MARINE GUIDANCE NOTE

Maritime and Coastguard Agency

MGN 379 (M+F)

Navigation: Use of Electronic Navigation Aids

Notice to all Owners, Masters, Skippers, Officers and Crews of Merchant Ships and Fishing Vessels

This notice replaces MGN 63

PLEASE NOTE:-
Where this document provides guidance on the law it should not be regarded as definitive. The way the law applies to any particular case can vary according to circumstances - for example, from vessel to vessel and you should consider seeking independent legal advice if you are unsure of your own legal position.

Summary

This note emphasises the need for correct use of navigational equipment by watch-keepers.

Key Points:-

- Be aware that each item of equipment is an aid to navigation.
- Be aware of the factors which affect the accuracy of position fixing systems.
- Appreciate the need to cross check position fixing information using other methods.
- Recognise the importance of the correct use of navigational aids and knowledge of their limitations.
- Be aware of the dangers of over-reliance on the output from, and accuracy of, a single navigational aid.

1. INTRODUCTION

Accidents have occurred where the primary cause has been over-reliance on a single electronic navigational aid. Watch-keepers must always ensure that positional information is regularly cross-checked using other equipment, as well as visual aids to navigation. In other cases accidents have occurred where the watch-keeper was not fully conversant with the operation of equipment or its limitations.

2. PROVISION OF NAVIGATIONAL EQUIPMENT ON SHIPS

The Merchant Shipping (Safety of Navigation) Regulations 2002 (SI 2002 No 1473) implement the carriage requirements for navigational equipment set out in Regulation 19 of Safety of Life at Sea (SOLAS) Chapter V. These requirements, together with guidance notes, are contained in the 2007 Edition of the Maritime and Coastguard Agency (MCA) publication "Safety of Navigation – Implementing SOLAS Chapter V 2002"

Ships built before 1 July 2002 may continue to comply with the requirements of SOLAS Chapter V/74 in force prior to 2002 Regulations, with regard to Signalling Lamps (Reg. 11/74), Navigation Equipment (Reg. 12/74) and Nautical Publications (Reg. 20/74). However they must carry a Global Navigation Satellite System (GNSS) receiver or a terrestrial radio-navigation receiver, Automatic Identification System (AIS) and Voyage Data Recorder (VDR) or Simplified Voyage Data Recorder (S-VDR) in accordance with the timetables set out in Regulations 19 and 20 of SOLAS V 2002.

Guidance is also given in Annex 20 of the MCA Safety of Navigation publication on siting and servicing of the installations.

3. RADAR AND PLOTTING AIDS

3.1 General

Collisions have been frequently caused by failure to make proper use of radar and radar plotting aids in both restricted visibility and clear weather. Common errors have been deciding to alter course on the basis of insufficient information and maintaining too high a speed, particularly when a close-quarters situation is developing. Information provided by radar and radar plotting aids in clear weather conditions can assist the watch-keeper in maintaining a proper lookout in areas of high traffic density. It is most important to remember that navigation in restricted visibility can be more demanding and great care is needed even with all the information available from the radar and radar plotting aids. Where continuous radar watch-keeping and plotting cannot be maintained even greater caution must be exercised. A "safe speed" should at all times reflect the prevailing circumstances.

3.2 Electronic radar plotting aids

Radars must be equipped with plotting aids, the type of which depends upon the size of ship as follows;

a) Electronic Plotting Aid (EPA)

EPA equipment enables electronic plotting of at least 10 targets, but without automatic tracking (Ships between 300 and 500 Gross Tonnage (GT)).

b) Automatic Tracking Aid (ATA)

ATA equipment enables manual acquisition and automatic tracking and display of at least 10 targets (Ships over 500 GT).

On ships of 3000 GT and over the second radar must also be equipped with an ATA, the two ATAs must be functionally independent of each other.

c) Automatic Radar Plotting Aid (ARPA)

ARPA equipment provides for manual or automatic acquisition of targets and the automatic tracking and display of all relevant target information for at least 20 targets for anti-collision decision making. It also enables trial manoeuvre to be executed (Ships of 10000 GT and over).

