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**INTERIM GUIDANCE ON TRAINING AND ASSESSMENT IN THE OPERATIONAL
USE OF THE ELECTRONIC CHART DISPLAY AND INFORMATION
SYSTEM (ECDIS) SIMULATORS**

- 1 The Sub-Committee on Standards of Training and Watchkeeping, at its thirty-second session (22 to 26 January 2001), noted that interim guidance on training and assessment in the operational use of the Electronic Chart Display and Information System (ECDIS) simulators was necessary.
- 2 The Sub-Committee developed interim guidance on training and assessment in the operational use of ECDIS simulators given at annex.
- 3 The Maritime Safety Committee, at its seventy-fourth session (30 May to 8 June 2001), approved this interim guidance.
- 4 Member Governments are invited to bring the interim guidance to the attention of all concerned.

ANNEX**INTERIM GUIDANCE ON TRAINING AND ASSESSMENT IN THE OPERATIONAL USE OF THE ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM (ECDIS) SIMULATORS*****Introduction**

1 When simulators are being used for training or assessment in the operational use of Electronic Chart Display and Information Systems (ECDIS) the following interim guidance should be taken into consideration in any such training or assessment.

2 Training and assessment in the operational use of the ECDIS should:

- .1 incorporate the use of an ECDIS simulation equipment; and
- .2 conform to standards not inferior to those given in paragraphs 3 to 31 below.

3 ECDIS simulation equipment should, in addition to meeting all applicable performance standards set out in section A-I/12 of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, as amended, be capable of simulating navigational equipment and bridge operational controls which meet all applicable performance standards adopted by the Organization, incorporate facilities to generate soundings and:

- .1 create a real-time operating environment, including navigation control and communications instruments and equipment appropriate to the navigation and watchkeeping tasks to be carried out and the maneuvering skills to be assessed; and
- .2 realistically simulate 'own ship' characteristics in open water conditions, as well as the effects of weather, tidal stream, and currents.

4 Demonstrations of, and practice in, ECDIS use should be undertaken where appropriate through the use of simulators. Training exercises should preferably be undertaken in real time, in order to increase trainees' awareness of the hazards of the improper use of ECDIS. Accelerated time-scale may be used only for demonstrations.

GENERAL**Goals of an ECDIS training programme**

5 The ECDIS trainee should be able to:

- .1 operate the ECDIS equipment, use the navigational functions of ECDIS, select and assess all relevant information and take proper action in the case of a malfunction;

* IMO Model Course 1.27 – *The Operational Use of Electronic Chart Display and Information Systems (ECDIS)* may be of assistance in the preparation of courses.

- .2 state the potential errors of displayed data and the usual errors of interpretation; and
- .3 explain why ECDIS should not be relied upon as the sole reliable aid to navigation.

Theory and demonstration

6 As the safe use of ECDIS requires knowledge and understanding of the basic principles governing ECDIS data and their presentation rules as well as potential errors in displayed data and ECDIS-related limitations and potential dangers, a number of lectures covering the theoretical explanation should be provided. As far as possible, such lesson should be presented within a familiar context and make use of practical examples. They should be reinforced during simulator exercises.

7 For safe operation of ECDIS equipment and ECDIS-related information (use of the navigational functions of ECDIS, selection and assessment of all relevant information, becoming familiar with ECDIS man-machine interfacing), practical exercises and training on the ECDIS simulators should constitute the main content of the course.

8 For the definition of training objectives, a structure of activities should be defined. A detailed specification of learning objectives should be developed for each topic of this structure.

Simulator exercises

9 Exercises should be carried out on individual ECDIS simulators, or full-mission navigation simulators including ECDIS, to enable trainees to acquire the necessary practical skills. For real time navigation exercises, navigation simulators are recommended to cover the complex navigation situation. The exercises should provide training in the use of the various scales, navigational modes, and display modes which are available, so that the trainees will be able to adapt the use of the equipment to the particular situation concerned.

