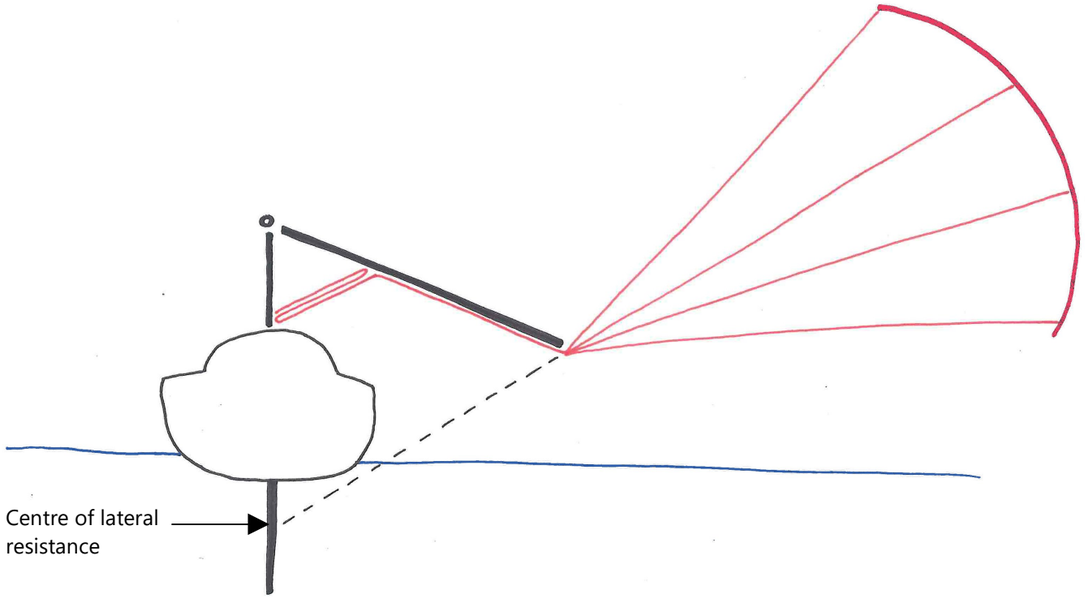

Figure 2.1 The line of action of the kite always passes through the centre of lateral resistance

2 General arrangement, principles and terminology

The *WINDFLY Rig* connects a kite or wing ("the kite") to boat so that the kite drives the boat forwards, or backwards, without applying any heeling moment to the boat.

A short mast supports one end of a boom. The boom is free to rise and fall about the pivot point where the boom is connected to the mast. The mast is supported by a base unit which allows the mast (and the boom which it supports) to rotate around the longitudinal ('vertical') axis of the mast.

The kite lines pass two or more times between the base of the mast and a point on the boom from where the lines continue to the end of the boom and then to the kite. The boom, mast, lines and associated fixings to the vessel constitute the *WINDFLY Rig*.

If the *WINDFLY Rig* geometry is correctly selected then, regardless of the position of the kite, the line of action of the kite always passes through the centre of lateral resistance ("CLR"). Therefore the kite drives the boat forwards without applying a heeling moment is to the boat.

There are many theoretically possible geometries, however in practice the kite lines running from the base of the mast to the boom are required to fix to the boom either at the mid-point, or at the third point closest to the mast.

The kite lines passing between the boom and the mast form the "biasing arrangement" which counters the tendency of the boom to be lifted by the lines passing from the end of the boom to the kite.

