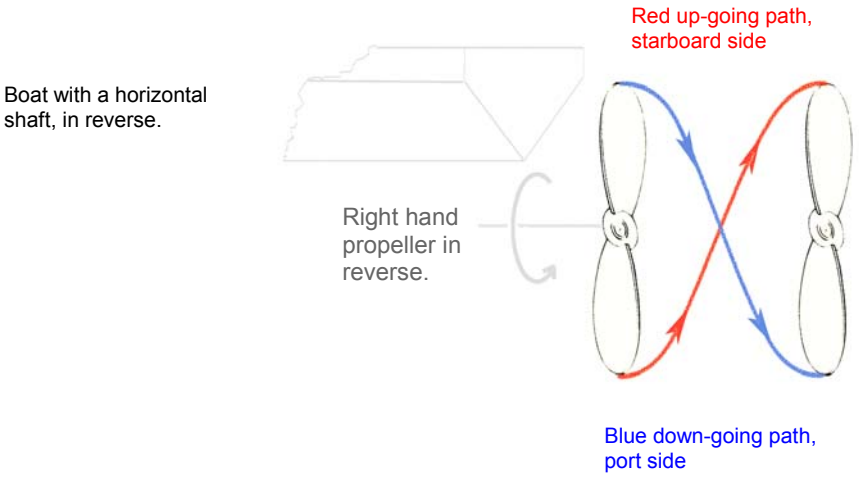
Prop Walk. An explanation of its causes and effect.

Prop walk is also known as, asymmetric blade effect, asymmetric thrust and P-effect. It affects boats, propeller driven aircraft and helicopters. Here we consider the effect on boats.

This paper explains how the propeller shaft angle (the angle between the surface of the water and the shaft) causes the thrust of the up-going and down-going blades to differ, so producing prop walk. The example uses a two bladed propeller; this is for ease of explanation only, the number of blades makes no difference to the effect.

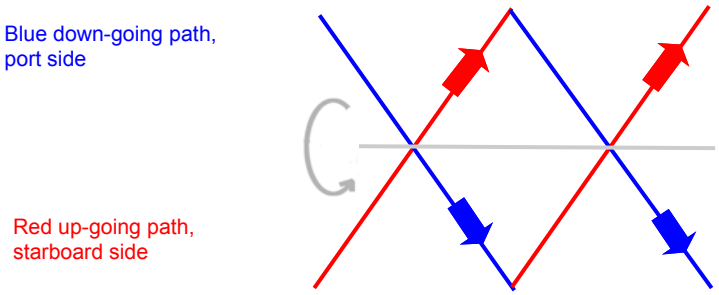
Case 1. A propeller with no shaft angle.

Consider below, a right-handed propeller, in reverse. The propeller blades are scribing the red and blue lines on a cylinder of water. This shows the paths of the red up-going and blue down-going blades during the rotation of the propeller.

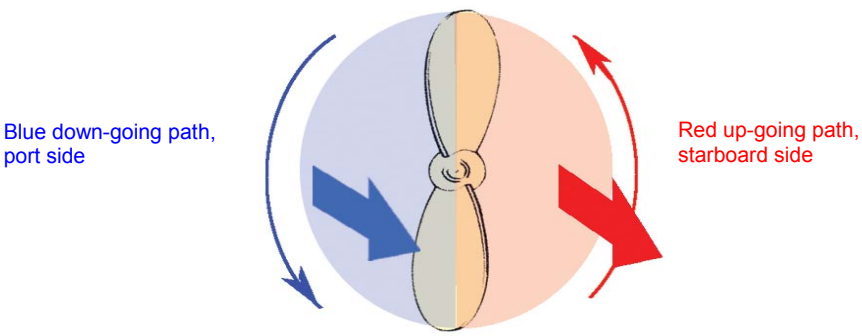


The schematic below shows the cylindrical paths of the blades as a flat representation during one rotation.

As can been seen the red and blue paths are of the same length, the blades travel the same distance, therefore the thrust from the up and down blades of the propeller is equal.

