



SIMULATED ELECTRONIC NAVIGATION COURSES

REVISION 2
JUNE 2008



Responsible Authority	Approval
<p>The Director, Marine Personnel Standards and Pilotage is responsible for this document, including any change, correction, or update.</p>	<hr/> <p style="text-align: center;">Capt. Naim Nazha Director, Marine Personnel Standards and Pilotage Marine Safety</p>

Original Date Issued: July 2000

Date Revised: June 2008

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Transport, 2000.

Permission is granted, by Transport Canada, to copy this TP 4958E as required. While use of this material has been authorized, Transport Canada shall not be responsible for the manner in which the information is presented, nor for any interpretations thereof. This TP 4958E may not be updated to reflect amendments made to the original content. For up-to-date information, contact Transport Canada.

TP 4958E
(06/2008)

TC-1002797

DOCUMENT INFORMATION

Title	SIMULATED ELECTRONIC NAVIGATION COURSES		
TP No.	4958E	Revision	2 RDIMS # 3691784
Originator	Marine Personnel Standards and Pilotage (AMSP) Tower C, Place de Ville 330 Sparks Street, 11 th Floor Ottawa, Ontario K1A 0N8	Telephone	613-991-3120
		Fax	613-990-1538
		E-mail	MarineSafety@tc.gc.ca
		URL	http://www.tc.gc.ca/MarineSafety

REVISIONS

Last Review				
Next Review				
Revision No.	Date of Issue	Affected Pages	Author(s)	Brief Description of Change
1	July 2007	All document	Capt. George Ianiev Capt. Zenon Szlachetka Capt. Jules St-Laurent	Complete revision of the publication and change in the template
2	June 2008	All document	Multimedia Publishing Services	Change in the template

TABLE OF CONTENTS

CHAPTER 1 – GENERAL	1
Scope and Application.....	1
1.1 Purpose	1
1.2 Scope	1
1.3 Authority.....	1
1.4 Effective Date	1
1.5 Course Approval Conditions	1
1.6 Duration of Courses	2
1.7 IMO References.....	3
1.8 Class Size.....	4
1.9 Student Instructor Ratio	4
1.10 Attendance	4
1.11 Course Entry Requirements	4
1.12 Qualification of Instructors and Main Instructor Approval	5
1.13 Examination and Assessment/Evaluation of Students	6
1.14 Proof of Successful Course Completion	6
1.15 Refresher Courses	6
1.16 Navigation Equipment List.....	7
CHAPTER 2 – SEN 1	8
Simulated Electronic Navigation, Level I, Part A	8
2.1 Course Goal	8
2.2 Wording on Training Certificate (EXN 24).....	8
2.3 Course Outline	8
CHAPTER 3 – SEN 1	19
Simulated Electronic Navigation, Level I, Part B.....	19
3.1 Course Goal	19
3.2 Wording on Training Certificate.....	20
3.3 Course Outline	20
CHAPTER 4 – SEN 2	25
Simulated Electronic Navigation, Level II	25
4.1 Course Goal	25
4.2 Wording on Training Certificate.....	26
4.3 Course Outline	26

CHAPTER 5 – ARPA	31
Simulated Electronic Navigation – Refresher Training	31
5.1 Purpose	31
5.2 Scope	31
5.3 Wording on Training Certificate.....	31
5.4 Course Outline.....	31
CHAPTER 6 – ECDIS	36
Electronic Chart Display and Information Systems	36
6.1 Purpose	36
6.2 Scope	36
6.3 Wording on Marine Training Certificate	36
6.4 References	36
6.5 Course Outline.....	37
6.6 Course References	46
CHAPTER 7 – SEN LIMITED	47
Navigation Instruments for Entry Level Marine Certification	47
7.1 Course Goals.....	47
7.2 Wording on Training Certificate.....	47
7.3 Course Material and Equipment	47
7.4 Attendance and Pre-requisite Requirements	47
7.5 Examination and Assessment/Evaluation of Students	48
7.6 Course Outline.....	48

CHAPTER 1 – GENERAL

SCOPE AND APPLICATION

1.1 PURPOSE

To address the goals of the International Maritime Organization (IMO) and parties to the Standards of Training Certification and Watchkeeping (STCW) Convention of 1978 as amended in 1995, in their desire to promote the safety of life at sea and the protection of the marine environment.

1.2 SCOPE

Training of masters and deck officers in the application of electronic navigation systems and instruments by following standards regarding watchkeeping.

1.3 AUTHORITY

The *Marine Personnel Regulations*, made pursuant to the *Canada Shipping Act 2001*.

1.4 EFFECTIVE DATE

The Transport Publication (TP) 4958 takes effect on July 01, 2007.

1.5 COURSE APPROVAL CONDITIONS

(1) Course and Program Approval

a) Submission for approval

- i) In order to be recognized by Transport Canada, the Institution must submit its course or program proposal to Marine Personnel Standards and Pilotage, AMSP, for approval. The proposal must cover all the topics in the relevant chapter of the TP document, as amended from time to time. A detailed outline must be prepared in a learning objective format, explaining the depth of knowledge required and the means by which students demonstrate the knowledge, skills or competency achieved. The method of preparing the course or program must be explained, along with the various inputs and assessment methods.
- ii) The Institution must provide its publications containing the list of courses that it offers and the diplomas or training certificates that it grants, as well as general information on the Institution such as campus description, services to students and available activities, so as to describe its full range of activities and show how its work relates to the Marine program.
- iii) If so specified in the formal letter of approval for a program that is of a duration greater than 36 months, the Institution which teaches that program will advise their students that, as set out in section 114 of the *Marine Personnel Regulations*, they will receive additional service credit if they successfully complete the program.

b) Provisional approval

The proposed course or program will be given a preliminary assessment at AMSP based on the criteria set out in this document, and if it is accepted, the Director will issue a notice of provisional approval. The notice will indicate any additional requirements for final approval and for auditing purposes.

c) Assessment and formal approval

- i) Following the provisional approval at a time agreed upon by AMSP, the Institution will be visited in order to carry out an assessment of the course or program.
- ii) An examiner will be carried out an audit during delivery of the course or program at the Institution so that course presentation can be observed and so that the administration and delivery process for the course or program can be approved. If the examination in accordance with section 114 of the *Marine Personnel Regulations* is satisfactory, formal approval will be given via a letter from the Director within four weeks of the date of the assessment visit.

- (2) Institution Approval
- a) Institution suitability
- i) In order to provide a suitable teaching environment, an Institution must be equipped for all academic, laboratory and practical work required by the course/program content approved by AMSP.
 - ii) Up-to-date reference materials on Marine programs and related topics must be available to all teaching staff and students.
 - iii) In order to be considered for approval, the Institution must be served by public transport and have student accommodations within commuting distance of all program delivery sites, or else have on-site student accommodations and meal facilities within walking distance of the main delivery site. It must also have:
 - A) a learning resource centre and library with sufficient holdings to allow independent study of marine subjects; and
 - B) access to vessels sufficient for the practical aspects of the program.
- b) Course or program design
- i) The design of the course or program must follow the IMO format, as contained in the IMO document *Guidance on the implementation of IMO model courses*, or some other format approved by AMSP as equivalent.
 - ii) A Recognized Institution may incorporate Simulated Electronic Navigation (SEN) or Propulsion Plant Simulator courses in its program. However it will then have to arrange for Marine Safety examinations and issue the applicable training certificate for such courses in addition to the graduation diploma.
- c) Compliance with TP program content
- Institutions that wish to be recognized for a program are to view the content of the relevant TP as the minimum requirement with respect to equipment, subject areas, and total number of hours of student-teacher contact. With respect to the knowledge to be transferred, the overall program objectives and course goals set out in the TP represent the minimum requirement. The Institution must include in its program all subjects mentioned in the TP, but it may apportion the content differently on the basis of its process for continuous improvement and client feedback, in order to keep its program up to date.

