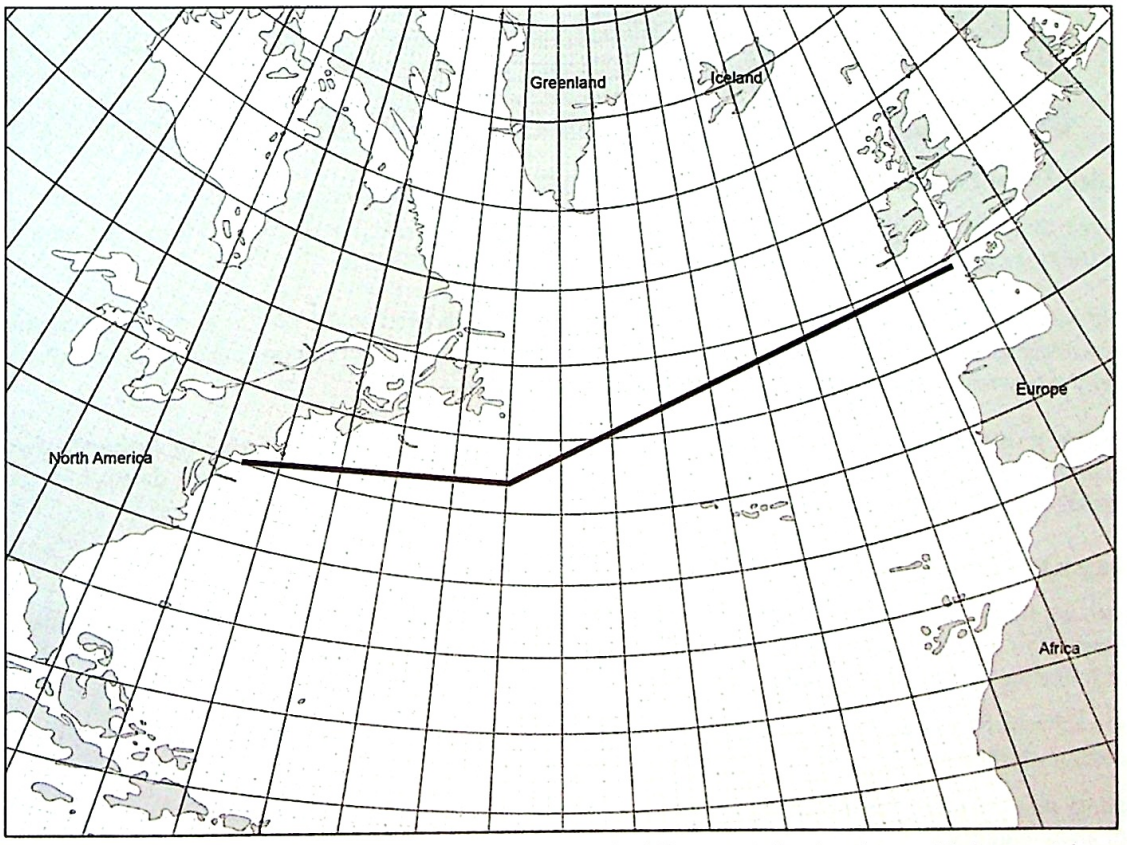


Figure 73: Gnomonic chart to determine GC tracks. The black line annotation has been added separately.
Source: British Admiralty Chart 5095 *(Courtesy of UKHO)*

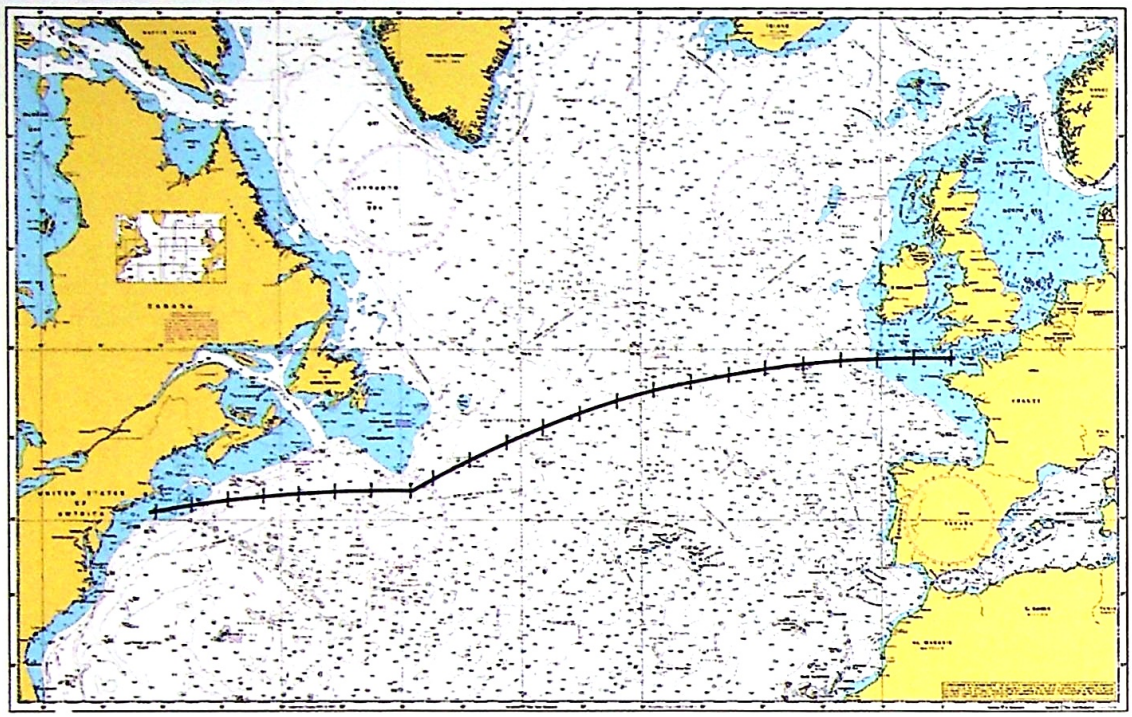


Figure 74: RL segments of a GC course between New York and Land's End. The black line annotation has been added separately.
Source: British Admiralty Chart 4011 *(Courtesy of UKHO)*

The possibility of positional inaccuracies of remote islands and reefs as a result of survey methods used should be considered. The high positional accuracy of GNSS, and particularly DGPS, may have been unavailable at the time of the survey, especially if the route is not one regularly used by shipping. The use of relative navigation techniques, such as visual and radar fixing or PI, will help to ensure the ship remains a safe distance off land (see Annex D).

3.7.8 Additional Considerations for an Ocean Passage

Ocean passages, due to their long duration and distance from land, require careful evaluation prior to their commencement. A ship about to undertake an ocean passage should be as well prepared as possible.

The predicted weather will have been considered when the route was approved by the Master at the appraisal stage. Any factors that have subsequently changed, either prior to commencing the passage or during it, should be re-evaluated by the navigator and the Master to ensure the ocean passage plan remains safe.

The participation in ship routeing systems, including the USCG Automated Mutual-Assistance Vessel Rescue System (AMVER), may provide additional assistance should the ship encounter difficulties. It is important that voyage data submitted to AMVER is kept up to date throughout the voyage.

3.7.9 Passage Planning Sheet

Details of each leg should be recorded in a passage planning notebook for reference during both the current and any future voyages between the same ports (see Annex E). An example of the information for a leg of a passage plan sheet is shown in Annex F. The following should be considered:

- Method and frequency of position fixing, including primary and secondary methods and areas where maximum position fixing accuracy is required
- contingency plans to place the ship in deeper water or identify the nearest safe anchorage that can be utilised in the event of an emergency
- checklists, as appropriate (see Annex B)
- watchkeeping manning levels for both the bridge and engine room, which are often included for the different phases of navigational status and usually include coastal, pilotage and/or TSS passage.

3.8 Risk Assessment

At the passage planning stage, it is vital that consideration is given to potential problems, including the possibility of equipment failure. This is known as contingency planning and can be aided by proper risk assessment.

Risk assessment should follow a predetermined format in line with the ship's SMS and be appropriate to each stage of the voyage. It should identify the likely hazards and the potential harm of each, evaluate the risks and specify the control measures required to manage those risks.

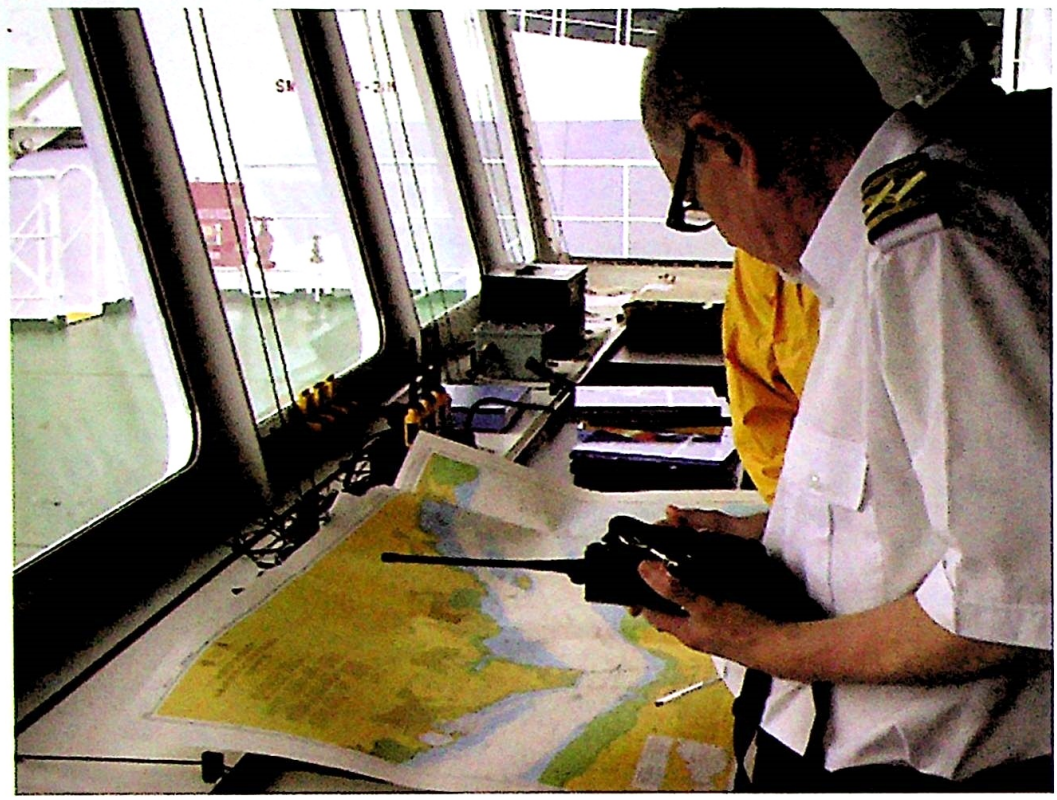
A risk assessment for contingency planning should consider the following:

- Damage to the ship or cargo
- crew injury or medical emergency
- engineering restrictions
- failure of navigation equipment
- failure to achieve the planned passage speed
- adverse weather conditions.

The control measures should take into account:

- The ship's range and endurance
- available speed
- available navigation methods
- weather forecast and sea state
  - options to minimise rolling and pitching
- places of safety
  - distance and direction
- alternative routes to avoid weather, navigational or security restrictions.

3.9 Completion of the Planning Stage



(Photograph courtesy of Duncan Bruce)

Once the navigator has completed detailed planning, the Master should be briefed and review the overall plan to ensure that no navigational dangers or planning details have been overlooked. Any changes from the details discussed at the appraisal report should be brought to the Master's attention.

The Master's review is an essential part of the passage plan. Adequate time should be allowed to ensure it is properly considered and that any amendments required by the Master are completed before sailing.

On completion of the brief and following any necessary amendments, the Master should approve the plan.

3.10 Coastal Passage – Example

A laden product tanker, length 126 m and draught on sailing of 9 m, is to make passage from Milford Haven (Valero Terminal) to Liverpool (Tranmere Oil Terminal) between 23 and 24 May. The ship's maximum speed is 16 kts and the economical speed is 10 kts. The ship will be ready to sail from the berth at Milford Haven at 19:00 on 23 May and the Master wishes to proceed at an economical speed for as much of the passage as possible.

The *'Admiralty Distance Tables'* show the distance between Milford Haven to Liverpool as 171 nm but, after reading Note 6 (see Chapter 2, Figure 5), the navigator found this distance was for a route to the east of Grassholm, which the *'Sailing Directions'* and notes on the chart (see Chapter 2, Figure 6) highlighted should not be used by laden tankers. The navigator, therefore, calculated the distance for a route via The Smalls and Off Skerries TSSs, as 195 nm between the points of departure and arrival.

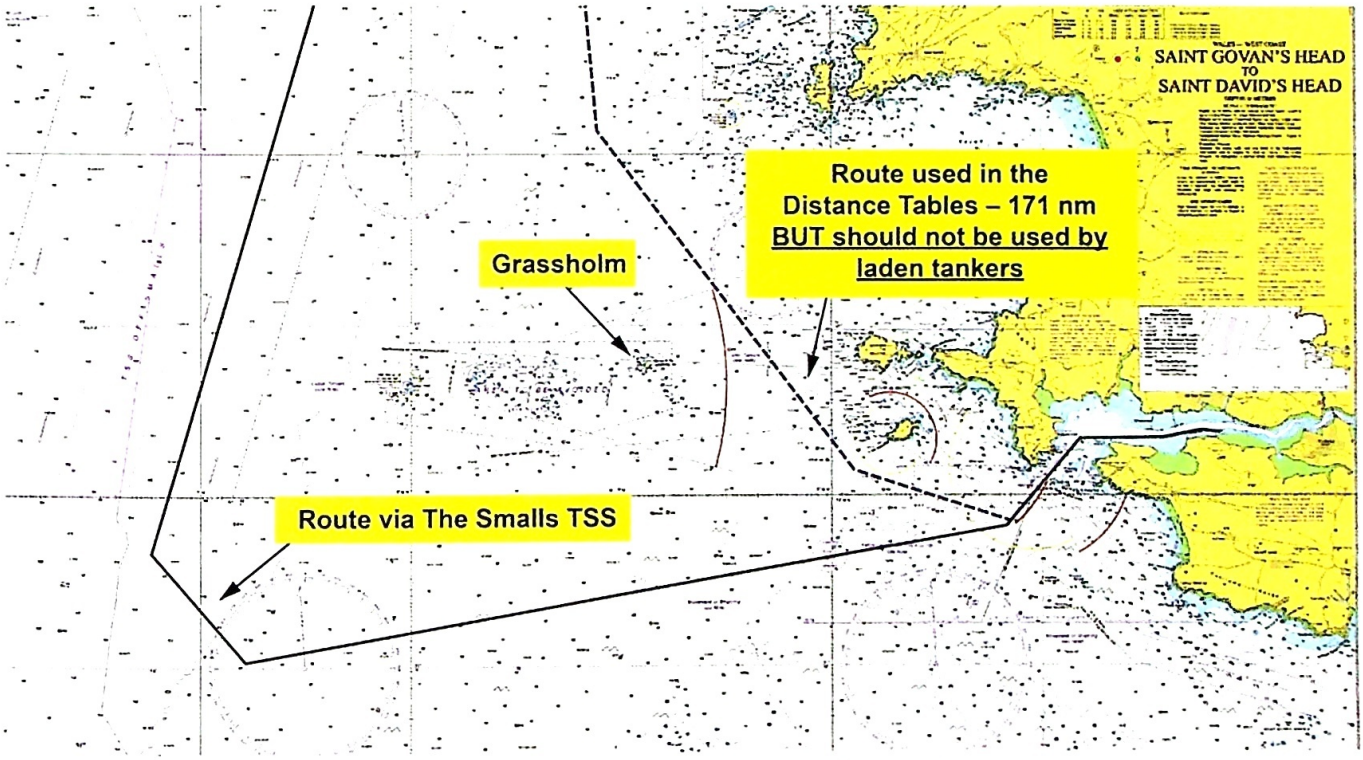


Figure 75: Passage options in the vicinity of Grassholm.
Source: British Admiralty Chart 1478 *(Courtesy of UKHO)*

The distances are as follows (see Figure 76 for overall passage):

From	To	Distance (nm)
No. 3 berth	Milford Haven point of departure (St Ann's Buoy)	6.4
Milford Haven (St Ann's Buoy)	Liverpool point of arrival (Bar Light Buoy)	195
Liverpool (Bar Light Buoy)	Tranmere Oil Terminal berth	18.2
	Total Distance	**219.6**

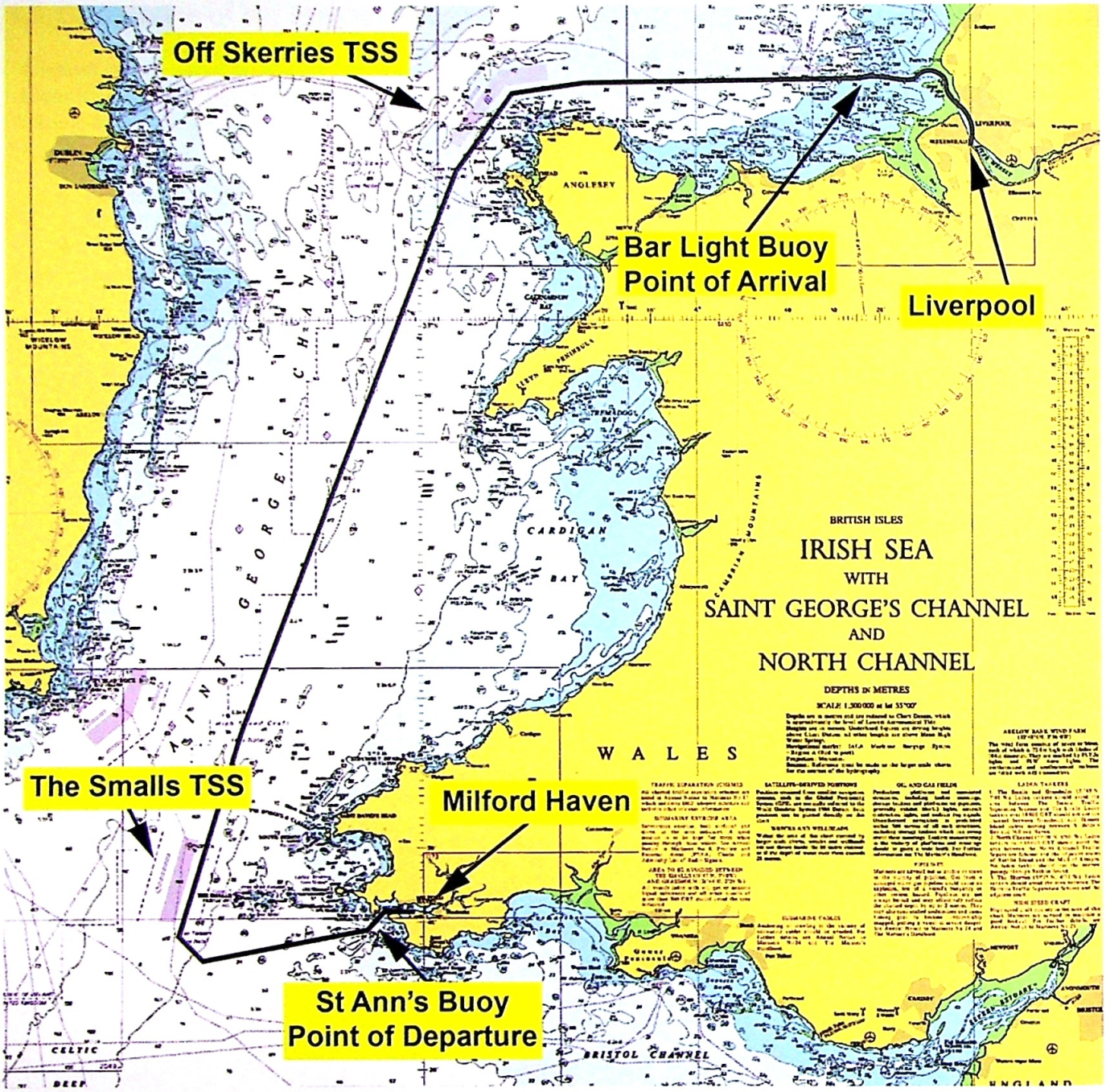


Figure 76: Overview of passage between Milford Haven and Liverpool.
Source: British Admiralty Chart 1121 *(Courtesy of UKHO)*

3.10.1 Coastal Passage Example – Tidal Calculations

The times and HoT of HW and LW at Milford Haven, Liverpool and Seacombe are as follows:

Milford Haven: 23 May (All times GMT)			Liverpool Bar: 24 May (All times GMT)			Seacombe: 24 May (All times GMT)		
LW	00:55	1.1 m	HW	00:01	8.8 m	HW	00:20	9.0 m
HW	06:56	6.6 m	LW	06:38	1.6 m	LW	06:54	1.4 m
LW	13:11	1.2 m	HW	12:16	8.5 m	HW	12:40	8.8 m
HW	19:13	6.7 m	LW	18:56	1.7 m	LW	19:08	1.5 m
HW Dover: (All times GMT) 23 May: 11:53 24 May: 00:03 and 12:19			% rate of springs calculated as 80%			*Note: Seacombe is the nearest tidal reference to Tranmere Oil Terminal.*		

The Master requires a minimum UKC of 2 m at all times and an additional allowance of 1 m for squat. The minimum charted depth of the channel in Milford Haven is 16.5 m. There are no HoT restrictions for the departure from Milford Haven, although the Master wishes to be clear of Milford Haven prior to sunset (20:18 GMT) on 23 May and to conduct the majority of the passage at an economical speed.

At Liverpool, the minimum charted depth in the River Mersey is 5.9 m, found in the Crosby Channel. Therefore, the minimum HoT to transit from the Bar Light Buoy to the berth is:

HoT required = (draught + minimum UKC + squat) – minimum charted depth
= (9 m + 2 m + 1 m) – 5.9 m
= 12 m – 5.9 m
= **6.1 m**

The earliest time the HoT reaches 6.1 m is 10:30 GMT on 24 May. The *'Sailing Directions'* advise that berthing at Tranmere Oil Terminal normally takes place on the outgoing tide, up to 1 hr 30 mins after HW (see Figure 77).

> **Docking** at the terminal is normally carried out on the out-going tide up to 1½ hours after HW. Undocking takes place 4 hours before HW up to HW; on occasions undocking can be after HW according to tide and weather. All vessels swing before proceeding down river.

Figure 77: Advice for docking at Tranmere Oil Terminal from *'Sailing Directions'*.

The tide at Seacombe starts to ebb 20 mins after HW. As HW is at 12:40, the tide will therefore start to ebb at 13:00. As docking/berthing is carried out on the outgoing tide, the earliest that this can occur is 13:00 and the latest is 14:10. As it will take 1 hr 50 mins for the product tanker to transit from the river entrance to the berth at 10 kts, the window to enter the river is between 11:10 and 12:20 to achieve the calculated berthing window of 13:00 to 14:10.

3.10.2 Coastal Passage Example – Speed and ETA Calculations

The navigator expected to pass St Ann's Buoy (the point of departure from Milford Haven) at 19:50 on 23 May. The navigator then reviewed the ETA options at Liverpool Bar Buoy, a distance of 195 nm from St Ann's Buoy.

ETA at Liverpool Bar	Time	Speed to make good
24 May 10:30 **Option 1** (earliest time to pass over the Bar with minimum UKC)	14 hrs 40 mins	13.5 kts
24 May 11:10 **Option 2** (to be off Tranmere berth at start of ebb)	15 hrs 20 mins	12.5 kts
24 May 12:20 **Option 3** (to be off berth at latest recommended berthing time)	16 hrs 30 mins	11.8 kts

The navigator then considered the option of proceeding faster for the earlier part of the passage to complete the remaining part at economical speed. Using the formula in Chapter 2 (see Figure 16), the following options for the speed plan were calculated:

	Times (GMT)	Speed	Duration	Distance (nm)
Option 1	23/19:50 – 24/03:53	16 kts	6 hrs 37 mins	66.1
	24/03:53 – 24/10:30	10 kts	8 hrs 3 mins	128.9
			Total 14 hrs 40 mins	**Total 195**
Option 2	23/19:50 – 24/02:47	16 kts	6 hrs 57 mins	111.1
	24/02:47 – 24/11:10	10 kts	8 hrs 23 mins	83.9
			Total 15 hrs 20 mins	**Total 195**
Option 3	23/19:50 – 24/00:50	16 kts	5 hrs 0 mins	80
	24/00:50 – 24/12:20	10 kts	11 hrs 30 mins	115
			Total 16 hrs 30 mins	**Total 195**

The navigator considered the strength and direction of the tidal stream, which would be with the ship from departure at Milford Haven until midnight, against the ship until approximately 06:00 on 24 May and then with it for the remainder of the passage to Liverpool. These options were discussed with the Master.

Option 1: the ship would proceed at maximum speed for longer than the economical speed and arrive at the earliest time the ship could enter the river with the minimum required UKC, but would result in the ship either transiting from the river entrance to the Tranmere berth at a relatively slow speed or arriving at the berth before the recommended berthing window.

Option 2: the ship would proceed at the economical speed for a longer period than the maximum speed, arriving at the berth at the start of the recommended berthing window and allowing time in hand before the last recommended berthing time.

Option 3: the ship would proceed at economical speed for the longest period and be the most economical for fuel consumption, arriving at the berth at the end of the recommended berthing window, but allowing no margin for any delay.

The Master selected Option 2 and approved the navigator's recommendation to plan the track via The Smalls and Off Skerries TSSs.

3.10.3 Coastal Passage Example – Preparing the Charts

The navigator prepared the charts, passage graph (see Figure 78) and supporting planning sheets accordingly (see Figures 79 to 83).

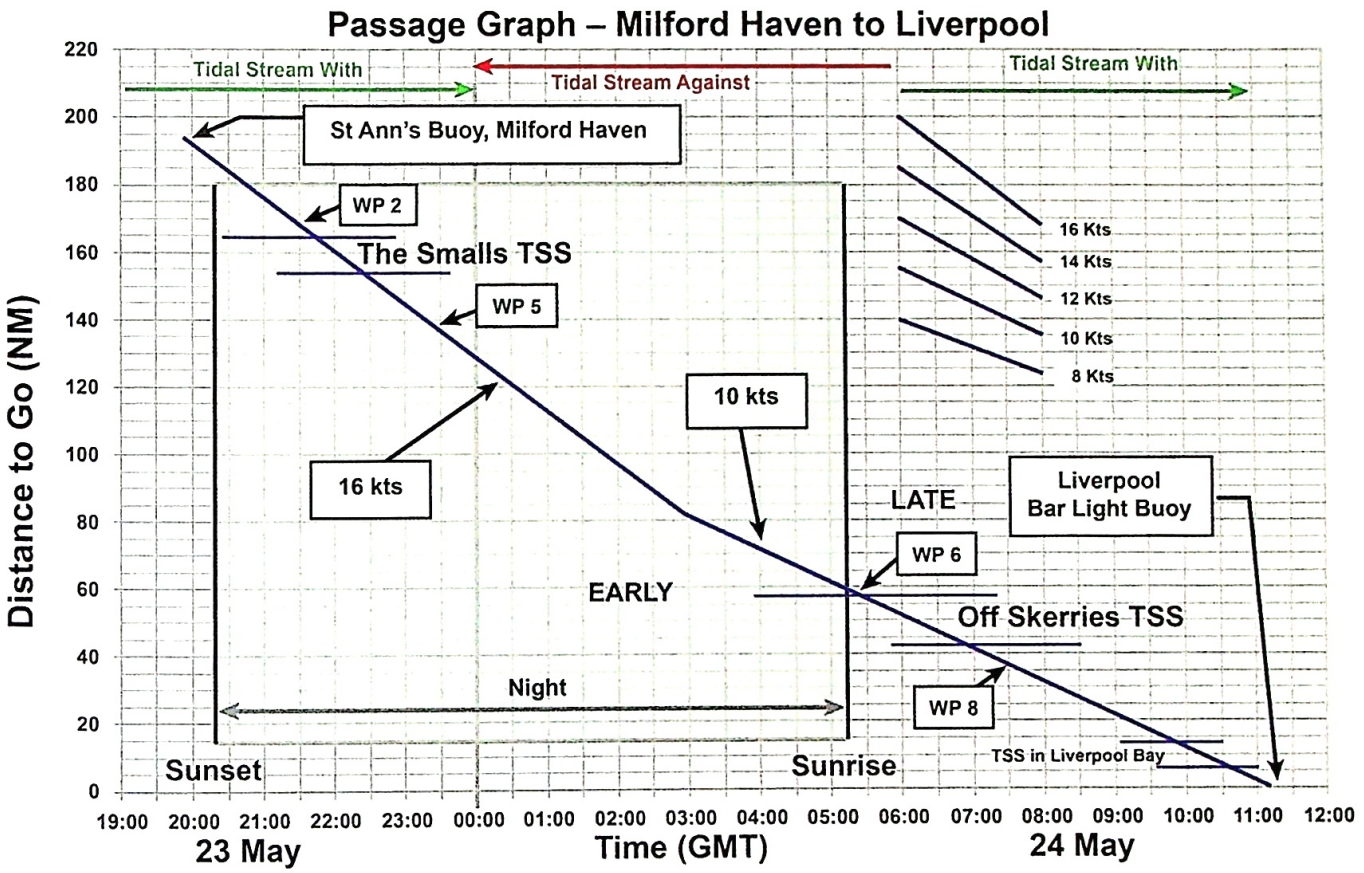


Figure 78: Passage graph – Milford Haven to Liverpool.

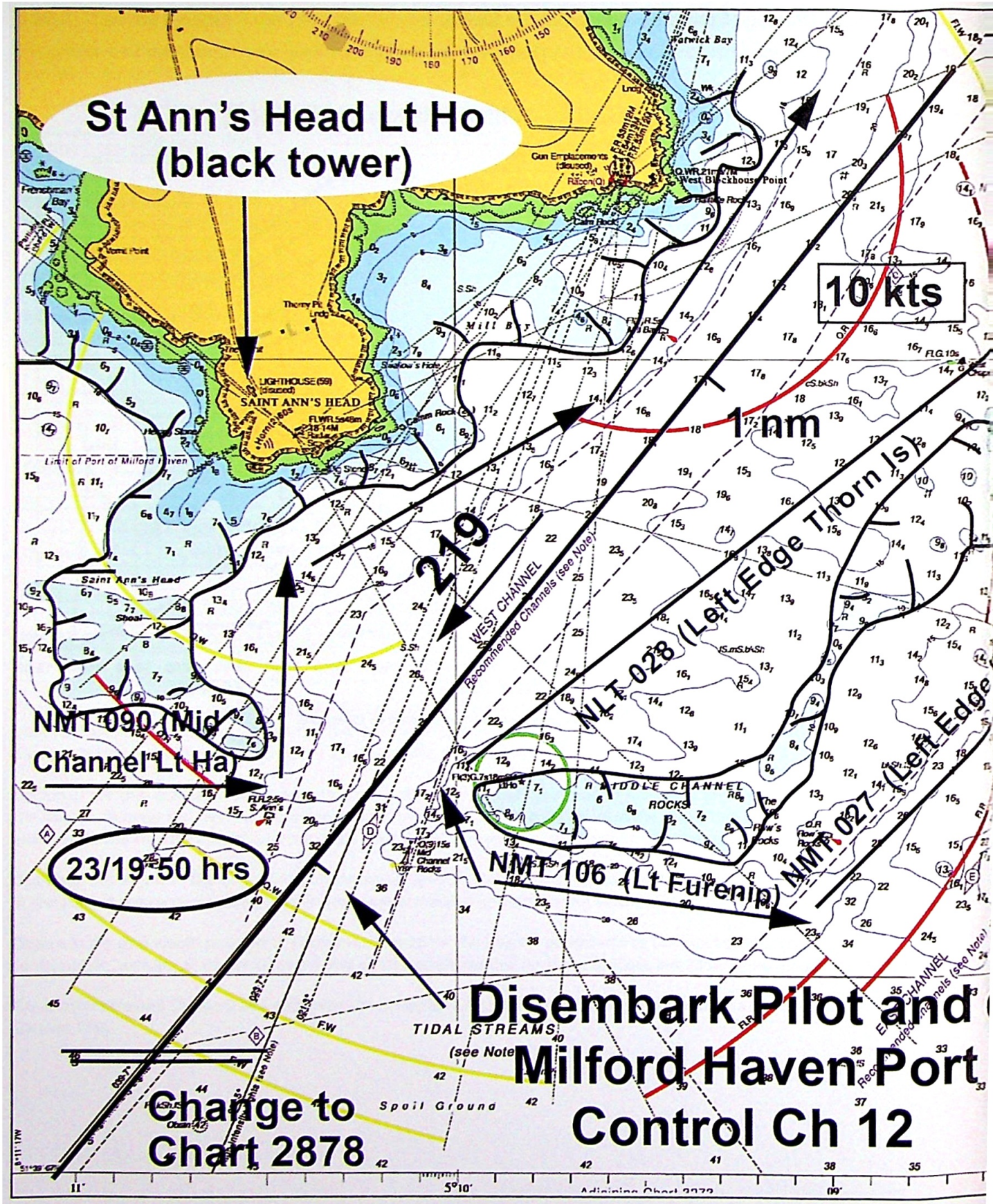
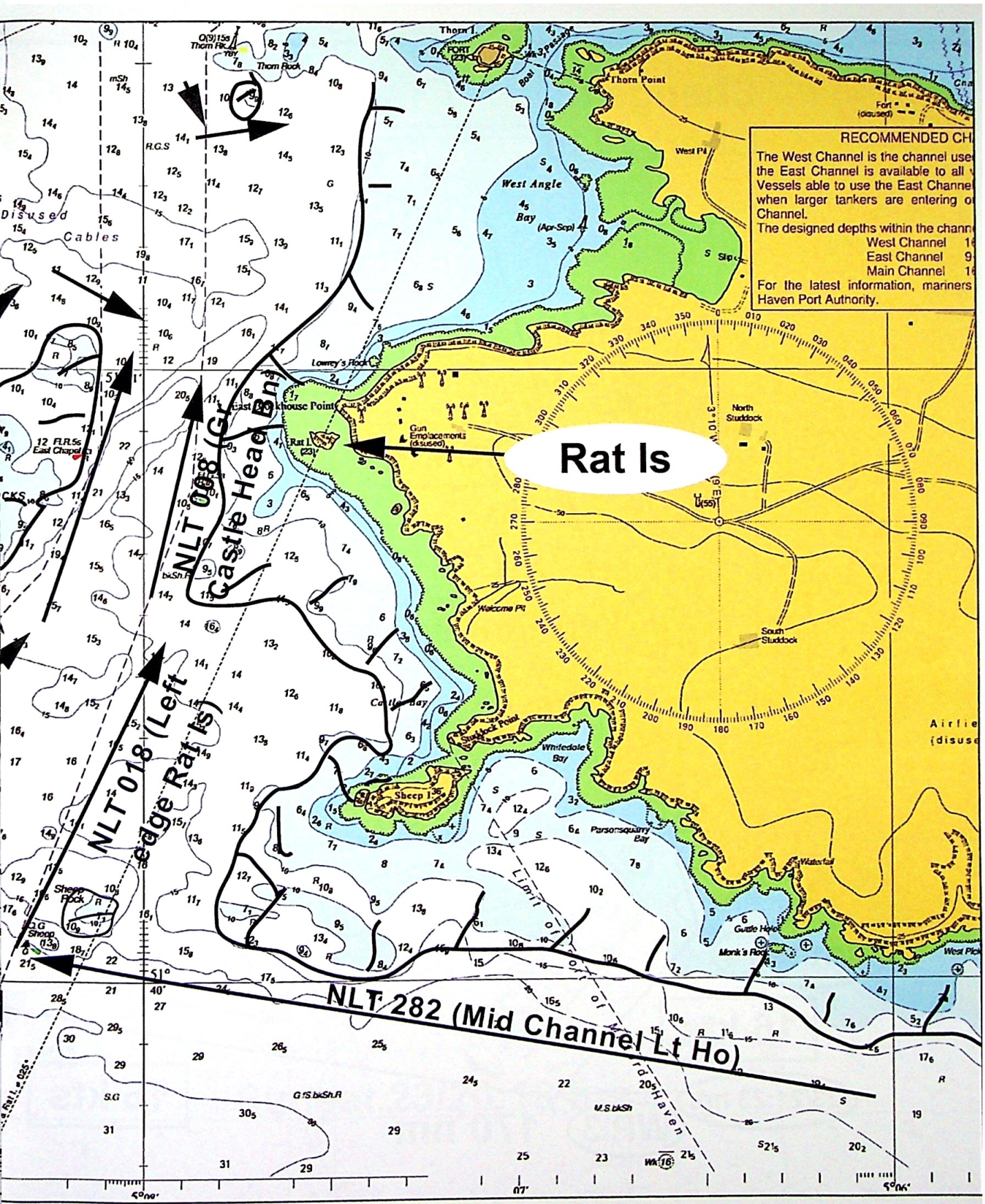


Figure 79: Example of port approach chart used for departure outbound from Milford Haven (not all clearing bearings have been fully anno
Source: British Admiralty Chart 3274 *(Courtesy of UKHO)*



