

GUIDE LINES

Navigation, Radar and ARPA simulator training

Prepared by: Leslie Hemachandra

28th March 2006

Contents

Introduction

Use of simulators in training and assessment

Conditions for approval of short courses

SECTION ONE.

Navigation, radar and ARPA simulator training - operational level

SECTION TWO

Navigation, radar and ARPA simulator training - management level

SECTION THREE

Automatic radar plotting aids (ARPA) training

SECTION FOUR

Bridge watchkeeping preparatory course

SECTION FIVE

Navigation and radar training – small ships

SECTION SIX

Bridge team management

SECTION SEVEN

IMO Performance Standards for the use of simulators for training and assessment

Introduction

The requirements for certification as officer in charge of a navigational watch, chief mate and master are set out in Chapter II of the IMO STCW Convention and corresponding sections of the STCW Code.

Candidates for the above certificates must complete approved education and training and meet the standards of competence specified in the Code. Within these training programmes, evidence of candidates' competence in the use of radar and ARPA must be obtained from approved radar simulator and ARPA simulator training. The DMS believes that this is best undertaken in conjunction with related training in navigation, bridge teamwork and the principles to be observed in keeping a navigational watch. The purpose of this document is to give guidance to those designing and delivering training programmes as to how this can be achieved.

The DMS is of the view that the guidelines in Sections 1, 2 and 3 of this document will meet the standards in the Convention where simulators are used for demonstrating and assessing competence in the function of navigation at operational and management levels, including mandatory radar and ARPA training. (Ship handling and manoeuvring at operational and management levels and search and rescue at operational level are not covered by these guidelines). This document also contains details of additional training that may be attended on a voluntary basis either to extend the scope and understanding of topics covered by the mandatory training or to meet specific training needs.

Use of simulators in training and assessment

Performance standards and other requirements for the use of simulators, referred to in Regulation I/12 of the STCW Convention as amended in 1995, are set out in the STCW Code. They are reproduced in Section Seven They apply to all mandatory simulator-based training, any assessment of competency carried out by means of a simulator and any demonstration of continued proficiency by means of a simulator.

The following IMO performance standards apply to the training and assessment covered by this document:

- Radar and ARPA simulation equipment
- Navigational and watchkeeping simulation equipment

All new simulators used for navigational and watchkeeping training must be approved by DMS and must comply with the IMO performance standards.

Conditions for approval of short courses

- 1 The training centre is responsible for ensuring that trainees meet the entry requirements for the relevant training programme and other conditions for the issue of a certificate (where applicable).
- 2 The same person must not undertake the training and assessment of an individual candidate.
- 3 The training centre must advise DMS if there is any change (e.g. in facilities, equipment, staff) that is likely to affect the conduct of the training and/or assessment.
- 4 Certificates shall be issued only to those trainees who successfully complete the training programme and meet other requirements for the issue of the certificate.
- 5 All certificates shall be issued in the form approved by DMS, having regard to the specimen certificate included with this document. Centres should confirm with DMS that the certificate they intend to issue meets this requirement.
- 6 Full records of all certificates issued to trainees must be retained by the centre and kept in such a way that authenticity or confirmation of issue of a certificate can be verified at a later stage if necessary.
- 7 A record of the original approval given by DMS must be maintained by the centre as part of the quality standards system for approved short courses.

Section One

Navigation, radar and ARPA simulator training - operational level

Mandatory for candidates for certificates of competency as officer in charge of a navigational watch in accordance with regulation II/1 of the STCW Convention

Aim	The aim of the training at this level is to equip the trainee officer with the fundamental knowledge and skills needed to keep a safe navigational watch and to use radar, ARPA and other electronic aids to maintain safety of navigation.
Intended for	Candidates for certificates of competency as officer in charge of a navigational watch, in accordance with regulation II/1 of the STCW Convention.
Objective	<p>The intended outcomes of this training are at Annex A. On completion and within the context of the principles to be observed in keeping a navigational watch, the trainee should be able to:</p> <ul style="list-style-type: none">a. understand and use the information presented by electronic navigation systems, including radar and ARPA, to determine the ship's position and maintain safety of navigation;b. understand the importance of effective bridge teamwork procedures and apply the principles to be observed in keeping a safe navigational watch. <p>These objectives are reflected in:</p> <ul style="list-style-type: none">a. Table A-II/1 of the STCW Code.
Training plan	It is intended that this training should form an integral part of and be complementary to other navigational studies required for a first certificate of competency.

For those following planned and structured training programmes approved by DMS, it is recommended that the training be undertaken in progressive stages during college-based phases and the intervening periods of sea service.

Where this is done, it is not appropriate to specify the duration of the learning devoted to NARAS (O) provided achievement of the outcomes (see Annex A) is properly assessed and recorded and at least 30 hours are devoted to simulator exercises dealing with bridge watchkeeping and teamwork procedures in accordance with the guidance at Annex C during the later stages of the training programme.

Alternatively, for candidates who are not following a planned and structured training programme, the training may be provided as a full time block course of at least 180 hours duration, inclusive of at least 30 hours devoted to simulator exercises dealing with bridge watchkeeping and teamwork in accordance with the guidance at Annex C.

Simulator exercises undertaken by candidates as part of an approved Bridge Watchkeeping Preparatory Course (see Section Four on page 53) may be substituted for the simulator exercises dealing with bridge watchkeeping and teamwork procedures referred to above provided the evidence needed for Outcome 8 is obtained and assessed in accordance with the requirements of this section.

Conduct of the training

Practical training is essential. It enables the candidate to acquire and demonstrate proficiency in the operation of specific items of equipment in relation to the role of the watchkeeping officer. A full appreciation of the inter-relationship and safe use of all methods of navigation must be the keynote throughout the training.

Simulation may be used as appropriate but must be used for training and assessment in:

- a. the proper use of Radar and ARPA, through exercises that give the candidates experience of real-time radar plotting and the use of radar and

ARPA for continuous position monitoring
(Outcome 6);

and

- b bridge watchkeeping and teamwork procedures, through exercises that consolidate previous learning and experience and prepare candidates for all aspects of the duties of watchkeeping officers (Outcome 8).

The provisions of the STCW Code concerning the use of simulators for training and assessment must be observed (see Section Seven on page 76). These include:

- a simulator training objectives
- b training procedures
- c assessment procedures
- d qualifications of instructors and assessors.

Evidence of competence All candidates for certificates of competency, will be required to present sufficient evidence that they have met all the performance criteria within the range of circumstances specified in Annex 'A'.

In accordance with STCW requirements for demonstrating competence, evidence of competence in the use of radar and ARPA must be obtained from approved radar and ARPA simulator training as well as in-service experience. Guidelines on the conduct of such training and assessment are at Annex B.

Subject to the above, a variety of sources of evidence may be used but must include evidence of candidates' ability, under realistic conditions, to apply relevant knowledge and understanding and procedures for keeping a safe navigational watch. Direct observation, simulation and role-play would be considered ideal approaches to generating much of the evidence required. Additional evidence may be gained by oral and written questioning.

Assessment procedures	<p>Centres must devise appropriate instruments of assessment, for consideration as part of the approval process, having due regard to the provisions of the STCW Code concerning the use of simulators.</p> <p>An assessment plan should be given to the candidate at the start of the training. The plan should include written assessments and oral questioning as part of practical demonstrations of procedures for setting up and using equipment. Accurate records should be made of the assessment instruments used, showing how evidence for each outcome is generated, including details of marking schemes. Records of candidates' achievements must be kept and retained for subsequent verification.</p>
Equipment	<p>The minimum range of equipment for navigation, radar and ARPA simulator training and assessment is at Annex D.</p>
Qualifications	<p>Training and assessment must be undertaken by persons qualified in accordance with the provisions of Section A-I/6 of the STCW Code.</p>
Quality standards	<p>The arrangements for delivering the training and assessing competence must be continuously monitored through a quality standards system to ensure achievement of defined objectives.</p> <p>Centres are required to maintain a quality standard through documented procedures that shall be inspected and monitored by DMS.</p> <p>The quality standards system and evaluation arrangements may be part of a centre's overall quality assurance system.</p>
Documentation	<p>Achievement of the desired standard of competence will be attested to by a certificate issued by the centre, in the format approved by DMS</p>

Specification for navigation, radar and ARPA simulator training - operational level

Outcomes

The intended outcomes for navigation, radar and ARPA simulator training at operational level are that the candidate:

- 1 understands the principles of operation and demonstrates the proper use of electronic navigational position fixing and information systems
- 2 understands the principles of operation and demonstrates the proper use of the Loran C Navigation System
- 3 understands the principles of operation and demonstrates the proper use of satellite positioning systems
- 4 understands and demonstrates the proper use of ECDIS (Electronic Chart Display Information System)
- 5 understands the principles of operation and demonstrates the proper use of the electronic log and the marine echo sounder
- 6 understands the principles of operation and demonstrates the proper use of marine radar and ARPA equipment to maintain safety of navigation
- 7 understands and demonstrates the proper use of AIS (Automatic Identification Systems)
- 8 understands the basic principles of and demonstrates ability to apply effective bridge watchkeeping and teamwork procedures

Additional guidance on the knowledge needed to support competence and achieve the intended outcomes is given after the section detailing the outcomes and, for radar and ARPA simulator training, in Annex B.

When conducting assessments, sufficient evidence will be required to ensure that all the performance criteria have been met across the specified range of circumstances.

It is important to appreciate that training undertaken as part of navigational studies for a first certificate of competency will contribute evidence towards the achievement of these outcomes.

Outcome 1

Understands the principles of operation and demonstrates the proper use of electronic navigational position fixing and information systems

Performance criteria

- i The principles relating to the propagation of radio waves are clearly understood with respect to frequencies used in electronic navigational systems
- ii The principles of hyperbolic navigation systems are clearly understood with respect to coverage and accuracy
- iii The principles, limitations and use of marine electronic navigational systems are clearly understood
- iv The dangers of using instruments other than in accordance with manufacturers' instructions are clearly understood
- v The accuracy and errors of electronic position fixing and information systems are clearly understood
- vi The methods and effects of integrating electronic navigation systems are clearly understood
- vii The precautions to be taken when interfacing integrated navigation systems are clearly explained

Range

The use of standard shipboard electronic navigation equipment in any geographical area and in any environmental condition

Evidence

Written and oral evidence is required to show understanding of the principles of operation and use of electronic navigational systems as defined in criteria (i)-(vii) across the indicated range.

