



Purpose:

The e-learning module is designed for theoretical training of navigators at operational level in accordance with Chapter II of the STCW Convention in the part concerning of basic concepts of navigation.

What is an e-learning module?

E-learning module is the electronic textbook on one or more sections. Theoretical materials can be accompanied by drawings, diagrams, photos, animations and videos. There is a test for assessment of knowledge gained at the end of each section.

Contents:

- **Navigation and its role and place in ship's operation:**
 - The purpose and objectives of the discipline.
 - Place of navigation among other sciences of ship's operation.

- **Basic concepts of navigation and sailing directions:**
 - Shape and models of the Earth.
 - Geographic coordinates: latitude, longitude.
 - Difference in latitude (D'LAT) and difference in longitude (D'LONG).
 - Sea direction counting systems. Use of gyrocompasses.
 - Terminology of nautical units of length and speed. Using lags.
 - Range of visibility of landmarks and lights.

Target groups

Deck - Operational

Ship types

Generic



Regulations

Table A-II/1 STCW Code

Competence:

Plan and conduct a passage and determine position



BASIC CONCEPTS OF NAVIGATION AND SAILING DIRECTIONS
Version: 1.0/2022

Section 2. Basic concepts of navigation and sailing directions: 2.1 Shape and models of the Earth

I stage. We will conditionally call 'MATTER'

In the first approximation, an aploid could be taken as the Earth's surface - a pear-shaped body in which the area of the North Pole is somewhat elevated, and the South Pole is depressed. But the aploid cannot be described mathematically rigorously, and therefore it is not used in geodesy.

Therefore, the first material approximation is the geoid (translated from Greek - Earth-like). This is an imaginary terrestrial body formed by a level surface covered with the waters of the oceans (at each point the Earth's surface is perpendicular to the gravity vector), there are no mountains, the bulges and depressions of the surface are somewhat smoothed. However, this material body continues to have a complex configuration, due to the uneven distribution of masses in the Earth's thickness, and as a result, the unevenness of the gravity vector, which does not always coincide with the normal to the Earth's surface. It is not possible to describe this surface mathematically, which, in turn, does not allow its mapping.

Figure 1

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BASIC CONCEPTS OF NAVIGATION AND SAILING DIRECTIONS
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Section 2. Basic concepts of navigation and sailing directions: 2.2 Geographic coordinates: latitude, longitude

2.2 Geographic coordinates: latitude, longitude

To determine the position of a point on the surface of the earth's ellipsoid (the Earth's sphere), some accepted coordinate system is required.

Several systems are used in navigation:

- local;
- polar;
- geodetic;
- astronomical;
- quasi-geographical.

The most widely used geographic.

Figure 3

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Section 2. Basic concepts of navigation and sailing directions: 2.4 The system of counting directions at sea

The azimuth circle of a magnetic compass, radio direction finders and some other technical means of navigation have heading angle scales calibrated in a circular count. Heading angles measured in a circular account are called opposite relative bearing (ORB).

If ORB is less than 180°, then it is equal to starboard RB. If the ORB is greater than 180°, then to obtain the port RB, it is necessary to subtract the ORB from 360°

$RB(p) = 360^\circ - ORB (12)$

The solution of this type of problem should be accompanied by a graphic illustration, which will significantly reduce the probability of a mistake in the solution.

Figure 13

Figure 14

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Section 2. Basic concepts of navigation and sailing directions: 2.6 Visibility of landmarks and lights

Then the geographical visibility of the landmark (object) Do is equal to the sum of De and Dh:

$Do = De + Dh (53)$

Substituting into expression (53) the values from formulas (51) and (52), we obtain the calculation formula for the geographic range of visibility of the landmark (object) Do:

$Do(\text{miles}) = 2.09(\sqrt{e} (m) + \sqrt{h} (m)) (54)$

According to formula (54), a table of the geographical visibility range of the Navigational Tables (MT-2000) object was calculated (Table 2.3).

Figure 24

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Section 2. Basic concepts of navigation and sailing directions: 2.3 Difference in latitude (D'LAT) and difference in longitude (D'LONG)

Calculating of graphic tasks (on the sphere).

Example 3

Given: $\varphi_1 = 35^\circ N$; $\varphi_2 = 40^\circ S$

Determine: D'LAT = ?

Solution: $D'LAT = \varphi_2 - \varphi_1 = |40^\circ - 35^\circ| = 5^\circ$ to S Answer: D'LAT = 5° to S.

Example 4

Given: $\varphi_1 = 30^\circ S$; $\varphi_2 = 40^\circ N$

Determine: D'LAT = ?

Solution: $D'LAT = \varphi_2 - \varphi_1 = 40^\circ - (-30^\circ) = 70^\circ$ to N Answer: D'LAT = 70° to N.

Figure 8

Figure 9

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Section 2. Basic concepts of navigation and sailing directions: 2.4 The system of counting directions at sea

3. Transfer from a semi-circular system to a circular one.

Schemes of the transition from a semi-circular system to a circular system and back are shown in fig. 15.

Example 3:

Translate:

a) from a semicircular account to a circular one N 130°E and S 50°E;

b) from a circular count to a semicircular 320°

Solution:

a) N 130°E = S 50°E = 130°;

b) 320° = N 40°W = S 140°W.

Figure 15

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