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TP 4958 E

Simulated Electronic Navigation Courses

Canada

Revisions		
Title	Issue Date	Revision No.

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Revisions

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Scope and Application

1.1   Purpose

(1)   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

(1)   Training of masters and deck officers in the application of Electronic Navigation Systems by following standards regarding watchkeeping.

1.3   Authority

(1)   The *Marine Certification Regulations* (SOR/97-391), section 4 made pursuant to the *Canada Shipping Act* (R.S.C. 1985, c.s-9), as amended.

1.4   Effective date

(1)   The TP 4958 (2000) takes effect on December 1, 2000.

Course Approval Conditions

2.1 Inspection and approval of facility, equipment and courses

(1) The approval to conduct Simulated Electronic Navigation (SEN) courses is granted by the Board of Steamship Inspection. Initial approval is granted after the facility and equipment are inspected by a Transport Canada Marine Safety (TC MS) examiner.

(2) Thereafter, marine schools/organizations will be required to submit a request to the Transport Canada Marine Safety Directorate for the course to be monitored by supplying a detailed course curriculum in an IMO format, which meets the TP 4958 requirements. The audit for course approval will be arranged and conducted on mutually agreed dates after the submitted curriculum has been approved.

(3) Continued approval will be granted only on receipt of a formal request by the previously approved school/organization by August 31 of each year.

(4) Inspection of approved courses will be conducted by Transport Canada Marine Safety Directorate on an ongoing basis and Transport Canada Marine Safety Examiners may monitor a course or part of a course at any time.

2.2 Duration of courses

(1) SEN 1A — Minimum duration 120 hours, including 10 hours evaluation.

(2) SEN 1B — Minimum duration 72 hours, including evaluation.

(3) SEN 2 — Minimum duration 84 hours, including evaluation.

(4) ARPA — Minimum duration 24 hours.

2.3 Class size

(1) SEN 1A - Classroom Lectures — No limit.

(2) SEN 1A - Navigation Instrument Laboratory — Maximum of two (2) students per unit of equipment, maximum to be determined by Marine Safety audit.

(3)   SEN 1B - Practical Simulated Exercises

Maximum of two (2) students per O/S.

(4)   SEN 2 - Simulator

Maximum of two (2) students per O/S.

2.4   Student instructor ratio

(1)   Two (2) students per own ship. Student/instructor ratio 8:1, or as determined by Transport Canada audit.

2.5   Attendance

(1)   At least a 90% attendance is required.

2.6   Course entry requirements

(1)   SEN 1A -   Nil.

(2)   SEN 1B -   ROC, Knowledge of Chartwork (040/041) and Rules of the Road (061/060).

(3)   SEN 2   -   ROC, SEN 1 A & B or Marine Safety approved qualifying service.

(4)   ARPA   -   Successful completion of SEN 1 or SEN 2.

2.7   Qualification of instructors and main instructor approval

(1)   The main SEN 1 instructor shall:

(a)   Hold Canadian Command level certificate unlimited as to tonnage; OR Canadian Fishing Master, First-Class when teaching fishing candidates only;

(b)   Have successfully completed approved SEN 1 and SEN 2 courses which included ARPA;

(c)   Within two (2) years of employment, obtain a teaching certificate or equivalent, issued by either of the following:

(i)   A provincial government in Canada having jurisdiction in the field of education;

(ii) A training directorate or similar section of a government in Canada;

(iii) An approved firm in Canada engaged in providing education, technology or technical services.

(2) The main SEN 2 instructor shall:

(a) Hold Canadian Command level certificate unlimited as to tonnage; OR Canadian Fishing Master, First-Class when teaching fishing candidates only;

(b) Have successfully completed approved SEN 1 and SEN 2 courses which included ARPA;

(c) Shall hold a teaching certificate or equivalent as stated in 2.7(1)(c).

(3) All assistant instructors must hold qualifications acceptable to Transport Canada.

(4) Main course instructors, in addition to holding qualifications described in 2.7(1) or 2.7(2) above 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. This course will be audited by Marine Safety prior to approval of the instructor as a Main Course Instructor. Exceptions may be made in these training requirements in special circumstance by Marine Safety, after considering all circumstances.

2.8 Examination and assessment/evaluation of students

(1) Successful completion of the SEN 1 or SEN 2 courses shall be determined by the approved instructor conducting the course.

(2) The course main instructor shall maintain an ongoing evaluation of students during both the SEN 1 and SEN 2 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 and SEN 2 courses.

(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.