1.6 DURATION OF COURSES

SEN 1A	Minimum duration 120 hours, including 10 hours evaluation.
SEN 1B	Minimum duration 72 hours, including evaluation.
SEN 2	Minimum duration 84 hours, including evaluation.
ARPA	Minimum duration 24 hours.
ECDIS	Minimum duration 30 hours
SEN Limited	Minimum duration 30 hours, INCLUDING 14 hours of practical training utilizing PC based simulator equipment and 2 hours evaluation

1.7 IMO REFERENCES

SEN 1A & SEN 1B2	<p>STCW Regulation I/12 & II/1 STCW Code, Table A-II/1</p> <p>Competencies:</p> <ul style="list-style-type: none"> – Plan and conduct passage and determine position – Maintain safe navigational watch – Use of radar and ARPA to maintain safety of navigation* – Respond to emergencies – Manoeuvre the ship <p>IMO model course 1.07</p>
SEN 2	<p>STCW Regulations I/12, II/2 & II/3 STCW Code, Table A-II/2</p> <p>Competencies:</p> <ul style="list-style-type: none"> – Plan a voyage and conduct navigation – Determine position and the accuracy of resultant position fix by any means. – Determine and allow for compass errors. – Coordinate search and rescue operation – Establish watchkeeping arrangements and procedures – Maintain safe navigational watch through the use of radar and ARPA and modern navigation systems to assist command decision-making* – Manoeuvre and handle a ship in all condition <p>STCW Code, Table A-II/3</p> <p>Competencies:</p> <ul style="list-style-type: none"> – Plan and conduct a coastal passage and determine position (navigational aids and equipment*) – Maintain safe navigational watch – Respond to emergencies – Respond to distress at sea <p>IMO model course 1.08</p>
ARPA	<p>STCW Regulations I/11, I/12, II/1, II/2, II/3, 1.1 STCW Code A-I/11 1.2 STCW Code, Table A-II/1</p> <p>Competency:</p> <ul style="list-style-type: none"> – Use of radar and ARPA to maintain safety of navigation* <p>1.3 STCW Code, Table A-II/2</p> <p>Competency:</p> <ul style="list-style-type: none"> – Maintain safe navigational watch through the use of radar and ARPA and modern navigation systems to assist command decision-making* <p>1.4 STCW Code, Table A-II/3</p> <p>Competencies:</p> <ul style="list-style-type: none"> – Plan and conduct a coastal passage and determine position (<i>navigational aids and equipment*</i>) <p>IMO model courses 1.07 & 1.08</p>

ECDIS	1.5 STCW Regulation II/1 STCW Code, Table A-II/1 Competency: – Plan and conduct passage and determine position IMO model course 1.27
SEN Limited	Not applicable. Used with: Limited, Domestic and Fishing certificates of competency.
NOTE: *competencies refer to STCW mandatory simulator-based training	

1.8 CLASS SIZE

SEN 1A – Classroom Lectures	No limit.
SEN 1A – Navigation Instrument Laboratory	Maximum of two (2) students per unit of equipment, maximum to be determined by Marine Safety audit.
SEN 1B – Practical Simulated Exercises	Maximum of two (2) students per own ship simulation room (O/S).
SEN 2 – Simulator	Maximum of two (2) students per O/S.
ARPA	Maximum of two (2) students per unit of equipment.
SEN Limited	Maximum of two (2) students per unit of equipment.
ECDIS	Maximum of two (2) students per unit of equipment.

1.9 STUDENT INSTRUCTOR RATIO

Student/instructor ratio 8:1 for courses other than SEN Limited. 12:1 ratio for SEN Limited, or as determined by Transport Canada audit.

1.10 ATTENDANCE

At least, 90% attendance is required. See section 7.5 for additional provisions for SEN Limited.

1.11 COURSE ENTRY REQUIREMENTS

SEN 1A	Nil.
SEN 1B	SEN 1A, ROC-MC, knowledge of Chartwork and Pilotage (C&P2), and Rules of the Road related to Navigation Safety (NS1).
SEN 2	ROC-MC, SEN 1 A & B, or Marine Safety approved qualifying service.
ARPA	Successful completion of SEN 1, or SEN 2.
ECDIS	Knowledge of Chartwork and Pilotage (C&P2).
SEN Limited	Nil.

1.12 QUALIFICATION OF INSTRUCTORS AND MAIN INSTRUCTOR APPROVAL

- (1) The main instructor to deliver SEN 1 courses shall:
 - a) Hold one of the following certificates:
 - i) Canadian Master, Near Coastal;
 - ii) Chief Mate, Near Coastal; or
 - iii) Fishing Master, First-Class.
 - b) Have successfully completed approved SEN 1 and SEN 2 courses which included ARPA;
 - c) have experience in course and curriculum development or have attended a course on this subject. Program instructors must hold teaching qualifications incorporating training in instructional techniques, educational technology and evaluation methods. These qualifications may be obtained in one of the following ways:
 - i) Through a federal government department in Canada, or an overseas government which operates a recognized teacher training program;
 - ii) Through a provincially accredited post-secondary education institution in Canada;
 - iii) Through a firm in Canada which is recognized by a provincial government or by the federal government, and which is engaged in providing education and training or educational technology consulting services.
- (2) The main instructor to deliver SEN 2 and ARPA courses shall:
 - a) hold one of the following certificates:
 - i) Canadian Master Mariner;
 - ii) Master, Near Coastal;
 - iii) Chief Mate, Unlimited;
 - iv) Fishing Master, First-Class; or
 - v) Equivalent level determined by TC.
 - b) have successfully completed approved SEN 1 and SEN 2 courses, which included ARPA and ECDIS;
 - c) shall hold a teaching certificate or equivalent as stated in 1.12(1)(c).
- (3) The main instructor to deliver ECDIS courses shall comply with section 1.12(2).
- (4) The main instructor to deliver SEN Limited courses shall:
 - a) hold at least Watchkeeping Mate, Master 500 Gross Tonnage, Domestic or Fishing Master, Second Class certificate of competency;
 - b) hold teaching qualification as stated in 1.12(1) c), or complete a mentoring program acceptable to Transport Canada.
- (5) All assistant instructors must hold qualifications acceptable to Transport Canada.
- (6) Main course instructors, in addition to holding qualifications described in 1.12 (1), 1.12(2), 1.12(3) or 1.12 (4) as applicable must undergo training as an Assistant Instructor for one (1) course and then teach a course under the supervision of an accredited Main Course Instructor. Marine Safety will audit this course prior to approval of the instructor as a Main Course Instructor. Marine Safety may make exceptions in these training requirements, after considering all circumstances. Instructors approved by TC prior to July 2007 are deemed as meeting the requirements of Section 1.12.

1.13 EXAMINATION AND ASSESSMENT/EVALUATION OF STUDENTS

- (1) The approved instructor conducting the course shall determine successful completion of the SEN 1, SEN 2, ARPA, ECDIS or SEN Limited courses.
- (2) The course main instructor shall maintain an ongoing evaluation of students during the SEN 1, SEN 2, ARPA, ECDIS and SEN Limited courses.
- (3) SEN 1A students must successfully complete an objective examination at the end of the course.
- (4) Simulators will be used to assess the ability and skill of candidates in the SEN 1B, SEN 2 and ARPA courses. Simulator application programs will be used to assess the ability and skills of candidates for SEN Limited and ECDIS.
- (5) Specific learning objectives are to be used to indicate precisely what the trainee must do to demonstrate knowledge, understanding (viva-voce) and skill (application) as an end product of the learning process.
- (6) The main course instructor shall ensure that: (STCW Code section A-1/12.8)
 - a) performance criteria are identified clearly and explicitly, are valid and available to the candidates;
 - b) assessment criteria are established clearly and are explicit to ensure reliability and uniformity of assessment to optimize objective measurement, evaluation, and minimize subjective judgments;
 - c) 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;
 - d) assessment of performance takes into account normal operating procedures and any behavioral interaction with other candidates during simulation or with instructors;
 - e) scoring or grading methods to assess performance are to be used with caution until they have been validated;
 - f) the prime criterion is that a candidate demonstrates the ability to carry out a task safely and effectively to the satisfaction of the assessor;
 - g) specific number of training exercises to be marked by the lead instructor.

1.14 PROOF OF SUCCESSFUL COURSE COMPLETION

- (1) Certificate of successful course completion from the institution on the approved Transport Canada Training Certificate.
- (2) Institution or organization to maintain record of training certificates issued to students/participants. Lists of participants and serial numbers of training certificates to be sent to the local TC office.

1.15 REFRESHER COURSES

Course	Refresher Course
SEN 1 and SEN 2	ARPA
SEN Ltd	SEN Ltd has to be repeated

- (1) ARPA must be used as a refresher course for SEN courses, thus, meeting the *Marine Personnel Regulations* requirements for applicants who wish to renew their certificate after having been away from the marine environment for more than five years.
- (2) The ARPA course may be used as a refresher course for SEN 1 and SEN 2, whereas SEN Ltd should have to be repeated again.

1.16 NAVIGATION EQUIPMENT LIST

Instrument	Category	SEN Lab	Simulator
Radar*	1	Real	Real
Radar/ARPA*	1	Real	Real
GPS*	1	Real	Stylized
GPS/DGPA*	1	Real	Stylized
Loran C*	1	Real	Stylized
Gyro Compass	1	Real	Stylized
Echo Sounder	1	Real	Stylized
Steering Control System	1	Real	Stylized
Log (Speed & Distance)	1	–	Stylized
Propulsion & Maneuvering System	1	–	Stylized
VHF	1	–	Stylized
Radio Telephone	1	–	Stylized
Rate of Turn Indicator	2	–	Stylized
Internal Communication	2	–	Stylized

Category 1: Those instruments on which full instruction on user controls pertaining to navigation is given.

Category 2: Those instruments which are included in the course by highlighting their main feature(s).