The second radar must incorporate ATA if not ARPA.

Manual plotting equipment is no longer acceptable except for existing vessels still complying with SOLAS V/74.

Watch-keepers must be fully conversant with the operation and limitations of these plotting facilities and should practice using them in clear-weather conditions to improve their skills.

In addition to the advice given above and the instructions contained in the Operating Manual(s), users of radar plotting aids should ensure that:

(i) performance of the radar is monitored and optimised

(ii) test programmes provided are used to check the validity of the plotting data, and

(iii) speed and heading inputs to the ARPA/ATA are satisfactory. Correct speed input, where provided by manual setting of the appropriate ARPA/ATA controls or by an external input, is vital for correct processing of ARPA/ATA data. Serious errors in output data can arise if heading and/or speed inputs to the ARPA/ATA are incorrect.

For full details of the carriage requirements and associated guidance see Regulation 19 and Annex 16 of the MCA Safety of Navigation publication.

3.3 Plotting

To estimate risk of collision with another vessel the closest point of approach (CPA) must be established. Choice of appropriate avoiding action is facilitated by the knowledge of the other vessel's track using the manual or automatic plotting methods (see 3.2 above). The accuracy of the plot, however obtained, depends upon accurate measurement of own ship's track during the plotting interval. It is important to note that an inaccurate compass heading or speed input will reduce the accuracy of true vectors when using ARPA or ATA. This is particularly important with targets on near-reciprocal courses where a slight error in own-ship's data may lead to a dangerous interpretation of the target vessel's true track. The apparent precision of digital read-outs should be treated with caution.

If two radars are fitted (mandatory for ships of 3000 GT and over) it is good practice, especially in restricted visibility or in congested waters, for one to be designated for anti-collision work, while the other is used to assist navigation. If only one of the radars is fitted with ARPA then this should be the one used for anti-collision work and the other for navigation.

3.4 Interpretation

It is essential for the operator to be aware of the radar's current performance which is best ascertained by the Performance Monitor. The echo return from a distant known target should also be checked. Be aware of the possibility that small vessels, ice floes or other floating objects such as containers may not be detected.

Echoes may be obscured by sea- or rain-clutter. Correct setting of clutter controls will help but may not completely remove this possibility. When plotting larger targets on a medium range scale, the display should be periodically switched to a shorter range, and the clutter controls adjusted, to search for less distinct targets.

The observer must be aware of the arcs of blind and shadow sectors on the display caused by masts and other on-board obstructions. These sectors must be plotted on a diagram placed near the radar display. This diagram must be updated following any changes which affect the sectors.

3.5 Choice of range scale

Although the choice of range scales for observation and plotting is dependent upon several factors such as traffic density, speed of own ship and the frequency of observation, it is not generally advisable to commence plotting on a short range scale. Advance warning of the approach of other vessels, changes in traffic density, or proximity of the coastline, should be obtained by occasional use of longer range scales. This applies particularly when approaching areas where high traffic density is likely, when information obtained from the use of longer range scales may be an important factor in determining a safe speed.

3.6 Appreciation

A single observation of the range and bearing of an echo will give no indication of the track of a vessel in relation to own ship. To estimate this, a succession of observations must be made over a known time interval. The longer the period of observation, the more accurate the result will be. This also applies to ARPA/ATA which requires adequate time to produce accurate information suitable for assessing CPA / TCPA and determining appropriate manoeuvres.

Estimation of the target's true track is only valid up to the time of the last observation and the situation must be kept constantly under review. The other vessel, which may not be keeping a radar watch or plotting, may subsequently alter its course and/or speed. This will take time to become apparent to the observer. Electronic plotting will not detect any alteration of a target's course or speed immediately and therefore should also be monitored constantly.