NOT TO BE USED FOR NAVIGATION

All times noted in UTC

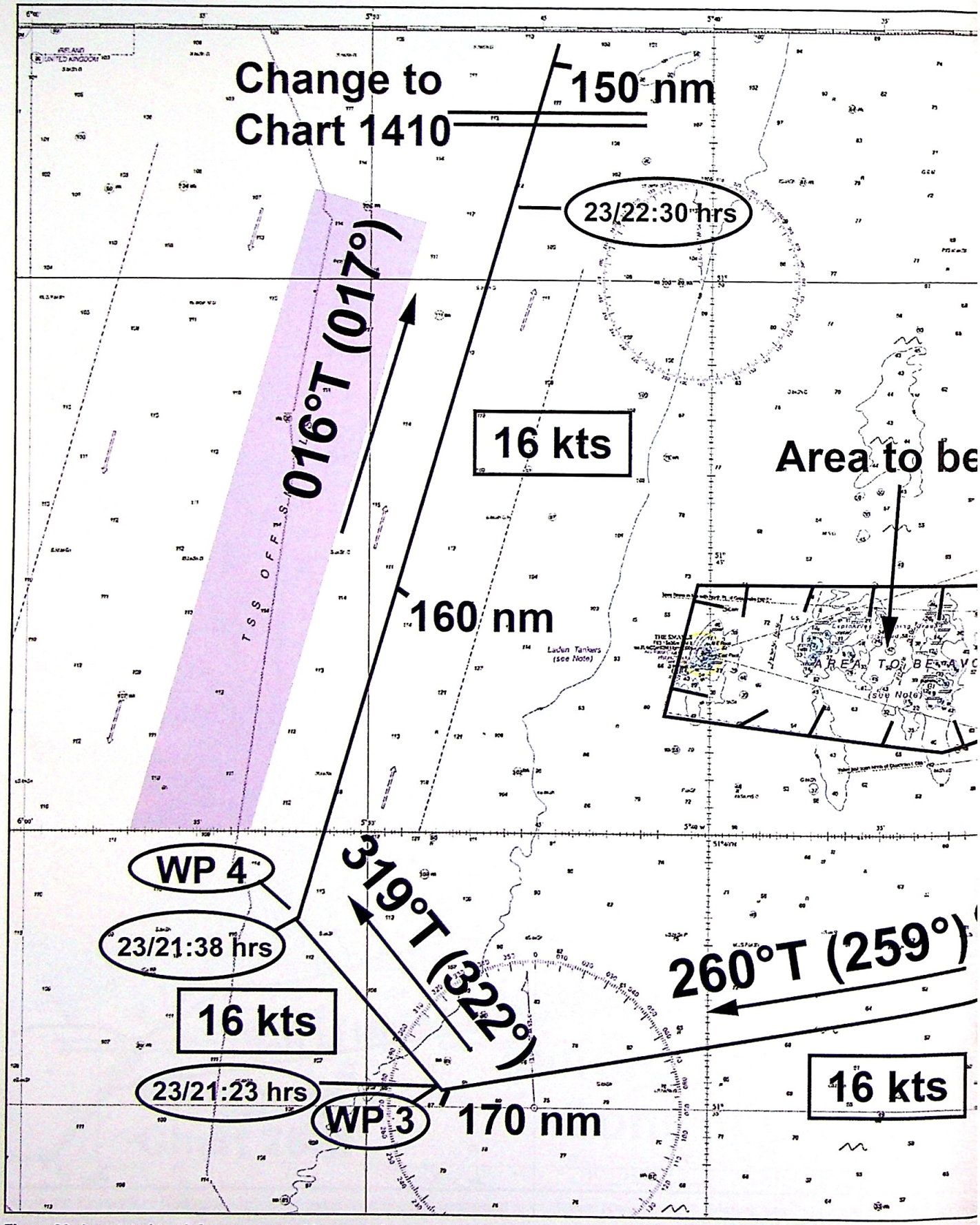
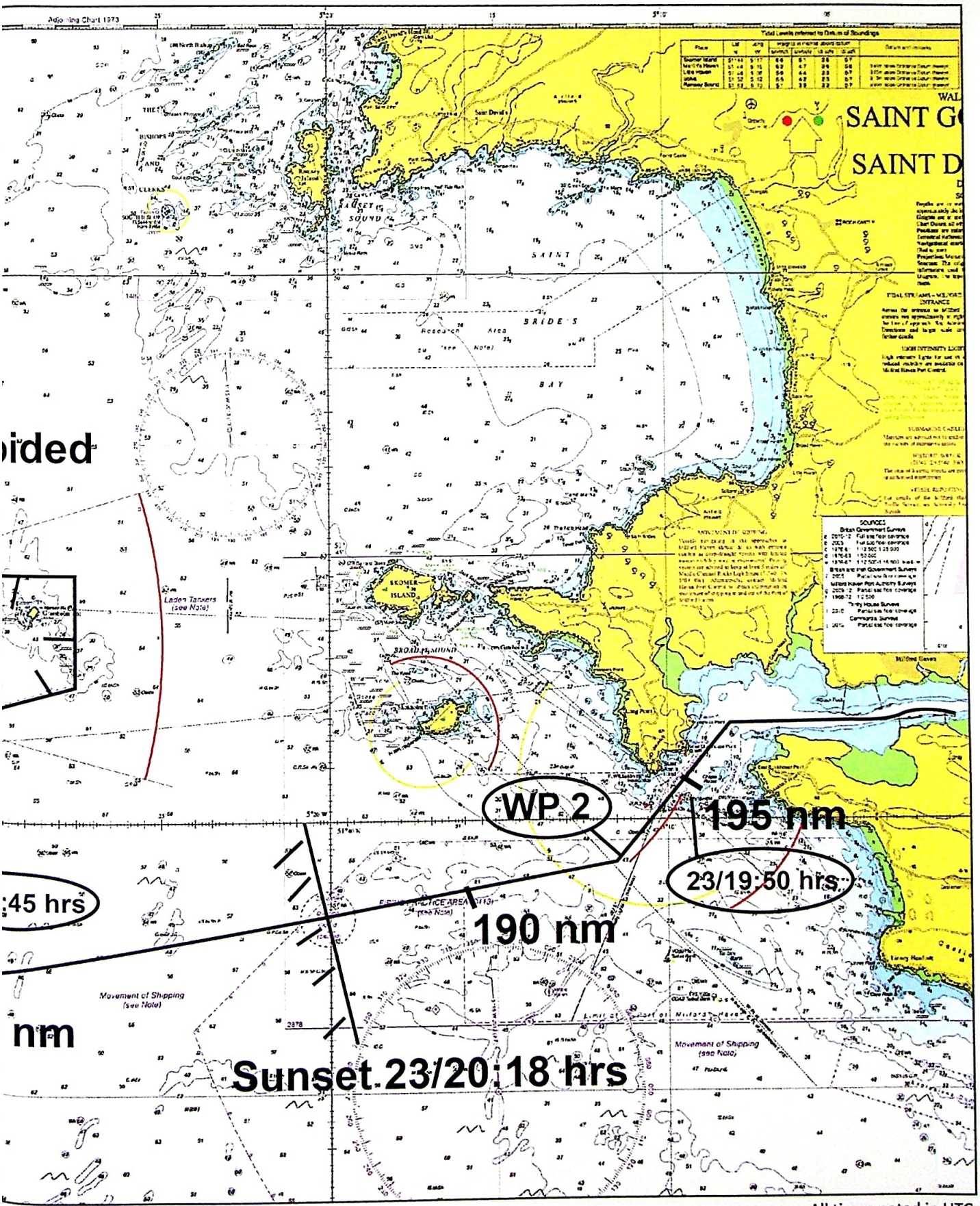


Figure 80: Annotated track for passage to Liverpool. Source: British Admiralty Chart 1478 *(Courtesy of UKHO)*


WP 2
195 nm
23/19:50 hrs
190 nm
Sunset 23/20:18 hrs
:45 hrs
nm
Laden Tankers (see Note)
Movement of Shipping (see Note)
SKOMER ISLAND
BRIDE'S BAY
SAINT
SAINT G
SAINT D
Milford Haven
All times noted in UTC.
NOT TO BE USED FOR NAVIGATION

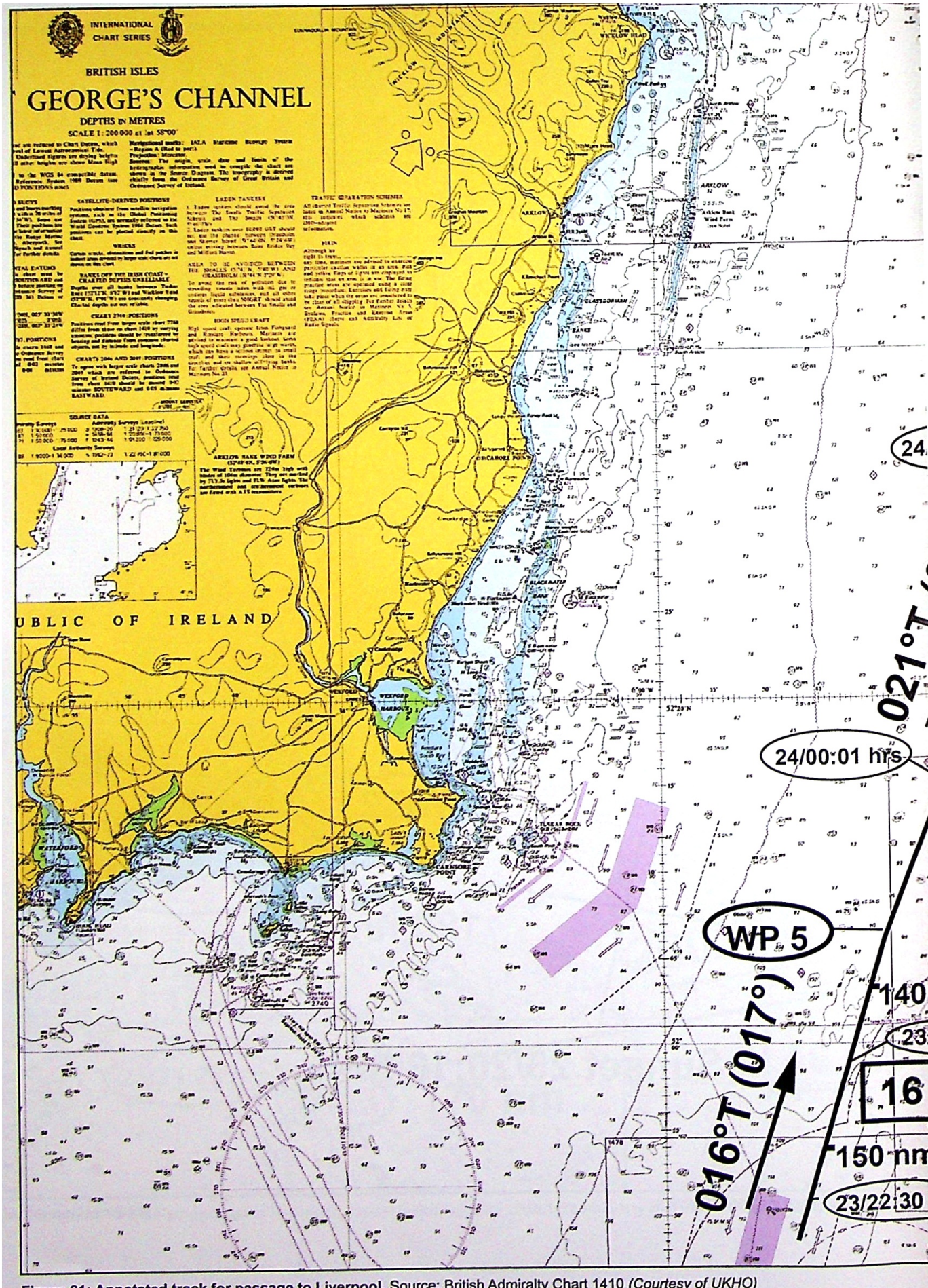
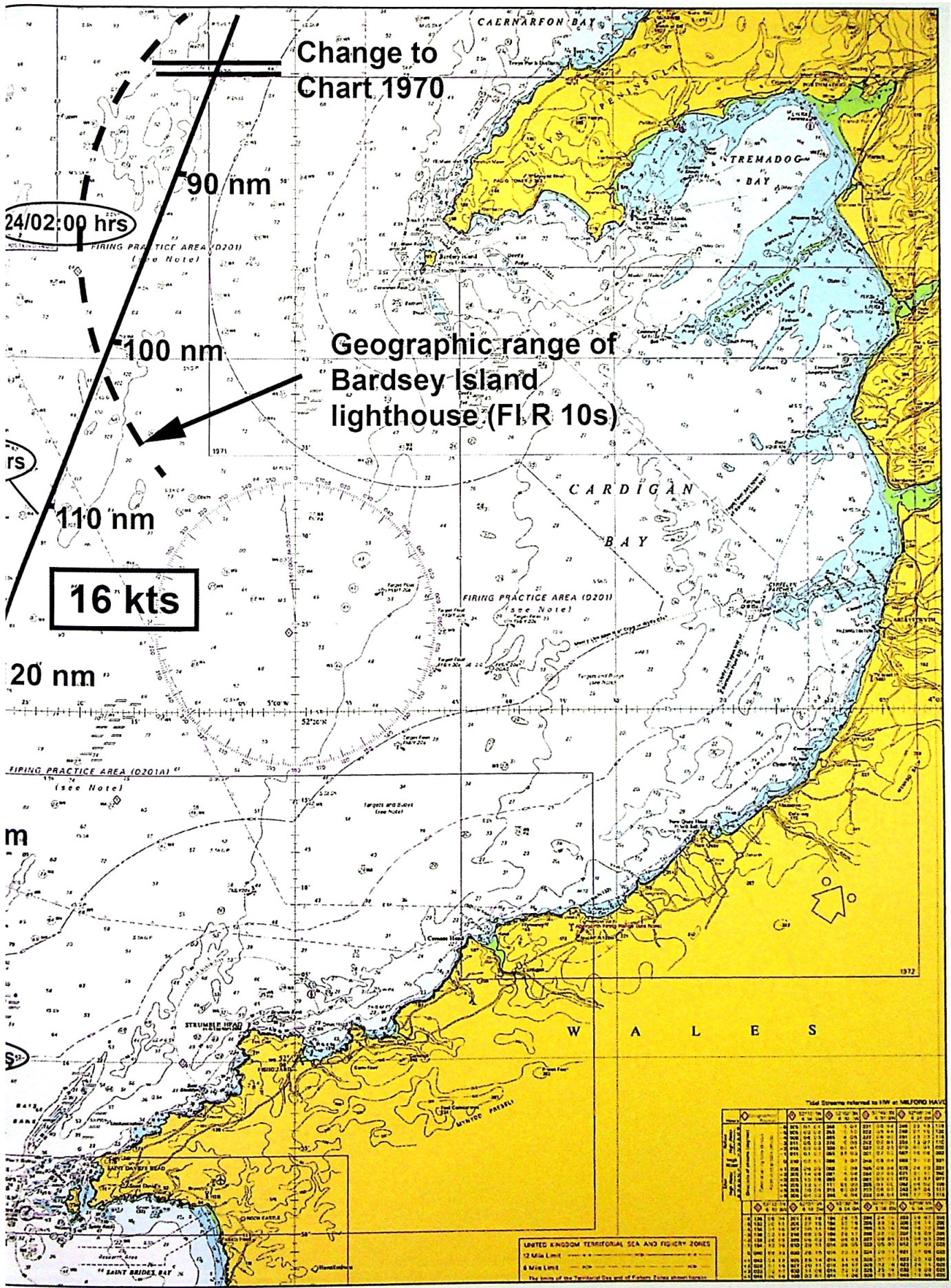


Figure 81: Annotated track for passage to Liverpool. Source: British Admiralty Chart 1410 *(Courtesy of UKHO)*



NOT TO BE USED FOR NAVIGATION

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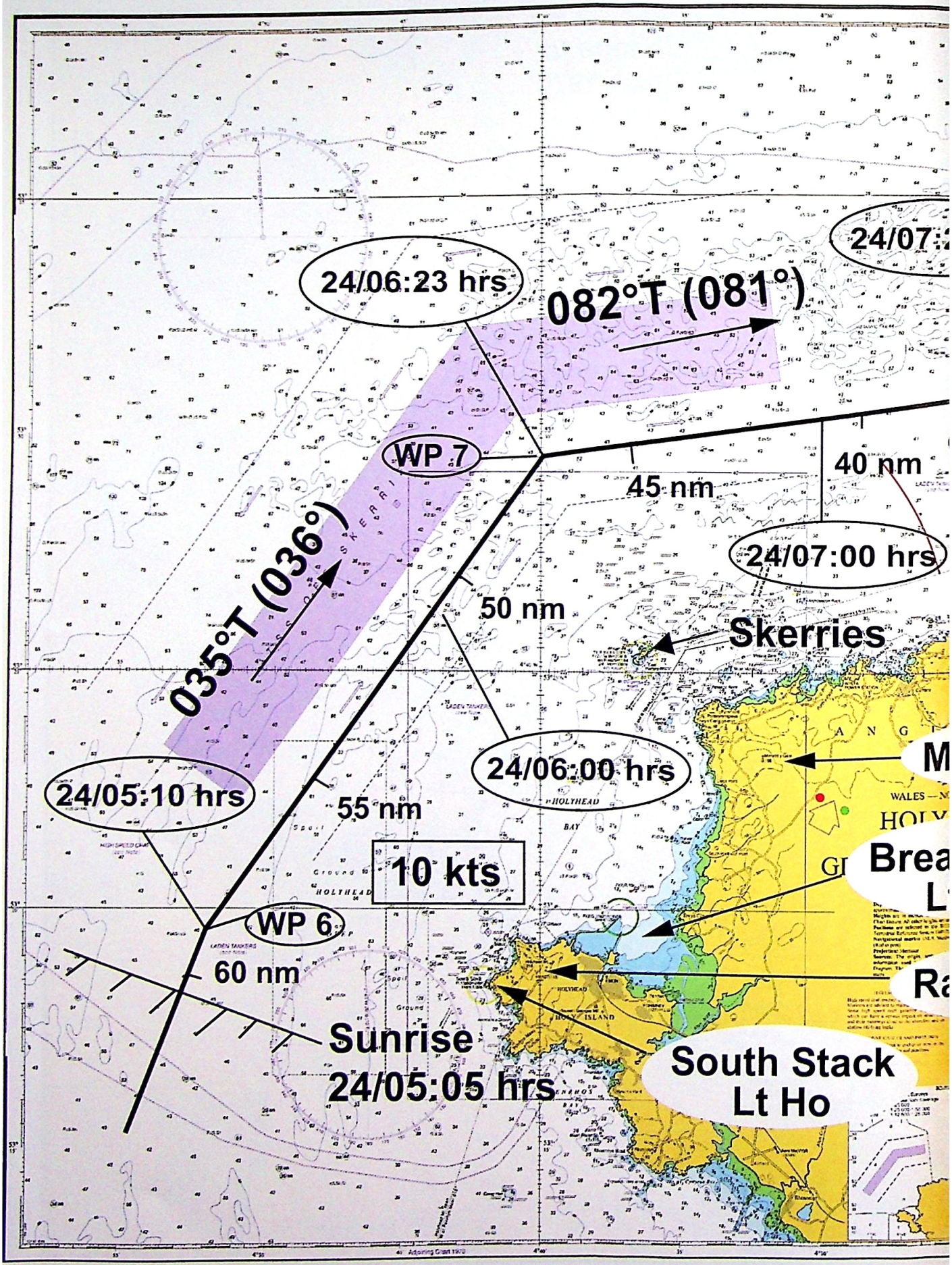
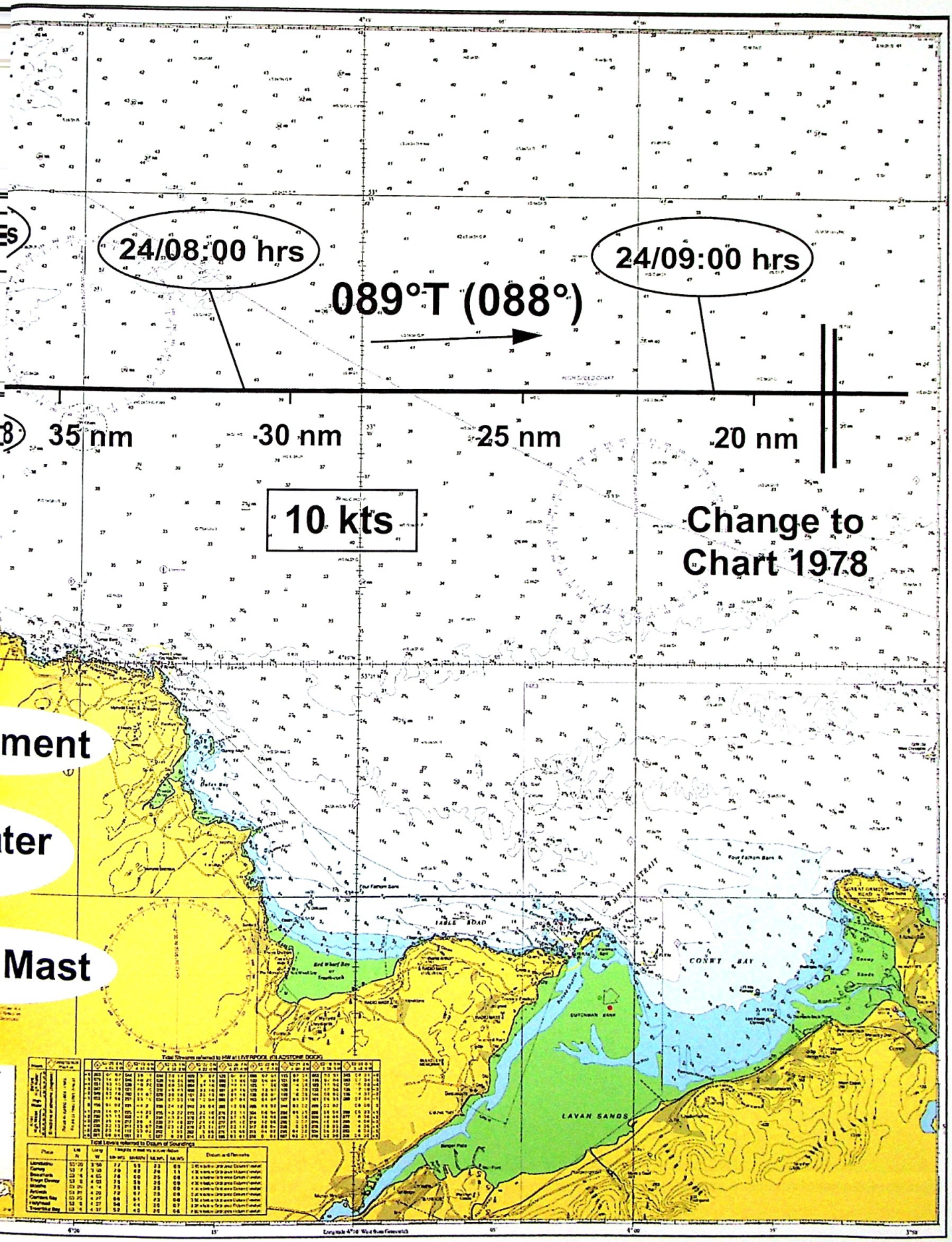


Figure 82: Example of annotated passage chart. Source: British Admiralty Chart 1977 *(Courtesy of UKHO)*



NOT TO BE USED FOR NAVIGATION

All times noted in UTC.

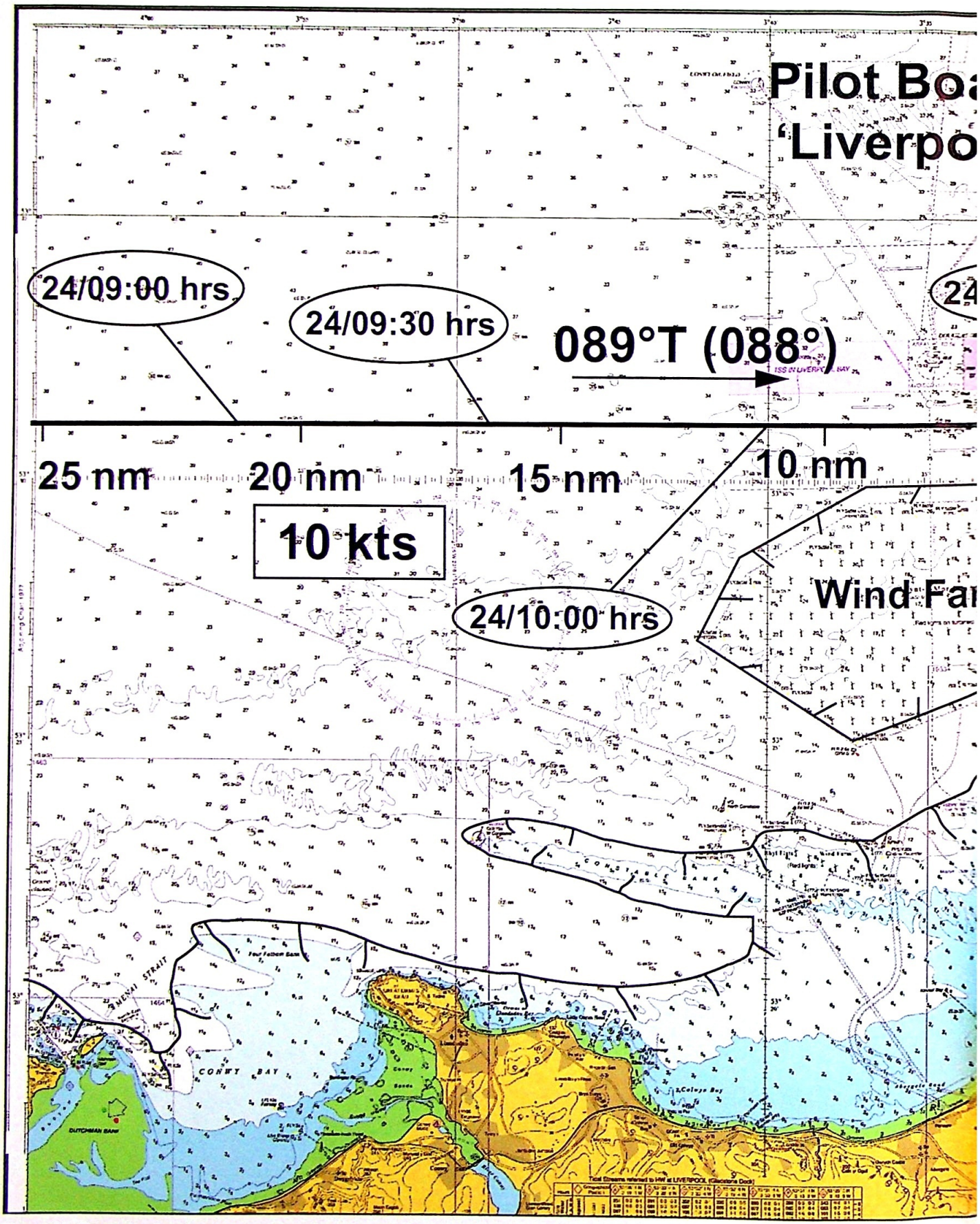
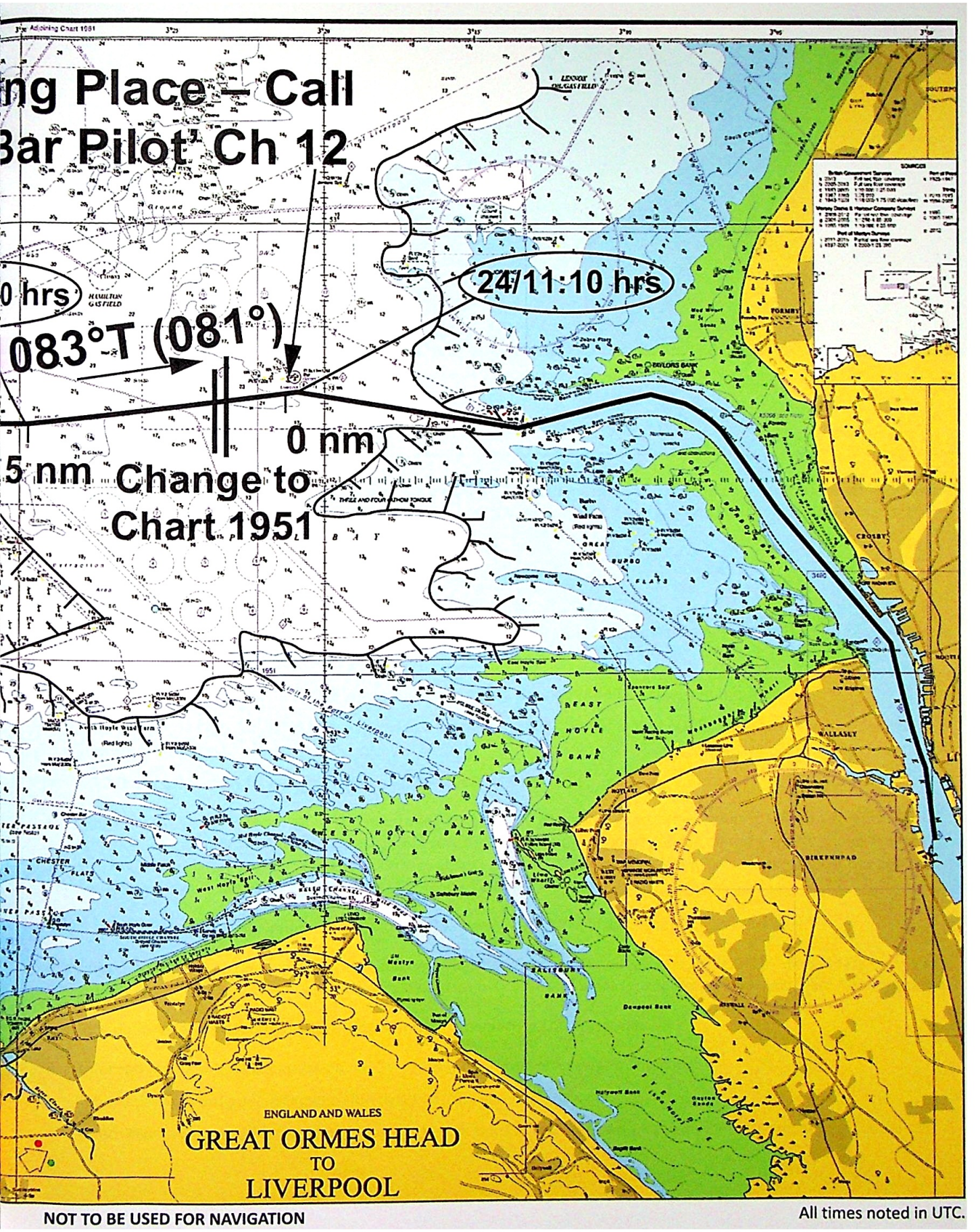


Figure 83: Example of annotated passage chart. Source: British Admiralty Chart 1978 *(Courtesy of UKHO)*



NOT TO BE USED FOR NAVIGATION

All times noted in UTC.

CHAPTER 4

Passage Planning on ECDIS

4 Effective Use of ECDIS

This chapter provides an overview of ECDIS passage planning. The content should be used in conjunction with other, more detailed, publications on ECDIS. As the principles of passage planning are the same as when planning on paper charts, the content of Chapter 3 should also be consulted.

Introduction

A correctly configured ECDIS is a powerful means of navigation. To obtain the complete benefits of ECDIS and be confident in its use, a good ECDIS operator will:

- Be proficient in setting up the ECDIS, particularly the safety settings and the display optimisation
- be aware that ECDIS is always going to provide a 'position', understand how that position has been derived and know how to confirm its accuracy
- take the responsibility to gain an in-depth knowledge of ECDIS.

Learning how to use ECDIS thoroughly, and mentoring others to do the same, contributes towards safer ship operation and a more effective bridge team. Practising the use of every function and technique available on the ECDIS is one of the best ways an officer can improve their core competencies at sea. It is one of the few areas in which a junior officer can develop knowledge and experience that can be shared with fellow bridge team members.

ECDIS is a mandatory carriage requirement under Regulation V/19.2.10 of SOLAS (see Section 2.2.4.2).

In addition, to the SOLAS requirements, each flag State has its own requirements for use of ECDIS as the primary means of navigation (PMN). Officers, Masters and owners should be fully aware of what is required by their Flag State Administration.

The international organisations involved with standards concerning ECDIS include:

- International Maritime Organization (IMO) – Resolutions and Performance Standards
- International Hydrographic Organization (IHO) – ECDIS and ENC standards
- International Electrotechnical Commission (IEC) – Operational and performance requirements and testing standards.

ENCs must be the latest available edition, kept up to date and correctly displayed according to the latest IHO standard (see Table 3).

Standard	Revision
Specifications for Chart Content and Display Aspects of ECDIS	S-52 Edition 6.1(.1)
Presentation Library (PL)	Edition 4.0(.2)
Test Data Sets	S-64 Edition 3.0.2

Table 3: Latest revision of IHO standards required for installation on all ECDIS.

Reference: Current IHO ECDIS and ENC Standards
(Last update: 06 December 2018)
http://www.iho.int/mtg_docs/enc/ECDIS-ENC_StdsIn_Force.htm

Once the appraisal report is complete (see Chapter 2) and the high level plan has been approved by the Master, detailed planning can take place. The planning phase is made up of five stages:

- Display configuration
- route creation
- supplementary information
- route check
- detailed brief.

Effective planning, execution and monitoring of a passage plan, conducted on ECDIS, must take into account the following:

- The reliability and condition of navigational equipment
- the height of tide and rate of tidal streams
- meteorological conditions and the availability of weather routeing information
- traffic conditions and areas of traffic density
- navigational focal points
- night-time versus daytime passing of danger points
- continuous monitoring of the ship's position and progress along the route
- factors that may impede the safe navigation of the vessel, including manoeuvring characteristics
- protection of the marine environment
- circumstances that may introduce an unacceptable hazard to the safe conduct of the voyage
- specific points of the voyage where additional personnel are required
- that changes to the plan should be made in accordance with the SMS and be clearly marked and recorded
- the plan should be readily available on the bridge at all times
- the effect of any chart updates received after the appraisal stage and their impact on the intended route
- actions to be taken on receipt of new navigational warnings.

Configuration of ECDIS involves review of the:

- Sensors
- safety parameters
- display parameters.

Not all ECDIS can integrate with digital publications or additional databases.

4.1 Configuration of ECDIS Settings

The ECDIS should be set up and configured prior to constructing the route.

ECDIS sensors provide information that is essential for navigation and situational awareness. These include position sources (GNSS and others), speed sources and heading sources (gyrocompass and others). The reliability and condition of navigational equipment should be checked regularly. All sensors connected to the ECDIS should be checked and tested. If there are multiple sensors, the most accurate available should be selected as the primary input, the next best as secondary and so on.

Ensure that ECDIS alerts are turned on and test alerts to ensure they are audible. When the inputs from position, heading or speed sources are in error (or lost), ECDIS should provide an alert. All other adjustable route alarms should be adjusted on or off as required and, if turned on, parameters should be entered with care.

The palette should be configured correctly for the corresponding light conditions.

Vessel display parameters (such as vector lengths and ship display) should be adjusted for optimum use.

ENCs provide a layering of information, much of which can be turned on or off by selecting the relevant display category. To ensure that all relevant information for planning the passage is shown, display settings must be configured prior to constructing the route.

4.1.1 ECDIS Planning Settings

First, configure the ENC settings to enable efficient planning. The following should be considered:

- Unload all routes
- unload all mariner-added objects
- select full screen by hiding the sidebar, if applicable
- where applicable, if the ECDIS supports it, set default values for safety depth, safety contours, XTD and radius of turn or rate of turn, etc, which may reduce the amount of editing required
- select the appropriate palette
- select ENC as chart priority
- allow automatic chart loading and scaling.

Unloading all routes and supplementary information and selecting full screen, where available, will provide the navigator with a clear display. ENC settings (such as chart autoload, autoscale and priority, or equivalent functions) should be optimised to facilitate the efficient automatic loading of charts in the chosen format, at their respective compilation scales, in the cursor position and when zooming.

When loading ENCs for display, ECDIS is able to automatically select an ENC based upon the ship's present location. This means that ENCs are loaded as the position of the ship changes. The alternative is to manually load the ENC from a list or to fix a particular ENC in place. The latter options may be useful when the ECDIS operator does not wish the ENC to be constantly refreshed to their location, for example when conducting look-ahead.

ENC scale is also important to ensure that the ENC is loaded at its best scale for the ship's position. Manufacturers usually provide an automatic scaling option or equivalent function. The alternative is that the ENC is loaded at the selected screen scale. Again, it is useful to know how to override this setting to view a larger area for the purpose of look-ahead. Note that it is a minimum requirement for a single operator action to load the ENC directly according to the ship's present position.

Finally, chart priority sets the ENC loading priority under the own ship position to ensure that the required format is selected. Options may include ENC, HCRF (hydrographic chart raster format) or RNC and other data formats.

It is recommended that ENC is the priority selected. Automatic chart loading, scaling and priority must all be set appropriately to ensure that an ENC is:

- Automatically loaded for the own ship position
- displayed at the best scale.

Some systems combine the automatic loading and scale functions to ensure that the most suitable ENC is displayed at all times. The ECDIS operator should know how to override this function to allow adequate lookahead.

It is also important to understand how the ECDIS prioritises ENC display. For example, if there is no ENC available for the ship's position but there is an RNC, the system will either automatically load the RNC (giving a warning) or the ECDIS operator must load it manually.

4.1.2 Safety Contour

Values for the safety contour calculated during the appraisal should now be entered into the ECDIS (refer to Annex G – Safety Depth and Safety Contours). The safety contour is selected from the available contours in the ENC. It indicates the limit of safe navigable water and is emphasised over other contours.

The safety depth marks spot soundings and isolated dangers with a depth that is insufficient for a ship to safely pass over. Soundings and isolated dangers of a depth equal to the safety depth value or shallower are displayed in bold type.

It is possible on some systems to set the safety contour value as 0 m. It is also possible to set the safety depth as a larger value than the safety contour. Values should be carefully entered and checked prior to planning.

4.1.3 ENC Display

The ECDIS operator has control over which layers are displayed on an ENC. Much of this control, outside of what is mandated, depends on the manufacturer as they are responsible for organising ENC features, viewing sets and viewing groups for display in such a way that the ECDIS operator has reasonable flexibility in selecting what they see, without the process being too complex.