*Live antenna optional

CHAPTER 2 – SEN 1

SIMULATED ELECTRONIC NAVIGATION, LEVEL I, PART A

2.1 COURSE GOAL

To provide the student with the knowledge of the principles, ability to use and the skill required for the correct operation of the navigational equipment.

2.2 WORDING ON TRAINING CERTIFICATE (EXN 24)

A Training Certificate will be issued after completion of SEN 1, which is divided in two parts: Part A (SEN 1A) and Part B, (SEN 1B). (Refer to section 3.2.)

2.3 COURSE OUTLINE

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar			
1.1 Describe the principles of Radar.			
1.1.1 Define the acronym RADAR (Radio Detection and Ranging).	X		
1.1.2 Explain the principles of electro-magnetic energy transmission.	X		
1.1.3 State how radar uses electro-magnetic energy to perform its function.	X		
1.1.4 Safe Distances are explained correctly (explains the importance of not storing radar spares nearer to magnetic compasses than the specified safe distances) as per IMO Model Course 1.07, Section 1.2.	X		
1.1.5 Radiations hazards and precautions are stated correctly (state the safety precautions necessary in the vicinity of open equipment and the radiation hazard near antennae and open waveguides) as per IMO Model Course 1.07, Section 1.3.	X		
1.2 List the five (5) main components of a marine radar system and describe the basic functions of each main component.			
1.2.1 Describe the function of the transmission unit and its related components: Power supply. Modulator. Trigger signals, Transmit/ Receiver (T/R) switch. Timing circuitry. Antenna. X versus S band.	X		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar (Continued)	x		
1.2.2 Describe the function of the Antenna and its related components: Transmission of pulses. Beam width. Horizontal scanning time. Reception of echoes.			
1.2.3 Describe the function of the receiving unit and its related components: Detection of pulses. Processing of pulses.	x		
1.2.4 Describe the display unit and its related components: Cathode-Ray Tube (CRT). Painting of echoes. Raster versus radial scan. Touch screen display.	x		
1.2.5 Describe the main performance controls: Performance monitor. Clutter controls. Gain. Tuning. Analogue specific; brilliance, focus. Digital specific; brilliance, contrast.	x		
1.3 Recognize that radar consists of computer components.			
1.3.1 List the main components of a computer system: Input device. Output device. Printed circuit boards. Central Processing Unit (CPU). Memory.	x		
1.3.2 Relate computer processing to radar: Analogue and digital concepts. Analogue to digital converter. Auto-tuning. Auto clutter. Trails.Manual plotting. Image expansion. Image averaging.	x		
1.4 Recognize IMO radar terms, symbols, controls and symbols.			
1.4.1 IMO Performance Standards for Radar Equipment.	x		
1.4.2 Define radar associated terms and symbols/controls, IMO and others.	x		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar (Continued)			
1.5 Demonstrate the correct set-up and shut-down procedure of a marine Radar.			
1.5.1 Perform pre power-on checks.			
1.5.2 Describe the function of each display control.	X		
1.5.3 Demonstrate the use of each control in the setting up procedure.	X		
1.5.4 Prepare a radar display for operational use in: Head-up orientation. Course-up orientation. North-up orientation. True motion (ground stabilized) mode. True motion (sea stabilized) mode.			X
1.5.5 Perform radar shut-down procedure.			X
1.5.6 Identify the limitations of different display modes and orientations and the dangers of misinterpretation.		X	
1.6 Demonstrate basic knowledge of the physical, atmospheric and inherent errors and limitations in a marine radar system.			X
1.6.1 Describe how a target's characteristics affect its displayed echo on a radar screen.	X		
1.6.2 Describe how atmospheric conditions can affect the performance of a marine radar.	X		
1.6.3 Describe how maladjustment or improper operation of certain radar components can affect the radar's performance.	X		
1.6.4 Describe the inherent errors, which exist in a marine radar.	X		
1.6.5 Demonstrate the use of the operating manual and system check menu(s) to identify malfunction of major components.	X		X
1.7 Demonstrate an ability to use radar for navigation.			
1.7.1 Describe the presentation of: Head-up. Course-up. North-up. Relative motion mode. True motion mode.			X
1.7.2 Describe and demonstrate the function of each radar display control.			X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar (Continued)			X
1.7.3 Perform navigational position fixing using radar ranges and bearings (true and relative) from stabilized and unstabilized presentations.			
1.7.4 Discuss and set warning parameters.		X	
1.7.5 Describe use of Nav Lines and Nav Points.	X		
1.7.6 Recognize and correct maladjustment of controls.			X
1.7.7 Determine the heading marker, bearing marker, range marker, range ring and variable range marker error.			X
1.7.8 Correct range and bearing data for known errors.			X
1.7.9 Describe detection of a SART and action required by the Officer of the Watch (OOW). Demonstrate detection of a SART.	X		
1.7.10 Describe detection, function and navigational use of Radar Beacons (RACON) and radar reflectors.	X		
1.7.11 Discuss the operation of radar in high speed craft (Ref. <i>High Speed Craft Code</i>).		X	X
1.8 Describe the use of radar for collision avoidance in all conditions of visibility including:			
1.8.1 Use of radar as a collision-warning device.	X		
1.8.2 The function of echo trail or echo track.	X		
1.8.3 The function of manual plotting on the radar presentation.	X		
1.8.4 Appropriate <i>Collision Regulations</i> as they pertain to radar.	X		
1.9 Identify routine radar checks.			
1.9.1 Demonstrate the periodic operational checks to be performed by the radar operator.			X
1.9.2 Describe the purpose and contents of the radar log.	X		
2. ARPA			
2.1 Recognize the need for Automatic Radar Plotting Aid (ARPA).			
2.1.1 Define the acronym ARPA.	X		
2.1.2 Relate ARPA to maintaining a radar watch.		X	

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
<p>2. ARPA (Continued)</p> <p>2.2 Recognize ARPA as a computer.</p> <p> 2.2.1 Relate computer processing to ARPA.</p> <p>2.3 Appreciate ARPA as a component of marine radar system.</p> <p> 2.3.1 Identify the sensors that supply ARPA input data.</p> <p> 2.3.2 Explain the processing of the input data.</p> <p> 2.3.3 Describe the ARPA output displays.</p> <p>2.4 Identify ARPA terms, symbols and limitations.</p> <p> 2.4.1 Discuss the IMO performance Standard for Automatic Radar Plotting Aids.</p> <p> 2.4.2 Define ARPA (IMO) associated terms and symbols.</p> <p> 2.4.3 Define ARPA limitations, inaccuracies of information, and dangers of over reliance.</p> <p>2.5 Explain how ARPA data is used for determination of risk of collision and collision avoidance.</p> <p> 2.5.1 Discuss appropriate action based on ARPA data and <i>Collision Regulations</i>.</p> <p> 2.5.2 Describe the function of each ARPA control.</p> <p> 2.5.3 Describe operation of trial maneuver.</p> <p> 2.5.4 Describe target history and its use.</p> <p>2.6 Identify other ARPA/Radar features and sensors that are used for navigation.</p> <p> 2.6.1 Geographic functions.</p> <p> 2.6.2 Set and drift prediction.</p> <p> 2.6.3 Other ARPA features and sensors used for navigation.</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>
<p>3. Radar Plotting</p> <p>3.1 Describe the need for radar plotting in collision avoidance.</p> <p> 3.1.1 Review the <i>Collision Regulations</i>, which apply to radar plotting. Explain the rules that apply under all conditions of visibility. Explain the rules that apply when vessels are in sight of one another. Explain the rules that apply when vessels are not in sight of one another.</p>		<p>X</p>	

