

Deck Yacht Modules

Contents

General Ship Knowledge (OOW Yachts).....	page 1
Navigation & Radar (OOW Yachts)	page 10
Business & Law (Master Yachts)	page 22
Navigation, RADAR & ARPA Simulator (Master Yachts)	page 33
Seamanship & Meteorology (Master Yachts)	page 41
Stability (Master Yachts)	page 49

General Ship Knowledge (OOW Yachts)

Duration

The course must take place over 5 days or 30 hours of formal instruction.

Contents

The course is divided into four sections.

- Ship Construction
- Stability
- Meteorology
- Seamanship

Assessment

Assessment will be by a written 2.5 hour examination of seven questions. The pass mark will be 60%.

Topic 1 - Ship Construction

1. Understands ship construction terminology

a) Explains and illustrates the following terms: forward perpendicular, after perpendicular, length between perpendiculars, length overall, amidships, beam, depth, draught, freeboard, camber, sheer, flare, CL (Centre line) and transverse cross section

b) States that gross tonnage (GT) is a measure of the internal volume of the ship and net tonnage is obtained by making deductions from GT

c) Explains the difference between measurement tonnage and displacement

2 Distinguishes between longitudinal, transverse and local stresses due to static and dynamic loading

a) Explains the causes of longitudinal stresses with reference to hogging and sagging

b) Explains the effects of dynamic stresses with reference to wave action and loading.

c) Explains the hull stresses caused by a sailing boat's mast and rigging and the stresses and loads present in the rig

d) Explains how local stresses arise due to panting, pounding, vibration, discontinuities at hull openings and local loading

3. Understands methods of yacht construction

a) Is aware that the bottom, side shell and upper deck structure are important strength members

b) Explains the methods of construction employed to resist the stresses in 2a to 2d with reference to transverse, longitudinal and combined systems of framing and local considerations. The importance of continuity of strength

c) Describes and illustrates the following terms: centre girder, side girders, stringers, transverse bulkheads, transverse frames, beams, beam knees, floors, pillars, coamings and insert plates

d) Draws mid section sketches of sail and motor yachts and identifies and explains the function of the principal components given in 3c

e) Discusses the advantages and disadvantages of wood, steel, aluminium alloy, and Fibre Reinforced Plastic (FRP) and other composite systems used in yacht construction

f) Explain common defects found in FRP hull construction

4. Understands plans normally carried on board

- a) Describes the contents of a general arrangement drawing

5. Understands the cause and prevention of chemical and galvanic corrosion

- a) Outlines the process of chemical corrosion (e.g. acids and alkalis)
- b) Describes the process of galvanic corrosion between dissimilar metals by explaining the electro-chemical cell
- c) Identifies areas prone to galvanic corrosion and explains and illustrates methods of joining and attaching dissimilar metals and fittings
- d) Explains the function of a paint system in the prevention of corrosion and the importance of its proper maintenance
- e) Describes the process of preparing steel and aluminium plate for paint application
- f) Outlines the principle of cathodic protection using sacrificial anodes and impressed current systems

6. Understands the functions of classification societies

- a) States the role of the Classification Society

7. Understands load lines, reserve buoyancy and methods of damage control

- a) Defines the terms freeboard deck, superstructure deck, superstructure, assigned freeboard, weathertight and watertight
- b) States the purpose of the Load Line.
- c) Defines FWA and states that the FWA = 1/48th Summer draught
- d) Explains the importance of reserve buoyancy and the necessity for maintaining its integrity
- e) States the items which affect the stability and seaworthiness of the ship with reference to: hatchways and coamings, doorways, side scuttles, skylights, windows, ventilators and exhausts, air pipes, and water freeing arrangements
- f) Discusses the routine maintenance to ensure the efficiency of closing arrangements for the items listed in 7e
- g) Explains the importance of non-return valves on tank vent pipes especially when fitted low down on a vessel
- h) Describes water freeing arrangements, scuppers and freeing ports

8. Understands bilge-pumping systems

- a) Draws a simple bilge pumping diagram
- b) Describes the following components: pump, strum box, mud box, screw down non-return valve, screw down valve, manifold, overboard discharge
- c) Recognises the correct symbols used for the following components: pump, strum box, mud box, screw down non-return valve, screw down valve, manifold and overboard discharge

Topic 2 - Stability

1. Understands basic principles of hydrostatics and related terms

- a) Defines density and relative density and explains the use of the marine hydrometer
- b) States the Law of Flotation
- c) Defines light displacement, load displacement, deadweight, buoyancy, reserve buoyancy
- d) States that Displacement = Underwater volume x density
- e) Calculates the displacement of a box shaped vessel for a given draught and relative density
- f) Is aware of the information given in the hydrostatic data relating to displacement, TPC and KM scales only
- g) Extracts the displacement, TPC and KM from the hydrostatic data for a given mean draught using tabulated format
- h) Calculates the displacement, change in draught and GM from the tabulated hydrostatic data.

2. Understands the concept of initial stability

- a) Defines centre of gravity, centre of buoyancy, transverse metacentre, metacentric height, righting lever and righting moment
- b) Draws a diagram for a vessel in stable equilibrium heeled to a small angle to show the positions and forces through the centre of gravity and centre of buoyancy and explains the creation of the righting lever, righting moment, and transverse metacentre
- c) States that righting moment (RM) = $GZ \times \text{displacement}$

- d) Explains the concept of the metacentric height (GM) as an assessment of initial stability
- e) Describes the motion of stiff and tender vessels and states their advantages and disadvantages
- f) Using a simple diagram, explains the difference between stable, neutral and unstable equilibrium with reference to GM
- g) Describes the effect on GM due to adding, removing and transferring weights including fuel and water
- h) Explains the effect on GM of suspended weights
- i) States that the effect of free surface can be considered as a reduction in GM or a rise in KG and this change is known as the Free Surface Correction

Topic 3 – Meteorology

1. Understanding of Global wind distribution

- a) Draws a diagram showing the general Global pressure distribution
- b) States and explains the practical use of Buys Ballot's Law
- c) Describes, with the aid of a simple sketch, the general pattern of global circulation of wind over the earth's surface
- d) Describes the modifying effect of large landmasses on the general pattern of global circulation of winds.
- e) Describes the conditions associated with the ITCZ, Trade Winds and the Variables
- f) Defines the ITCZ

2. Understands the causes of Local Winds

- a) Describes with the aid of a simple diagram the formation of land and sea breezes.
- b) Describes katabatic winds and the associated dangers to small vessels
- c) Describes how local effects may modify winds caused by pressure systems and the effects on sea conditions.
- d) Determines from a surface analysis chart the strength and direction of the wind.

3. Understands the effects of water vapour in the atmosphere

- a) Defines dew point and relative humidity
- b) Describes the formation of cloud
- c) Describes the formation of advection, frontal and radiation fog

4. Understands the practical use and care of common meteorological instruments

- a) Describes the operation and use of the aneroid barometer
- b) Gives a simple explanation of the function of the barograph. Describes its practical use in forecasting weather conditions
- c) Explains the use of wet and dry bulb thermometers and the practical use of the information obtained

5. Understands the movement and occurrence of tropical revolving storms (TRS).

- a) States the principle areas and times of year when tropical revolving storms can be expected
- b) Describes with the aid of a simple diagram the normal tracks of tropical revolving storms

6. Understands the sources of weather information available to ships

- a) Knowledge of the published sources of information, including The Mariners Handbook, Admiralty List of Radio Signals Vol.3, NP 283 (1 & 2), Routing charts, Admiralty Sailing Directions and Ocean Passages of the World
- b) Knowledge of broadcast sources of information, including weather facsimile, satellite pictures, text messages, NAVTEX and internet
- c) Describes a surface analysis chart and a forecast chart

Topic 4 - Seamanship

1. Understands the principles to be observed in keeping a safe navigational watch

- a) Has a thorough understanding of the International Regulations for Preventing Collisions at Sea (ColRegs)

- b) Demonstrates an understanding of the application of the STCW Code and in particular Chapter VIII
- c) Appreciates the requirement for all crew to be well rested before standing a navigational watch
- d) Is fully aware of the implications of the requirement to keep a proper lookout
- e) Explains the handover procedure when taking over a navigational watch
- f) Describes the Bridge log book entries to be made
- g) States the circumstances when the Master should be called
- h) Explains the actions to be taken when encountering and during a period of restricted visibility
- i) Explains the requirements for keeping a watch on a vessel at anchor

2. Understands the responsibilities of the Officer of the Watch in relation to a Pilot on a vessel under pilotage

- a) States the precautions to be taken on deck when embarking and disembarking a pilot
- b) States the authority and responsibility of the pilot in the conduct of the navigation of the vessel
- c) Understands the responsibilities of the Officer of the Watch and the Master in relation to the pilot and the safe navigation of the vessel

3. Understands the precautions to be taken in preparing a vessel for sea

- a) Explains the importance of the completion of pre-sailing check-lists
- b) Explains the importance of maintaining watertight integrity including the fitting of storm shutters
- c) Explains the requirement to secure heavy or bulky items e.g. tenders, jet-skies and helicopters
- d) Explains the importance of maintaining access to emergency equipment at all times
- e) Is aware of importance of draining swimming pools