Performance evidence is required to show ability to select and demonstrate the use of appropriate electronic navigational systems.

Outcome 2

Understands the principles of operation and demonstrates the proper use of the Loran C Navigation System

Performance criteria

- i The principles of operation of the Loran C Navigation System are clearly explained
- ii The limitations of the Loran C Navigation System are clearly identified
- iii The information obtained from the Loran C Navigation System is interpreted correctly and used in accordance with established procedures and guidelines
- iv The correct use of the Loran C Navigation System is clearly demonstrated

Range

The use of standard shipboard equipment in any geographical area and in any environmental condition

Evidence

Written and oral evidence is required to show understanding of the principles of operation and use of the equipment as defined in performance criteria (i)-(iv) across the full scope of the indicated range.

Performance evidence is required to show ability to set up the equipment and interpret and use the information obtained for safe navigation.

Outcome 3

Understands the principles of operation and demonstrates the proper use of satellite positioning systems

Performance criteria

- i The principles of operation of satellite positioning systems are clearly explained
- ii The limitations of satellite positioning systems are clearly identified
- iii The information obtained from satellite positioning systems is interpreted and used correctly
- iv The correct use of satellite positioning systems is clearly demonstrated
- v The principles and limitations of local and wide area augmentation and the super-imposition and interfacing of signals from other systems are clearly explained

Range

The use of standard shipboard equipment in any geographical area and in any environmental condition.

Evidence

Written and oral evidence is required to show understanding of the principles of operation and use of the equipment as defined in performance criteria (i)-(v) across the full scope of the indicated range.

Performance evidence is required to show ability to set up the equipment and interpret and use the information obtained for safe navigation.

Outcome 4

Understands and demonstrates the proper use of ECDIS (Electronic Chart Display Information System)

Performance criteria

- i The principles of the ECDIS are clearly explained
- ii The limitations of the ECDIS are clearly identified
- iii The information obtained from the ECDIS is interpreted and used correctly
- iv The correct use of the ECDIS is clearly demonstrated
- v The correct action to take in the case of an ECDIS malfunction is clearly explained and demonstrated

Range

The use of standard shipboard equipment in any geographical area and in any environmental condition.

Evidence

Written and oral evidence is required to show understanding of the principles of operation and use of the equipment as defined in performance criteria (i)-(v) across the full scope of the indicated range.

Performance evidence is required to show ability to set up the equipment and interpret and use the information obtained for safe navigation.

Outcome 5

Understands the principles of operation and demonstrates the proper use of the electronic log and the marine echo sounders.

Performance criteria

- i The principles of operation of marine logs are clearly explained
- ii The limitations of marine logs are clearly identified
- iii The information obtained from marine logs is interpreted and used correctly
- iv The correct use of marine logs is clearly demonstrated
- v The principles of the generation of ultrasonic waves in sea water are clearly explained
- vi The principles of operation of the marine echo-sounder are clearly explained
- vii The limitations of the marine echo-sounder are clearly identified
- viii The information obtained from the marine echo sounder is interpreted and used correctly
- ix The correct use of the marine echo-sounder is clearly demonstrated

Range

The use of standard shipboard equipment in any geographical area and in any environmental condition.

Evidence

Written and oral evidence is required to show understanding of the principles of operation and use of the equipment as defined in performance criteria (i)-(ix) across the full scope of the indicated range.

Performance evidence is required to show ability to set up the equipment and interpret and use the information obtained for safe navigation.
navigation, radar and ARPA simulator training 11

Outcome 6

Understands the principles of operation and demonstrates the proper use of marine radar and ARPA equipment to maintain safety of navigation.

Performance criteria

- i The principles of marine radar are clearly explained with reference to optimum performance
- ii The factors affecting the quality of the displayed picture are clearly identified with respect to the optimum control settings in all sea and weather conditions
- iii The advantages and the disadvantages of different radar and ARPA displays modes are clearly understood with respect to target detection and tracking
- iv Factors which affect the performance and accuracy of marine radars and ARPA are understood
- v The correct interpretation of radar information is clearly demonstrated
- vi The setting-up and use of radar and ARPA in accordance with manufacturers instructions is demonstrated
- vii The correct methods of anti-collision radar plotting of targets are demonstrated
- viii Information obtained from radar and ARPA is correctly interpreted and analysed, taking into account the limitations of the equipment and prevailing circumstances and conditions
- ix Action taken to avoid a close encounter or collision with other vessels is in accordance with the International Regulations for Preventing Collisions at Sea

Range

The use of standard shipboard radar and ARPA equipment in any geographical area and in any environmental condition.

Evidence

Written and oral evidence is required to show understanding of the principles of operation and use of the equipment as defined in performance criteria (i)-(ix) across the full scope of the indicated range.

Performance evidence is required to show ability to set up the equipment and interpret and use the information obtained for safe navigation. Evidence of the proper use of Radar and ARPA to maintain safety of navigation, as defined in (v) to (ix) above, must be obtained from approved radar and ARPA simulator training as well as in-service experience.

Outcome 7

Understands the basic principles and demonstrates the proper use of AIS (Automatic Identification System)

Performance criteria

- i The principles of operation of the AIS are clearly explained
- ii The principles of propagation of digital data over VHF are clearly explained
- iii The various modes of AIS operation are clearly understood
- iv The limitations of the AIS are clearly identified
- v The setting up and use of the AIS in accordance with manufacturers' instructions is demonstrated
- vi The advantages and disadvantages of the presentation and the mode of presentation of the graphical display of AIS are clearly understood
- vii The information obtained from the AIS is interpreted, analysed and used correctly
- viii The information generated by the operator's AIS is clearly understood

Range

The use of approved AIS equipment in any geographical area and in any environmental condition.

Evidence

Written and oral evidence is required to show understanding of the principles of operation and use of the equipment as defined in performance criteria (i)-(viii) across the full scope of the indicated range.

Performance evidence is required to show ability to set up the equipment and interpret and use the information obtained for safe navigation.

Outcome 8

Understands the basic principles of and demonstrates ability to apply effective bridge watchkeeping and teamwork procedures

Performance criteria

- i The conduct, handover and relief of the navigational watch conforms with accepted principles and procedures
- ii A proper lookout is maintained at all times in accordance with accepted principles and procedures
- iii Lights, shapes and sound signals conform with the requirements contained in the International Regulations for Preventing Collisions at Sea and are correctly identified
- iv The frequency and extent of monitoring of traffic, the ship and the environment conform with accepted principles and procedures
- v A proper record is maintained of the movements and activities relating to the safe navigation of the ship
- vi Responsibility for the safety of navigation is clearly defined at all times, including periods when the master is on the bridge and while under pilotage
- vii Information obtained from radar and ARPA is correctly interpreted and analysed, taking into account the limitations of the equipment and prevailing circumstances and conditions
- viii Action taken to avoid a close-quarter situation or collision with other vessels is in accordance with the International Regulations for Preventing Collisions at Sea
- ix Decisions to amend course and/or speed are both timely and in accordance with accepted navigation practice
- x Adjustments made to the ship's course and speed maintain safety of navigation
- xi Communication is clear, concise and acknowledged at all times in a seaman-like manner
- xii Manoeuvring signals are made at the appropriate time and are in accordance with the International Regulations for Preventing Collision at Sea

Range

Planning and conducting a passage in open and confined waters, including periods when the master is on the bridge and while under pilotage. Procedures for keeping a safe navigational watch.

Evidence

Within the context of the duties of the officer in charge of a navigational watch, evidence is required:

- i to show knowledge and understanding of the principles of bridge watchkeeping and effective bridge teamwork procedures across the indicated range
and
- ii from simulator-based exercises, of ability to apply principles of bridge watchkeeping and effective bridge teamwork procedures in practice (see Annex(C)).

Additional guidance

The following additional guidance on knowledge required to underpin competence corresponds to outcomes numbered as above:

1 Principles

Waveforms, velocity, wavelength, frequency, amplitude, cycles, fundamental frequency, radiation patterns. The nature of electromagnetic waves, propagation through liquids and gases. Reflection, refraction and absorption at atmospheric layers. Skywaves, skip distance, ground waves.

Types of transmission in common use, phase coding, pulse modulation, amplification requirements.

Principles of hyperbolic navigation, definition of hyperbola, hyperbolic pattern for two foci, methods used to resolve ambiguity, accuracy.

SNR, signal strength

Position Lines, Fixed and variable errors, Front and back cover,

HDOP, VDOP, GDOP, Fix geometry

Menu driven systems, Integrated systems (Loran/GPS etc.), NMEAs, Interfacing of navigation aids.

Menu driven systems; simple interfaces; digitised data; data ports.

Interface protocol; keyboard selectable NMEAs.

Integrated navigation systems; compatibility; benefits and limitations.

Position fixing by combination of hyperbolic patterns. Base line extension. Effect of sky wave interference.

Way point navigation

Man overboard facilities

2 **Loran C**

Production of hyperbolic pattern by staggered pulses from master and slave.

Use of pulsed transmissions, number of pulses, pulse coding, GRI , CRI, power.

Chain identification. Cycle matching. Ground and sky waves reception by receiver. Slave identification, slave selection, corrections.

Coverage. Accuracy. ASF. Automatic operation and limitations

Possible errors, fixed and variable. Apply corrections. Blink. ECD

Operate equipment. Functions of controls. Selection of chain, change chains.

3 **GNSS**

Satellite systems. Measurement of pseudo-range.

Transmitted information, frequencies, C/A, P code, status.

How equivalent user clock error is measured to produce an estimate of the observers position.

How independent range error is calculated to give true user clock error and hence the true position of the observer. Auto and manual operation.

The importance of the configuration of the satellite constellation and its effects on outages.

Dilution of Precision (DOP), Datum, UTM.

The effects on position determination due to Selective Availability, multipath effects and sources of potential interference.

Description of receiver, functionality and sequence for initiating observations.

Mode of operation and routine operation. 3D, 2D, DR.

The use of wide area and local area augmentation.

Operate receiver, check operator settings.

4 **Electronic charts (ECDIS)**

Legal aspects and requirements.

Principal types of electronic charts.

ECDIS data and presentation of ECDIS data.

Performance limits of sensors and their impact on the safe use of ECDIS.
Basic navigational functions and settings.
Specific functions of route planning and route monitoring.
Updating and correcting ECDIS charts.
Radar and ARPA superimposition; automatic track-keeping.
Use of AIS transponders.
Errors in displayed data and errors in interpretation.
Status indications, indicators and alarms.
Automatic voyage recording and reconstruction of past track.
Integrity monitoring – on-line test, manual and visual tests, and verification of proper functioning.
Back-up systems in case of ECDIS failure.
Risk of over-reliance on ECDIS.

