Sailing for Dummies

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"To succeed in life, you need two things: ignorance and confidence."

-Mark Twain

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Introduction

As a rule books are written by experts, but this book is an exception. Both authors took only one sailing course, ASA A+ Cat. One distiguished himself by doing so with very limited English, the other one managed to fail one of the tests (the grades for the other tests he passed sucsessfully have not been great either).

The above qualifications combined with the desire to complete the course produced the book built on the authors' own experience, and the exiting modern tecnological wonder-internet. The book attempts to cover the material of ASA A+ Cat based on [3], [4], [5], and [6]. Unlike these publications the book is designed as a reference tool rather than a reading text. It focuses on explanations, pictures, terms' index, and references to the subject related literature, both printed, and available on line.

In addition, the book is a "living organism"-we plan to update and modify it from time to time. The reader is invited to participate in this process. You are welcome to provide your comment, suggestions, and offers of additional material to be covered. All this can be done at `http://www.what-in.store/SailForAll/index.htm`.

A streightworard reading of this work is boring, and hardly possible at all. Hence the book is available on line for free. To entertain the reader we provide companion on line tests. This material is available for a fee. We hope a combination of the book and the tests will engage the reader and facilitate mastering of the material.

Chapter 1

Navigation

1.1 Longitude and Latitude

We shall consider the surface of the Earth as a sphere with circumference of 40,075.017 km or 24,901.461 mi. Exactly as a plane it is a two dimensional object, and location of a point on a sphere can be described by two numbers, longitude and latitude. To explain how these numbers are defined we start with some geometry.

If a sphere is cut by a plane the result is a circle (Figure 1.1). We select a line passing

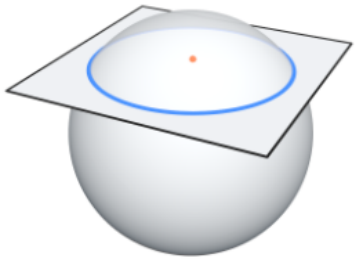

Figure 1.1: Sphere–plane intersection

through the Geographic North and South poles–the Earth's axis (Figure 1.2) and intersect the shere by planes perpendicular to this line. The size of the intersections depend on the planes' distance from the poles (Figure 1.3, left). The largest circle is obtained when the plane is equidistant from the poles. This circle is called equator (Figure 1.3, right).

Definition 1.1.1 *Equator is a circle around Earth that is everywhere equidistant from*

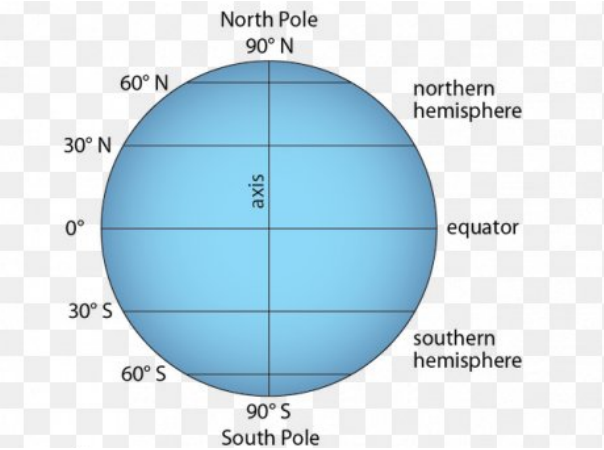

Figure 1.2: Poles

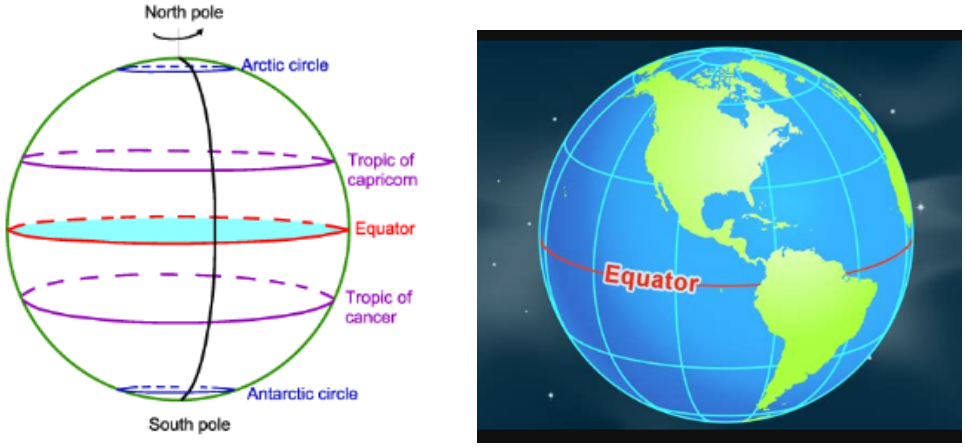

Figure 1.3: Equator

the geographic poles and lies in a plane perpendicular to Earth's axis.