10 The choice of exercises and scenarios is governed by the simulator facilities available. If one or more ECDIS workstations and a full-mission simulator are available, the workstations may primarily be used for basic exercises in the use of ECDIS facilities and for passage planning exercises, whereas full-mission simulators may primarily be used for exercises related to passage monitoring functions in real time, as realistic as possible in connection with the total workload of a navigational watch. The degree of complexity of exercises should increase throughout the training programme until the trainee has mastered all aspects of the learning subject.

11 Exercises should produce the greatest impression of realism. To achieve this, the scenarios should be located in fictitious sea area. Situations, functions and actions for different learning objectives which occur in different sea areas can be integrated into one exercise and experienced in real time.

12 The main objective of simulator exercises is to ensure that a trainee understands his responsibilities in the operational use of ECDIS in all safety-relevant aspects and is thoroughly familiar with the used system and equipment.

Principal types of ECDIS systems and their display characteristics

13 The trainee should gain knowledge of the principal types of ECDIS in use; their various display characteristics, data structure and an understanding of:

- .1 differences between vector and raster charts;
- .2 differences between ECDIS and ECS;
- .3 differences between ECDIS and RCDS*;
- .4 characteristics of ECDIS and their different solutions;
- .5 characteristics of systems for special purposes (unusual situations/emergencies).

Risks of over-reliance on ECDIS

14 The training in ECDIS operational use should address:

- .1 the limitations of ECDIS as a navigational tool;
- .2 potential risk of improper functioning of the system;
- .3 system limitations, including those of its sensors;
- .4 hydrographic data inaccuracy; limitations of vector and raster electronic charts (ECDIS vs. RCDS and ENC vs. RNC); and
- .5 potential risk of human errors.

Emphasis should be placed on the need to keep a proper look-out and to perform periodical checking, especially of the ship's position, by ECDIS-independent methods.

Detection of misrepresentation of information

15 Knowledge of the limitations of the equipment and detection of misrepresentation of information is essential for the safe use of ECDIS. The following factors should be emphasized during training:

- .1 performance standards of the equipment;
- .2 radar data representation on an electronic chart, elimination of discrepancy between the radar image and the electronic chart;
- .3 possible projection discrepancies between an electronic and paper charts;

* SN/Circ.207 - Differences between RCDS and ECDIS.

- .4 possible scale discrepancies (overscaling and underscaling) in displaying an electronic chart and its original scale;
- .5 effects of using different reference systems for positioning;
- .6 effects of using different horizontal and vertical datums;
- .7 effects of the motion of the ship in a seaway;
- .8 ECDIS limitations in raster chart display mode;
- .9 potential errors in the display of:
 - .1 the own ship's position;
 - .2 radar data and ARPA information;
 - .3 different geodetic co-ordinate systems; and
- .10 verification of the results of manual or automatic data correction:
 - .1 comparison of chart data and radar picture; and
 - .2 checking the own ship's position by using the other independent position fixing systems.

16 False interpretation of the data and proper action taken to avoid errors of interpretation should be explained. The implications of the following should be emphasized:

- .1 ignoring overscale of the display;
- .2 uncritical acceptance of the own ship's position;
- .3 confusion of display mode;
- .4 confusion of chart scale;
- .5 confusion of reference systems;
- .6 different modes of presentation;
- .7 different modes of vector stabilization;
- .8 differences between true north and gyro north (radar);
- .9 the same data reference system;
- .10 appropriate chart scale;

- .11 using the best-suited sensor to the given situation and circumstances;
- .12 entering the correct values of safety data; and
 - .1 the own ship's safety contour;
 - .2 safety depth (safe water); and
 - .3 events; and
- .13 proper use of all available data.

17 Appreciation that RCDS is only a navigational aid and when operating in the RCDS mode and that ECDIS equipment should be used together with an appropriate portfolio of up-to-date paper charts.