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
3. Radar Plotting (Continued)			
3.2 Construct a motion triangle using M.O.T. symbols (Motion, Own, Target).			
3.2.1 Explain plotting geometry and relative motion concepts. Relative motion stabilized. Relative motion unstabilized.			X
3.2.2 Review radar display modes. Relative motion stabilized. Relative motion unstabilized.		X	
3.2.3 Develop the motion triangle. Head-up. North-up.			X
3.3 Interpret the motion in all display modes.			
3.3.1 Predict Closest Point of Approach (CPA) and time of CPA (TCPA) using the motion triangle.			X
3.3.2 Determine target course and speed using motion triangle.			X
3.3.3 Find the aspect by construction.			X
3.3.4 Recognize the use of the manual plotting facility on radar as an alternative process for the paper plot.			X
3.4 Plan collision avoidance action using motion triangle for head up and north up.			
3.4.1 Identify possible collision avoidance options.			X
3.4.2 Construct appropriate prediction motion triangle based on selected options.			X
3.4.3 Verify safety of planned action.			X
3.4.4 Verify the necessity for action.			X
3.5 Discuss application of radar plotting in multi-target situation.			
3.5.1 Determine data report for all targets.			X
3.5.2 Analyze target data reports.			X
3.5.3 Plan the most appropriate action based on the data reports in accordance with <i>Collision Regulations</i> .			X
3.5.4 Execute the planned action and evaluate effectiveness.			X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
4. Satellite Navigation (GPS/DGPS)			
4.1 Describe three (3) main segments of Global Positioning System (GPS).			
4.1.1 Discuss the space segment.	X		
4.1.2 Discuss the Terrestrial segment.	X		
4.1.3 Discuss the user segment.	X		
4.2 Describe how the GPS works.	X		
4.2.1 Discuss the IMO performance standards for GPS receiver equipment.	X		
4.2.2 Discuss how the position is calculated.	X		
4.2.3 Discuss the concept of time, pseudo ranges, codes and noise.	X		
4.2.4 Discuss the military and civilian signals.	X		
4.2.5 State GPS precision.	X		
4.2.6 Describe the various types of receivers.	X		
4.3 Describe the errors of GPS.			
4.3.1 Describe the system errors.	X		
4.3.2 Describe the independent errors.	X		
4.4 Describe the operation and the use of GPS.	X		
4.4.1 Demonstrate the setting up procedure of a GPS receiver. Identify the data required for initialization. Initialize the receiver. Perform the necessary data input. Discuss the updating process. Demonstrate the use of the receiver/search, acquire and lock on.			X
4.5 Discuss geodesy as it relates to GPS.			
4.5.1 Explain the concept of geodesy.		X	
4.5.2 Identify GPS coordinate systems.		X	
4.5.3 Discuss various datum.		X	
4.6 Discuss Differential Global Positioning System (DGPS).			
4.6.1 Explain the principles of extracting errors.		X	
4.6.2 Discuss the principles of applying differential corrections.		X	
4.6.3 Discuss GPS with reference to Satellite Based Augmentation Systems (SBAS).		X	

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
4. Satellite Navigation (GPS/DGPS) (Continued)	x		
4.7 Recognize Other satellite navigation systems.			
4.7.1 Discuss GLONASS System.	x		
4.7.2 Discuss Galileo Systems.	x		
5. LORAN-C			
5.1 Describe the components of the Loran-C System.			
5.1.1 Discuss IMO performance standards for Loran C.		x	
5.1.2 Discuss the principles of hyperbolic navigation.		x	
5.1.3 Discuss the land-based components of the Loran-C system.		x	
5.1.4 Discuss the ship borne component of the Loran-C system.		x	
5.2 Demonstrate the setting up of a Loran-C Receiver.			
5.2.1 Explain the setting up procedure of a Loran-C receiver.	x		
5.2.2 Demonstrate the setting up procedure of a Loran-C receiver.			x
5.3 Explain the navigational functions of a Loran-C Receiver.	x		
5.3.1 Explain the various navigational displays.	x		
5.3.2 Identify the uses of Loran-C data.	x		
5.3.3 Describe the use of the built in navigation computer.	x		
5.3.4 Identify the additional applications of a Loran-C.	x		
5.4 Identify the errors and limitations of the Loran-C system.			
5.4.1 Discuss the inherent errors of the system.		x	
5.4.2 Discuss the operational errors of the system.		x	
5.4.3 Discuss the variable errors of the system.		x	
5.4.4 Discuss the limitations of the system.		x	
5.5 Features common to GPS and Loran C instruments.			
5.5.1 Demonstrate route planning.			x
5.5.2 Demonstrate route monitoring.			x
5.5.3 Identify interface protocols.	x		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
6. Gyro-Compass, Auto Pilot and Course Recorder			
6.1 Describe the basic principle of a gyro-compass.	X		
6.2 Describe the performance standard for heading control systems.	X		
6.3 Describe the starting and stopping procedure for a gyrocompass.			
6.3.1 Recognize the importance of the operator's manual.	X		
6.3.2 Demonstrate the correct starting procedure.			X
6.3.3 Describe the correct stopping procedure.			X
6.4 Describe the set-up procedure for a gyrocompass repeater system.			
6.4.1 List various applications of gyrocompass repeaters.	X		
6.4.2 Describe the set-up procedure for each type.	X		
6.5 State the operational checks and performance monitoring functions to be performed on a gyro-compass and repeaters.			
6.5.1 List the checks required for a gyro-compass.	X		
6.5.2 Detail the documentation necessary.	X		
6.6 Identify the limitations of a gyro-compass.			
6.6.1 List the limitations of a gyro-compass.	X		
6.6.2 Describe the effect of each limitation.	X		
6.7 Discuss the characteristics of auto-pilot.			
6.7.1 List the advantages of auto-pilot.	X		
6.7.2 List the disadvantages of auto-pilot.	X		
6.8 Discuss the basic operation of auto-pilot.			
6.8.1 Describe the basic components of an auto-pilot.	X		
6.8.2 Describe the function of the main controls on an auto-pilot.	X		
6.8.3 Explain the changeover procedure from auto to manual and emergency steering.	X		
6.8.4 Describe the adjustment of controls for optimum performance.	X		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
<p>6. Gyro-Compass, Auto-Pilot, and Course Recorder (Continued)</p> <p>6.9 Identify the uses of a course recorder.</p> <p>6.9.1 Describe the operation of a course recorder.</p> <p>6.9.2 List the uses of a course recorder.</p> <p>6.10 Identify and discuss other compass systems.</p> <p>6.10.1 GPS Compass.</p> <p>6.10.2 Fiber Optics Gyro Compass.</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p>		
<p>7. Echo Sounder</p> <p>7.1 Describe the principles of echo sounding.</p> <p>7.1.1 Explain the principles of sound transmission in water.</p> <p>7.1.2 Show how an echo sounder uses sound to perform its functions.</p> <p>7.2 Describe the components of an echo sounder.</p> <p>7.2.1 Identify the principal components.</p> <p>7.2.2 Describe the function and operational maintenance of each principal component.</p> <p>7.3 Demonstrate the setting up procedure for an echo sounder.</p> <p>7.3.1 List the controls found on an echo sounder.</p> <p>7.3.2 Demonstrate the function of each control.</p> <p>7.3.3 Prepare an echo sounder display for use.</p> <p>7.4 Explain the use of the echo sounder data.</p> <p>7.4.1 Application of echo sounder data to general navigation.</p> <p>7.4.2 Application of echo sounder data to specific navigation.</p> <p>7.5 Discuss the errors and limitations of an echo sounder.</p> <p>7.5.1 List and describe the errors of an echo sounder.</p> <p>7.5.2 List and describe the limitations of an echo sounder.</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p>

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
8. Logs 8.1 Name the different types of log. 8.1.1 Appreciate the need for a log. 8.1.2 Determine the speed of the vessel. 8.1.3 Determine the distance traveled by the vessel. 8.1.4 Determine the log error. 8.1.5 Determine the vessel's position. 8.2 Identify the information given by a log. 8.2.1 Identify the vessel's speed through the water. 8.2.2 Find the vessel's speed over the ground.	x		x x x x x x x
9. Voyage Data Recorders (VDR) 9.1 Discuss the function and carriage requirements of VDR.	x		
10. Automatic Identification System (AIS) 10.1 AIS Concepts. 10.2 AIS Data. 10.3 AIS Ship Installation. 10.4 Use of AIS at sea. 10.5 Familiarization training.	x x x x		x

CHAPTER 3 – SEN 1

SIMULATED ELECTRONIC NAVIGATION, LEVEL I, PART B

3.1 COURSE GOAL

- (1) To provide the student thorough knowledge of the application of the *Collision Regulations* and principles to be observed in keeping a navigational watch in a simulated environment while using electronic aids to plot the ship's position and progress, and in a one-on-one ship situation to take necessary action to avoid collision without putting vessel at risk.
- (2) Minimum National Standards that the candidate must attain to be assessed as having successfully completed the SEN 1B course:
 - a) Prior to beginning the exercise, the candidate studies the necessary chart(s) and publications relating to the voyage.
 - b) The candidate adjusts the radar, the VHF and operating controls of all other available instruments.
 - c) The candidate determines the position of the ship by all available means and plots the course, which the ship has to follow.
 - d) The candidate continuously monitors all targets appearing on the radar screen and plots the two targets, which could result in close quarter situation.
 - e) The candidate fixes the position of the ship before and after each maneuver and at appropriate intervals.
 - f) The candidate maintains an optimal adjustment of the radar and uses scanning at various ranges, and also maintains optimal adjustments of all other instruments.
 - g) The candidate prepares a radio message for a maritime traffic center and transmits this message if the ship reaches the required position before the end of the exercise.
 - h) The candidate works on the chart according to generally accepted chart work practices.
 - i) The candidate must adhere to the *Collision Regulations* and *Safe Watchkeeping Practices*.
 - j) The candidate must be able to explain clearly all that has happened during the exercise and also explain the reasons for all actions with complete paper records.
 - k) During a maneuver, the candidate must verify the margins of safety for the ship with respect to the environment (coast, shoals, other dangers to navigation).
 - l) Additionally, when plotting the candidate must:
 - (i) continue to plot each target until it is finally past and clear;
 - (ii) determine the relative movement of each target;
 - (iii) determine the true course and true speed of each critical target;
 - (iv) determine the closest point of approach and the time of the closest point of approach of each target.
 - m) The candidate plans the desired maneuver, anticipating the moment of the maneuver when the course and speed leading the ship to its destination will be resumed by:
 - (i) observing the required CPA and anticipating the new relative movement of each target before each maneuver;
 - (ii) ensuring that after each maneuver the targets maintain the predicted relative movement.