One can also intersect the sphere with a plane that passes through the Earth's axis. This can be done in many ways, and any such intersection is called a meridian. A particular intersection that passes through Greenwich, a borough of London, is called the prime meridian (Figure 1.4).

Definition 1.1.2 *Meridian is a north–south line on the Earth's surface that connects both geographic poles. The prime meridian divides Earth into the Western and Eastern hemispheres. It is also known as the Greenwich Meridian because it passes through Greenwich, a borough of London*

Next we show how location of a point on a sphere can be described by two numbers–

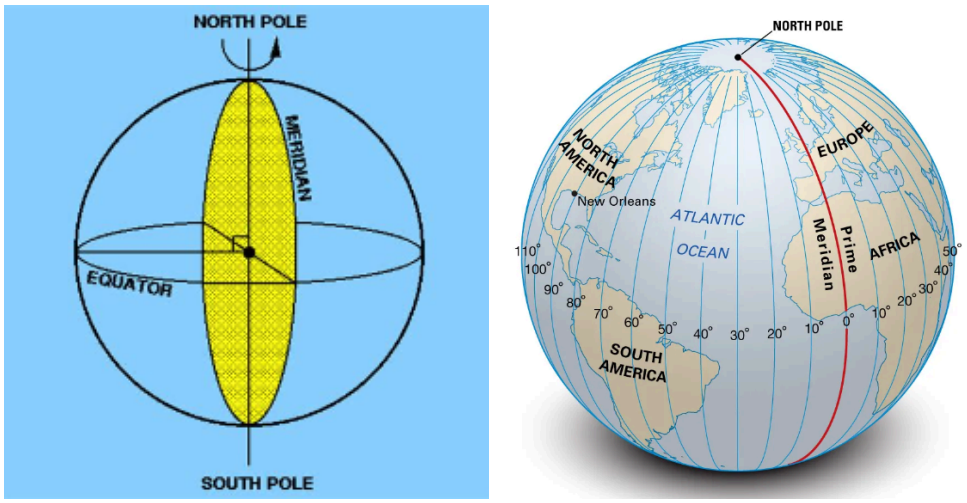

Figure 1.4: Meridian (left) and Prime Meridian (right)

latitude and longitude. Exactly as in the case of a two dimensional plane we need the "origin", and two "axes". In case of the Earth the "origin" is the intersection of the Prime Meridian and the Equator (**O**), and the "axes" are the Prime Meridian and the Equator.

As an example we select New Orleans (Figure 1.5). Consider three points: New Orleans on the map (**A**), the Earth center (**B**), and intersection of the meridian crossing New Orleans and the Equator (**C**). The angle $\angle\mathbf{ABC} = 30^o$ is the latitude of New Orleans. The angle $\angle\mathbf{CBO} = 90^o$ is the longitude of New Orleans.

Definition 1.1.3 *Longitude is the distance measured in degrees between a point on the Equator and intersection of the Equator and the Prime Meridian.*

Definition 1.1.4 *Latitude-the angular distance north or south of the earth's equator, measured in degrees along a meridian.*

Definition 1.1.5 *Nautical mile is a unit of length equals the meridian arc length corresponding to one minute (1/60 of a degree) of latitude at the equator. One nautical mile is defined as 1,151* $\left(\text{almost } \dfrac{24901.461}{360 \times 60}\right)$ *mi or 1,852 metres.*

The problems below illustrate the difference between "plane" and "spherical" navigations.