2.9 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
Course Recorder	2	-	Stylized
Decca**	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
** Operational emphasis only

2.10   Sen 1A Navigation instrument checklist

Name: _____

School: _____

Course: SEN 1A - Instruments

Instrument	Date	Instructor's Initials
Radar		
Radar/ARPA		
GPS		
GPS/DGPS		
Loran C		
Gyro Compass		
Echo Sounder		
Steering Control System		
Log (Speed & Distance)		
Propulsion & Maneuvering System		
VHF		
Radio Telephone		
Rate of Turn Indicator		
Internal Communication		
Course Recorder		

The instructor's initials indicate that the student has received instruction on and has demonstrated an ability to operate each of the listed instruments.

SEN 1A

3.1 Course goal

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

3.2 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**		
1.2 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**		
1.2.2 Describe the function of the Antenna and its related components: ⇒ Transmission of pulses. ⇒ Beam width. ⇒ Horizontal scanning time. ⇒ Reception of echoes.	**X**		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar (Continued)			
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		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar (Continued)			
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 Identify IMO radar terms, symbols and controls.			
1.4.1 Identify IMO Performance Standards for Radar Equipment.	X		
1.4.2 Define radar associated terms and symbols/controls, IMO and others.	X		
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

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar (Continued)			
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)				
1.7.3	Perform navigational position fixing using radar ranges and bearings (true and relative) from stabilized and unstabilized presentations.			X
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 the function and detection of a SART and action required by the Officer of the Watch (OOW).	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. *High Speed Craft Code*).		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 *Collision Regulations* as they pertain to radar.	X		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
1. Radar (Continued)			
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).	X		
2.1.1 Define the acronym ARPA.			
2.1.2 Identify appropriate *Collision Regulations* as they pertain to ARPA.		X	
2.1.3 Relate ARPA to maintaining a radar watch.		X	
2.2 Recognize ARPA as a computer.			
2.2.1 Relate computer processing to ARPA.	X		
2.3 Appreciate ARPA as a component of marine radar system.			
2.3.1 Identify the sensors that supply ARPA input data.		X	
2.3.2 Explain the processing of the input data.	X		
2.3.3 Describe the ARPA output displays.	X		
2.4 Identify ARPA terms, symbols and limitations.			
2.4.1 Discuss the IMO performance Standard for Automatic Radar Plotting Aids.		X	
2.4.2 Define ARPA (IMO) associated terms and symbols.	X		
2.4.3 Define ARPA limitations, inaccuracies of information, and dangers of over reliance.	X		
2.5 Explain how ARPA data is used for determination of risk of collision and			

collision avoidance.

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
2. ARPA (Continued)			
2.5.1 Discuss appropriate action based on ARPA data and *Collision Regulations.*		X	
2.5.2 Describe the function of each ARPA control.		X	
2.5.3 Describe operation of trial maneuver.		X	
2.5.4 Describe target history and its use.		X	
2.6 Identify other ARPA/Radar features that are used for navigation.		X	
2.6.1 Geographic functions.			X
2.6.2 Set and drift prediction.			X
3. Radar Plotting			
3.1 Describe the need for radar plotting in collision avoidance.			
3.1.1 Review the *Collision Regulations* 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.		X	
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. ⇒ True motion.			X
3.2.2 Review radar display modes. ⇒ Relative motion stabilized. ⇒ Relative motion unstabilized. ⇒ True motion.		X	

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
3. Radar Plotting (Continued)			
3.2.3 Develop the motion triangle.			
⇒ Head-up.			
⇒ North-up.			
⇒ True-motion.			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 all presentations.			
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 *Collision Regulations.*			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 and identify levels of service available.	X		
4.2.5 State GPS precision.	X		
4.2.6 Describe the various types of receivers.	X		
4.2.7 Explain the levels of service available.	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.			X
⇒ 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.			

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
4. Satellite Navigation (GPS/DGPS) (Continued)			
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 and WAAS (Wide Area Augmentation System) corrections.		**X**	
4.7 Recognize Global Navigation Satellite System (GLONASS) as a satellite navigation system.	**X**		
4.7.1 Discuss GLONASS operation.	**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			

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
5. LORAN-C (Continued)			
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		
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**		