4. Understanding of the MARPOL regulations

- a) Understands the general content of the IMO international MARPOL pollution prevention regulations with special reference to oil, garbage and bunkering

- b) Lists the 6 annexes
- c) Demonstrates an appreciation of the serious effect of operational or accidental pollution of the Marine Environment and the need to comply with international and port regulations

5. Understand the provisions of the Code of Safe Working Practices for Merchant Seaman (CoSWP)

- a) Have an outline knowledge of the content of the CoSWP
- b) Understands the precautions to be observed when using lifting equipment
- c) Explains the requirement to use certified chains, shackles, strops and slings
- d) Describes the care, maintenance and records of such equipment,
- e) States the need for retesting of equipment to maintain validity of certificates
- f) Understands the significance of the terms Safe Working Loads and Breaking Strains
- g) Understands the precautions to be observed when engaged in mooring, anchoring and towing operations. Explains the dangers involved and the precautions necessary to prevent injury to personnel
- i) Anchoring:
 - i.1) Explains the precautions necessary for clearing away the anchors for use
 - i.2) Explains the precautions to be taken before letting go the anchor
 - i.3) States the difference between self-stowing and non self-stowing anchor chain
- ii) Mooring:
 - ii.1) Explains the correct use of rope and chain stoppers
 - ii.2) States the dangers of excessive loads on the mooring ropes and the dangers involved should a rope part, with particular reference to snap back zones
 - ii.3) Explains the correct procedure for securing to a mooring buoy
- iii) Towing:
 - iii.1) Understands the precautions to be observed when passing and connecting a towline to another vessel
- h) Understands the precautions to be observed when rigging stages or bosun's chairs aloft or overside

- i) Understands the importance of Risk Assessments and the correct completion of Permits to Work
- j) Understands the precautions to be observed if involved in an Enclosed Space entry

6. Understand selection, care and maintenance of wires and ropes of all types

- a) Explains the correct procedure for inspecting a rope or wire for the effects of damage in order to ascertain its safety
- b) Describes the care of synthetic and natural fibre ropes and in particular the factors that affect strength

7. International code of Signals

- a) Understands the international distress signals and Appendix IV of the International Regulations for Preventing Collisions at Sea (ColRegs)
- b) Understands the use of the International Code of Signals

1 SI 1998/1838 The Merchant Shipping (Code of Safe Working Practices for Merchant Seamen) Regulations 1998 or any subsequent amendment

Navigation and Radar (OOW,Yacht)

Duration

This module will be conducted over a minimum period of 15 days.

Content

The module will consist of sections on the Collision Regulations, chart work, Buoyage, Electronic Navigation Aids, ECDIS, AIS, Radar and ARPA.

Examination and Assessment

Navigational theory and radar plotting will be covered in the first two weeks of the course, concluding with a written examination: this examination may also cover topics previously covered in the RYA Yachtmaster syllabus.

Additionally, in course assessment and examination will include demonstrating competence in:-

Basic Chartwork and position fixing, including:-

- Running fix with tides and leeway;
- Compass bearings and conversion from compass to true bearings;
- Horizontal angles;
- Clearing bearings and transits.

Operation and setting up of Electronic Navigation Aids including:-

- GPS;
- Loran C;
- ECDIS;
- Echo Sounders and Logs;
- Radar;
- Knowledge of chart symbols and abbreviations;
- The IALA system of buoyage both A & B and the Cardinal system;

The written examination will consist of a 2½-hour theory paper in two parts. Part 1 will consist of 3 questions – 1 each on Chartwork, Tides and Radar Plotting. Part 2 will consist of 3 questions to test “under pinning knowledge”. Candidates must achieve a minimum of 60% in both parts.

The third week’s training will be conducted in a Radar and Navigation Systems Bridge Simulator where the candidates will be required to demonstrate competence in the use of radar, ARPA, and ECDIS as well as traditional navigational skills and compliance with the IRCPS.

The practical, simulation part of the course will occupy the third week and be the subject of continuous assessment.

Bridge Simulator Performance Criteria

1. The advantages and disadvantages of different radar and ARPA display modes are clearly understood with respect to target detection and tracking.
2. Appropriate use is made of sea and ground stabilised radar displays selecting appropriate course and speed sensor inputs.
3. The correct interpretation of radar information is clearly demonstrated.
4. The correct methods of anti-collision radar plotting of targets are demonstrated.
5. Evidence of the above will be demonstrated by the candidate's appropriate use of modes of display, appropriate length of trails and appropriate control of vectors.
6. Action taken to avoid a close encounter, or collision, with other vessels is in accordance with the International Regulations for Preventing Collisions at Sea:
 - i. Action taken will be made in ample time and will result in passing at a safe distance: if the candidate (in the role of OOW) is in doubt he should inform the Master.
 - ii. When appropriate the candidate will verify collision avoidance manoeuvres, and subsequent return to track, utilising the trial manoeuvre.
7. The candidate (as OOW) when in charge of the navigation will:
 - i. Fix the vessel's position at appropriate intervals by the best means available and check the position by a second means when possible.
 - ii. Monitor and maintain the planned track by Parallel Index when possible.
 - iii. When navigating by ECDIS will:
 - a. maintain the ECDIS display at the appropriate range
 - b. maintain an appropriate look ahead
 - c. maintain appropriate safety settings and safety zone
 - d. display appropriate information and object layers
 - e. recognise and respond to alarms and warnings
 - f. monitor the integrity of the system by cross checking against appropriate PI information, radar overlay or ARPA overlay, as available.
 - iv. Maintain a visual lookout at all times.
 - v. Maintain a VHF listening watch on the appropriate channels.
8. The candidate (as OOW) when in charge of the navigation will:
 - i. Utilise AIS target data to maintain situation awareness.
9. If in any doubt, the candidate (as OOW) will inform the Master.

TOPIC 1 COMPASS WORK.

1. Magnetic Compass.

- 1 Understands basic magnetism;
- 2 Draws a diagram of the earth's magnetic field;
- 3 Understands the difference between Magnetic and geographic poles;
- 4 Understands the Magnetic Meridian;
- 5 Explains the reason for Magnetic Variation;
- 6 Recognises the method of obtaining local magnetic variation from the chart.

2. Understands Deviation of the magnetic compass.

- 1 Understands the reasons for the change in deviation of the magnetic compass with changes in the ships head;

3. Shows correct application of Deviation & Variation to Compass courses & bearings.

- 1 Converts Compass course to True and True to compass;
- 2 Converts Compass bearings to True bearings and True bearings to compass bearings.

4. Understands the need for regular checks of the Compass Error.

- 1 Demonstrates the ability to calculate compass error using transits;
- 2 Applies compass error correctly.

TOPIC 2 GYRO COMPASS.

1. Understands the practical application of the gyro compass.

- Understands the need to regularly check the accuracy of the gyro compass;
- 2 Calculates gyro error using transits;
 - 3 Applies latitude and speed correction correctly.

TOPIC 3 CHARTWORK.

1. Demonstrates ability to interpret information on Admiralty Charts.

1

- Recognises chart symbols and abbreviations;
- 2 Understands the significance of the Notes, Warnings and Chart Datums;

2. Recognises chart projections; gnomonic, Mercator

- 1 Outline knowledge and use of gnomonic projection and port plans
- 2 Awareness of the effect of each projection on the shape of the land mass
- 3 Awareness of the difference between GC and Rhumb lines

3. Position line, circle of position and transferred position lines.

- 1 Understands differences between a position and a position line;
- 2 Understands the definition of DR, EP and Fix.
- 3 Plots ship's Dead Reckoning position using Compass and Speed log;
- 4 Plots ship's Estimated Position applying set and drift;
- 5 Plots running fix with tide and leeway.

4. Understands the difference between ground and water track.

5. Fixes position by:

- 1 Compass bearings
- 2 Ranges and bearings
- 3 Dipping distances
- 4 Calculates distance off by vertical angle.

6. Understands the use of Danger Angles and danger circles.

- 1 Calculates the correct danger angle allowing for height of tide.

7. Fix ship's position using Echo Sounder.

- 1 Use of line of soundings combined with range or bearing.

8. Introduction to Voyage Planning

- 1 Awareness of the Key Elements
 - Appraisal
 - Execution
 - Monitoring
 - Admiralty List of Radio Signals
 - Planning
- 2 Awareness of sources of information
 - navigational charts (including ECDIS and RCDS),
 - sailing directions,
 - light lists, tide tables,
 - radio navigational warnings and ship routing information
 - ALRS

TOPIC 4 CHART CORRECTING.

1. Understands the importance of up to date charts

- 1 Recognise the latest correction on a chart;
- 2 Understands how to check that a chart is up to date.

2. Understands information contained in the Weekly Notices to Mariners and cumulative lists of chart corrections.

- 1 Demonstrates ability to correct charts accurately;
- 2 Demonstrates ability to correct other publications including ALL, ALRS etc.

TOPIC 5NOTICES TO MARINERS.

1. Understands the importance of up to date information

- 1 Uses NAVTEX and radio to obtain latest information before and during voyage.

2. Understands use and value of T's & P's

3. Awareness of the contents of the Annual Summary of N to M

TOPIC 6 TIDES AND TIDAL CALCULATIONS.

