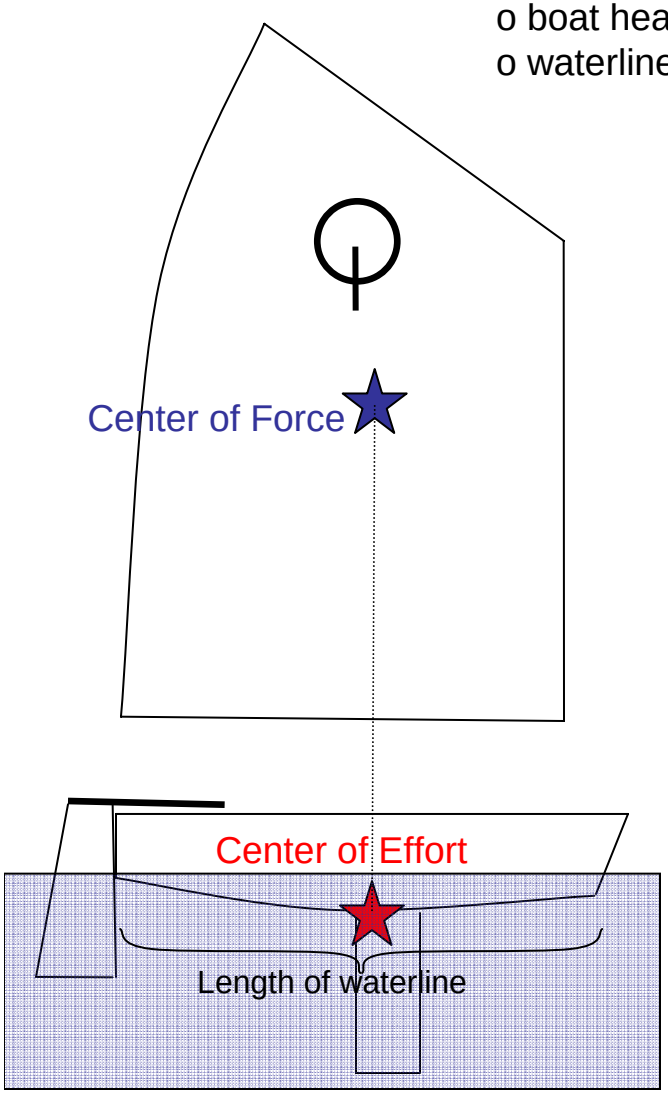
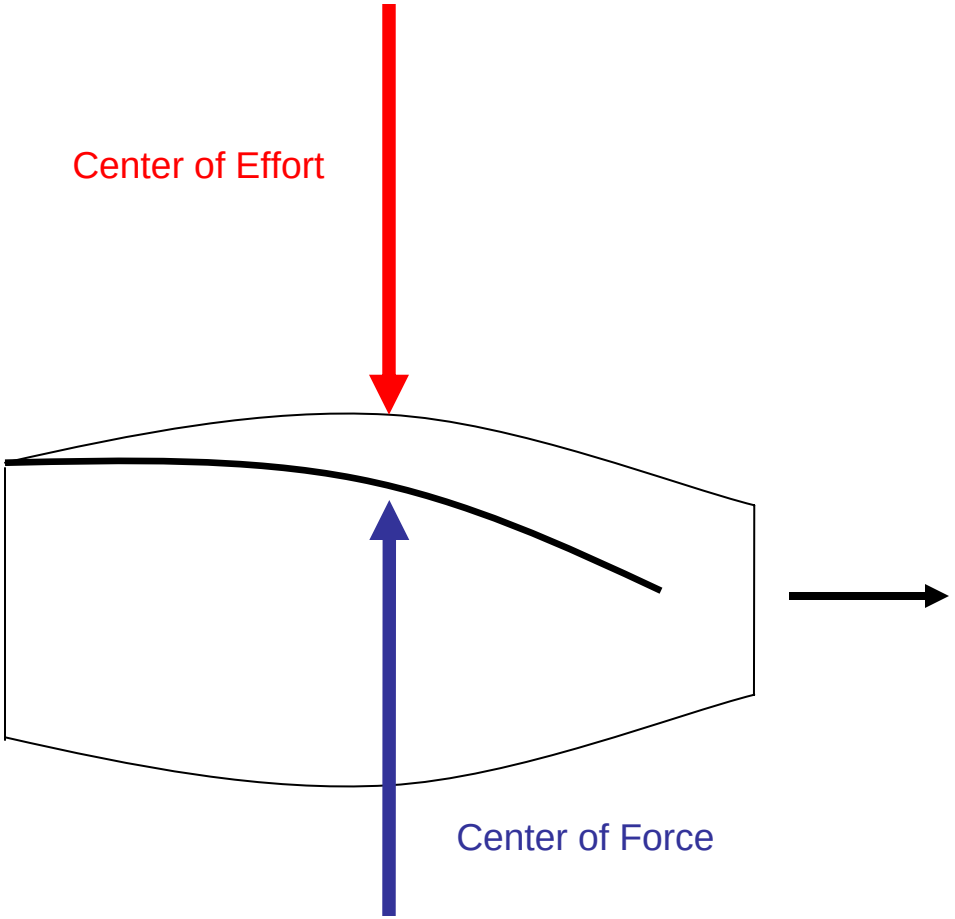
Position - neutrally balanced boat