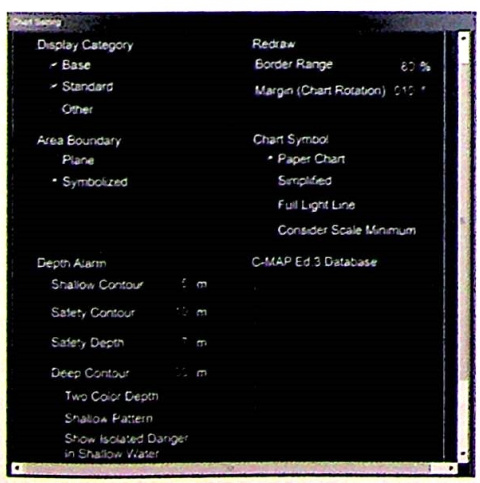
Configuring the ENC display is a crucial element of effective ECDIS use. The process of determining display parameters must be risk assessed and closely controlled at all times. However, many companies will mandate these settings in their SMS.

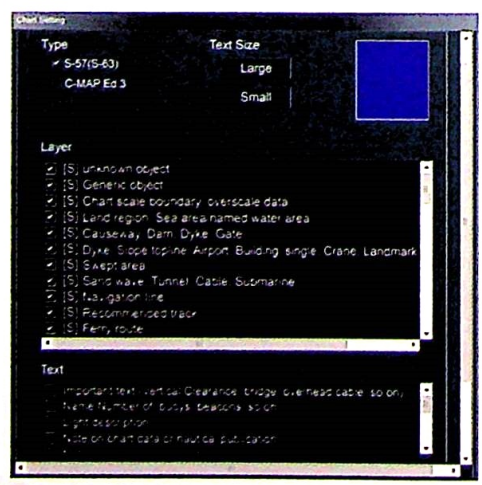
When passage planning and route checking, these profiles may obscure or hide potential hazards to navigation. Therefore, all features should be displayed at this stage.

Be aware that your route check function will not check for items that are not included in your display settings.

Some systems may provide a more detailed ability to configure the ENC display, by allowing the navigator to select display layers from a list of display categories (see Figure 85).

ENC symbols must be adequately understood. Symbols that have no equivalent in paper charts, such as simplified symbols, plain boundaries and new symbols, may be found within ECDIS Chart 1 installed in ECDIS by pick report function or by referencing NP5012.





Figures 84 and 85: Examples of ENC display options that are selectable by the navigator.

It is important to understand exactly what information is displayed when certain settings are chosen for display, as only then will the navigator know whether or not they are relevant. It may be that additional information is required when planning different parts of the route. The display may then need to be reconfigured throughout the process. For example, the display of submarine cables and pipelines may only be relevant when planning an anchorage. However, the navigator must ensure that all features are displayed again prior to performing the route check.

4.1.4 Display Category

The ECDIS operator can control which features appear on the chart display, subject to the overriding requirements of the IMO viewing group category. This is achieved by placing all available ENC objects into viewing groups, which the ECDIS operator can switch on or off as required. To provide some control over chart content during route monitoring, viewing group layers are subdivided into three prescribed display categories by the IMO: display base, standard display and all/other.

Display Base
Display base is a list of minimum objects considered to be vital information required at all times, in all geographic areas and under all circumstances. It is not possible to remove information contained within the display base and so this information is permanently shown on the ECDIS display. Display base consists of:

- Coastline (high water)
- own ship's safety contour
- isolated underwater dangers, of depths less than the safety contour or of unknown depth, that lie within the safe waters defined by the safety contour
- isolated dangers that lie within the safe water defined by the safety contour such as fixed structures, overhead wires, etc
- scale, range and north arrow
- units of depth and height
- display mode.

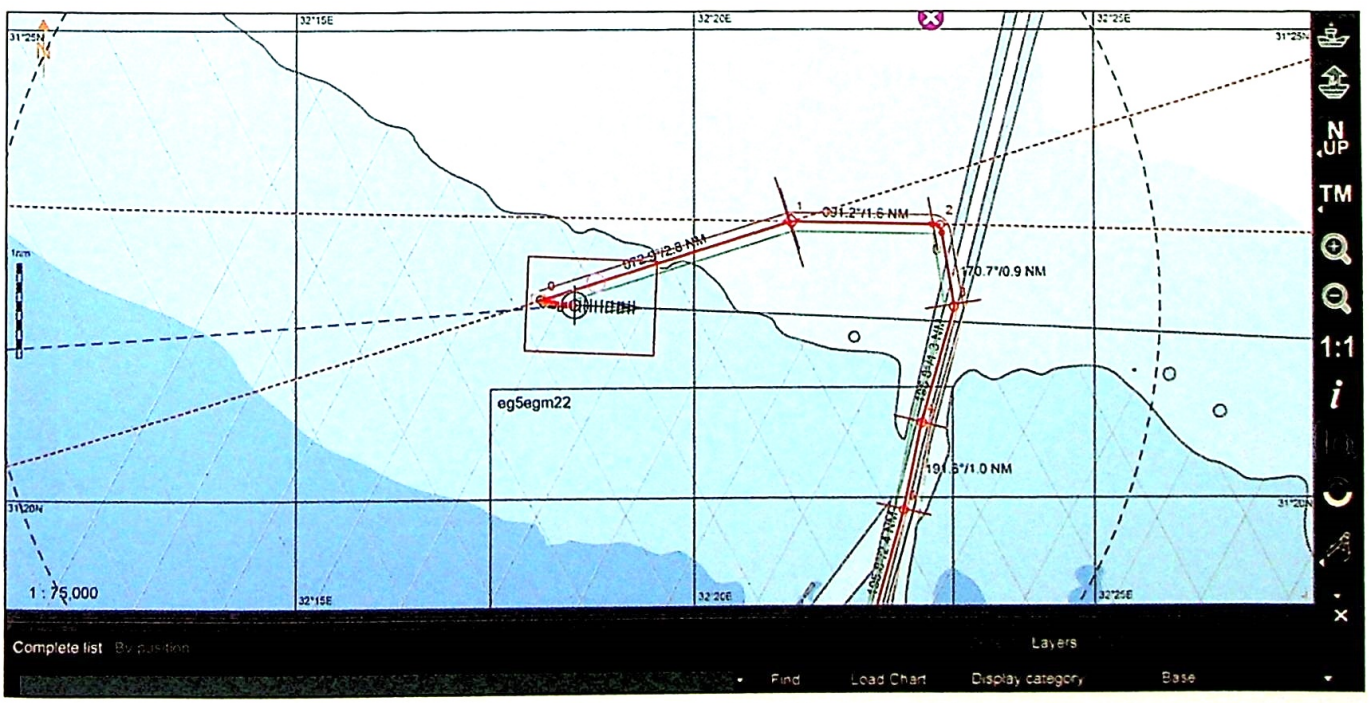


Figure 86: ENC display base. (Transas)

Standard Display

Display base does not provide sufficient information to execute navigation on its own, so the IMO standard display is provided.

This consists of display base plus an additional list of objects that the ECDIS operator may selectively add or remove from the display. The standard display is the default ECDIS display, containing objects deemed important to the ECDIS operator. It represents a minimum level of detail required for safe navigation and consists of:

- Display base
- drying line (note that some manufacturers include this in display base)
- buoys, beacons, other AtoN and fixed structures
- boundaries of fairways, channels, etc
- visual and radar conspicuous features
- prohibited and restricted areas
- chart scale boundaries
- indication of cautionary notes
- ships' routeing systems and ferry routes
- archipelagic sea lanes.

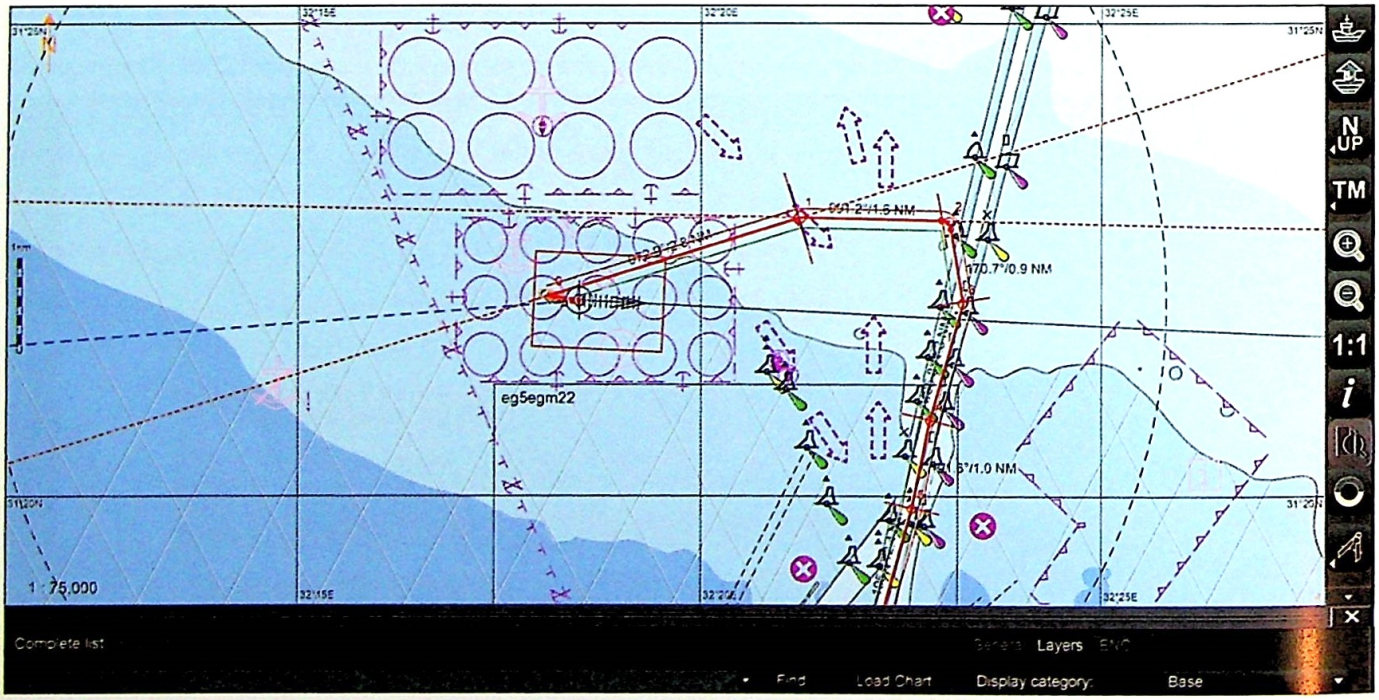


Figure 87: ENC standard display. (Transas)

All/Other/Custom

Beyond the standard display is all/other information, which contains all other objects in the ENC not classed as standard display. The ECDIS operator should be able to selectively add items from all/other information to the standard display, individually and on demand. For example:

- Spot sounding depths
- submarine cables and pipelines
- details of all isolated dangers
- details of AtoN
- contents of cautionary notes
- ENC edition date
- most recent ENC update
- magnetic variation
- graticule (latitude and longitude grid)
- place names.

To configure the system correctly, it helps to know which objects are contained within these three display categories. Sometimes, to aid this process, manufacturers provide the ability to configure a custom display, allowing user configurations to be saved. Manufacturers are able to group together display options. Due to this, the ECDIS operator must be aware that it will not be possible to develop a custom display exactly to their preference. In such cases, a risk assessment may be required when determining display settings.

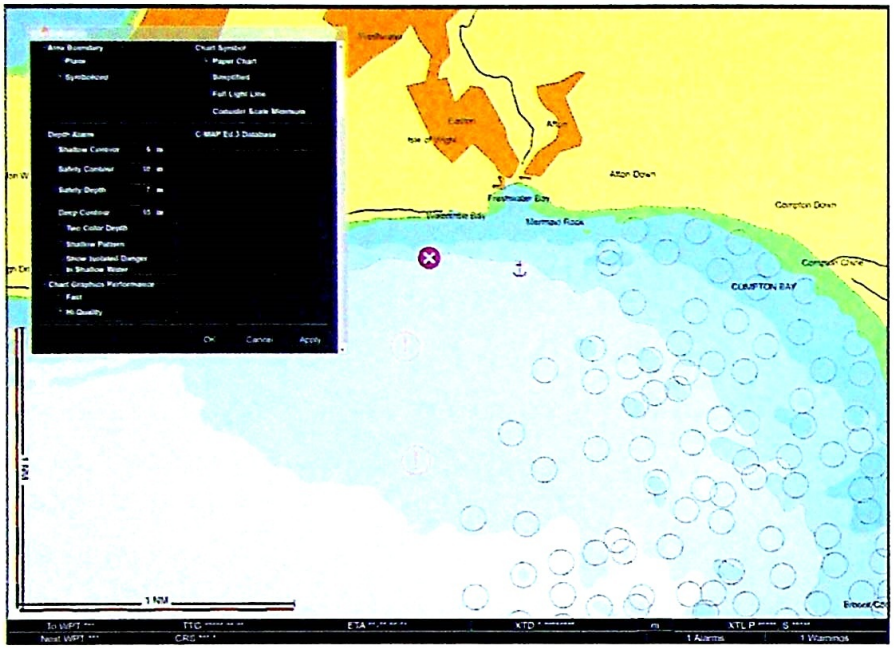
ECDIS operators must be aware of the manner in which these groups are associated with the display options in their ECDIS. The features displayed on ECDIS will need to be reviewed with the phases of the voyage (eg pilotage, coastal, ocean passage). This should be decided upon during the planning stage and in consultation with any company procedures. Some ECDIS systems allow these changes to be saved as separate display configurations so that they can be loaded quickly by the ECDIS operator.

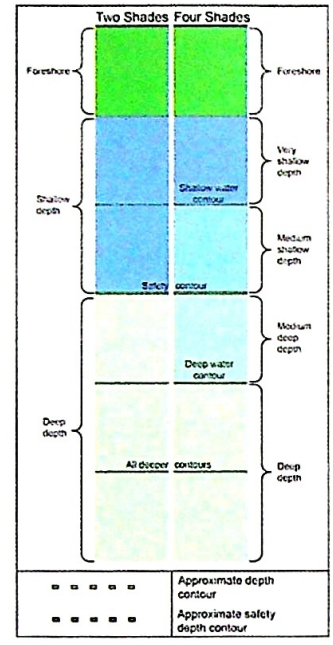
A list of mandatory selectors and optional selectors that the manufacturer may provide is set out in Annex I – Independent Mariner Selectors.

The standard display can always be restored by single operator action directly on the ECDIS.

The utility of four-colour depth shading will depend on the individual vessel and circumstances, but its use is encouraged as it visually highlights the onset of shallow water in advance. Numerous accident reports have shown that the use of four-colour depth shading provides a good visual indication to enhance situational awareness.

Four-colour depth shading (see Figures 88 and 89) is dependent upon the availability of the desired depth contour within the ENC. If using four-colour depth shades during the planning phase, ensure that adequate shades are then selected for route monitoring.





Figures 88 and 89: Four-colour shading.

The display of auxiliary layers provided by integration with other software or equipment should be considered such as:

- Admiralty Information Overlay (AIO)
- NAVTEX
- route planning software
- satellite imagery
- environmental and weather data (tidal stream/current etc)
- AIS overlay
- Radar Information Overlay (RIO)
- parallel index lines.

The AIO enables additional information that may affect the passage to be quickly identified, allowing the navigator to plan the route accordingly (see Figure 90). Where NAVTEX is integrated with ECDIS, the navigator can benefit from displaying the latest navigational warnings (see Figure 91).

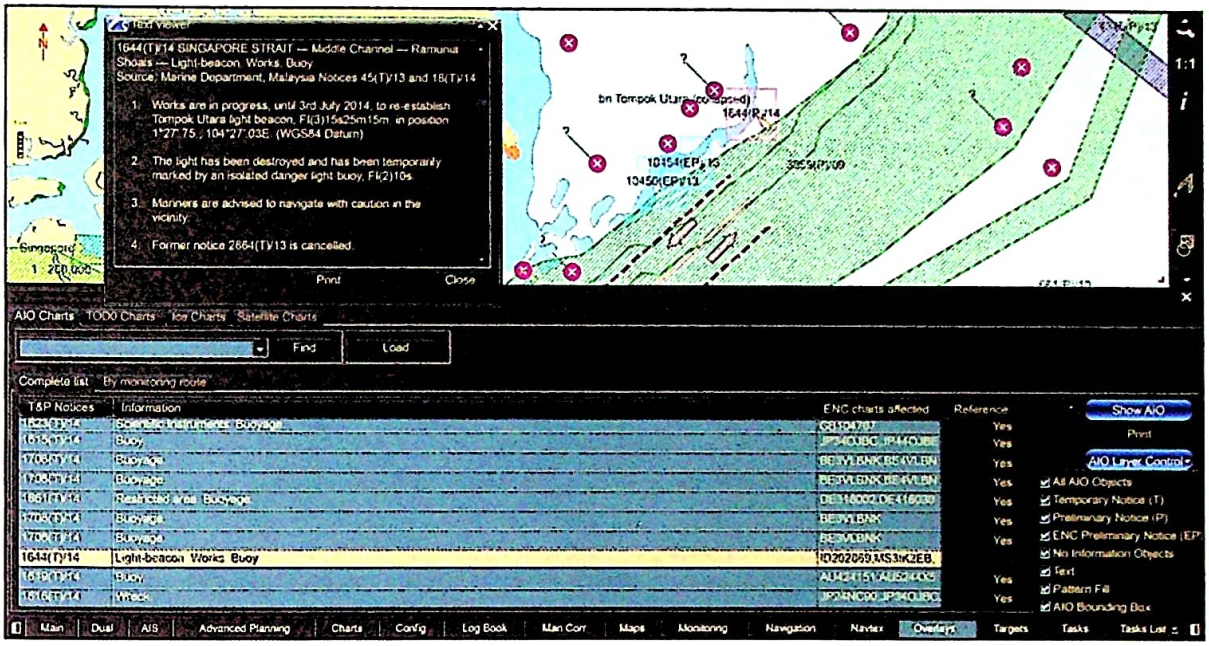


Figure 90: The AIO provides important T&P information relevant to the voyage. (Transas)

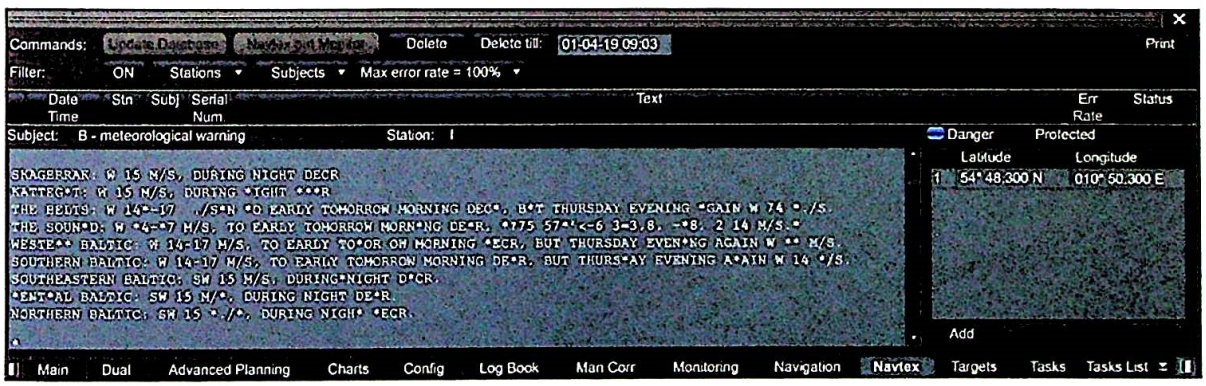


Figure 91: NAVTEX integration with ECDIS allows the display of the latest navigational warnings.

Configuration of the ENC display is a delicate balance between displaying too little information, where important safety information may be omitted, and too much, where information can overlap and be obscured. The degree of detail depends largely upon the display category chosen.

PL 4	PL 4 mandates the inclusion of a date-dependent object function. This facilitates the display of certain objects and provides the ECDIS operator with visibility of objects, such as a new TSS, before they come into force. This is important because route execution may coincide with an entry into force date, for example seasonal mooring buoys.

4.1.5 Route Options

Select the primary route and make it active on the primary and backup ECDIS. There are many display settings that may be applied, depending on the manufacturer. Examples are:

- Route display
  - course
  - leg
  - planned speed
  - XTD
  - calculated turn radius
  - waypoint names
  - wheel over lines
  - remarks

  - headmarks
  - clearing bearings
- waypoint selection
  - automatic: this determines whether the method of selecting the next waypoint is done automatically or manually. Sometimes, the first waypoint must be selected manually to ensure a logical progression along the route
  - manual.

Certain display options, such as planned speed, may not be available for display until a value is entered by the navigator in the route table (see Section 4.2.5 – Route Table).

Some systems allow password protection to prevent the route being modified accidentally or by unauthorised personnel. If no password protection exists, persons other than the navigator will be able to edit the route and this fact should be clearly documented and the consequences fully understood.

Route planning software available from chart agents can be utilised to create and review optimum voyage routes (see Figures 92 and 93). These are integrated with chart management and ordering tools, as well as overlays of piracy warnings and NAVAREA warnings, etc.

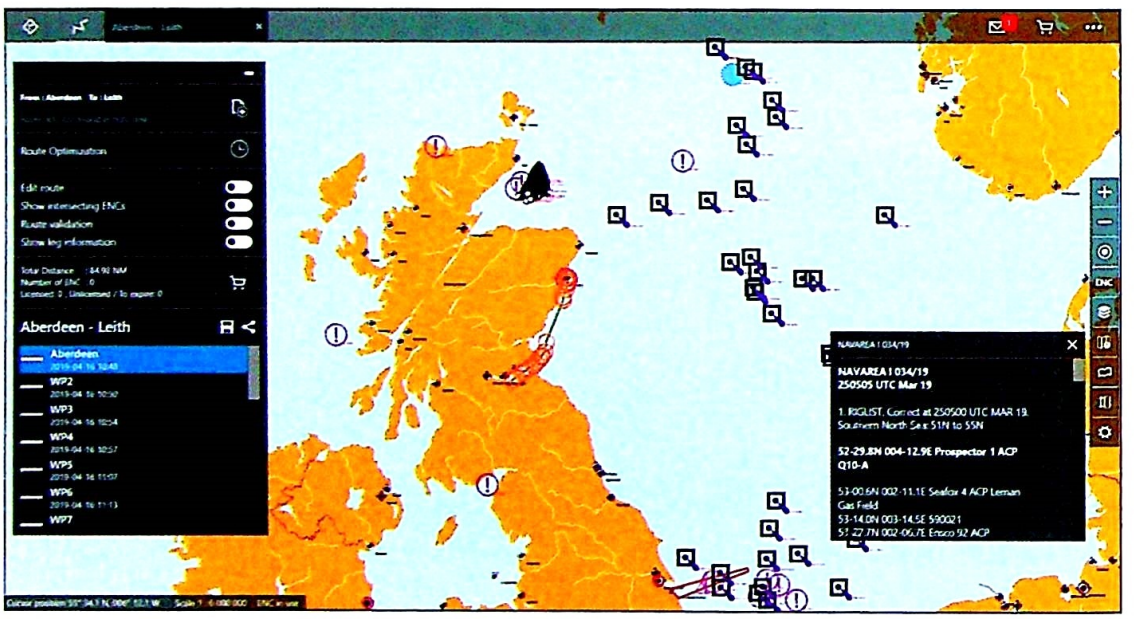


Figure 92: An example of a NAVAREA overlay *(NaviPlanner, Courtesy StormGeo)*

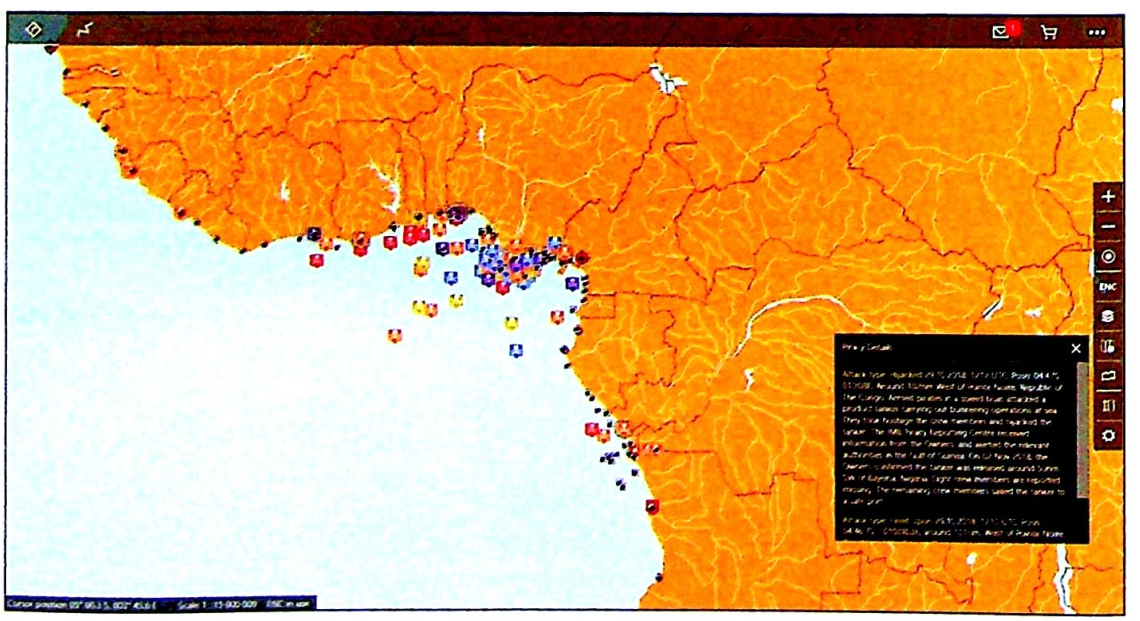


Figure 93: An example of a piracy overlay *(NaviPlanner, Courtesy StormGeo)*

4.2 Route Creation

Detailed planning should cover the entire passage from berth to berth, including pilotage areas. The objective is to use all information obtained during the appraisal to create the safest possible route. The IMO PS require that it should be possible to do the following on ECDIS:

- Carry out route planning (for example, rhumb lines and Great Circle sailings)
- adjust a planned route alphanumerically (route table) and graphically (on screen) including:
  - adding waypoints to a route
  - deleting waypoints from a route
  - shifting the position of a waypoint
- plan one or more alternative routes in addition to the active route
- distinguish the active route from the other routes.

4.2.1 New Route

Open the route planning function and select 'new route'. Some systems will allow the route to be named at this stage. If so, name the route clearly in a standard format, for example: from, to, date of planned passage, so it can be found easily when it comes to executing the route. Prior to adding waypoints, it is important to understand the difference between the various ENC usage bands (also known as navigational purpose bands), as the scale of the ENCs when planning the route should be appropriate (see Figures 94 to 100).

4.2.2 Adding Waypoints

Using small scale ENCs, begin by adding a waypoint in the vicinity of the start location using the cursor. When two waypoints are inserted, the system automatically joins them together to form legs, which are rhumb lines by default. Remaining on small scale ENCs, and utilising the knowledge acquired during the appraisal, construct the route by adding successive waypoints, completing the route by adding a waypoint in the vicinity of the destination. Waypoint positions need only be approximate at this stage as they will be adjusted later. The method described is a graphical method of constructing a route using the cursor to enter waypoints.

An alternative method is to use the tabular method, where the latitude and longitude of waypoints are entered manually in the route table. Leg details, such as true course and distance, can be viewed in the route table or chosen for display, where available, along the route itself.

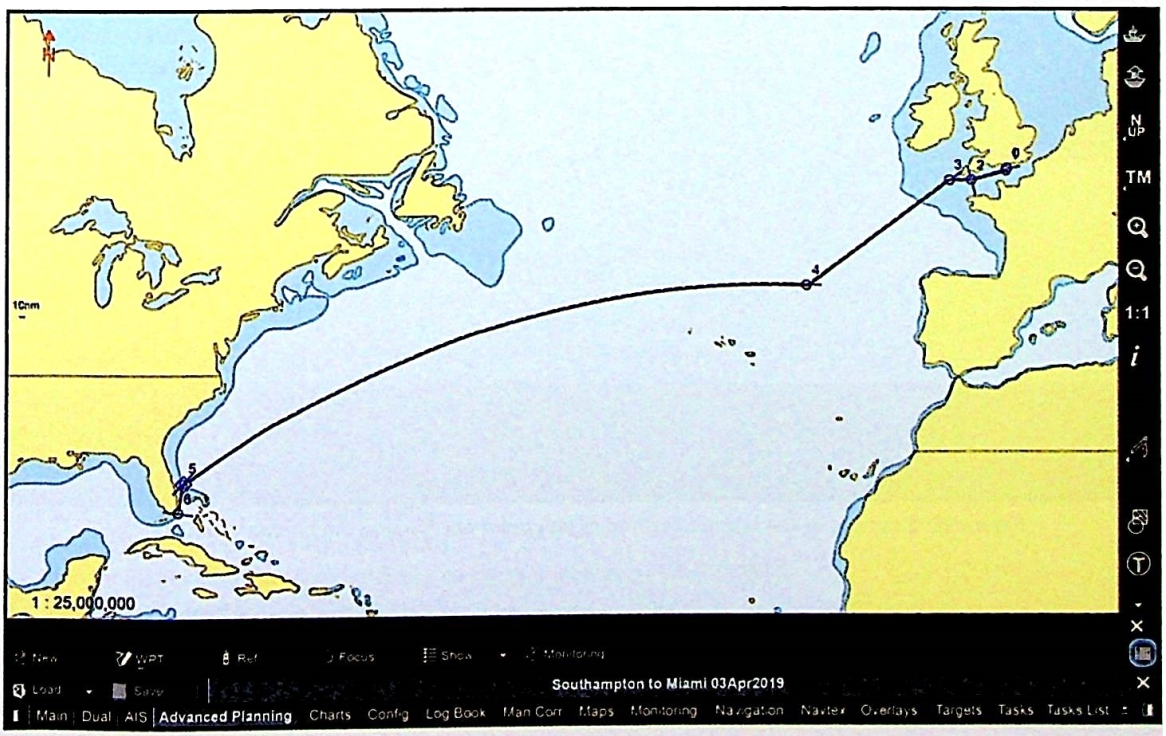


Figure 94: Approximation of the route using small scale charts. (Transas)

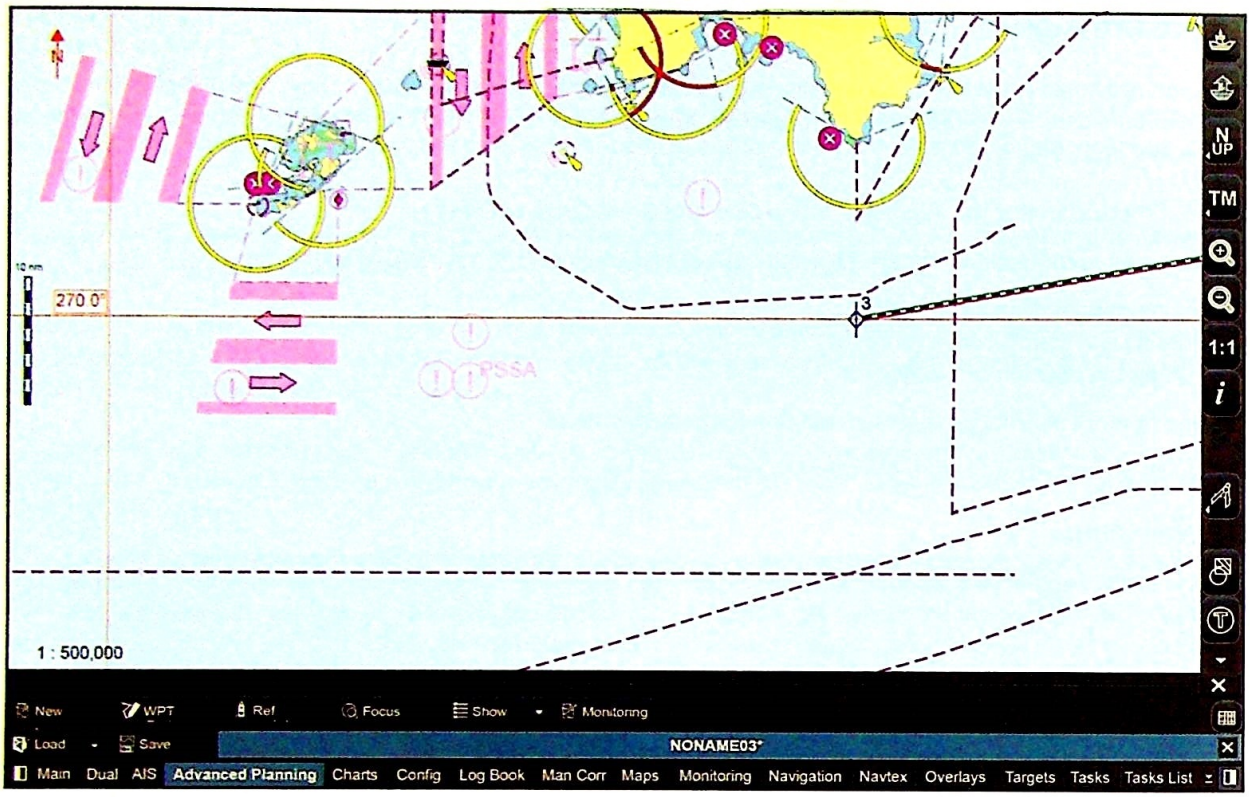


Figure 95: Example of the graphical method of waypoint entry using the cursor. (Transas)

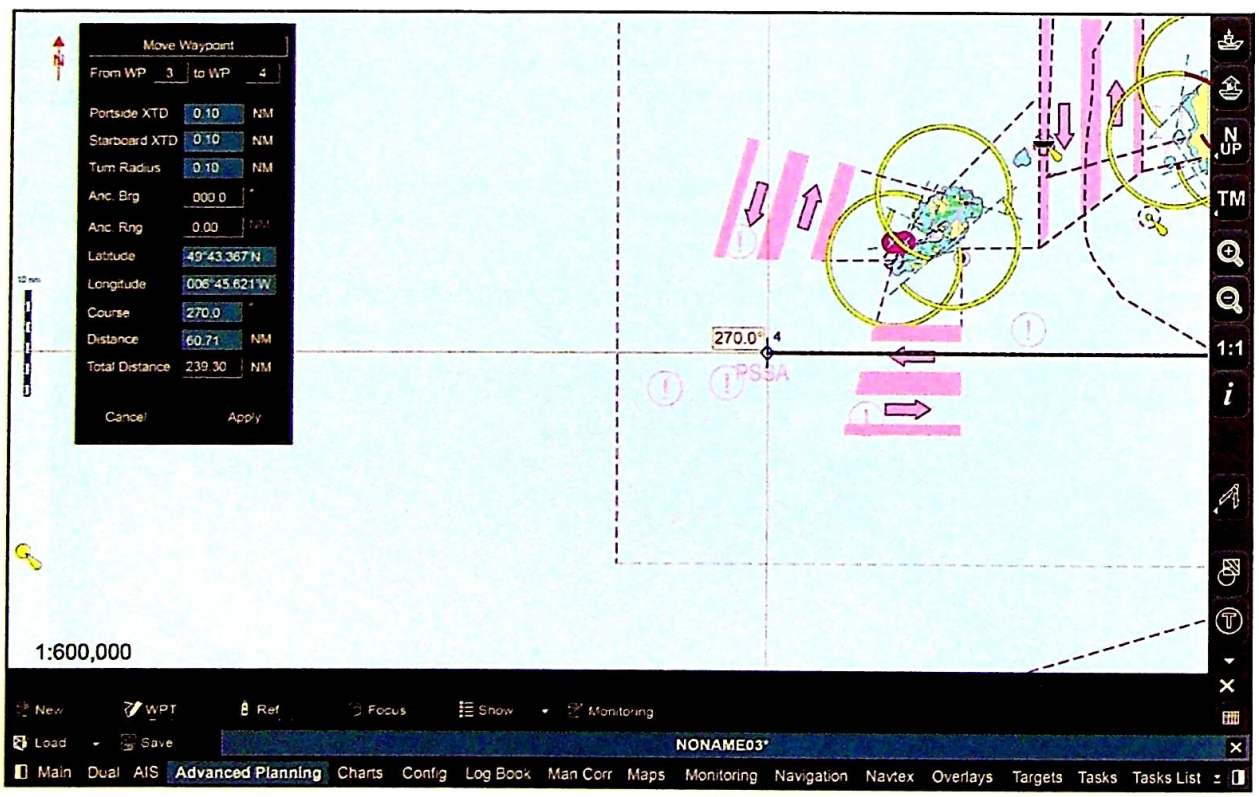


Figure 96: Example of the tabular method of waypoint entry using the cursor. (Transas)

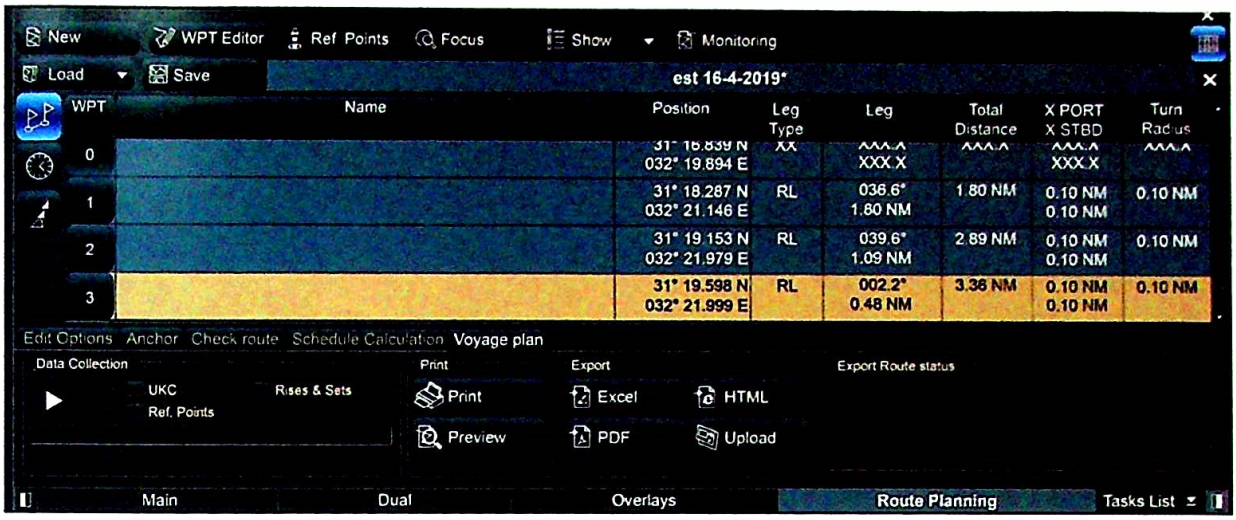


Figure 97: Example of waypoints in the route planning table. (Transas)

4.2.3 Adjusting Waypoints

Once an approximation of the entire route has been achieved on small scale charts, it is necessary to return to the start position and conduct more accurate planning by refining waypoints using appropriate large scale charts.