1. Tides and calculations

1. Understands basic causes of tides;
2. Differentiates between Spring and Neap tides;
3. Understands relationship between Chart Datum, LATS, MHWS etc;
4. Understands information contained in the Admiralty Tide Tables;
5. Calculates height and range of tide at standard ports;
6. Calculates times and heights of tide at secondary European ports;
7. Calculates height of tide for a given time at standard and secondary ports;
8. Calculates the time for a given height of tide at standard and secondary ports;
9. States the difference in calculation of Pacific tides including secondary ports.

TOPIC 7 INTERNATIONAL REGULATIONS FOR PREVENTION OF COLLISION AT SEA.

1. IRCPS

1 Full Knowledge of the IRCPS.

TOPIC 8 BUOYAGE SYSTEM.

1. Understands IALA system A & B.

TOPIC 9 NAVIGATION AIDS.

1. Hyperbolic Navigation Systems.

Has a knowledge of the basic principle of Loran C;

- Time difference;
- Understands the basic principle of the Loran C system;
- Understands the errors and limitations of the Loran C system;
- Day/night effect;
- Propagation effect;
- Additional secondary factors;

2. Satellite Navigation Systems. (GNSS)

- 1 Understands the principle of satellite navigation systems;
- 2 Aware of the errors in GNSS and their causes;
- 3 Demonstrate an understanding of the terms DOPS etc;
- 4 Aware of the problems associated with datum shifts;
- 5 An outline knowledge of Differential GNSS.

3. Echo Sounders.

- 1 Understand the echo ranging principles;
- 2 Use of echo ranging for depth calculation;~
- 3 Time base measurement;
- 4 Understand the operation of a simple echo sounder;
- 5 Demonstrates the correct setting up procedures:

- Correct range;
- Alarms;
- Correct gain;
- Correct datum (depth below keel);

6 Understands the errors of the Echo sounders;

- Effect of water density;
- Effect of shallow water;

- Aeration;
- Cavitation;
- Multiple returns (second trace);

4. Speed Logs

- 1 Basic knowledge of measuring speed and distance through the water
- 2 Towed and rotating logs
- 3 Doppler logs:
 - knowledge of Doppler shift principle
 - explains the method used in Doppler log to measure ship speed
 - states that speed can be measured in all directions
 - understands the errors of a Doppler log system, and
 - understands the dangers associated with Doppler logs for speed input into true motion radar and ARPA
- 4 Electromagnetic and Impellor logs:
 - knowledge of the principles of operation
 - understand these logs read speed through the water, and
 - understands the errors of these logs

5. Electronic Chart Display and Information Systems.

- 1 Understands the difference between ECS & ECDIS;
- 2 Understands the principal types of electronic charts available;
 - Raster charts;
 - Vector charts;
 - Be aware of S-52 & S-57 IHO performance standards.
 - Be aware of the significance of ENC and their use with ECDIS.
- 3 Basic navigational functions and settings
- 4 Specific functions of route monitoring
- 5 Radar and ARPA and AIS overlays
- 6 Status indications, indicators and alarms
- 7 Integrity monitoring
- 8 Risk of over reliance on ECDIS
- 9 Awareness of updating and correcting ECDIS charts
- 10 Awareness of back up systems in event of ECDIS failure

6. Understands the display of the ship position symbol on ECS;

- 1 DGPS and Loran-C etc;
- 2 Understands the potential errors due to incorrect chart Datum;
- 3 Understands the limitations of accuracy;

TOPIC 10 RADAR

1. Principles of Radar.

- 1 Understands echo ranging principle;
- 2 Understands the principle of the radar beam;
- 3 Describes the function of the scanners and associated aerial system;
- 4 Describes bearing determination by azimuth of scanner;
- 5 Appreciates the effect beam width has on beam distortion and bearing error;
- 6 Describes the formation of side lobes and multiple echoes;
- 7 Appreciates the importance of vertical beam width;
- 8 Understands factors affecting minimum range and discrimination;
 - Pulse Repetition Frequency;
 - Pulse length;
 - Target aspect;
 - Height of Scanner;
- 9 Understands the factors affecting target size and quality;
 - Aspect of target;
 - Material;
- 10 Understands the errors in radar information and identifies false targets;
 - Multiple echoes;
 - Side lobes;
 - Shadow and Blind sectors;
 - Second trace echoes;
 - Meteorological effects.

2. Operation of Radar.

- 1 Understands correct setting up procedure;
- 2 Understands the action of each of the following controls;
 - Brilliance, Gain, Tuning, Pulse length, range;
 - Clutter, sea and rain;
 - Auto clutter controls;
- 3 Understands the use of the heading marker;
 - Understands the dangers of incorrectly aligned heading marker;
 - Uses the heading marker switch correctly during watch keeping;
- 4 Takes ranges and bearings using the electronic bearing line (EBL) and variable range markers;
- 5 Understands the errors in range and bearing;
- 6 Understands the use of the offset electronic range and bearing line (ERBL)
- 7 Understands parallel indexing techniques;
 - Understands the methods of parallel indexing using index lines;
 - Sets up index lines correctly;
- 8 Correctly interprets the information supplied by the Radar;
- 9 Displays and interprets relative and true tracks correctly.

3. Radar Plotting.

- 1 Understands the method of laying out a paper plot;
 - The Plotting Triangle;
 - Understands CPA;
 - TCPA and method of calculating the true target track;
- 2 Interprets plotted information correctly and acts according to IRCPS;
- 3 Understands the effects of alteration of course and/or speed of own ship.
- 4 Demonstrates the effect of an alteration of course and/or speed for a critical target on the CPAs of other ships.

TOPIC 11 ARPA (Note: the term 'ARPA' includes 'Target Tracking' introduced with the revised Performance Standards)

1. IMO Performance Standards for ARPA

1 An appreciation of the performance standards in particular the standards relating to accuracy

2. Factors affecting system performance and accuracy

2 Knowledge of ARPA sensor input parameters – radar, compass and speed inputs and the effects of sensor malfunction on the accuracy of ARPA data.

3 Knowledge of :

i The effects of the limitations of radar range and bearing discrimination and accuracy and the limitations of compass and speed input accuracies on the accuracy of ARPA data

i iFactors which influence vector accuracy

3. Tracking capabilities and limitations

4 Knowledge of :

i. The criteria for the selection of targets by automatic acquisition

ii. The factors leading to the correct choice of targets for manual acquisition

iii. The effects on tracking of lost targets and target fading

iv. The circumstances causing 'target swap' and its effects on displayed data

v. The limits imposed on both types of acquisition in multi-target scenarios

4. Processing delays

5 Knowledge of:

i. The delays inherent in the display of processed ARPA information, particularly on acquisition and re-acquisition or when a tracked target, or own ship, manoeuvres.

5. Operational warnings

6 Appreciation of:

i. The uses, benefits and limitations of ARPA operational warnings and their correct setting, where applicable, to avoid spurious alarms and distraction

6. True and relative vectors and typical graphic representation of target information and danger areas

7 Thorough knowledge of true and relative vectors, derivation of targets' true courses and speeds, including:

i. threat assessment, derivation of predicted closest point of approach and

predicted time to closest point of approach from forward extrapolation of vectors, the use of graphic representation of danger areas

ii. the effects of alteration of course and/or speed of own ship and/or targets on predicted closest point of approach and predicted time to closest point of approach and danger areas

iii. the effects of incorrect vectors and danger areas

iv. the benefits of switching between true and relative vectors

7. Information on past positions of targets being tracked

8 Knowledge of:

i. the derivation of past positions of targets being tracked

ii. recognition of historic data as a means of indicating recent manoeuvring of targets and as a method of checking the validity of the ARPA's tracking

8. Setting up and maintaining displays

9 Ability to demonstrate:

i. the selection of display presentation; stabilised relative motion displays and true motion displays

ii. the correct adjustment of all variable radar display controls for optimum display of data

iii. the selection as appropriate of required speed input

iv. the selection of ARPA tracking controls, manual automatic acquisition, vector/graphic display of data

v. the selection of the time scale of vectors/graphics

vi. the use of exclusion areas when automatic acquisition is utilised

vii. performance checks of radar, compass and speed input sensors and ARPA

9. Obtaining information from the ARPA display

10 Ability to obtain information in both relative and true modes of display, including:

i. the identification of critical echoes

ii the speed and direction of target's relative movement

iii the time to and predicted range at target's closest point of approach

iv the courses and speeds of targets

v detecting changes of targets' courses and speeds and the limitations of such information

vi the effect of changes in own ship's course or speed or both

vii the operation of the trial manoeuvre

viii the use and limitations of the mapping facility

11. Application of the International Regulations for Preventing Collision at Sea

11 Analysis of potential collision situations from displayed information, determination and execution of action to avoid close quarters situations in accordance with the International Regulations for Preventing Collision at Sea.