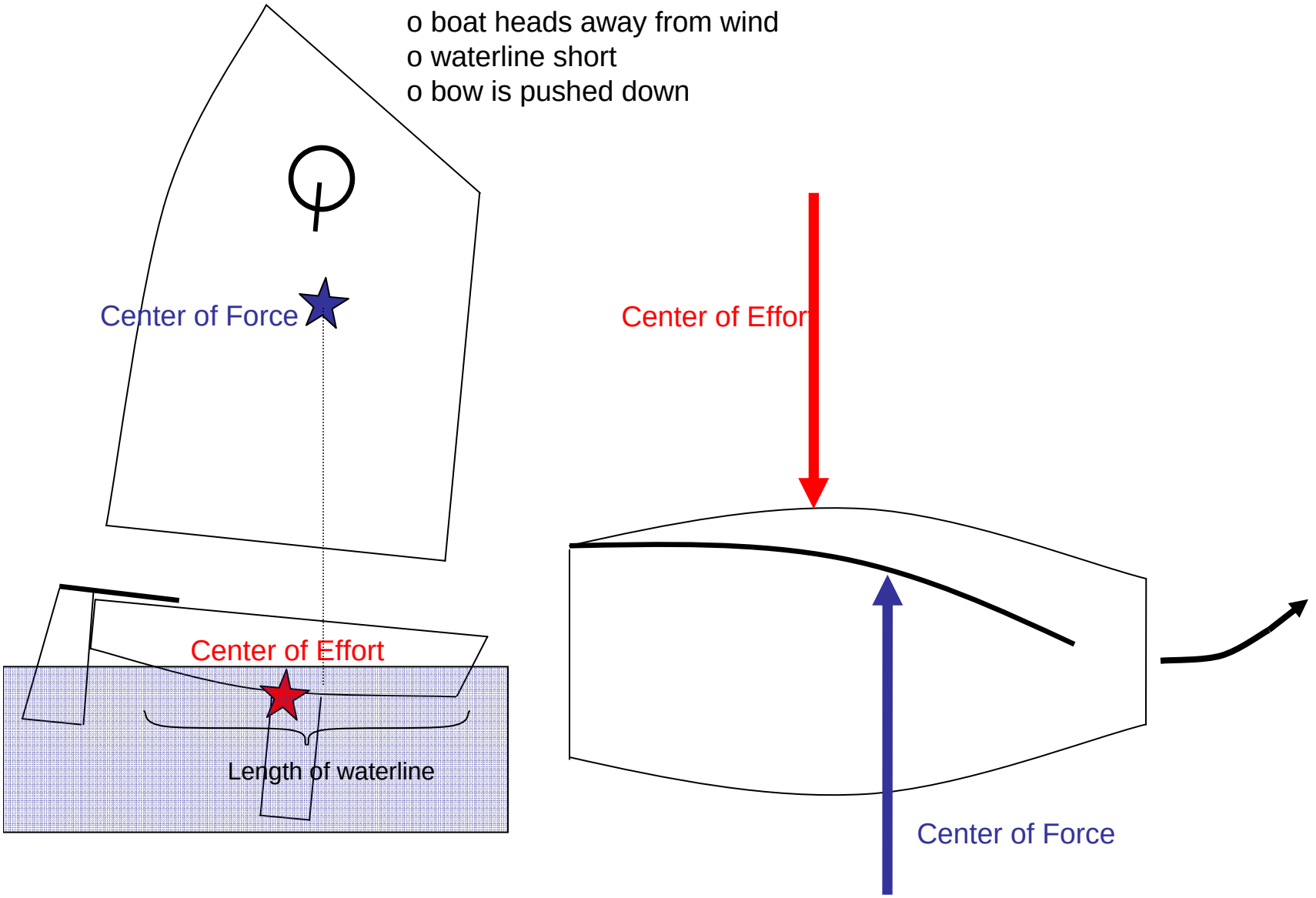
Effect:
o boat heads straight
o waterline is as long as possible





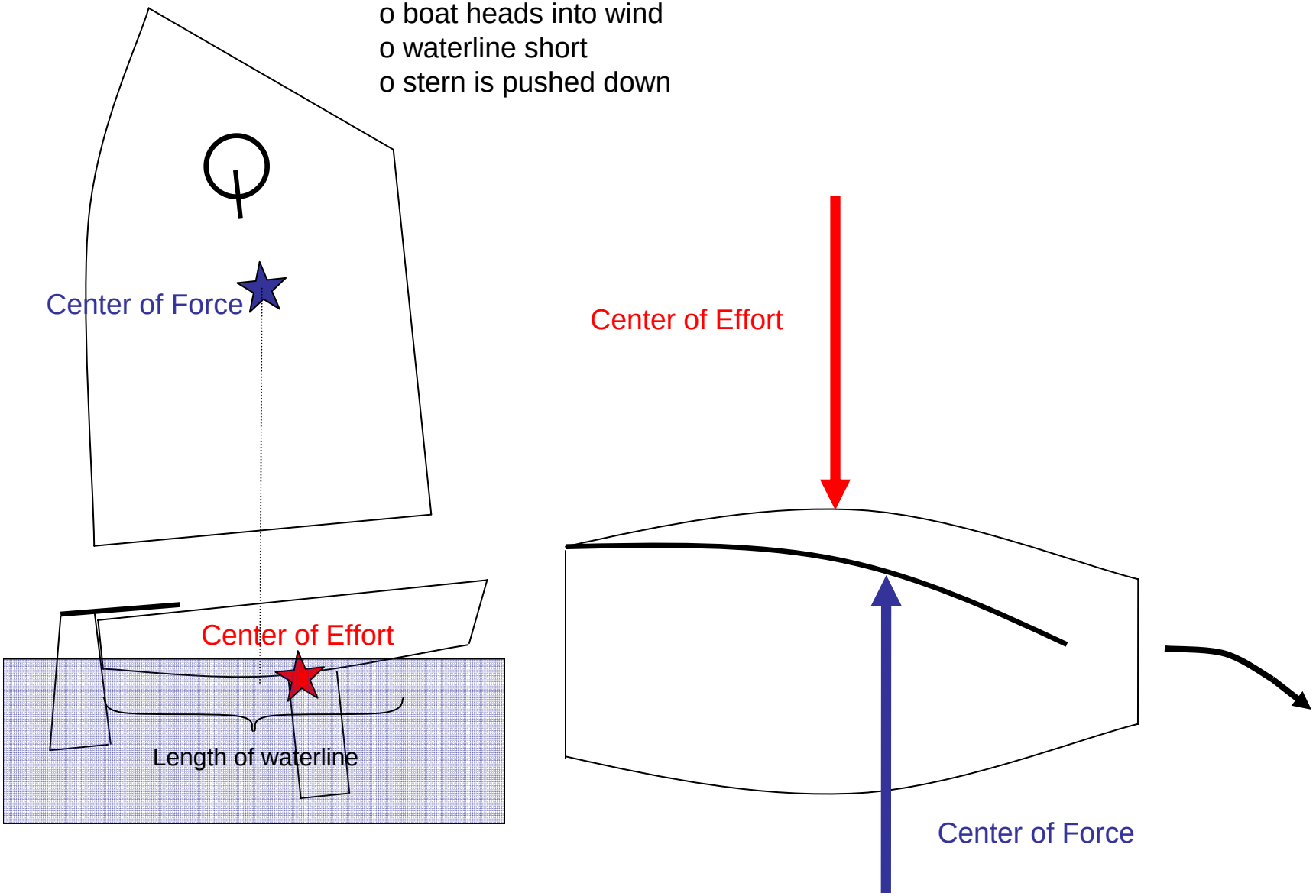
Position - weight too far forward

Effect:
o boat heads away from wind
o waterline short
o bow is pushed down

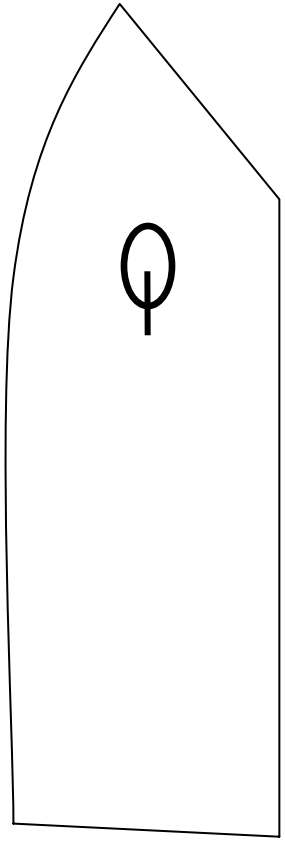


Position - weight too far aft

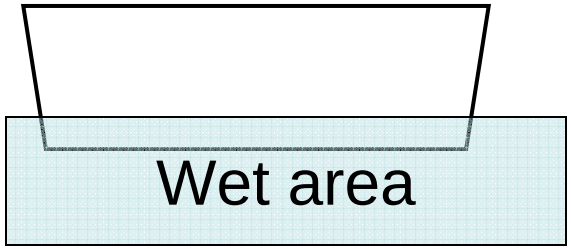
Effect:
o boat heads into wind
o waterline short
o stern is pushed down