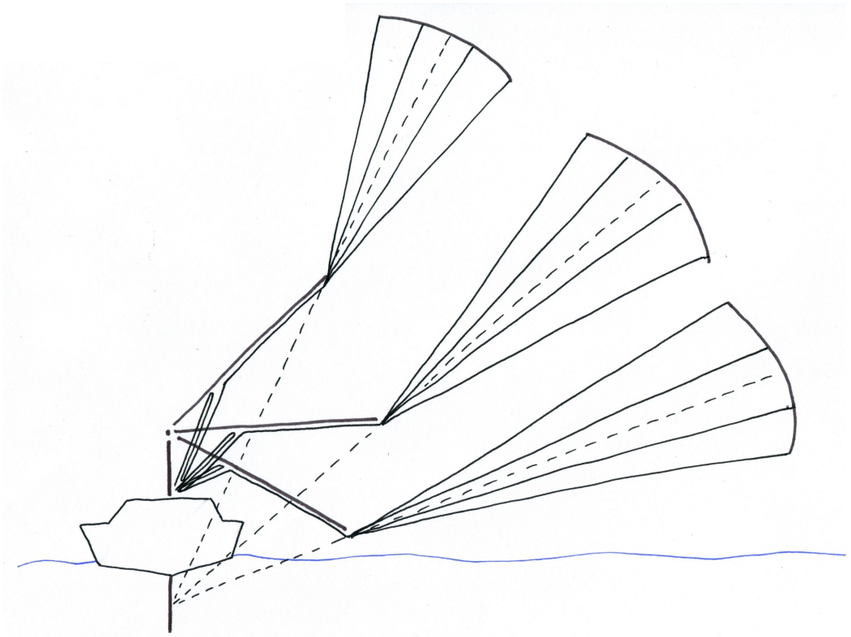

Figure 2.2 The boom rises and falls to track the kite as it climbs and descends

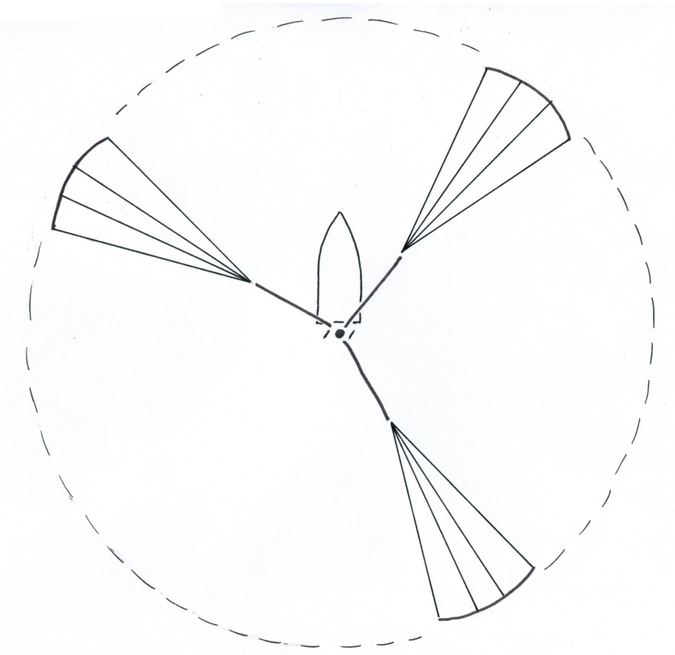

Figure 2.3 The mast rotates to track the kite as it moves around the boat

The *WINDFLY Rig* tracks the kite so that the line of action of the kite always extends through the centre of lateral resistance of the boat. No external control or energy input is required as the *WINDFLY Rig* tracks the kite as it is flown higher or lower, to port or starboard, ahead or astern.

Simple manual control of the kite or wing is delivered by a single crew member safely positioned in the cockpit. The crew member can easily and simply adjust the power of the kite / wing and fly the kite / wing higher or lower.

The *WINDFLY Rig* can be rigged so that the flight of the kite / wing is automatically controlled without active control by the crew.

