

NS-12

INTRODUCTION TO NAVIGATION

DEFINITION:

1. Navigation – the art or science of determining the ship's or aircraft and/or directing the movement of a ship or aircraft from one position to another. The problem of Navigation are those of Position, Direction and Distance.
2. Branches of Navigation:
 - A. Deck Reckoning – a method of navigation by which the position of the ship is calculated from the direction and rate of progress through the water from the latest well determined position.
 - B. Piloting – a near shore navigation method by which the movements of a ship are directed by reference to landmarks, navigational aids or soundings.
 - C. Electronic Nav – a method of navigation which employs the use of various electronic devices. Differs from piloting primarily in the manner of collecting information.
 - D. Celestial Nav – the position of a ship is determined by the observation of celestial bodies such as Sun, Moon, Planets and Stars.
3. Earth – the planet with which we are most familiar. Although it is approximately an oblate spheroid for the navigational purposes, we assumed it to be a true sphere,

DIAMETER OF THE EARTH:

- A. Polar diameter – 6,864.57 Nautical Miles
 - B. Equatorial Diameter – 6,887.91 Nautical Miles
- *Difference of 23.34 Nautical Miles
4. Axis – the diameter about which the earth rotates. The North end is the north pole while south end is the south pole.
 5. Great circle – a circle on the surface of the earth, the plane of which passes through the center of the earth.
 6. Small circle – a circle on the surface of the earth, the plane of which *does not* passes through the center of the earth.
 7. Equator – the great circle which is equidistant to the pole. The plane is perpendicular to the surface of the earth axis.

8. Meridians – great circles on the surface of the earth that passes through the poles
9. Prime Meridians – meridians used as the origin of measurement of longitude – in Greenwich England.
10. Latitude – the angular distance between the position and the equator measured northward or southward from the equator along a meridian and labeled as appropriate N or S.
11. Longitude - the angular distance between the position of the prime meridian measured either Eastward or Westward from the prime meridian along the arc of the equator to the meridian of the position in degrees from 0 deg to 180 deg and labeled E or W.
12. Directions – angular inclination of that line to the meridian right or counter clockwise from the north point of the meridian and expressed in three digits.
13. Course – as applied to marine navigation is the intended direction of travel of a ship through the water.
14. Heading – the direction of the ship points or head at a given time.
15. Bearing – the direction of terrestrial object from the observer, azimuth as applied to celestial bodies.
16. Distance – the length of a line joining two places on the surface of the earth and expressed in nautical miles. The shortest distance between two points on the surface of the earth is along the great circle joining them.
17. Speed – the velocity of travel and is expressed in knots. One (1) knot = 1 nautical mile/hr.

Note: One nautical mile equals to 6,080.2 feet one minute of arc of a great circle and also for navigation purposes equals to 2,000 yards.

DEFINITION OF TERMS:

1. Direction Measuring Instruments
 - a. Compass – instrument that indicates direction
 - b. Magnetic Compass – depends on earth's magnetic field for its directive force
 - c. Gyro Compass – depends on the tendency of the pedolus gyroscope to seek to align its axis with that of the earth
 - d. Gyro Compass Repeaters – located at various parts throughout the ship to indicate the master gyro heading

- e. Bearing Circles – a non-magnetic ring to fit snugly over the compass bowl about which it can be turned to any desired direction
 - f. Azimuth Circles – similar to the bearing circle with special attachment for observing the sun; used in determining the bearing of celestial objects
 - g. Pelorous (Dumb Compass) – consist of a compass stand, compass bowl and compass card; used in determining bearings
 - h. Alidade – an azimuth circle having a telescopic sight mounted over it
2. Speed Measuring Instruments
- a. Traffrail Log
 - b. Pito-static Log
 - c. Engine revolution Counter
3. Short Range Measuring Device
- Stadimeter used to find range of objects of known height of objects on known distance.
4. Depth Measuring Device
- a. Head Lead – lead weight attach to a marked line from 7 to 14 lbs
 - b. Deep Sea Land – from 30 to 100 lbs
 - c. Sounding Machine – works under pressure
 - d. Echo Sounder (FATHOMETER) - works under speed of sound
5. Electronic Instruments
- a. Radio Receiver – receives signals and weather information
 - b. Radio Direction Finder (RDF) – receiver and a loop antenna which has directional properties
 - c. Radio Detection and Ranging (RADAR) – used for obtaining bearings and rages of objects in all conditions of visibility
 - d. Long Range Navigation (LORAN) – measures the difference in the time of reception of two synchronized signals which is used to determine hyperbolic line of position
 - e. Sonic Ranging (SONAR) – it uses speed of sound under water; it gives bearing and distance of objects underwater
6. Celestial Navigation Instruments

- a. Sextant – measures angular heights of celestial bodies measuring angles between two visible objects
- b. Star Finder-(HO-2102-D) – provides the navigator with the position of the celestial body relative to the position of the observer
- c. Chronometer – accurate clock of superior construction for maintaining accurate time aboardship
- d. Ship's Clock – ordinary clocks set to keep standard or zone time
- e. Comparing Watch – used for timing celestial observation
- f. Stopwatch – useful in piloting for identification of lights and in celestial observation

7. Piloting Instruments

- a. Pencils – soft lead with eraser
- b. Parallel Ruler – for drawing straight lines and plotting directions
- c. Drafting Machine – measuring machines
- d. Protractor – for measuring angles
- e. Triangles – for transferring lines from compass rose to any place on the chart or vice versa
- f. Navigator Case – contains drawing compass dividers and screw drivers

8. Weather Instruments

- a. Barometer – measures atmospheric pressure (mercury and aneroid)
- b. Thermometer – determine temperature
- c. Psychrometer – measures relative humidity (wet or dry)
- d. Anemometer – measures wind direction and speed

9. Miscellaneous Instruments

- a. Binoculars – provides for early sighting of object and identification of navigational aids
- b. Flashlight – useful during twilight for reading the watch and sextant

- A. Chart – pictorial presentation of the earth's surface or part of it with provision for determining position, distance and direction and information of interest to the navigator. This shows usually coastal areas and give a great deal of hydrographic information which is useful to the navigator.
- B. Map – for most part shows land areas, their political subdivision and topography
- C. Chart Projection – methods of presenting the curved surface of the earth on a flat surface

KINDS OF CHART PROJECTIONS

- a. Mercator Projections
- b. Gnomonic Projections
- c. Lambert Conformal Projections
- d. Polytomic Projections

CHART CLASSIFICATION AND THEIR CORRESPONDING SCALES

- a. Sailing Charts - - - 1:600,000 - - - and smaller
- b. General Charts - - - 1:000,000 - - - to 1:600,000
- c. Coast Charts - - - 1:50,000 - - - 1:000,000
- e. Harbor Charts - - - Scales larger than 1:50,000

D. Chart Numbering

Charts are stowed aboardship by portfolio and are arranged in each portfolio in accordance with the consecutive numbers. Numbers consist of a letter and portfolio number followed by 2 digits number which indicates chart position within the portfolio.

Letter A – for General Chart

Letter B – for Supplementary Charts

Letter W – General Charts, gives information for the entire World

Examples:

A1310 – The consecutive number of the 10th chart in the portfolio 13th in the general in nature.

B1212 – The consecutive number of the 12th chart in the Portfolio 12th in the supplementary in nature.

E. Guides for probable Accuracy of Charts

- a. Reconcy of the surveying agency
- b. Completeness of soundings
- c. Printing
- d. Scale

F. Chart Symbols

- a. Fathom lines – system of lines that indicates extent of fairway and restricted waters
- b.