> **A detailed check is essential where ENCs overlap, to ensure no critical data has been obscured.**
>
> **A list of overlapping cells is provided in the README file (AVCS update report or the UKHO website).**

Waypoints should be placed as accurately as possible. The following are considerations when adjusting waypoints:

- With particular regard to the vessel
  - draught in relation to the available depth and width of navigable water and minimum UKC
  - effect on vessel draught and turning circle during course alteration
    - planned speed
    - effect of expected tidal stream
    - effect of expected current
    - increase in draught due to squat and heel effect
- with particular regard to the route
  - adequate XTD
  - alterations of speed en route
  - avoidance of danger areas
  - considerations relating to the protection of the marine environment
  - contingency/emergency planning
    - deep water
    - place of refuge or safe anchorage in the event of an emergency
    - shore-based emergency response arrangements and equipment
  - depth of water
  - limitations of night passage
  - location of course alterations
  - method and frequency of position fixing
    - primary and secondary fixing options
    - availability of visual and radar fixing to cross-check accuracy of GNSS
    - radar image overlay
    - parallel index lines
    - astronomical observation
  - safe speed and proximity of navigational hazards
  - piracy and security

- tidal restrictions
- use of ships' routeing, reporting systems and vessel traffic services.

The relevance of these considerations will depend upon the situation of the route. For example, pilotage planning will require a different mindset and ECDIS configuration to planning in open ocean. The manufacturer may provide tools to facilitate planning in this regard, such as:

- Pilotage
  - advance and transfer
  - anchorage planning
  - blind pilotage planning (navigation in restricted visibility)
  - clearing line
  - distance to wheel over marks
  - headmark, sternmark and beammark (if available)
  - wheel over bearings
- coastal
  - nominal range of lights and light sectors
  - parallel index lines
- open ocean
  - Great Circle calculations.

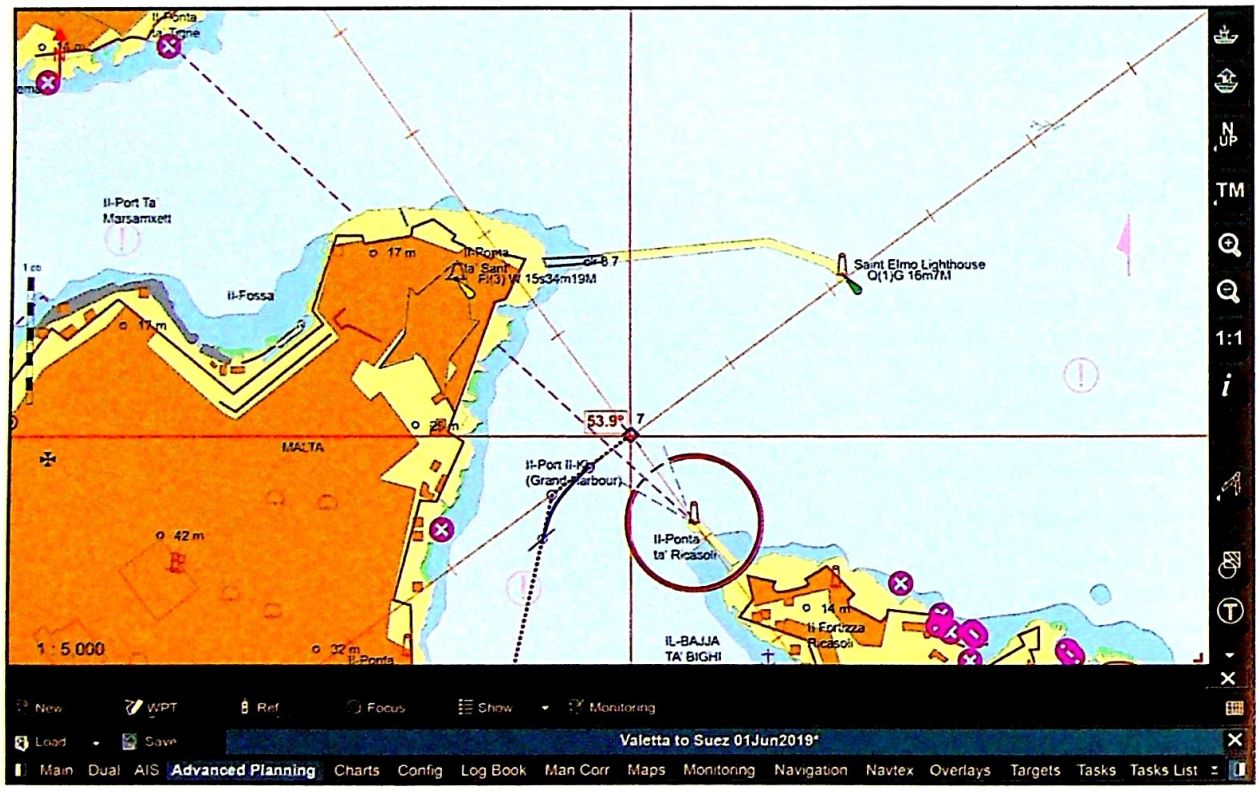


Figure 98: Example of pilotage planning using a headmark and beammark tool. (Transas)

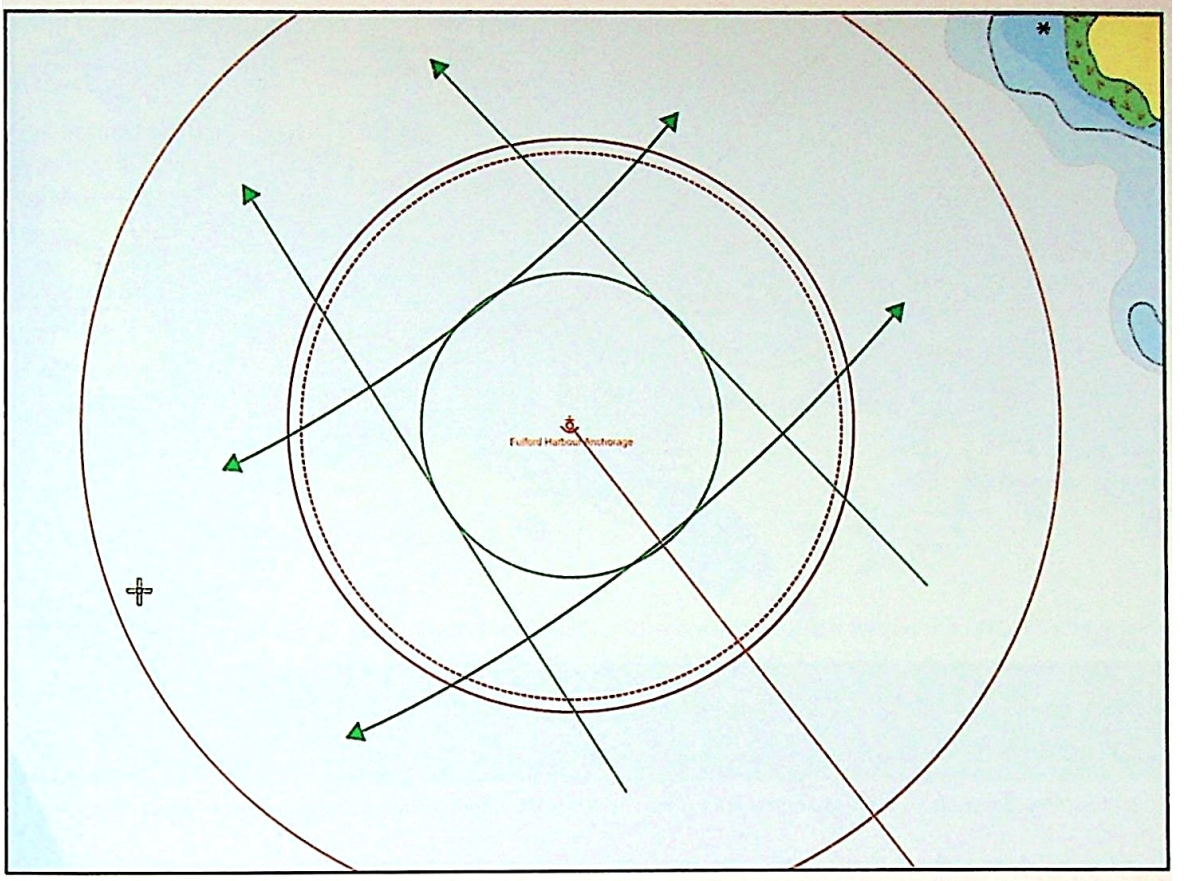


Figure 99: Example of detailed anchorage planning.

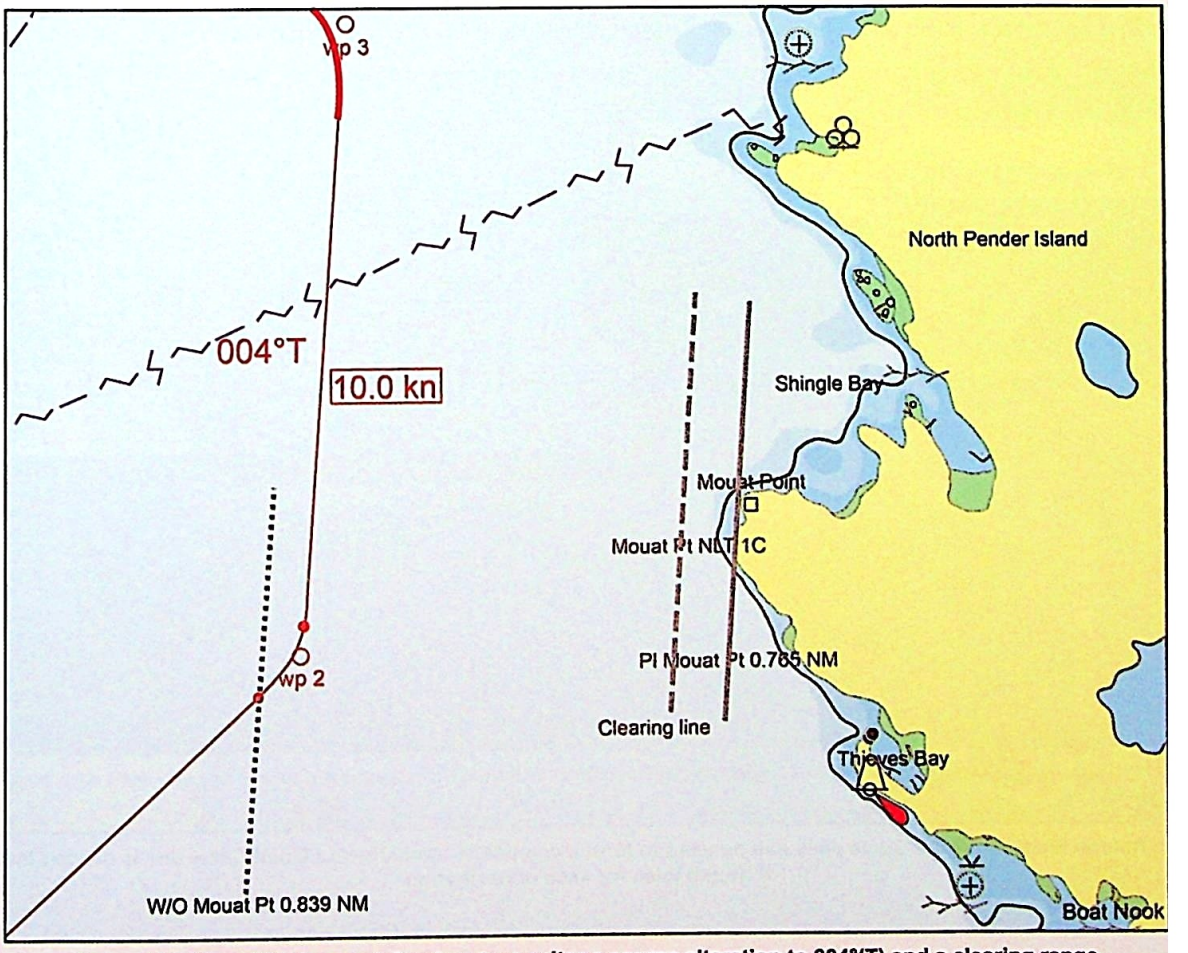


Figure 100: Use of PIs in coastal waters to monitor a course alteration to 004°(T) and a clearing range.

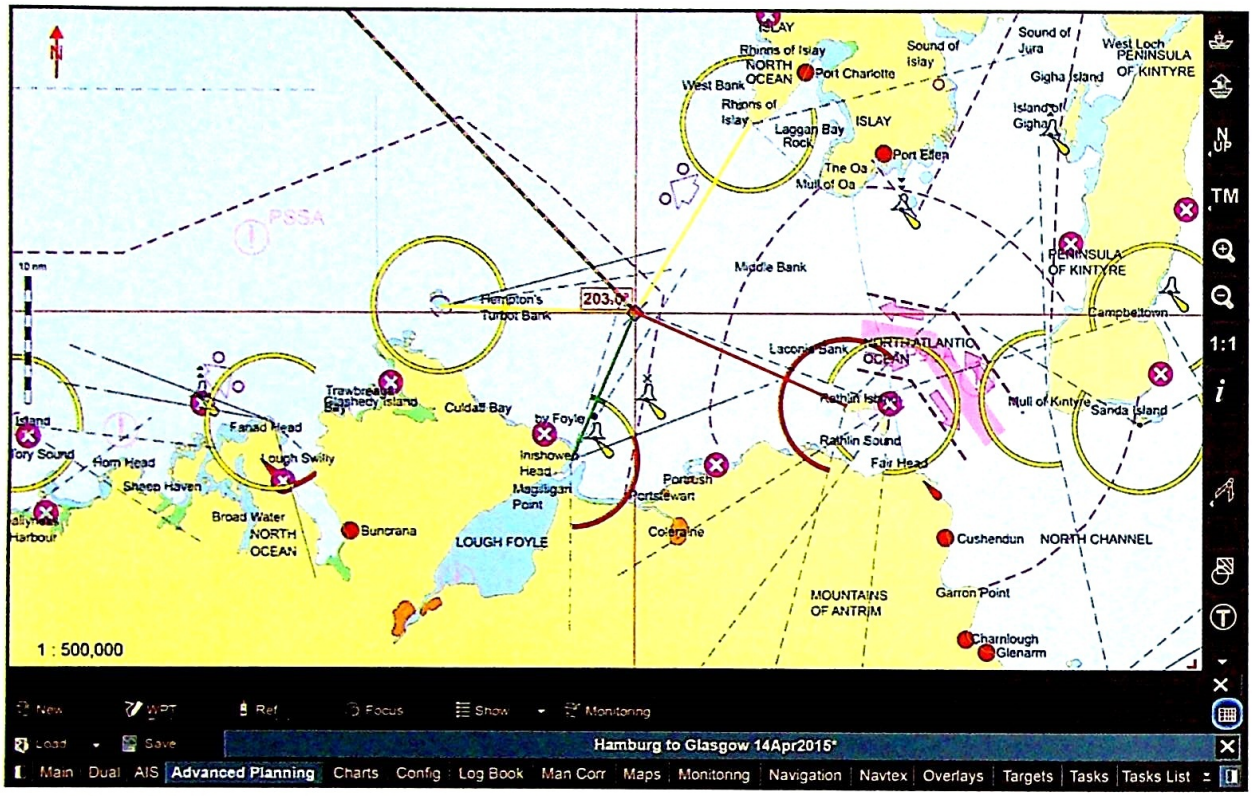


Figure 101: Example of route planning taking into account the nominal range and sectors of lights. (Transas)

By default, ECDIS will create legs as rhumb lines, but for ocean passages this can be changed to a Great Circle line. When doing so, Great Circle lines can usually be divided into a series of individual rhumb lines for ease of navigation, either by longitude or a set distance. Some ECDIS manufacturers also provide the ability to restrict the latitude of a Great Circle line by entering a limiting latitude. If required, a combination of rhumb lines and Great Circles can be used to form a composite track.

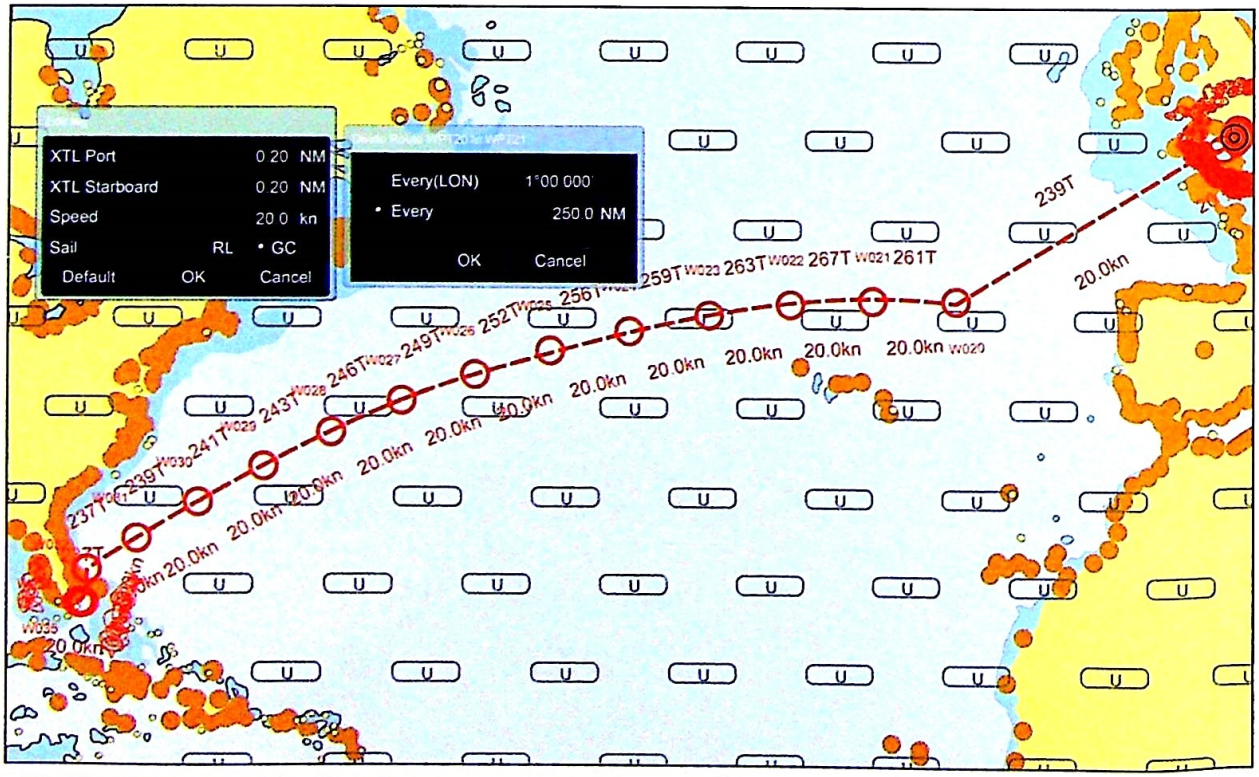


Figure 102: Rhumb lines and Great Circle lines can be used to form a composite track. Here, a Great Circle line is divided into a series of rhumb lines for ease of navigation.

Checks should be conducted for quality control throughout route planning, using the following sources of information:

- Visual check of ENC
  - ENC accuracy and quality (CATZOCs)
  - gaps in ENC coverage
  - isolated dangers
- pick report
  - unknown object symbol
  - objects and areas where more information is required
- digital publications
  - list of lights
  - list of radio signals
- other warnings
  - T&P NM information
  - navigation warnings.

The pick report function can be used to access useful additional information contained within the ENC. This may include diagrams, images and text documents to assist the ECDIS operator (see Figures 103 to 108).

Although ENC pick reports contain useful information, publications and NM must be used to verify this information as they may be more up to date than the ENC.

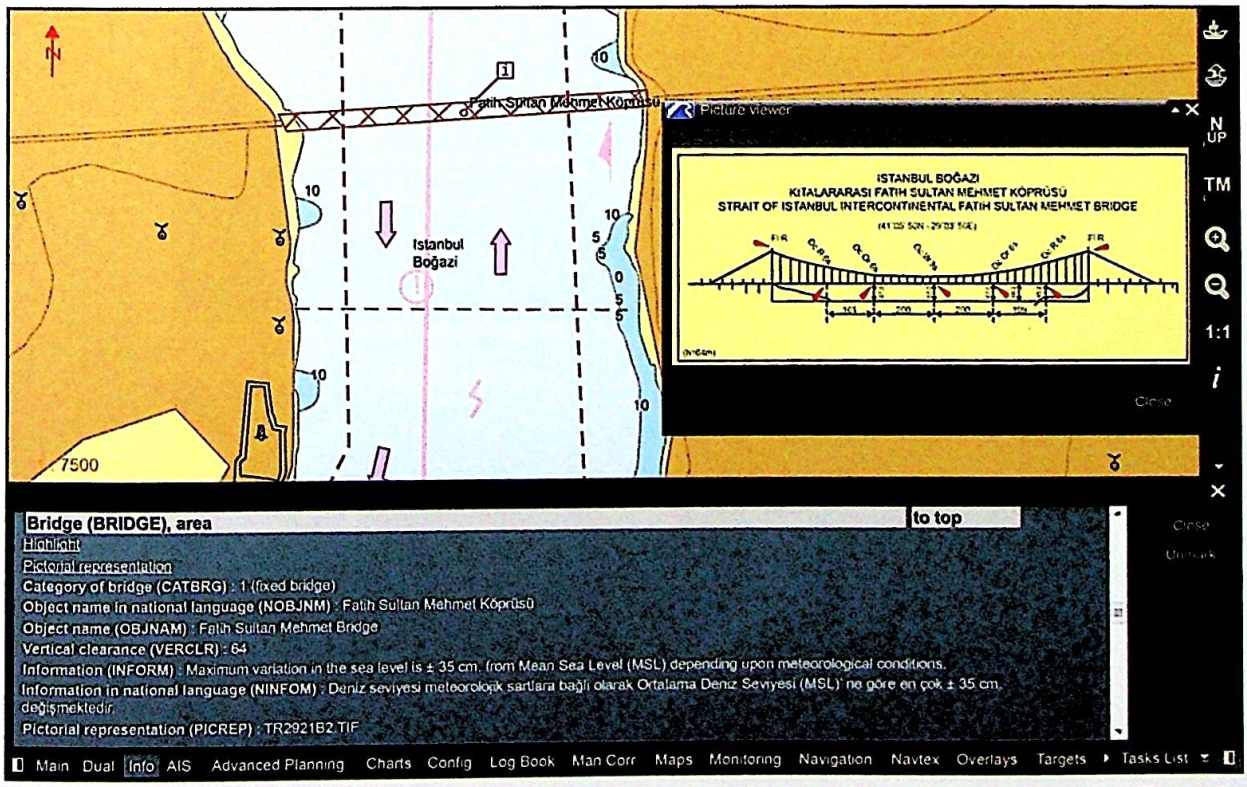


Figure 103: Pick reports can contain useful information displayed graphically, such as clearance information. (Transas)

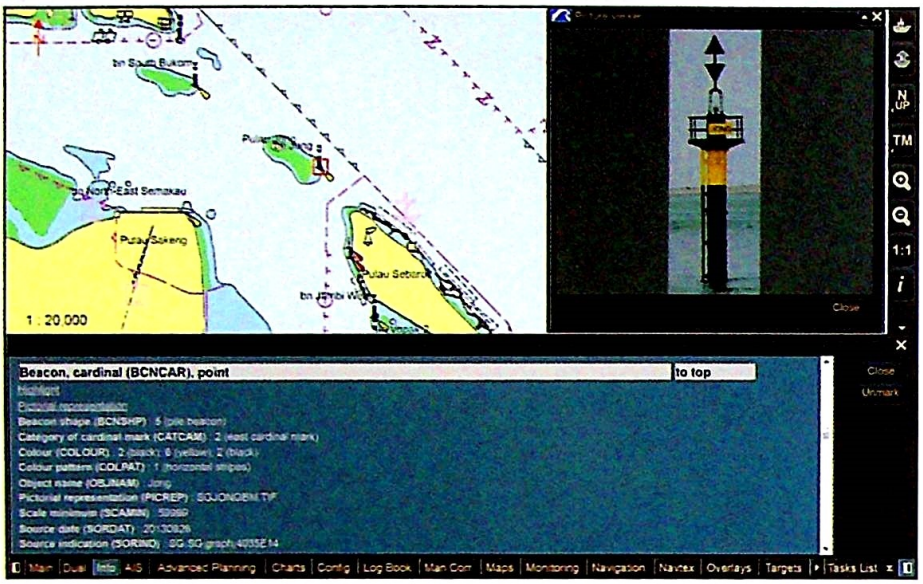


Figure 104: Images of beacons. (Transas)

Figure 105: Images of ports and harbours. (Transas)

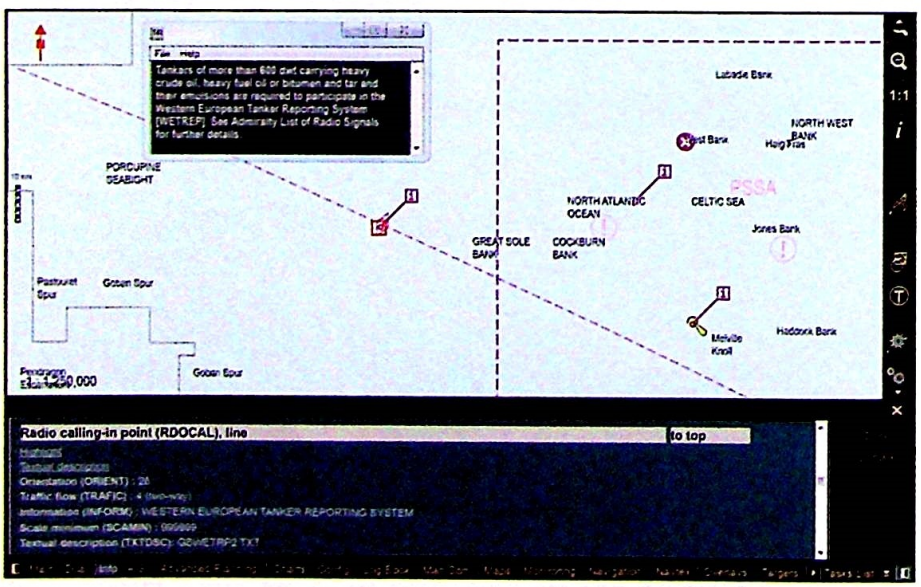


Figure 106: Text information. (Transas)

In addition, digital publications are of use when details of radio signals and light signals are not contained within the ENC.

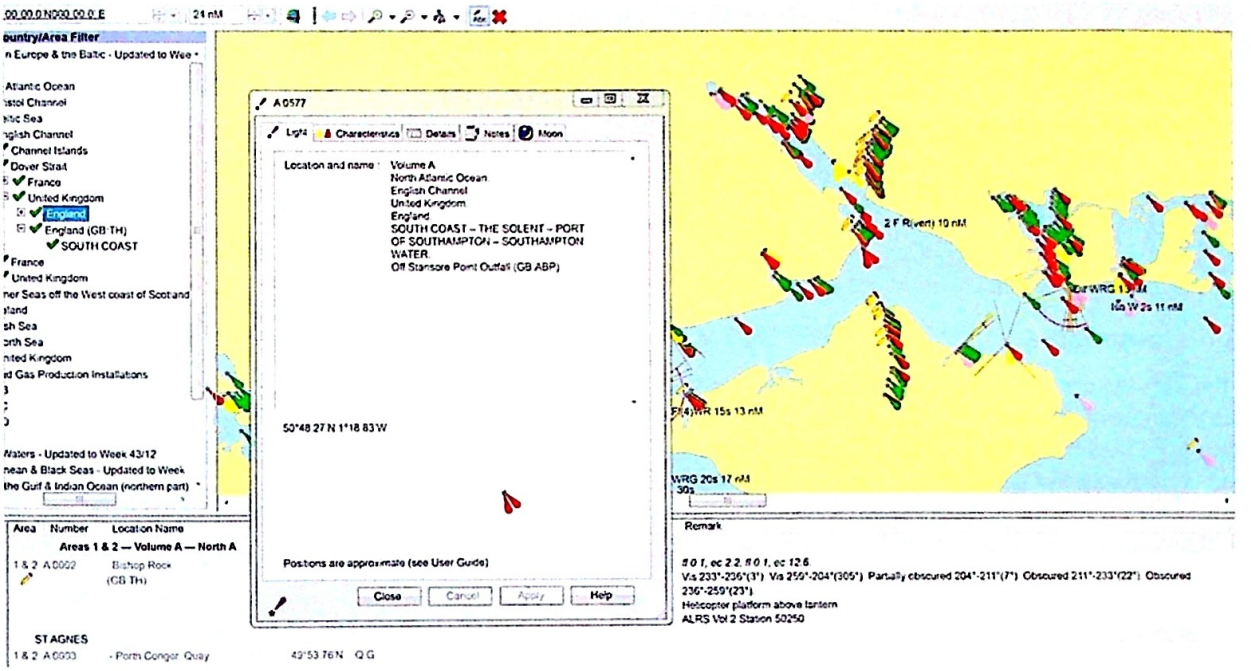


Figure 107: *'Admiralty Digital List of Lights'*. (UKHO)

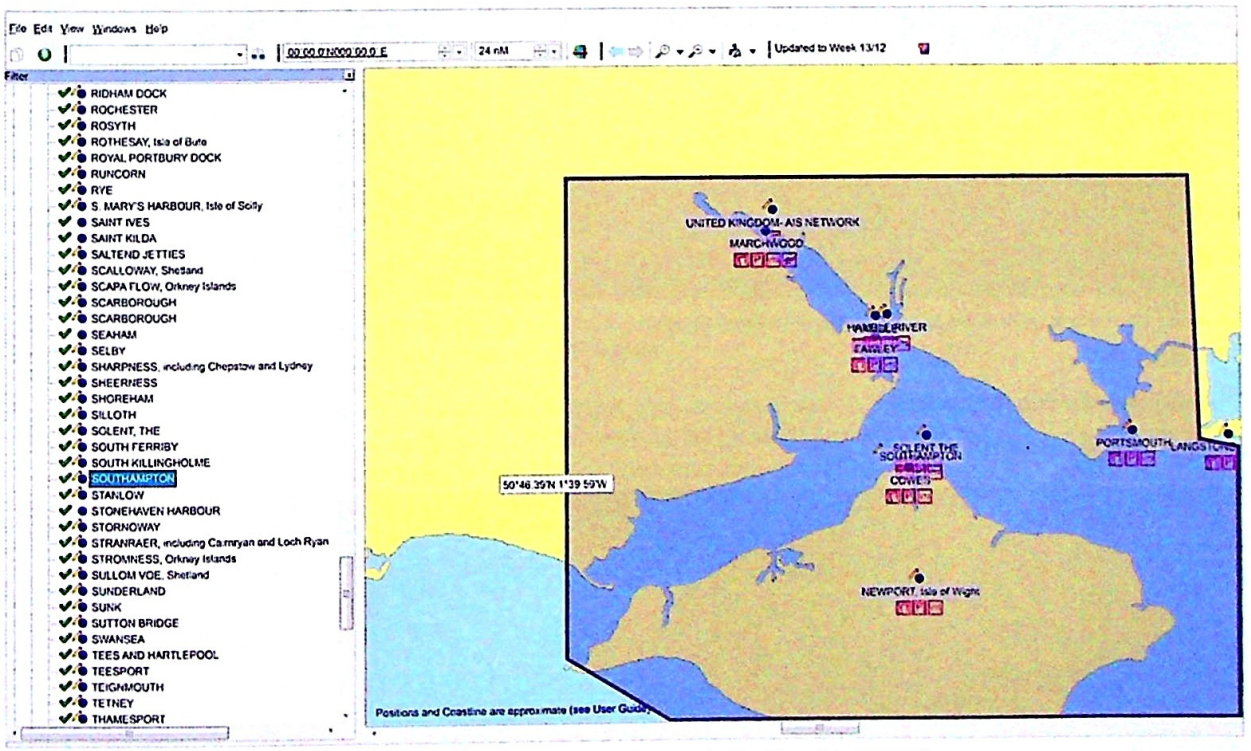


Figure 108: *'Admiralty Digital List of Radio Signals'*. (UKHO)

4.2.4 Multiple Route Options

While all ships are expected to create a 'berth to berth' passage plan, in many cases you may not know exactly which berth you are destined for until approaching the pilot station. In such cases, it is prudent to prepare multiple routes in advance from the pilot station to each possible berth. You may also construct multiple routes as part of contingency planning.

The ECDIS operator should be aware that certain ECDIS associate the safety contour/safety depth to the route, while on other systems the safety contour/safety depth is controlled independently or the ECDIS operator may select a 'user profile'. The ECDIS operator must understand which method their particular system uses. When changing routes, you must be able to verify that the safety depth value has remained appropriate.

4.2.5 Route Table

Once the detailed planning has been completed, elements of the route can be refined by editing the route table. Doing so will provide essential detail with which speed, time and distance calculations can be made. For example, ECDIS cannot accurately calculate the ETA without the provision of a planned speed for every leg (on some ECDIS models, each leg speed might be entered individually, but with others a single speed value can be used), or the overall speed required without an ETD and ETA. These calculated values will be used by the ECDIS operator to manage speed and ETAs, both at waypoints and the final destination, during the monitoring phase. Values for the following can normally be manually entered for individual legs:

- Course
- distance
- ETA
- ETD
- leg sailing type (RL or GC)
- planned speed
- rate of turn
- remarks
- time zone
- turn radius
- waypoint name
- waypoint latitude and longitude
- XTD (port and starboard).

Route Name: 20052019 | Comment: Southampton to Miami 20May2019 | Type: Normal | Graphic Editor

Route Check | Safety Check

Close | New... | Open... | Save | Print | Insert | Delete | Divide | Default | View SYNC | Total

WPT No.	Position		XTL		ARR	SPD	Sail	ROT	Turn	Time	CRS	DIST	ETA
	LAT	LON	PORT	STBD	RAD	[Kn]	RL/GC	[°/min]	RAD	Zone	[°]	[NM]	[DATE HH:MM]
3	50°50.546'N	1°19.634'W	0.10	0.10	0.50	10.0	RL	019.1	0.50	+00:00	130.2	5.2	15-05-20 09:31
4	50°48.994'N	1°17.563'W	0.10	0.10	0.50	10.0	RL	019.1	0.50	+00:00	139.8	7.3	15-05-20 09:43
5	50°48.380'N	1°17.357'W	0.10	0.10	0.50	10.0	RL	019.1	0.50	+00:00	168.0	7.9	15-05-20 09:47
6	50°47.095'N	1°19.180'W	0.10	0.10	0.50	10.0	RL	019.1	0.50	+00:00	221.9	9.6	15-05-20 09:57
7	50°46.778'N	1°18.651'W	0.10	0.10	0.50	10.0	RL	019.1	0.50	+00:00	133.4	10.1	15-05-20 10:00
8	50°45.902'N	1°14.095'W	0.10	0.10	0.50	10.0	RL	019.1	0.50	+00:00	106.9	13.1	15-05-20 10:18
9	50°45.529'N	1°07.717'W	0.10	0.10	0.50	10.0	RL	019.1	0.50	+00:00	095.3	17.1	15-05-20 10:42
10	50°43.453'N	1°02.112'W	0.10	0.10	0.50	12.0	RL	022.9	0.50	+00:00	120.3	21.3	15-05-20 11:03
11	50°42.738'N	0°58.535'W	0.10	0.10	0.50	12.0	RL	022.9	0.50	+00:00	107.5	23.6	15-05-20 11:15
12	50°42.403'N	0°57.427'W	0.20	0.20	0.50	15.0	RL	028.7	0.50	+00:00	115.5	24.4	15-05-20 11:18
13	50°40.604'N	0°56.248'W	0.20	0.20	0.50	15.0	RL	028.7	0.50	+00:00	157.4	26.4	15-05-20 11:26
14	50°34.206'N	0°59.269'W	0.20	0.20	0.50	20.0	RL	038.2	0.50	+00:00	196.7	33.1	15-05-20 11:46

Figure 109: The route table offers an alternative to plotting waypoints graphically and allows route elements such as course, speed and distance to be adjusted manually.

Once the route table is complete, elements of the planned route such as speed, time, distance and likely fuel consumption (see Figure 110) can be checked against the calculations made during the appraisal. At this point, any significant differences can be highlighted and the plan changed if required. For example, it may be necessary to refine the ETD, ETA or overall planned speed. Of particular importance is the value entered for XTD (this may also be called the 'corridor', 'channel limit', etc), as it is this value that defines the boundaries for the route check. This must be carefully considered to provide adequate sea room to allow for a suitable safety margin (eg chart inaccuracies (CATZOC), leeway and alterations of course for collision avoidance).