The compass bearing, either visual or radar should be used to assess risk of collision. The relative bearing of a target should not be used when own ship's course and/or speed alters, as risk of collision may still exist even where the relative bearing is changing. Mariners should also be aware that at close range, risk of collision may exist even with a changing compass bearing.

Radar displays may be equipped to display AIS target data. Such information may be used to assist the observer in assessing the situation and taking correct action to avoid a close-quarters situation. Watch-keepers should be aware that not all vessels transmit AIS data. In addition it is possible that not all the AIS data displayed will be accurate, particularly data which is inputted manually on the target vessel.

3.7 Clear weather practice

Radar should be used to complement visual observations in clear weather to assist assessment of whether risk of collision exists or is likely to develop. Radar provides accurate determination of range enabling appropriate action to be taken in sufficient time to avoid collision, taking into account the manoeuvring capabilities of own ship.

It is important that watch-keepers should regularly practice using radar and the electronic plotting system in clear weather. This allows radar observations and the resulting electronic vectors to be checked visually. It will show up any misinterpretation of the radar display or misleading appraisal of the situation, which could be dangerous in restricted visibility. By keeping themselves familiar with the process of systematic radar observations, and comparing the relationship between radar and electronically plotted information and the actual situation, watchkeepers will be able to deal rapidly and competently with the problems which may confront them in restricted visibility.

3.8 Operation

Radar if fitted should be operating at all times. When weather conditions indicate that visibility may deteriorate, and at night when small craft or unlit obstructions such as ice are likely to be encountered, both radars if fitted should be operating, with one dedicated to anti-collision work. This is particularly important when there is a likelihood of occasional fog banks, so that vessels can be detected before entering the fog. Radars are designed for continuous operation and frequently switching them on and off could damage components.

3.9 Parallel Index technique

Investigations into cases where vessels have run aground have often shown that, when radar was being used as an aid to navigation, inadequate monitoring of the ship's position was a contributory factor.

Parallel Index techniques provide the means of continuously monitoring a vessel's position in relation to a pre-determined passage plan, and would in some cases have helped to avoid these groundings. Parallel indexing should be practised in clear weather during straightforward passages, so that watch-keepers remain thoroughly familiar with the technique and confident in its use in more demanding situations (in confined waters, restricted visibility or at night).

The principles of parallel index plotting can be applied, using electronic index lines. A number of index lines may be pre-set and called up when required on all modes of display: electronic index lines remain at the set cross index range (CIR) enabling the operator to change range without corrupting the range of the index line. Care should be exercised when activating preset parallel index lines that the correct line(s) for the passage are being displayed.

a) Parallel indexing on a relative motion display

On a relative motion compass-stabilised radar display, the echo of a fixed object will move across the display in a direction and at a speed which is the exact reciprocal of own ship's ground track: parallel indexing uses this principle of relative motion. Reference is first made to the chart and the planned ground track. The index line is drawn parallel to the planned ground track at a perpendicular distance (cross index range or offset) equal to the planned passing distance off an appropriate fixed target. Observation of the fixed object's echo movement along the index line will indicate whether the ship is maintaining the planned track: any displacement of the echo from the index line will immediately indicate that own ship is not maintaining the desired ground track, enabling corrective action to be taken.

b) Parallel indexing on a true motion display

The use of a true motion radar presentation for parallel indexing requires an ability to ground-stabilise the display reliably. Parallel index lines are fixed relative to the trace origin (i.e. to own ship), and consequently move across the display at the same rate and in the same direction as own ship. Being drawn parallel to the planned charted track and offset at the required passing distance off the selected fixed mark, the echo of the mark will move along the index line as long as the ship remains on track. Any displacement of the fixed mark's echo from the index line will indicate that the ship is off track, enabling corrective action to be taken.

c) Integration with ECDIS

Where the radar display is integrated with an Electronic Chart Display and Information System (ECDIS) the practice of parallel indexing continues to enable the navigator to monitor the ship's position relative to the planned track and additionally provides a means of continuously monitoring the positional integrity of the ECDIS system.

d) Precautions

Some older radars may still have reflection plotters. It is important to remember that parallel index lines drawn on reflection plotters apply to one range scale only. In addition to all other precautions necessary for the safe use of radar information, particular care must therefore be taken when changing range scales.