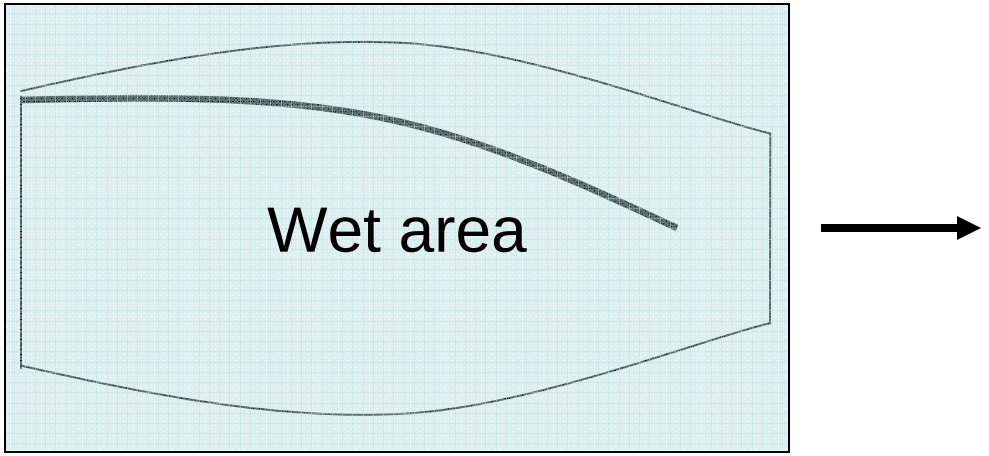


Position - flat boat

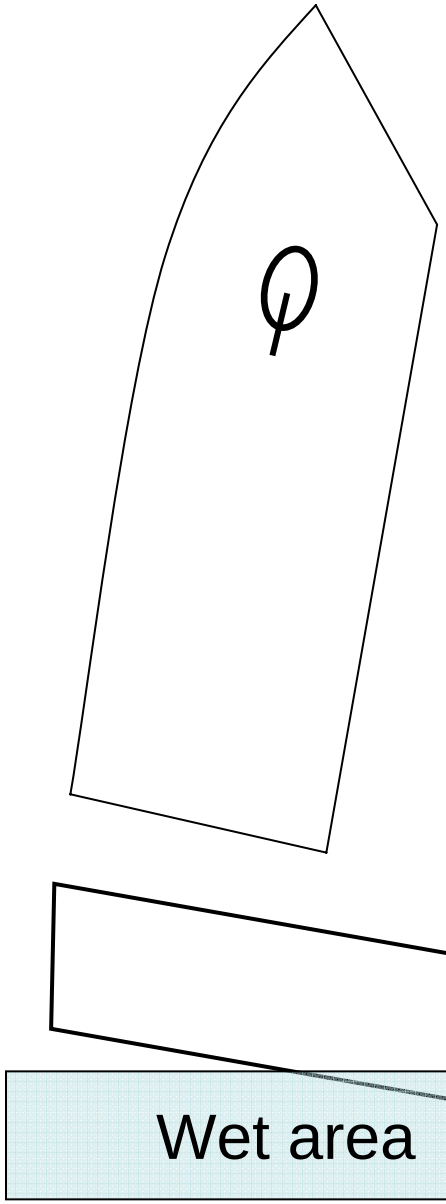


Both the windward and the leeward sides of the hull are in the water - the forces balancing themselves out and the boat will go straight

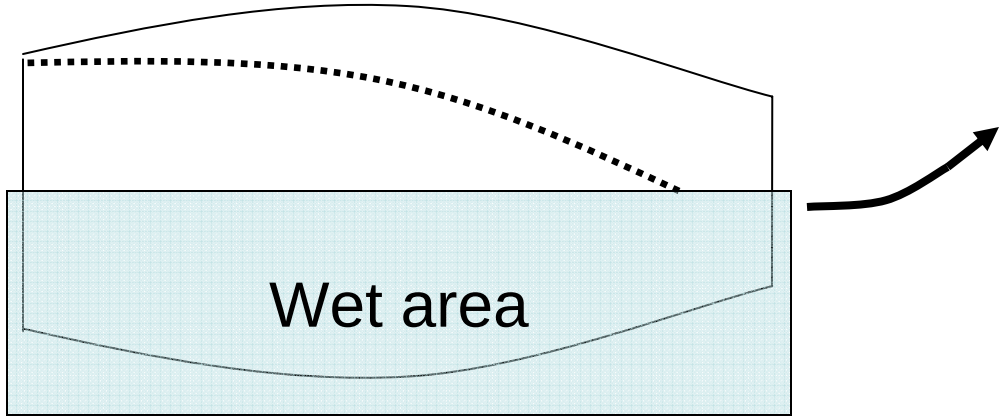




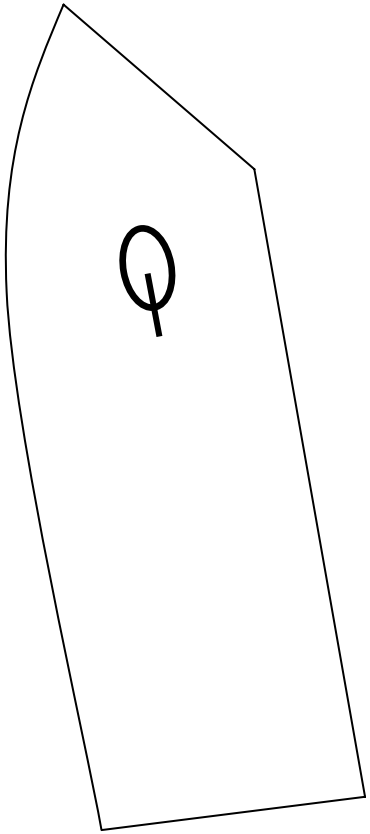
Position - windward heel

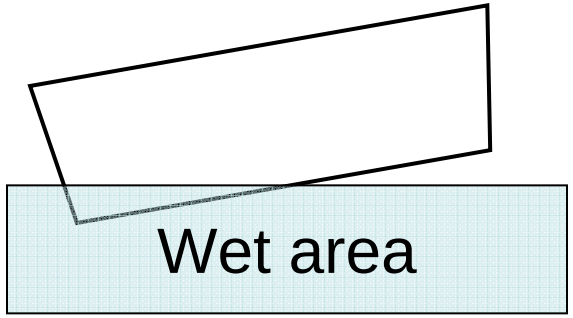


The windward heel of the boat will cause more curvature of the windward hull to be exposed to the water - the result is that the bow is pushed to leeward

