RESOLUTION A.483(XII)

Revoked by A.921(22)

Adopted on 19 November 1981
Agenda item 10(b)

TRAINING IN RADAR OBSERVATION AND PLOTTING

THE ASSEMBLY,

RECALLING Article 16(i) of the Convention on the Inter-Governmental Maritime Consultative Organization,

NOTING the minimum knowledge requirements for the operation and use of radar prescribed by Chapter II of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, for the certification of masters, chief mates and officers in charge of navigational watch,

NOTING ALSO resolution 18 of the International Conference on Training and Certification of Seafarers, 1978, which recommends that radar simulator training be given to all masters and deck officers,

RECOGNIZING that collisions have frequently been caused by improper use of radar,

RECOGNIZING FURTHER that practical experience alone without adequate training may lead to improper use of radar,

HAVING ADOPTED resolution A.482(XII) on training in the use of automatic radar plotting aids (ARPA), which, ***inter alia,*** recommends Member Governments to ensure that ARPA training should be preceded by training in radar observation and plotting to the standards recommended by IMCO,

CONSIDERING that it is essential that all masters, chief mates and officers in charge of a navigational watch on ships fitted with radar should have received adequate training and be capable of undertaking manual plotting for anti-collision purposes, whether or not the ship is fitted with ARPA,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its forty-fourth session,

1. ADOPTS the Recommended Training Programme in Radar Operation and Plotting annexed hereto;

2. RECOMMENDS that Member Governments:

   (a) Ensure, when developing training programmes for courses in radar observation and plotting, that such programmes conform to standards not inferior to those specified in the Annex to this resolution and are complementary to the Recommended Training Programme in the Operational Use of Automatic Radar Plotting Aids (ARPA) adopted by resolution A.482(XII);

   (b) Require that the radar installation is under the control of a properly trained radar observer when radar watch is being kept at sea;

(c) Encourage masters, chief mates and officers in charge of a navigational watch to gain experience and maintain ability in radar observation and radar plotting by practice at sea when it is safe to do so and when radar observations can be checked visually and misinterpretation of the radar display or false appreciation of the situation would not be potentially dangerous.

ANNEX

RECOMMENDED TRAINING PROGRAMME IN RADAR OBSERVATION AND PLOTTING

1 GENERAL

1.1 The following training programme should be undertaken to fulfil the minimum training requirements of paragraph 4 of the Appendix to Regulation II/2 and paragraph 3 of the Appendix to Regulation II/4 of the 1978 STCW Convention. In order to achieve the practical aims of this programme, demonstrations of and practice in radar observation should be undertaken where appropriate on live marine radar equipment, including the use of simulators or other effective means approved by the Administration. Plotting exercises should preferably be undertaken in real-time in order to increase the student's awareness of the hazards of the improper use of radar data and improve his plotting techniques to achieve a standard of radar plotting commensurate to that necessary for the safe execution of collision avoidance manoeuvring under actual sea-going conditions.

2 THEORY

2.1 Factors affecting performance and accuracy

2.1.1 Elementary understanding of the principles of radar; range and bearing measurement. Characteristics of the radar set which determine the quality of the radar display; the radar antenna; polar diagrams; the effects of power radiated in directions outside the main beam; non-technical description of the radar system including variations in the features encountered in different types of radar set. Performance monitors. Equipment factors which affect maximum and minimum detection ranges and accuracy of information.

2.1.2 Marine radar performance specification (Assembly resolution A.222(VII)).

2.1.3 Effects of the siting of the radar antenna, shadow sectors and arcs of reduced sensitivity, false echoes, effects of antenna height on detection ranges, etc. Siting radar units and storing spares near magnetic compasses; magnetic safe distances.

2.1.4 Radiation hazards. Safety precautions to be taken in the vicinity of antenna and open waveguides.

2.2 Detection of misrepresentation of information including false echoes and sea returns

2.2.1 A knowledge of the limitations to target detection is essential to enable the observer to estimate the dangers of failure to detect targets. The following factors should be emphasized:

.1 performance standard of the equipment;

.2 brilliance, gain and video processor control settings;

.3 radar horizon;

.4 size, shape, aspect and composition of targets;

.5 effects of the motion of the ship in a sea-way;

.6 propagation conditions;

.7 meteorological conditions; sea clutter and rain clutter;

.8 anti-clutter control settings;

.9 shadow sectors;

.10 radar-to-radar interference.

2.2.2 Factors which might lead to faulty interpretation: false echoes, effects of nearby pylons and large structures, effects of power lines crossing rivers and estuaries, echoes from distant targets occurring on second or later traces.

2.2.3 Aids to interpretation: corner reflectors, radar beacons. Detection and recognition of land targets; the effects of topographical features; effects of pulse length and beamwidth. Radar conspicuous and inconspicuous targets; factors which affect the echo strength from targets.