5 **Echo sounders**

Basic principles, velocity of sound in sea water, comparison of different sound frequencies.
Functions of units. Types of transducer. Closed hull and pierced hull types.
Errors: effects of salinity, temperature and pressure on velocity of sound. Stylus speed.
Typical displays, phased scales. Recording papers. Depth alarms
Sources of noise, interference, aeration, false echoes. Instrument and scale error.
Suppression.
Operation of typical sounder. Range and phase, sensitivity, gain.
Chart datum, checking accuracy.
Logs
Electromagnetic: principles, operation, siting of units, errors, measurement.
Doppler: principles, effect of a moving source and observer on pitch, operation, siting of transducers, errors, measurement. Ground and sea tracking.
Dual axis logs.

6 **Marine radar and ARPA:**

N.B. Additional guidance on training and assessment in the operational use of Radar and ARPA in accordance with STCW requirements is given in Annex B.

Knowledge of the fundamentals of radar and automatic plotting aids (ARPA).

Ability to operate and to interpret and analyse information obtained from radar, including:

- factors affecting performance and accuracy
- setting up and maintaining displays
- detection of misrepresentation of information, false echoes, sea return, etc., racons and SARTs
- range and bearing; course and speed of other ships; time and distance of closest approach of crossing, meeting overtaking ships
- identification of critical echoes; detecting course and speed changes of other ships; effect of changes in own ship's course or speed or both
- application of the International Regulations for Preventing Collisions at Sea
- plotting using relative and true motion concepts
- parallel indexing

Principal types of ARPA, their display characteristics, performance standards and the dangers of over-reliance on ARPA, including:

- system performance and accuracy, tracking capabilities and limitations, and processing delays
- use of operational warnings and system tests
- methods of target acquisition and their limitations
- true and relative vectors, graphic representation of target information and danger areas
- deriving and analysing information, critical echoes, exclusion areas and trial manoeuvres

7 **Automatic Identification Systems**

Overview and configuration of components of AIS:

- STDMA radio transponder.

- use of GPS/DGPS receiver for position information and precise time base for synchronisation.
- position of the AIS antenna.
- communication processor.
- STDMA data communication scheme.
- output to other systems e.g. RADAR / ARPA, ECDIS, VDR, IBS, INMARSAT etc.

Pilot plug.

AIS information sent by ships including frequency of repetition:

- static data.
- dynamic data.
- voyage related data.
- safety related messages.

Operation modes.

Use and limitations of AIS in ship reporting, navigation, collision avoidance, search and rescue and VTS

Interpretation of displayed data; identification of vessels; target tracking; situation awareness; dynamic information; voyage related information.

The reception and transmission of safety related messages.

Manual input of data, data updating, checking data.

System performance and accuracy, inherent limitations of AIS.

Priority of AIS information over ARPA data.

Benefits of AIS; targets in radar shadow sectors; targets in rain and sea clutter.

Limitations imposed in areas frequented by pirates, commercial limitations.

Future developments in ship reporting and the establishment of "pseudo" navigational marks.

8 Bridge watchkeeping and teamwork

The content, application and intent of the International Regulations for Preventing Collisions at Sea.

Effective bridge teamwork procedures.

Principles to be observed in keeping a navigational watch, including:

- procedures for taking over and handing over a watch
- the need to maintain an efficient lookout at all times
- Standing Orders, Bridge Procedure Guides and Night Order Books
- navigational log books and records.

Appreciation of vessels' turning ability and stopping distances to aid decision making.

Planning, implementing and monitoring passage plans.

Preparation and testing of bridge equipment prior to departure and arrival.

Allocation and use of available resources. Assignment of duties to watchkeeping personnel. Performance checks and tests of navigation equipment.

Provision of support to the master, pilot, or senior officer as appropriate.

Monitoring, assessing and reporting traffic situations; identification of collision risk and appropriate action to maintain safety of navigation in clear weather and in reduced visibility.

Monitoring the progress of the vessel and action to maintain intended track.

Circumstances in which it may be necessary to call the Master.

Appropriate response to navigational emergencies and malfunctioning equipment.

Specification for navigation, radar and ARPA simulator training - operational level

Radar and ARPA simulator training (based on Section B-I/12 of the 1995 STCW Code)

General

1. When simulators are being used for training or assessment of competency, the following guidelines should be taken into consideration.
2. Paragraphs 3 to 17 apply equally to the use of radar and ARPA whilst paragraphs 18 to 33 apply to ARPA only. Centres will be expected to adopt an integrated approach where the training forms part of a broader training programme encompassing the use of electronic navigation systems. Training and assessment in radar observation and plotting and the operational use of automatic radar plotting aids (ARPA) must:
 - .1 incorporate the use of radar/ARPA simulation equipment as appropriate; and
 - .2 conform to standards not inferior to those in this Annex.

Radar

3. Demonstrations of and practice in radar should be undertaken where appropriate on live marine radar equipment, in addition to the use of simulators. Plotting exercises should preferably be undertaken in real time, in order to increase trainees' awareness of the hazards of the improper use of radar data and improve their plotting techniques to a standard of radar plotting commensurate with that necessary for the safe execution of collision-avoidance manoeuvring under actual seagoing conditions.

Factors affecting performance and accuracy

4. An elementary understanding should be attained of the principles of radar, together with a full practical knowledge of:

- .1 range and bearing measurement, characteristics of the radar set which determine the quality of the radar display, radar antennae, polar diagrams, the effects of power radiated in directions outside the main beam, a non-technical description of the radar system, including variations in the features encountered in different types of radar set, performance monitors and equipment factors which affect maximum and minimum detection ranges and accuracy of information;
- .2 the current marine radar performance specifications adopted by the International Maritime Organisation;
- .3 the effects of the siting of the radar antenna, shadow sectors and arcs of reduced sensitivity, false echoes, effects of antenna height on detection ranges and of siting radar units and storing spares near magnetic compasses, including magnetic safe distances; and
- .4 radiation hazards and safety precautions to be taken in the vicinity of antenna and open waveguides.

Detection of misrepresentation of information, including false echoes and sea returns

- 4. A knowledge of the limitations to target detection is essential, to enable the observer to estimate the dangers of failure to detect targets. The following factors should be emphasised:
 - .1 performance standard of the equipment;
 - .2 brilliance, gain and video processor control settings;
 - .3 radar horizon;
 - .4 size, shape, aspect and composition of targets;
 - .5 effects of the motion of the ship in a seaway;
 - .6 propagation conditions;
 - .7 meteorological conditions; sea clutter and rain clutter;
 - .8 anti-clutter control settings;
 - .9 shadow sectors; and
 - .10 radar-to-radar interference.
- 6. A knowledge should be attained of factors which might lead to faulty interpretation, including false echoes, effects of nearby pylons and large structures, effects of power lines crossing rivers and estuaries, echoes from distant targets occurring on second or later traces.
- 7. A knowledge should be attained of aids to interpretation, including

corner reflectors and radar beacons; detection and recognition of land targets; the effects of topographical features; effects of pulse length and beam width; radar-conspicuous and -inconspicuous targets; factors which affect the echo strength from targets.

Setting up and maintaining displays

8. A knowledge should be attained of:

- .1 the various types of radar display mode including: unstabilised ship's-head-up, course-up and north-up stabilised relative motion and true motion;
- .2 the effects of errors on the accuracy of information displayed; effects of transmitting compass errors on stabilised and true motion displays; effects of transmitting log errors on a true motion display; and the effects of inaccurate manual speed settings on a true motion display;
- .3 methods of detecting inaccurate speed settings on true motion controls; the effects of receiver noise limiting ability to display weak echo returns, and the effects of saturation by receiver noise, etc.; the adjustment of operational controls; criteria which indicate optimum points of adjustment; the importance of proper adjustment sequence, and the effects of maladjusted controls; the detection of maladjustments and corrections of:
 - .3.1 controls affecting detection ranges, and
 - .3.2 controls affecting accuracy;
- .4 the dangers of using radar equipment with maladjusted controls; and
- .5 the need for frequent regular checking of performance, and the relationship of the performance indicator to the range performance of the radar set.

Range and bearing

9. A knowledge should be attained of:

- .1 the methods of measuring ranges; fixed range markers and variable range markers;

- .2 the accuracy of each method and the relative accuracy of the different methods;
- .3 how range data are displayed; ranges at stated intervals, digital counter and graduated scale;
- .4 the methods of measuring bearings;
- .5 bearing accuracy and inaccuracies caused by: parallax, heading marker displacement, centre maladjustment;
- .6 how bearing data are displayed; and
- .7 the need for regular checking of the accuracy of ranges and bearings, methods of checking for inaccuracies and correcting or allowing for inaccuracies.

Plotting techniques and relative motion concepts

- 10. Practice should be provided in manual plotting techniques with the objective of establishing a thorough understanding of the interrelated motion between own ship and other ships, including the effects of manoeuvring to avoid collision. At the preliminary stages of this training, simple plotting exercises should be designed to establish a sound appreciation of plotting geometry and relative motion concepts. The degree of complexity of exercises should increase throughout the training until all aspects of the subject have been mastered. Competence can best be enhanced by exposing the trainee to real-time exercises performed on a simulator or using other effective means.

Identification of critical echoes

- 11. A thorough understanding should be attained of:
 - .1 position fixing by radar from land targets and sea marks;
 - .2 the accuracy of position fixing by ranges and by bearings;
 - .3 the importance of cross-checking the accuracy of radar against other navigational aids; and
 - .4 the value of recording ranges and bearings at frequent, regular intervals when using radar as an aid to collision avoidance.

Course and speed of other ships

- 12. A thorough understanding should be attained of:

- .1 the different methods by which course and speed of other ships can be obtained from recorded ranges and bearings, including a plot (relative or true);
- .2 the relationship between visual and radar observations, including detail and the accuracy of estimates of course and speed of other ships, and the detection of changes in movements of other ships.

Time and distance of closest approach of crossing, meeting or overtaking ships

13. A thorough understanding should be attained of:

- .1 the use of recorded data to obtain:
 - .1.1 measurement of closest point of approach and bearing, and
 - .1.2 time to closest approach, and
- .2 the importance of frequent, regular observations.