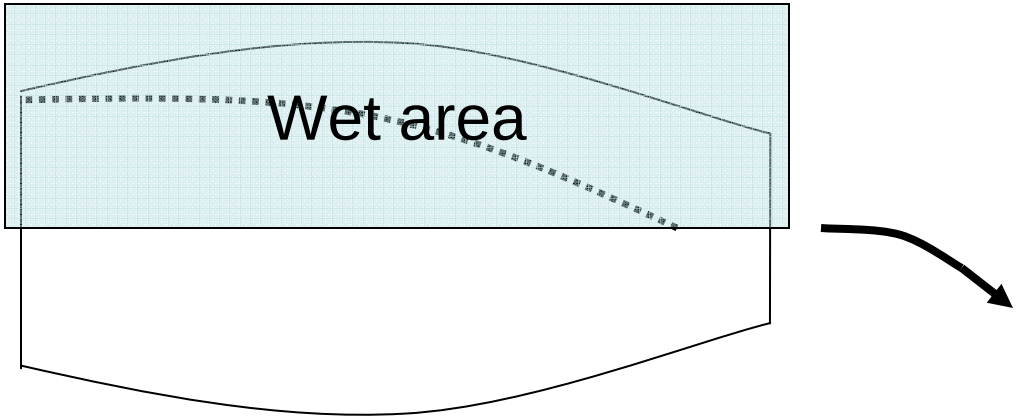


Position - leeward heel



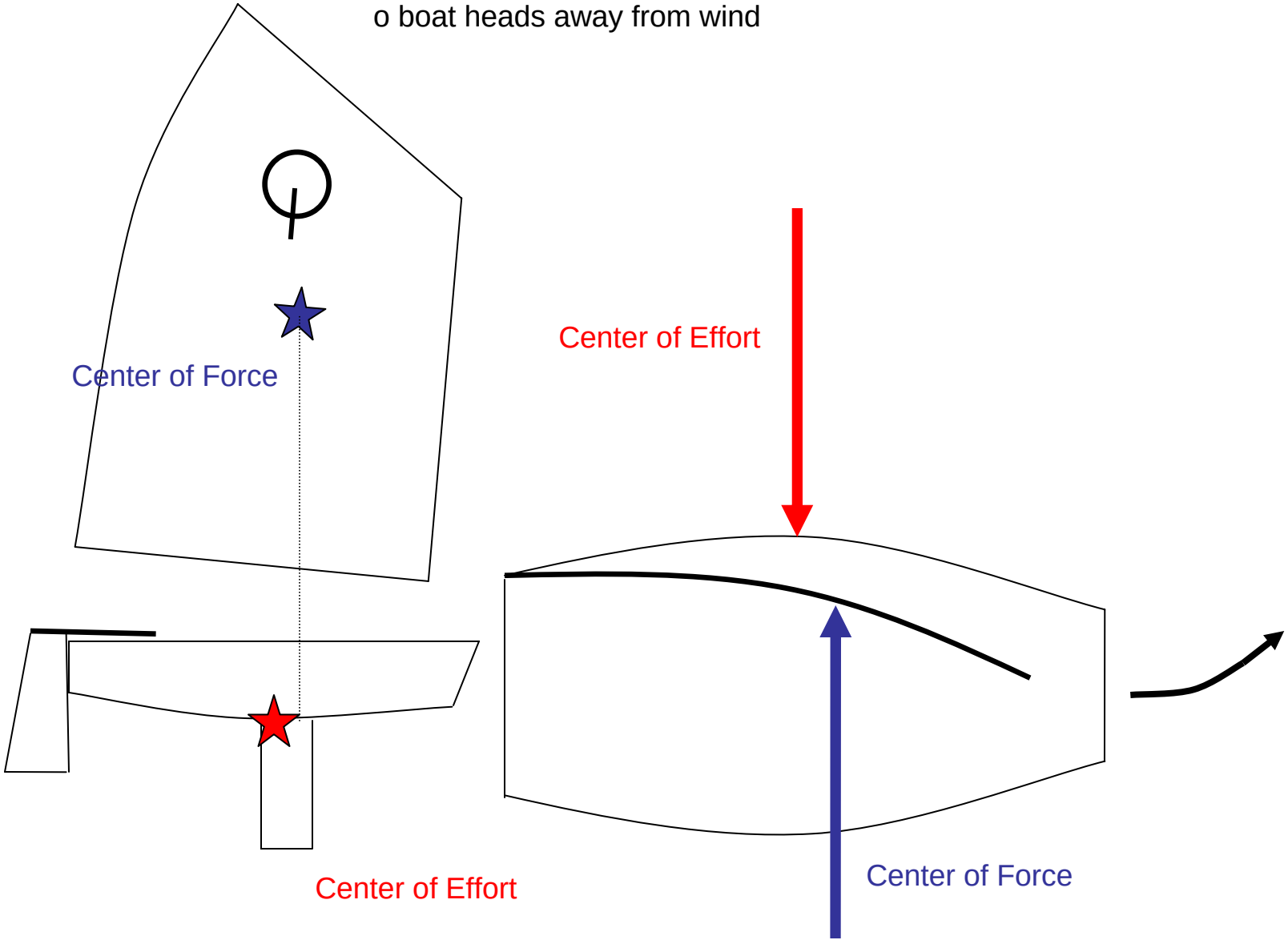


The leeward heel of the boat will cause more curvature of the lee hull to be exposed to the water - the result is that the bow is pushed to windward. This is known as **rounding up**