The use of parallel indexing does not remove the requirement for position fixing at regular intervals using all appropriate methods available including visual bearings, since parallel indexing only indicates if the ship is on or off track and not its progress along the track.

When using radar for position fixing and monitoring, check:

- (i) the identity of fixed objects,
- (ii) the radar's overall performance,
- (iii) the gyro error and accuracy of the heading marker alignment,
- (iv) that parallel index lines are correctly positioned on a suitable display, and
- (v) the accuracy of the variable range marker, bearing cursor and fixed range rings.

3.10 Chart Radar

Some radars are provided with electronic chart overlays. These charts may have a limited amount of data and are not the equivalent to an Electronic Navigational Chart (ENC) used in the ECDIS or paper charts. They should not therefore be used as the primary basis for navigation.

3.11 Regular operational checks

Frequent checks of the radar performance must be made to ensure that the quality of the display has not deteriorated.

The performance of the radar should be checked using the Performance Monitor before sailing and at least every four hours whilst a radar watch is being maintained.

Misalignment of the heading marker, even if only slightly, can lead to dangerously misleading interpretation of potential collision situations, particularly in restricted visibility when targets are approaching from ahead or fine on own ship's bow. It is therefore important that checks of the heading marker should be made periodically to ensure that correct alignment is maintained. If misalignment exists it should be corrected at the earliest opportunity. The following procedures are recommended:

a) Check that the heading marker is aligned with the true compass heading of the ship.

b) Ensure that the heading marker line on the display is aligned with the fore-and-aft line of the ship. This is done by selecting a conspicuous but small object with a small and distinct echo which is clearly identifiable and lies as near as possible at the edge of the range scale in use. Measure simultaneously the relative visual bearing of this object and the relative bearing on the display. Any misalignment must be removed in accordance with the instructions in the equipment manual.

To avoid introducing serious bearing errors, adjustment of the heading marker should not be carried out:

(i) when alongside a berth by using the berth's alignment.

(ii) using bearings of targets which are close to the vessel, not distinct or have not been identified with certainty both by radar and visually.

3.12 Stabilisation modes

It is important to select the optimum stabilisation mode for the radar display. To assess risk of collision the relative motion of a target gives the clearest indication of CPA and may be monitored by observing either the direction of the target's relative trail, or the CPA predicted by the relative vector.

By default, relative motion will display relative target trails and true motion will display true target trails.

Where true target trails is selected, a sea stabilised display will indicate all targets' motion through the water. A ground stabilised display will indicate all targets' motion over the ground.

In coastal, estuarial and river waters where a significant set and drift may be experienced, a sea stabilised display will produce significant target trails from all fixed (stationary) objects possibly producing an unacceptably high level of clutter and masking. In such circumstances a ground stabilised display may reduce its effect and enable the observer to detect clearly the trails of moving targets, thus enhancing the observer's situational awareness.

It should be noted that the observed and predicted relative motion of a target is unaffected by the choice of sea or ground stabilisation, allowing the same assessment of CPA and risk of collision. If switching between sea and ground stabilisation, the observer should be aware of the time required for the radar equipment to reprocess the stabilisation input data.

3.13 Speed Input

It should be noted that in determining a target's aspect by radar; the calculation of its true track is dependent on the choice and accuracy of the own ship's course and speed input. A ground-stabilised target plot may accurately calculate the ground track of the target, but its heading may be significantly different from its track when experiencing set, drift or leeway. Similarly, a sea stabilised target plot may be inaccurate when own ship and the target, are experiencing different rates of set, drift or leeway.

3.14 Gyro failure

In cases of gyro failure when the radar's heading data is provided from a transmitting magnetic heading device (TMHD), watch-keepers should determine and apply the magnetic compass errors.