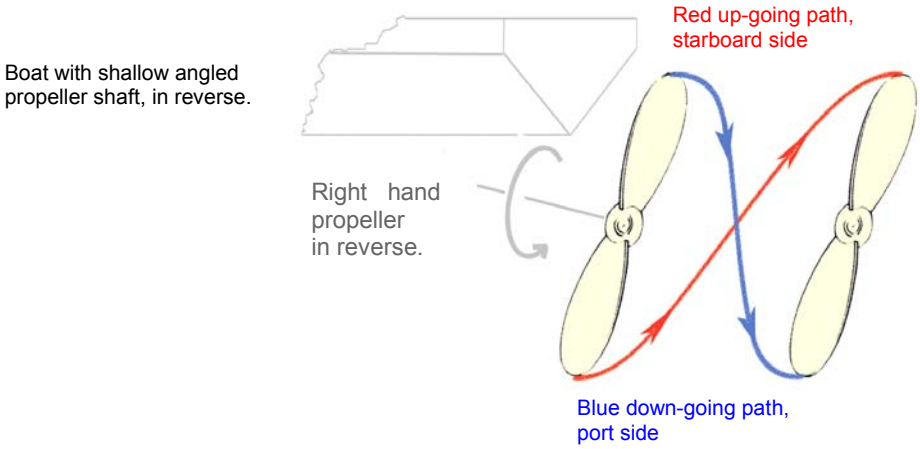


The thrust from the port and starboard sides is equal and in line with the propeller shaft; there is no prop walk.



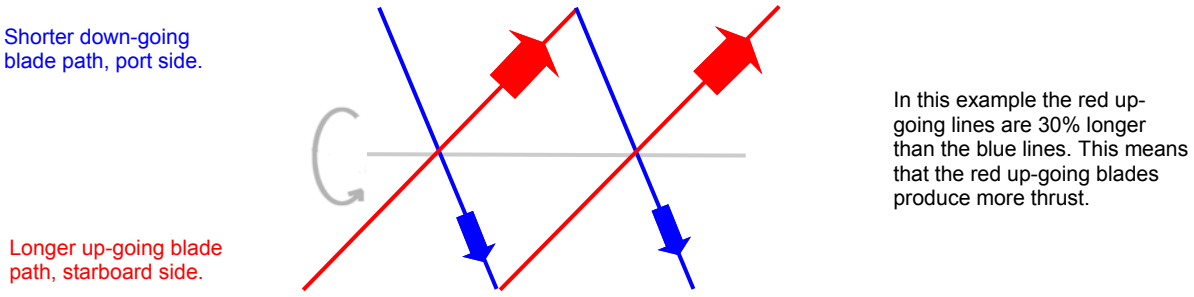
Case 2. A propeller with a shaft angle.

This propeller and shaft have a shaft angle to the water surface. As in Case 1, the propeller blades scribe the red and blue lines on the surface of a cylinder. The lines show the different paths of the up-going and down-going blades.

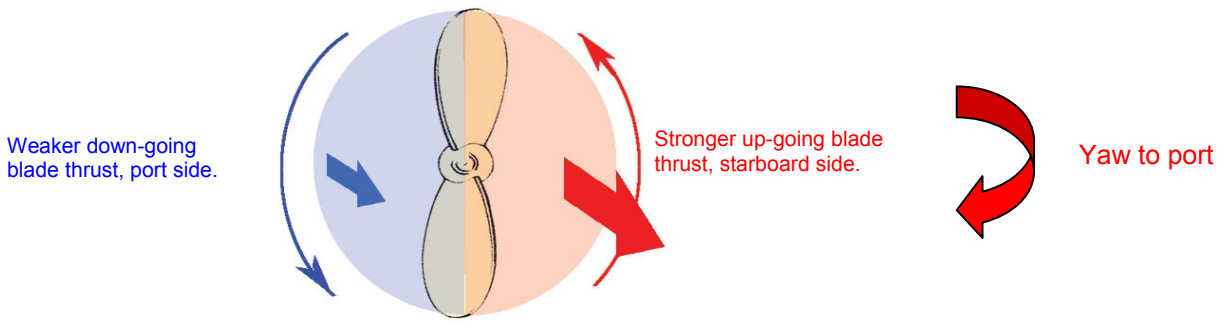


The schematic below shows the cylindrical paths of the blades as a flat representation during one rotation.

As can been seen the red paths are longer than the blue. This means that the up-going blade on the starboard side travels further than the down-going blade on the port side, This up-going blade travelling further pushes more water towards the bow of the boat, producing more thrust.



The thrust from the starboard side is stronger than the thrust from the port side, therefore prop walk yaws the stern to port.



Prop walk is caused by the angle of the propeller shaft to the water surface; if there is no angle, then there is no prop walk. For an increase in either the diameter or pitch of the propeller the effect is increased.

The effect is present in both forward and reverse gears. In forward gear the forces act to yaw the boat to starboard.

In forward gear the effect is easily overcome by the rudder. In reverse gear the rudder is less effective making prop walk more obvious and difficult to control.