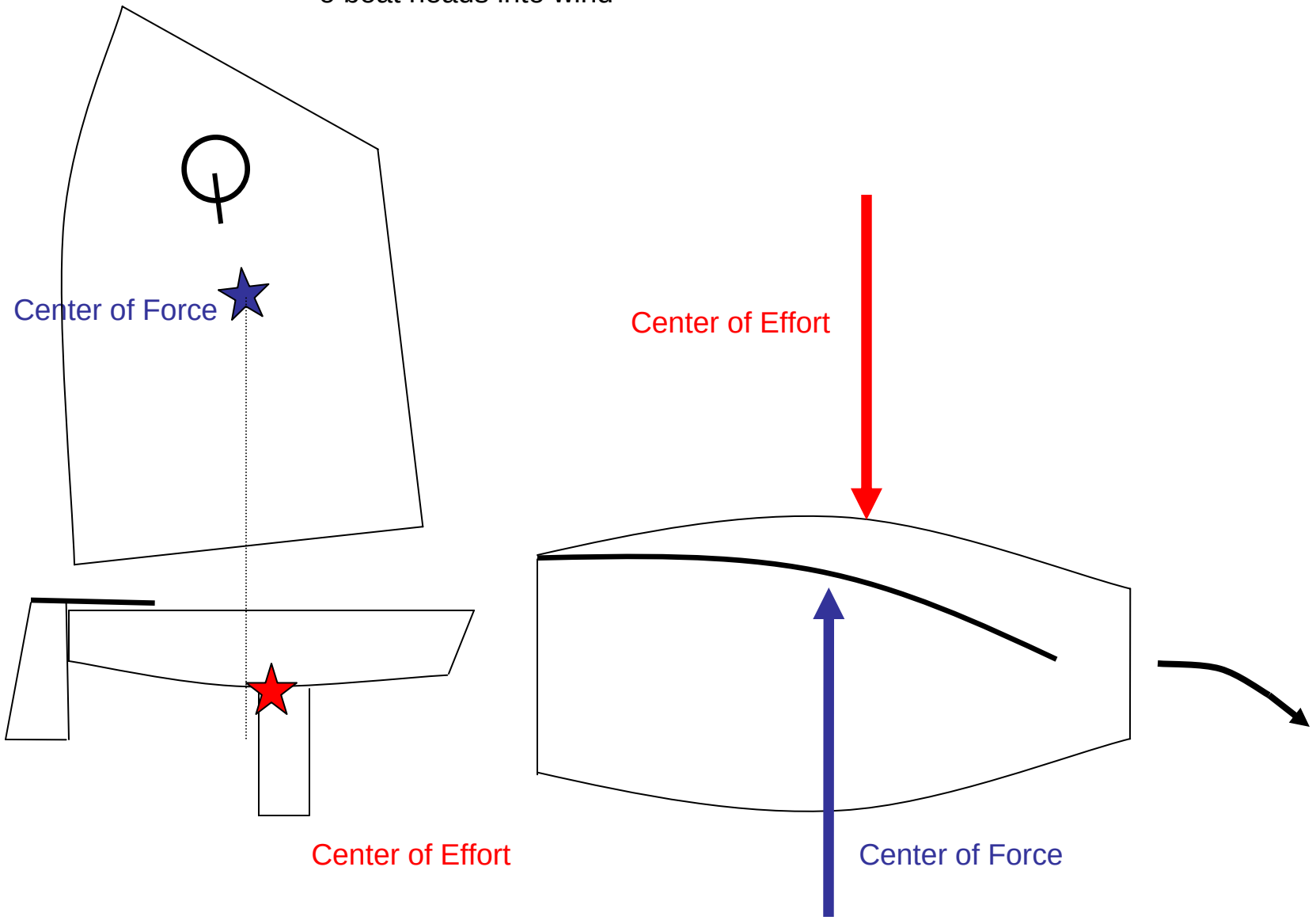
Mast Rake - too great

Effect:
o boat heads away from wind



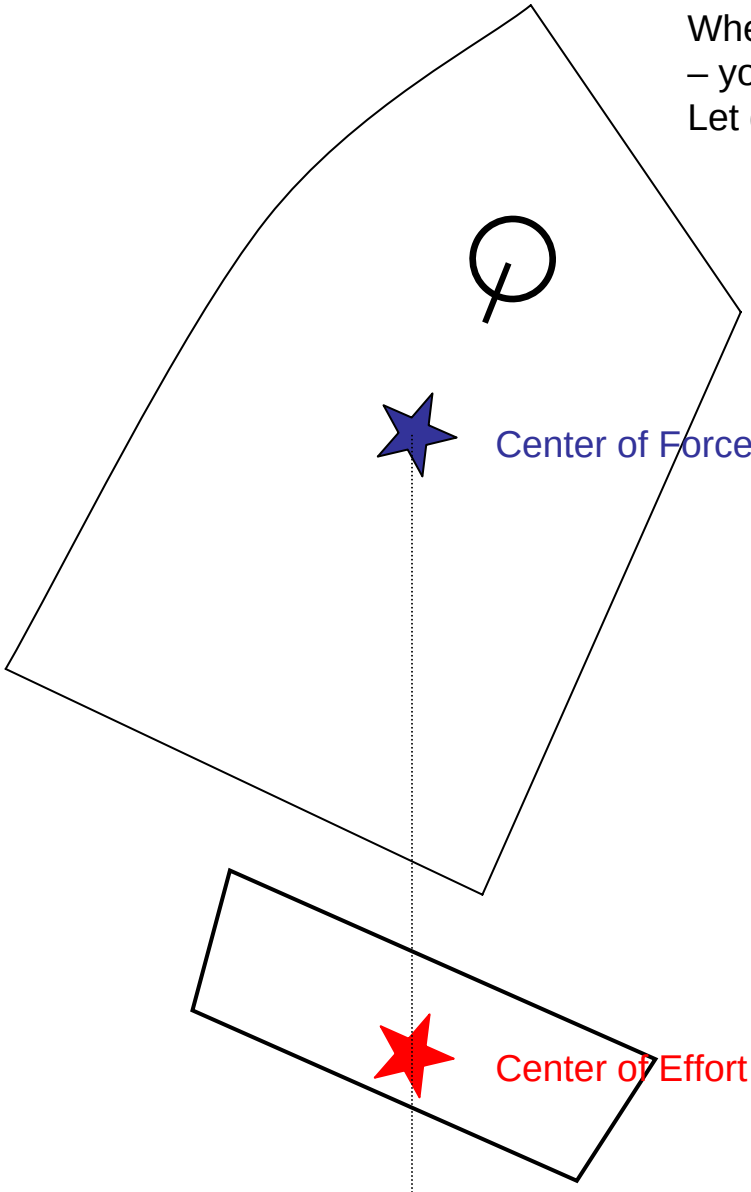
Mast Rake - too short

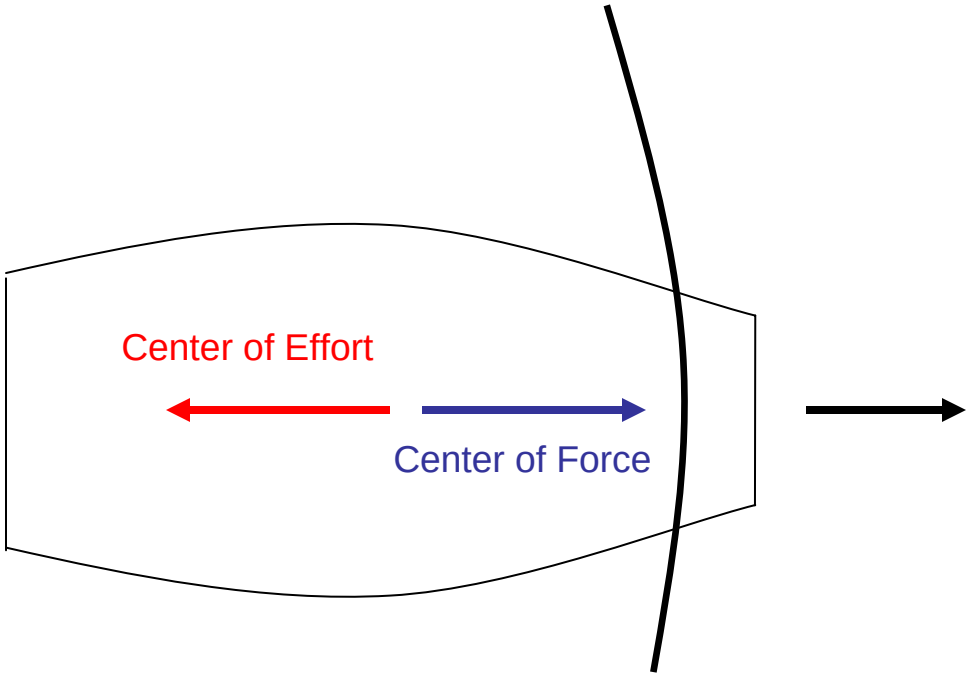
Effect:
o boat heads into wind



