Main Sail Shape, Draft Position and Twist

Draft is the sail's position of maximum depth. The draft position determines a sail's efficiency and is an important aspect of its design.

Key
Strong wind Trim
Light wind trim

Control Mechanisms	Impact Upon Draft/ Depth/ Angle of Attack	Purpose/ Why and When to make Adjustments	Indicators
Halyard (Luff) Tension on...	- Increased luff tension moves draft forward. - Opens up the leech.	- To spill wind out of the top of the main in strong winds.	- Luff wrinkles - bubble - speed stripes - tell tales
Cunningham on... It's like a fine tune for halyard tension which is easier to adjust for upwind and downwind legs.	- Moves draft forward. - Opens up the top of the leech which depowers the sail in strong wind.	- Strong pressure causes draft to move aft. Sail is not designed for this. - Move draft forward to its correct position using cunningham.	
Halyard (Luff) tension off... A little	- to produce a smooth, fuller shape near luff.	- in light airs downwind	
Cunningham off...	- Moves draft aft. - Closes up the top of the leech.	- which powers the sail up in light airs upwind/ downwind	
Outhaul Tension *on*	- Reduces the amount of depth in the lower third of the mainsail.	- to depower the main in strong winds.	- tell tales - leech ribbons - heel angle - helm
Outhaul Tension *off*	- Increases the amount of depth in the lower third of the mainsail.	- to power the main up in light winds.	
Mainsheet *on*	- Increases the angle of attack. - Closes up the leech.	- to power the main up in light/ medium winds.	
Mainsheet *off*	Upwind - To *decrease* the angle of attack. - Opens up the leech. Down wind - to *increase* angle of attack.	- to depower the main (Spill wind out of the sail) in medium to stronger wind.	

Main Sail Shape, Draft Position and Twist

Control Mechanisms	Impact Upon Draft/ Depth/ Angle of Attack	Purpose/ Why and When to make Adjustments	Indicators	Key
Traveller *on* (up)	- To keep the boom in the centreline of the boat. - Reduces the size of the slot between the jib and the main. - Increases weather helm-'feel on the helm.'	- To maintain power in the main by keeping the leech tight/ closed. - Ensures efficient exit of airflow through both sails so that they work together to create maximum lift. - Gives the skipper a more responsive feel on the helm in light airs.	- tell tales - leech ribbons - heel angle - helm	Strong wind Trim
Traveller *off* (down)	- To allow the boom to drop below the centreline of the boat. - Increases the size of the slot between the jib and the main. - Reduces weather helm-'feel on the helm. - Downwind allows the boom/ sail to go out further.	- To reduce power in the main by opening the leech. - Ensures efficient exit of airflowbetween the sails so that the jib doesn't backwind the main. - Reduces uncontrollable weather helm in strong wind.		Light wind trim
Boom vang *on*	- Upwind Bends mast down low by forcing boom forward at the gooseneck. - Stops the boom from rising when the main is eased. - Keeps the leech tight for pointing even when the sail is eased.	- Helps to flatten off the sail in heavy air. - Allows the main sheet trimmer to more easily trim the mainsail in sudden gusts.		
Boom vang *off* *in light air.*	- Straightens mast down low by reducing pressure of boom at the gooseneck height.	- Maintains fullness in the mainsail in light/ medium air.		
Boom vang *Partially off in medium/ strong wind* when going down wind.	- Allows the boom to be easily and safely eased without damage.	- The angle between the boom and mast increases rapidly when the main is eased out a long way in strong winds due to the increased angle of attack and resulting sudden extra pressure on the sail. - Stops the boom vang from breaking!		

Theory of Lift

Sail Shape	is designed to maximise lift and minimise drag.
Sails	like wings on a plane, are lifting foils.
	are designed, like the ajustable flaps on a plane's wings, can be fine-tuned to suit particular conditions.
Basic sail shape	is described in terms of the amount and position of depth (draft)
	draft of 10% at 40% would mean draft at deepest point would be 10% of chord length (length from luff to leech) and the deepest point would be 40% from the luff.
Other sail shape factors	smoothness of shape;
	horizontal shape distribution and exit shape;
	vertical shape distribution;
	angle of attack;
	twist.
Overall dimensions of a sail	can be described as the ratio of height to width (aspect ratio)
Theory of Lift Air *Flow*	Air flowing around the outside (convex shape) accelerates
	Air flowing around the inside (concave shape) 'piles up' and slows.
	If airflow was identical on both sides of the sail a vacuum would form on the outside (convex) of the sail. Air moves faster to fill the void.
	The sail stalls when air inside (on the cancave side) doubles back around the trailing edge to fill the void. This is caused by airflow separating from the sail before it reaches the leech. The sail is ontrimmed on too tight. Tell tales disappear behind the leech.
	Sails aren't very thick. Air flows faster because of the convex vs concave shape.(Not because air on the outside flows further)
Apparent Wind	a boat's motion combined with the true wind creates our apparent wind
	apparent wind is the wind that we trim to
	apparent wind is the wind that the sails use to create lift
Forces of Lift	Bernouli's Principl; a fast moving fluid exerts less pressure than a slow moving fluid-same for air.
	Relatively low pressure on outside of sail creates lift perpendicular to the chord of the sail.
	Forces of lift create a large unwanted healing force and relatively small forward force.
	Goal of trim is to improve this mix.
Main, jib and Upwash	Two sails work together- create combined lifting force greater than the sum of which either could create alone.
	As air approaches the sail it is slowed and bent-called upwash because it occurs upstream of sail.
	Consequence of lift jib sails in a relative lift, main in a relative knock.
	This affects how we trim each sail-jib is trimmed approx. 10 degrees off centre-line, main on centre-line.

	This affect of increased lift makes jib more efficient- its lifting force is rotated further forward; creating more forward force and less heeling force.
	The main in its relative header is helped by the jib which helps to shape air-flow around it.
	Although main is trimmed to centreline airflow reaches leech.
The Slot	Not all air flows outside the jib or inside the main. Some flows through the slot. Upwash steers some air around the slot.
	Air which does flow through the slot is slowed as it approaches. It accelerates through the slot and is bent to flow in to the back of the main.
Forward Motion - Keel Lift!	The combined force is predominantly heeling force.
	Keel generates lift which nearly off sets the the side force of the sails.
	Keel, even though symetricalworks like a wing- water flow hits it from a feew degrees to leeward- water does not see a symetric shape. Sees a foil with a long and a short side.
	Flow around the inside is slowed. Flow around the outside is accelaerated; difference in pressure- lift is generated perpendicular to the angle of attack.