TOPICS AND LEARNING OBJECTIVES		Compliance through		
		Knowledge	Viva-Voce	Application
6.	**Gyro-Compass, Auto Pilot and Course Recorder (Continued)**			
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		
6.9	Identify the uses of a course recorder.			
	6.9.1 Describe the operation of a course recorder.	X		
	6.9.2 List the uses of a course recorder.	X		
7.	**Echo Sounder**			
7.1	Describe the principles of echo sounding.			
	7.1.1 Explain the principles of sound transmission in water.	X		
	7.1.2 Show how an echo sounder uses sound to perform its functions.			X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
7. Echo Sounder (Continued)			
7.2 Describe the components of an echo sounder.			
7.2.1 Identify the principal components.	X		
7.2.2 Describe the function and operational maintenance of each principal component.	X		
7.3 Demonstrate the setting up procedure for an echo sounder.			
7.3.1 List the controls found on an echo sounder.	X		
7.3.2 Demonstrate the function of each control.			X
7.3.3 Prepare an echo sounder display for use.			X
7.4 Explain the use of the echo sounder data.			
7.4.1 Application of echo sounder data to general navigation.		X	
7.4.2 Application of echo sounder data to specific navigation.		X	
7.5 Discuss the errors and limitations of an echo sounder.			
7.5.1 List and describe the errors of an echo sounder.	X		
7.5.2 List and describe the limitations of an echo sounder.	X		
8. Logs			
8.1 Name the different types of log.			
8.1.1 Appreciate the need for a log.	X		
8.1.2 Determine the speed of the vessel.			X
8.1.3 Determine the distance traveled by the vessel.			X
8.1.4 Determine the log error.			X
8.1.5 Determine the vessel's position.			X
8.2 Identify the information given by a log.			
8.2.1 Identify the vessel's speed through the water.			X
8.2.2 Find the vessel's speed over the ground.			X

SEN 1B

4.1   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 Watchkeeping Standards. (TP 13067).

(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.

4.2 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.			X
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 twin propeller ships.			X
1.3 Read display of course and speed information.			X
1.4 Check displays of ordered and actual rudder angles, adjust parameters of auto-pilot as required.			X
1.5 Operate and read the navigational instruments to determine the ship's position.			X
1.6 Demonstrate the use of all radar controls.			X
1.7 Select and use appropriate navigation charts and publications.			X
1.8 Demonstrate proper radio procedures for safe navigation.			X
2. Describe Internal Communications, Engine Controls and Signaling 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.	X		
3.2 Explain the engine room response to the bridge command.	X		

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	**Viva-Voce**	**Application**
4. Describe Bridge Control System			
4.1 Illustrate controllable pitch system.		X	
4.2 Describe pitch/fuel combination system.		X	
5. Review of Plotting Skills			
5.1 Perform basic radar operations and plotting skills.	X		
6. Recognize the Following Factors Affecting the Detection of Targets			
6.1 The effect of meteorological conditions on the detection range.	X		
6.2 How sea and rain clutter affects the detection of targets, and demonstrate the use of anti-clutter controls.	X		
6.3 The methods of suppressing unwanted echoes.	X		
7. Set Up and Operate the Radar Display in all Modes.			
7.1 State the advantages and disadvantages of each mode of display.	X		
7.2 Choose between modes of display and explain the reasons for choices.	X		X
7.3 Demonstrate the ability to operate a radar to derive target course, speed, CPA, TCPA and aspect from relative plots, true plots and a manual plotting facility.			X
7.4 Use target trails and indexing lines to estimate CPA and TCPA (Time of Closest Point of Approach).			X
8. Maintaining a Bridge Navigational Watch			
8.1 Perform the Bridge Watchkeeping Duties of the OOW.			X
8.2 Apply Watchkeeping Standards (TP 13067).			X
8.3 Carry out Master's standing orders.			X
8.4 Recognize situations warranting informing the Master.			X
8.5 Recognize situations requiring immediate action.			X
8.6 Monitor bridge instruments.			X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
8. Maintaining a Bridge Navigational Watch (Continued)			
8.7 Carry out procedures in case of breakdown of equipment or instrument.			X
8.8 Interpret the *Collision Regulations* correctly if a close quarter situation cannot be avoided.			X
8.9 Maintain bridge records.			X
9. Collision Avoidance During Open Water Navigation			
9.1 Execute planned action and evaluate effectiveness in accordance with the *Collision Regulations.*			X
9.1.1 Indicate appropriate helm and engine maneuvers allowing for response time.			X
9.1.2 Determine the effectiveness of the action.			X
9.1.3 Recognize the causes of target deviation from predicted track.			X
9.1.4 Recognize supplementary action which may be required for deviation from predicted track in accordance with *the Collision Regulations.*			X
9.1.5 Complete the execution of collision avoidance.			X
10. Perform the Bridge Watchkeeping Duties of the OOW in Open Water			
10.1 Detect all targets and plot 2 targets which may result in close quarter situations.			X
10.2 Choose an adequate plotting interval based on an estimate of TCPA.			X
10.3 Determine own ship's maneuver to achieve a minimum CPA in head-on, crossing and overtaking situations.			X
10.4 Calculate the moment to resume original course and speed.			X
10.5 Execute the maneuver.			X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	**Viva-Voce**	**Application**
10. Perform the Bridge Watchkeeping Duties of the OOW in Open Water (Continued)			
10.6 Verify effectiveness of action taken by continuing to plot the critical target and taking further action if required.			X
10.7 Detects alterations of course or speed of target ships.			X
10.8 Navigate own ship in ideal and adverse weather conditions.			X
11. Operational Use of ARPA			
11.1 Set up and maintain displays.			X
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.			X
11.3 Demonstrate the procedure to manually and automatically acquire targets.			X
11.4 Operate the ARPA to obtain full data reports of targets.			X
12. Navigate the Vessel Safely Using ARPA			
12.1 Demonstrate ability to obtain ARPA information in both relative and true motion modes of display.			X
12.2 Determine own ship's maneuver to achieve a minimum CPA in head on, crossing and overtaking situations.			X
12.3 Execute the maneuver.			X
12.4 Verify effectiveness of action taken by observing the relative vector of critical target and taking further action if required.			X
12.5 Detect alterations of course or speed of target ships.			X
12.6 Calculate the moment to resume original course and speed.			X

