MARITIME SIMULATION AND RESOURCE CENTRE
Corporation of Lower St. Lawrence Pilots
http://www.sim-pilot.com/en

ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM (ECDIS)

(CE-010-035-ENG)

Objectives:	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. 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.
Duration:	35 hours (5 days)
Schedule:	Begins at 8:30
Participants:	Five (5)
Teaching strategies used:	Basically a hands-on approach. Theoretical explanations and exercises on the Navigation Simulator.
Training activities:	Theory followed by simulation exercises. Discussions among participants recommended during exercises.

Proposed timetable and description of training activities

Day One **8:30 to 11:30 a.m.**
Welcome/Registration
Tour of the Navigation simulator and general facilities Familiarization with the bridge and navigation instruments
Introduction and establishment of schedule
Distribution of teaching material, presentation of course plan
1. ECDIS definitions, concepts and related authorities *Describe and outline ECDIS concepts and related authorities* • Electronic Chart Display Information System (ECDIS) • Electronic Navigational Chart (ENC) • System Electronic Navigational Chart (SENC) • Standard display • Display base • SOLAS Regulation V/20 • IHO S-52 and S-57 • IMO
2. Chart display systems (main types) *Legal aspects and requirements* • Describe the essential legal aspects and responsibilities in the use of ECDIS. • Explain the SOLAS (Chapter V) carriage requirements concerning the carriage of charts. • Explain the equivalency of ECDIS and paper charts to make it clear that only ECDISs using the official ENC entitles him/her to navigate without paper charts. • Outline the IMO performance standards for ECDIS. • Explain and accept his/her responsibilities with regard to data procurement data. • Explain and accept the training requirements concerning the operation of navigation equipment.

3. Principal types of electronic charts

Specify the chief characteristics of the main types of electronic charts.

State:

- the difference between different ECDIS systems
- the differences between ECDIS and ECS
- the differences between vector and raster charts

12:30 to 3:30 p.m.

4. ECDIS data

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.

- 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.
- Explain:
  - data structure and database of ECDIS, including objects and their attributes (object catalogue);
  - that the display is a portrait of ECDIS data, that is, only the information contained and structured in the objects/attributes is available for display;
  - how manual updates are entered in the database.
- Outline the steps and responsibilities during ENC creation.
- Explain how chart data quality is dependent on factors such as:
  - survey accuracy, updatedness, coverage and completeness of chart data;
  - assess that the data quality is doubtful due to the change of the factors named above.
- 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 data.
- Assess all errors, inaccuracies and ambiguities caused by improper data management.
- Outline the organization of chart data distribution.
- 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.

5. Presentation of ECDIS data

Explain the main characteristics of the display of ECDIS data and select proper information for navigational tasks.

- Explain the major rules for presentation contained in the presentation library for ECDIS.
- Apply the major rules for presentation to the display presentation.
- 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.
- Describe the scope and selection of chart data to be displayed.
- Select the relevant information contents by the display categories "display base," "standard display" and "all other information."
- Apply the different possibilities of selection of the sea area.
- Outline the meaning of automatic presentation rules for ECDIS.
- Select and apply appropriate display modes, such as: display category, scales, day or night presentation.
- Assess the resulting differences in information.
- Identify the different modes of presentation, such as: true or relative motion, north-up or course-up stabilization.
- Select and apply the suitable mode of presentation for the actual situation.

6. Sensors

Describe the performance limits of sensors and assess their impact on the safe use of ECDIS.

- Explain the performance limits concerning availability, accuracy and integrity of all navigational sensors connected to the ECDIS, that is, devices to determine position, course, speed and depth, as well as radar.
  - Assess the impairment of ECDIS performance in the case of deterioration in sensor performance.
- 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.
- Explain the data reference system of each connected sensor, for example, geodesic system, position of antenna and transducer.
- Explain the need for selection of appropriate and unambiguous sensor data display in ECDIS.
- Assess the plausibility of sensor input values to ECDIS.

Review of the day and comments

Day Two

8:30 to 11:30 a.m.

7. Basic navigational functions and settings

Operate all basic navigational functions and settings.