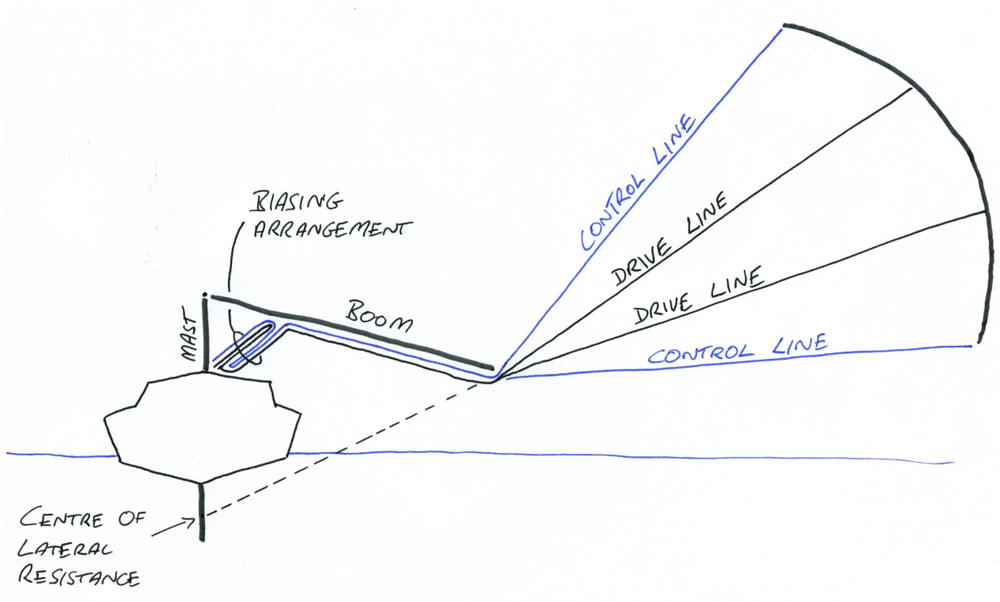

Figure 2.4 Drive lines and control lines

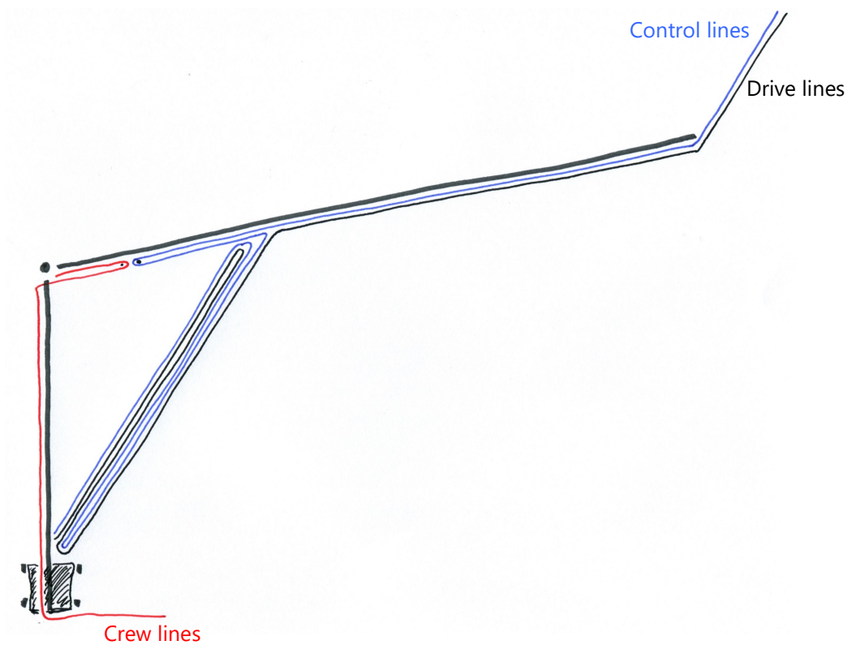

Figure 2.5 Crew lines

Most "power" kites have four lines, some have 3 or 5. This description is based on a four line kite, the principles are valid for a kite or wing with 3, 4, 5 or more lines.

Drive lines: The two central lines are the drive lines. These lines are notionally of fixed length. The majority of the kite load is carried by the drive lines.

Control lines: The two outer lines are the control lines, these lines are used to control the kite. By altering the length of the control lines the lift / pull of the kite can be adjusted and the kite can also be turned to fly in a different direction. The control lines may pass through the base unit and continue to the cockpit where the crew uses the control lines to control the kite.

Kite lines: The drive lines and the control lines.

Crew lines: The control lines may pass through pulleys which are attached to crew lines. The crew lines are used to take in and play out each of the control lines. The crew lines pass through the base of the mast to the cockpit where the crew uses the crew lines to control the kite. This arrangement allows the kite to be controlled while the length of the kite lines is altered to move the kite further from, or closer to, the boat.