TOPICS AND LEARNING OBJECTIVES	Compliance through		
	Knowledge	Viva-Voce	Application
13. Coastal Water Navigation			
13.1 Navigate vessel safely in coastal waters.			X
13.2 Draw a parallel index line to pass a given distance off a fixed point.			X
13.3 Draw parallel index lines for track keeping with change of course.			X
13.4 Identify radar conspicuous objects and fix.			X
13.5 Check the ship's position by any other means available.			X
13.6 Monitor the ship's track, using parallel indexing lines during a coastal passage making allowance for current and effect of wind.			X
13.7 Execute a passage through coastal waters and limited traffic with fundamental exposure to passage planning.			X
13.8 Execute passage in adverse weather conditions.			X
13.9 Monitoring a voyage with respect to ETA using all available instruments.			X
14. Navigation in or Near Vessel Routing Systems			
14.1 Navigate vessel safely in or near traffic separation schemes.			X
14.2 Interpret and apply the requirements of *Collision Regulations*, Rule 10 and Annual Notices to Mariners with regard to vessel routing systems.			X
14.3 Execute and monitor a passage in and near a traffic separation scheme.			X
14.4 Execute a passage, with limited traffic, using Marine Communications and Traffic Systems (MCTS) procedures.			X

SEN 2

5.1 Course goal

(1) To enable the student to make sound appropriate decisions in complex navigational situations, to effectively manage the bridge watchkeeping 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 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 or Automatic Plotting Aid to Marine Safety specified standards of accuracy during simulation exercises.

(c) Prepare Radar/ ARPA for use in a watch at sea in North-up/Course-up/Head-up orientations and Relative/True motion modes and assess any range error or heading marker misalignment.

(d) Prepare a passage plan using the four distinct stages for achievement of a safe passage: Appraisal, Planning, Execution and Monitoring.

(e) Execute a passage using the principles of passage planning.

(f) Create a turning circle deriving tactical/ final diameter, advance/ transfer data.

(g) Use maneuvering data to extract Advance, Transfer, Distance Next Course and Head Reach for engine movements.

(h) Explain the mandatory and commonly used optional facilities of an ARPA that meets IMO standards.

(i) Define relative and true vector, Potential Point of Collision (PPC) and Predicted Area of Danger (PAD), including their advantages and disadvantages.

(j) Effectively use the ARPA trial maneuver facility to determine a maneuver and then execute the maneuver adhering to the *Collision Regulations*.

(k) Draw a map, parallel index line and anchor positions using the ARPA map facility.

(l) Acquire targets manually. Using the ARPA automatic acquisition facility, adjust zones and boundaries.

(m) Adjust CPA and TCPA alarm parameters to suitable limits and recognize other ARPA alarms such as target loss, tracks full and ARPA failure.

(n) 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) .

(o) Anchor the vessel using the principles of parallel indexing and passage planning to an accuracy of 0.25 NM.

(p) Recognize the limitations of ARPA and dangers of over reliance.

(q) Produce night and standing orders.