Detecting course and speed changes of other ships

14. A thorough understanding should be attained of:

- .1 the effects of changes of course and/or speed by other ships on their tracks across the display;
- .2 the delay between change of course or speed and detection of that change; and
- .3 the hazards of small changes as compared with substantial navigation, radar and ARPA simulator training changes of course or speed in relation to rate and accuracy of detection.

Effects of changes in own ship's course or speed or both

15. A thorough understanding of the effects on a relative motion display of own ship's movements, and the effects of other ships' movements and the advantages of compass stabilisation of a relative display.

16. In respect of true motion displays, a thorough understanding should be attained of:

- .1 the effects of inaccuracies of speed and course settings;

- .2 the effects of changes in course or speed or both by own ship on tracks of other ships on the display; and
- .3 the relationship of speed to frequency of observation.

Application of the International Regulations for Preventing Collisions at Sea

- 17. A thorough understanding should be attained of the relationship of the International Regulations for Preventing Collisions at Sea to the use of radar, including:
 - .1 action to avoid collision, dangers of assumptions made on inadequate information and the hazards of small alterations of course or speed;
 - .2 determination of safe speed when using radar to avoid collision;
 - .3 the relationship of speed to closest point of approach and time of closest approach and to the manoeuvring characteristics of various types of ships;
 - .4 the importance of radar observation reports and radar reporting procedures being well defined;
 - .5 the use of radar in clear weather, to obtain an appreciation of its capabilities and limitations, compare radar and visual observations and obtain an assessment of the relative accuracy of information;
 - .6 the need for early use of radar in clear weather at night and when there are indications that visibility may deteriorate;
 - .7 comparison of features displayed by radar with charted features; and
 - .8 comparison of the effects of differences between range scales.

Automatic radar plotting aids (ARPA)

- 18. Training and assessment in the operational use of automatic radar plotting aids (ARPA) should:
 - .1 require prior completion of the training in radar observation and plotting or combine that training with the training given in paragraphs 19 to 35 below;
 - .2 incorporate the use of ARPA simulation equipment; and

- .3 conform to standards not inferior to those given in this Annex.

19

Where ARPA training is provided as part of general training for masters, chief mates and officers in charge of a navigational watch, training and assessment should be progressive in nature and commensurate with the responsibilities and role of the individual. It should ensure a proper understanding of the factors involved in decision-making based on the information supplied by ARPA in association with other navigational data inputs as well as the operational aspects and possible system errors of all modern electronic navigational systems.

Possible risks of over-reliance on ARPA

- 20. Appreciation that ARPA is only a navigational aid and:
 - .1 that its limitations, including those of its sensors, make over-reliance on ARPA dangerous, in particular for keeping a look-out; and
 - .2 the need to observe at all times the Principles to be observed in keeping a navigational watch and the Guidance on keeping a navigational watch.

Principal types of ARPA systems and their display characteristics

- 21. Knowledge of the principal types of ARPA systems in use; their various display characteristics and an understanding of when to use ground or sea stabilised modes and north-up, course-up or head-up presentations.
IMO performance standards for ARPA
- 22. An appreciation of the IMO performance standards for ARPA, in particular the standards relating to accuracy.

Factors affecting system performance and accuracy

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

- 24. Knowledge of:

- .1 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; and
- .2 factors which influence vector accuracy.

Tracking capabilities and limitations

25. Knowledge of:

- .1 the criteria for the selection of targets by automatic acquisition;
- .2 the factors leading to the correct choice of targets for manual acquisition;
- .3 the effects on tracking of "lost" targets and target fading;
- .4 the circumstances causing "target swap" and its effects on displayed data.

Processing delays

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

Operational warnings, their benefit and limitations

27. Appreciation of the uses, benefits and limitations of ARPA operational warnings and their correct setting, where applicable, to avoid spurious interference.

System operational tests

28. Knowledge of:

- .1 methods of testing for malfunctions of ARPA systems, including functional self-testing; and
- .2 precautions to be taken after a malfunction occurs.

Manual and automatic acquisition of targets and their respective limitations

29. Knowledge of the limits imposed on both types of acquisition in multi-target scenarios, and the effects on acquisition of target fading and target swap.

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

30. Thorough knowledge of true and relative vectors, derivation of targets' true courses and speeds including:
- .1 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;
 - .2 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 closes point of approach and danger areas;
 - .3 the effects of incorrect vectors and danger areas; and
 - .4 the benefits of switching between true and relative vectors

Information on past positions of targets being tracked

31. Knowledge of the derivation of past positions of targets being tracked, 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.

Setting up and maintaining displays

32. Ability to demonstrate:
- .1 the correct starting procedure to obtain the optimum display of ARPA information;
 - .2 the selection of display presentation; stabilised relative motion displays and true motion displays;
 - .3 the correct adjustment of all variable radar display controls for optimum display of data;
 - .4 the selection, as appropriate, of required speed input to ARPA;

- .5 the selection of ARPA plotting controls, manual/automatic acquisition, vector/graphic display of data;
- .6 the selection of the time scale of vectors/graphics;
- .7 the use of exclusion areas when automatic acquisition is employed by ARPA; and
- .8 performance checks of radar, compass, speed input sensors and ARPA.

System operational tests

- 33. Ability to perform system checks and determine data accuracy of ARPA against performance standards.

Obtaining information from the ARPA display

- 34. Ability to obtain information in both relative and true motion modes of display, including:
 - .1 the identification critical echoes;
 - .2 the speed and direction of target's relative movement;
 - .3 the time to, and predicted range at, target's closest point of approach;
 - .4 the courses and speeds of targets;
 - .5 detecting course and speeds changes of targets and the limitations of such information;
 - .6 the effect of changes in own ship's course or speed or both; and
 - .7 the operation of the trial manoeuvre facility
 - .8 the use and limitations of the mapping facility.

Application of the International Regulations for Preventing Collisions at Sea

- 35. 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 Collisions at Sea in force.

specification for navigation, radar and ARPA simulator training - operational level

Guidelines on simulator exercises

Candidates who attend an approved Bridge Watchkeeping Preparatory Course (see Section Four on page 53) will not be required to undergo additional simulator exercises, provided the evidence required for Outcome 8 is obtained and assessed from exercises forming part of that course.

For candidates who do not attend the Bridge Watchkeeping Preparatory Course, outcome 8 will be achieved by a series of realistic ship simulator exercises conducted in real time and supported by instruction through briefings, de-briefings and discussion. At least 30 hours must be devoted to exercises that enable candidates to:

- i appreciate the importance of the inter-relationship and safe use of all methods of navigation;
- ii consolidate previous learning and experience and prepare candidates for all aspects of the duties of watchkeeping officers.

The training plan should consist of several simulated voyages. Each exercise will be part of a logical and realistic sequence from berth/anchorage to berth/anchorage. Two or three 'own ship' types should be used. The length of each exercise will vary according to its particular requirements but the training should be related to the basic concepts of collision avoidance, watchkeeping procedures and bridge teamwork rather than the more complex exercises appropriate to the management level in Section Two.

The exercises should become progressively more onerous and should include:

- i familiarisation with ship, bridge equipment, manoeuvring characteristics, procedures and standing orders; familiarisation with the passage plan; preparing bridge equipment for sea passage; navigation in pilotage waters; keeping navigational records

- ii keeping a watch in traffic congested areas with or without the master having the con, and in clear and restricted visibility - calling the master, supporting the master; handing over the watch; keeping navigational records
- iii `keeping a watch in open/coastal waters in clear and restricted visibility; taking over the watch, monitoring and assessing traffic, identifying a collision risk and taking appropriate action; dealing with hazardous and emergency situations; handing over the watch; keeping navigational records
- iv keeping a watch in coastal/harbour approach areas in clear and restricted visibility; taking over the watch, supporting the master, preparing for arrival, approaching anchorage; use of other navigation equipment; navigational records
- v making appropriate responses to emergencies and equipment failures

Debriefs should be held after every exercise and before progressing to the next. navigation, radar and ARPA simulator training

specification for navigation, radar and ARPA simulator training - operational level

Equipment specification

Training and assessments must be undertaken on each of the following:

- i Hyperbolic navigation system (e.g. Loran C)
- ii Satellite positioning system
- iii Electronic Chart Display system
- iv Electronic Log
- v AIS
- vi Marine echo sounder
- vii Marine radar
- viii ARPA.

Competence in the use of equipment listed at i to v above must be demonstrated through examination and assessment of evidence from one or more of the following:

- in-service experience;
- in a dedicated radar/electronic navigation systems room or laboratory fitted with live or simulated equipment and providing ready access to equipment manufacturers' data sheets and other information needed to conduct the training;
- a training vessel fitted with live or simulated equipment, provided the vessel is not confined to a dock or narrow water;
- simulator training.

Where simulation is used for any of the above, the equipment must be capable of simulating the operational performance capabilities of shipboard navigational equipment which meets all applicable performance standards adopted by the International Maritime Organisation.

Training and assessments for (vii) and (viii) must be undertaken on radar and ARPA simulation equipment approved by DMS, supplemented by approved in-service experience.

The performance standards for radar and ARPA simulation equipment set forth in Part 1 of Section A-I/12 of the STCW Code (reproduced at paragraphs 1 to 5 in Section Seven of this document) must be complied with.

Training and assessments for outcome 8 – bridge watchkeeping and teamwork procedures – must be undertaken on simulation equipment approved by DMS

! Where simulation is used for the above, the equipment should comply with the IMO performance standards for Navigation and Watchkeeping simulation set forth in paragraph 37 of Section B-I/12 of the STCW Code (reproduced at paragraph 6 of Section Seven of this document).

Section Two

Navigation, radar and ARPA simulator training - management level

Mandatory for candidates for a second certificate of competency in accordance with regulation II/2 of the STCW Convention

Navigation, radar and ARPA simulator training - management level

Aim The aim of the training at this level is to maintain safe navigation through the use of radar and ARPA and modern navigation systems to assist command decision-making and the application of effective bridge team management principles and procedures.

Intended for Officers seeking a second certificate of competency (at management level) in accordance with Regulation II/2 of the STCW Convention.

Objective At the end of the training, the officer should be able to evaluate navigational information derived from all sources, including radar and ARPA, in order to make and implement command decisions for collision avoidance and for directing the safe navigation of the ship.