3.2 WORDING ON TRAINING CERTIFICATE

Wording on Training Certificate issued after completion of SEN 1 – (Candidate must successfully complete SEN 1A and SEN 1B):

SIMULATED ELECTRONIC NAVIGATION, LEVEL I (SEN 1)

(Type of Training or Course)

IN ACCORDANCE WITH STCW CODE A-II/1

(Description of the Level of Accepted Training or Approved Course of Study)

3.3 COURSE OUTLINE

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Familiarization with the Radar Simulator's Own Ship Controls and Characteristics 1.1 Demonstrate the use of instruments in the ship cubicle. 1.2 Demonstrate the use of own ship's course and speed controls to determine own ship's response to controls: manual and emergency rudder control. automatic pilot. throttles for single and/or twin propeller ships. 1.3 Read display of course and speed information. 1.4 Check displays of ordered and actual rudder angles, adjust parameters of auto-pilot as required. 1.5 Operate and read the navigational instruments to determine the ship's position. 1.6 Demonstrate the use of all radar controls. 1.7 Select and use appropriate navigation charts and publications. 1.8 Demonstrate proper radio procedures for safe navigation.			X X X X X X X X
2. Describe Internal Communications, Engine Controls and Signalling Apparatus 2.1 Describe the internal communication system: List the various types. Describe the correct operating procedures.	X		
3. Describe the Telegraph System 3.1 Explain how the bridge brings attention to the commands required. 3.2 Explain the engine room response to the bridge command.	X X		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
4. Describe Bridge Control System 4.1 Illustrate controllable pitch system. 4.2 Describe pitch/fuel combination system.		X X	
5. Review of Plotting Skills 5.1 Perform basic radar operations and plotting skills.	X		X
6. Recognize the Following Factors Affecting the Detection of Targets 6.1 The effect of meteorological conditions on the detection range. 6.2 How sea and rain clutter affects the detection of targets, and demonstrate the use of anti-clutter controls. 6.3 The methods of suppressing unwanted echoes.	X X X		X X
7. Set Up and Operate the Radar Display in all Modes 7.1 State the advantages and disadvantages of each mode of display. 7.2 Choose between modes of display and explain the reasons for choices. 7.3 Demonstrate the ability to operate radar to derive target course, speed, CPA, TCPA and aspect from relative plots, true plots and a manual plotting facility. 7.4 Use target trails and indexing lines to estimate CPA and TCPA (Time of Closest Point of Approach).	X X		X X X
8. Maintaining a Bridge Navigational Watch 8.1 Perform the Bridge Watchkeeping Duties of the OOW. 8.2 Apply Watchkeeping Standards (as per STCW Code, Section A – VIII/2, Part 2, 3 & 3-1). 8.3 Carry out Master’s standing orders. 8.4 Recognize situations warranting informing the Master. 8.5 Recognize situations requiring immediate action. 8.6 Monitor bridge instruments. 8.7 Carry out procedures in case of breakdown of equipment or instrument. 8.8 Maintain bridge records.			X X X X X X X X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
<p>11. Operational Use of ARPA</p> <p>11.1 Set up and maintain displays.</p> <p>11.2 Demonstrate the correct starting procedure to obtain the optimum display of ARPA information by: select appropriate display mode. select appropriate speed input. select appropriate ARPA plotting controls. select the time scale of vectors/graphics.</p> <p>11.3 Demonstrate the procedure to manually and automatically acquire targets.</p> <p>11.4 Operate the ARPA to obtain full data reports of targets.</p>			<p>X</p> <p>X</p> <p>X</p> <p>X</p>
<p>12. Navigate the Vessel Safely Using ARPA</p> <p>12.1 Demonstrate ability to obtain ARPA information in both relative and true motion modes of display.</p> <p>12.2 Determine own ship's maneuver to achieve a minimum CPA in head on, crossing and overtaking situations.</p> <p>12.3 Utilize trial manoeuvre to assess options for an effective collision avoidance action.</p> <p>12.4 Execute the maneuver.</p> <p>12.5 Verify effectiveness of action taken by observing the relative vector of critical target and taking further action if required.</p> <p>12.6 Detect alterations of course or speed of target ships.</p> <p>12.7 Calculate the moment to resume original course and speed.</p>			<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>
<p>13. Coastal Water Navigation</p> <p>13.1 Navigate vessel safely in coastal waters.</p> <p>13.2 Draw a parallel index line to pass a given distance off a fixed point.</p> <p>13.3 Draw parallel index lines for track keeping with change of course.</p> <p>13.4 Identify radar conspicuous objects and fix.</p> <p>13.5 Check the ship's position by any other means available.</p> <p>13.6 Monitor the ship's track, using parallel indexing lines during a coastal passage making allowance for current and effect of wind.</p>			<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
<p>13. Coastal Water Navigation (Continued)</p> <p>13.7 Execute a passage through coastal waters and limited traffic with fundamental exposure to passage planning.</p> <p>13.8 Execute passage in adverse weather conditions.</p> <p>13.9 Monitoring a voyage with respect to ETA using all available instruments.</p>			<p>X</p> <p>X</p> <p>X</p>
<p>14. Navigation in or Near Vessel Routing Systems</p> <p>14.1 Navigate vessel safely in or near traffic separation schemes.</p> <p>14.2 Interpret and apply the requirements of <i>Collision Regulations</i>, Rule 10 and Annual Notices to Mariners with regard to vessel routing systems.</p> <p>14.3 Execute and monitor a passage in and near a traffic separation scheme.</p> <p>14.4 Execute a passage, with limited traffic, using Marine Communications and Traffic Systems (MCTS) procedures.</p>			<p>X</p> <p>X</p> <p>X</p> <p>X</p>

CHAPTER 4 – SEN 2

SIMULATED ELECTRONIC NAVIGATION, LEVEL II

4.1 COURSE GOAL

- (1) To enable the student to make sound appropriate decisions in complex navigational situations, to effectively plan, organize and manage a bridge team and to comply with the standards regarding watchkeeping in a simulated environment. The student will prepare and execute a voyage plan from berth to berth using the necessary instruments and publications while assuming the duties and responsibilities of the master aboard ships having specified maneuvering characteristics.
- (2) Minimum national standards that the candidate must attain to be assessed as having successfully completed the SEN 2 course:

The student shall demonstrate the ability to:

- (a) Prepare Radar/ARPA for use on-watch at sea, in the Head-up/North-up/Course-up orientations and True/Relative motion modes and assess any range error or heading marker misalignment.
- (b) Plot approaching vessels using plotting sheets and Automatic Plotting Aid to Marine Safety specified standards of accuracy during simulation exercises.
- (c) Prepare a passage plan using the four distinct stages for achievement of a safe passage: Appraisal, Planning, Execution and Monitoring.
- (d) Execute a passage using the principles of passage planning.
- (e) Create a turning circle deriving tactical/ final diameter, advance/ transfer data.
- (f) Use maneuvering data to extract Advance, Transfer, Distance Next Course and Head Reach for engine movements.
- (g) Explain the mandatory and commonly used optional facilities of an ARPA that meets IMO standards.
- (h) Define relative and true vector, Potential Point of Collision (PPC) and Predicted Area of Danger (PAD), including their advantages and disadvantages.
- (i) Effectively use the ARPA trial maneuver facility to determine a maneuver and then execute the maneuver adhering to the *Collision Regulations*.
- (j) Draw a map, parallel index line and anchor positions using the ARPA map facility.
- (k) Acquire targets manually. Using the ARPA automatic acquisition facility, adjust zones and boundaries.
- (l) Adjust CPA and TCPA alarm parameters to suitable limits and recognize other ARPA alarms such as target loss, tracks full and ARPA failure.
- (m) Respond to a distress call and participate in a search and rescue operation in compliance with the information detailed in International Aeronautical and Maritime Search and Rescue Manual (Volume III) (IAMSAR).
- (n) Anchor the vessel using the principles of parallel indexing and passage planning
- (o) Recognize the limitations of ARPA and dangers of over reliance.
- (p) Produce night and standing orders.