5.2 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	Execute a planned passage by utilizing the principles of blind pilotage.			X
1.9	Explain the procedure for anchoring.	X	X	
1.10	Prepare a passage plan to anchorage.	X		X
1.11	Allocate tasks to OOW.			X
1.12	Demonstrate teamwork by assisting or getting assistance from OOW during all stages.			X
1.13	Communicate with shore services and other vessels to appropriate Industry Canada standards.			X
1.14	Anchor vessel at a planned location to a specified accuracy.			X
2.	**Orientation to Radar Simulation**			
2.1	Demonstrate own ship (O/S) controls and characteristics.			X
2.2	Read and analyze the exercise instruction cards.	X		
2.3	Use O/S course & speed controls.			X

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

TOPICS AND LEARNING OBJECTIVES			Compliance Through		
			Knowledge	**Viva-Voce**	**Application**
4.		**Review of Radar Plotting in all Modes (Continued)**			
4.5		Demonstrate effective performance in radar simulator by:			X
		⇒ Completing a full plot using a plotting sheet.			
		⇒ Completing a full plot using an Automatic Plotting Aid.			
		⇒ Using plotting techniques and the MOT vector triangle to determine course or speed adjustments that achieve a desire CPA in compliance with the *Collision Regulations*.			
		⇒ Using an Automatic Plotting Aid, determine course or speed adjustments that achieve a desired CPA in single and multiple target situations.			
5.		**Automatic Radar Plotting Aid (ARPA)**			
5.1		Demonstrate the ability to accurately and efficiently use ARPA.			X
5.2		Discuss the principle types of systems and principle characteristics.	X	X	
5.3		Discuss the tracking capabilities, errors and limitations of ARPA.	X	X	
5.4		Demonstrate the correct set-up of ARPA in true and relative motion modes.			X
5.5		Demonstrate the ability to navigate safely by analysis of the ARPA display.			X
5.6		Demonstrate in a real time exercise altering course and/or speed to avoid potential close quarters situations in compliance with the *Collision Regulations.*			X
5.7		Demonstrate in a real time exercise the resumption of track after maneuvering in congested coastal waters.			X
5.8		Discuss the risks of over reliance on ARPA.	X	X	

TOPICS AND LEARNING OBJECTIVES		Compliance Through		
		Knowledge	Viva-Voce	Application
6.	**Navigation and Collision Avoidance in Open Waters**			
6.1	Plot all targets using Automatic Plotting Aid and use other navigational aids as required.			X
6.2	Analyze the plot and identify potential dangers while maintaining situational awareness.	X		X
6.3	Maneuver the vessel in compliance with the *Collision Regulations* to avoid a potential close quarter situation or a collision.	X		X
6.4	Detect course and/or speed alterations of approaching targets in ample time to take appropriate action to avoid collision.			X
7.	**Navigation in Confined and Congested Waters and Collision Avoidance**			
7.1	Plot all targets and correctly identify dangerous targets.			X
7.2	Appraise anti-collision action applying the *Collision Regulations*.	X		X
7.3	Communicate effectively with Marine Communications and Traffic Systems.			X
7.4	Communicate effectively with other vessels on VHF.			X
7.5	Demonstrate knowledge of parallel index technique.			X
7.6	Use parallel index technique in complex situations.			X
7.7	Demonstrate use of radar for position fixing.			X
8.	**Navigation and Collision Avoidance in or Near Vessel Routing Systems**			
8.1	Navigate vessel safely in or near traffic separation schemes.			X
8.2	Interpret and apply the requirements of Rule 10 of the *Collision Regulations* and Notices to Mariners (Annual Edition) regarding traffic separation schemes.	X		X

TOPICS AND LEARNING OBJECTIVES		Compliance Through		
		Knowledge	Viva-Voce	Application
8.	**Navigation and Collision Avoidance on or near Vessel Routing Systems (Continued)**			
8.3	Describe how fishing vessels, vessels not under command, vessels restricted in their ability to maneuver, and vessels under 20 meters interact in or near traffic separation schemes in all conditions of visibility.	X	X	
8.4	Execute effectively and competently a passage in and near traffic separation scheme.			X
9.	**Maneuver a Ship in all Conditions**			
9.1	Maneuver when: ⇒ approaching pilot station. ⇒ embarking/disembarking pilots.	X		X
9.2	Maneuver a ship considering effects of: ⇒ Shallow water. ⇒ Squat. ⇒ Bank suction. ⇒ Tide. ⇒ Weather. ⇒ Current. ⇒ Passing ships. ⇒ Rolling and pitching.	X		X
10.	**Remote Control Operation of Propulsion Plant**			
	⇒ Discuss the limitations and capabilities of various propulsion plant systems.	X		
11.	**Distress Situations**			
11.1	Identify and discuss distress calls and procedures.	X	X	
11.2	Demonstrate the correct response to a distress situation as per IAMSAR.			X
11.3	Discuss the various types of search patterns and their application.	X	X	
11.4	Execute search patterns.			X

Automatic Radar Plotting Aids (ARPA)