TOPIC 12 AIS

1. Is aware of AIS concepts:

- i. Understands the objectives of AIS
- ii. Aware of the system concepts of AIS
- iii. Aware of the SOTDMA concept
- iv Describes the major constituents of a shipborne system

2. Understands the elements of AIS data:

- i. Understands the information included in static data
- ii. Understands the information included in dynamic data
- iii. Understands the information included in voyage related data
- iv. Understands the associated transmission intervals for each group of data
- v. Understands the use of safety and security related messages
- vi. Aware of the use of AIS as aids to navigation

3. AIS Ship Installations

- i Understands carriage requirements
- ii Understands the MKD configuration
- iii Understands the radar/ECDIS configuration

4. Use of AIS at Sea

- i Understands the need for checks of own ship input data
- ii Understands the use of AIS data on a radar or ECDIS display
- iii Aware of caution when making decisions based on AIS target data
- iv Understands the advantages and disadvantages of AIS compared with radar

Business and Law (Master Yachts)

Duration

The course must take place over five days or 30 hours of formal instruction. Candidates may be given course notes or a self-study preparation pack in advance.

Content

The syllabus is divided into three sections and 13 topics:

Section 1 - Legal Framework

Topic 1 Legal Framework

Topic 2 Arrival and departure

Topic 3 International Law

Section 2 - Safety Management

Topic 4 Safety certificate and documentation

Topic 5 Prevention of marine pollution

Topic 6 Statutory safety duties

Topic 7 Safety organisation

Topic 8 Seaworthiness and safe manning

Topic 9 Security

Section 3 – Contracts and Marine Insurance

Topic 10 Contracts of Salvage

Topic 11 Contracts of employment

Topic 12 Yacht Charter agreements

Topic 13 Marine insurance

Aims

The aim of this course is to enable Masters to understand:

- Their legal obligations for the safe, secure and pollution free operation of yachts in the context of statutory obligations and civil law
- The different legal jurisdictions that apply in a vessel operating in International waters

•Aspects of English law necessary for the correct administration of a UK-registered commercially or privately operated yacht

Level of Understanding

The level of understanding should be that considered necessary for the safe, secure and lawful operation of a commercially and privately operated yacht. The candidate need not display an academic grasp of the legal principles involved beyond that needed for this purpose on a practical level.

Assessment

Assessment will be by a written 2.5 hour examination of five questions. The pass mark will be 60%.

SECTION 1 LEGAL FRAMEWORK

Topic 1: Legal Framework

- a) Demonstrates an understanding of, in simple terms, the difference between civil and criminal law and can give examples of civil wrongs and criminal offences in the context of yacht operations.
- b) Can describe in general terms the concepts of 'negligence', 'duty of care', (and specifically 'reasonable care') 'non delegable responsibility' and 'vicarious liability'.
- c) Demonstrates an understanding of the basic criminal law procedure and can describe some of those offences giving rise to fines in excess of the statutory maximum on conviction in the Magistrates Court.
- d) Can describe the role of the MCA and the MAIB and recognise their separate functions.
- e) Demonstrates an understanding of the importance of the Merchant Shipping Acts, Statutory Instruments (SIs), Merchant Shipping Notices (MSNs), Marine Guidance Notes (MGNs), Marine Information Notes (MINs) and Codes of Practice and, in particular, The Large Commercial Yacht Code (LY2) (or as amended) and the role of the MCA within the structure of the UK marine administration
- f) Demonstrates an understanding of the role of the Official Logbook (OLB) and is able to:
 - i. state which yachts must keep an OLB,
 - ii. state the rules governing the recording of information, including the practice of annexing documents / information,
 - iii. state with reference to yachts, when this record must start and when it must be transferred to the Registrar at Cardiff,

- iv. state, given the considerable detail of the information to be recorded, the need to have a copy of the Official Log Book regulations for reference when making entries,
- v. demonstrate a working knowledge of the information to be recorded in the Official Log Book relevant to the operational management of a yacht and its crew and,
- vi. state the nature of the entries to be made in the narrative section of the Official Log Book.

Topic 2: Arrival and departure

- a) Demonstrates an understanding of the documentation required for arrival in port. e.g. Customs Declaration, Crew List, Clearance Documents.
- b) Demonstrates an understanding of the circumstances giving rise to a mandatory health report, and the procedure to be followed before arrival, on arrival and until health clearance is obtained.
- c) Demonstrates an understanding of the role of the International Maritime Declaration of Health.

Topic 3: International Law

- a) Can define territorial waters, inland waters and high seas as defined in UNCLOS.
- b) Can describe what is meant by 'freedom of the high seas'.
- c) Demonstrates an understanding of the rights and obligations of Flag State and Port State.
- d) Demonstrates an understanding of the importance of the geographical position of the yacht, the nationality of the crew and of the flag of the yacht in determining criminal jurisdiction.
- e) Demonstrates an understanding of the way international conventions can be policed, the nature of 'innocent passage' and when this may be denied.
- f) Can describe in general terms the role of Port State Control organisations.
- g) Demonstrates an understanding of the role of the UK Register in Cardiff and how to apply for a Certificate of Registry.
- h) Can distinguish between a United Kingdom registered yacht and a British yacht. Has a general understanding of the relationship between the United Kingdom and the Crown Dependencies and British Overseas Territories with reference to the statutory regulation of British yachts.
- i) Demonstrates an understanding of the contents of the MCA publication "A Master's Guide to the UK Flag – Large Yacht Edition".

SECTION 2 SAFETY MANAGEMENT

Topic 4: Safety Certificates and Documentation

a) Demonstrates an understanding of which vessels are required to comply with The Large Commercial Yacht Code (LY2) and recognises the benefits of complying with LY2.

b) Can describe the certificates listed below that may be issued for compliance with LY2 with regard to;

i). period of validity,

ii). timing of required surveys,

iii). general subject matter of the surveys,

iv). purpose of the issuing authority 'conditions of assignment'(where applicable),

v). consequences of failure to comply with the conditions of LY2,

Certificates

1.International Tonnage certificate for vessels of 24 meters or over.

2.International Load Line certificate for vessels of 24 meters or over.

3.International Safety Construction certificate for vessels of 500 GT or over.

4.International Safety Equipment certificate for vessels of 500 GT or over.

5.International Safety Radio certificate for vessels of 300 GT or over.

6.International Safe Manning certificate for vessels of 500 GT or over.

7.International Oil Pollution Prevention certificate for vessels of 400 GT or over.

8.International Safety Management certificate for vessels of 500 GT or over.

9.International Ship Security certificate for vessels of 500 GT or over.

10.Certificate of Compliance for vessels of 24 metres or over.

11.SOLAS combined safety certificate.

vi) Can summarise the content of any associated documents such as;

.1SOLAS training manual.

.2Load Line conditions of assignment.

- c) Demonstrates an understanding of the requirement to implement a safety management system on vessels of less than 500 GT as contained in Annex 2 of LY2.
- d) Demonstrates an understanding of the difference between a 'pleasure vessel' and a vessel 'engaged in trade' as defined in MSN 1802 (or as amended).
- e) Recognises that UK registered 'private' yachts (pleasure vessels) are subject to minimum safety standards as class XII vessels.
- f) Demonstrates an understanding of requirement for no yacht can carry more than 12 passengers without special dispensation and can define the word 'passenger' in this context.

Topic 5: Prevention of Marine Pollution

- a) Demonstrates an understanding of the principle constraints of the MARPOL convention, specifically:
 - i). that it applies to all yachts and,
 - ii). is able to identify the Annexes in force and the particular pollutants covered by each of these Annexes as relevant to yacht operations and,
 - iii). can state that MARPOL prohibits the discharge of Annex 1 substances into any sea area and,
 - iv). can explain the circumstances in which certain discharges of Annex 1 substances may be permitted and,
 - v). can recognise that all yachts must be constructed and equipped so as to prevent pollution by Annex 1 substances and that certain yachts must carry certificates to prove this and,
 - vi). can identify which yachts must carry an International Oil Pollution Prevention Certificate and a SOPEP and,
 - vii). can state the structure and function of the SOPEP and,
 - viii). can state which yachts must maintain an Oil Record Book in an approved form and describe its content and,
 - ix). can describe an Annex IV substance and,
 - x). can describe an Annex V substance and,
 - xi). can explain the rules governing the disposal of Annex V substances and,
 - xii). can state which yachts must maintain a Garbage Record Book and have a Garbage Management Plan and,

xiii). can describe an Annex VI substance and have a knowledge of certificates to be held and the equipment to be carried.

Topic 6: Statutory Safety Duties

a) Demonstrates an understanding of the duty of the Master to respond to signals of distress, and the circumstances when Master is released from his obligation to respond.

b) Demonstrates an understanding of the Master's statutory obligations following a collision.

c) Demonstrates an understanding of the actions to be taken in the event of a yacht sustaining material damage, with regard to possible consequences for statutory certificates and insurance.

d) Can state the definition of a reportable accident, major injury, serious injury and dangerous occurrence and;

i) can describe the initial report following an accident and the required follow up reports and,

ii) can describe the actions required after each type of incident, including declarations to other responsible authorities and,

iii) can states how the MAIB can respond to such reports,

e) Can state when the master has a duty to report dangers to navigation and can list the six categories and describe the action to be taken.

f) Can distinguish between compulsory and non compulsory pilotage and understands the responsibilities between Master, pilot and owner.

Topic 7: Safety Organisation

a) Demonstrates an understanding of the role of Master, safety officer and safety representative.

b) Can describe the role of the safety committee.

c) Can summarise, in general terms, the duties of employer and employee under the current Merchant Shipping (Health and Safety) Regulations

d) Demonstrates an understanding of, in general terms, the role of and the importance of the ISM Code.

e) Can describe the purpose of risk assessment and how this is applied in a yachting context.

f) Can describe the objectives and content of a Safety Management System.

g) Demonstrates an understanding of the purpose of the Code of Safe Working Practices for Merchant Seamen and describes its use in the management of safety on board a yacht.

h) Can state which yachts must carry copies of the Code of Safe Working Practices and how many copies are required.