Factors affecting system performance and accuracy

18 An elementary understanding should be attained of the principles of ECDIS, together with a full practical knowledge of:

- .1 starting and setting up ECDIS; connecting data sensors: satellite and radionavigation system receivers, radar, gyrocompass, log, echo-sounder; accuracy and limitations of these sensors, including effect of measurements errors and ship's position accuracy, manoeuvring on the accuracy of course indicators performance, compass error on the accuracy of course indication, shallow water on the accuracy of log performance, log correction on the accuracy of speed calculation, disturbance (sea state) on the accuracy of an echo-sounder performance; and
- .2 the current electronic chart display and information system performance standards adopted by the Organization*.

PRACTICE

Setting up and maintaining display

- 19 Knowledge and skills should be attained in:
- .1 the correct starting procedure to obtain the optimum display of ECDIS information;
 - .2 the selection of display presentation (standard display, display base, all other information displayed individually on demand);

* See: Resolution A.817(19) – Performance Standards for Electronic Chart Display and Information System (ECDIS);
Resolution MSC.64(67) annex 5 amending resolution A.817(19);
Resolution MSC.86(70) annex 4 amending resolution A.817(19).

- .3 the correct adjustment of all variable radar/ARPA display controls for optimum display of data;
- .4 the selection of convenient configuration;
- .5 the selection, as appropriate, of required speed input to ECDIS;
- .6 the selection of the time scale of vectors; and
- .7 performance checks of position, radar/ARPA, compass, speed input sensors and ECDIS.

Operational use of electronic charts

20 Knowledge and skills should be attained in:

- .1 the main characteristics of the display of ECDIS data and selecting proper information for navigational tasks;
- .2 the automatic functions required for monitoring ship's safety such as display of position, heading/gyro course, speed, safety values and time;
- .3 the manual functions (by cursor, electronic bearing line, range rings);
- .4 selecting and modification of electronic chart content;
- .5 scaling (including underscaling and overscaling);
- .6 zooming;
- .7 setting of the own ship's safety data;
- .8 using a daytime or night-time display mode;
- .9 reading all chart symbols and abbreviations;
- .10 using different kinds of cursors and electronic bars for obtaining navigational data;
- .11 viewing area in different directions and returning to the ship's position;
- .12 finding necessary area using geographical co-ordinates;
- .13 displaying indispensable data layers appropriate to navigational situation;
- .14 selecting appropriate and unambiguous data (position, course, speed, etc.);

- .15 entering the mariner's notes;
- .16 using north-up orientation presentation and other kinds of orientation; and
- .17 using true and relative motion modes.

Route planning

21 Knowledge and skills should be attained in:

- .1 loading the ship's characteristics into ECDIS;
- .2 sea area selection for route planning:
 - .1 reviewing required waters for the sea passage;
 - .2 changing over of chart scale;
- .3 route planning on a display by means of ECDIS using the graphic editor taking into consideration rhumb-line and great circle sailing:
 - .1 using ECDIS database for obtaining navigational, hydrometeorological and other data;
 - .2 taking into consideration turning radius and wheel over points/lines when it is expressed on chart scale;
 - .3 marking dangerous depths and areas and exhibiting guarding isolines;
 - .4 marking waypoints with the crossing isolines and critical cross-track deviations, as well as by adding, replacing and erasing of waypoints;
 - .5 taking into consideration safe speed;
 - .6 checking pre-planned route for navigational safety;
 - .7 generating alarms and warnings;
- .4 route planning with calculation in the table format including:
 - .1 way-points selection;
 - .2 recalling the way-points list;
 - .3 planning notes;
 - .4 adjustment of a planned route;

- .5 checking pre-planned route for navigational safety;
- .6 alternative route planning;
- .7 saving planned routes, loading and unloading or deleting routes;
- .8 making a graphic copy of the monitor screen and printing a route;
- .9 editing and modification of the planned route;
- .10 safety values setting according to size and manoeuvring parameters of the vessel;
- .11 back-route planning; and
- .12 connecting several routes.