6.1 Course outline

TOPICS AND LEARNING OBJECTIVES		Compliance Through		
		Knowledge	Viva-Voce	Application
1.	**Radar Plotting Techniques in all Modes**			
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 true and relative plots.			X
1.3	Determine CPA and TCPA from true and 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	
2.5	Describe the operational warnings required.	X	X	
2.6	List the data which should be available in alphanumeric form.	X	X	
2.7	Explain that the accuracy standards for ARPA are based on sensor errors for equipment compliant with IMO performance standards.	X	X	

TOPICS AND LEARNING OBJECTIVES		Compliance Through		
		Knowledge	Viva-Voce	Application
2.	**Introduction to ARPA (Continued)**			
2.8	State performance standards for gyro and log inputs.	X	X	
2.9	State performance standards for radar range, bearing accuracy and radar discrimination.	X	X	
3.	**Acquisition of Targets**			
3.1	Explain how ARPA acquires a target.	X		
3.2	State that the criteria for automatic selection of targets is provided in the operator's manual.	X	X	
3.3	Describe the criteria used for manual acquisition of targets.	X	X	
3.4	Explain that the number of targets that may be acquired is limited.	X	X	
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.	X		
3.6	Explain that target acquisition may be suppressed over certain areas and state when suppression should be used.	X		
3.7	Explain the limitations of guard rings.	X		
4.	**Tracking Capabilities and Limitations**			
4.1	Describe how a target is tracked by ARPA.	X		
4.2	Explain that an acquired target may be lost if its echo fades temporarily.	X		
4.3	Describe the circumstances leading to "target swap".	X		
4.4	Describe the effect of target swap on displayed data.	X		
4.5	Explain why there is a delay in the display of processed data after target acquisition.	X		
4.6	Explain the delay in the generation of new data when the target ship maneuvers.	X		

TOPICS AND LEARNING OBJECTIVES		Compliance Through		
		Knowledge	Viva-Voce	Application
4.	**Tracking Capabilities and Limitations (Continued)**			
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		
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

TOPICS AND LEARNING OBJECTIVES		Compliance Through		
		Knowledge	**Viva-Voce**	**Application**
6.	**Target Information (Continued)**			
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		
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

TOPICS AND LEARNING OBJECTIVES		Compliance Through		
		Knowledge	**Viva-Voce**	**Application**
7.	**Interpretation Errors (Continued)**			
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		
9.	**System Operational Tests**			
9.1	Use system of self-diagnostic routines and recognize their limitations.	X		X
9.2	Use ARPA test program to check performance against known solutions.			X
9.3	Check performance, including trial maneuver by manual plotting.			X
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.			X
10.2	Identify critical targets.			X
10.3	Obtain relative courses and speeds of targets.			X
10.4	Obtain CPA and TCPA of targets.			X

TOPICS AND LEARNING OBJECTIVES		Compliance Through		
		Knowledge	Viva-Voce	Application
10.	**Obtaining Information from ARPA Displays (Continued)**			
10.5	Obtain true courses and speeds of targets.			X
10.6	Interpret displays of past positions to detect change in course or speed of target.			X
10.7	Operate trial maneuver facility to check validity of intended alteration of course or speed.			X
10.8	Analyze displayed situation and determine and execute action to avoid a close quarter situation.	X		X
10.9	Monitor subsequent situation and resume original course and speed when safe to do so.			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	

Training Standard - Electronic Chart Display and Information Systems (ECDIS)

Scope and Application

Purpose

(1) To train the mariner in the safe operation of Electronic Chart Display and Information Systems (ECDIS).

7.2 Scope

(1) Upon course completion, the mariner 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.

7.3 Authority

(1) There are no regulatory requirements at present. The authority therefore derives from the IMO, Maritime Safety Committee approval of the course. Hence, its status at present is non-mandatory.

7.4 Effective date

(1) The revised TP 4958 will take effect on the date Transport Canada Marine Safety considers appropriate after it receives approval from the Canadian Marine Advisory Council (CMAC).

General Criteria

Course length

(1) Minimum 24 hours, subject to Transport Canada Marine Safety (TC MS) audit.

8.2 Instructor qualifications

(1) Canadian Command Level certificate unlimited to tonnage.

(2) Marine Safety approved teacher certification.

8.3 Equipment requirements

(1) Minimum of one (1) ECDIS per two (2) students.

8.4 Student/Instructor ratio

(1) Eight (8) students per one (1) instructor maximum or as determined by TC MS audit.

8.5 Course completion requirements

(1) Full attendance (not less than 90%).

(2) Proficiency demonstration through practical examination.

8.6 Proof of successful course completion

(1) Certificate of successful course completion from the institution on its letter head.

(2) Certificate to have a serial number for identification.

(3) Institution or organization to maintain record of certificates issued.

8.7 References

(1) IMO A.817:1995, Performance standards for Electronic Chart Display and Information System (ECDIS).