4.2 WORDING ON TRAINING CERTIFICATE

Wording on Training Certificate issued after completion of SEN 2:

SIMULATED ELECTRONIC NAVIGATION, LEVEL II (SEN 2)

(Type of Training or Course)

IN ACCORDANCE WITH STCW CODE A-II/2 AND A-II/3

(Description of the Level of Accepted Training of Approved Course of Study)

4.3 COURSE OUTLINE

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Passage Planning and Anchorage			
1.1 Demonstrate the principles and application of passage planning.			X
1.2 Prepare a checklist of all items and actions needed to appraise the passage.	X		X
1.3 Prepare a checklist of all planning requirements needed to Plan the passage.	X		X
1.4 State procedures itemizing all requirements needed to execute the passage.	X	X	
1.5 Explain procedures itemizing all requirements needed to monitor the passage.	X	X	
1.6 Discuss a ship's basic maneuvering characteristics and extract data from typical maneuvering curves.	X	X	X
1.7 Plan a passage using parallel index techniques correctly.	X		X
1.8 Brief Bridge team on the passage plan.			X
1.9 Execute a planned passage by utilizing the principles of blind pilotage.			X
1.10 Explain the procedure for anchoring.	X	X	
1.11 Prepare a passage plan to anchorage.	X		X
1.12 Allocate tasks to OOW.			X
1.13 Demonstrate teamwork by assisting or getting assistance from OOW during all stages.			X
1.14 Communicate with shore services and other vessels to appropriate Industry Canada standards.			X
1.15 Anchor vessel at a planned location to a specified accuracy.			X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
2. Orientation to Radar Simulation 2.1 Demonstrate own ship (O/S) controls and characteristics. 2.2 Read and analyze the exercise instruction cards. 2.3 Use O/S course & speed controls. 2.4 Maneuver O/S to determine response to controls. 2.5 Read display of course & speed information and adjust course and speed if required. 2.6 Check display of ordered & actual rudder angles. 2.7 Read display of other navigational data such as: Rate of turn. Depth from Sounder. Loran position. GPS/ DGPS position. 2.8 Use all radar controls. 2.9 Use VHF radio on appropriate channels.	X		X X X X X X X
3. Role of the Master 3.1 Identify the necessity and advantages of having a cooperative bridge team. 3.2 Demonstrate an ability to prepare standing and night orders. 3.3 Demonstrate thorough knowledge of the intent, content and application of the Watchkeeping Standards.	X X X	X	X X X
4. Review of Radar Plotting in stabilized/unstabilized 4.1 Identify and discuss basic principles of plotting. 4.2 Describe and discuss factors affecting the detection of targets. 4.3 Identify & discuss methods of determining maneuvers to achieve a designated CPA. 4.4 Demonstrate efficient and effective plotting.	X X X	X X X	X X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
<p>9. Maneuver a Ship in all Conditions</p> <p>9.1 Maneuver when: approaching pilot station. embarking/disembarking pilots.</p> <p>9.2 Maneuver a ship considering effects of: Shallow water. Squat. Bank suction. Tide. Weather. Current. Passing ships. Rolling and pitching.</p>	x		x
<p>10 Distress Situations</p> <p>10.1 Identify and discuss distress calls and procedures.</p> <p>10.2 Demonstrate the correct response to a distress situation as per IAMSAR.</p> <p>10.3 Discuss the various types of search patterns and their application.</p> <p>10.4 Execute search patterns.</p>	x	x	x

CHAPTER 5 – ARPA

SIMULATED ELECTRONIC NAVIGATION – REFRESHER TRAINING

5.1 PURPOSE

To establish continued professional competence as required under STCW regulation I/11.

5.2 SCOPE

The course covers components of SEN 1 and SEN 2 courses, for which STCW Code, Table A-II/1, A-II/2 and A- II/3 indicate mandatory simulator-based training.

5.3 WORDING ON TRAINING CERTIFICATE

Wording on Training Certificate issued after completion of Refresher Training (ARPA):

SIMULATED ELECTRONIC NAVIGATION – REFRESHER TRAINING (ARPA)

(Type of Training or Course)

IN ACCORDANCE WITH STCW CODE A-II/1, A-II/2 AND A-II/3

(Description of the Level of Accepted Training or Approved Course of Study)

5.4 COURSE OUTLINE

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar Plotting Techniques			
1.1 Use plotting sheet to construct the relative motion triangle and identify the sides and angles.			X
1.2 Determine course, speed and aspect of other ships from relative plots.			X
1.3 Determine CPA and TCPA from relative plots.			X
1.4 Determine changes in CPA and TCPA resulting from alteration of course or speed of own ship or target ship.			X
1.5 Using relative plot, determine the alteration of course or speed needed to achieve a required CPA.			X
1.6 Detect alteration of course or speed of a target and determine the alteration from a plot.			X
2. Introduction to ARPA			
2.1 Outline the IMO performance standards for ARPA.	X	X	
2.2 Describe the different methods of displaying information.	X	X	
2.3 Describe the different ways in which targets may be acquired.	X	X	
2.4 Describe the requirements for acquisitions and tracking of targets.	X	X	

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
2. Introduction to ARPA (Continued) 2.5 Describe the operational warnings required. 2.6 List the data, which should be available in alphanumeric form. 2.7 Explain that the accuracy standards for ARPA are based on sensor errors for equipment compliant with IMO performance standards. 2.8 State performance standards for gyro and log inputs. 2.9 State performance standards for radar range, bearing accuracy and radar discrimination.	X X X X X	X X X X X	
3. Acquisition of Targets 3.1 Explain how ARPA acquires a target. 3.2 State that the criteria for automatic selection of targets is provided in the operator's manual. 3.3 Describe the criteria used for manual acquisition of targets. 3.4 Explain that the number of targets that may be acquired is limited. 3.5 Explain that targets not posing a potential threat should be deleted from the tracker register if the limit for the number of acquired targets has been reached. 3.6 Explain that target acquisition may be suppressed over certain areas and state when suppression should be used. 3.7 Explain the limitations of guard rings.	X X X X X X X	X X X X	
4. Tracking Capabilities and Limitations 4.1 Describe how a target is tracked by ARPA. 4.2 Explain that an acquired target may be lost if its echo fades temporarily. 4.3 Describe the circumstances leading to "target swap." 4.4 Describe the effect of target swap on displayed data. 4.5 Explain why there is a delay in the display of processed data after target acquisition. 4.6 Explain the delay in the generation of new data when the target ship maneuvers. 4.7 State that the full accuracy of derived information may not be attained for up to three minutes after acquisition or target maneuver.	X X X X X X X		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
5. ARPA Displays			
5.1 Demonstrate the special features found in ARPA.			X
5.2 Select an appropriate display presentation considering the required task and current situation.	X		X
5.3 Adjust the radar controls for the optimum display of echoes.			X
5.4 Explain how derived information differs depending on whether the sea stabilized mode or the ground-stabilized mode is used.	X		X
5.5 Check that speed and heading inputs are functioning correctly for intended use of ARPA: Navigation. Collision avoidance.			X
5.6 Select the appropriate orientation and mode for the circumstances.			X
5.7 Select an appropriate time scale for vectors or graphics to produce the information required.			X
5.8 Demonstrate the use of manual acquisition to select and monitor critical targets.			X
5.9 Demonstrate the use of automatic acquisition and exclusion areas.			X
5.10 Explain the use of echo referencing in the true motion mode.	X		
6. Target Information			
6.1 Use display in true and relative modes and demonstrate the use of true and relative vectors in each mode.			X
6.2 Demonstrate the benefits of switching between true and relative vectors.			X
6.3 Explain the display of PPC and PAD graphics.	X	X	
6.4 Discuss PAD graphics.	X		
6.5 Explain how past positions of tracked targets are displayed.	X		X
6.6 Explain the limitations of trial maneuvers.	X		
6.7 Demonstrate the setting and acknowledgment of operational warnings.			X
6.8 Describe the benefits and limitations of operational warnings.	X		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
7. Interpretation Errors			
7.1 Explain that the incorrect interpretation of ARPA can lead to dangerous misunderstanding of the traffic situation.	X		
7.2 Explain that the interpretation of vectors in the wrong format is a common error.	X		
7.3 Check information from vectors with numeric display.			X
7.4 Explain that a lost target, which is subsequently re-acquired, may temporarily show a course and speed suggesting an alteration when none has occurred.	X		
7.5 Explain that the PAD and PPC graphics displayed apply only to own ship and targets and do not indicate mutual threats between targets.	X		
7.6 State that the track line between the target and the PAD is not an indicator of target speed.	X		
7.7 Assess history displays, changing radar mode and vector presentation.			X
7.8 State that a change of direction in the relative history display does not necessarily imply that the target has altered course.	X		
8. Errors in Displayed Data			
8.1 State that errors in bearing can be generated in the radar installation.	X		
8.2 State that errors in range can be generated in a radar.	X		
8.3 Explain that own ship alteration of course may temporarily produce unreliable indications because of the ARPA smoothing filter.	X		
8.4 State that errors will be introduced by inputs from gyro and log.	X		
8.5 Describe the effects of heading and speed errors on derived information.	X		
8.6 State that the smoothness of the displayed true history track gives some indication of satisfactory tracking by ARPA.	X		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
9. System Operational Tests 9.1 Use system of self-diagnostic routines and recognize their limitations. 9.2 Use ARPA test program to check performance against known solutions. 9.3 Check performance, including trial maneuver by manual plotting. 9.4 State action to take after ARPA malfunction.	X		X
10. Obtaining Information from ARPA Displays 10.1 Demonstrate ability to obtain information in both true and relative modes. 10.2 Identify critical targets. 10.3 Obtain relative courses and speeds of targets. 10.4 Obtain CPA and TCPA of targets. 10.5 Obtain true courses and speeds of targets. 10.6 Interpret displays of past positions to detect change in course or speed of target. 10.7 Operate trial maneuver facility to check validity of intended alteration of course or speed. 10.8 Analyze displayed situation and determine and execute action to avoid a close quarter situation. 10.9 Monitor subsequent situation and resume original course and speed when safe to do so.	X		X
11. Over Reliance on ARPA 11.1 State that the use of ARPA does not relieve the officer of the watch from the need to comply with basic principles in keeping a navigational watch.	X	X	