Topic 8: Seaworthiness and Safe Manning

a) Demonstrates an understanding of the Master's responsibility to ensure the seaworthiness of the vessel at the commencement of each voyage and the consequences of attempting to proceed to sea in an unsafe and unseaworthy condition.

b) Can show an appreciation of the fact that possession of valid statutory certificates does not, in itself, prove seaworthiness.

c) Demonstrates an understanding of that the concept of 'seaworthiness' can have a much broader definition in the civil courts.

d) Can demonstrate an understanding of the principles by which a vessel may be deemed to be safely manned in accordance with the STCW convention.

e) Can explain the application of United Kingdom manning regulations to a yacht, and the use of the LY21 as an alternative to these regulations.

f) Can demonstrate an understanding of the Maritime Labour Convention 2006 (or as amended) and the Hours of Work legislation as described in MSN 1767 (or as amended).

g) Can state the duties of Master and chief engineer under United Kingdom merchant shipping regulations as they relate to the organising and maintenance of safe navigational and engineering watches.

h) Can explain the use of standing orders as part of the process of safe delegation and supervision of delegated responsibilities and understands the Master's responsibilities to ensure that the navigation bridge is manned by an adequate number of suitably qualified people to deal with prevailing circumstances.

Topic 9: Security

a) Demonstrates an understanding of and can explain the objectives of the ISPS code.

b) Can demonstrate a general understanding of the possible consequences of carrying stowaways and knows the action to be taken to prevent stowaways and action to be taken upon discovery of stowaways.

c) Can demonstrate an awareness of the advice of the MCA concerning the carriage of firearms in British registered vessels and has a knowledge of the recommended

precautions in circumstances where armed robbery or piracy are a threat in the context of the Master's duty of care.

SECTION 3 CONTRACTS AND MARINE INSURANCE

Topic 10: Contracts of Salvage

- a) Demonstrates an understanding, in broad terms, of the definitions contained in the International Convention on Salvage (Articles 13 and 14) including SCOPIC.
- b) Can explain the practical use of Lloyds Open Form of salvage contract, and its advantages to both parties.
- c) Can define and explain the elements of a valid claim for Salvage in Admiralty Law, in the absence of any contractual obligation to pay for the services involved.
- d) Can explain the interpretation of the expression 'a place of safety' as used in Lloyds Open Form of salvage agreement and the need, wherever possible, to agree a 'place of safety'.
- e) Can explain who has the legal right to control the acceptance or rejection of assistance to yachts.
- f) Demonstrates an understanding of the legal definition of the word 'derelict'.
- g) Demonstrates an understanding of the 'Duties of the Salvor' and the 'Duties of the Master/Owner'.
- h) Can distinguish between contracts for assistance based on salvage principles (Lloyds open form) and contracts of hire (towage).
- i) Can explain the advantages and disadvantages to both parties in the use of each of the above forms of contract with reference to the practicality of negotiating and using such contracts at sea.

Topic 11: Contracts of Employment (Crew agreements)

- a) Can demonstrate an understanding of the United Kingdom regulations as they relate to the opening and closing of a crew agreement aboard yachts and be able to state the circumstances in which a yacht must have an approved crew agreement.
- b) Demonstrates an understanding that crewmembers are entitled to and are required to contract on the basis of an approved crew agreement.
- c) Can describe the standard form of approved crew agreement for yachts and explains how the various documents can be obtained.
- d) Can explain the relationship between an approved crew agreement and any other associated contract of employment.

- e) Can describe a procedure for engaging a crew under the standard form of approved crew agreement so as to comply with United Kingdom regulations.
- f) Demonstrates an understanding of the legal obligations of a Master as they relate to the maintenance of crew lists.
- g) Can describe the procedure for terminating a seaman(s) employment under the standard form of yacht crew agreement so as to comply with United Kingdom regulations.
- h) Can define, with regard to yachts, those persons on board who are passengers as opposed to crew.
- i) Demonstrates an understanding of the statutory obligations of an employer as they relate to the maintenance and repatriation of seaman.
- j) Can describe the procedure to be followed so as to comply with all United Kingdom regulations relevant to a crew member who:
- i). dies at sea
 - ii). is injured at sea on board a yacht
 - iii). is incapacitated due to illness and discharged to hospital
- k) Can demonstrate a basic understanding of United Kingdom employment law as it relates to yacht crew and be able to:
- i). understand and interpret the elements of the Code of Conduct for the Merchant Navy as it relates to yachts.
 - ii). understand how to apply paragraph 8, 9, 10 and 11 of the Code Of Conduct,
 - iii). understand fully paragraph 5 of the Code of Conduct (conduct in the case of emergencies),
 - iv). explain the meaning of fair dismissal, unfair dismissal, wrongful dismissal and constructive dismissal,
 - v). understand the remedies for unfair dismissal,
 - vi). understand the conditions for the termination of employment within the context of the crew agreement at the:
 - request of the Master;
 - request of the individual;
 - direct request of the Owner.

Topic 12: Yacht charter Agreements

- a) Can distinguish between 'bareboat' (Demise) and 'standard' time yacht charter party agreements
- b) Can describe the consequences of these types of agreement for the owner and charterer in terms of their:
 - i). responsibilities;
 - ii). liabilities;
 - iii). degree of operational control.
- c) Can demonstrate an awareness of the importance of prior reading through all charter agreements.

Topic 13: Marine Insurance

- a) Can recognise the voluntary and contractual nature of the insurance of yachts.
- b) Can distinguish between the insurance of a yacht and the insurance of other forms of Owners' liabilities.
- c) Can explain the following insurance principles:
 - i). indemnity, subrogation and contribution
 - ii). actual total loss
 - iii). constructive total loss
 - iv). particular average (partial loss)
 - v). deductibles
- d) Can state the difference between and implied warranty and express warranty and can explain the following marine insurance clauses;

Clause 1 Navigation

Clause 2 Breach of warranty

Clause 5 Termination

Clause 6 Perils

Clause 8 3/4 collision liability

Clause 10 GA and salvage

Clause 11 Sue and labour

Clause 19 Constructive total loss

Clause 24 War exclusion

- e) Recognises that hull insurance policies place various restrictions on the use of a yacht, in particular the use of the yacht to save or assist in saving property
- f) Recognises the change/loss of a Certificate of Class, change of flag or ownership and demise chartering, could all result in automatic termination of hull insurance
- g) Can explain why underwrites may prefer assistance to vessels at sea to be negotiated on the basis of Lloyds Open Form.
- h) Can describe the function of organisations known as P & I Clubs.
- i) Can state the type of risks that yacht owners usually insure with P & I Clubs.
- j) Can describe, in general terms, the likely sequence of events after a major claim. Can describe what must be done immediately after an incident and subsequently, in order to act in the owner's best interests.
- k) Can demonstrate an awareness of the importance of prior reading every contract of insurance.

1 MSN 1792 (M) or any subsequent amendment

2 MGN 280 (M) Small Vessels in Commercial Use for Sport or Pleasure, Workboats and Pilot Boats or any subsequent amendment

3 SI 1998/1838 The Merchant Shipping (Code of Safe Working Practices for Merchant Seamen) Regulations 1998 or any subsequent amendment

Navigation, Radar & ARPA Simulator Training (Master Yachts)

Duration:

This module will be conducted over a minimum period of ten days, or 60 hours, of formal instruction.

Content:

This module will contain sections on the Collision Regulations, Passage Planning, Search and Rescue (IAMSAR), Electronic Navigation Aids, ECDIS, AIS, radar and ARPA (Target Tracking). It will contain simulation navigation exercises to demonstrate competency in planning and monitoring techniques, blind pilotage, collision avoidance and a practical exercise in Search and Rescue. The structure of the module will incorporate at least five days use of an MCA type-approved Radar and Navigation Systems Bridge Simulator. A minimum of three days will be devoted to tuition in the practical use of ARPA (target tracking). The practical use of ECDIS for passage planning and monitoring must be exercised sufficiently to demonstrate navigational competence in the use of ECDIS.

The assessment will be in two parts:

1. In-course practical assessment: Candidates MUST satisfactorily complete the in-course assessment before they are eligible to take the written exam. The in-course assessment will consist of preparing a detailed passage plan for a passage, or port approach, in estuarial or coastal waters. This plan may be selected as one of the passages run in the simulator. Successful completion of a series of simulator exercises, demonstrating competence in:

i. General navigation including the use of electronic navigational aids (including radar, ARPA and ECDIS),

ii. Thorough understanding and application of the International Regulations for Preventing Collisions at Sea (ColRegs).

2. A written 3 hour exam. The written paper will include a radar plot, questions examining the candidates' under pinning knowledge and may also include passage plan.

To achieve a pass a candidate must obtain at least 60% in all parts.