Route monitoring

22 Knowledge and skills should be attained in:

- .1 using independent data to control ship's position or using alternative systems within ECDIS;
- .2 using look-ahead function
 - .1 changing charts and their scales;
 - .2 reviewing navigational charts;
- .3 vector time selecting;
- .4 predicting the ship's position for some time interval;
- .5 changing the pre-planned route (route modification);
- .6 entering independent data for the calculation of wind drift and current allowance;
- .7 reacting properly to the alarm;
- .8 entering corrections for discrepancies of the geodesic datum;
- .9 displaying time markers on a ship's route;
- .10 entering ship's position manually; and
- .11 measuring co-ordinates, course, bearings and distances on a chart.

Alarm handling

23 Knowledge and ability to interpret, react properly to all kinds of systems, such as navigational sensors, indicators, data and charts alarms and indicator warnings including switching the sound and visual alarm signalling system should be attained in case of:

- .1 absence of next chart in ECDIS database;
- .2 crossing a safety contour;
- .3 exceeding cross-track limits;
- .4 deviation from planned route;
- .5 approaching a waypoint;
- .6 approaching a critical point;
- .7 discrepancy between calculated and actual time of arrival to a waypoint;
- .8 information on underscale or overscale;
- .9 approaching an isolated navigational danger or danger area;
- .10 crossing a specified area;
- .11 different geodetic datum;
- .12 approaching other ships;
- .13 watch termination;
- .14 switching timer;
- .15 system test failure;
- .16 malfunctioning of positioning system used in ECDIS;
- .17 failure of dead-reckoning; and
- .18 inability to fix vessel's position using navigational system.

Manual correction of a ship's position and motion parameters

24 Knowledge and skills should be attained in manually correcting:

- .1 the ship's position in dead-reckoning mode, when the satellite and radionavigation system receiver is switched off;

- .2 the ship's position, when automatically obtained co-ordinates are inaccurate; and
- .3 course and speed values.

Records in the ship's log

25 Knowledge and skills should be attained in:

- .1 automatic voyage recording;
- .2 reconstruction of past track taking into account:
 - .1 recording media;
 - .2 recording intervals;
 - .3 verification of database in use;
- .3 viewing records in the electronic ship's log;
- .4 instant recording in the electronic ship's log;
- .5 changing ship's time;
- .6 entering the additional data;
- .7 printing the electronic ship's log content;
- .8 setting up the automatic record time intervals;
- .9 composition of voyage data and reporting; and
- .10 interphase with a voyage data recorder (VDR).

Chart updating

26 Knowledge and skills should be attained in:

- .1 performing manual updating of electronic charts. Special attention should be paid to reference-ellipsoid conformity and to conformity of measurements units used on a chart and in the correction text;
- .2 performing semi-automatic updating of electronic charts using the data obtained on a diskette in the electronic chart format; and

- .3 performing automatic updating of electronic charts, obtained via modern communication lines.

In the scenarios where non-updated data are employed to create a critical situation, trainees should be required to perform *ad hoc* updating of the chart.

Operational use of ECDIS where radar/ARPA connected

27 Knowledge and skills should be attained in:

- .1 connecting ARPA to ECDIS;
- .2 indicating target's speed vectors;
- .3 indicating target's tracks;
- .4 archiving target's tracks;
- .5 viewing the table of the targets;
- .6 simulating the manoeuvre;
- .7 corrections of a ship's position using a reference point captured by ARPA; and
- .8 corrections using the ARPA's cursor and electronic bar.

Operational use of ECDIS where AIS connected

28 Knowledge and skills should be attained in:

- .1 interface with AIS; and
- .2 interpretation of AIS data.

Operational warnings, their benefits and limitations

29 Trainees should gain an appreciation of the uses, benefits and limitations of ECDIS operational warnings and their correct setting, where applicable, to avoid spurious interference.

System operational tests

30 Knowledge and skills should be attained in:

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

- .3 adequate back-up arrangements (takeover and navigate using the back-up system).

Debriefing exercise

31 The instructor should analyse the results of all exercises completed by all trainees and print them out. The time spent on the debriefing should occupy between 10% and 15% of the total time used for simulator exercises.