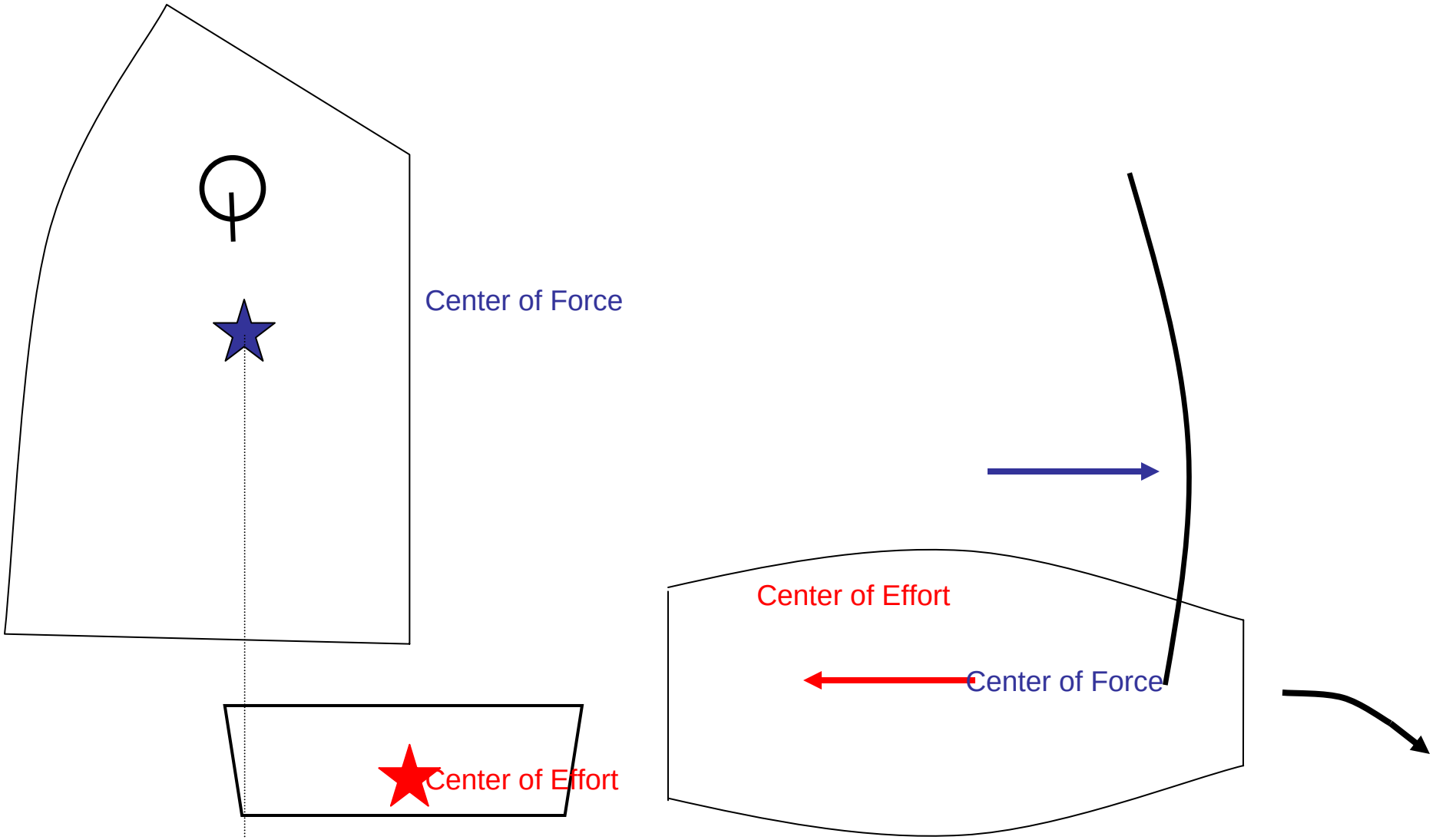
Downwind - Perfect heel, boat goes straight

When balancing the boat like this you have the most control – you can head up or down as needed.
Let go of your tiller to confirm your boat is going straight