Passage Planning

Appraisal and planning

1 Identify most suitable route – consult all relevant documentation

- a) Pilot book information: shallow patches, restricted areas, conspicuous landmasses, offshore dangers, etc
- b) Set courses on charts, berth to berth, between points of departure and destination
- c) Prevailing currents and tides (heights and directions) in relevant places
- d) Reporting areas, VTS and other communication requirements
- e) Pilotage area requirements
- f) Identify and highlight dangers on the charts
- g) Assess and allow suitable margins of safety from dangers
- h) Weather throughout route, winds, potential fog, ice and any other aspect including TRS storms that could restrict passage or require deviation

2 Determine all aspects affecting navigation

- a) Identify position fixing arrangements
- b) Identify transit bearings and other means of determining the compass error
- c) Determine suitable parallel indexing and identify index ranges
- d) Define contingency arrangements
- e) Establish 'abort' position when approaching confined waters
- f) Identify Traffic Separation areas
- g) Identify any other special areas and restrictions, which may affect the safe navigation
- h) Determine changes in compass errors by variation chart or similar

3 Pre-sailing briefing

- a) Understand the importance of pre-sailing briefing
- b) Identify information to be discussed at pre-sailing briefing

4 Use of ECDIS with Passage Planning

- a) Plan and save a route using ECDIS, adding text and warnings, where necessary
- b) Set appropriate alarm parameters, i.e. safety depth, safety contour, deviation limits
- c) Determine the availability of appropriate charts and their coverage

5 Fuel consumption and range

- a) Determine total distance to travel and fuel consumption
- b) Determine a safe fuel reserve required
- c) Determine fuel required at departure port

Execution and monitoring

7 Navigation safety

- a) Determine course to steer to make good a desired course
- b) Fix vessel's position by visual and/or radar – cross check
- c) Fix vessel's position by electronic navigational aids - cross check
- d) Effectively monitor the vessels progress by ECDIS
- e) Monitor the vessel's position by parallel index with reference to the planned track in coastal and estuarial waters and port approaches
- f) Maintain the vessel in a safe position
- g) Execute 'contingency arrangements' in the event of steering failure, engine breakdowns, blackouts etc
- h) Monitor other vessels by radar/ARPA
- i) Comply fully with the International Regulations for Preventing Collisions at Sea
- j) Utilise AIS information from an MKD unit or AIS/ARPA/ECDIS interface to enhance situation awareness.
- k) Conduct a pre-planned coastal passage in the simulator in clear and/or reduced visibility demonstrating seamanlike navigation and chartwork skills.

8 Conduct Arrival briefing

- a) Understand the importance of arrival briefings
- b) Identify the information to be discussed at an arrival briefing

International Regulations for Preventing Collisions at Sea

9 Application of the ColRegs - practical exercises on an approved simulator

- a) Appreciate the need for early and substantial action and dangers of assumptions made on inadequate information
- b) Take suitable action in compliance with the Rules to avoid close quarter situations with vessels in sight of one another
- c) Take suitable action in compliance with the Rules to avoid close quarter situations with vessels detected by radar alone, but not observed visually
- d) Determine a safe speed taking into account all prevailing conditions
- e) Whilst conducting a simulated passage, analyse potential collision risks when in a potential multi-vessel encounter, determine and execute best action to avoid a close quarter situation

Search and Rescue

10 Principles of search and rescue - practical application of search and Rescue

- a) Understand the basic contents and use of International Aeronautical and Marine Search and Rescue (IAMSAR) Manual
- b) Conduct a simulated multiple ship SAR exercise to include at least three ships

- c) Establish an OSC for exercise clear of coastal control
- d) Delegate responsibilities
- e) Establish a datum
- f) Conduct full communications and instructions
- g) Initiate multiple ship search patterns
- h) Establish inter-ship communications to prepare for recovery
- i) Understand how the use of ECDIS can aid the search patterns
- j) The exercise should reflect the implications of GMDSS and other additional facilities available to assist SAR
- k) Make own ship ready for SAR operations and casualty recovery
- l) Manoeuvre to recover survivors

Radar

11 Radar display

1 Understand modes of operation

- a) Understand and utilise the advantages of the different display orientations
- b) Understand and utilise the advantages of the different modes of display
- c) Understand and utilise the advantages of sea and ground stabilisation
- d) Appreciate and utilise target trails

.2 Use of Radar in Navigation

- a) Operate ARPA radar interfaced with an ECDIS
- b) Understand advantages and limitations of ARPA and tracked target overlay on ECDIS display
- c) Understand advantages and limitations of overlaying radar picture onto ECDIS

12 Practical radar plotting~

- a) Perform paper and real-time simulator plotting of more than one target
- b) Determine effect of own ship alteration of course on CPAs of other targets

ARPA & Target Tracking Radar

Introduction

This part of the course follows the structure of the MCA approved ARPA course: it serves as refresher training for those candidates already ARPA qualified.
(Note: the term ARPA includes the target tracking capabilities of newer radars)

Aim

The aim of the course is to provide training in the fundamentals and operation of ARPA radar equipment and in the interpretation and analysis of information obtained

from this equipment. To comply with IMO and statutory requirements, the ARPA radar must be under the control of a person qualified in the operational use of ARPA.

Objectives

At the end of the course the officer should be capable of effectively using ARPA equipment as safe aid to navigation and collision avoidance through ability to:

- Follow procedures for operating the equipment and maintaining the display
- Obtain and analyse the data provided
- Take action as required for the safe conduct of navigation based on correct
- Interpretation and analysis of ARPA data

Design of Exercises

The exercises will require the participants to illustrate the principles of keeping a safe navigational watch, chartwork and collision avoidance. The design and conduct of the exercises will be progressive with the later exercises designed to stretch the ability of the participants.

ARPA & Target Tracking Radar

a) IMO Performance Standards for ARPA

An appreciation of the performance standards in particular the standards relating to accuracy

b) Factors affecting system performance and accuracy

Knowledge of ARPA sensor input parameters – radar, compass and speed inputs and the effects of sensor malfunction on the accuracy of ARPA data.

Knowledge of:

i. The effects of the limitations of radar range and bearing discrimination and accuracy and the limitations of compass and speed input accuracies on the accuracy of ARPA data

ii. Factors which influence vector accuracy

c) Tracking capabilities and limitations

Knowledge of :

i. The criteria for the selection of targets by automatic acquisition

ii. The factors leading to the correct choice of targets for manual acquisition

iii. The effects on tracking of lost targets and target fading

iv. The circumstances causing 'target swap' and its effects on displayed data

v. The limits imposed on both types of acquisition in multi-target scenarios

d) Processing delays

Knowledge of:

- i. the delays inherent in the display of processed ARPA information, particularly on acquisition and re-acquisition or when a tracked target, or own ship, manoeuvres.

e) Operational warnings

Appreciation of:

- i. The uses, benefits and limitations of ARPA operational warnings and their correct setting, where applicable, to avoid spurious alarms and distraction

e) True and relative vectors and typical graphic representation of target information and danger areas

Thorough knowledge of true and relative vectors, derivation of targets' true courses and speeds, including:

- i. threat assessment, derivation of predicted closest point of approach and predicted time to closest point of approach from forward extrapolation of vectors, the use of graphic representation of danger areas

- ii the effects of alteration of course and/or speed of own ship and/or targets on predicted closest point of approach and predicted time to closest point of approach and danger areas

- iii the effects of incorrect vectors and danger areas

- iv the benefits of switching between true and relative vectors

f) Information on past positions of targets being tracked

Knowledge of:

- i the derivation of past positions of targets being tracked

- ii recognition of historic data as a means of indicating recent manoeuvring of targets and as a method of checking the validity of the ARPA's tracking

g) Setting up and maintaining displays

Ability to demonstrate:

- i. the selection of display presentation; stabilised relative motion displays and true motion displays

- ii. the correct adjustment of all variable radar display controls for optimum display of data

- iii. the selection as appropriate of required speed input

- iv. the selection of ARPA tracking controls, manual automatic acquisition, vector/graphic display of data

- v. the selection of the time scale of vectors/graphics

- vi. the use of exclusion areas when automatic acquisition is utilised
 - vii. performance checks of radar, compass and speed input sensors and ARPA
- h) Obtaining information from the ARPA display

Ability to obtain information in both relative and true modes of display, including:

- i. the identification of critical echoes
- ii the speed and direction of target's relative movement
- iii the time to and predicted range at target's closest point of approach
- iv the courses and speeds of targets
- v detecting changes of targets' courses and speeds and the limitations of such information
- vi the effect of changes in own ship's course or speed or both
- vii the operation of the trial manoeuvre

i) Application of the International Regulations for Preventing Collision at Sea

Analysis of potential collision situations from displayed information, determination and execution of action to avoid close quarters situations in accordance with the International Regulations for Preventing Collision at Sea.

j) Interfacing ARPA with other systems

- a) Understands the ability to integrate data between navigational aids and their limitations, i.e. ARPA to ECDIS, GPS to ARPA and ECDIS
- b) Appreciates the dangers and limitations of data transfer between equipment

ECDIS (Electronic Chart Display and Information Systems)

Thorough knowledge of and ability to use ECDIS, particularly:

