2.3 The Traditional Way to Represent the Hull Form

A ship's hull is a very complicated 3D shape. With few exceptions, an equation cannot be written that fully describes the shape of a ship. Therefore, engineers have placed great emphasis on the graphical description of hull forms. Until very recently, most of this work was done by hand. Today high-speed digital computers assist the engineer with the drawings, but they are not substitutes for imagination and sound judgment.

Traditionally, the ship's hull form is represented graphically by a lines drawing. The lines drawings consist of the intersection of the hull with a series of planes. The planes are equally spaced in each of the three dimensions. Planes in one dimension will be perpendicular to planes in the other two dimensions. We say that the sets of planes are mutually perpendicular or orthogonal planes.

The points of intersection of these planes with the hull results in a series of lines that are projected onto a single plane located on the front, top, or side of the ship. This results in three separate projections, or views, called the Body Plan, the Half-Breadth Plan, and the Sheer plan, respectively. Figure 2.2 displays the creation of these views.

Representing a 3D shape with three orthogonal plane views is a common practice in all aspects of engineering. The engineer must be able to communicate an idea graphically so that it can be fabricated by a machinist or technician. In engineering terms, this type of mechanical drawing is referred to as an “orthographic plate” because it contains three orthogonal graphic pictures of the object. Orthographic projections are used in all engineering fields.

To visualize how a “lines drawing” works, place the ship in an imaginary rectangular box whose sides just touch the keel and sides of the ship. A viewed from the front, slice the box like a loaf of bread, and then trace each slice onto the front imaginary wall. Repeat slicing and tracing from the bottom and side, as the basis for three orthogonal projection screens. The lines to be projected result from the intersection of the hull with planes that are parallel to each of the three orthogonal planes mentioned. Refer to Figure 2.2.

To draw a ship’s hull, first a convenient axis and reference system must be understood. Using the three conventional plans, each plan will show a grid and curves. A grid on one plan may represent a curve on another plan for the same hull, and vice versa. Measurements to port or starboard are measured from a centerline (℄) out to a buttock line. To measure the vertical location, distance from a baseline (B℄) at the ship’s keel is determined. Each vertical spacing above this baseline is called a waterline (WL). To measure longitudinal distance, a forward perpendicular (FP), aft perpendicular (AP), and midships (⊠) are convenient reference planes. Stations or section lines are measured aft of the FP. These reference planes will be explained further and used in developing the three orthogonal lines plans