- Identify all automatic functions required for monitoring vessel's safety, such as the display of position, heading/ gyro course, speed, safety values and time.
- Demonstrate:
  - how manual functions and elements such as cursor, electronic bearing line and range rings are used;
  - how a position which was not automatically determined is marked on the ECDIS display;
  - how position-fixing methods are applied within ECDIS (line of position);
  - how the range scale and/or the scale is changed, how own vessel's safety values, such as "safety contour" or the "safety depth" are set.
- Demonstrate:
  - how own chart entries, like "Mariner's notes" or events, are applied;
  - how own chart entries are removed.
- Demonstrate how the presentation of navigation marks is changed.
- Demonstrate:
  - how additional information on particular ENC objects, such as lights are switched on for display;
  - how depth values and spot soundings are picked.
- Demonstrate the two vector types indicating the vessel's motion over ground and through the water, and their benefits and drawbacks.

8. Specific functions for route planning

Operate all specific functions and obtain all relevant information for route planning from ECDIS.

- Demonstrate how the sea areas and the waters required for planning the whole passage are selected for display.
- Demonstrate:
  - how relevant route planning information, such as sailing instructions, tidal or meteorological information is gained from ECDIS and other sources;
  - how information required for specific situations, such as anchoring is obtained.
- Demonstrate how the construction of a route is performed by the input or waypoints, both directly on the ECDIS display and alphanumerically.

- Demonstrate how the adjustment of a planned route by editing waypoints is performed.
- Demonstrate:
  - how curved track planning is performed by the input of turning radii, wheel-over points/lines and safe speeds;
  - how courses and distances of the track are obtained from the chart by different methods, such as cursor position, selection of legs or calling up the waypoint list;
  - how time marks are set;
  - how track limits are set.
- Demonstrate:
  - how planning notes, such as courses, rudder angles and speeds to be maintained in a specific area are applied;
  - how expected passage times are determined;
  - how current is to be considered when plotting a track in the ECDIS display.
- Assess which safety values are to be selected in accordance with the vessel's dimensions and the manoeuvring parameters to be applied.
- Demonstrate how a planned route is checked for navigational safety.
- Assess:
  - if a track is reliably safe by considering all predictable hazards along it;
  - which ultimate route is to be taken;
  - which points/areas are critical.

12:30 to 1:30 p.m.

9. Specific functions for route monitoring

Operate all specific functions for route monitoring and obtain all relevant information for navigation and for the vessel's safety.

- Demonstrate how a monitored area is selected, left and returned to.
- Demonstrate how the required route is selected, called up and, if necessary, modified.
- Demonstrate how a predicted position can be generated by setting a "vector time" and explain the relevance of "vector time" information.
- Demonstrate how to check measurements of the vessel's position, independent of the ECDIS equipment, including its sensors, are performed and plotted in ECDIS.
- Explain the relevance of the "look-ahead function" and demonstrate how the "look-ahead function" is performed.
- Explain how the alarms concerning route monitoring are triggered, for example:
  - by crossing a safety contour or prohibited area;
  - by violation of the set limits for deviation from on arrival at a critical point of the route;

- Demonstrate how alarms are set with regard to their presentation and their alarm levels.
- Assess the significance of the different alarms concerning route monitoring.
- Demonstrate how values for current and wind which are obtained from external sources are applied to ECDIS.

10. Updating

Apply updates and assess the importance of updating.

- Outline:
  - how the production of updates by national hydrographic services is performed;
  - how the distribution of updates by regional data centres is organized and executed.
- Explain the essentials of manual, semi-automatic and automatic updating.
- Perform updates on board by:
  - Performing the manual and semi-automatic updating procedures;
  - Indicating how items which are added to, removed or altered on the original ENC are marked and indicated;
  - displaying updates in order to:
    - review content;
    - ascertain that they have been included in the SENC.
- Realize that only continuously updated data allow safe navigation.

11. Display and function of other navigational information

Explain the display and possible dangers, and demonstrate the function of navigational information.

- Demonstrate how a radar superimposition is employed:
  - explain and assess possible offsets of radar echoes of fixed charted objects from their charted position.
- Indicate how automatic track-keeping is employed:
  - describe the potential dangers of the automatic track-keeping mode.
- Demonstrate the use of information from transponders.

12. Errors of displayed data

Explain the potential errors in displayed data and take proper action.

- Explain the potential errors of the ECDIS display due to:
  - inaccurate hydrographic data;
  - poor resolution;
  - the shifting of buoys.
- Explain that potential errors introduced by:
  - inaccurate input from the electronic position-fixing system;
  - inaccurate input of radar data;
  - different geodetic co-ordinate systems;
  - reference position of sensors on board may result in errors in the display of own vessel's position.
- Check the correctness of displayed data:
  - by comparing ECDIS and radar information;
  - by checking the vessel's position by means of a second independent position-fixing system.