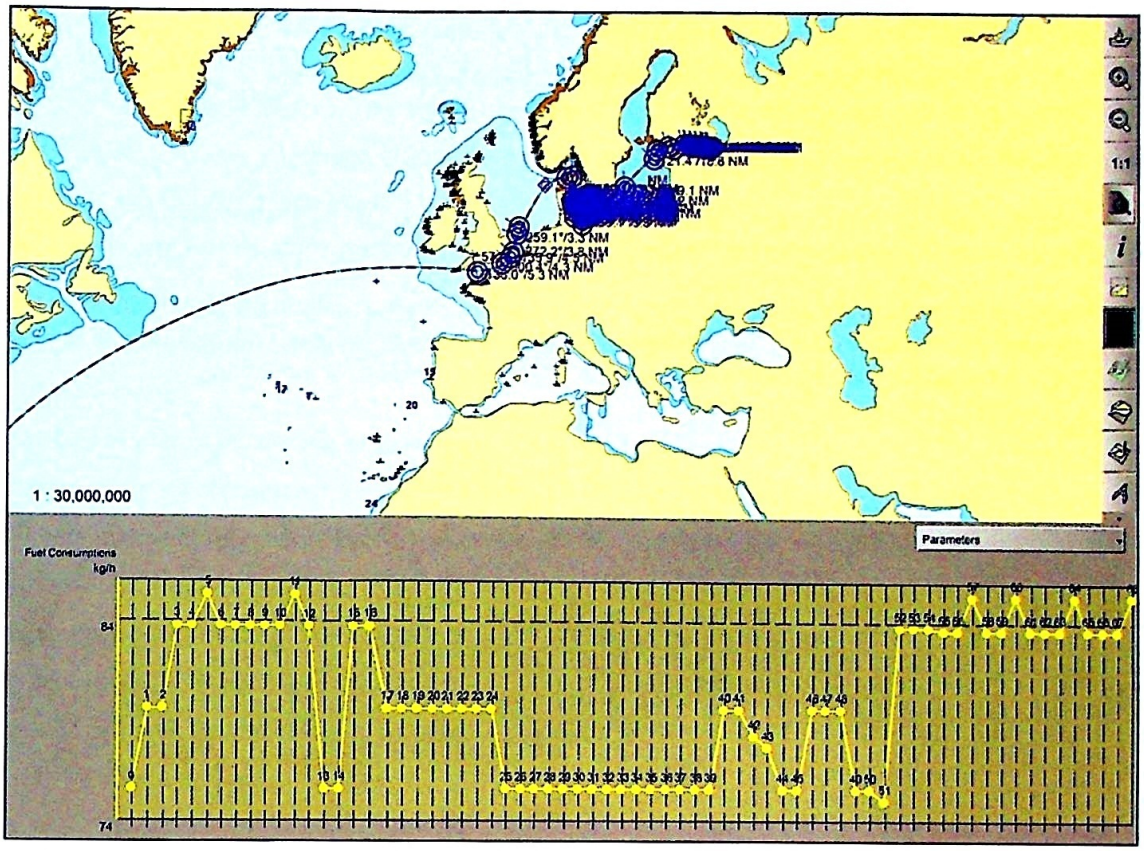


Figure 110: Example of ECDIS passage planning software being used to predict fuel consumption during a planned passage. (Transas)

When satisfied with the plan and its associated elements, name the route and save it, if this has not already been done. If the ECDIS is connected to a printer, details of the planned route can now be printed. Alternatively, the route can be exported or it can be written down to create the voyage plan, in accordance with your company SMS.

There is always a chance of hardware or software failure resulting in the loss of route data (not just for the current route but including all saved routes). It is, therefore, recommended that the route is saved regularly during the planning phase, including a backup to an external USB drive, complying with cyber security hygiene procedures (these should be defined within the company SMS).

Depending on the manufacturer, the generated voyage plan will include information such as:

- A list of waypoints
- schedule
- accepted alarms
- ENCs used
- publications to be used
- safety settings.

Some systems give the option to create a tailored voyage plan direct from the ECDIS and this will usually be more than just the list of waypoints.

4.3 Mariner-added Objects

Passage planning requires the inclusion of supplementary information, such as navigational warnings, local notices to mariners and explanatory notes pertinent to the route. For this purpose, ECDIS provides the capability of adding symbols, lines and areas to the ENC in the form of mariner-added objects, while also being able to revise or delete them. Mariner-added objects include:

- Danger highlight – this is used by the ECDIS operator to draw attention to a hazard deemed to be a danger to own ship. A danger highlight will trigger an alert
- mariners' note – this contains textual information defined by the ECDIS operator relating to a certain geographic position. The note is either in the form of a caution or information note, depending on the content's importance
- mariners' feature – this consists of symbols, lines or areas drawn by the ECDIS operator.

Mariner-added objects should be used to define 'no-go' areas (with danger alerts) within the passage plan, as appropriate. This is especially true for circumstances when the ship must navigate within the safety contour.

The ECDIS operator should ensure that mariner-added objects are also backed up, usually in the same manner as backing up the route/passage plan. Additionally, mariner-added objects can often be saved or grouped with routes (with the name of the route), so that the objects can be removed/added, depending on the route selected for monitoring.

4.4 Supplementary Information

Inserting 'danger highlight' notes and features using mariner-added objects (see Section 4.3 – Mariner-added Objects) ensures that the ECDIS operator is informed and reminded of potential dangers and actions to be taken at various points during the passage.

If using pre-existing mariner-added objects from a previous voyage, the ECDIS operator should review the relevance and applicability of mariner-added objects such as 'danger highlights', 'call points', etc. The quantity of additional information should be limited to that which is necessary to safely and efficiently execute the route, although this will depend upon the complexity of the plan, the environmental conditions and the proximity of dangers. The following list provides examples of additional information, if applicable:

- Areas of danger
- areas of ENCs known to be of poor quality
- areas of overlapping ENC data
- areas of poor GNSS coverage
- areas where there is datum mismatch (datum unknown/not WGS 84)
- areas of RCDS mode
- areas of special interest or concern, such as anti-piracy measures to be taken
- areas where accuracy of position fixing is critical (determine cross-checking interval)
- areas where marine environmental protection considerations apply (MARPOL, emission control areas)
- changes in IALA systems of buoyage
- contingencies, abort (commit/no return) points, etc
- headmarks, points of interest, fixing points
- any specific national regulations that may apply to phases of the voyage
- manoeuvring characteristics
- no-go lines
- pilotage information
- planned alterations of speed
- planned changes of settings (for example, safety depth, safety contour values, etc)
- planned time zone changes
- positions where a change in machinery status is required
- positions where additional bridge or engine room manning is required
- reporting points
- ships' routeing and reporting systems
- sunrise and sunset times (some ECDIS manufacturers provide this function in the ECDIS)
- tides and currents
- vessel traffic services (VTS)
- where multiple routes are used, the planned loading of routes.

When adding information to the passage plan, it should be carefully checked to ensure that it does not obscure important charted information and that it is prominent in the night palette. Where the safety contour is appropriate, no-go lines may not need to be added.

In many cases, information can be included in the printed/exported voyage plan, rather than as a mariner-added object.

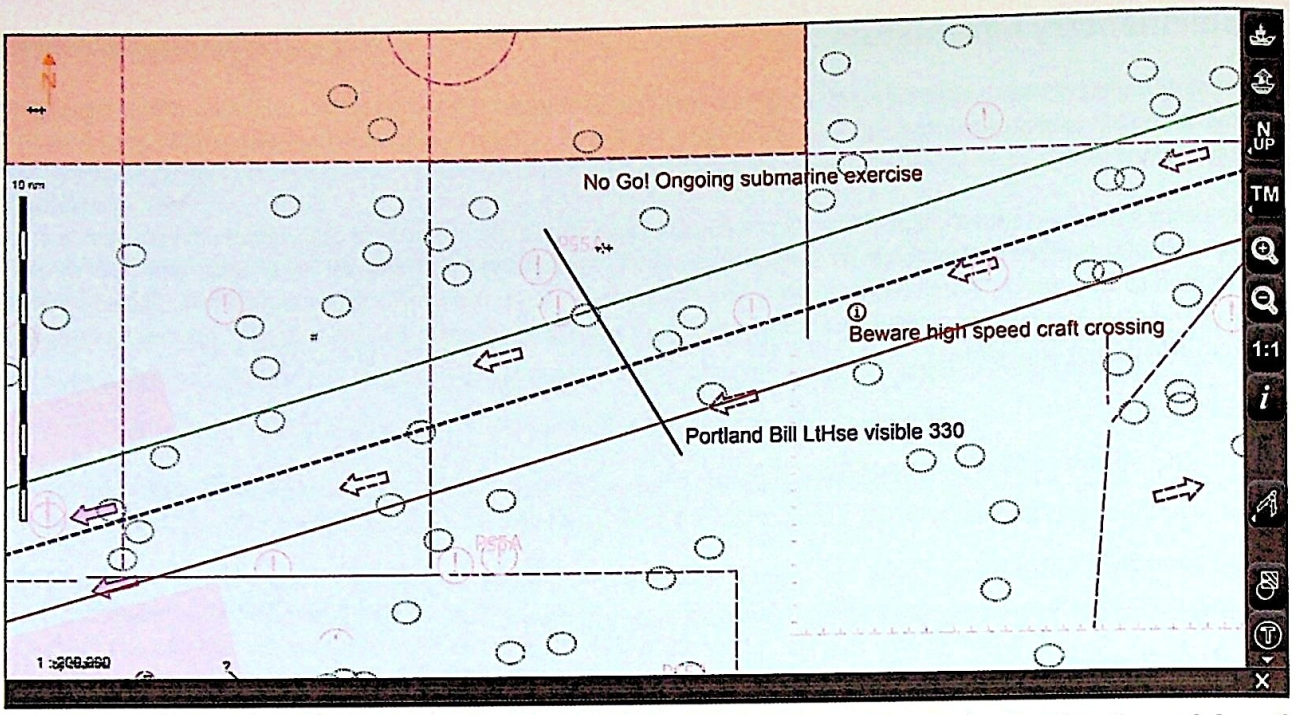


Figure 111: Example of mariner-added objects being used to highlight dangers and add navigational and cautionary information (Transas)

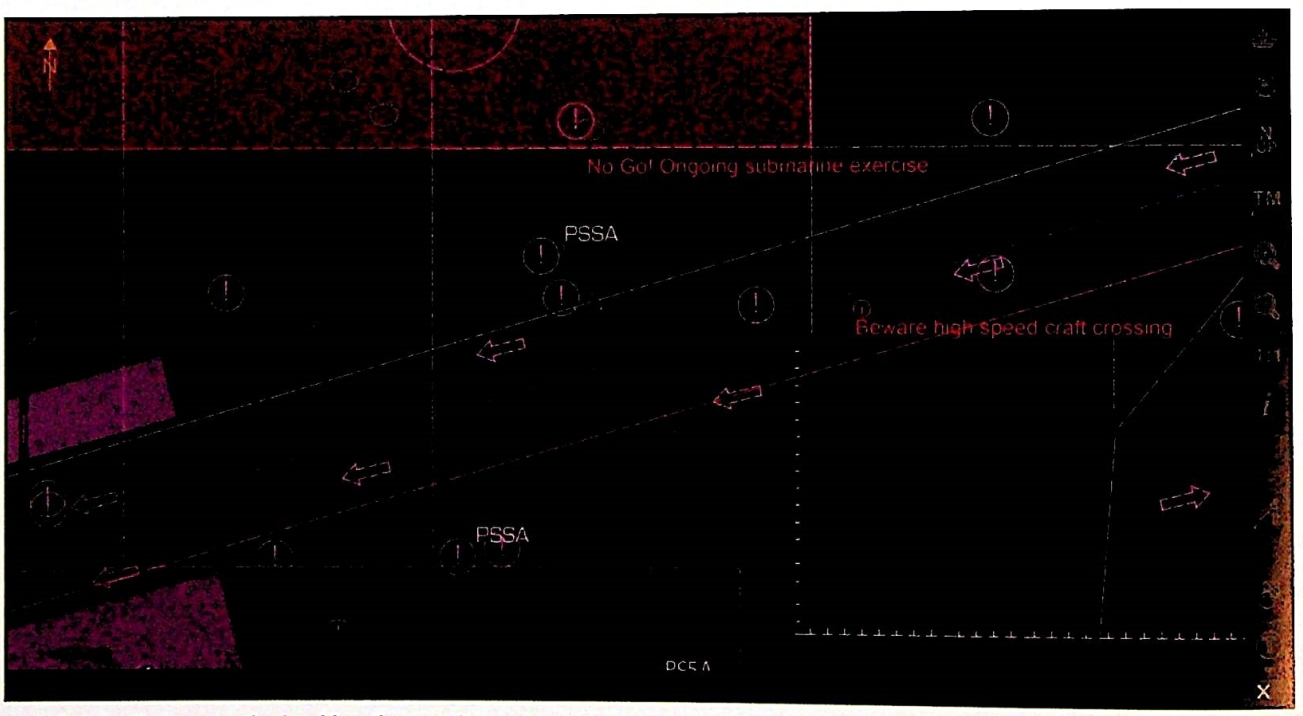


Figure 112: It is always worth checking that mariner-added objects are prominent in the night palette, particularly if that area will be transited at night. (Transas)

A key feature of mariner-added objects is the ability to add a danger highlight. Points and areas inserted using this feature will trigger an indication during route checking, and an alarm during route monitoring, when they interact with the detection area. This is a useful tool for manually constructing no-go areas on RNCs that can be alarmed, or on ENCs where specific contours do not exist. If the contour is available, drawing additional no-go areas will cause excessive clutter and alerts.

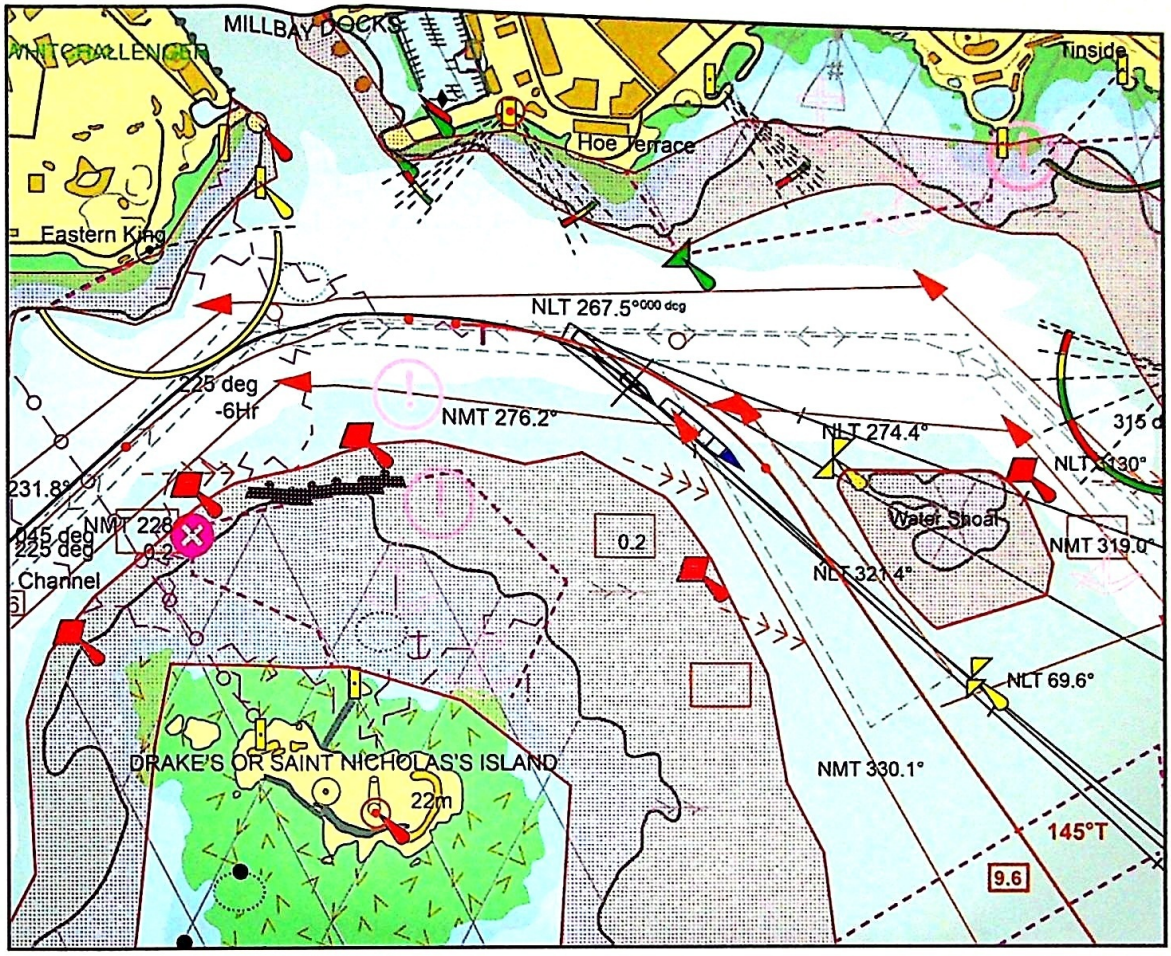


Figure 113: Example of danger highlight being used to indicate no-go areas. In this example, the shallow water pattern is also enabled, although this only encapsulates areas less than the safety contour and does not accurately represent the available safe water.

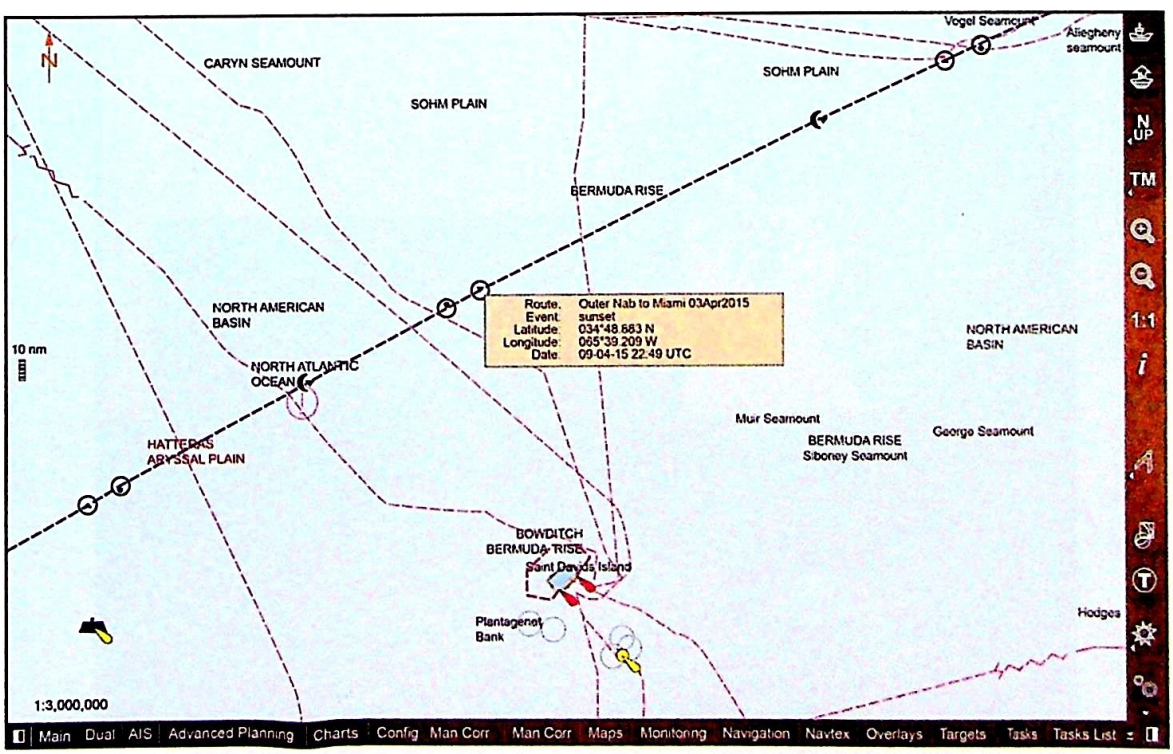


Figure 114: Example of ECDIS being used to calculate and display rising and setting times of astronomical bodies based upon estimates of ship position. (Transas)

Ensure that inserted notes are positioned where they can be clearly seen by the ECDIS operators. Some ECDIS models may allow a scale minimum (SCAMIN) value to be attributed to an inserted mariner-added object. If this is done, ensure it is visible at appropriate scales to avoid it being hidden when the route is executed.

When complete, all supplementary information files should be named appropriately to ensure the correct files are loaded and saved during the monitoring phase. Note that some ECDIS manufacturers provide an option to associate mariner-added objects to a specific route or a specific group.

4.5 Manual Updates

Where the ENC requires updating manually, the manual update/corrections function can be used to insert additional S-52 objects, including symbols, lines and areas. This may be required, for example, where information relevant to the planned route is received in the form of a navigational warning and the sailing date precedes the inclusion of such information within an automatic update. Other reasons include adding supplementary information or local navigation warnings (where, for example, these are not available as an overlay, eg NAVTEX). However, in many cases, using mariner-added objects may be the best method of highlighting supplementary information on the ENC from the passage plan.

To replicate ENC symbols, the ECDIS operator should have access to any of the chart symbols contained within the PL. In addition, the ECDIS is capable of sensing indications and alerts related to any manual updates inserted in the ENC, as it does for automatic ENC updates. However, the operator should be aware that alarms will only trigger if they are assigned the danger attribute when created. The ECDIS operator should also be aware that official ENC data cannot be deleted/ permanently removed but can only be crossed out, as shown in Figure 115.

The ECDIS operator should be aware that any subsequent automatic update will not remove any manual update/correction. It is therefore recommended to document when a manual update/correction is applied and ensure that periodic checks remove any manual updates that become obsolete and no longer relevant. To assist with this, the update history log provides a record of manual updates.

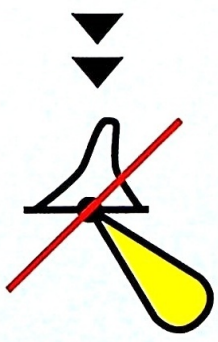


Figure 115: Deleted manual update.

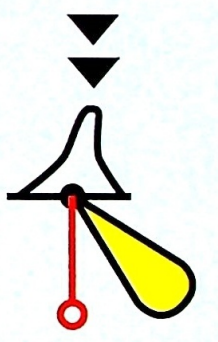


Figure 116: Inserted manual update.

Figure 117: Manual correction objects. (Transas)

4.6 Route Check

The route must now be comprehensively checked. When the ECDIS route check is performed, charted dangers, unsafe depths and potential hazards will be identified within the user-specified distance of the planned route (often referred to as XTD or safety corridor).

The route check will detect the following danger to navigation parameters within the user-specified XTD, generating an indication when it does so:

- If a route is planned across the safety contour
- if a route is planned closer than a user-specified distance from the boundary of a prohibited area or a geographic area for which special conditions exist, such as:
  - anchorage area
  - areas to be avoided
  - cautionary area
  - inshore traffic zone
  - marine farm/aquaculture
  - military practice area
  - offshore production area
  - PSSA
  - restricted area
  - seaplane landing area
  - submarine transit lane
  - TSS
  - user-defined areas to be avoided
- if a route is planned closer than a user-specified distance from a point object, such as:
  - a fixed or floating AtoN
  - isolated danger.

The user-specified distance stated above refers to the width of the XTD. The capabilities of ECDIS with regard to the route check vary considerably and some ECDIS may have additional functionality within the route check, such as:

- Configuration of route check criteria:
  - prohibited areas
  - geographic areas for which special conditions exist
- detection of soundings equal to or less than the safety depth value
- detection of additional layers, such as:
  - anti-piracy
  - NAVTEX
  - AIO
- draught and UKC checked against charted depths within the XTD
- turning data to ensure that planned turns are achievable
- detection of abnormalities in route construction (eg two waypoints in a single location).

4.6.1 Configuration

To optimise the route check, all elements must be appropriately configured, including verifying that safety depth/safety contour are appropriate. The following are considerations when configuring the route check:

- XTD
- route check parameters
- chart display
- rate of turn/turn radius
- chart scale.

Of critical importance are the values for the XTD. If these values are too small, dangers within close proximity to the route will not be detected. If these values are too large, a substantial number of alerts will be generated (see Figure 118). Where it is possible to select which areas will be detected in the check, such parameters must be assessed and carefully configured to ensure that relevant dangers are detected.

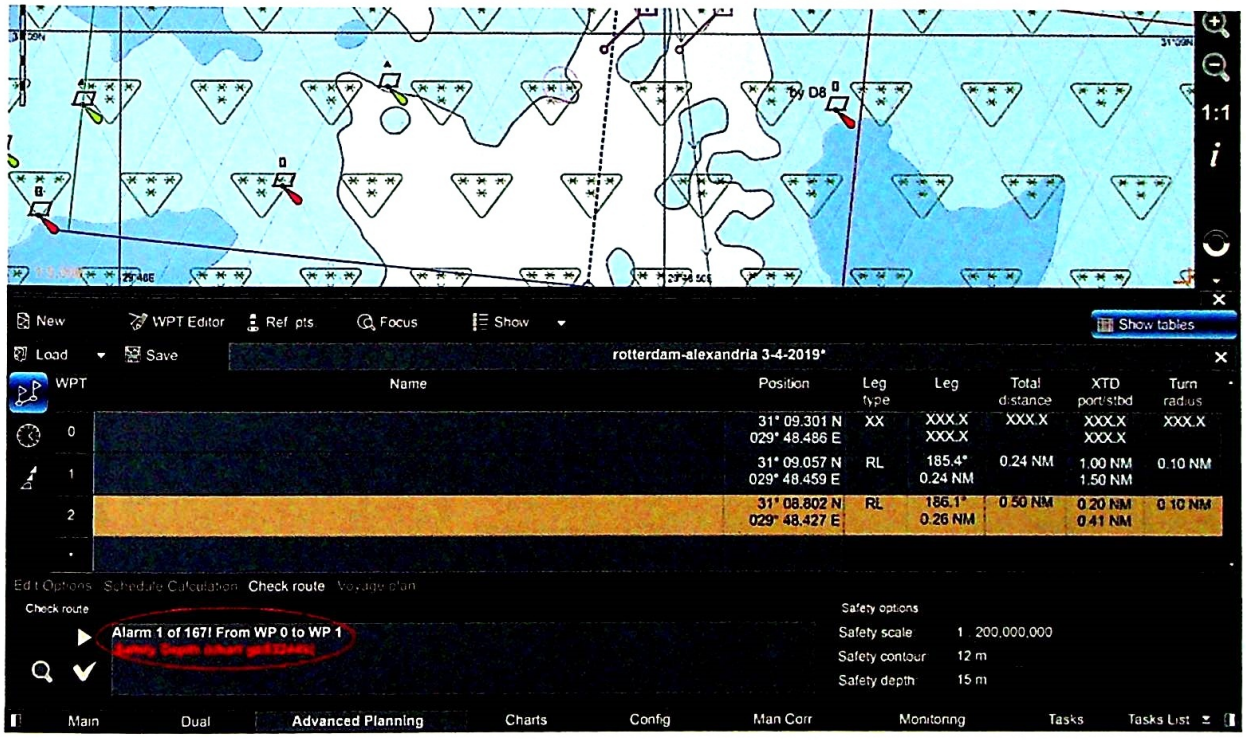


Figure 118: An inappropriately configured XTD can result in hundreds of alerts being generated. (Transas)

The chart display must also be configured so that potential dangers detected by the route check are shown. Selection of the all/other display category is recommended. Another factor that must be considered is the ability, on some ECDIS, to select between conducting the route check on all scales or on the best scale ENCs only.

Supplementary information can be loaded for the route check, although it should be noted that any mariner-added objects containing the danger attribute will be highlighted during the check where it meets the XTD.

4.6.2 Conducting the Route Check

Load the planned route and activate the route check function. ECDIS will now check for potential dangers within the XTD of the entire route. When the check is complete, all potential dangers will be available for viewing. Some systems may list this information according to the relevant leg affected. It should be possible to view each individual danger, which in turn will be highlighted by the system so that it can be differentiated from other dangers. You must interrogate the dangers to ascertain further information. Some detected dangers can be disregarded, while others will require revision of the route, which is normally facilitated within the route check function itself. When editing is complete, the modified passage plan will need to be route checked again.

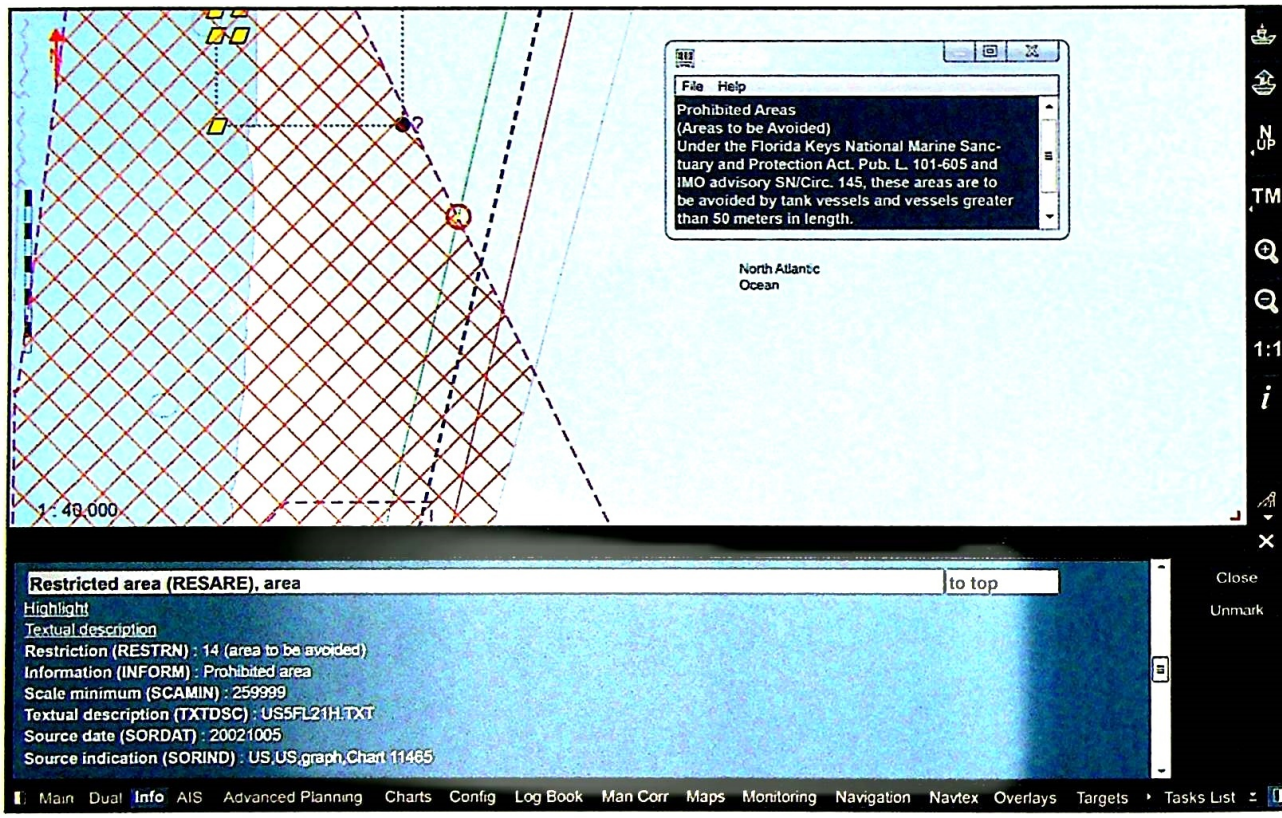
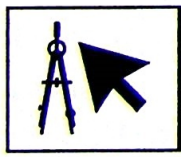


Figure 119: The restricted area has been highlighted. On certain systems, it may be necessary to interrogate this by means of a cursor pick. (Transas)

The number of parameters that the automatic route check detects means that even the shortest of routes may result in a large number of detected dangers. If the route check does not list any detected dangers, this may be an indication that settings have not been configured correctly. The most likely cause is that no value has been set for XTD. If this occurs, set the XTD to an appropriate value. A route check should be performed prior to departure and:

- Following modification of a route
- following an ENC update
- following a change in the safety settings.



When modifying the route for a change of destination while underway, the change must be clearly marked and recorded in the passage plan, with approval from the Master.

Particular care should be taken when planned routes cross areas where only small scale ENCs (usage bands 1 and 2) are available. In certain display configurations, such as when no names are shown, small islands and other point features may be difficult to identify or could be obscured by surrounding depth contours.

4.6.3 Visual Check

Careful visual inspection of the entire planned route on the ECDIS must also be conducted.

4.7 Detailed Briefing

The detailed passage plan can now be presented to the bridge team for consideration and Master's approval.

The bridge team's scrutiny of the detailed plan provides a further safety check. The ECDIS should be used to brief the bridge team, so that any critical phase of the passage can be better explained. Key points that may be appropriate in the briefing are as follows:

- Overall speed, time (ETD, ETA) and distance
  - any elements that have changed significantly from the appraisal
  - changes to speed en route
  - estimated fuel consumption
- route and any alternatives
  - safety margins
  - areas where it is planned to cross the safety contour
  - areas of high traffic density
  - marine environment protection measures
  - MARPOL/SECA
  - no-go lines
- other
  - anti-piracy
  - change of time zones and locations
  - known meteorological data
  - reporting points
  - predicted currents with their likely strength and direction
  - sunrise and sunset times
  - territorial sea boundaries
  - critical areas where bridge watchkeeping levels may need to be increased.

On completion of the briefing, any amendments should be incorporated and rechecked. The approval of the plan by the Master should be recorded and documentation retained for inspections and audits.

Although some changes to the plan are inevitable, never underestimate the value of sound planning. The more complete the preparation, the easier the monitoring.

4.8 ECDIS References

Organisation	Source
IHO	S-32 Hydrographic Dictionary, Appendix 1, Glossary of ECDIS Related Terms S-52 Specifications for Chart Content and Display Aspects of ECDIS S-52 Annex A, IHO Presentation Library for ECDIS Edition 4.0.0 S-52 Appendix 1, Guidance on Updating the Electronic Navigational Chart S-52 Appendix 2, Colours and Symbols Specifications for ECDIS S-57 Maintenance Document No. 8 S-57 Transfer Standard for Digital Hydrographic Data S-63 IHO Data Protection Scheme
IEC	IEC 61174 ECDIS – Operational and Performance Requirements, Methods of Testing and Required Test Results Edition 4.0
IMO	Resolution MSC.232(82), Revised Performance Standards for ECDIS Resolution MSC.252(83), Revised Performance Standards for INS Circular MSC.1/Circ.1503/Rev.1, ECDIS – Guidance for Good Practice Circular SN.1/Circ.255, Additional Guidance on Chart Datums and the Accuracy of Positions on Charts
NOAA	US Chart 1

Note: Circular MSC.1/Circ.1503/Rev.1, ECDIS – Guidance for Good Practice has revoked and replaced: MSC.1/Circ.1391, MSC.1/Circ.1503 and Corrigenda 1, SN.1/Circ.207/Rev.1, SN.1/Circ.266/Rev.1, SN.1/Circ.276, SN.1/Circ.312, STCW.7/Circ.10 and STCW.7/Circ.18.

Annex A – Example Appraisal Report Format

Appraisal Report	
General Information	**References/Remarks**
From: ..... To: ..... Distance: ..... (RL/GC/Composite GC) Planned time of departure: ..... (local) ..... (GMT) Planned time of arrival: ..... (local) ..... (GMT) Time required: ..... (hrs) Speed overall: ..... (kts) Estimated fuel consumption: ..... Fuel on departure: ..... Estimated fuel remaining on arrival: ..... Bunkering required to complete passage: Yes/No	Distance determined using: a. ..... b. .....
Predicted HoT on departure: ..... (m) Time of HW: ..... (time zone) HoT at HW: ..... (m) Time of LW: ..... (time zone) HoT at LW: ..... (m) Time of sunrise/sunset at departure port: ..... (local) % rate of springs: ..... Squat/heel allowance: ..... (m) Minimum UKC: ..... (m) No-go line/safety depth: ..... (m)	

Predicted HoT on arrival: ..... (m) Time of HW: ..... (time zone) HoT at HW: ..... (m) Time of LW: ..... (time zone) HoT at LW: ..... (m) Time of sunrise/sunset at destination port: ..... (local) % rate of springs: ..... Squat/heel allowance: ..... (m) Minimum UKC: ..... (m) No-go line/safety depth: ..... (m)	
• Outline route(s) on an overview chart, highlight any routeing information from '*Sailing Directions*' or '*Ocean Passages for the World*', ie TSSs, deep water routes, areas to avoid, etc.	Explain the advantages/disadvantages of alternative routes
• Highlight any navigational hazards along the route that require specific consideration, ie areas of shoals, poor survey data, restricted sea room, etc.	
• Relevant port information such as minimum charted depths in fairways/ channels, pilot boarding position, availability of tugs, berths and their charted depths, port regulations, etc.	Sources of information:
• Weather/climatological information: – Statistical weather or climatological information – Forecast weather (if available at time of briefing).	Sources of weather information:
• Predicted tidal streams or ocean currents, whether assisting or impeding progress.	Sources of tidal/current information:
• Name of weather routeing service (if applicable).	
• Highlight any MARPOL restrictions along the route.	
• Highlight any ballast water exchange requirements along the route.	
• Highlight any advisories from flag State/P&I Clubs that relate to the route.	
• Confirm that all necessary charts and publications to support the passage are held and updated with NM and warnings.	
• Highlight the available navigation methods/aids available along the route.	
• Have different route options been prepared and presented to the Master?	
• Has the Master finalised the route choice?	
• Advise whether ship has been to the destination port(s) in the past. (If so, the navigator can draw upon the record of previous passage(s) to identify the route selected and any comments made either at the appraisal or post passage analysis stages.)	Dates of voyage/copy of previous passage plan .....
• Advise whether any officer on board has experience relevant to that area/ port.	Officer's name ..... Record of information obtained .....