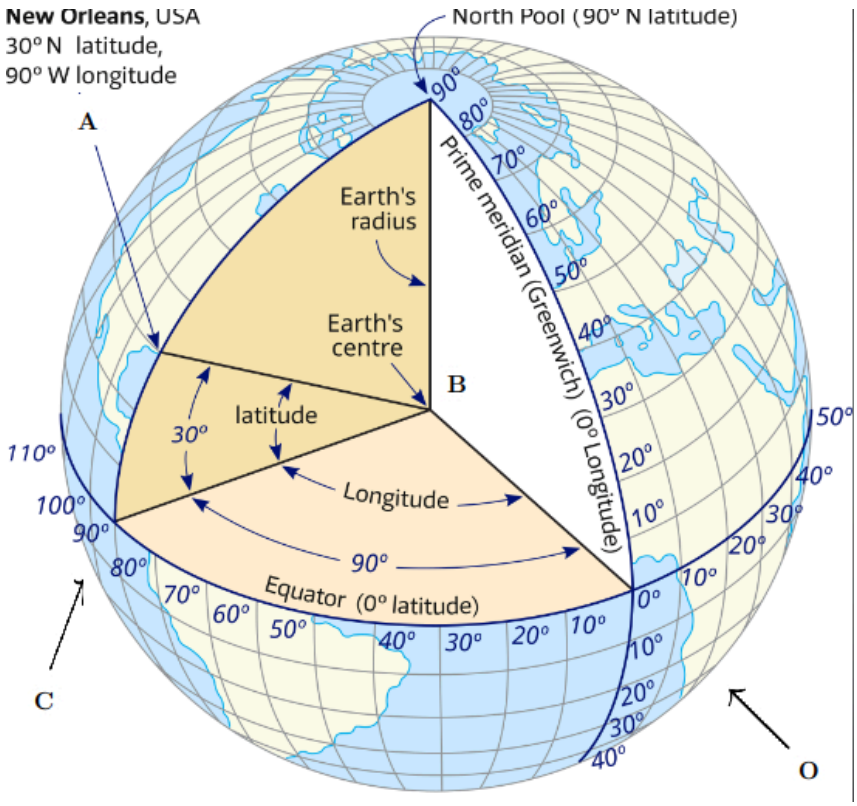

Figure 1.5: Latitude and Longitude

Problem 1.1.1 *A hunter starts walking south, and after a 10 miles walk turns west. After walking 10 miles west he turns north, and walking 10 miles. This brings him back to the point he started to walk from. Identify the start point of the walk.*

The next challenge is to provide a complete solution to Problem 1.1.1. Namely,

Problem 1.1.2 *Identify all points on the Earth surface possessing the feature described in Problem 1.1.1.*

For solutions and additional cute problems we refer an interested reader to [1].

1.2 Whistle Blasts

Some sound signals for boats under 12 meters (39 feet and 4 inches) in length are listed below:

1. One short whistle blast-I intend to leave you on my port side.
2. Two short whistle blasts-I intend to leave you on my starboard side.
3. Three short whistle blasts-I am operating astern propulsion.
4. One long blast-used by power-driven vessels during times of limited visibility. Used at intervals of not more than two minutesand.
5. One prolonged blast plus two short blasts-used at intervals of not more than two minutes during times of limited visibility.
6. Five short whistle blasts-danger, I am unsure of your intentions.

The vessel to which the signal is directed must response. The same response indicates the agreement with the signaling vessel, disagreement is indicated by the five short whistle blasts.

1.3 Navigation Lights

Between sunset and sunrise, and in times of reduced visibility all vessels under way, except sailboats under 23 feet (7 meters), must display lights listed below.

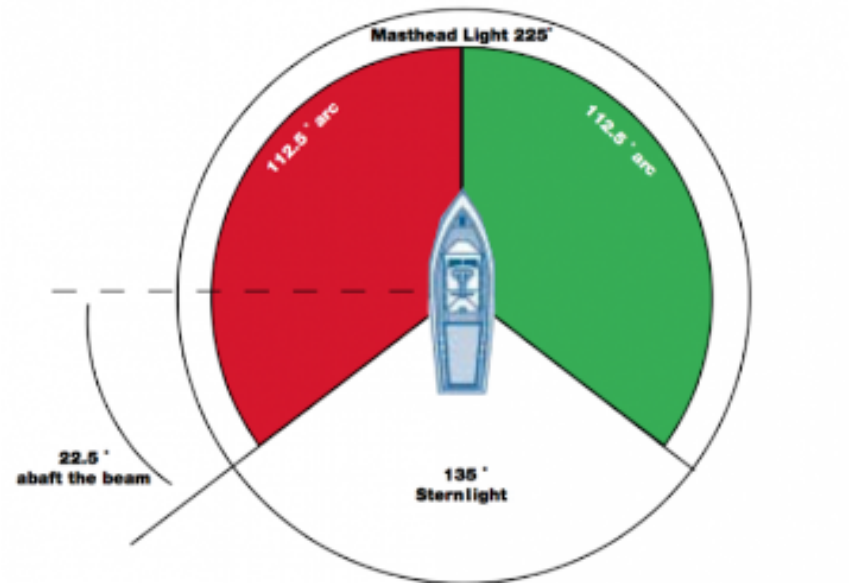

Figure 1.6: Red and Green lights

1. A red light (sidelight) to be displaied on the port side. The arc of visibility is 112.5 degrees from bow to 22.5 degrees abaft the beam.

2. A green light (sidelight) to be displaied on the starboard side. The arc of visibility is 112.5 degrees from bow to 22.5 degrees abaft the beam.