13. Errors of interpretation

Explain the potential errors of interpretation and take proper action to avoid these errors.

- Explain the errors of interpretation errors due to:
  - different modes of vector stabilization;
  - overscale of the display;
  - neglecting the 95% probability of the accuracy standard of the fixing sensor
  - automatic track-keeping features, such as the continuous display of own vessel's position on the preplanned track.
- Avoid errors of interpretation by verifying the selection:
  - a common reference system;
  - the appropriate scale;
  - the sensors best suited for the given situation;
  - the safety values;
  - display categories;
  - usage, etc.

Day Three 8:30 to 11:30 a.m.

14. Status indications, indicators and alarms
 	
Explain the status indications, indicators and alarms for different kinds of situation and take proper action.
 	
• Outline the definition and meaning of status indications, indicators and alarms related to ECDIS, including the areas for which ECDIS should provide an alarm or indication.
• Explain and analyse:
  ○ the nautical indications during route planning;
  ○ the nautical alarms during route monitoring;
  ○ the sensor alarms and indications, and apply appropriate measures in the case of their occurrence.
• Explain and analyse the data and chart alarms resulting from non-WGS 84 geodetic datum or overscale setting.

15. Documentation
 	
Understand the meaning of voyage recording and operate the corresponding functions.
 	
• Outline the essentials of automatic voyage recording.
• Demonstrate:
  ○ how the contents of automatic voyage recording are called up, in particular:
  ○ how a past track is constructed, and
  ○ how the database is verified,
  ○ how possible selections of, for example, recording media or recording intervals are carried out.

12:30 to 3:30 p.m.

16. Integrity monitoring
 	
Analyse and assess the proper functioning of ECDIS.
 	
• Outline:
  ○ the proceeding of the on-line test during booting;
  ○ the on-line system check during normal operation.
• Perform:
  ○ manual tests of the major functions of hardware, MMI and sensor data;
  ○ visual tests of chart data.
• Recognize all status indications.
  ○ Verify:
  ○ the proper functioning of the ECDIS display and the position-fixing system by comparing ECDIS and radar objects or back-up positioning system;
  ○ that all received updates are contained in the ECDIS display.
  ○ Assess that the navigation process is safe.

17. Back-up
 	
Navigate as safely as possible using the back-up system in the case of an ECDIS failure.
 	
• Perform:
  ○ a safe takeover by the back-up system;
  ○ a safe transfer of all relevant passage planning data from the ECDIS to the back-up system;
  ○ a transfer of all relevant updates immediately to the back-up system.
• Explain the reduced functional capabilities which are available with the back-up system:
  ○ appreciate that the back-up system is only of limited performance and that the back-up system should be replaced by a properly functioning ECDIS as soon as possible.
• Explain that periodical functioning tests and practice of the takeover procedure are necessary in order to verify proper functioning of the back-up device in an emergency.

Day Four

8:30 to 11:30 p.m.

18. Risk of over-reliance on ECDIS

Assess the limits of ECDIS as a tool that does not release navigators from proper watchkeeping.

- Recognize:
  - that a potential risk of improper functioning of the system and of data inaccuracy is inherent in the system;
  - that the displayed hydrographic data are not more reliable than the survey data on which they are based;
  - that the display sensor data are not more reliable than the respective sensor systems they originate from;
  - that ECDIS is only a tool that supports the mariner in the performing of navigational tasks;
  - that errors/inaccuracies in one subsystem may influence the performance of other subsystems and potentially render the ECDIS useless.
- Perform a navigational watch that is not based on only one system.
- Assess:
  - the integrity of the system and all data at all times;
  - the possibility that he/she should also use other available aids to navigation and determine which ones are appropriate.

12:30 to 3:30 p.m.

Period dedicated specifically to potential system errors:

- GPS errors
- DGPS errors
- ECDIS errors
- installation errors
- ENC data conversion errors
- carte errors
- survey errors
- sensor errors
- bugs

Day Five 8:30 to 11:30 a.m.
SSL period
Preparation and performance of a voyage
12:30 to 3:30 p.m.

Demonstration of each participant's skill:
 	
SCOPE
 	
• Upon course completion, the mariner will be able to demonstrate proficiency in the following areas:
  ○ basic principles of ECDIS data, sensors, presentation of Electronic Navigational Chart (ENC);
  ○ operation of ECDIS and associated functions for passage planning and monitoring, including display options, ENC identification, alarms, chart updating and other navigational functions;
  ○ 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.