The true vector function of automatic plotting and tracking equipment should be operated with caution when the heading input is derived from a Transmitting Magnetic Compass (TMC). ARPA prediction is reliant on steady state tracking, where course and speed remain steady: In a seaway a transmitting magnetic compass may not produce a sufficiently steady heading resulting in unreliable vectors.

3.15 Warnings and alarms

Audible operational warnings and alarms may be used to indicate that a target has closed on a pre-set range, enters a user-selected guard zone or violates a preset CPA or TCPA limit.

When the ARPA is in automatic acquisition mode, these alarms should be used with caution, especially in the vicinity of small radar-inconspicuous targets. Users should familiarise themselves with the effects of error sources on the automatic tracking of targets by reference to the ARPA Operating Manual. Such alarms do not relieve the user from the duty to maintain a proper lookout by all available means.

3.16 SARTS and other Radar Transponders

Information on detection and use of Search and Rescue Transponders (SARTs) is provided in Chapter 4 of Volume 5 of the Admiralty List of Radio Signals. Watch-keepers should note that 3 GHz ("S" Band) radars will not detect SARTS or other radar transponders, such as small-craft radar enhancers, as these transmit only in the 9 GHz ("X" Band) frequency.

4. ELECTRONIC POSITIONING SYSTEMS

4.1 General

Ships are required to carry a Global Navigation Satellite System (GNSS) receiver or a terrestrial radio-navigation receiver. While both Omega and Decca have already been discontinued, LORAN C is to be retained for the time being but does not give world-wide coverage. Within its chain coverage area LORAN provides maritime users with a terrestrial system to back-up GNSS in the event of that system's failure.

4.2 LORAN C

LORAN C is based on the measurement of time difference between the reception of transmitted pulses. The ground-wave coverage is typically between 800 and 1200 miles, although the accuracy of positional information will depend upon the relative position of the transmitters. LORAN coverage is limited to North America, Europe, the Middle East, SE Asia and parts of the Pacific Rim.

When entering the coverage, or when passing close to transmitters on the coast, the receiver may have difficulty in identifying the correct ground-wave cycle to track. Under these conditions care should be taken to cross-check the positions obtained from the LORAN C receiver with positions from other position-fixing systems to ensure that it is tracking on the correct cycle.

The fixed errors of the LORAN C system are caused by variations in the velocity at which the pulses travel. Additional Secondary Factor (ASF) corrections are provided to allow for these errors which may be very significant in some areas. Some receivers automatically allow for calculated ASF values and display a corrected position.

4.3 Enhanced LORAN

In order to provide an accurate terrestrial backup to satellite systems such as GPS, a more accurate Enhanced LORAN (eLORAN) system is under development in Europe. Tests have shown that eLORAN will provide positional accuracy within the coverage area to the same level as GPS.

eLORAN is an internationally standardised positioning, navigation, and timing (PNT) service. It is the latest in the long-standing and proven series of low-frequency, Long-Range (LORAN) systems and takes full advantage of 21st century technology.

eLORAN is an independent, dissimilar, complement to GNSS and allows GNSS users to retain the safety, security and economic benefits of GNSS, even when their satellite services are disrupted.

As eLORAN uses high-powered transmitters and low-frequency signals (not microwatts and microwaves like GNSS), it is very unlikely to be disrupted or jammed by the same causes that would disrupt GNSS signals. Therefore low-cost, eLORAN receivers, even built into GNSS units, can mitigate the impact of disruptions to GNSS.

At sea, a new concept of navigation – enhanced navigation (e Navigation) – is being developed which requires an exceptionally reliable input of position, navigation and time data. The combination of GNSS and eLORAN has the potential to meet its needs.

Maritime users are strongly encouraged to use eLORAN as a navigational input system to back-up and complement the widespread use of GPS if the service is available.