3. A white stern light with the arc of visibility 135 degrees, 22.5 degrees abaft the beam on the starboard side, and also 22.5 degrees abaft the beam on the port side (see Figure 1.7).

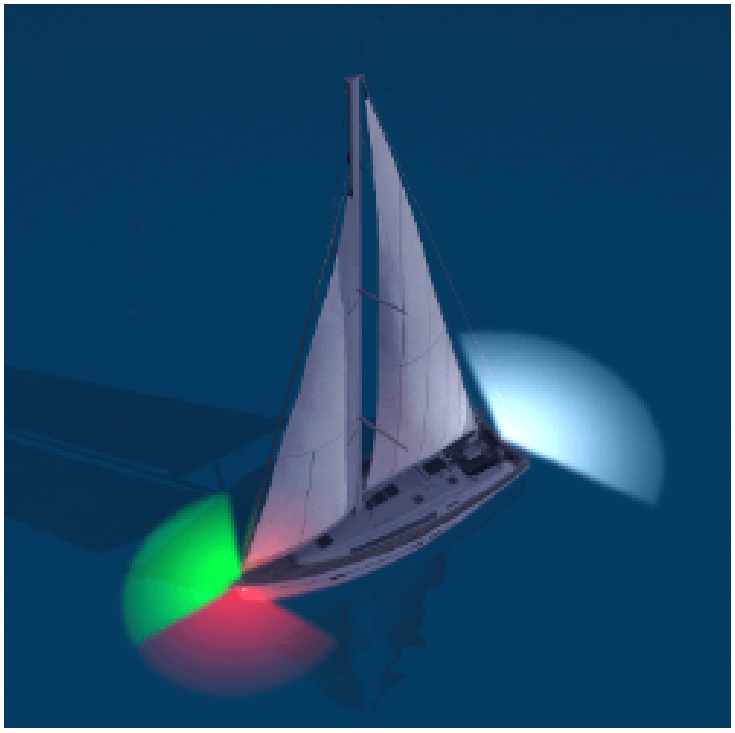

Figure 1.7: sidelights and stern light

4. power driven vessel must display a white masthead light with the arc of visibility as the red and green sidelights combine (see Figure 1.8).

All vessels at anchor are required to display an all round white light where it can be best be seen.

1.4 Mooring and Anchoring

1. Anchoring-to hold in place in the water by an anchor.

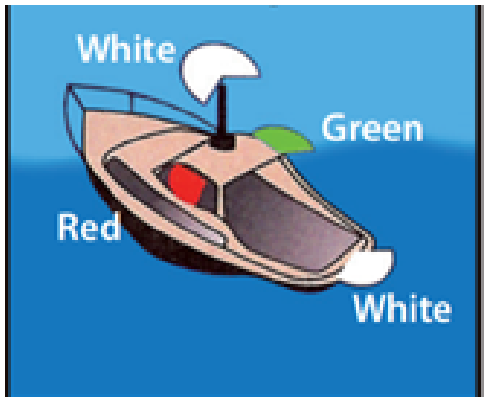

Figure 1.8: masthead light

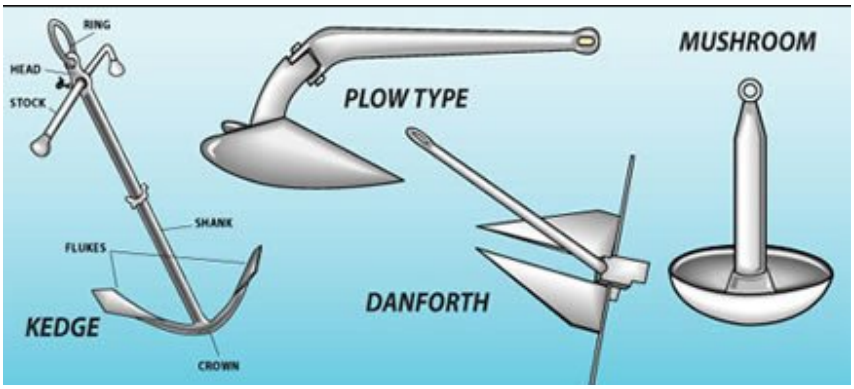

Figure 1.9: Several types of anchors

2. Dragging anchor-a vessel is moving over the ground when its anchor is not holding (see e.g. [2]).

3. Kedge-a small anchor.

4. Mooring-an act of making fast a boat with lines or anchors.

5. Propwalk-the tendency of a propeller to push a boat's stern sideways.

   - A right-handed propeller on reverse walks pushes the stern to port.
   - A left-handed propeller on reverse walks pushes the stern to starboard.

   For additional details see e.g. [7].

6. Slip (a boat slip)-a single parking space for a boat.

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