(2) IEC 61174:1996, Electronic Chart Display and Information System (ECDIS) Operational and performance requirements, methods of testing and required results.

(3)   IHO S-52:1996: 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.

8.8 Course outline
24 hour format

Subject Areas	Time on Task Hours	
	Lecture	Practical
01. ECDIS definitions, concepts and related authorities	.3	.2
02. Legal aspects and requirements	.5	
03. Chart Display Systems	.25	.25
04. ECDIS data	.3	.2
05. Sensors and interfaces	.25	.25
06. Chart updating	.5	1
07. Errors in displayed data	.25	.25
08. Errors of interpretation	.25	.25
09. Risk of over-reliance	.5	
10. Back-up arrangements	.25	.75
11. Presentation of ECDIS data	.4	.35
12. System status alarms and indications	.25	.25
13. Basic navigational functions and settings	.5	1
14. Route planning specific functions	.5	1.75
15. Route monitoring specific functions	.5	1
16. Route planning and monitoring practical exercise	.5	3.5
17. Display and function of other navigational information	.5	1
18. Documentation	.2	.8
19. Integrity monitoring	.25	.25
20. Proficiency demonstration		4

Subject Areas	Compliance Through		
	Knowledge	Demonstration	Exercise
01. ECDIS definitions concepts and related authorities: *Describe and outline ECDIS related concepts, authorities and definitions.*			
a. Electronic Chart Display and Information System (ECDIS)	•	•	
b. Electronic Navigational Chart (ENC)	•	•	
c. System Electronic Navigational Chart (SENC)	•	•	
d. standard display	•	•	
e. display base	•	•	
f. SOLAS	•		
g. IHO S-52 and S-57	•		
h. IMO	•		
02. Legal aspects and requirements: *Explain the standards and processes associated with the lawful use of ECDIS.*			
a. responsible and lawful use of ECDIS	•		
b. performance standards	•		
c. carriage requirements	•		
d. authority of data and procurement	•		
e. standard for ECDIS back-up	•		
03. Chart Display Systems: *Describe system types and chart formats and assess their differences.*			
a. vector and raster format	•	•	
b. non-equivalent systems	•	•	
c. difference between Raster Chart Display Systems and ECDIS	•	•	

Learning Objectives	Compliance Through		
	Knowledge	Demonstration	Exercise
04. ECDIS data: *Outline the major characteristics of ECDIS data, explain the safety relevant characteristics and assess the errors and inaccuracies of improper data management.*			
a. terms and definitions	•		
b. data structure and database	•		
c. ENC creation and data quality	•		
d. reference systems	•	•	
e. data distribution	•		
f. loading, storing and data management	•	•	
g. errors, inaccuracies and improper data management	•	•	
05. Sensors and interfaces: *Identify the various ECDIS associated sensors, describe their performance limits and assess the impact of sensor limits on ECDIS.*			
a. D/GPS	•	•	
b. GLONASS	•		
c. performance limits and accuracy of sensor systems	•	•	
d. fall-back sensor system	•	•	
e. data reference system	•		
f. interface protocol	•	•	
06. Chart updating: *Perform ECDIS updates and explain associated processes.*			
a. update production and distribution	•		
b. manual/ semi-automatic/ automatic updates	•	•	
c. onboard updating and update confirmation	•	•	

Learning Objectives	Compliance Through		
d. updating and safe navigation	•		
	Knowledge	Demonstration	Exercise
07. Errors in displayed data:			
Explain displayed data errors and take proper actions.			
a. potential errors of ECDIS display	•		
b. potential errors in display of own ship's position	•	•	
c. accuracy of displayed data	•	•	
d. appropriate response to potential and realized errors	•	•	•
08. Errors of interpretation:			
Explain errors of interpretation and take proper actions.			
a. appropriate use of sensors	•		
b. display over-scale/ under-scale recognition	•	•	
c. change of safety margins	•	•	
d. appropriate response to potential and realized errors	•	•	•
09. Risks of over-reliance:			
Assess the limits of ECDIS and explain the role of ECDIS in safe watch-keeping.			
a. limitations of ECDIS	•		
b. proper watch-keeping arrangements	•		
10. Back-up arrangements:			
Navigate safely using ECDIS back-up system and outline back-up requirements.			
a. safe take-over of ECDIS functions	•	•	•
b. requirements for back-up system	•		
c. functional limitations of back-up system	•		
d. test and verification of back-up system	•	•	