CHAPTER 6 – ECDIS

ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS

6.1 PURPOSE

To train the mariner in the safe operation of Electronic Chart Display and Information Systems (ECDIS) and electronic chart systems on board vessels equipped with such systems.

6.2 SCOPE

- (1) Upon course completion, the mariner will achieve knowledge of basis theory and will be able to demonstrate proficiency in the following areas:
 - (a) Basic principles of ECDIS data, sensors, presentation of Electronic Navigation Chart (ENC);
 - (b) Operation of ECDIS and associated functions for passage planning and monitoring, including display options, ENC identification, alarms, chart updating and other navigational functions;
 - (c) Appreciation of the limitations of ECDIS and ENC data, and awareness of the legal aspects and responsibilities associated with the use of ECDIS as an aid to navigation.

6.3 WORDING ON MARINE TRAINING CERTIFICATE

Wording on Training Certificate issued after completion of ECDIS:

ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS (ECDIS)

(Type of Training or Course)

IN ACCORDANCE WITH REGULATION II/1 STCW CODE, TABLE A-II/1

(Description of the Level of Accepted Training or Approved Course of Study)

6.4 REFERENCES

- (1) IMO A.817(19): Performance standards for Electronic Chart Display and Information System (ECDIS).
- (2) IEC 61174: Maritime Navigation and Radio Communication Equipment and Systems, Electronic Chart Display and Information System (ECDIS) Operational and performance requirements, methods of testing and required results.
- (3) IHO S-52: Specification for Chart Content and Display Aspects of ECDIS.
- (4) IHO S-52 Appendix 1: 1996 Guidance on Updating the Electronic Navigational Chart.
- (5) IHO S-52 Appendix 2: 1997, Color and Symbol Specification for ECDIS.
- (6) IHO S-52 Appendix 3: 1993, Glossary of ECDIS – Related Terms.
- (7) IHO S-57: Transfer Standard for Digital Hydrographic Data.
- (8) N. Bowditch, The American Practical Navigator 1995 edition, chapter 14.

6.5 COURSE OUTLINE

L = Lecture; D = Demonstration; E = Exercise.

SUBJECT	L	D	E
<p>1. ECDIS definitions concepts and related authorities <i>Describe and outline ECDIS related concepts, authorities and definitions.</i></p> <p>1.1 Electronic Chart Display and Information System (ECDIS). 1.2 Electronic Navigational Chart (ENC). 1.3 System Electronic Navigational Chart (SENC). 1.4 Standard display. 1.5 Display base. 1.6 SOLAS Regulation V/20. 1.7 IHO S-52 and S-57. 1.8 IMO.</p>	 X X X X X X X X	 X X X X X 	
<p>2. Legal aspects and requirements <i>Describe the essential legal aspects and responsibilities in the use of ECDIS.</i></p> <p>2.1 explain the SOLAS (chapter v) carriage requirements concerning the carriage of charts 2.2 explain the equivalency of ECDIS and paper charts to make it clear that only ECDIS using the official ENC entitles him/her to navigate without paper charts 2.3 outline the IMO performance standards for ECDIS 2.4 explain and accept his/her responsibilities with regard to data procurement 2.5 explain and accept the training requirements concerning the operation of navigation equipment</p>	 X X X X X		
<p>3. Principal types of electronic chart <i>State the main characteristics of principal types of electronic charts.</i></p> <p>State: 3.1 the difference between different ECDIS systems 3.2 the differences between ECDIS and ECS 3.3 the differences between vector and raster charts</p>	 X X X X	 X X X	
<p>4. ECDIS data <i>Explain all safety-relevant as well as all other major characteristics of ECDIS data, such as data contents, handle ECDIS data on board and assess all errors, inaccuracies and ambiguities caused by improper data management.</i></p> <p>4.1 describe the terms and definitions used in the context of ECDIS, such as S-52, S-57, object-oriented data, vector data, ENC and SENC</p>	 X	 X	

SUBJECT	L	D	E
<p>4. ECDIS data (Continued)</p> <p>4.2 explain:</p> <p>4.2.1 data structure and database of ECDIS, including objects and their attributes (object catalogue)</p> <p>4.2.2 that the display is a portrait of ECDIS data, i.e. only the information contained and structured in the objects/attributes is available for display</p> <p>4.2.3 how manual updates are entered in the database</p> <p>4.3 outline the steps and responsibilities during ENC creation</p> <p>4.4 explain how chart data quality is dependent on factors such</p> <p>4.4.1 as (survey-) accuracy, updatedness, coverage and completeness of chart data</p> <p>4.4.2 assess that the data quality is doubtful due to the change of the factors named above</p> <p>4.5 explain the different reference systems used for positioning (including time, direction, speed) and associated problems in ECDIS as well as the effects of horizontal and vertical datum</p> <p>4.5.1 assess all errors, inaccuracies and ambiguities caused by improper data management</p> <p>4.6 outline the organization of chart data distribution</p> <p>4.7 demonstrate the loading and storing of ECDIS data by calling up the directory of available chart data and by importing the chart data for the waters in question</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p></p> <p></p> <p>X</p> <p>X</p> <p></p> <p>X</p> <p>X</p> <p></p> <p>X</p> <p></p> <p></p> <p></p>	<p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p>X</p>
<p>5. Presentation of ECDIS data</p> <p><i>Explain the main characteristics of the display of ECDIS data and select proper information for navigational tasks.</i></p> <p>5.1 explain the major rules for presentation contained in the presentation library for ECDIS</p> <p>5.1.1 apply the major rules for presentation to the display presentation</p> <p>5.2 explain the factors characterizing and modifying the chart presentation, such as projection, colours and symbols as well as data quality such as accuracy, resolution and completeness</p> <p>5.3 describe the scope and selection of chart data to be displayed</p> <p>5.3.1 select the relevant information contents by the display categories “display base,” “standard display” and “all other information”</p> <p>5.3.2 apply the different possibilities of selection of the sea area</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p></p> <p>X</p> <p></p> <p>X</p> <p></p> <p>X</p> <p>X</p>	<p></p> <p>X</p> <p></p> <p></p> <p></p> <p>X</p> <p>X</p>

SUBJECT	L	D	E
<p>5. Presentation of ECDIS data (Continued)</p> <p>5.4 outline the meaning of automatic presentation rules for ECDIS</p> <p>5.4.1 select and apply appropriate display modes such as:</p> <p>5.4.1.1 display category</p> <p>5.4.1.2 scale</p> <p>5.4.1.3 day or night presentation</p> <p>5.4.2 assess the resulting differences in information</p> <p>5.5 identify the different modes of presentation such as:</p> <p>5.5.1.1 true or relative motion</p> <p>5.5.1.2 north-up or course-up stabilization</p> <p>5.5.2 select and apply the suitable mode of presentation for the actual situation</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>
<p>6. Sensors</p> <p><i>Describe the performance limits of sensors and assess their impact on the safe use of ECDIS.</i></p> <p>6.1 explain the performance limits concerning availability, accuracy and integrity of all navigational sensors connected to ECDIS (i.e. devices to determine position, course, speed and depth as well as radar)</p> <p>6.1.1 assess the impairment of ECDIS performance in the case of a deterioration in sensor performance</p> <p>6.2 select and use an appropriate fall-back sensor system by switching to it or alternatively notice automatic switch-over and use of the fall-back system</p> <p>6.3 explain the data reference system of each connected sensor (e.g. geodetic system, position of antenna and transducer)</p> <p>6.4 explain the need for selection of appropriate and unambiguous sensor data display in ECDIS</p> <p>6.5 assess the plausibility of sensor input values to ECDIS</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>
<p>7. Basic navigational functions and settings</p> <p><i>Operate all basic navigational functions and settings.</i></p> <p>7.1 identify all automatic functions required for monitoring ship's safety such as the display of position, heading/gyro course, speed, safety values and time</p> <p>7.2 demonstrate:</p> <p>7.2.1 how manual functions and elements such as cursor, electronic bearing line and range rings are used</p> <p>7.2.2 how a position which was not automatically determined is marked on the ECDIS display</p> <p>7.2.3 how position-fixing methods are applied within ECDIS (line of position)</p> <p>7.2.4 how the range scale and/or the scale is changed, how own ship's safety values such as "safety contour" or "safety depth" are set</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>