- a) Understand the operational difference between ECS & ECDIS;
- b) Understand the principal types of electronic charts available;
 - i Raster charts;
 - ii Vector charts;
- c) Be aware of S-52 & S-57 IHO performance standards.
- d) Understand of the significance of ENC's and their use with ECDIS.
- e) Create a voyage plan
- f) Apply appropriate safety settings
- g) Execute a safety check on the voyage plan
- h) Control of navigational functions and settings
- i) Manage specific functions of route monitoring

- j) Understand status indications, indicators and alarms
- k) Manage Radar, ARPA and AIS overlays
- l) Monitor integrity of the system
- m) Understand the dangers of over reliance on ECDIS
- n) Knowledge of procurement and licensing and updating procedures
- o) Knowledge of the voyage log requirements and procedures

AIS (Automatic Identification System)

- a) Is aware of the AIS concepts:
 - i Understands the objectives of AIS
 - ii Aware of the system concepts of AIS
 - iii Aware of the SOTDMA concept
 - iv Describes the major constituents of a shipborne system
- b) Understands the elements of AIS data:
 - i Understands the information included in static data
 - ii Understands the information included in dynamic data
 - iii Understands the information included in voyage related data
 - iv Understands the associated transmission intervals for each group of data
 - v Understands the use of safety and security related messages
 - vi Aware of the use of AIS as aids to navigation
- c) AIS Ship Installations
 - i Understands carriage requirements
 - ii Understands the MKD configuration
 - iii Understands the radar/ECDIS configuration
- d) Use of AIS at Sea
 - i Understands the need for checks of own ship input data
 - ii Understands the use of AIS data on a radar or ECDIS display
 - iii Aware of caution when making decisions based on AIS target data
 - iv Understands the advantages and disadvantages of AIS compared with radar
 - v Understands the principles and use of target association

1 SI 1998/1838 The Merchant Shipping (Code of Safe Working Practices for Merchant Seamen) Regulations 1998 or any subsequent amendment

Seamanship and Meteorology (Master Yachts)

Duration

This course must take place over five days or 30 hours of formal instruction.

Content

The course is divided into five Topics:

1. Seamanship
2. Navigation and Passage Planning
3. Meteorology
4. MARPOL
5. Code of Safe Working Practices for Merchant Seamen

Assessment

Assessment will be by written 2.5 hour examination of five questions with one question being taken from each of the following topics. The pass mark will be 60%.

TOPIC 1: Seamanship

1 Dangers and precautions necessary during heavy weather

- a) Can explain the precautions necessary when heavy weather is forecast
- b) Can explain the dangers of synchronous rolling
- c) Can describe the dangers to the vessel and crew of heavy rolling and pitching with particular reference to structural damage and injury to personnel
- d) Can demonstrate an awareness of the dangers of running before a following sea
- e) Is able to demonstrate an appreciation of the dangers of excessive speed in adverse conditions
- f) Can describe the procedure for heaving to, bow and stern to the sea
- g) Can explain the dangers of squalls in smaller vessels

2 Heavy weather emergencies

- a) Can describe the precautions when launching and manoeuvring a rescue boat or survival craft in heavy weather
- b) Can discuss the handling of a disabled vessel in heavy weather and methods that can be used to prevent the vessel broaching too in a heavy sea

3 Precautionary measures for maintaining buoyancy

- a) Can explain the importance of ensuring water freeing arrangements are maintained with particular reference to deck drains and scuppers
- b) Can demonstrate an awareness of the importance of securing anchors and chains with reference to closing the hawse and spurling pipes
- c) Can demonstrate an awareness of the dangers of side openings and shell doors
- d) Can demonstrate an awareness of the importance of securing jet-skies, tenders etc., instructions to the crew and routine checks
- e) Can demonstrate an awareness of the practical aspect of keeping records regarding watertight integrity

4 Procedures when towing and being towed

- a) Can explain the selection of suitable towing points
- b) Can outline the procedure for preparing to tow or be towed including the selection of suitable gear
- c) Can discuss the various methods of passing and securing a tow
- d) Can explain the methods of steering a vessel under tow and when being towed
- e) Can explain the procedure of letting go a tow

5 Ship handling

- a) Can discuss methods of handling a vessel in rivers, estuaries, restricted waters, and in harbours
- b) Can demonstrate an awareness of the effects of weather, tide, headreach, stopping distance and currents
- c) Can discuss the considerations when approaching a dock or berth
- d) Can demonstrate an understanding of the effects experienced when manoeuvring in shallow waters, including reduction of underkeel clearance by squat, rolling and pitching;
- e) Can demonstrate awareness sources of manoeuvring data
- f) Can demonstrate an understanding of interaction between passing vessels
- g) Can demonstrate an understanding of the use and limitations of manoeuvring and propulsion systems
- h) Can explain the procedures and precaution necessary when embarking and disembarking a pilot

6 Procedures for bring a vessel to anchor

- a) Can explain the factors that effect the choice of anchorage, including the expected weather and the quality of the holding ground
- b) Can demonstrate an understanding of methods of anchoring using one or two anchors
- c) Can explain how to achieve a running moor, standing moor and Mediterranean moor
- d) Can discuss procedures for clearing a fouled anchor
- e) Can explain the requirement for an anchor watch, actions when dragging anchor and when anchoring in heavy weather
- f) Can explain actions required when anchoring in deep water

7 Navigational dangers

- a) Can demonstrate an awareness of dangers likely to be encountered in shallow waters
- b) Can demonstrate an awareness of dangers likely to be encountered in and near reefs

8 Actions in Emergency situations

- a) Can explain action to assist a ship or aircraft in distress, including sources of information
- b) Can explain actions to be taken if grounding is imminent, and after grounding
- c) Can discuss re-floating a grounded vessel with and without assistance
- d) Can explain the procedure for beaching a vessel
- e) Can explain the action to be taken after a collision
- f) Can discuss measures to preserve stability and trim in event of damage
- g) Can demonstrate an understanding of man-over-board manoeuvres
- h) Can explain the necessity to keep records and make reports to meet statutory and organisational requirements

9 Response in emergency

- a) Can define and plan strategic procedures in event of an emergency
- b) Can discuss the allocation of resources, and emergency duties to teams and individuals

- c) Can explain the practical use of contingency plans
 - d) Can explain the organisation and benefits of drills, musters and other emergency training
 - e) Can discuss the possible effect of emergency action on the external environment
 - f) Can discuss crowd control and the handling of passengers and personnel
 - g) Can explain the actions necessary when preparing to abandon ship, and when abandoning ship
 - h) Can explain the risk of precipitated abandoning of the vessel
- 10 Action required in the event of loss of essential systems
- a) Can discuss action to be taken in the event of loss of steering
 - b) Can explain the operation of emergency steering systems
 - c) Can discuss the options available when rigging of a jury rudder
 - d) Can demonstrate an awareness of the actions to be taken in a drifting vessel

TOPIC 2: Navigation and Passage Planning

1 Watchkeeping

- a) Can explain the procedures for the keeping of a safe navigational watch
- b) Can explain the procedures for establishing a navigational policy, including watchkeeping arrangements and hours of work
- c) Can demonstrate an understanding of the importance of handing over, relieving and maintaining a watch in accordance with established principles and procedures
- d) Can discuss the watch-keeper's role and responsibilities with particular reference to maintaining a lookout, monitoring traffic, the vessel and environment
- e) Can explain the responsibilities and duties of lookouts
- f) Can demonstrate an understanding of the precautions necessary when changing over from hand to automatic steering and vice-versa
- g) Can explain the possible dangers in the use of VHF in collision avoidance;
- h) Can demonstrate an understanding of practical application of the International Regulations for Preventing Collisions at Sea
- i) Can state the importance of correct logbook entries and other record maintenance activities

j) Can state the necessity for clear bridge communication between the various members of the bridge team including a pilot when on board

k) Can demonstrate an understanding of the importance of Master's standing instructions, standing order and night orders

TOPIC 3: Meteorology

1 Assessing the weather

a) Can demonstrate an elementary knowledge of lapse rates and atmospheric stability.

b) Can explain the process of cloud formation and understands the classification of clouds

c) Can explain local and regional effects of heating and cooling

d) Can give a simple explanation of the causes of monsoons

e) Can explain the formation of permanent and semi-permanent high and low pressure areas

f) Can state the relationship between pressure distribution and wind

g) Can demonstrate a basic understanding of air masses and their properties

h) Can discuss the weather associated with rising and falling pressure

i) Can demonstrate an understanding of the terms pressure tendency and pressure gradient

j) Can demonstrate an ability to interpret simple marine weather forecasts

k) Can demonstrate an understanding of the dangers of navigation in or near ice

l) Can explain the formation of ice accretion on vessels and the associated dangers

m) Can demonstrate an understanding of the formation of tropical revolving storms and where they are likely to occur

n) Can explain using diagrams the probable path of a tropical revolving storm in the southern and northern hemisphere and the strategies for the avoidance of these storms as contained in the Mariners Handbook

o) Can demonstrate a knowledge of the types of weather messages including surface analysis and forecast charts and common weather chart symbols.

p) Can demonstrate knowledge of the organisations providing meteorological information to shipping

q) Can describe the reliability of weather forecasts with respect to interval and forecast duration

r) Can describe the use of weather messages to deduce the probable weather and changes in the weather

TOPIC 4: MARPOL

1 Regulatory requirements

a) Can demonstrate an understanding of the IMO conventions concerning safety of life at sea and the protection of the environment

b) Can demonstrate a knowledge of the SOPEP Manual

c) Can demonstrate a knowledge of the Oil Record Book and the contents, including record keeping

d) Can discuss the Garbage Management Plan, including the requirement for record keeping

e) Can explain the requirements and limitations associated with at sea garbage disposal areas

f) Can explain the problems associated with garbage segregation, onboard storage and landing garbage in port

g) Can discuss the precautions required necessary to protect the marine environment

h) Can explain the practical prevention of oil spills with particular reference to bunkering operations

i) Can demonstrate an understanding of the action to be taken in the event of an accidental oil spillage

j) Can demonstrate an understanding of anti-pollution procedures and associated equipment

TOPIC 5: Code of Safe Working Practices for Merchant Seamen¹

1 Personal hygiene and safety

a) Can demonstrate an understanding of the importance of complying with the health and hygiene requirements.

b) Can discuss the importance of personal care in hot climates.

c) Can demonstrate an understanding of the importance of regular inspections of accommodation.