Learning Objectives	Compliance Through		
	Knowledge	Demonstration	Exercise
11. Presentation of ECDIS data:			
Explain the main characteristics of ECDIS data and select proper information for navigational tasks.			
a. presentation library	•		
b. modification the chart presentation	•		
c. scope and selection of chart display categories	•	•	
d. automatic presentation rules	•		
e. modes and orientations of display	•	•	
f. identification of display base and standard display	•	•	
g. distinguish updates from other displayed information	•	•	
h. display adjacent areas	•	•	
i. select and sequence charts	•	•	
j. display own-ship as true scale and symbol	•	•	
12. System status alarms and indications:			
Explain the various alarms and indications that are part of ECDIS and take proper action.			
a. define alarm and indication	•		
b. identify navigational alarms/ indications and sensor indications	•	•	
c. identify system and chart related alarms/ indications	•	•	
13. Basic navigational functions and settings:			
Operate all basic functions and settings.			
a. automatic functions	•	•	
b. manual functions	•	•	
c. own chart entries	•	•	

Learning Objectives	Knowledge	Demonstration	Exercise
d. presentation of navigational marks	●	●	
e. additional information	●	●	

Learning Objectives	Compliance Through		
	Knowledge	Demonstration	Exercise
f. vector types	●	●	
14. Route planning specific functions: *Operate all specific functions and obtain information to plan an ECDIS route.*			
a. sea area selection		●	
b. route planning information		●	
c. construction of a route	●	●	
d. adjustment of planned route		●	
e. curved track planning	●	●	
f. planning notes		●	
g. safety margins		●	
h. check for navigational safety		●	
i. alternate route		●	
15. Route monitoring specific functions: *Operate specific functions for monitoring of route, secure relevant information and navigate safely.*			
a. monitored area		●	
b. required route		●	
c. vector time		●	
d. measurement checks	●	●	
e. look-ahead function		●	
f. status alarms/ indications		●	
g. current and wind	●	●	

Learning Objectives	Compliance Through		
	Knowledge	Demonstration	Exercise
16. Route planning and route monitoring practical exercise: *Operate specific ECDIS functions relevant to the planning and conduct of a safe passage.*			
a. plan route	•		•
b. adjust/ set monitoring and safety functions		•	•
c. add/ delete/ change position of way-points		•	•
d. change order of way-points		•	•
e. plan a turn	•	•	•
f. plan an alternate route		•	•
g. demonstrate safe passage planning practices			•
h. set appropriate alarm parameters		•	•
i. select/ deselect look-ahead function		•	•
j. set markers and planning notes		•	•
k. recognize indication of position system/ sensor failures		•	•
l. establish fall-back positioning system		•	•
m. check for navigational safety	•	•	•
17. Display of other navigational features: *Demonstrate the function of and explain potential limitations associated with other navigational features.*			
a. radar image	•	•	•
b. chart and radar image scale and orientation	•	•	
c. target track interface ARPA/ ATA/ APA	•	•	•
d. use of transponders	•		
e. identify offset between radar antenna and conning position	•	•	

Learning Objectives	Compliance Through		
	Knowledge	Demonstration	Exercise
18. Documentation: *Explain voyage recording and demonstrate voyage recording functions.*			
a. voyage recording past track/ entire voyage	●	●	●
b. reconstruction of past track	●	●	●
c. identification of ENC source	●	●	
19. Integrity monitoring: *Assess ECDIS integrity related functions and appreciate the value of such tests.*			
a. on-line tests		●	
b. manual and visual tests		●	
c. verification of proper functioning	●	●	
20. Proficiency Demonstration: *Demonstrate competency in planning and conducting a safe passage using ECDIS.*			
a. plan passage			●
b. monitor passage			●
c. prepare alternate route			●
d. establish back-up arrangements			●
e. update charts and verify integrity of ENC data			●

Course References

Subject Areas	References						
	IMO 817	IEC 61174	IHO S-52	IHO S-52 App 1	IHO S52 App 2	IHO S-52 App 3	IHO S-57
01. ECDIS definitions, concepts and related authorities	●	●	●	●	●	●	
02. Legal aspects and requirements	●	●	●	●			●
03. Chart Display Systems		●	●	●			
04. ECDIS data	●	●	●				●
05. Sensors and interfaces	●	●					
06. Chart updating	●	●		●	●		●
07. Errors in displayed data	●	●	●				
08. Errors of interpretation							
09. Risk of over-reliance							
10. Back-up arrangements	●	●					
11. Presentation of ECDIS data	●	●	●		●		
12. System status alarms and indications	●	●			●		
13. Basic navigational functions and settings	●	●	●				
14. Route planning specific functions	●	●					
15. Route monitoring specific functions	●	●					
16. Route planning and monitoring practical exercise							
17. Display and function of other navigational information	●	●			●		
18. Documentation	●	●					
19. Integrity monitoring	●	●					
20. Proficiency demonstration							