To achieve this objective, the training must:

- a. extend the application of navigational and collision avoidance techniques studied and

practised at the operational (first certificate) level, including:

- appreciation of system errors and thorough understanding of the operational aspects of modern navigational systems;
 - blind pilotage techniques;
- b demonstrate the importance of the inter-relationship and the optimum use of all navigational data available for conducting navigation;
- c ensure that officers are aware of the value of effective bridge procedures and can make the best use of the resources of the bridge team and equipment.

Training Plan

In drawing up the training plan, it has been assumed that students will be proficient in basic procedures, including passage planning, parallel indexing, radar plotting and anti-collision regulations.

When the training is taken as part of a planned scheme of training approved by DMS or as part of a college based study course of preparation for a second certificate of competency, it should be complementary to and form the culmination of related studies dealing with practical navigation and passage planning procedures. The training need not be treated as a discrete module outside the mainstream programme of studies and may be commenced prior to service as a watchkeeping officer. However, the simulator exercises that form part of the training must be undertaken after the qualifying sea service for a second certificate of competency has been completed. A minimum of 36 hours must be devoted to such exercises.

The training for candidates undergoing this training other than as part of a planned scheme of training or as part of a full study course may be run as a full-time block course of at least 60 hours duration after at least 12 months of qualifying sea service for a second certificate of competency has been completed. Centres should bear in mind that such candidates may need additional time for revision of basic procedures,

including passage planning, parallel indexing and radar plotting, before commencing the simulator exercises.

Training Programme

The training programme and exercises to be conducted are shown at Annex 'A'.

Equipment

The list of equipment required for conduct of the training is given at Annex 'B'. Colleges may wish to consider utilising other suitable equipment where available. Ship bridge simulators and training vessels may be used for conducting exercises in addition to the prescribed simulator exercises. This would further enhance certain aspects and achievement of the overall aims of the training, particularly in relation to blind pilotage and bridge teamwork procedures.

Conduct of Training

It is for training establishments to decide on their own detailed planning of training and time-table arrangements. However, in implementing the exercises to meet the stated objectives, the following guidelines must be taken into account:

- a. the exercises should be intensive and appropriate to the objectives of the training;
- b. the environment in which the exercises are conducted must be conducive to learning through participation rather than formal classroom teaching or lectures;
- c. the roles played by the students must be representative of the real situation to enable bridge teamwork procedures to be followed;
- d. following every exercise there should be a general discussion amongst all the officers, when the exercise will be analysed and actions criticised.

Assessment

Candidates' performance and understanding of basic principles must be closely monitored throughout in accordance with the requirements at Annex C.

If a trainee undergoing the simulator exercises or attending the block course does not undertake the required hours, he/she should be made to make good the deficiency before a certificate is issued.

Qualifications	Training and assessment must be undertaken by persons qualified in accordance with the provisions of Section A-1/6 of the STCW Code.
Quality standards	<p>The arrangements for delivering the training and assessing competence must be continuously monitored through a quality standards system to ensure achievement of defined objectives.</p> <p>The quality standards system and evaluation arrangements may be part of a centre's overall quality assurance system.</p>
Documentation	<p>Achievement of the desired standard of competence will be attested to by a certificate issued by the centre, in the format shown in Annex D.</p> <p>Approval Centres offering training and assessment must be approved by DMS</p>

specification for Navigation, radar and ARPA simulator training -Management Level

Training programme and simulator exercises

Introduction

- 1 The training must include the programme of simulator exercises described in this Annex, but training establishments are free, within the following general guidelines, to design the details of their own exercises to meet the objectives listed for each stage and also to decide appropriate exercise areas and the duration each exercise.

Design of exercises

- 2 The design and conduct of exercises should take into account that:
 - .1 the use and operation of the full range of navigation equipment will have been studied during achievement of competence in the use of electronic navigational systems at operational level, which includes radar and ARPA simulator training exercises;
 - .2 principles of keeping a safe navigation watch, chartwork, passage planning and bridge team work procedures are studied as part of the related work for certificates of competency. The practical and realistic nature of the simulator exercises will reinforce the application of those principles and provide revision of basic techniques of, for instance, passage planning and radar plotting;
 - .3 officers undertaking navigation and simulator training at this level other than as part of a study course or programme of training may need additional time for revision of the basic principles before commencing the simulator exercises;
 - .4 officers must have completed the appropriate modules covering ARPA, ECDIS and AIS in the specification for NARAS (Operation Level) or have completed specialised training and hold valid certificates before embarking on these exercises;

- .5 the student will have gained at least 12 months experience at sea as a certificated watchkeeping officer prior to undertaking the simulator exercises.
- 3 In meeting the stated objectives of the training, due regard should be paid to:
- .1 planning and execution of passages in confined and open waters;
 - .2 the use of radar and ARPA for anti-collision, navigation and blind pilotage;
 - .3 the selection and use of other navigation equipment and data as appropriate to the prevailing circumstances;
 - .4 other services and navigational information.
- 4 Effective bridge teamwork procedures should be emphasised throughout the training.

Organisation

- 5 It is felt that the objectives of the simulator exercises could not be achieved with less than four students in two teams, each of two students. The maximum number on each bridge should reflect the amount of bridge equipment available for the students to remain actively involved throughout an exercise.

Team Roles

- 6 The roles played should be representative of the real situation to enable bridge team work procedures to be followed. For example, it is expected that the Master will act as the receiver/co-ordinator of information and will make overall decisions for the safe conduct of own ship while the officer of the watch will have a primary role in the conduct of the exercise appropriate to the duties of an officer in charge of a navigational watch, assisted by the third team member where available.
- 7 The teams should devise their own plan for the passage to be followed, in accordance with recognised procedures. Suitable publications, (e.g. Admiralty Sailing Directions and Tide Tables) should be available for this purpose.
- 8 Roles should be changed as appropriate during the exercises to give each student ample opportunity to control own ship and to operate equipment at each own ship position.

Conduct of Exercises

- 9 On completion of the first stage of the training, the officer in charge of own ship must be allowed choice in the techniques to be used for planning the intended passage, in obtaining radar and navigational information and in manoeuvring the ship.
- 10 Discussions should be held amongst all the students following every exercise to analyse and criticise actions taken and records of the exercise should be available for this purpose. Discussions may be followed by demonstrations of the effects of any alternative action which could have been taken or which was suggested in discussion. On occasion it may also be beneficial to demonstrate and compare alternative types of radar display presentation.

Exercises

Stage 1 - Collision Avoidance Exercises

Theme: Open water exercises involving encounters with one or two target ships and progressing to multi-ship encounters.

The initial exercise(s) should introduce the student to the equipment and update knowledge of the use of radar and ARPA for collision avoidance.

Objectives:

- a) To refresh the trainee's plotting and interpretation abilities and to increase appreciation of plotting limitations and errors (including those associated with the use of ARPA systems).
- b) To recognise, where action is necessary, the need for generally making substantial alterations of course and/or speed at an early stage in the encounter.

Outline of Exercises:

The exercises should include examples of all categories of realistic encounters which may call for alterations in own ship course and/or speed. It is important during this stage that exercises and demonstrations highlight those situations which have occurred in actual collision cases.

Where possible, these exercises may be conducted in good and reduced visibility to enhance the benefits of the course.

Stage 2 - Navigation and collision avoidance

Theme: Exercises involving multi-ship encounters when approaching a coastline or other navigational hazard from open waters.

Objectives: To continue practice of collision avoidance manoeuvres involving single and multi-ship encounters and, at the same time:

- a) enhance the student's ability to work as part of a bridge team when making landfall and navigating in coastal waters;
- b) illustrate the need to ascertain position of own ship and to monitor its progress into coastal waters;
- c) test each team's ability to monitor the ship's track in coastal waters and maintain an efficient radar watch.

Outline of Exercises:

The exercises should cover the following points:

- i the production and execution of a navigation plan for landfall;
- ii monitoring of the ship's track in coastal waters, including use of parallel index techniques and the use of ECDIS;
- iii position fixing using electronic aids to navigation;
- iv the effects on track keeping of tidal streams, current and wind;
- v the interpreting of ground and sea stabilised radar displays;
- vi collision avoidance manoeuvres;
- vii limitations of ARPA and AIS in the navigational role;
- viii the occasional malfunction of equipment used in navigation and collision avoidance.

Stage 3 - Search and Rescue

Theme Exercise(s) in either open or coastal waters involving the need to conduct a search and rescue operation while continuing practice in collision avoidance and navigational techniques and procedures. The exercise should reflect the implications of GMDSS and the

additional facilities incorporated on modern navigational aids to assist the SAR operation.

Objectives

- a). To practise, both in-ship and inter-ship, search and rescue procedures and techniques, emphasising the need for the search to be co-ordinated and planned to carry out a rescue in the minimum time using to maximum effect the resources available;
- b) To enhance the concept of effective bridge team work procedures.
- c) To enhance the importance of effective and explicit communication.

Outline of Exercise(s)

The casualty should be realistically controlled by the instructor and may, for instance, sink before rescue ships arrive on the scene. Each own ship, together with instructor-controlled targets (including helicopter(s) and a coast station), should be involved in the response to the distress. Exercise(s) should include:

- a) navigation and anti-collision considerations. The need for the casualty to assist location by others;
- b) the use of EPIRBS and SARTS;
- c) co-ordination and planning of the search and rescue, including the use of the MERSAR manual;
- d) manoeuvre to pick up survivors.

Stage 4 - Navigation and Collision Avoidance

Theme Intensive exercises involving the approaches to and passage through areas of heavy traffic with navigational restrictions.

Objectives To consolidate correct passage planning and watchkeeping procedures required for effective control of navigation in confined waters with heavy traffic.

Outline of Exercises

The exercises should stretch the ability of individuals and teams to the realistic maximum. They should include as many aspects as possible of navigation and collision avoidance.

Points covered in Stages 1 and 2 should be introduced as appropriate and the exercises should also include the following:

- a) the production and execution of a passage plan through an area containing focal points for traffic and traffic separation zones;
- b) the production and execution of detailed passage plan(s) of a voyage which includes a confined waters passage and the approach to a pilot station and pilot embarkation. The exercise(s) should require a plan to show all relevant details including: margins of safety, clearing lines, limits, etc. and include pre-arrival and departure briefing to enhance bridge teamwork;
- c) a shore-based traffic information system.

General

At least one exercise should be of sufficient duration to enable realistic hand-overs to be effected between members of the team as appropriate to prevailing circumstances, e.g. the onset of restricted visibility.