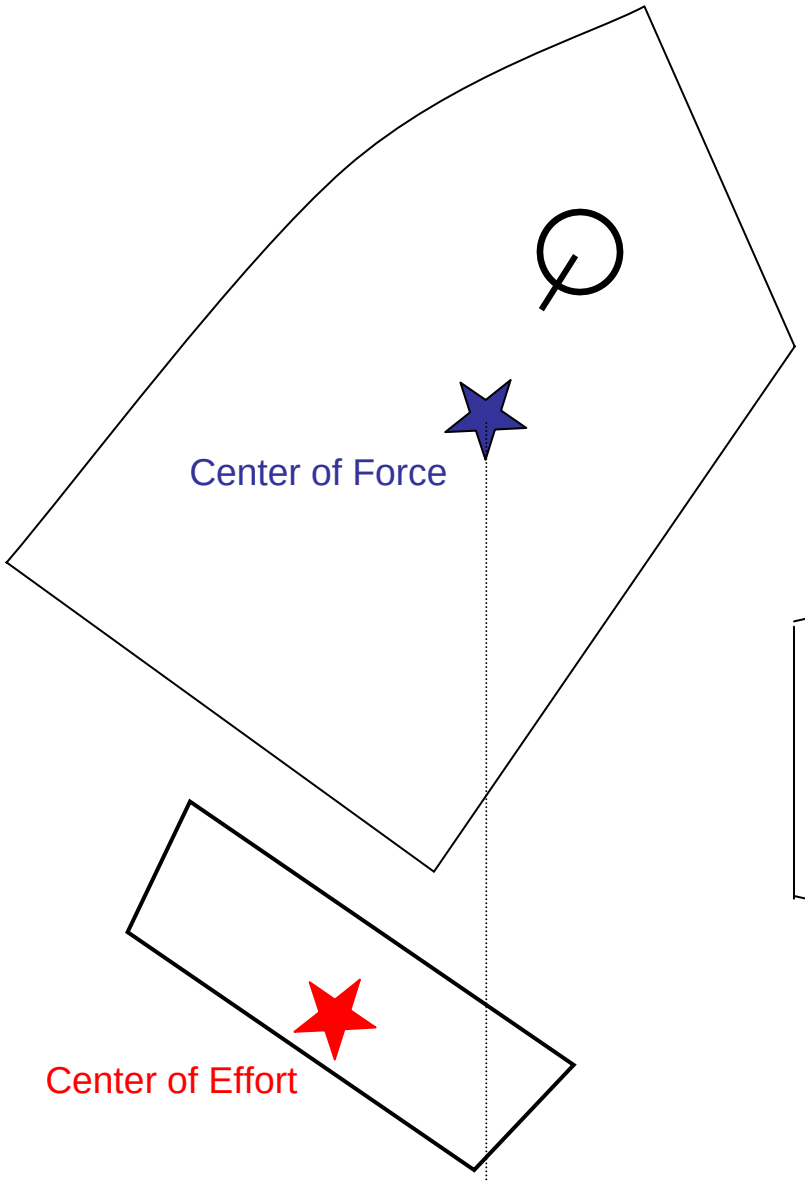




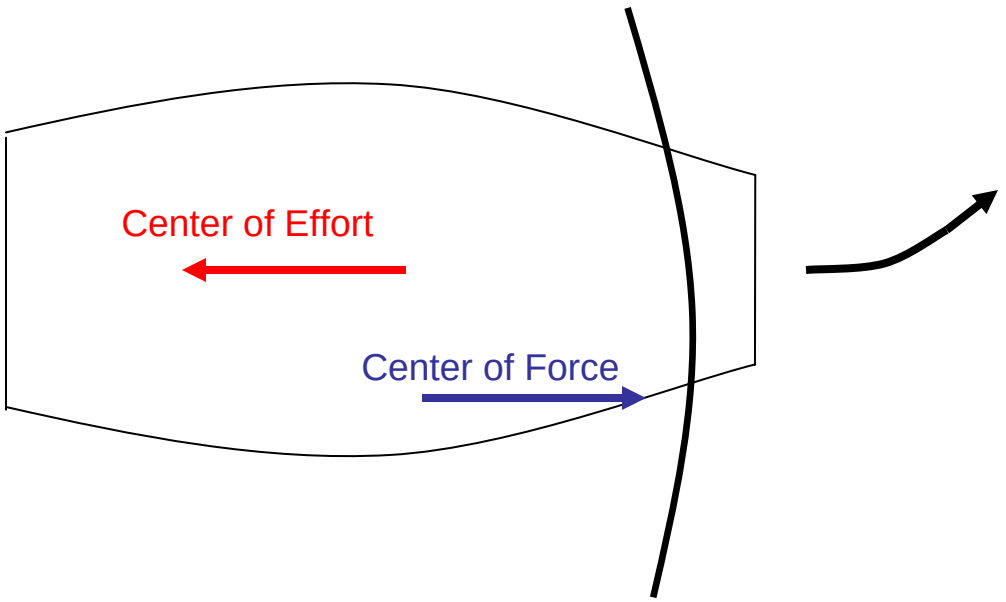
Downwind - flat boat, boat will head up



Downwind - too much heel, boat will head down

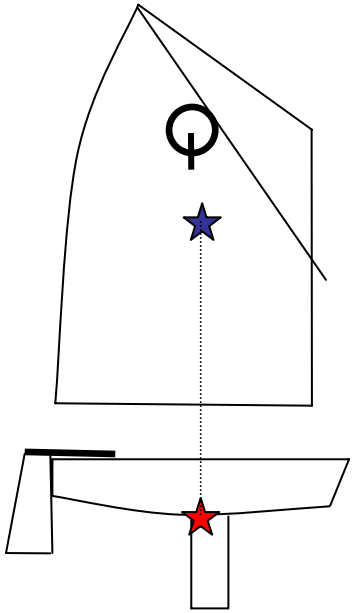


Dangerous! You don't have much control – the rudder probably hasn't much effect.

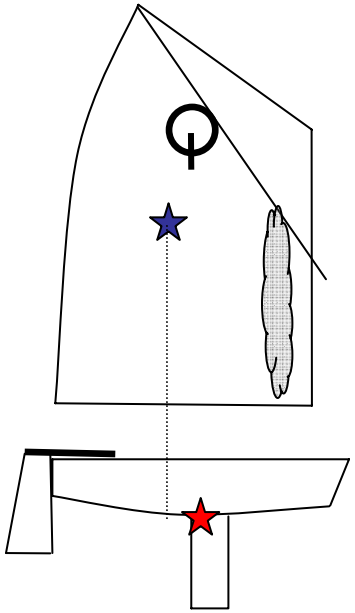


Effects of easing heel by raising centerboard

Boat goes straight

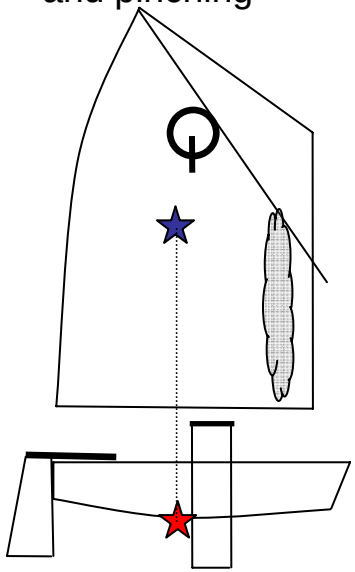


Pinching / luff bubble



Pinching - the center of force is moved aft

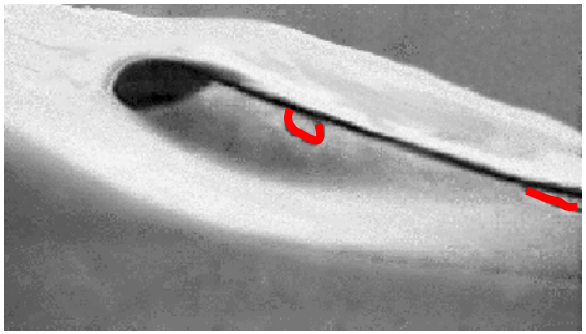
Raised centerboard and pinching



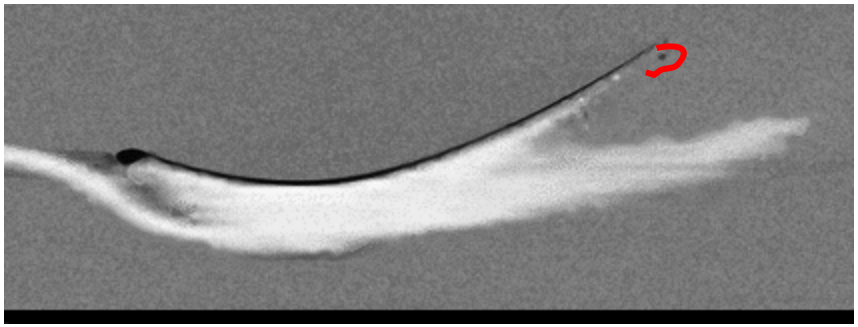
Raising centerboard - the center of effort is moved aft

The trailing edge of your boat and your sail have great effects on performance. An important principle in fluid dynamics, such as aerodynamics (air) and hydrodynamics (water), is that good / clean separation from the fluid is important. The point of separation is the trailing edge.
Bad separation will cause disturbances, which result in unwanted performance impacts.
An example: if you sit far aft in your boat (pushing your stern down) in slow or medium wind and look at the wake close to the stern, what does the water appear to do? Doesn't it look as if the top layer of water is flowing towards the boat? The reason for this is the disturbance you cause by pushing your boat's stern too far down. Clearly "pulling" water towards your boat is unwanted and an unnecessary use of the available power.
With the trailing edge of the sail you'd be able to observe similar effects, when trimming the sail wrong, if there was smoke (see pictures next side).
Different air speeds require different wing shapes in order to perform the best. A sail is essentially an aircraft wing, and yes, aircraft "trim" their wings too! When taking off or landing (the aircraft is traveling slower than normal) the pilot extends flaps, which "trim" / change the shape of the wing.