SUBJECT	L	D	E
<p>15. Documentation <i>Understand the meaning of voyage recording and operate the corresponding functions.</i></p> <p>15.1 outline the essential of automatic voyage recording</p> <p>15.2 demonstrate:</p> <p> 15.2.1 how the contents of automatic voyage recording are called up, in particular:</p> <p> 15.2.1.1 how a past track is constructed and</p> <p> 15.2.1.2 how the database in use is verified</p> <p> 15.2.1.3 how possible selections of, for example, recording media or recording intervals are carried out</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p>
<p>16. Integrity monitoring <i>Analyse and assess the proper functioning of ECDIS.</i></p> <p>16.1 outline:</p> <p> 16.1.1 the proceeding of the on-line test during booting</p> <p> 16.1.2 the on-line system check during normal operation</p> <p>16.2 perform:</p> <p> 16.2.1 manual tests of the mayor functions of hardware, MMI and sensor data</p> <p> 16.2.2 visual tests of chart data</p> <p>16.3 recognize all status indications</p> <p> 16.3.1 verify:</p> <p> 16.3.1.1 the proper functioning of the ECDIS display and the position-fixing system by comparing ECDIS and radar objects or back-up positioning system</p> <p> 16.3.1.2 that all received updates are contained in the ECDIS display</p> <p> 16.3.2 assess that the navigation process is safe</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>
<p>17. Back-up <i>Navigate safely as possible using the back-up system in the case of an ECDIS failure.</i></p> <p>17.1 perform:</p> <p> 17.1.1 a safe takeover by the back-up system</p> <p> 17.1.2 a safe transfer of all relevant passage planning data from the ECDIS to the back-up system</p> <p> 17.1.3 a transfer of all relevant updates immediately to the back-up system</p> <p>17.2 explain the reduced functional capabilities which are available with the back-up system</p> <p> 17.2.1 appreciate that the back-up system is only of limited performance and that the back-system should be replaced by a properly functioning ECDIS as soon as possible</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p> <p>X</p>	<p>X</p> <p>X</p>

6.6 COURSE REFERENCES

Subject Areas	References						
	IMO 817	IEC 61174	IHO S-52	IHO S-52 App 1	IHO S-52 App 2	IHO S-52 App 3	IHO S-57
01. ECDIS definitions, concepts and related authorities	X	X	X	X	X	X	
02. Legal aspects and requirements	X	X	X	X			X
03. Chart Display Systems		X	X	X			
04. ECDIS data	X	X	X				X
05. Sensors and interfaces	X	X					
06. Chart updating	X	X		X	X		X
07. Errors in displayed data	X	X	X				
08. Errors of interpretation							
09. Risk of over-reliance							
10. Back-up arrangements	X	X					
11. Presentation of ECDIS data	X	X	X		X		
12. System status alarms and indications	X	X			X		
13. Basic navigational functions and settings	X	X	X				
14. Route planning specific functions	X	X					
15. Route monitoring specific functions	X	X					
16. Route planning and monitoring practical exercise							
17. Display and function of other navigational information	X	X			X		
18. Documentation	X	X					
19. Integrity monitoring	X	X					
20. Proficiency demonstration							

CHAPTER 7 – SEN LIMITED

NAVIGATION INSTRUMENTS FOR ENTRY LEVEL MARINE CERTIFICATION

7.1 COURSE GOALS

To provide the student with the knowledge of the principles, the ability to use and the skill required for the proper operation of typical navigation electronic equipment found on board a coastal vessel.

7.2 WORDING ON TRAINING CERTIFICATE

Wording on Training Certificate issued after completion of Navigation Instruments for Entry Level Marine Certification (SEN Limited):

NAVIGATION INSTRUMENTS FOR ENTRY LEVEL MARINE CERTIFICATION
(SEN LIMITED)

(Type of Training or Course)

FOR ENTRY LEVEL: LIMITED, DOMESTIC AND FISHING CERTIFICATES
OF COMPETENCY

(Description of the Level of Accepted Training or Approved Course of Study)

7.3 COURSE MATERIAL AND EQUIPMENT

This program will utilize the following materials and equipment:

- a) Instructor and student training manuals.
- b) Radar plotting sheets.
- c) Reference materials and publications.
- d) Personal computers interconnected with LAN system.
- e) DNV class X Bridge Operation Navigation Software capable of displaying radar, depth sounder, loran-C and/or GPS, as well as operational own-ship helm controls.
- f) (optional) Models of some navigation electronic equipment to illustrate typical features (equipment may or may not be 'live' as classroom facilities and local services permit).
- g) Navigation charts (up-to-date) of exercise areas.

7.4 ATTENDANCE AND PRE-REQUISITE REQUIREMENTS

Each course participant must attend a minimum of 90% of lecture classes and 100% attendance is required during simulation exercises and evaluation. Participants must have prior training in topics such as basic Chart Work and Navigations Safety in order to have background knowledge required for the navigation of a vessel under simulated conditions. Training institution will determine if the level of prerequisite training is approved.

7.5 EXAMINATION AND ASSESSMENT/EVALUATION OF STUDENTS

- 1) Successful completion of the Electronic Navigation course shall be determined by the approved instructor conducting the course. To demonstrate their abilities and as part of the evaluation process, participants must successfully complete a fifty question multiple-choice exam and an exercise utilizing the navigation simulator. The practical exercise will include course planning and updating vessel position on navigational charts using GPS or LORAN-C for positional information, radar and depth sounder will be used to verify position information from GPS or LORAN-C, radar will be used for detecting targets and plotting sheets will be used for determining threatening targets and appropriate actions to be taken in considering international collision regulations and good seamanship.
- 2) 50% of the final mark will be based on the multiple-choice questions and the remaining 50% of the final mark will be based on the practical exam. Any collisions, groundings, or similar distress situations during the practical exam will be marked as a “fail” for the person operating the vessel involved. A final mark of 70% or more on each part is required for a “pass”. The institution, then after, will issue a Transport Canada training certificate.

7.6 COURSE OUTLINE

SUBJECT AREA	Hours	
	Theory	Practical
<p>RADAR</p> <p>Basic understanding of the RADAR and early developments.</p> <p>Basic understanding of the RADAR and early developments.</p> <p>Basic understanding of the RADAR and early developments.</p> <p>An understanding of various types of RADAR displays.</p> <p>A general knowledge of the various types of controls on RADAR.</p> <p>An in-depth understanding of RADAR watchkeeping.</p> <p>Understanding RADAR plotting.</p> <p>Calculating CPA, TCPA, and interpreting information to plan the most appropriate action in accordance with the <i>Collision Regulations</i>.</p> <p>An understanding of the various phenomena that effect RADAR.</p> <p>An understanding of the factors affecting a RADAR display.</p> <p>An understanding of the various errors that can affect RADAR.</p> <p>Use of operation manuals.</p>	6	14*
<p>LORAN C</p> <p>Basic understanding of the LORAN C system.</p> <p>A general understanding of the accuracy/reliability of the LORAN C system.</p> <p>An understanding of how to use the LORAN C.</p> <p>A general knowledge of initializing LORAN C receiver.</p> <p>A general knowledge of how to plot and obtain LORAN C positions on a chart.</p> <p>Use of operation manuals.</p>	2	

SUBJECT AREA	Hours	
	Theory	Practical
GPS / DGPS Basic understanding of the GPS/DGPS systems. A general understanding of the accuracy/reliability of the GPS/DGPS systems. An understanding of how to use GPS/DGPS. A general knowledge of how to plot and obtain GPS/DGPS position on a chart. Use of operation manuals.	1	
Compass Types of marine compasses. Advantages and disadvantages with different types. Repair rips for magnetic compass.	1	
Sounder An introduction to depth sounders and how they work. Demonstrate the setting up procedure for an echo sounder. Explain the use of the echo sounder data. Discuss the errors and limitations of an echo sounder. Use of operation manuals.	1	
Electronic Charting Systems (ECS) An introduction to various types of ECS. Advantages of ECS. Disadvantages of ECS.	1	
Situation Awareness Actions required maintaining situational awareness. The clues to loss of situational awareness. The five barriers to situational awareness. The three levels to human error.	1	
Questions And Answers / Review Material	1	
	14 hours	14 hours
Practical And Written Evaluation	2 hours	
Total	30 hours	