Specification for Navigation, radar and ARPA simulator training -Management Level

Equipment

The following minimum outfit is required for the conduct of Navigation, radar and ARPA simulator training at management level:

- 1 A marine navigational equipment simulator which has been approved by the Maritime and Coastguard Agency as complying with:
 - a) the IMO performance standards for radar and ARPA simulation equipment; and
 - b) the recommended standards for navigation and watchkeeping simulation equipment.
- 2 The simulator shall drive, in real time, at least three own ship positions. Each own ship position shall be provided with:
 - a) an ARPA radar display and a trainee control station for manoeuvring of own ship;
 - b) data provided through real, representative, or graphic displays, or in alpha-numeric forms from an electronic position fixing aid (Loran C, GPS, DGPS, ECDIS), an echo sounder and AIS (when available);
 - c) appropriate charts, manual plotting aids, a plotting table, a time clock, a compass and ship's speed readouts. Additionally a simulated radio-telephone communications system shall be provided (ship-to-ship and ship-to-shore (instructor's position)).
- 3 The display of ARPA features shall be related to the simulation of the own ship's position.
- 4 The navigational displays and data outputs required in paragraph 2 and 3 above shall be controlled by the simulator computer and be related to the respective own ship position with typical errors of these displays being controlled by the instructor. Where appropriate, the relevant operating instructions and error correction data shall be made available to the trainees.

- 5 Each own ship position shall be accommodated in a cubicle or room separated from the other own ships, the main simulator computer and the instructor's position by adequate sound proofing.
- 6 A space for briefing and de-briefing shall be made available.

Specification for Navigation, radar and ARPA simulator training -Management Level

Assessment requirements

General The principal aim of assessment is to ascertain whether the student achieves the stated objectives of the training to a level which, in the opinion of the assessor and taking account of the criteria below, is considered satisfactory. The assessor must evaluate the performance of each student progressively over the entire duration of the training. In most cases weaknesses will be highlighted during de-briefing sessions and due account must be made of any subsequent improvement in performance.

On the other hand, it is vital that a failed assessment should be considered where a student does not show a significant improvement in performance after initially reacting to potentially dangerous situations in an unacceptable manner. The certificate should be withheld until satisfactory re-training has been undertaken. Relevant weak points must be discussed between the assessor and the student concerned.

- Criteria:** At the end of the training the student should:
- i take correct (and reasonable) decisions in accordance with the International Regulations for Preventing Collisions at Sea;
 - ii appreciate the dangers of allowing a situation to develop through failure to take early and positive counter-measures;
 - iii justify actions taken, and learn from own actions and those of others;
 - iv use navigational and collision avoidance data in a co-ordinated and interrelated manner for the safe navigation of his/her ship;
 - v obtain and apply correctly data from the navigational instruments available to him/her;
 - vi effectively take charge of "own ship";
 - vii react effectively during emergency situations;
 - viii appreciate those environmental and operational factors which could restrict the manoeuvrability of "own ship" or other ships;

ix apply the principles of effective bridge teamwork.

Note: Failure to comply with the foregoing criteria at specific points during the training should not imply a failed assessment if the student is subsequently aware of mistake(s) and gives positive indications that subsequent performance has improved to an acceptable level. The final performance will be an indication of the competence level achieved and the issue of the certificate should reflect an acceptable level of competence. Particular attention should be paid to the fact that this may be the last simulator training within the training scheme and the last opportunity to present to an assessor, a level of competence in certain navigational skills.

Section Three

Automatic radar plotting aids (ARPA) training

For officers who have not previously undertaken approved training in the use of ARPA

Automatic radar plotting aids (ARPA) training

Aim: To provide training in the fundamentals and operation of ARPA equipment and in the interpretation and analysis of information obtained from this equipment.

Intended for Masters and officers in charge of a navigational watch serving or intending to serve on ships fitted with ARPA equipment who have not received previous training as part of another programme (e.g. the Electronic Navigation Systems (ENS) course or Navigation and Radar and ARPA Simulator Training at operational level (NARAS (O))).

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

- a) follow procedures for operating the equipment and maintaining the display;

- b) obtain and analyse the data provided;
- c) take action as required for the safe conduct of navigation based on correct interpretation and analysis of ARPA data.

Outcomes The outcomes for this training are as specified in Outcome 6 of the training at operational level in Annex A of Section 1 of this publication. Further guidance can be found in Annex B of Section 1 of this publication, paragraphs 18 to 35.

Equipment The minimum equipment for conduct of this course is an approved ARPA set that meets the IMO specification for such equipment. A simulator that has an inter-active capability approved by DMS must provide the inputs to the ARPA.

Entry to the course Students entering this course must hold a Radar Observer's Certificate (or an equivalent acceptable to DMS) or a certificate of attendance at a Small Ships Navigation and Radar Course.

Officers required to undertake this course who have not previously attended a Radar Simulator Course will be required to follow a preliminary intensive period of revision of basic radar plotting on a radar simulator. It is for the training establishment to decide on the extent of any such preliminary training needed to enable the objectives of the ARPA training to be achieved and whether to allow groups of students having a varied background of radar experience entry on to the same ARPA course.

Duration and conduct The time needed to achieve the objectives will depend to a large extent upon previous experience and training and the equipment available for the conduct of the course. The objectives of the course can be achieved if there are no more than two students per ARPA display. Each pair should spend a minimum of nine hours using the ARPA equipment, and each student should be given equal opportunity to operate the equipment.

The syllabus topics should be covered, as appropriate, by instruction, demonstrations, and intensive simulator exercises on the use of ARPA. Attention is drawn to

the need for the trainees to undergo a series of real-time exercises followed by de-briefing and discussion of actions taken during the exercises. Due attention must be given to:

- a) the need to act at all times in accordance with the provisions of the Collision Regulations and Chapter VIII of the STCW Convention Standards Regarding Watchkeeping
- b). he dangers inherent in over-reliance on ARPA data;
- .c) the capabilities and limitations of the system and those factors which can affect the system's performance and accuracy.

Qualifications

Training and assessment must be undertaken by persons qualified in accordance with the provisions of Section A-1/6 of the STCW Code.

Quality standards

The arrangements for delivering the training and assessing competence must be continuously monitored through a quality standards system to ensure achievement of defined objectives.

Centres are required to maintain a quality standard through documented procedures.

The quality standards system and evaluation arrangements may be part of a centre's overall quality assurance system.

Documentation

Achievement of the desired standard of competence will be attested to by a certificate issued by the centre.

Section Four

Bridge watchkeeping preparatory course

An optional course which complements the mandatory training in section 1

Bridge watchkeeping preparatory course

Aim	To consolidate the previous training of potential officers and prepare them for all aspects of the duties of watchkeeping officers.
Intended for	<p>Candidates for certificates of competency as officer in charge of a navigational watch who have completed at least 9 months sea service whilst following an approved programme of on-board training.</p> <p>This training incorporates, expands and extends in depth the mandatory training described in for Navigation, Radar and ARPA Simulator Training at Operational Level. It may therefore be integrated into an approved programme of training leading to certification as officer in charge of a navigational watch as a voluntary addition. (See also 'assessment' below)</p>
Objectives	<p>At the end of the course the student should be able to:</p> <ol style="list-style-type: none">1 understand the need to maintain an efficient look-out at all times.2 understand the importance of reading and following Standing Orders with Bridge Procedure Guides and Night Order Books.3 maintain all necessary navigational log books and records.4 appreciate the vessel's turning ability and stopping distances to enable proper and effective action to be taken.5 appraise the information required to plan a passage from berth to berth.

- 6 prepare a passage plan using all relevant navigational information available.
- 7 prepare the vessels' bridge equipment for departure and arrival and be aware of other vessel preparation needs. e.g. flags, pilot ladders, etc.
- 8 take over and subsequently hand over a watch.
- 9 keep a navigational watch in clear and restricted visibility, when in open, coastal, traffic congested and pilotage waters and when at anchor. In particular, be able to:
 - i. understand the need to monitor and assess
 - ii monitor and assess traffic situations and effectively report them as necessary;
 - iii identify a collision risk in both clear weather and in reduced visibility situations and to take appropriate action;
 - iv appreciate the need to monitor all bridge equipment and to respond to the information received or to a malfunction;
 - v monitor navigational equipment and respond efficiently to the information received or to a malfunction;
 - vi understand the need to monitor the progress of the vessel at all times;
 - vii adjust the progress of the vessel if required;
 - viii anticipate and identify situations where it is necessary to call the Master and to take that appropriate action;

- ix understand the level of support required from junior members of a bridge team in pilotage or confined waters;
- x provide support to the master, Pilot, or Senior Officer of the watch;
- xi communicate clearly, concisely and correctly;
- xii respond appropriately to emergency and hazardous situations;
- xiii maintain a watch when at anchor.

Conduct of the course

The objectives of the course will be achieved by a series of realistic ship simulator exercises, conducted in real time, supported by instruction through briefings, de-briefings, discussions and films.

The training plan must incorporate at least 70 hours of exercises and instruction over a period of two weeks. It is expected that during the average day of seven hours some four and a half hours will be spent by each group in the simulator. It is strongly recommended that wherever possible the course is organised on a residential basis.

Each group will undergo a minimum of eighteen simulator exercises. For the purpose of each exercise the roles of officer of the watch, helmsman and lookout/standby will be allocated in turn to each of the four participants in a group. No participant will be required to play the role of the master or pilot; these tasks will be carried out by members of the instructing staff. Normally there will be three members of the bridge team on the bridge. The fourth person will not usually be on the bridge, but will be gainfully employed.

The training plan will be made up of several simulated voyages. Each exercise will form part of the logical and realistic sequence of a voyage from berth/anchorage to berth/anchorage. The length of each exercise will vary according to its particular requirements. No more than three 'own ship' types

should be used during the training and, wherever possible, the models used should be representative of the ship types on which those undergoing training have served.

Course programme

The exercises should become progressively more onerous. Details should include:

- i joining ship; familiarisation with ship, bridge equipment, manoeuvring characteristics, procedures and standing orders; appraisal and planning of the passage; preparing bridge equipment for sea passage; navigation in pilotage waters, supporting the pilot; disembarking the pilot; keeping navigational records.
- ii keeping a watch in traffic congested areas with or without the master having the con, and in clear and restricted visibility - calling the master, supporting the master. handing over the watch; keeping navigational records.
- iii keeping a watch in open/coastal waters in clear and restricted visibility; taking over the watch, monitoring and assessing traffic, identifying a collision risk and taking appropriate action; dealing with hazardous and emergency situations; handing over the watch; keeping navigational records; preparations for making a landfall.
- iv keeping a watch in coastal/harbour approach areas in clear and restricted visibility; taking over the watch, supporting the master, preparing for arrival, embarking the pilot, support the pilot; anchoring and keeping an anchor watch; use of other navigation equipment; navigational records;
- v emergencies (e.g. steering failures).