2 Code of Safe Working Practices for Merchant Seamen

- a) Can explain the purpose and carriage requirements of the Code of Safe Working Practices for Merchant Seamen
- b) Can describe the advice concerning the maintenance and use of Personal Protective Equipment (PPE)
- c) Can discuss the regulatory status of the Code of Safe Working Practices for Merchant Seamen.
- d) Can state the importance of personal responsibility for ensuring safe working practices, safe work area and following safety procedures
- e) Can demonstrate an understanding of the principles of risk assessment and the permit to work systems.
- f) Can demonstrate an understanding of the precautions necessary and the dangers involved in the following;
 - (i) Enclosed space entry
 - (ii) Working aloft
 - (iii) Working over the side
 - (iv) Working at height
 - (v) Launching and recovering tenders
 - (vi) Using chemicals
 - (vii) Using power tools
- g) Can demonstrate knowledge of the sources of information available for chemicals that are potentially hazardous when used or carried onboard.
- h) Can explain the importance of safety briefings
- i) Can explain the importance of fire prevention on board and the content and completion of fire fighting emergency training exercises

3 Role and responsibility of the Safety Officer

- a) Can explain the requirement for and importance of safety meetings
- b) Can discuss the requirements for practical aspects of safety inspections
- c) Can explain the importance of keeping records
- d) Can explain the duties and powers of the Safety Officer

4 Reporting of unsafe practices and incidents

- a) Can explain the requirement for near miss reporting
- b) Can demonstrate an understanding of accident investigation
- c) Can explain the action required on encountering an unsafe operation
- d) Can explain the importance of rectifying and eliminating unsafe conditions and potential hazards

5 Principles of planning work activities, setting objectives and priorities to ensure requirements are met

- a) Can discuss the importance of onboard working relationships
- b) Can explain the importance of crew resource management
- c) Can explain the strategies for encouraging effective and working relationships

1 SI 1998/1838 The Merchant Shipping (Code of Safe Working Practices for Merchant Seamen) Regulations 1998 or any subsequent amendment

Stability (Master Yachts)

Duration

The course must take place over five days or 30 hours of formal instruction.

Content

The course will consist of five topics:

1. Basic principles
2. List and related problems
3. Curves of statical stability
4. Loll and related problems
5. Dry docking and longitudinal stability

Assessment

Assessment will be by written 2.5 hour examination. The pass mark will be 60%.

TOPIC 1: Basic Principles

1. Basic principles of hydrostatics and related terms

- a) Can calculate the draught and freeboard for a box shaped vessel given the displacement and relative density
- b) Can calculate the displacement of a vessel given the length, breadth, draught, relative density and block coefficient

2. Fineness of hull form and resistance to forward motion

- a) Can define block coefficient and appreciates its influence with regard to resistance to forward motion
- b) Can outline how fluid flow causes resistance to forward motion with regards to skin friction, and wave making
- c) Can demonstrate a basic understanding of planing
- d) Can outline the hull forms required for semi-displacement and planing craft

3. Concept of Statical Stability

- a) Can draw a sketch of a vessel in stable equilibrium showing the positions of G, M, Z and B when heeled to an angle up to deck edge immersion

b) Can explain, with reference to the sketch in 3a, how the forces through G and B create a righting lever and righting moment and how the magnitude of GZ is influenced by the vessel's beam

4. Concept of initial stability

a) Can define the transverse metacentre (M) and initial metacentric height (GM)

b) Can demonstrate an understanding that KM is influenced by the beam of a vessel

c) Can demonstrate an understanding that the vessel will have a restoring moment if G is below M and an capsizing moment if G is above M using diagrams

d) Can demonstrate an appreciation of the magnitude of GM with regards to safety and stiff and tender motion

5. Problems involving loading, discharging and shifting weights

a) Can demonstrate the ability to solve problems regarding the effect on the C of G when loading, discharging and transferring weights

b) Can calculate, by taking moments about the keel, the final position of KG when loading and discharging weights and obtains GM

c) Can demonstrate an understanding of the effects of moving weights off the centreline

TOPIC 2: List and Related Problems

1. List

a) Can draw a diagram to show that the force lines through G & B lie in the same vertical line when at an angle of list and that the ship oscillates about this equilibrium angle

b) Can show that an angle of list is influenced by the magnitude of GM

c) Can calculate an angle of list using $\tan\theta = GG_1/GM$. (Data sheet giving Natural Function of Angles 0° to 60° to be supplied.)

d) Can explain how to correct list by adding, removing and transferring weights.

2. The inclining experiment

a) Can state the reasons for conducting an inclining experiment

b) Can give an elementary explanation of the procedures involved in conducting an inclining experiment

c) Can prepare a check list of precautions to be observed before and during an inclining experiment in order to ensure an accurate result

3. The effect of slack tanks on the centre of gravity

a) Can demonstrate an understanding that a slack tank causes a reduction in GZ and can explain that this can be considered as a free surface correction resulting in an increased KG and virtual loss of GM

b) Can explain the factors affecting free surface effect with reference to FSM, RD, displacement, position of tank in vessel, depth of liquid in the tank and the effect of longitudinal sub-division

c) Can state that the Virtual GM = Solid GM minus Free Surface Correction

d) Can state that Free Surface Correction:

= Free Surface Moment x Relative Density

Displacement

e) Can obtain Free Surface Moment from stability data book and calculates correction and virtual GM

TOPIC 3: Curves of Statical Stability

1. Curves of statical stability

a) Can sketch a GZ curve for a vessel in stable equilibrium and identifies the following information on the curve:

i. range of positive stability

ii. maximum GZ and angle at which it occurs

iii. angle of vanishing stability

iv. approximate angle of deck edge immersion

v. dynamical stability

vi approximate initial GM

b) Can sketch a curve for a vessel in stable equilibrium given initial GM, maximum GZ and angle at which it occurs, range and the angle of vanishing stability

c) Can distinguish between curves for stiff and tender vessels

d) Can explain how a change in KG (with reference to comparison between departure and arrival conditions) affects the shape and main features of the curve

- e) Can explain how a change in freeboard affects the shape and main features of the GZ curve
- f) Can state the criteria for minimum stability identified in the code with regards to GM, maximum GZ and angle at which it occurs
- g) Can define and describe dynamical stability
- h) Can state that a simplified stability curve or table of maximum KG's can be provided to ensure that the minimum stability criteria are met
- i) Can use simplified stability information in conjunction with simple loading/discharging problems including an allowance for free surface effect
- j) Can explain the effect of a steady and gusting beam wind on a motor and sailing vessel and how the respective angles of heel can be assessed from the GZ curve using a constant wind-heeling lever
- k) Can plot wind-heeling moments and determine angles of heel for a sailing vessel

2. Stability data supplied to yachts

- a) Can demonstrate awareness of the stability data supplied to yachts
- b) Can use a typical yacht stability booklet to determine stability in various load conditions

TOPIC 4: Angle of Loll, Dry Docking and Longitudinal Stability

1. Angle of Loll

- a) Can show that when GM is negative an upsetting moment is created and, provided the negative GM is not too large, the vessel will attain stable equilibrium at an angle of loll
- b) Can compare the dangers that can arise to a vessel when lying at an angle of loll in still water and at sea
- c) Can explain that loll is corrected by achieving a positive GM and that this must be achieved under a controlled manner
- d) Can state that loll can be corrected by removing weights from the high side first and adding to the low side first and explains the danger of reversing the procedures
- e) Can explain the procedure and the response of the vessel if loll is corrected by filling a sub divided centreline tank
- f) Can distinguish between list and loll

2. Dry-docking

- a) Can demonstrate an understanding of dry-docking, slipping and lifting
- b) Can explain the use of a docking plan
- c) Can explain the preparation of the yacht and dry dock prior to dry-docking
- d) Can explain the need for an acceptable trim and adequate GM with reference to the buoyancy lost at the waterline being transferred to the point of contact at the keel and that the rise in KG (loss of GM) can be considered as a weight removed from the keel
- e) Can explain the importance of aligning the support structure and lifting equipment with the vessel's main strength members
- f) Can explain the importance of Block Soundings

3. Longitudinal Stability

- a) Can define forward perpendicular, after perpendicular, length between perpendiculars, and length overall
- b) Can define trim, change of trim, longitudinal centre of floatation and MCTC