Annex B – Passage Planning Checklists

Checklist A: Questions		References/Remarks
General Information 1. Name of the destination port(s) and confirmed by the Master?	☐	→ Name ..... → Lat/Long .....
2. Ship's draught and stability confirmed by Chief Officer?	☐	→ Confirmed Draught: Fwd ..... m/ft Aft ..... m/ft
3. Ship's condition; loaded or in ballast? (For ship's manoeuvring data)	☐	→ Loaded/In ballast
4. Bunkering requirements confirmed by Chief Engineer?	☐	→ Bunkers on departure ..... m^3 ..... % Predicted bunkers on arrival ..... m^3 ..... %
5. Are there any port/pilot/agent/charterer's requirements for the intended passage?	☐	→ Yes/No (If YES, Sheet No.) .....
6. Does the company have any special instructions pertaining to the route?	☐	→ Yes/No (If YES, Sheet No.) .....
7. Has the Master given any particular instructions?	☐	→ Yes/No (If YES, Sheet No.) .....
8. Is the ship required to use weather routeing? Name of service.	☐	→ Yes/No (If YES, name of weather routeing service) .....
9. Are there any MARPOL requirements applicable to this passage?	☐	→ Yes/No (If YES, Sheet No.) .....
10. Are there any ballast water exchange requirements applicable to this passage?	☐	→ Yes/No (If YES, Sheet No.) .....
11. Are there any advisories from the flag State or task forces?	☐	→ Yes/No (If YES, Sheet No.) .....
12. Have different route options been prepared and presented to the Master?	☐	→ Yes/No (If YES, Sheet No.) .....
13. Has the Master selected the route choice? Chosen option?	☐	→ Yes/No (If YES, which route option selected?) .....
14. Has the ship been to the destination port(s) in the past? (If so, the record of previous passage can help identify the route and the navigation officer can construct a new route with amendments.)	☐	→ Date of voyage/Copy of previous passage plan → .....
15. Has any deck officer on board previously visited this area/port?	☐	→ Name of officer/Record of information obtained → .....

Checklist B: Questions		References/Remarks
a) Ship		
1. Is there any bunker port diversion to consider bunkering? Are charts held for diversion port?		→ Yes/No (If YES, Name of port and Sheet No.) .....
2. Has the pilot card been updated? (If possible, obtain a copy and attach with passage plan.)		→ Yes/No (If YES, Sheet No.) .....
3. Does the ship have sufficient UKC throughout passage?		→ Planned minimum UKC: ..... m/ft
4. Has room been planned to allow the ship to manoeuvre in the pilot boarding area to provide a lee for pilot boat?		→ Yes/No (If YES, Location and Chart No.) .....
5. Are there any overhead cables/bridges in the passage for consideration of air draught?		→ Yes/No (If YES, Location and Chart No.) .....
6. Are there any special cargo condition/requirements that may affect the passage plan?		→ Yes/No (If YES, Sheet No.) .....
b) Weather		
1. What meteorological conditions are expected on passage?		→ Sources of weather data: .....
2. Does the plan take meteorological conditions into account?		→ Yes/No (If YES, Sheet No.) .....
3. Have the latest weather forecasts/warnings been obtained, checked and allowed for?		→ Time of most recent forecast: .....
4. Does the ship follow advice from any weather routeing service?		→ Yes/No (If YES, Sheet No.) .....
c) Watchkeeping and Other Personnel		
1. Has additional bridge manning been considered with respect to adverse weather/restricted visibility/critical approaches?		→ Yes/No (If YES, Sheet No.) .....
2. Have the crew calling points for anchor/berthing stations and piracy watches been established and noted on the chart/passage plan?		→ Yes/No (If YES, Sheet No.) .....
3. Have the rest hours for watchkeepers been considered?		→ Yes/No (If YES, Sheet No.) .....
d) Passage		
1. Are there any mandatory ship reporting schemes?		→ Yes/No (If YES, Location(s) and Sheet No.) .....
2. Have the positions of pilot boarding/disembarkation points been established?		→ Yes/No (If YES, Position and Sheet No.) .....
3. Has clock adjustment with respect to local times been considered and times/positions noted on chart to advance/retard clocks?		→ Yes/No (If YES, Position(s), Dates and Sheet No.) .....
4. Has location, suitability and availability of anchorage berths been considered? Are suitable charts held for anchorage berths?		→ Yes/No (If YES, Position(s) and Sheet No.) .....
5. Has a risk assessment been carried out for predicted areas of danger?		→ Yes/No (If YES, Position(s) and Sheet No.) .....

Checklist C: Questions		References/Remarks
Publications		
1. Are all the correct scale charts and publications necessary to plan and execute the passage held on board? If additional charts are required, will they be received before sailing?	☐	→ Yes/No (If No, list missing charts or publications) .....
2. Are there any local charts or publications required for the departure and destination ports? Have they been ordered/will they be received prior to departure?	☐	→ Yes/No (If Yes, list required local charts or publications) .....
3. Are the following publications held on board and corrected up to date?		
a. *Charts and Publications Catalogue* (NP131)	☐	→ Edn .....
b. Navigational Charts	☐	→ Corrected to NM .....
c. *Routeing Charts*	☐	→ Edn .....
d. Mariner's Routeing Charts	☐	→ Latest NM on board .....
e. Port Approach Guide Charts		→ Edn .....
f. – Admiralty Weekly Notices to Mariners – Annual Summary Notice to Mariners		→ Latest NM on board .....
g. Admiralty/other Distance Tables		→ .....
h. *Sailing Directions*	☐	→ Edn ..... Corrected to NM ....
i. *Tide Tables*	☐	→ Edn .....
j. *Tidal Stream Atlases*	☐	→ Edn .....
k. *List of Lights and Fog Signals*	☐	→ Edn ..... Corrected to NM ....
l. *List of Radio Signals*	☐	→ Edn ..... Corrected to NM ....
m. Guide to Port Entry	☐	→ Edn .....
n. *The Mariner's Handbook* (NP100)	☐	→ Edn ..... Corrected to NM ....
o. *Ocean Passages for the World* (NP136)	☐	→ Edn ..... Corrected to NM ....
p. *Ships' Routeing* (IMO)	☐	→ Edn .....
q. Load Line Chart	☐	→ Edn .....
r. Other	☐	→ Edn .....
4. Additional Publications		
a. Flag State notices and regulations	☐	→ Latest number held .....
b. Manuals for all the navigational equipment	☐	→ Location on bridge .....
c. International Code of Signals	☐	→ Edn .....
d. Paper Chart Maintenance Record (NP133A)	☐	→ Edn .....
e. IALA Maritime Buoyage System (NP735)	☐	→ Edn .....
f. Symbols and Abbreviations (BA Chart 5011)	☐	→ Edn .....
g. Additional	☐	→ .....

Checklist D: Questions		References/Remarks
Plan		
1. Have the following been marked/drawn on the chart:		
a. Margins of safety as required by the Master/Company.	☐	→ Yes/No (If YES, Sheet No.) .....
b. Predicted areas of danger and no-go areas.	☐	→ Yes/No (If YES, Sheet No.) .....
c. Minimum UKC required for each leg of the passage, particularly in shallow waters.	☐	→ Yes/No (If YES, Sheet No.) .....
d. Courses as recommended by local/international regulations, company and the Master's instructions.	☐	→ Yes/No (If YES, Sheet No.) ..... References .....
e. Waypoints and wheel over points.	☐	→ Yes/No (If YES, Leg No.) .....
f. Waypoint number on each waypoint, with wheel over info.	☐	→ Yes/No marked on Charts
g. Radar conspicuous objects, eg cliffs, hills, RACONs, etc.	☐	→ Yes/No marked on Charts
h. Transits, clearing bearings, clearing marks.	☐	→ Yes/No marked on Charts
i. Points for and cross index range (CIR) for parallel indexing (PI).	☐	→ Yes/No (If YES, Chart No(s)) .....
j. Position on chart where additional navigation aids are required to be switched on.	☐	→ Yes/No (If YES, marked on Chart No(s)) .....
k. Abort points and points of no return.	☐	→ Yes/No (If YES, marked on Chart No(s)) .....
l. Tidal streams and currents.	☐	→ Yes/No (If YES, marked on Chart No(s)) .....
m. Sequence of charts for the passage.	☐	→ Yes/No marked on Charts Total number of Charts .....
n. Position from where to move onto next chart along with chart number.	☐	→ Yes/No marked on all Charts
o. VTS or other reporting points marked on the chart and noted in the passage plan sheet.	☐	→ Yes/No (If YES, marked on Chart No(s)) .....
p. Pilot boarding position and alternate pilot boarding position in case of adverse weather.	☐	→ Yes/No (If YES, marked on Chart No(s)) .....
q. Speed reduction points.	☐	→ Yes/No (If YES, marked on Chart No(s)) ..... New Speed(s) ..... Time .....
r. Notices to engine room.	☐	→ Yes/No (If YES, marked on Sheet No(s)) .....
s. Point where call is given to ship's crew for anchor/berthing stations.	☐	→ Yes/No (If YES, marked on Chart No(s)) ..... Time(s) .....
t. Specific meteorological information related to any area, eg haze, dust storms, areas of restricted visibility, ice.	☐	→ Yes/No (If YES, marked on Chart No(s)) ..... References .....
u. T&P corrections from Notices to Mariners?		→ Yes/No (If YES, marked on Chart No(s)) ..... NM No ..... NAVAREA ..... WZ .....
v. Areas of special marine environmental protection en route?	☐	→ Yes/No (If YES, marked on Chart No(s)) ..... References ..... Recorded on leg passage plan sheet .....
2. Have the latest navigational warnings been taken into account?	☐	→ Yes/No (If YES, marked on Chart No(s)) ..... NAVAREA ..... WZ .....
3. Have the primary and secondary means of position fixing been agreed?	☐	→ Yes/No Recorded on leg passage plan sheet .....
4. Have the fixing intervals been agreed with the Master for each leg?	☐	→ Yes/No Recorded on leg passage plan sheet .....
5. Is there a datum shift correction to apply to WGS 84 positions before plotting on any of the passage charts?	☐	→ Yes/No Recorded on leg passage plan sheet .....

Checklist E: Questions		References/Remarks
Contingency Plans 1. Are there contingency plans available for the following?		
a. Man overboard	☐	→ Yes/No SMS procedure reference .....
b. Fire	☐	→ Yes/No SMS procedure reference .....
c. Flood	☐	→ Yes/No SMS procedure reference .....
d. Steering gear failure	☐	→ Yes/No SMS procedure reference .....
e. Main engine failure	☐	→ Yes/No SMS procedure reference .....
f. Distress or emergency in own ship	☐	→ Yes/No SMS procedure reference .....
g. Piracy/armed robbery/terrorist activity	☐	→ Yes/No SMS procedure reference .....
h. Failure of electronic navigational aids	☐	→ Yes/No SMS procedure reference .....
i. Radar/ARPA failures	☐	→ Yes/No SMS procedure reference .....
j. Receipt of a distress message from another vessel or shore station	☐	→ Yes/No SMS procedure reference .....
k. Helicopter operations	☐	→ Yes/No SMS procedure reference .....
l. Adverse weather/visibility/ice/TRS	☐	→ Yes/No SMS procedure reference .....
m. Unavailability of pilot/OOW/lookout/helmsman	☐	→ Yes/No SMS procedure reference .....

Checklist F: Questions		References/Remarks
Briefings and Approval		
1. Are all officers and crew fully familiar with relevant bridge equipment and procedures?		→ Yes/No (If not, reference to company procedure) .....
2. Have OOWs and bridge crew been briefed about the passage plan?		→ Yes/No Signature on passage plan sheet
3. Have all OOWs seen, understood and signed the passage plan?		→ Yes/No Signature on passage plan sheet
4. Has the Master reviewed and approved the plan?		→ Yes/No Signature on passage plan sheet

Annex C – ECDIS Planning Checklists

System Configuration			
A. CHART INSTALLATION			
☐	**Official chart formats**	☐	SOLAS compliant (government hydrographic office)
		☐	ENCs of an appropriate scale and accuracy
☐	**RCDS mode**	☐	Appropriate RNCs
		☐	Appropriate folio of paper charts
		☐	Risk assessment
☐	**Contingency chart provision**		
☐	**Time to procure and receive**		
☐	**Time to install**		
B. UPDATES			
☐	**Safety notices**	☐	Notices to mariners (NM)
		☐	Temporary and preliminary notices (T&P NM, AIO)
		☐	Local NM
		☐	Radio navigational warnings (NAVAREAS and WZs)
		☐	Time to update all ECDIS
☐	**Chart permits and licence**	☐	Relevant ENC and RNC permits held on board
		☐	Chart permits up to date
		☐	Chart permit expiry
		☐	ECDIS licence expiry
☐	**ECDIS**	☐	Latest software
		☐	Generic and type specific training
C. SOFTWARE CONFIGURATION			
☐	**ECDIS software**	☐	Latest manufacturer's software patch is installed
		☐	Latest presentation library (IHO S-52)
		☐	Latest data protection standards (IHO S-63)
☐	**ECDIS anomalies**	☐	Read the latest IMO guidance on ECDIS anomalies
		☐	Report ECDIS anomalies to the appropriate authority

D. DISPLAY CONFIGURATION			
☐	**Display set-up**	☐	Unload all routes
		☐	Unload all mariner-added objects
		☐	Full screen (hide sidebar)
		☐	Day white palette
☐	**Chart settings**	☐	Display mode 'all other'
		☐	Chart priority ENC
		☐	Chart autoload ON
		☐	Chart autoscale ON
		☐	Scale minimum ON
		☐	AIO layer ON
		☐	Shallow pattern ON
		☐	Full light lines ON
		☐	Show correction ON
		☐	Chart boundaries ON
		☐	Show isolated dangers in shallow water ON
		☐	Traditional chart symbols or simplified
		☐	Traditional areas or symbolised
		☐	Two or four-colour shades
☐	**Safety settings**	☐	Safety depth
		☐	Safety contour
		☐	Shallow contour
		☐	Safety height/air draught
		☐	Deep contour
☐	**Route settings**	☐	Display of XTD/XTE
		☐	Display of distances
		☐	Display of true courses
		☐	Display of waypoint names
		☐	Display of turn radius
☐	**Other values**	☐	Shallow contour
		☐	Deep contour

Route Planning			
A. MANUAL CONSTRUCTION			
☐	**New route**	☐	Berth to berth
		☐	Areas where the services of a pilot will be used
		☐	Name the route
		☐	Locate start and end points
☐	**Adding waypoints**	☐	Add waypoint at start location
		☐	Construct route on small scale
		☐	Define leg properties as RL or GC
B. ADJUSTING WAYPOINTS			
☐	**Draught, available depth of water and minimum UKC**		
☐	**Manoeuvring characteristics**		
☐	**Effect of course alteration on draught and turning circle**	☐	Planned speed
		☐	Effect of expected tidal stream
		☐	Effect of expected current
		☐	Decrease in UKC due to squat or heel effect
☐	**Positions where change in machinery status is required**		
☐	**Positions where additional manning is required**		
☐	**Depth of water**		
☐	**Safe speed and proximity of navigational hazards**		
☐	**Use of ships' routeing, reporting systems and VTS**		
☐	**Protection of the marine environment**		
☐	**Avoidance of danger areas**		
☐	**Alterations of speed on passage**		
☐	**Location of course alterations**		
☐	**Limitations of night passage**		
☐	**Tidal restrictions**		
☐	**Adequate XTD/XTE**		
☐	**Contingency planning**	☐	Deep water
		☐	Port of refuge or safe anchorage in emergency
		☐	Shore-based emergency response arrangements
		☐	Nature of the cargo and of the emergency itself

☐	**Method and frequency of position fixing**	☐	Primary and secondary fixing options
		☐	Areas where accuracy of position fixing is critical
		☐	Areas of poor reliability for position fixing
		☐	Availability of relative navigation technique visual and radar fixing
			☐ Radar image overlay
			☐ Parallel index lines
			☐ Astronomical observations
☐	**Save route**		
	C. QUALITY CONTROL CHECKS		
☐	**Visual check of ENC**	☐	Isolated dangers
		☐	Gaps in ENC coverage
		☐	CATZOCs and accuracy of ENC
		☐	Comparison of equivalent RNC where possible
☐	**Cursor pick**	☐	Interrogate symbols
		☐	Interrogate objects and areas for more information
☐	**T&Ps, updates and warnings**	☐	T&P NM information
			☐ Spot-check weekly ENC updates actually display
			☐ Cross-check with printed NM from ENC producer nation
			☐ Manually apply NAVTEX and other warnings
☐	**Route table**	☐	Latitude and longitude of waypoint
		☐	XTD/XTE (port and starboard)
		☐	Arrival radius (for use with track control systems)
		☐	Planned speed
		☐	Leg property (RL or GC)
		☐	Rate of turn
		☐	Turn radius (where minimum radius is too large for the turn, add multiple waypoints close together)
		☐	Time zone
		☐	Course
		☐	Distance
		☐	ETD
		☐	ETA
		☐	Name waypoints where necessary
		☐	Draught (provided on some systems)
		☐	UKC (provided on some systems)

Route Check			
A. ROUTE CHECK FUNCTION			
☐	Occasions for check	☐	After route planning
		☐	After modification of a route
		☐	After a chart update
☐	Configuration	☐	All other display mode
	Detected dangers	☐	Draw route over danger and verify functionality
☐	Route crosses own ship's safety contour		
☐	Point objects	☐	Fixed or floating aid to navigation
		☐	Isolated danger
☐	Boundaries of a prohibited or geographic area	☐	Traffic separation zone
		☐	Inshore traffic zone
		☐	Restricted area
		☐	Caution area
		☐	Offshore production area
		☐	Areas to be avoided
		☐	User-defined areas to be avoided
		☐	Anchorage area
B. ACTIONS FOLLOWING CHECK			
☐	View listed dangers		
☐	Use cursor pick to view additional information		
☐	Modify route to avoid listed dangers		
☐	Disregard dangers deemed not relevant		
☐	Re-check relevant legs following modifications		
☐	If gaps in ENC coverage, visually check RNCs		
☐	Visual check of entire route on appropriate scale charts		
☐	Save route		

Supplementary Information

A. MARINER-ADDED OBJECTS

☐	**Highlight**	☐ Planned changes of safety depth and safety contour
		☐ No-go lines
		☐ *'Ships' Routeing'*, reporting systems and VTS
		☐ Planned time zone changes
		☐ Tidal diamonds
		☐ True direction of the planned route
		☐ All areas of danger
		☐ Areas of limited data
		☐ Areas of special interest and concern
		☐ Areas of marine environmental protection
		☐ Points of 'no return' and contingencies
		☐ Changes in IALA systems of maritime buoyage
		☐ Areas where accuracy of position fixing is critical
		☐ Areas of poor reliability for position fixing
		☐ Weather concerns and measures to be taken

B. DETAILED BRIEFING

☐	**Overall speed, time (ETD, ETA) and distance**	☐ Significant changes from the appraisal report
		☐ Changes to speed on passage
		☐ Passage graph
☐	**Route and alternatives**	☐ No-go lines
		☐ Likely concentrations of fishing vessels
		☐ Main shipping routes
		☐ Marine environment protection measures
		☐ MARPOL
☐	**Other**	☐ Sunrise and sunset times and locations
		☐ Change of time zones and locations
		☐ Predicted currents, likely strength and direction
		☐ Known meteorological data
		☐ Territorial sea boundaries
		☐ Areas of piracy and armed robbery

Annex D – Parallel Indexing

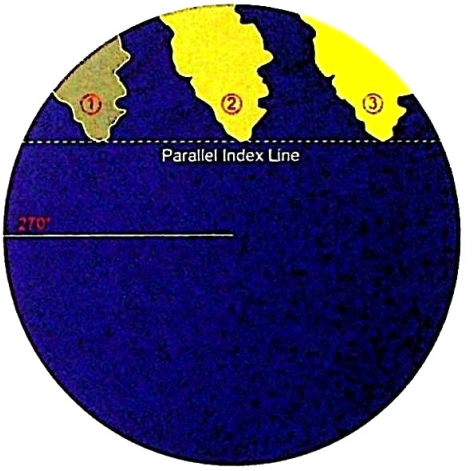
Parallel indexing is a useful method of monitoring a ship's progress using the radar. As a ship progresses, stationary objects on the radar display appear to be moving in a reciprocal direction to the ship's direction of travel. Parallel indexing provides the radar observer with a real-time view of the ship's lateral position relative to the planned course. This provides an instant visual indicator that the ship is drifting off course.

This technique can be used in most conditions of visibility to monitor the ship's cross-track movement.

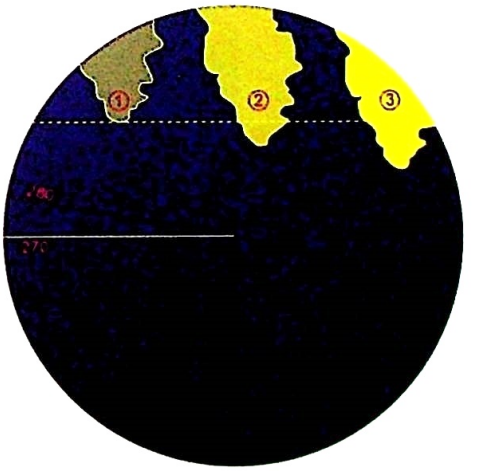
The following must be confirmed before using the radar in this way:

- The performance of the radar must be checked at regular intervals
- gyro errors must be checked and compared with radar heading
- the heading marker should be in alignment with the ship's fore and aft line
- the accuracy of range rings and the variable range marker (VRM) should be checked against a good fix
- the fixed target that is to be tracked must be correctly identified.

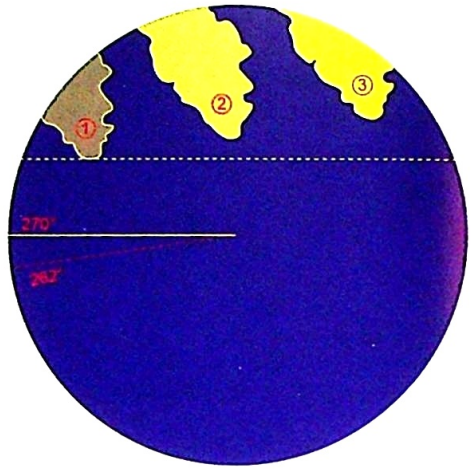
The ship is shown to be maintaining the required course, with the target (point of land) moving from position 1 to position 3, down the starboard side of the ship following the PI line. The ship is following a course over the ground of 270°T.



The ship is shown to be setting towards the shore. The point of land is moving inside the PI line and getting progressively closer to the ship. The ship has made a course over the ground of 280°T.



The ship is shown to be setting away from the shore. The point of land is moving outside the PI line and getting progressively further from the ship. The ship is now making a course over the ground of 262°T.

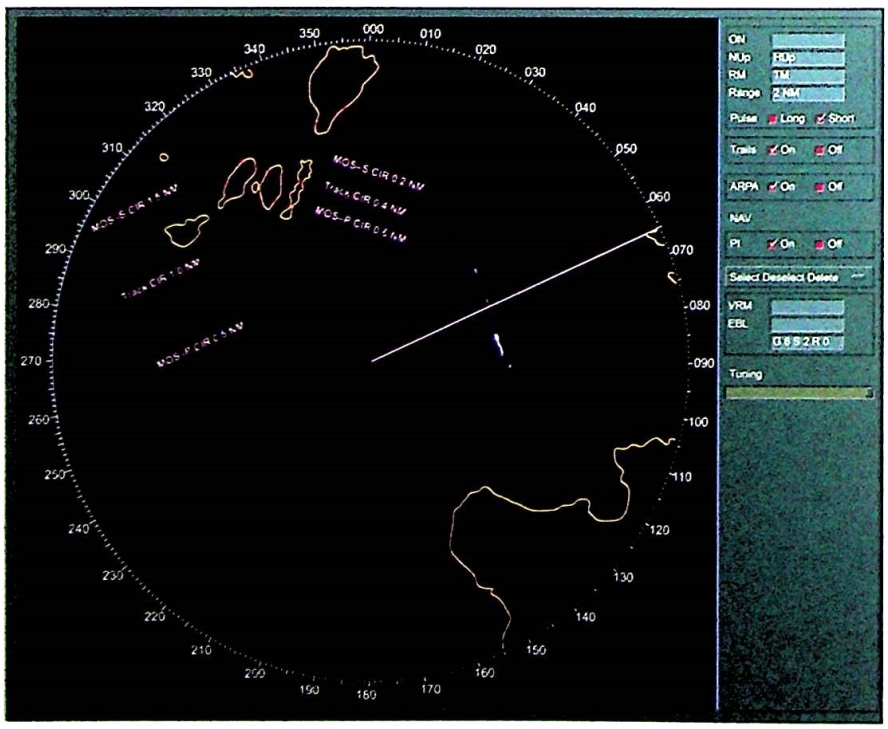


Cross Index Range (CIR)

This is based on the lateral distance of the planned course from a selected object. It can be used with parallel indexing to provide a safe 'channel' when the ship needs to move from the charted course line. The following method can be used:

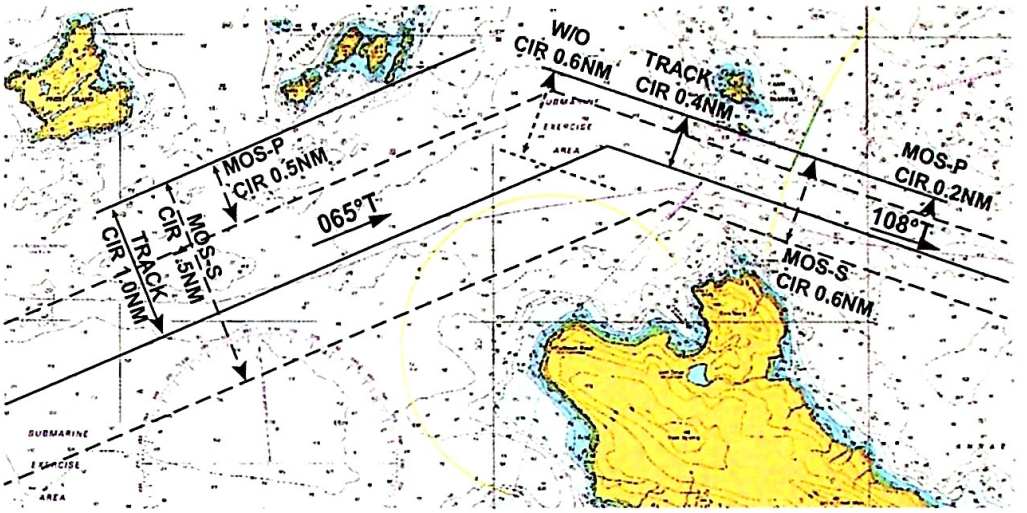
- Identify the hazards and mark the limiting danger lines and courses
- select a suitable charted object (radar conspicuous)
- draw a line on the chart parallel to the planned course on the closest edge of the selected object
- mark maximum margins of safety on either side, or on the side with adjacent dangers
- measure the perpendicular distance from the track to this line (this distance is the CIR)
- measure distances for the margins of safety.

The margin of safety port distance is treated as a 'not less than' (NLT) distance from the danger and margin of safety starboard as a 'not more than' (NMT) distance from the PI. Mark these three lines on the radar screen as index and margins of safety lines, either electronically or on the plotter using VRM and cursor.



Radar display with track CIR and margins of safety index lines.

By using additional PI lines, alterations can be incorporated and include the use of wheel over positions marked on the chart.



PI lines incorporating the next course line.
Source: British Admiralty Chart 2500

ntegration with ECDIS

Where the radar display is integrated with an ECDIS, the practice of parallel indexing continues to enable the navigator to monitor the ship's position relative to the planned course and, additionally, provides a means of continuously monitoring the positional integrity of the ECDIS system.

Precautions

The use of parallel indexing does not remove the requirement for position fixing at regular intervals, using all appropriate methods available including visual bearings.

Passage Plan		
Vessel:_____ Voyage No:_____ From:_____ Berth:_____ To:_____ Berth:_____ (Name of berth/wharf/anchorage) Draught Fwd: m Aft: m	Prepared by:_____ (Navigating Officer) Date:_____ Approved by:_____ (Master) Date:_____ OOW 1:_____ OOW 2:_____	References: (Publication NP No. / Vol No. / Page No.) Update State: Date:_____ NM No.:_____ Sailing Directions: _____ Ocean Passages for the World:_____ ALRS:_____ ATT:_____ ALLFS:_____ NAVTEX Stations:_____ VHF Channels:_____

Waypoints				Distance and Times						Reference Marks		Fixing	Current Tidal Stream	Remarks
												Frequency		
No.		Course	Speed	Next Waypoint		To Destination		Charts		Parallel Index	Wheel Over	Primary		
Name	Lat / Long	TRUE / (CTS)	Eng Order	Distance	Time	Distance	Time remaining	Nos	Datum	CIR	Bearing x Range	Secondary		
			kts											
			kts											
			kts											

Annex F – Example of Passage Planning Notes

Passage	Milford Haven to Liverpool			
Leg	From Waypoint 6 (53 29.4N 004 52.05W) to Waypoint 7 (53 30.7N 004 24.35W)			
Course	True:	035	Course to steer:	034
Tides and Currents	Time of HW: GMT at:	24/0001 Liverpool	Direction:	228
	% Springs:	78%	Strength:	1.6 kts
Minimum Predicted Height of Tide	1.1 m		Minimum predicted UKC:	30 m
Distance on Leg	12.3 nm			
Times	At start of leg:	0510	At end of leg:	0623
Primary Fixing Method and Marks	Visual/Radar • South Stack Lighthouse (Fl 10 s) (28 m white round tower) (Visual and Radar) • Radio Mast (113) (53 15.55N 004 40.1W) (Visual) • Holyhead Breakwater Light (Fl(3)10 s) (19 m white square stone tower, with black band) (Visual) • Mynydd y Garn monument (168) (53 23.14N 004 32.1W) (Visual) • The Skerries Lighthouse (Fl(2) 15 s) (23 m white round tower with red band) (AIS – MMSI 992351121 and Racon (T)) (Visual and Radar) • North Stack headland (Radar)			
Chart(s)	BA 1977			
Fixing Frequency Minimum	12 mins			
Cross-Checking	GPS and Parallel Indexing			
Parallel Indexing	South Stack Headland (5.32 nm to starboard) Margin of Safety (to remain within traffic lane): 4.32 nm starboard / 6.32 nm port Skerries Lighthouse (3.95 nm to starboard) Margin of Safety (to remain within traffic lane): 2.95 nm starboard / 4.95 nm port			
Safe Water	To Port: In excess of 10 nm		To Starboard: To edge of TSS 1 nm	
Position/ Lining Up	Track approaches and enters to the Skerries TSS. It is positioned in the centre of the NE-bound traffic lane of the TSS. Width of the lane is 2 nm. To port lies the TSS separation zone and to starboard the edge of the TSS.			
Traffic	The port of Holyhead lies 8 nm to starboard. This is a ferry port for Dublin and at the start of Leg 6 it may be busy with crossing ferry traffic, including high speed craft. Traffic in the TSS is expected to follow the traffic lanes. Small craft, sailing vessels and fishing vessels may be encountered both in the approaches to the TSS and in the TSS itself. NOTE: LADEN TANKERS SHOULD AVOID THE AREA BETWEEN THE TSS AND THE COAST. Commercial traffic bound for Liverpool and the ports in Liverpool Bay, fishing vessels and recreational craft following the lane may be encountered. A good lookout using all means available (visual, radar, AIS and VHF radio information) needs to be maintained to watch for unusual craft, recreational and fishing vessels operating in or in the vicinity of the TSS.			
Reporting	There are no reports points on this leg.			
Monitoring	Holyhead Port Control Ch 16 and 14 Holyhead Coastguard on Ch 14 and 67 Weather forecasts on Ch 23 and 86: 0150 / 0450 / 0750 / 1050 / 1350 NAVTEX: Portpatrick (O)			
Bridge Manning and Engine Availability	As per ship's passage plan.			
Contingencies	Anchorage may be found in Holyhead Bay, but laden tankers should not navigate between the TSS and the coast.			
Notes	Sunrise occurs at 0505 GMT.			

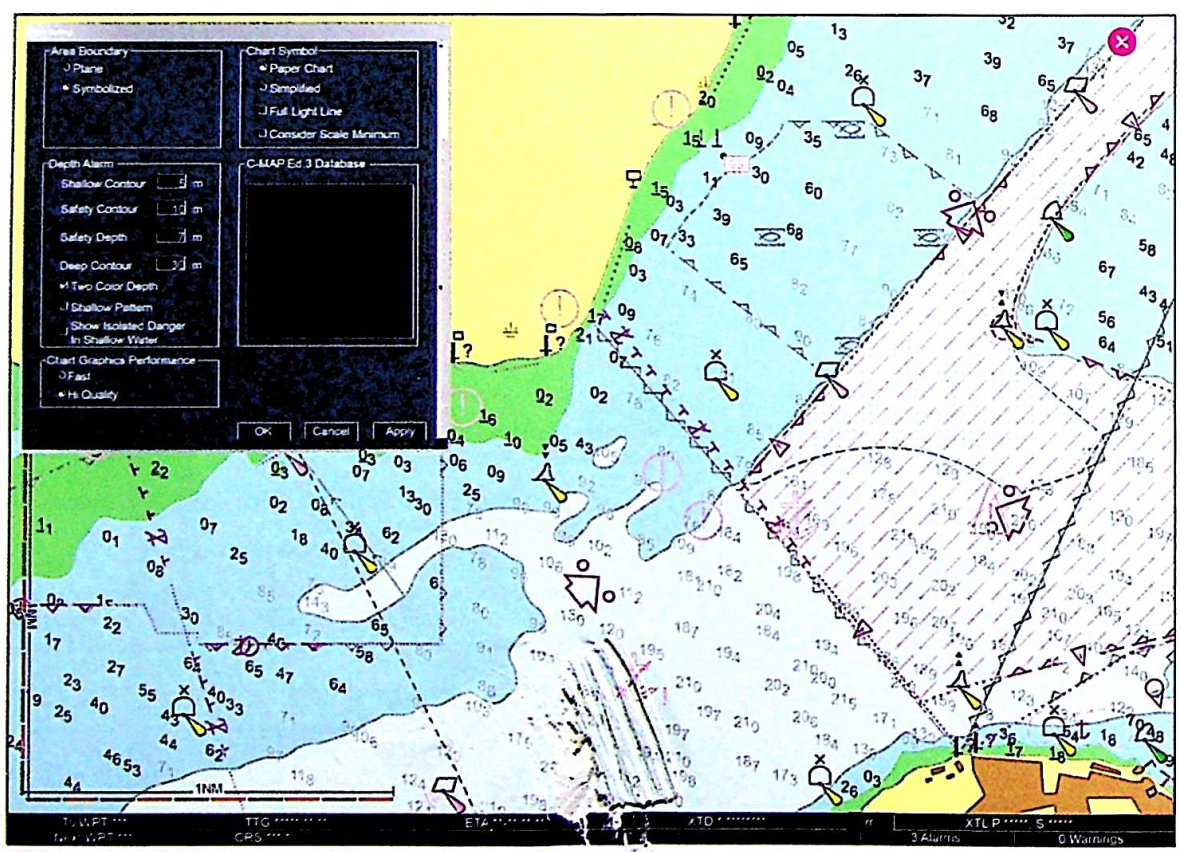
Annex G – Safety Depth and Safety Contours

The value for the safety depth/safety contour should be calculated during the planning phase and entered in the ECDIS by the ECDIS operator.

It is recommended practice that the passage plan incorporates a planned safety depth/safety contour based on the planned draught and required UKC, appropriate for each leg of the passage plan. These planned values may change and having a UKC plan allows the safety depth/safety contour to be reviewed proactively at any stage of the voyage.

Prior to departure, the ECDIS operator must check that the planned safety depth/safety contour remains appropriate. This could be affected by delays in sailing, tidal restrictions, weather conditions or other factors such as a change in draught. Where the safety depth/safety contour has changed, the route must be checked again prior to sailing.

In the absence of any safety contour being specified by the ECDIS operator, the ECDIS will select a 30 m safety contour by default.



Where the calculated safety contour value differs from that displayed, it does not represent the actual limits of safe water. These are represented by the bold soundings, but only if the All/Other Display Mode is selected or if the 'show dangers in shallow water' feature is enabled as there could be hidden dangers inside the safety contour that are not being displayed.

The calculation for safety depth/safety contour is as follows:

Safety contour = Draught + UKC (including Squat + Safety Margin) – HoT

In most circumstances, the value for the safety depth is usually the same value as the safety contour. The purpose of the safety depth is to highlight soundings visually, either in grey for deeper depths or black for shallower depths.

Note: For the safety margin, take into consideration the quality of the ENC (CATZOC) and a minimum UKC safety margin (this should be specified in the SMS).

The ECDIS operator should also ensure sufficient vertical clearance for any area of the voyage where the ship passes under an overhead object, eg cables, bridges.