Debriefs will be held after every exercise and before progressing to the next. The 'voyage' cycle of exercises will provide the added advantage of a voyage debrief.

In order to facilitate the running of two groups in one simulator it will be necessary for one group to start earlier than the other on each day. For some exercises one group will hand over/take over the watch to/from the other group.

Equipment

A bridge simulator as defined in Section Seven of this document (see page 76) for Navigation and Watchkeeping simulation.

Assessment

Candidates' performance and understanding of the basic principles will be closely monitored throughout the course.

Evidence obtained from the exercises in this course may count towards achievement of outcome 8 of the specification for Navigation, Radar and ARPA Simulator Training at Operational Level if it is assessed in accordance with the requirements in Section One of this document.

Qualifications

\ Training and assessment must be undertaken by persons qualified in accordance with the provisions of Section A-1/6 of the STCW Code.

Quality standards

The arrangements for delivering the training and assessing competence must be continuously monitored through a quality standards system to ensure achievement of defined objectives.

Centres are required to maintain a quality standard through documented procedures that shall be inspected and monitored at intervals not exceeding five years.

The quality standards system and evaluation arrangements may be part of a centre's overall quality assurance system.

Certificate

A college Bridge Watchkeeping Preparatory Course attendance certificate will be issued to officers who satisfactorily complete the course. The certificate must indicate that the training was undertaken in accordance with this recommendation.

Where a student on a course does not meet the specified objectives within the suggested duration for the course programme, he/she should be made to make good the deficiency before a certificate is issued.

Approval

Centres offering training and assessment must be approved by DMS

Section Five

Navigation and radar training – small ships

Aim

The aim of this is to equip the trainee with the fundamental knowledge and skills needed to keep a safe navigational watch and to use radar and other electronic aids to maintain safety of navigation in small vessels.

Intended for

Candidates for a certificate of competency as deck officers on NCV and who have not previously undertaken approved training in radar/electronic navigational systems.

The training will also be suitable for other seafarers serving in ships of limited size requiring familiarisation or updating/refresher training in the use of radar and other electronic navigation systems.

Objective

At the end of the course the participants should be able to evaluate and make efficient use of navigational information to aid the safe navigation of their vessels and fully appreciate the dangers involved with the mis-use of radar and other electronic navigation systems.

Course programme

The course covers the basic principles of coastal navigation, passage planning and the use of radar and other electronic aids to navigation commonly found on small vessels. The course is designed to be mainly practical and includes simulator based exercises representative of real situations and tailored wherever possible to local navigational circumstances. The exercises will be appropriate to the maturity and experience of the course participants and will seek to

promote high standards of safe navigation and watchkeeping. The group discussion and analysis after every exercise is regarded as a significant contribution to achieving the aims of this course.

Conduct of the course It is intended that the course shall be not less than 36 hours duration. This period can be split into short sessions to suit local needs by arrangement with the training centre concerned; and flexible methods of training delivery are encouraged wherever this is possible.

The programme of exercises to be conducted is at Annex A. Guidance on the content of the course is at Annex B.

Equipment The training must be undertaken using the following minimum range of equipment, which may be live or simulated:

- i a GPS receiver
- ii an echo sounder
- iii a marine radar set
- iv a radar simulator of a type approved by DMS. The use of a training vessel to supplement the simulator would be at the discretion of the training centre.

Note: Generally, it is anticipated that the equipment could be that used for other approved training in radar, ARPA and other electronic navigation systems. Alternatively, equipment of a type more commonly found on small vessels may be used.

Assessment The student's performance and understanding, with respect to the basic principles on which the simulated exercises are based will be closely monitored by the instructors.

Qualifications Training and assessment must be undertaken by persons qualified in accordance with the provisions of Section A-I/6 of the STCW Code.

Quality standards

The arrangements for delivering the training and assessing competence must be continuously monitored through a quality standards system to ensure achievement of defined objectives.

Centres are required to maintain a quality standard through documented procedures that shall be inspected and monitored by DMS.

The quality standards system and evaluation arrangements may be part of a centre's overall quality assurance system.

Documentation

Achievement of the desired standard of competence will be attested to by a certificate issued by the centre – see Annex C. The certificate must indicate that the training was undertaken in accordance with this recommendation.

Specification for training in Small Ships Navigation and Radar Course programme

Introduction

- 1 The course must include the programme of simulator exercises described in this annex but training centres are free, within the following general guidelines to design the details of their own exercises.
- 2 The conduct of the simulator exercises and of the course as a whole must be adapted as appropriate to take account of the prior experience of the course participants.
3. The format of practical exercises will take into account the following:
 - i the principles of safe navigational watchkeeping;
 - ii the use of radar and other typical navigational equipment including correct setting up procedures;
 - iii the use of radar plotting aids;
 - iv sound basic chartwork;
 - v selection of navigational data appropriate to prevailing circumstances;
 - vi use of radiotelephony;
 - vii effective bridge watchkeeping organisation;
 - viii access to weather reports and predictions;
 - ix the planning and execution of passages in confined and open waters, including the use of relevant navigational publications.

Exercises

- 4 The practical exercises will be designed and conducted around three main themes and will emphasise the importance of the principles of keeping a safe navigational watch and bridge procedures as applied to small vessels:

Theme 1 Collision avoidance

Objectives

- i to enable the student to understand and use the information presented by electronic navigation systems, including radar, to determine the ship's position and maintain safety of navigation;
- ii to recognise, where action is necessary, the need for generally making substantial alterations of course and/or speed at an early stage in the encounter;
- iii to recognise the possibility that action taken by one ship may negate action taken by another, particularly when bearings are initially changing slowly.
- iv to understand the importance of effective bridge teamwork procedures and apply the principles to be observed in keeping a safe navigational watch.

Theme 2 Navigation and collision avoidance

Objectives

- i to illustrate the need to ascertain the position of own ship and monitor progress when making a landfall and navigating in coastal waters;
- ii to maintain a proper radar watch, using various types of radar display;
- iii the production and execution of a navigational voyage plan to include the use of electronic aids to navigation, the concept of parallel index techniques, the effects of tidal streams and wind prediction and allowances, the recognition and response to malfunction of equipment.

Theme 3 Navigation and collision avoidance when making an extended passage in clear and in poor visibility through an area of heavy traffic and navigation restrictions.

Objectives

- I to produce and execute a passage plan through an area containing focal points for traffic and traffic separation zones;
- ii to effect the proper handover between watchkeepers appropriate to the prevailing circumstances;

- iii to appreciate the input of shore originated traffic information and the effect of pilot stations in the area.

Specification for training in Small Ships Navigation and Radar

Principles of operation of electronic position fixing systems and radar

1 Radar

Radar as a ranging device

Limitations of radar in determining the range of targets

Radar for bearing measurement

Limitations of radar in determining the bearing of targets, the effect of horizontal beam-width particularly on land targets

Display setting up procedures including the use of performance monitoring facilities

Heading marker and its alignment

Sea and precipitation clutter

Relative motion displays:

- Head up display - unstabilised

- North up display - stabilised

True motion displays

Shadow sectors and blind arcs

False echoes

Plotting as an aid to collision avoidance

Position fixing and radar navigation

Parallel indexing -basic form

Semi-automatic or automatic plotters

2 Chartwork

Courses: True, magnetic and compass

Currents and sets

Leeway

Fixes:

- Bearings, ranges and transits

- Use of sector lights and leading lines

Tides:

- Corrections to soundings

Charts:

- Admiralty and other national charts
- Chart catalogue
- Buoyage system in use

Passage planning

3 **Compass**

Check for errors of both magnetic and gyro compasses

Consistently apply such corrections effectively and appreciate that course errors may be accumulative. Recognise errors in position fixes due to bearing errors

Recognise the need for proper record keeping of courses steered, being steered and projected

Effective monitoring of courses steered by manual or automatic helmsman.

Examine bridge procedures for watch changeover

4 **General navigation**

Setting up procedures for Satellite Navigator and other navigational aids other than previously referred to. Operational limitations and errors in the use of equipment

Echo sounders, use of, operational misunderstandings. Use of warning limits.

Relevant M Notices

Use of VHF

Navtex printers, navigational plotters

Development of a proper passage plan with full use of sailing directions and allowance for tides. Anticipation of zones where position-fixing is difficult and/or where particular hazards exist. Proper communication between those involved

Watchkeepers to be adequately briefed

Full records to be maintained

5 **Meteorology**

How to obtain weather information

Use of weather reports in relation to a proposed passage

Occurrence of reduced visibility. An appreciation of voyage limitations imposed by reduced visibility

Possible effect of wind direction and strength on tracks made good. Effect of wind on tides and tidal streams

Local weather anomalies

Section Six

Bridge team management

Bridge team management training

Aim	The aim of this training is to promote the use of procedures for effective bridge team management.
Objectives	<p>On completion of the training, trainees should be:</p> <ul style="list-style-type: none">i aware of the need for and be able to prepare a detailed voyage plan from berth to berthii able to make the best use of all relevant information and resources when executing and monitoring a planned passage, including:<ul style="list-style-type: none">- the use of ships' manoeuvring data to carry out standard manoeuvres- assessment of the effects of wind and tidal forces that may be encountered and application of effective countermeasuresiii able to communicate effectively with other members of a bridge teamiv aware of the necessity of carrying out a risk assessment for each stage of the voyage, with particular regard to passages in confined watersv able to implement effective appropriate crisis management procedures and initiate appropriate responses to emergenciesvi able to organise and conduct a bridge team effectively, with particular regard to the importance of briefing and de-briefing and factors such as attitude, cultural differences, workload and stress, human factors in error chains, decision making and challenge and response.

Intended for Officers who have obtained a certificate of competency as officer in charge of a navigational watch (STCW Reg II/1) and gained some experience in performing chart work and conducting routine tasks associated with standard navigational procedures and equipment.

Training plan

The course should be designed in such a way as to create an opportunity for participants to discuss and implement best practice with regard to bridge team management procedures and highlight the consequences of weaknesses in such procedures and in the organisation of the bridge team.

Although the course will need to be designed with both junior as well as senior officers in mind, a greater emphasis and task burden should be placed on the more experienced officers.