4.4 Global Navigation Satellite System (GNSS)

When navigating in confined waters, navigators must bear in mind that the received position from any satellite positioning system is that of the antenna.

a) Global Positioning System (GPS)

GPS provides a global positioning capability giving 95% accuracy in the order of +/- 25 metres. Differential GPS (DGPS) is also available in many areas of the world including the UK coast. DGPS receivers apply instantaneous corrections (determined and transmitted by terrestrial monitoring stations) to raw GPS signals. Positional accuracy of better than 5 metres may be possible. DGPS was developed when the accuracy of commercial GPS receivers was deliberately degraded by a random error input referred to as “selective availability”. Although the primary need for a differential signal correction was removed when selective availability was suspended in 2000, the DGPS function now provides a facility to independently monitor the integrity of the GPS position. Details of GPS and DGPS are given in Admiralty List of Radio Signals Volume 2.

b) Global Navigation Satellite System (GLONASS)

GLONASS is operated by the Russian Federation and available to commercial users. It is similar in concept to GPS in that it is a space-based navigation system providing a continuous world-wide position fixing system. Some receivers use both GPS and GLONASS signals to compute a more precise position. The repeatable accuracy of GLONASS is similar to GPS. Details of GLONASS are given in Admiralty List of Radio Signals Volume 2.

c) GALILEO

The European GALILEO system is still under development. This is expected to provide a world-wide position fixing capability to a similar accuracy to that of GPS and GLONASS.

4.5 GNSS – related accidents

Serious accidents have occurred because of over-reliance on satellite positioning equipment. In one case a passenger vessel grounded in clear weather because the watch-keepers had relied totally upon the GPS output which had switched to dead reckoning (DR) mode because of a detached antenna lead which was not detected by the watch-keepers. Checking the position using other means, including visual observations, would have prevented the accident.

Accidents have occurred when using a track control system linked to the GNSS. In some cases positions of aids to navigation such as buoys have been inserted as waypoints and the vessels have collided with them.

4.6 Datum and Chart Accuracy

GPS positions are referenced to the World Geodetic System 1984 Datum (WGS 84). This may not be the same as the horizontal datum of the chart in use, meaning that the position when plotted may be in error. The receiver may convert the position to other datum; however these facilities should be used with caution (see 5.6). In this case the observers must ensure that they are aware of the datum of the displayed position. Where the difference in datums is known, a note on the chart provides the offset to apply to positions referenced to WGS 84 for plotting on the chart, but where this offset is not provided, the accuracy of the plotted position should be treated with caution. DGPS positions are normally referenced to WGS 84 though regional datums, corresponding to WGS 84, may be used [e.g. North American Datum 1983 (NAD 83) in the USA] and European Terrestrial Reference System 1989 (ETRS 89).

Many areas of the world have not been surveyed to modern standards hence the positional accuracy of the charted detail on the paper chart, Raster chart or ENC may not be as accurate as the GNSS receiver derived position. Mariners should allow a sensible safety margin to account for any such discrepancies.

The prudent navigator should never rely totally on GNSS navigation and should regularly cross check the ship's position using other means particularly in areas where the charts are based on old surveys. (See also notes on use of ECDIS in section 5 below.)

Mariners must read the note on satellite-derived positions on the Admiralty charts for more information. Further information can be found in the Mariner's Handbook (NP 100) and in Annual Summary of Admiralty Notices to Mariners, No19.

Volume 2 of The Admiralty List of Radio Signals published by UKHO contains full descriptions of all GNSS systems, with notes on their correct use and limitations. Also included are descriptions and examples of over-reliance on GNSS, and a full account of the problems caused by differing horizontal datums. Mariners using satellite navigation systems are strongly advised to study the information and follow the advice contained in this publication.

5. ELECTRONIC CHARTS

5.1 General

There are two basic types of electronic chart systems. Those that comply with the IMO requirements for SOLAS class vessels, known as the **Electronic Chart Display and Information System (ECDIS)**, and all other types of electronic chart systems, regarded generically as **Electronic Chart Systems (ECS).** If an ECS is carried on board, the continuous use of up-to-date paper charts remains essential for safe navigation and to fulfil carriage requirements.