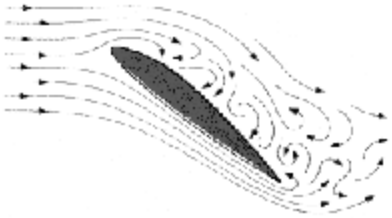
Wind and telltales



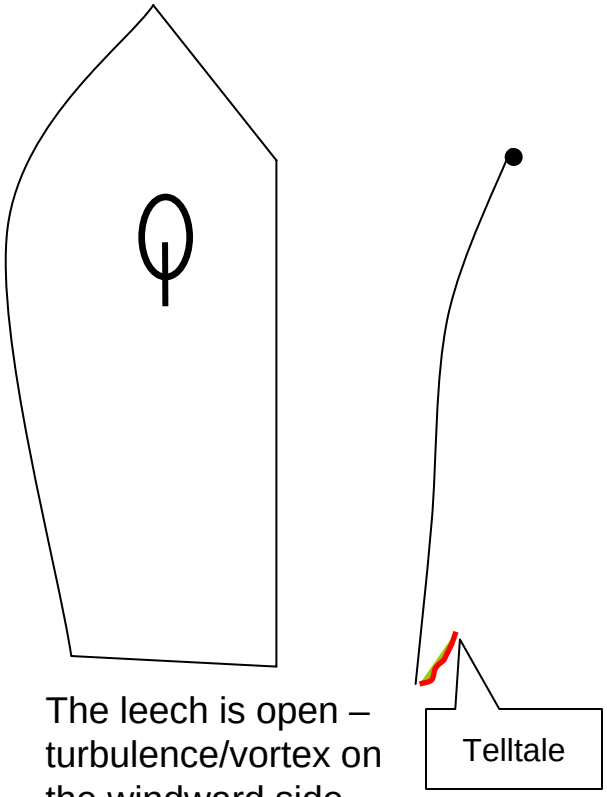
Luff separation bubble



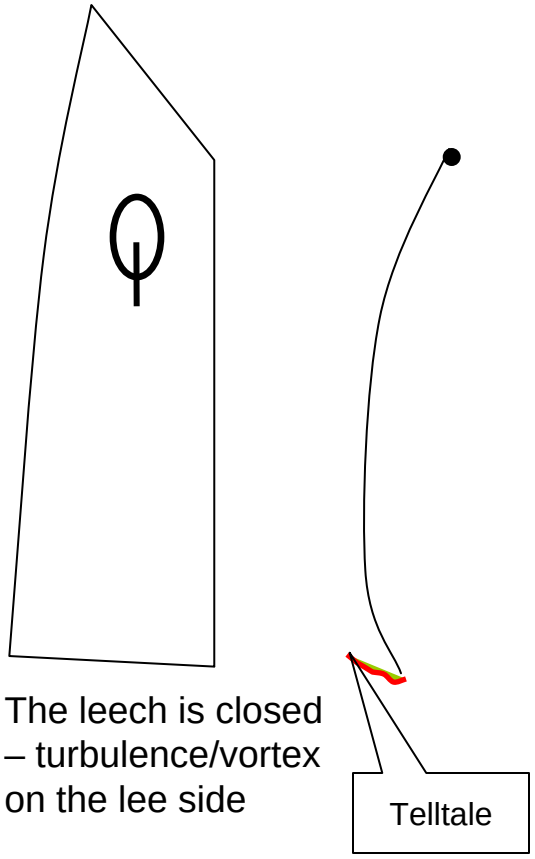
Trailing edge separation.



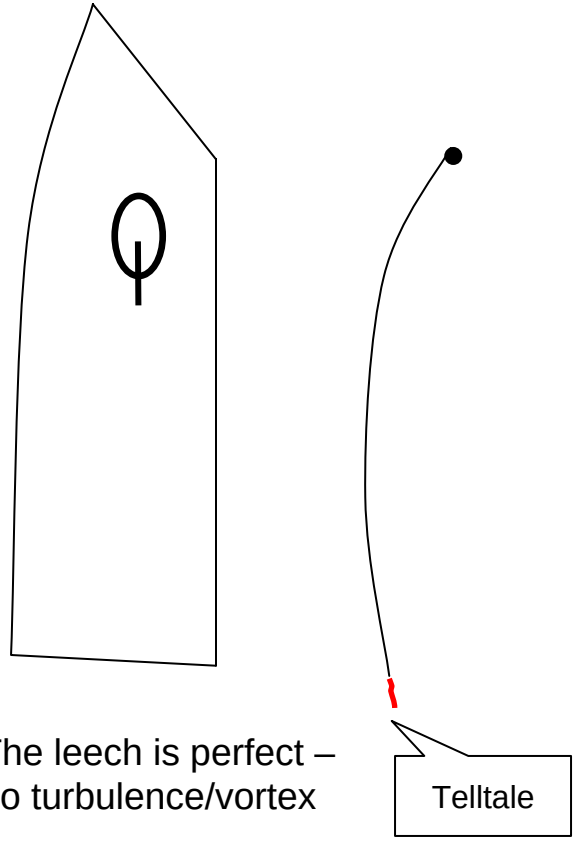
An aircraft wing



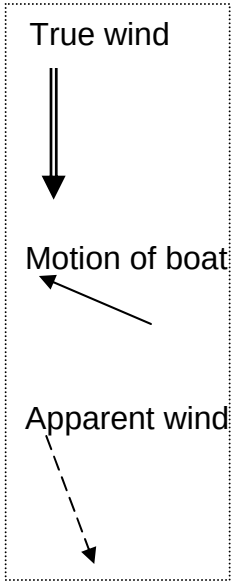
The leech is open – turbulence/vortex on the windward side



The leech is closed – turbulence/vortex on the lee side



The leech is perfect – no turbulence/vortex



Apparent wind

The wind the crew experiences is the **apparent wind**. The apparent wind changes both with the **true wind** and with the speed and direction of the boat. You might have wondered why a gust often also seems to be a lift and a lull often a header… That phenomena/impression is caused by change in apparent wind speed and direction. Notice that the true wind direction doesn't change - only the speed!