Additional guidance on the knowledge required to underpin competence is given at Annex A.

Conduct of the training

The objectives of the course can best be achieved by a series of realistically designed real time simulated exercises, aided by multi-media presentations, films, notes and discussions, including the study of relevant case histories.

As debrief is an essential and integral part of simulator training, means must be provided to record exercises and communication between team members. Sufficient time must be allocated to debriefing. Any weaknesses should be identified and the consequences of such weakness should be highlighted to encourage progressive learning.

Sufficient flexibility should be incorporated into the design and running of simulator exercises to take into account prior knowledge, experience and training of course participants. If it will prove to be of additional benefit, as far as possible participants' current ship type/s should be used for the design and running of navigational exercises.

The duration of the training will be dependant on the prior experience and training of course participants but

it is not considered that the objectives of the training could be achieved in less than five days.

Assessment	<p>The successful achievement of the objectives of the training must not be hindered by formal assessment of the performance of those undergoing training. Nevertheless, suitable formative assessment techniques should be used to demonstrate that those undergoing training have achieved an acceptable level of understanding of the basic principles and of performance.</p>
Equipment	<p>A bridge simulator as defined in Section Seven of this document Navigation and Watchkeeping simulation.</p>
Qualifications	<p>Training and assessment must be undertaken by persons qualified in accordance with the provisions of Section A-1/6 of the STCW Code.</p>
Quality standards	<p>The arrangements for delivering the training and assessing competence must be continuously monitored through a quality standards system to ensure achievement of defined objectives.</p> <p>Centres are required to maintain a quality standard through documented procedures that shall be inspected and monitored by DMS.</p> <p>The quality standards system and evaluation arrangements may be part of a centre's overall quality assurance system.</p>
Documentation	<p>Achievement of the desired standard of competence will be attested to by a certificate issued by the centre. The certificate must indicate that the training was undertaken in accordance with this recommendation.</p> <p>A certificate cannot be issued prior to approval of the training by DMS</p> <p>Approval Centres offering training and assessment must be approved by DMS</p>

Specification for training in Bridge Team Management

Guidance on content of training

The following guidance is given for those preparing training plans on the underpinning knowledge required for competence in bridge team management.

1 Voyage Planning

Appraise and plan a detailed passage plan in coastal, confined and/or pilotage waters

A berthing/un-berthing plan must also be conducted. During the appraisal and planning stage the following factors should be taken into account: vessels particulars; operational restrictions; hazards; weather; traffic density; international and local regulations.

Execute and monitor the plan with the use of standard manoeuvres and information obtained from vessels data sheets

All available resources should be made use of for this purpose. In appraising, planning, executing and monitoring a voyage plan, the comprehensive guidelines contained in annex 24 and 25 of SOLAS Chapter V should be adhered to.

Additional guidance can be obtained from the following publications:

- Bridge Team Management-A Practical Guide. Published by the Nautical Institute
- Bridge Procedures Guide published by the International Chamber of Shipping

The scope of the exercises should include but not be restricted to arrival and or departure from an anchorage, embarking and/or disembarking a pilot, turning, stopping, conduct with a pilot on board as well as berthing and/or un-berthing. When appropriate, realistic environmental conditions should be incorporated into exercise scenarios. Participants should be made aware of shallow water, bank and interaction effect with the aid of either demonstration or real time exercises.

2 Risk awareness

Conduct of risk assessment for each leg of a planned voyage.

Elements likely to give rise to hazard or risk should be identified and appropriate proactive measures planned to minimise or eliminate such risk.

3 Bridge team management

Exercise effective two-way flow of knowledge between bridge team members

The pilot, if on board, is to be considered to be a member of the bridge team. Continuous monitoring of equipment as well as team member action/s must be conducted throughout any operation to ensure the limitations and incorrect action/s of any team member will be immediately identified

4 Communications

Effective communications plays a major role in efficient bridge team management. The effect of attitude, cultural differences, workload and stress and human factors on communication chains should be considered. Challenge and response between team members must be actively encouraged to reduce or eliminate error chains.

5 Emergency and non-routine situations

Study, develop and implement procedures to respond to emergency situations as covered by IAMSAR and other relevant publications caused by the following failures:

- Communication
- Power
- Steering
- Compass
- Aids to navigation

6. Update on skills, techniques and equipment

To assist in effectively executing and monitoring a passage using all available resources course attendees should be:

- Re-appraised in their navigation skills and techniques including the best use of modern ARPA
- Advised on the limitations of electronic navigation systems and the dangers of over-reliance on a single source
- Informed on new developments in the marine industry.

Section Seven

IMO Performance Standards for the use of simulators for training and assessment

IMO Performance Standards for the use of simulators for training and assessment

PART 1 - PERFORMANCE STANDARDS

General performance standards for simulators used in training

1. Any simulator used for mandatory simulator-based training shall:
 - .1 be suitable for the selected objectives and training tasks;
 - .2 be capable of simulating the operating capabilities of shipboard equipment concerned, to a level of physical realism appropriate to training objectives, and include the capabilities, limitations and possible errors of such equipment;
 - .3 have sufficient behavioural realism to allow a trainee to acquire the skills appropriate to the training objectives;
 - .4 provide a controlled operating environment, capable of producing a variety of conditions, which may include emergency, hazardous or unusual situations relevant to the training objectives;
 - .5 provide an interface through which a trainee can interact with the equipment, the simulated environment and, as appropriate, the instructor, and
 - .6 permit an instructor to control, monitor and record exercises for the effective debriefing of trainees.

General performance standards for simulators used in assessment of competence

2. Any simulator used for the assessment of competence required under the Convention or for any demonstration of continued proficiency so required shall:
 - .1 be capable of satisfying the specified assessment objectives;

- .2 be capable of simulating the operational capabilities of the shipboard equipment concerned to a level of physical realism appropriate to the assessment objectives, and include the capabilities, limitations and possible errors of such equipment;
- .3 have sufficient behavioural realism to allow a candidate to exhibit the skills appropriate to the assessment objectives;
- .4 provide an interface through which a candidate can interact with the equipment and simulated environment;
- .5 provide a controlled operating environment, capable of producing a variety of conditions, which may include emergency, hazardous or unusual situations relevant to assessment objectives; and
- .6 permit an assessor to control, monitor and record exercises for the effective assessment of the performance of candidates.

Additional performance standards

- 3. In addition to meeting the basic requirements set out in paragraphs 1 and 2, simulation equipment to which this section applies shall meet the performance standards given hereunder in accordance with their specific type.

Radar simulation

- 4. Radar simulation equipment shall be capable of simulating the operational capabilities of navigational radar equipment which meets all applicable performance standards adopted by IMO and incorporate facilities to:
 - .1 operate in the stabilised relative motion mode and sea and ground stabilised true motion modes;
 - .2 model weather, tidal streams, current, shadow sectors, spurious echoes and other propagation effects, and generate coastlines, navigational buoys and search and rescue transponders; and
 - .3 create a real-time operating environment incorporating at least two own-ship stations with ability to change own ship's course and speed, and include parameters for at least 20 target ships and appropriate communication facilities.

Automatic Radar Plotting Aid (ARPA) simulation

5. ARPA simulation equipment shall be capable of simulating the operational capabilities of ARPAs which meet all applicable performance standards adopted by IMO, and shall incorporate the facilities for:
 - .1 manual and automatic target acquisition;
 - .2 past track information;
 - .3 use of exclusion areas;
 - .4 vector/graphic time-scale and data display; and
 - .5 trial manoeuvres.

Navigation and watchkeeping simulation

6. Navigation and watchkeeping simulation equipment should, in addition to meeting all applicable performance standards set out above, be capable of simulating navigational equipment and bridge operational controls which meet all applicable performance standards adopted by the Organisation, incorporate facilities to generate soundings and:
 - .1 create a real-time operating environment, including navigation control and communications instruments and equipment appropriate to the navigation and watchkeeping tasks to be carried out and the manoeuvring skills to be assessed;
 - .2 provide a realistic visual scenario by day or by night, including variable visibility, or by night only as seen from the bridge, with a minimum horizontal field of view available to the trainee in viewing sectors appropriate to the navigation and watchkeeping tasks and objectives; and
 - .3 realistically simulate 'own ship' dynamics in open water conditions, including the effects of weather, tidal stream, currents and interaction with other ships.

PART 2 - OTHER PROVISIONS

Simulator training objectives

7. The aims and objectives of simulator-based training must be defined within an overall training programme. Specific training objectives and

tasks are to be selected so as to relate as closely as possible to shipboard tasks and practices.

Training procedures

8. In conducting mandatory simulator-based training, instructors shall ensure that:
 - .1 trainees are adequately briefed beforehand on the exercise objectives and tasks and are given sufficient planning time before the exercise starts;
 - .2 trainees have adequate familiarisation time on the simulator and with its equipment before any training or assessment exercise commences;
 - .3 guidance given and exercise stimuli are appropriate to the selected exercise objectives and tasks and to the level of trainee experience;
 - .4 exercises are effectively monitored, supported as appropriate by audio and visual observation of trainee activity and pre- and post-exercise evaluation reports;
 - .5 trainees are effectively debriefed to ensure that training objectives have been met and that operational skills demonstrated are of an acceptable standard;
 - .6 the use of peer assessment during debriefing is encouraged; and
 - .7 simulator exercises are designed and tested so as to ensure their suitability for the specified training objectives.

Assessment procedures

9. Where simulators are used to assess the ability of candidates to demonstrate the levels of competency, assessors shall ensure that:
 - .1 performance criteria are identified clearly and explicitly and are valid and available to the candidates;
 - .2 assessment criteria are established clearly and are explicit to ensure reliability and uniformity of assessment and to optimise objective measurement and evaluation, so that subjective judgements are kept to the minimum;

- .3 candidates are briefed clearly on the tasks and/or skills to be assessed and on the tasks and performance criteria by which their competency will be determined;
- .4 assessment of performance takes into account normal operating procedures and any behavioural interaction with other candidates on the simulator or simulator staff;
- .5 scoring or grading methods to assess performance are used with caution until they have been validated; and
- .6 the prime criterion is that a candidate demonstrates the ability to carry out a task safely and effectively to the satisfaction of the assessor.

Qualifications of instructors and assessors

- 10. Instructors and assessors must be appropriately qualified and experienced for the particular types and levels of training and corresponding assessment of competence (as specified in regulation I/6 and section A-I/6 of STCW95).