To satisfy the chart carriage requirements of SOLAS Chapter V, ECDIS must use Electronic Navigational Charts ENCs. These are vector charts produced to International Hydrographic Organization standards and officially issued by or on the authority of a Government authorised Hydrographic Office or other relevant government institution. At present, ENC data is not available world-wide which limits the use of ECDIS in some areas. This situation, however, is rapidly changing and comprehensive ENC coverage of the world's major trading routes and ports is forecast to be completed before 2012.

The ENC contains all the chart information necessary for safe navigation, and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation.

ENC data must be used where it is available, but, where ENC data is not available; Raster Navigational Charts (RNC) may be used with the ECDIS in the Raster Chart Display System (RCDS) mode. However, when operating in RCDS mode, the RCDS must be used in conjunction with an appropriate folio of up-to-date paper charts.

Further guidance on the use of ECDIS with ENC or RNC data is contained in Annex 14 of the MCA SOLAS V publication and Marine Guidance Note currently MGN 285.

5.2 ENCs

The ENC is a database of individual items of digitised chart data which can be displayed as a seamless chart. ENCs of appropriate detail are provided for different navigational purposes such as coastal navigation, harbour approach and berthing. The amount of detail displayed is automatically reduced when the scale of a particular ENC is reduced, in order to lessen clutter. Individual items of data can be selected and all relevant information will be displayed (for instance, all the available information relevant to a light or navigation mark).

ENCs are therefore very much more than an electronic version of the paper chart. With vector charts the data is "layered", enabling the user to de-select certain categories of data, such as textual descriptions, which may clutter the display and may not be required at the time. It is also possible for the user to select a depth contour so providing an electronic safety contour which may automatically warn the watch-keeper when approaching shallow water. Mariners should use the facility to de-select data with extreme caution as it is possible accidentally to remove data essential for the safe navigation of the vessel.

5.3 RNCs

The Raster Chart Display System (RCDS) uses RNCs, which are exact facsimiles of official paper charts, and for which Hydrographic Offices take the same liability as for their paper products. RCDS does not have the same functionality as ECDIS. Further information on ECDIS and RCDS can be found in Annex 14 of the MCA publication “Safety of Navigation – Implementing SOLAS Chapter V 2002”. This Annex also contains the text of IMO SN Circular 207 “Differences between RCDS and ECDIS”

5.4 Compliance with latest IHO Standards

ECDIS in operation comprises hardware, software and data. It is important for the safety of navigation that the application software within the ECDIS works fully in accordance with the Performance Standards and is capable of displaying all the relevant digital information contained within the ENC.

Any ECDIS which has not been upgraded to be compliant with the latest version of the ENC Product Specification or the S-52 Presentation Library may be unable to correctly display the latest charted features. Additionally the appropriate alarms and indications may not be activated even though the features have been included in the ENC. Similarly any ECDIS which is not updated to be fully compliant with the S-63 Data Protection Standards may fail to decrypt or to properly authenticate some ENCs, leading to failure to load or install.

ECDIS that is not updated for the latest version of IHO Standards may not meet the chart carriage requirements as set out in SOLAS regulation V/19.2.1.4.

The IHO Standards that relate to ECDIS, ENC production and distribution, are listed below:

IHO ECDIS Standards	**Current Edition**
ECDIS Display and Presentation	S-52 PresLib Edition 3.4
Electronic Navigational Chart (ENC)	S-57 Edition 3.1, S-57 Edition 3.1.1 and S-57 Maintenance Document (Cumulative) Number 8
IHO Recommended ENC Validity Checks	S-58 Edition 3.0
Raster Navigational Chart (RNC)	S-61 Edition 1.0
ENC Producer Codes	S-62 Edition 2.4
ENC Data Protection	S-63 Edition 1.1
IHO Test Data Sets for ECDIS	S-64 Edition 1.0
ENC Production Guidance	S-65 Edition 1.0

A list of all the current IHO standards is maintained within the ENC/ECDIS section of the IHO website (www.iho.int) Mariners should be aware that proper ECDIS software maintenance is an important issue and adequate measures need to be in place in accordance with the International Safety Management (ISM) Code. This may be subject to verification during Port State Control inspections.

