Figure 2 shows a yacht sailing on starboard tack. In order for the yacht to hold a steady course the magnitude and line of action of the aerodynamic and hydrodynamic forces must be the same. The VPP adopts an iterative procedure at each true wind speed and angle to find "equilibrium" sailing conditions, defined by unique values of boat speed (Vs), heel angle (ϕ), and the sail trim parameters (reef, flat) where;

1) Thrust (driving force) from the sails equals the hydrodynamic drag.
2) The heeling moment produced by the couple between the aerodynamic and hydrodynamic Heeling Force equals the hull righting moment, as shown in *Figure 3*.

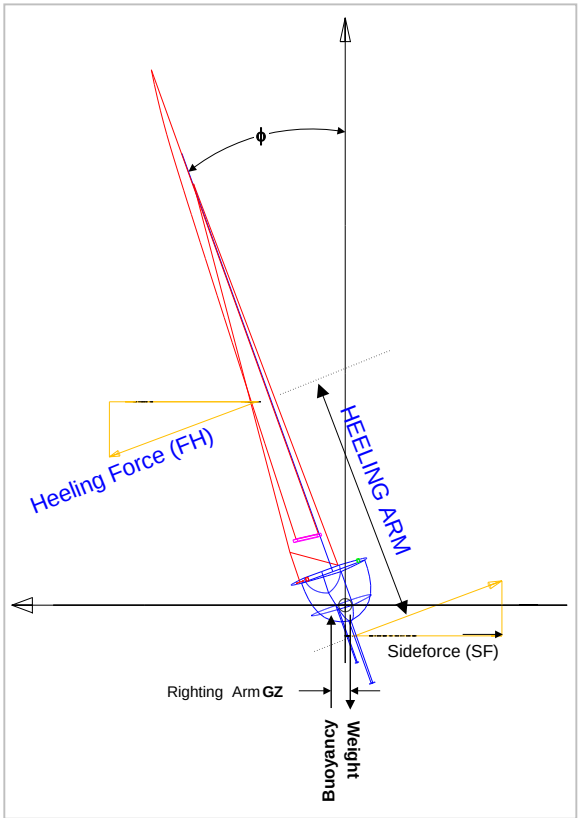

Figure 3 - Roll Moment Equilibrium

It should be noted that the VPP solves only for a balance of force and moment about the track axis. The yaw moment balance is ignored so that sail trimming options, or speed and heel values that produce excessive yaw moments, are not reflected in terms of their influence on speed.

3.2 Boat Model

The boat model may be thought of as a black box into which boat speed, heel angle, and the sail trim parameters, reef and flat are input. The output is simply four numbers:

- the aerodynamic driving force,
- the heeling moment from the above water part of the hull and rig,
- the drag of the hull keel and rudder and,
- the righting moment from the hull and crew.

The solution algorithm iterates to a solution by interrogating the boat model with each new guess of the input values until a set of conditions is found that produces a match of thrust and drag and heeling moment and righting moment. The solution algorithm also seeks to find the highest speed on each point of sailing by adjusting the sail trim parameters for optimum performance.