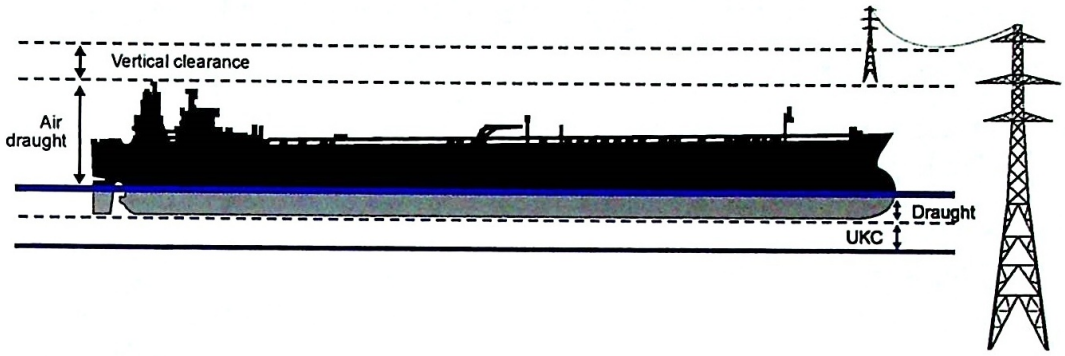
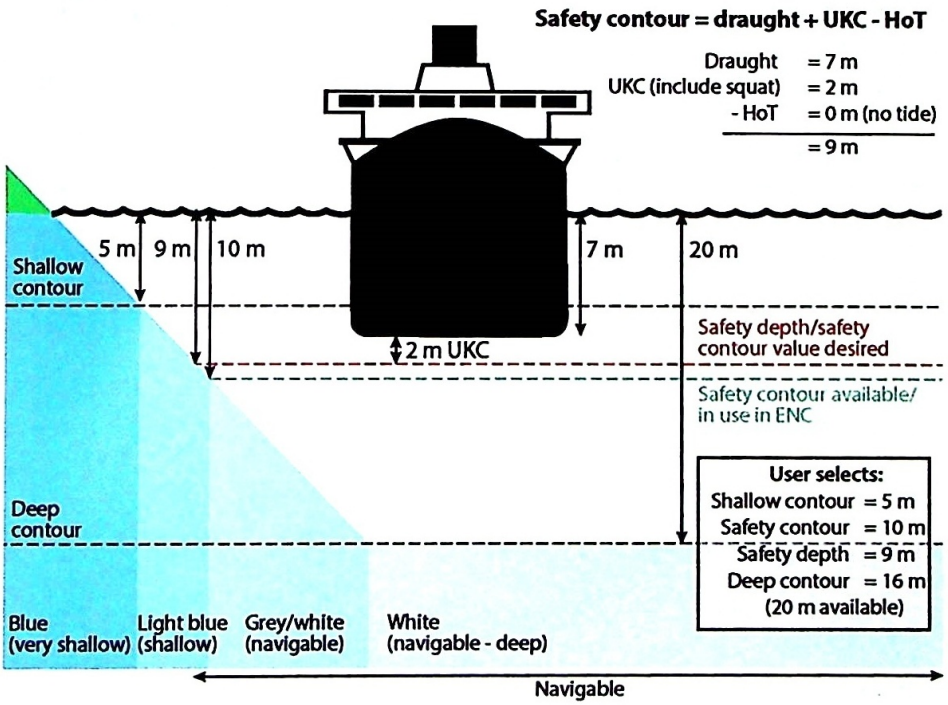


Illustration of UKC and vertical clearance.



Example of the safety contour calculation with reference to the four-colour depth shading.

The contours available for use will vary with each ENC. However, in many cases, the desired safety contour value may not be available within the ENC in use. This is because most ENC cells only have hydrographic data sufficient to generate contours at 5 m intervals.

For example, if a safety contour input value of 8 m is chosen but there is no 8 m depth contour available in the ENC, the next deepest contour will be chosen automatically, eg 10 m.

The displayed safety contour may change during a voyage for the following reasons:

- If the safety contour selected by the ECDIS operator is not available in the ENC, the ECDIS will select the next deepest contour
- when the ship moves onto a new ENC and the safety contour previously in use is no longer available, the ECDIS will select the next deepest contour and trigger an alert.

Soundings equal to or less than the safety depth selected are displayed in bold type when the display of spot sounding depths is turned on, making them more conspicuous than deeper soundings. This is important because the safety depth value is intended as an aid when no appropriate safety contour is available in the ENC.

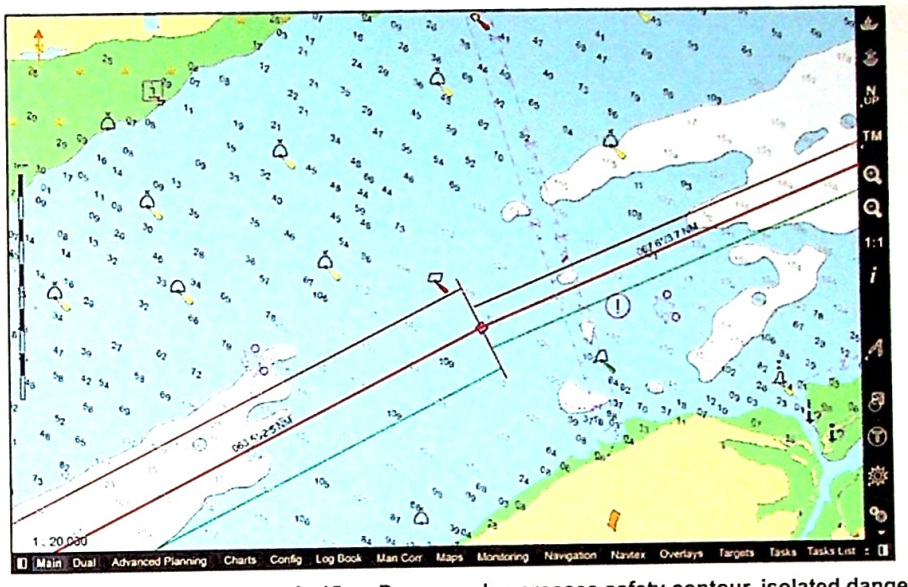
Where the safety contour defaults to a value deeper than that specified by the ECDIS operator, the safety contour may not represent the limit of navigable water. In such cases, the ECDIS operator may be forced to navigate in these waters and the limit of navigable water will be represented by the spot sounding depths in bold type. This decision should be thoroughly risk assessed and discussed with the Master. This will particularly affect ships navigating in restricted sea areas.

If the ship must cross the safety contour to continue along the planned route, the following factors should be considered:

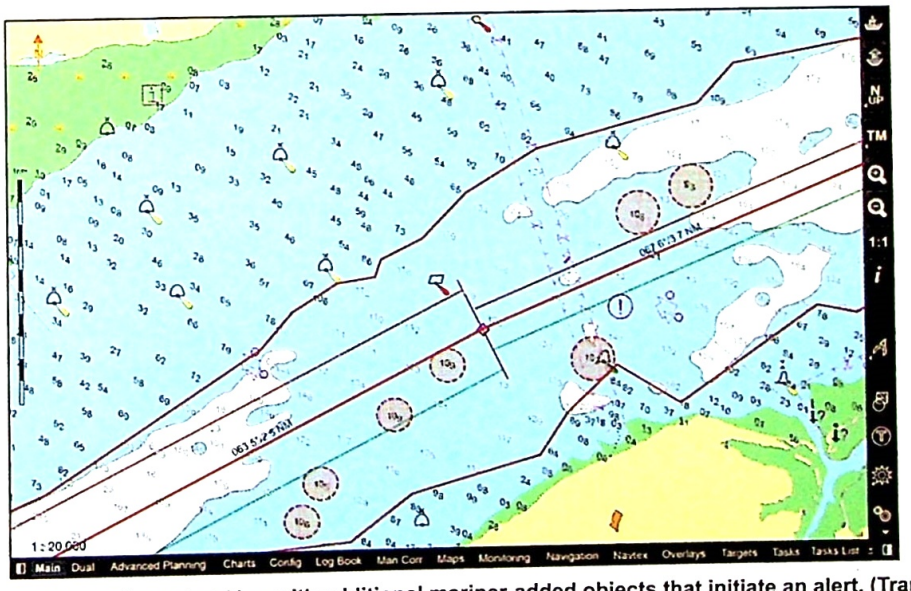
- Confirm that isolated dangers are displayed in shallow waters
- turn on the display of spot sounding depths
- check that suitably scaled ENCs are available
- confirm that CATZOC quality has been assessed.

To mitigate the risks when navigating within the safety contour, ECDIS operators should apply the following techniques:

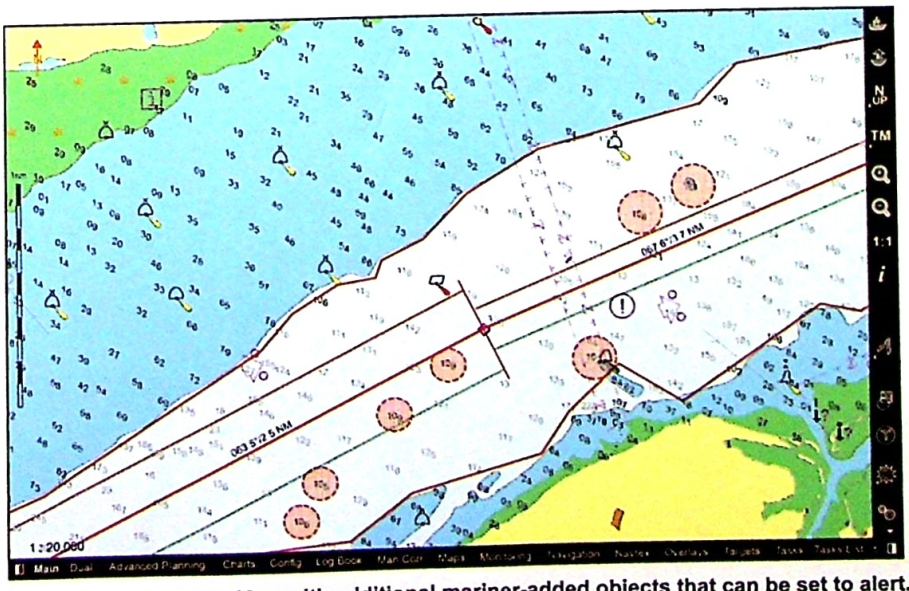
- Switch on display category 'All Other'
- define no-go areas through the use of mariner-added objects
- monitor the echo sounder
- use additional bridge manning
- increase frequency of position cross-checking
- clearly mark in the passage plan whenever the ship will cross the safety contour.



Safety depth value is 11 m and the safety contour is 15 m. Passage plan crosses safety contour, isolated dangers switched off, bold soundings show limit of navigable water. Bold soundings are less than the safety depth, indicating the limit of navigable water. (Transas)



Safety contour value set at 11 m with additional mariner-added objects that initiate an alert. (Transas)



Safety contour value reduced to 10 m with additional mariner-added objects that can be set to alert. (Transas)

It is important to be aware that the main tool to clearly distinguish between safe and unsafe water remains the no-go areas defined by the ECDIS operator.

When navigating within the safety contour, the ECDIS operator must ensure that isolated dangers are displayed.

When monitoring an active route, ECDIS will alert the ECDIS operator prior to crossing the safety contour.

However, during planning, ECDIS may not alert and may only give a minor indication during the route check function. ECDIS operators should not rely solely on the automatic route check function to replace a detailed verification of the route conducted by the navigator and the Master.

Annex H – List of Useful Publications

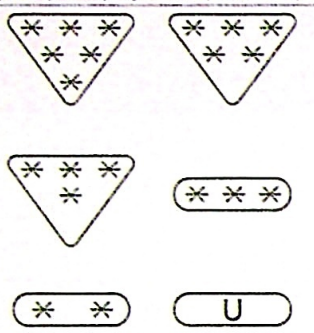
Admiralty Guide to ENC Symbols used in ECDIS (NP5012)
Admiralty Guide to the Practical Use of ENCs (NP231)
Admiralty Manual of Navigation
Annual Summary of Notices to Mariners (NP247)
Anti-Piracy Planning Chart
Bridge Procedures Guide
Distance Tables
ECDIS Procedures Guide (Witherby Publishing)
IALA Buoyage System
IMO Resolution A.893(21) Guidelines for Voyage Planning
List of Light and Fog Signals (NP74)
List of Radio Signals (NP281)
Mariner's Handbook (NP100)
Nautical Almanac
Navigation Advanced for Mates/Masters (Witherby Publishing)
Navigation for Masters (Witherby Publishing)
Norie's Nautical Tables
Ocean Passages for the World (NP136)
Passage Planning Guide: English Channel, Dover Strait and Southern North Sea (Witherby Publishing)
Passage Planning Guide: Straits of Malacca and Singapore (SOMS) (Witherby Publishing)
Passage Planning Guide: Great Barrier Reef and Torres Strait (Witherby Publishing)
Passage Planning Practice (Witherby Publishing)
Passage Planning Principles (Witherby Publishing)
Peril at Sea and Salvage: A Guide for Masters, 5th Edition (ICS/OCIMF)
Routeing Charts
Routeing Guides
Sailing Directions
Ships' Routeing (IMO)
The ECDIS Manual (Witherby Publishing)
Tidal Stream Atlases
Tide Tables
UKHO Maritime Security Charts ('Q Charts')

Annex I – Independent Mariner Selectors

Mandatory

Accuracy

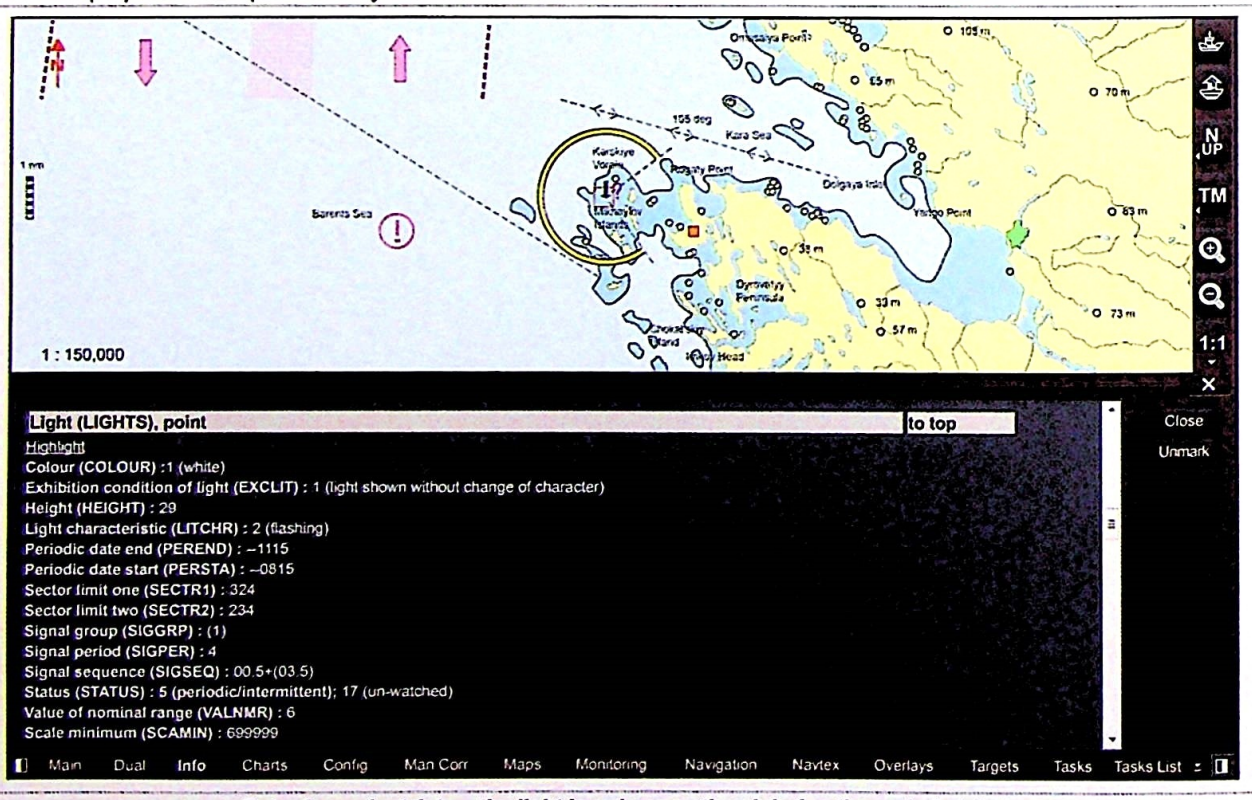
Turns the display of *quality of data (CATZOC)* and *low accuracy* symbols ON or OFF.



CATZOC	Low Accuracy
A CATZOC is an area within which a uniform assessment of the quality of the data exists. This is sometimes referred to as M-quality objects or quality of data on some systems.	*The Low Accuracy symbol identifies low accuracy data. It applies to point and area wrecks, rocks and obstructions and to point land areas.*

Date-dependent

Turns the display of *date-dependent objects* ON or OFF.

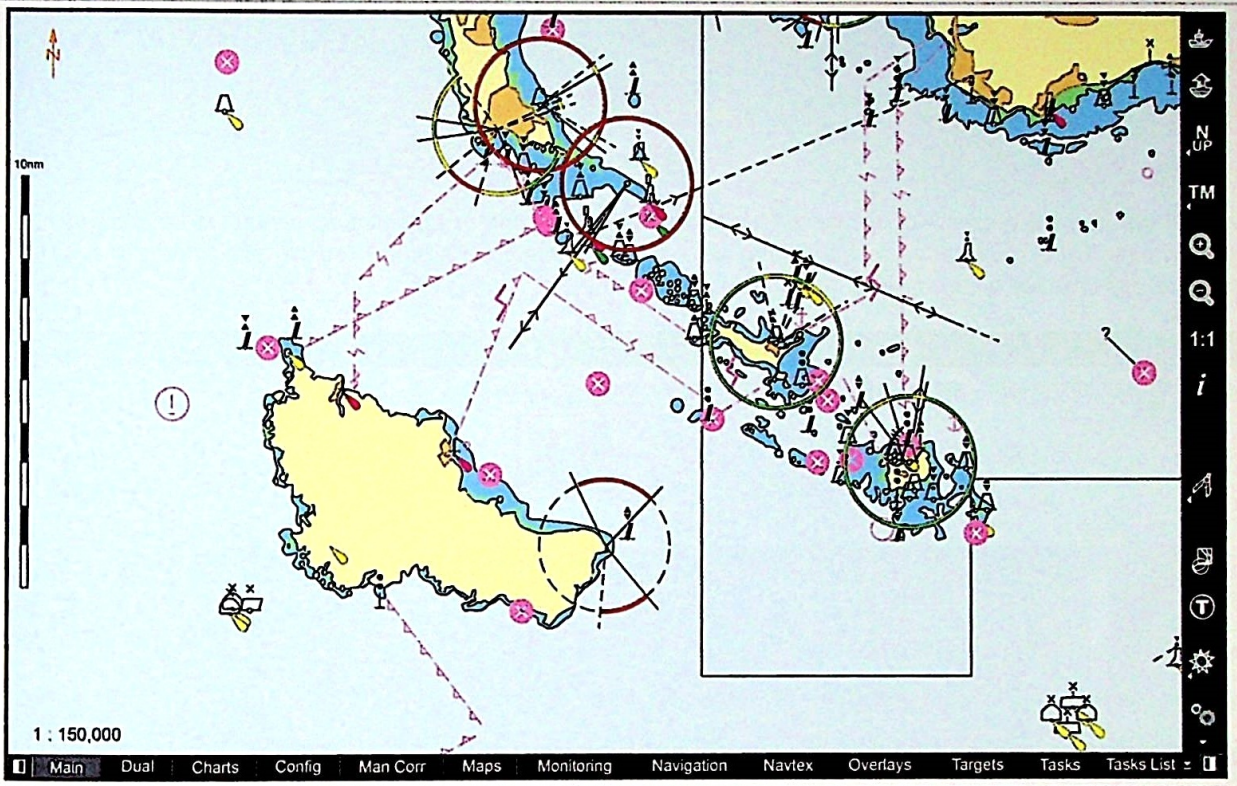


***Date-dependent* data – the light is only operational during the period stated**

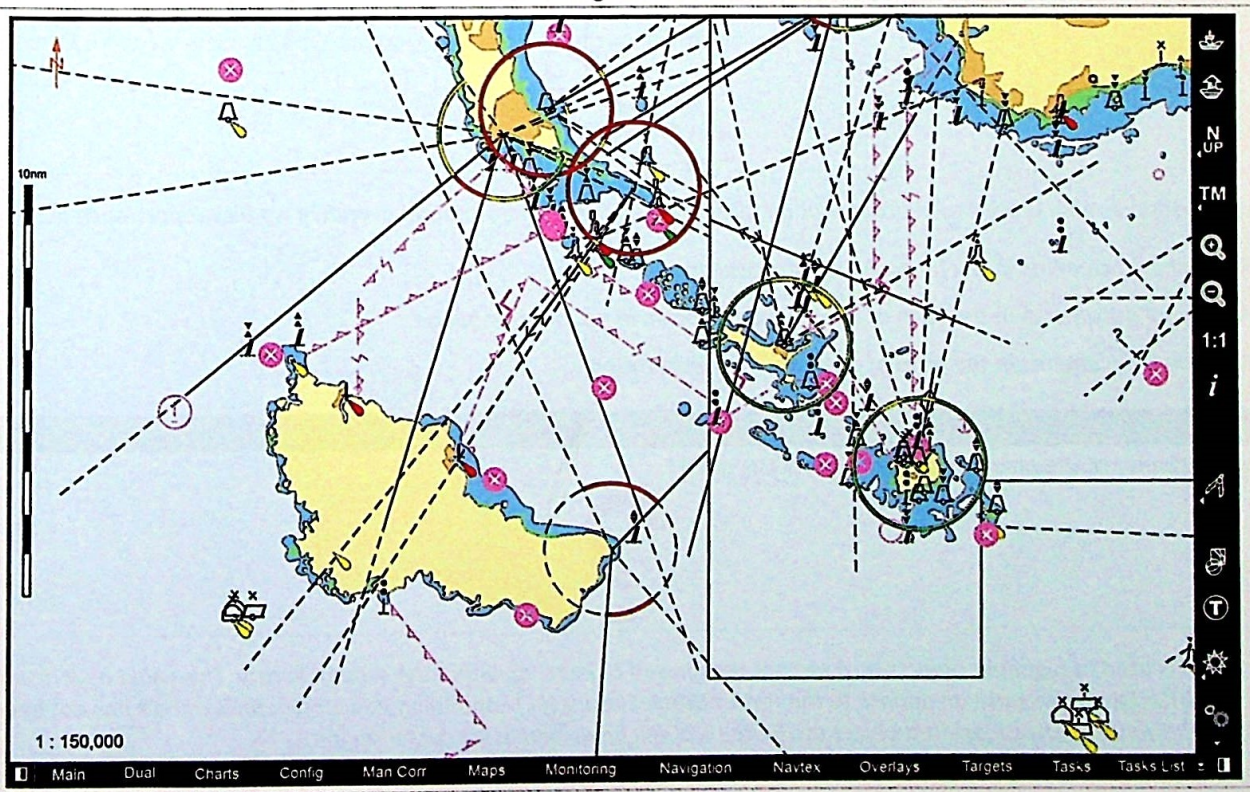
Date-dependent objects are seasonal objects, such as racing buoys, encoded with a period start (PERSTA) and period end (PEREND) attribute allowing them to be displayed over a certain period only, and other objects, such as traffic separation schemes, that use the attributes date start (DATSTA) and date end (DATEND) to indicate their introduction or removal. Given that Hydrographic Offices are required to provide updates or new editions containing alterations at least one month before they come into force, this function allows the navigator to view an object's introduction or removal in advance. The ECDIS operator must be able to select a date or date range to display all date-dependent objects.

Full light lines

Turns the display of *Full Light Sector* lines ON or OFF.

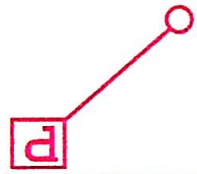


Full light lines off

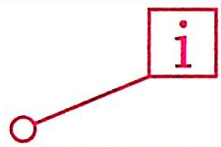


Full light lines on

When turned on, all light sectors are displayed extended to the nominal range of the light.

Highlight date-dependent
Turns the display of the *date-dependent objects* symbol ON or OFF.


This symbol indicates the presence of all objects that have the attribute date start, date end, period start or period end that coincides with the ECDIS operator's selected date range. A permanent indication on the chart display informs the ECDIS operator that the date has been adjusted.

Highlight info
Turns the display of the *information available by cursor pick* symbol ON or OFF.


The information symbol is used to indicate that an object has additional information available via pick report, such as:

- *Additional information (INFORM)*
- *Additional information in national language (NINFOM).*

Highlight document
Turns the display of the *information available by cursor pick* symbol ON or OFF.


The information symbol is used to indicate that an object has additional information available via pick report, such as:

- *Additional documents in the form of a textual description*
- *Additional documents in the form of a textual description in national language*
- *Additional documents in the form of a pictorial representation.*

Unknown
Turns the display of the *unknown object* symbol ON or OFF.


This symbol is used to highlight objects that are not recognised as existing within the symbol library. This could be a result of using non-IHO data or because an update to the Presentation Library (PL) containing new or deleted symbols has not been installed. The value of any associated object attributes will still be available via cursor enquiry.

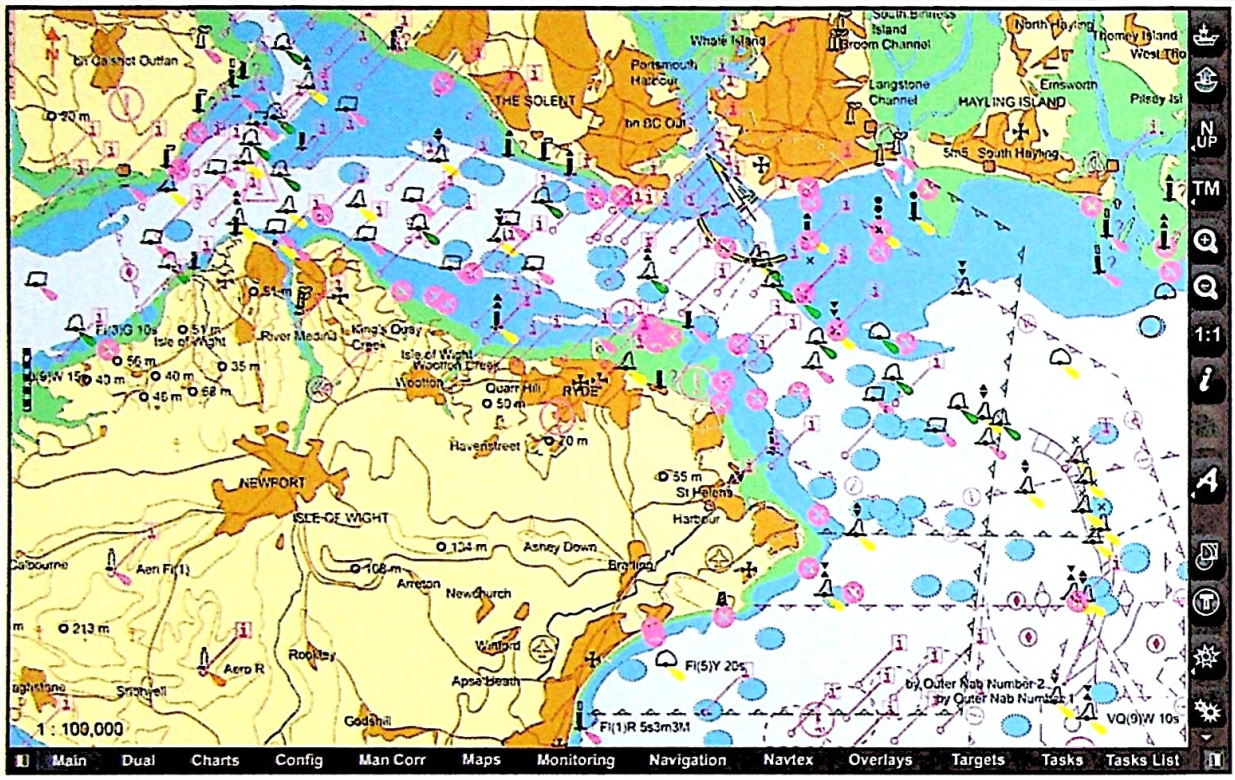
Update review

Turns the *highlighting of the latest corrections* ON or OFF.

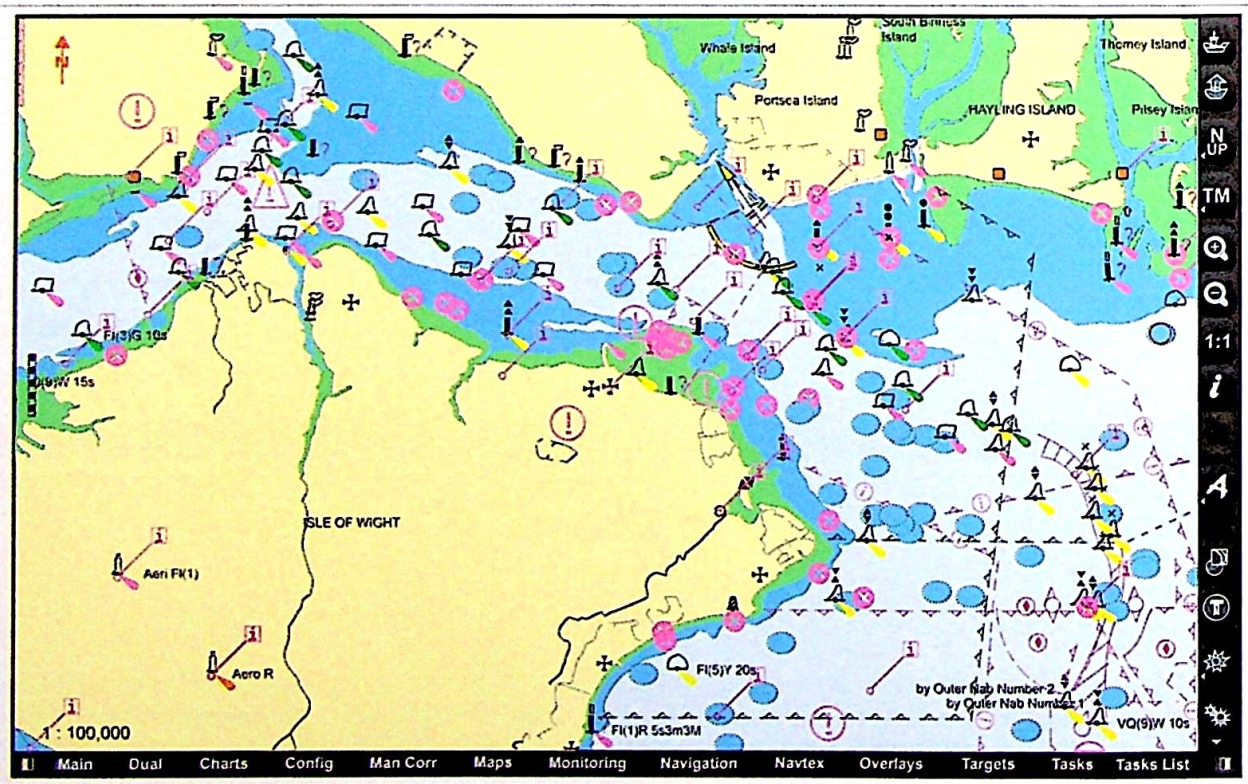
This turns on colour highlighting to show corrections from the latest accepted update. Note that a deleted feature will only appear on the display when its IMO category and viewing group are displayed.

Scale min (SCAMIN)

Turns the display of *SCAMIN* ON or OFF.



SCAMIN off

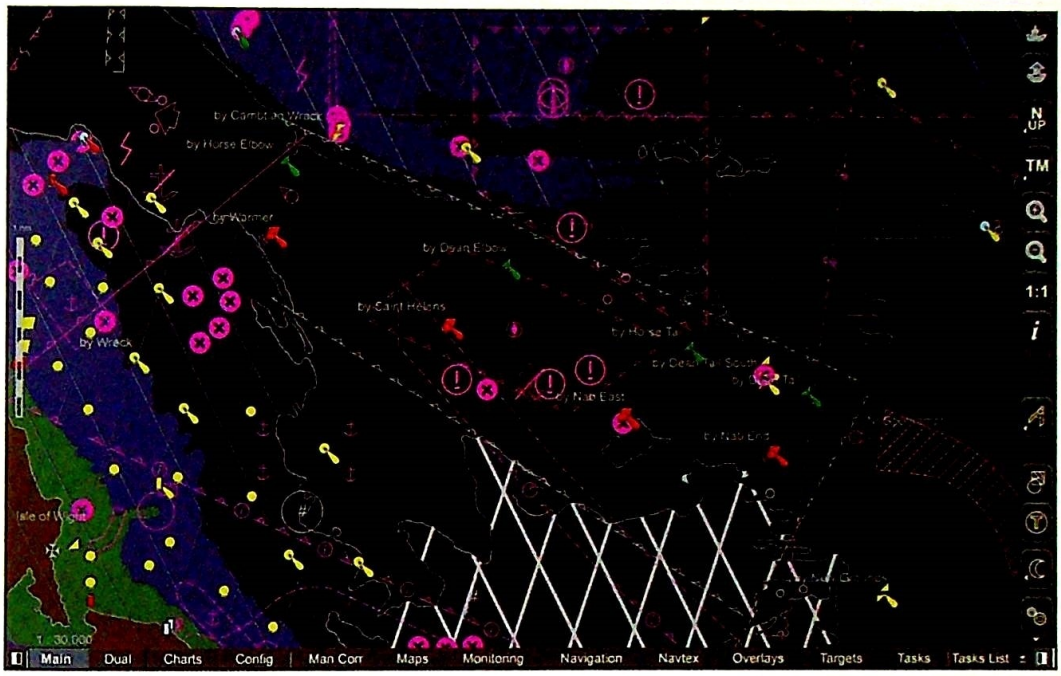


SCAMIN on

A SCAMIN value attributed to an object specifies the display scale at which it must be drawn. For example, an object with a SCAMIN value of 50,000, indicating a scale of 1:50,000, must not be drawn on an ECDIS display scale of 1:60,000. This reduces clutter on the ECDIS display. However, SCAMIN is not universally applied by Hydrographic Offices in the same way and so ECDIS operators require the ability to turn the SCAMIN attribute off in order that all objects in the chart display can be viewed.

Shallow water pattern

Turns the display of the *shallow water pattern* ON or OFF.

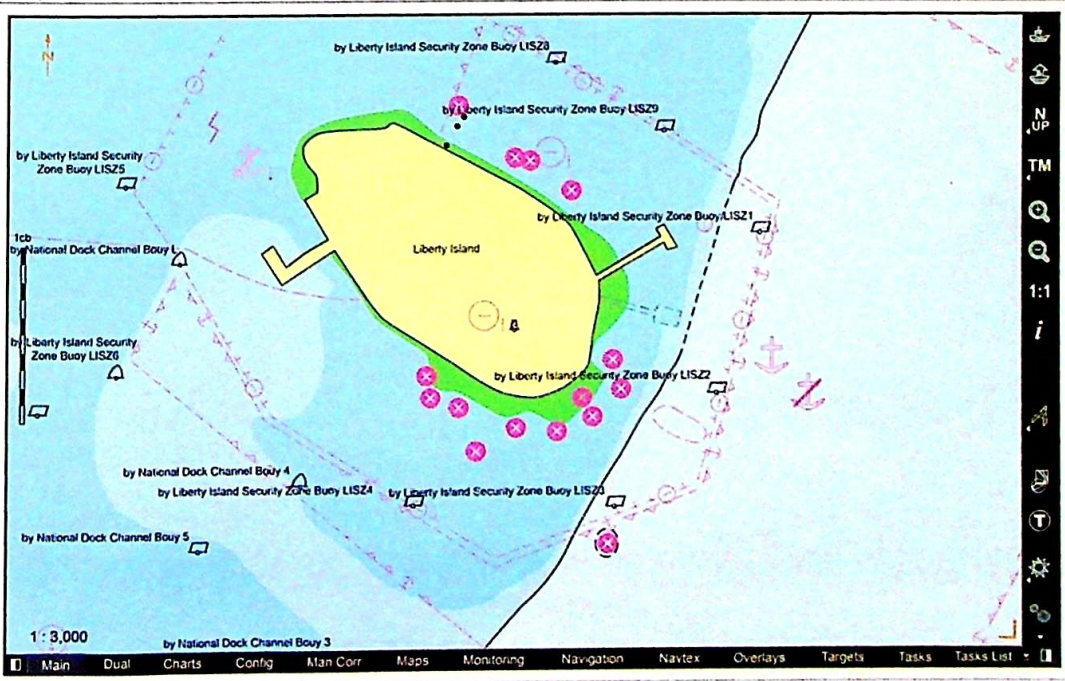


The shallow water pattern is a faint diamond pattern that covers areas of depth less than the safety contour (the faint diamond pattern has been enhanced in the image for the benefit of the reader). It is used to better distinguish shallow water when:

- *Large areas of the ECDIS display are of a depth less than the safety contour*
- *changes in depth shades are difficult to detect in the night palette.*

Shallow water dangers

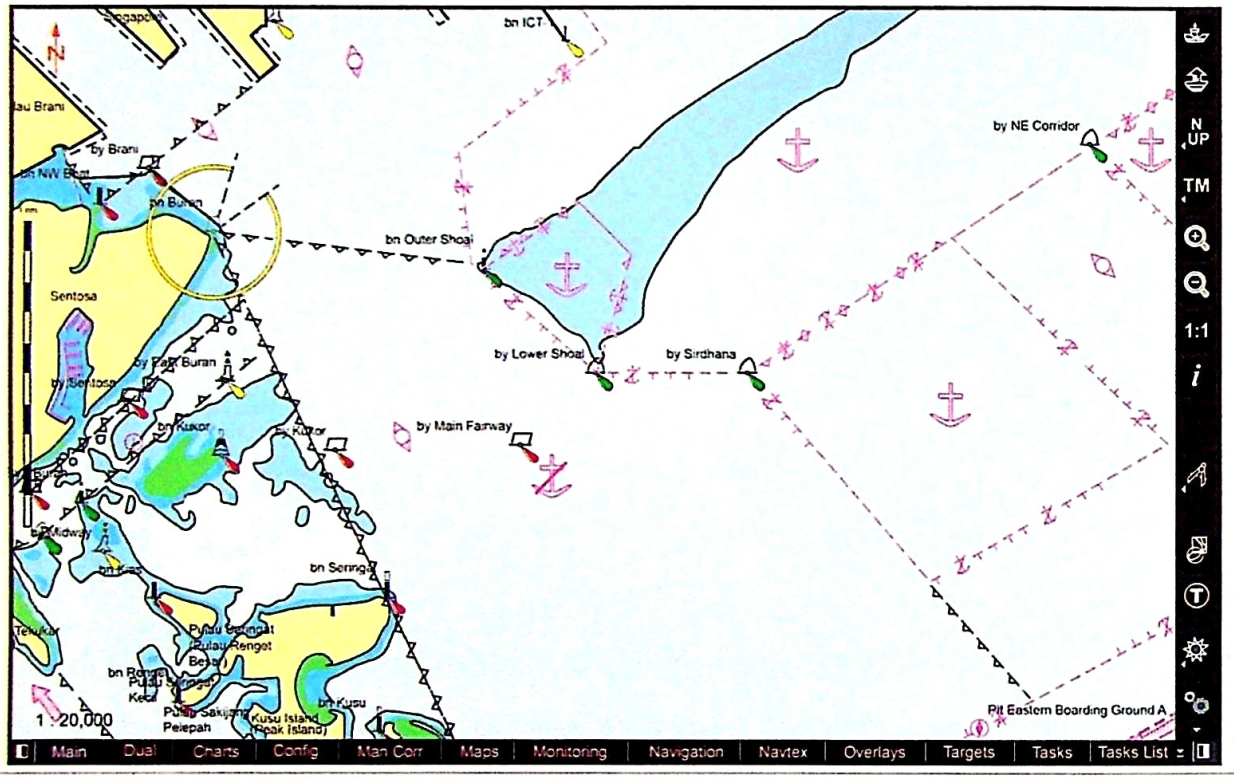
Turns the display of *isolated dangers in shallow water* ON or OFF.