5.5 ECDIS Alarms and Indicators

ECDIS should give alarm and or indication as per following table;

• Crossing safety contour	• Alarm
• Area with special conditions	• Alarm or Indication
• Deviation from route	• Alarm
• Positioning system failure	• Alarm
• Approach to critical point	• Alarm
• Different geodetic datum	• Alarm

□ Malfunction of ECDIS	□ Alarm or Indication
□ Default safety contour	□ Indication
□ Information over scale	□ Indication
□ Large scale ENC available	□ Indication
□ Different reference system	□ Indication
□ No ENC available	□ Indication
□ Customised display	□ Indication
□ Route planning across safety contour	□ Indication
□ Route planning across specified area	□ Indication
□ Crossing a danger in route monitoring mode	□ Indication
□ System test failure	□ Indication

Alarm: An alarm or alarm system which announces by audible means, or audible and visual means, a condition requiring attention.

Indicator: Visual indication giving information about the condition of a system or equipment.

5.6 ECDIS Integration

Electronic chart systems are integrated with the GNSS, enabling the vessel's position to be continuously displayed. Caution should be used in areas when raster charts cannot be referenced to WGS84. Electronic charts may also be integrated with the radar and electronically plotted data from ARPA, ATA or EPA, with part or all of the radar display overlaid or under-laid on the chart display. There is a danger that the combined display may become over-cluttered with data. The overlay of target data on an electronic chart does not reduce the need for the targets to be observed on the radar display. Mariners should also exercise caution where target vectors based on the vessel's water-track are overlaid on an electronic chart which displays the vessel's ground track. (See also "Chart Radar" in paragraph 3.10 above.)

Electronic charts are becoming an essential part of the navigation system of a ship's bridge and contribute greatly to navigational safety. However they must be used prudently bearing in mind the existence of unapproved equipment and the absence of official vector data in some regions.

5.7 System based datum conversions

Manufacturers of GPS receivers, ECDIS and ECS often incorporate a user selectable datum transformation capability into their software. This capability enables users to deal with datum differences in a systematic and apparently automatic manner. Whilst this might appear to be a good thing, considerable caution needs to be exercised.

A potential problem is that a single systematic transformation is not always accurate for large regional datums. A GPS receiver position (WGS84) transformed to a regional datum by means of an average set of shifts may differ from the GPS receiver position (WGS84) amended to the regional datum by the shift note on an individual chart. The shifts provided on an individual chart are calculated specifically for the chart and the area that it covers and will be more accurate than a set of generalised shifts.

Interfacing issues might also emerge when connecting a GPS receiver to an ECDIS or ECS, particularly if the GPS receiver is configured to convert its position output to a local or regional datum. Care must be taken to ensure that GPS receivers are configured to provide position in the datum that is expected by the ECS or ECDIS. In the majority of cases this will be the WGS84 datum, but manufacturers instructions should always be carefully consulted to ensure correct system operation.

6. CONCLUSION

The accuracy and functionality of electronic aids to navigation has increased considerably in recent years. However there is still a danger that over-reliance on the output from a single item of equipment may lead to an accident. The need to cross-check the vessel's position using other means is as important today as it ever was, as is the basic requirement under Rule 5 of the International Regulations for Preventing Collisions at Sea, 1972 as amended, known as COLREGS to maintain a proper lookout. Accidents have occurred with ships equipped with the best of equipment where watch-keepers have been over-reliant on the equipment output, and disaster could have been averted by the simple expedient of maintaining a proper lookout.

Further information on electronic chart systems and charts is available in 'Facts about electronic charts and carriage requirements', available for download from UKHO website (www.ukho.gov.uk).

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