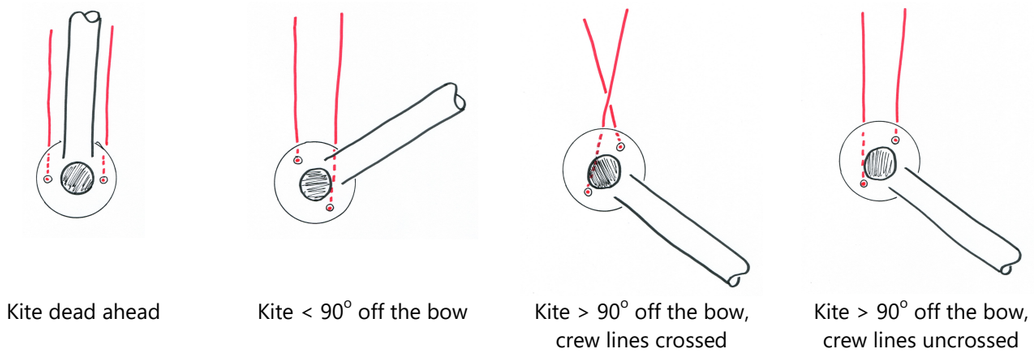

Figure 2.6 Local plan view of the lines passing through the base unit as the mast rotates

The crew lines or control lines which extend through the base of the mast and on to the cockpit may be passed over one another to avoid entanglement as the mast completes any number of 360 degree rotations or part rotations of the mast, as illustrated in figure 2.6 which shows a local plan view of the lines passing through the base unit as the mast rotates.

A spring may be provided to counter self weight of the boom in an arrangement similar to a spring balanced cantilever.

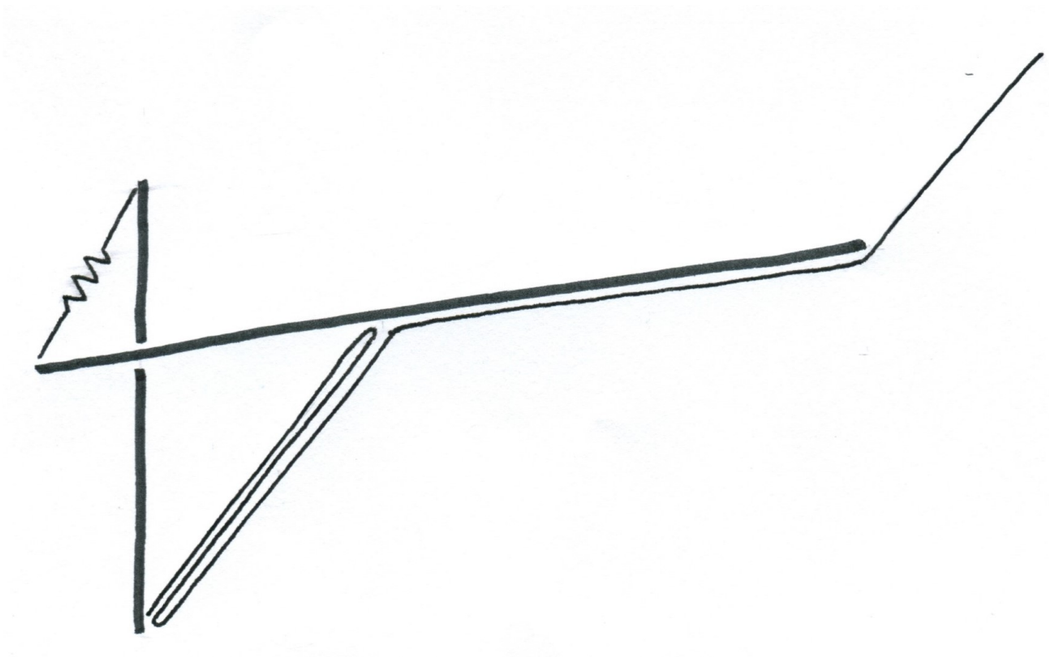

Figure 2.7 A spring may be used to counter the self weight of the boom