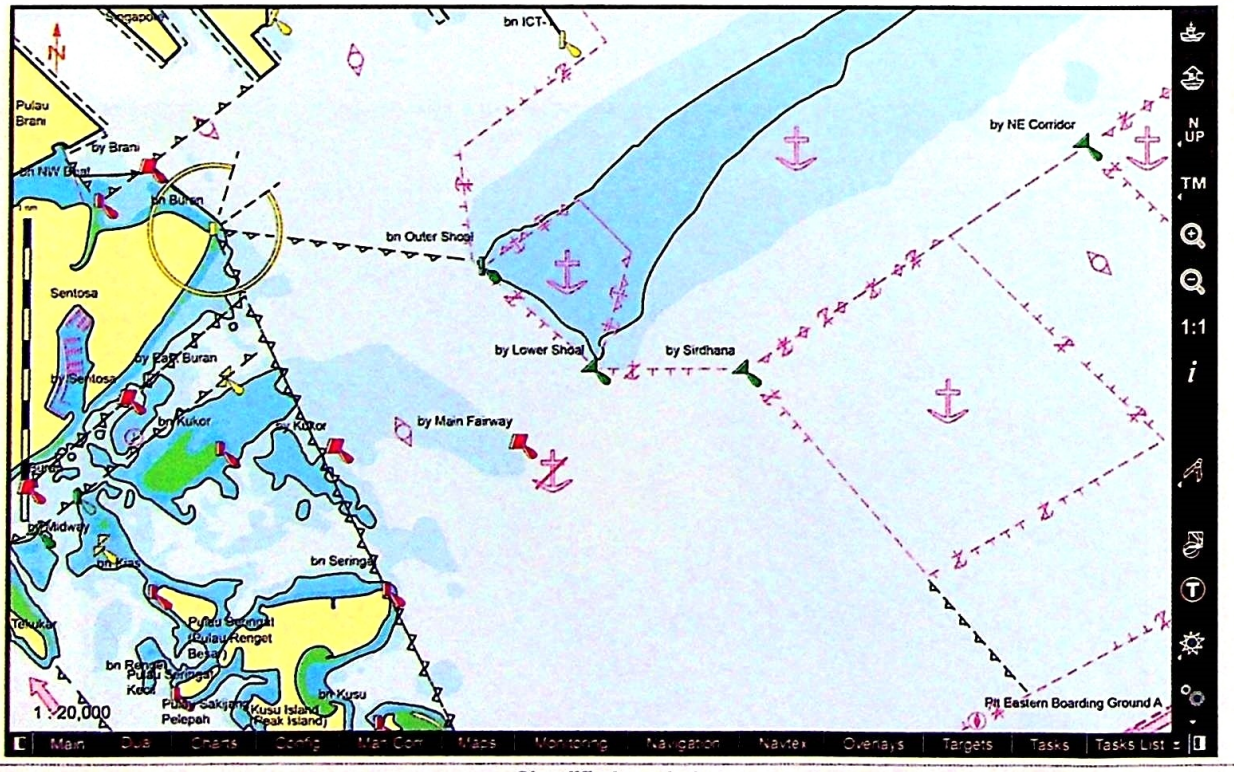
All rocks, wrecks and obstructions that lie in unsafe shallow waters, between the safety contour and the drying line, will be highlighted with the isolated danger symbol. This gives the ECDIS operator, who may be forced by circumstances to navigate in waters shallower than the safety contour (for example, if the safety contour should default to a value much deeper than that preferred by the mariner), the flexibility to do so with or without the isolated danger symbol.

Paper chart/simplified symbols

Switches between the display of *traditional* or *simplified* symbols.



Traditional/paper chart symbols

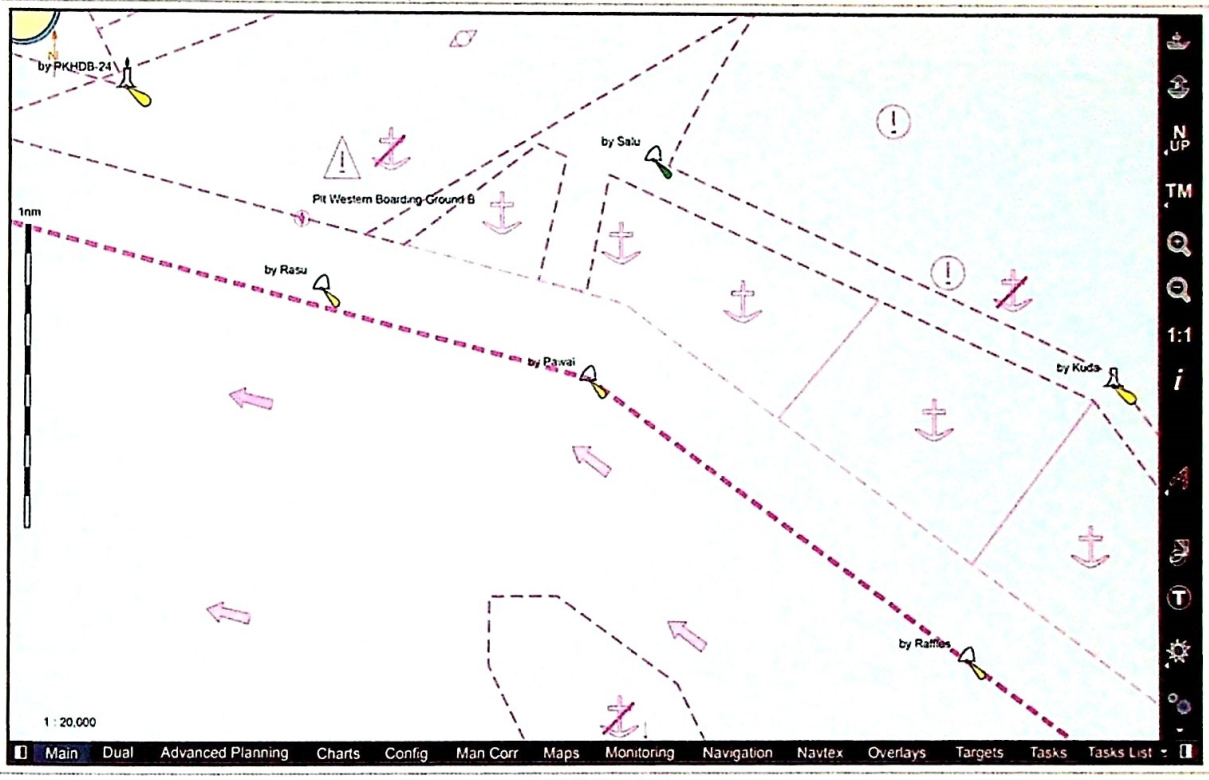


Simplified symbols

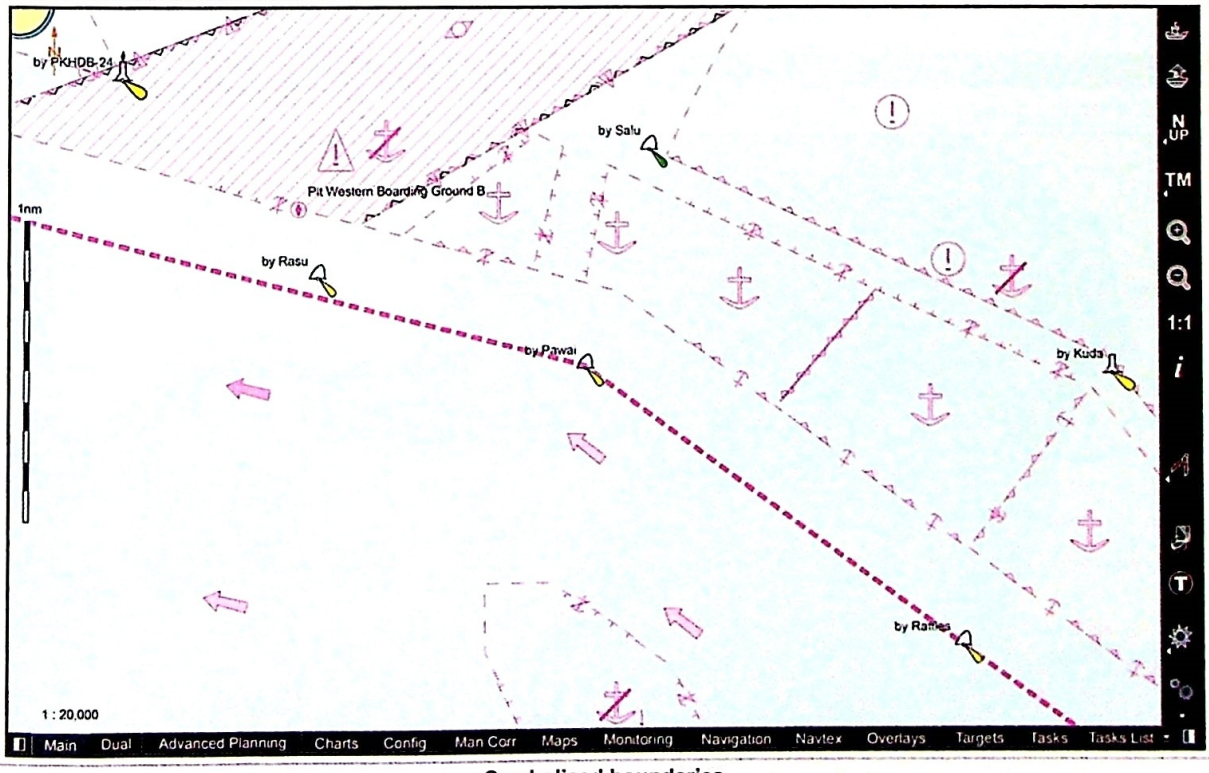
This allows the ECDIS operator to choose between traditional symbols, like those found on paper charts, and simplified symbols. Despite being unfamiliar, the compact nature of simplified buoy and beacon symbols offers greater prominence, particularly on the night display.

Plain/symbolised boundaries

Switches between the display of *plain* and *symbolised* area boundaries.



Plain boundaries



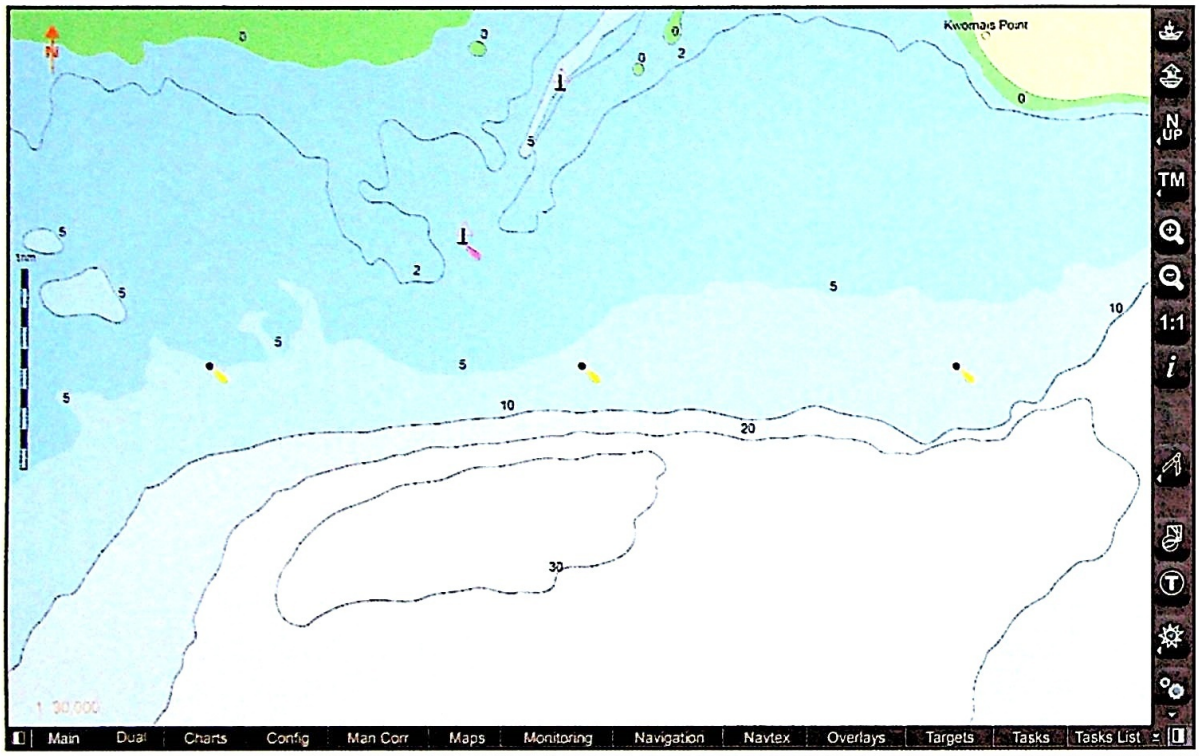
Symbolised boundaries

This allows the ECDIS operator to choose between two line styles for area boundaries, simple (solid, dashed or dotted lines with varying colour and thickness) and complex (repeating line patterns). The simple line style is called plain and is intended for use at small scale to reduce clutter. Complex line styles are known as symbolised and are intended for use at larger scales to help the ECDIS operator identify different types of areas, as well as indicating on which side of the boundary line the area lies.

Optional

Contour label

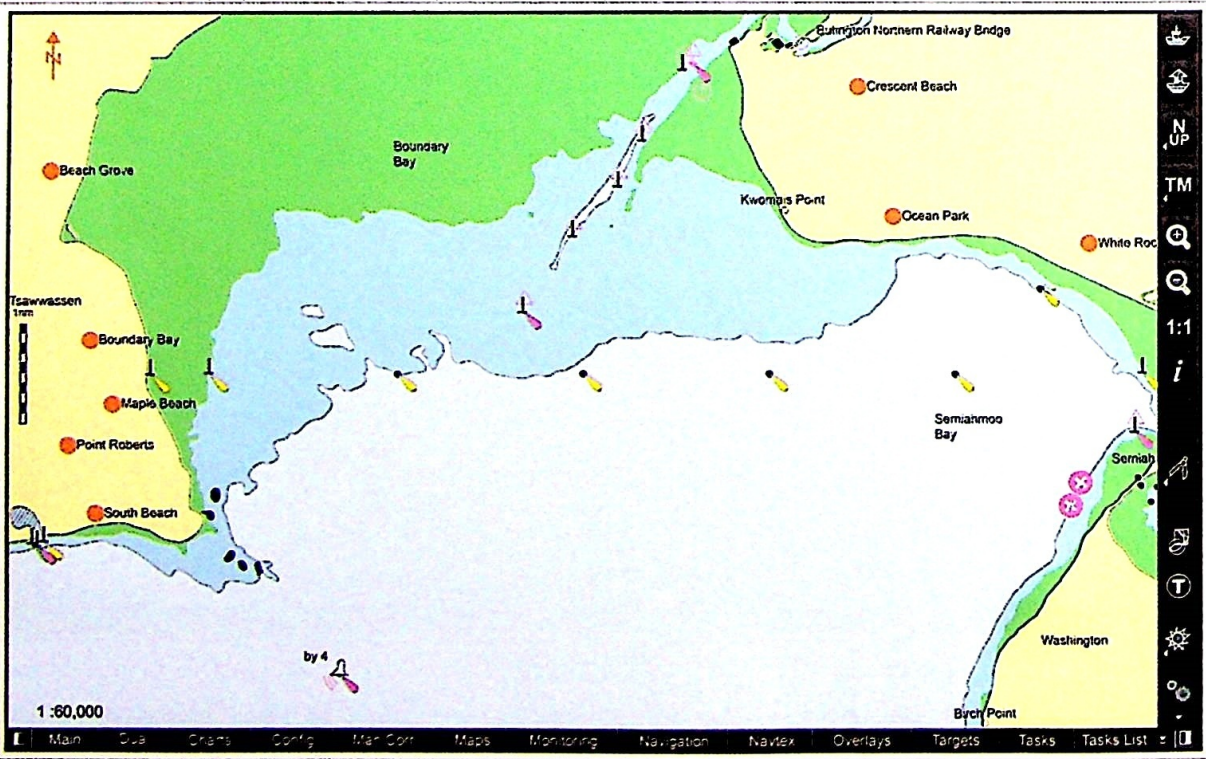
Turns the display of *contour labels* ON or OFF.



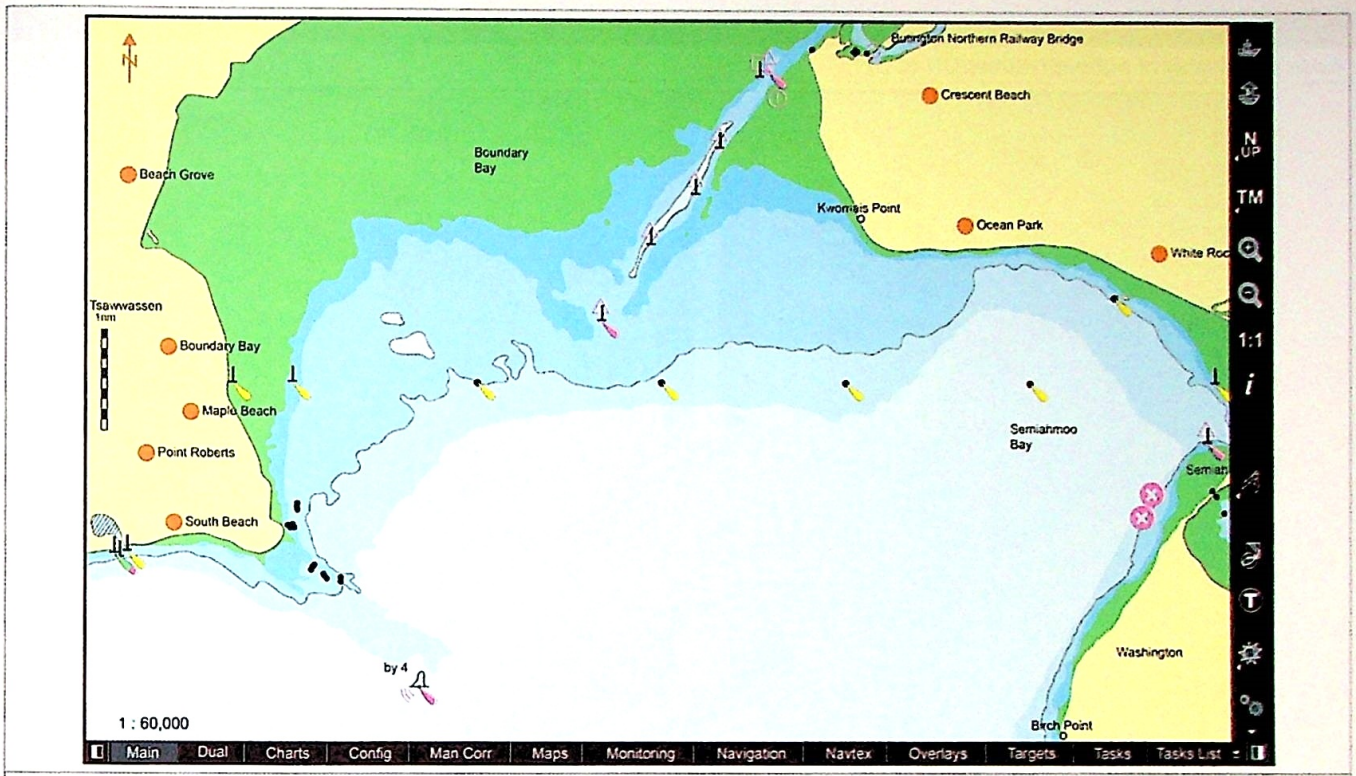
Turns on *contour labels*, including the safety contour.

Four shades

Switches between the display of *two-colour depth shades* and *four-colour depth shades*.



Two-colour depth shades



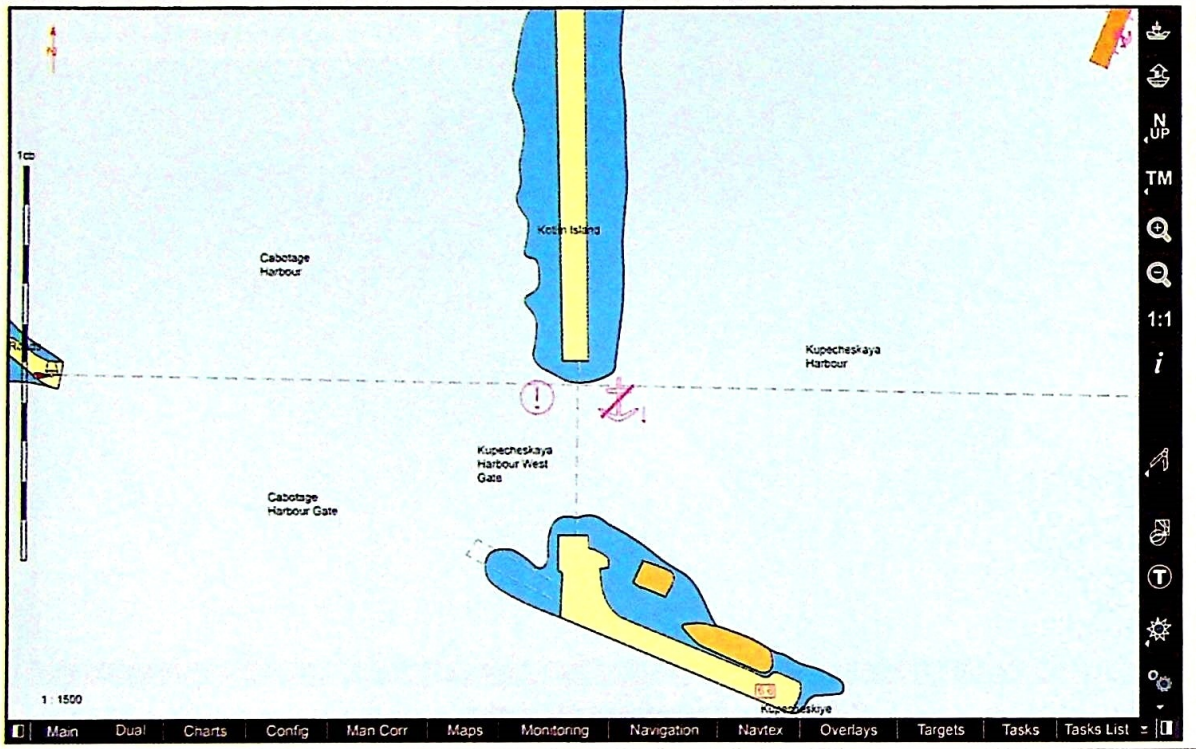
Four-colour depth shades

This provides the ECDIS operator with the option of selecting a deep contour and a shallow contour from among the contours in the ENC and establishing the following five depth zones:

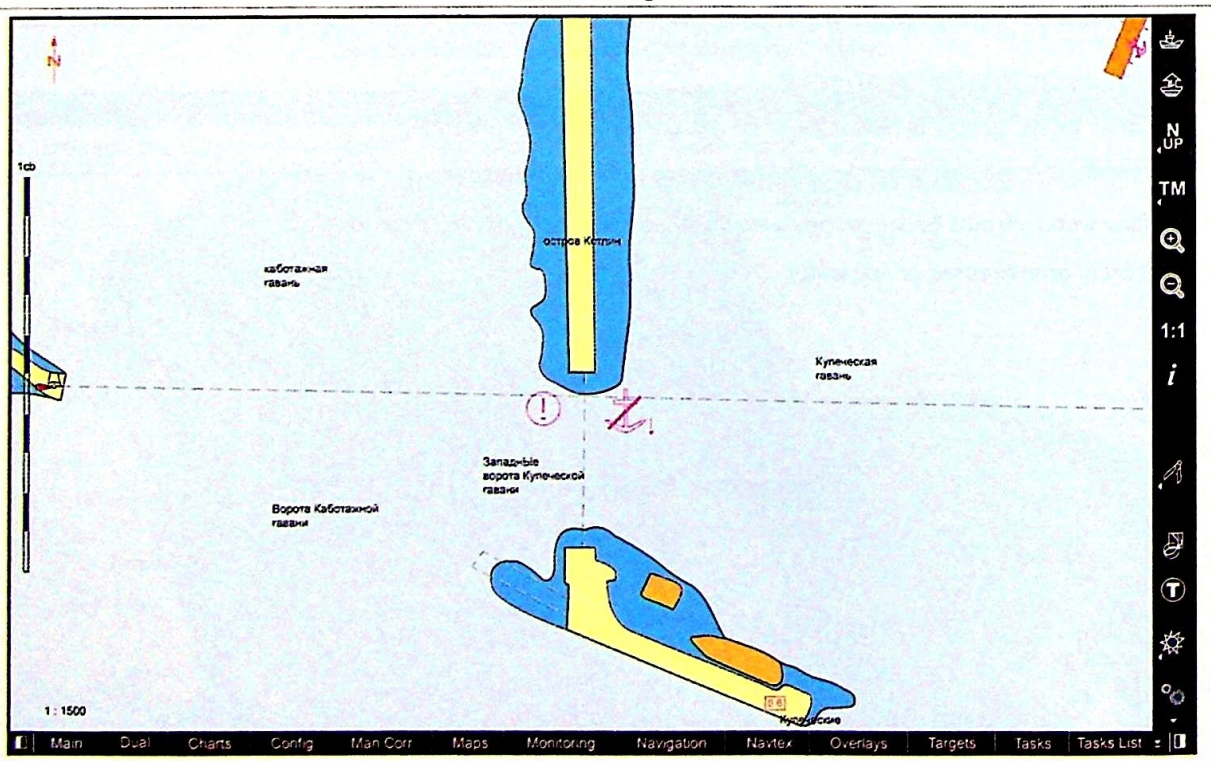
- *Deep water: deeper than the deep contour*
- *medium-deep water: depths between the deep contour and the safety contour*
- *medium-shallow: depths between the safety contour and the shallow contour*
- *very shallow water: depths between the shallow contour and the zero metre contour*
- *intertidal area: area exposed at low water.*

National language

Turns the display of *national names* ON or OFF.



Names in English

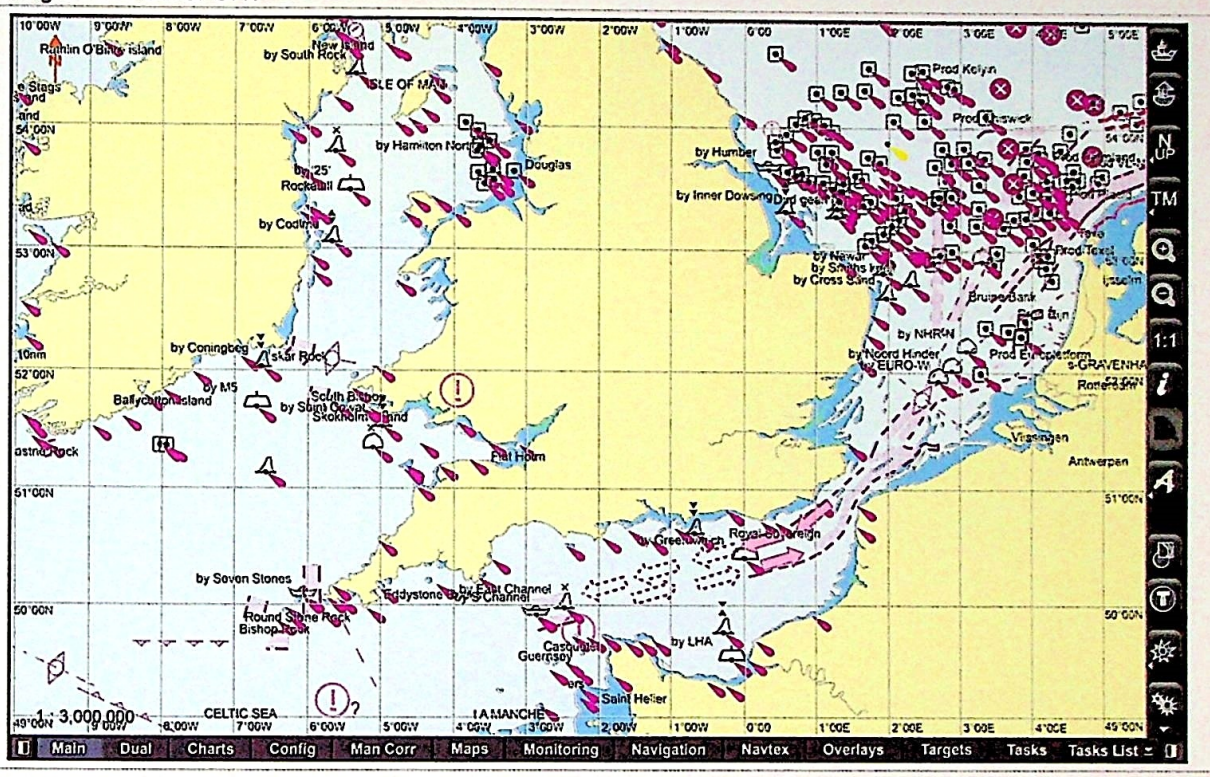


Names in national language

Switches the display of object names between English and the national language. National language information is not covered by the IMO PS, but it is strongly recommended that ECDIS manufacturers support all text formats contained in the national language attributes and files.

Graticule

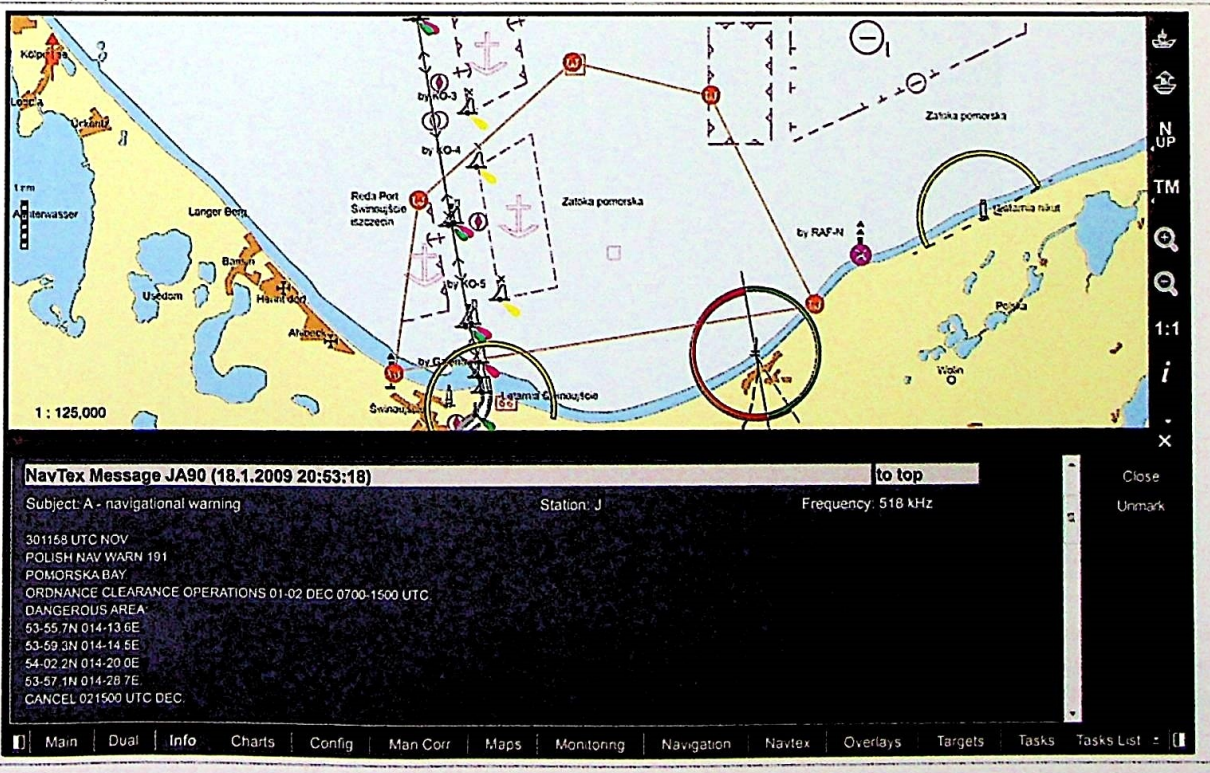
Turns the *graticule* ON or OFF.



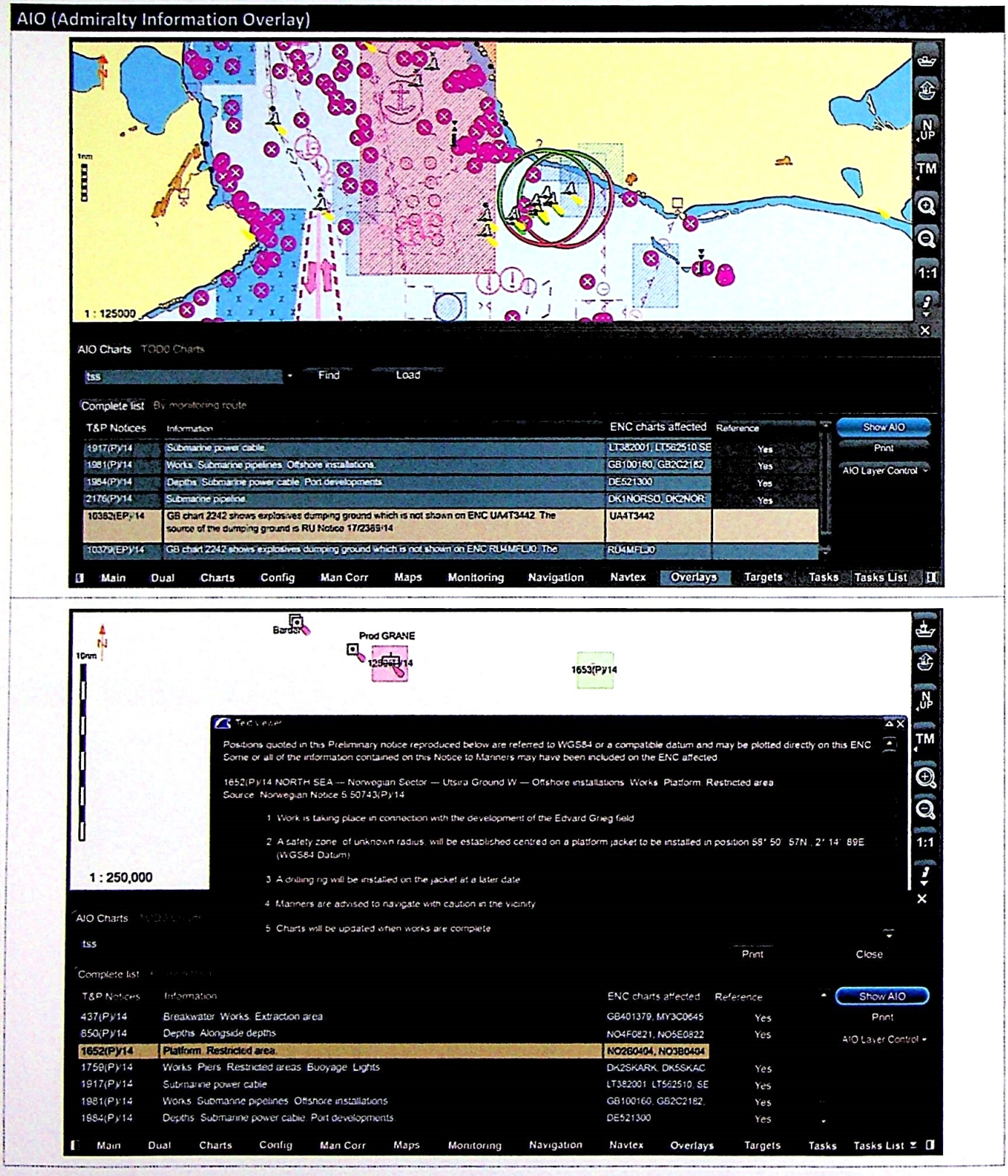
Displays the latitude and longitude grid.

NAVTEX

Turns the display of *NAVTEX* data ON or OFF.



Displays points, lines and areas from NAVTEX, if integrated. This can be shown within the area in the orange boundary.



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