3 PRACTICE

3.1 Setting up and maintaining displays

3.1.1 The various types of radar display mode; unstabilized ship's-head-up relative motion, ship's-head up and north-up stabilized relative motion, true motion.

3.1.2 The effects of errors on the accuracy of information displayed; effects of transmitting compass errors on stabilized and true motion displays, effects of transmitting log errors on a true motion display, effects of inaccurate speed settings on a true motion display.

3.1.3 Methods of detecting inaccurate speed settings on true motion controls. Effects of receiver noise limiting ability to display weak echo returns, effects of saturation by receiver noise, etc. Adjustments of operational controls; criteria which indicate optimum points of adjustment, importance of proper sequence, etc. Effects of maladjusted controls, detection of maladjustments and correction of:

.1 controls affecting detection ranges;

.2 controls affecting accuracy.

3.1.4 Dangers of using radar equipment with maladjusted controls.

3.1.5 Need for frequent regular checking of performance, relationship of performance indicator to range performance of the radar set.

3.2 Range and bearing

3.2.1 Methods of measuring ranges; fixed range markers, variable range marker. Accuracy of each method and the relative accuracy of the different methods. How range data are displayed; ranges at stated intervals, digital counter, graduated scale, etc. Methods of measuring bearings; rotatable cursor on transparent disc covering the display, electronic bearing cursor and other methods. Bearing accuracy. Inaccuracies due to: parallax, heading marker displacement, centre maladjustment; how bearing data are displayed; graduated scale, digital counter, etc.

3.2.2 Need for regular checking of the accuracy of ranges and bearing, methods of checking for inaccuracies and correcting or allowing for inaccuracies.

4 PLOTTING TECHNIQUES AND RELATIVE MOTION CONCEPTS

4.1 Practice in manual plotting techniques including the use of reflection plotters should have the objective of establishing a thorough understanding of the interrelated motion between own ship and other ships, including the effects of manoeuvring to avoid collision. At the preliminary stages of this training, simple plotting exercises should be designed to establish a sound appreciation of plotting geometry and relative motion concepts. The degree of complexity of exercises should increase throughout the training course until the trainee has mastered all aspects of the subject. Competence can best be enhanced by exposing the trainee to real-time exercises performed on a simulator or using other effective means.

4.2 Identification of critical echoes

4.2.1 Position fixing by radar from land targets and sea marks.

4.2.2 Accuracy of position fixing by ranges and by bearings.

4.2.3 Importance of cross checking accuracy of radar against other navigational aids.

4.2.4 The value of recording ranges and bearings at frequent, regular intervals when using radar as an aid to collision avoidance.

4.3 Course and speed of other ships

4.3.1 Different methods by which course and speed of other ships can be obtained from recorded ranges and bearings;

.1 unstabilized relative plot;

.2 stabilized relative plot; and

.3 true plot.

4.3.2 Relationship between visual and radar observations; detail, accuracy of estimates of course and speed of other ships. Detection of changes in movements of other ships.

4.4 Time and distance of closest approach of crossing, meeting or overtaking ships

4.4.1 Use of recorded data to obtain:

.1 measurement of closest approach distance and bearing;

.2 time to closest approach.

4.4.2 The importance of frequent, regular observations.

4.5 Detecting course and speed changes of other ships

4.5.1 Effects of changes of course or speed by other ships on their tracks across the display.

4.5.2 Delay between change of course or speed and detection of that change.

4.5.3 Hazards of small changes as compared with substantial changes of course or speed in relation to rate and accuracy of detection.

4.6 Effects of changes in own ship's course and speed or both

4.6.1 On a relative motion display; effects of own ship's movements, effects of other ships' movements; advantages of compass stabilization of a relative display.

4.6.2 On a true motion display.

4.6.3 Effects of inaccuracies; of speed and course settings on a true motion display, of compass stabilization data driving a stabilized relative motion display.

4.6.4 Effects of changes in course or speed by own ship on tracks of other ships on the display.

4.6.5 Relationship of speed to frequency of observations.

5 APPLICATION OF THE INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA

5.1 Relationship of the Regulations for Preventing Collisions at Sea to the use of radar.

5.2 Action to avoid collision; dangers of assumptions made on inadequate information and the hazards of small alterations of course or speed. The advantages of safe speed when using radar to avoid collision. The relationship of speed to closest approach distance and time and to the manoeuvring characteristics of various types of ships.

5.3 The importance of radar observation reports being well defined; radar reporting procedures.

5.4 Use of radar in clear weather, to obtain an appreciation of its capabilities and limitations, compare radar and visual observations and obtain an assessment of the relative accuracy of information.

5.5 The need for early use of radar in clear weather at night and when there are indications that visibility may deteriorate. Comparison of features displayed by radar with charted features. Comparison of the effects of differences between range scales.