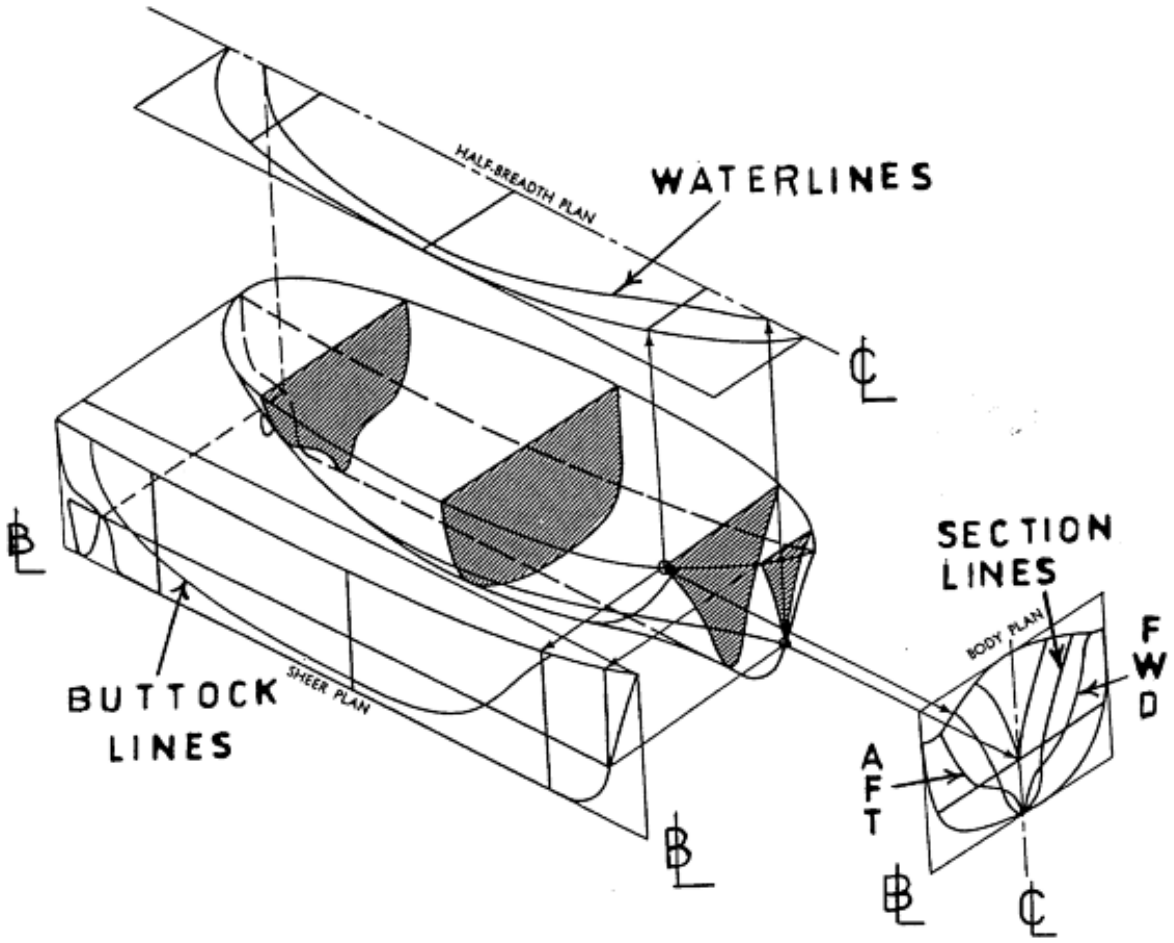

Figure 2.2 The Projection of Lines onto Three Orthogonal Planes

Planes parallel to the front and back of the imaginary box are called stations. A ship is typically divided into 11, 21, 31, or 41 evenly spaced stations, with larger ships having more stations. An odd number of stations results in an even number of equal blocks between the stations.

The first forward station at the bow is usually labeled station number zero. This forward station is called the forward perpendicular (FP). By definition, the FP is located at a longitudinal position as to intersect the stem of the ship at the DWL.

The after-most station is called the after perpendicular (AP). By definition the AP is located at a longitudinal position as to intersect the stern at the DWL for ships with a transom stern or alternatively through the rudder stock of the vessel.

The station midway between the perpendiculars is called the midships station, usually represented by the ⋈ symbol. The length between perpendiculars has the symbol "L_{PP}." Engineers typically use the L_{PP} for calculations. There is also an overall ship length "LOA" that

might be a more useful number to use if you were docking the ship. Figure 2.3 displays these hull form characteristics.

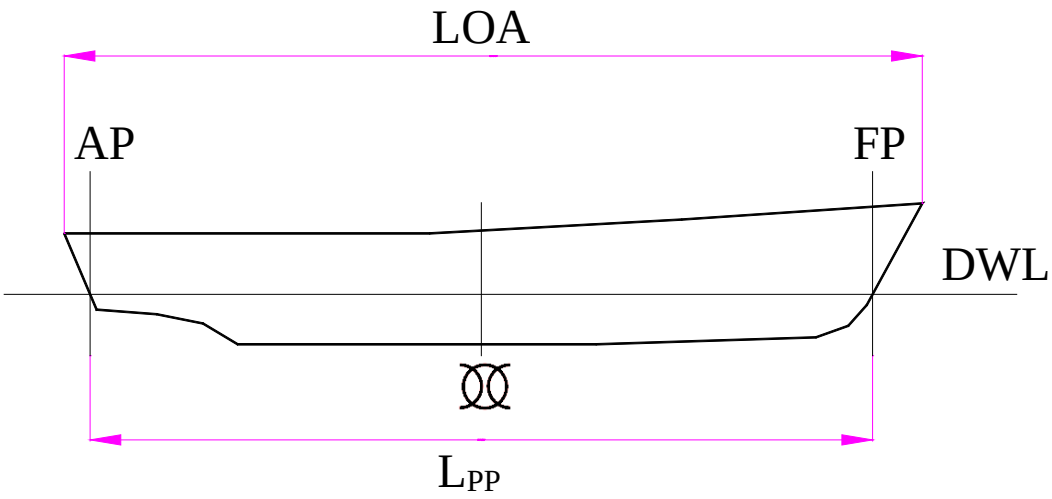

Figure 2.3 Hull Form Nomenclature

2.3.1 The Sheer Plan

Grid lines: Waterlines and Station lines
Curves: Buttock lines (measured port/stbd from centerline)

A plane that runs from bow to stern directly through the center of the ship and parallel to the sides of the imaginary box is called the centerline plane. A series of planes parallel to one side of the centerline plane are imagined at regular intervals from the centerline. Each plane will intersect the ship's hull and form a curved line at the points of intersection. These lines are called “buttock” or “butt lines” and are all projected onto a single plane called the “Sheer Plan”. Figure 2.4 shows the creation of this plan.

Each buttock line shows the true shape of the hull from the side view for some distance from the centerline of the ship. This allows them to serve as a pattern for the construction of the ship’s longitudinal framing.

The centerline plane shows a special butt line called the “profile” of the ship.