Tuning Your Boat

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This is a simple introduction to tuning your boat for new sailors in Sun City. The art of tuning is to adjust the sails and rigging to achieve the best performance from the boat. I will leave the reader to define for themselves their definition of “best performance”.

Suffice it to say that most sailors want their boat to perform as well if not better than the other boats on the pond. I would like to point out here that most of the boat’s performance lies in the hands of the skipper and not the current tuning of the boat; bad tuning can make your boat uncompetitive, but good tuning will not make it win unless combined with skilled skippering.

Before I begin to explain the tuning process as best as I understand it, be assured that I’m not the most skillful boat tuner at the pond, many are a lot more skilled than me. As such, the best way to get your boat tuned is to persuade one of the better skippers to tune it for you.

Let me give you some words of advice. Please don’t pester a good skipper to tune your boat for you every time you arrive at the pond. You need to learn how to do it yourself. Once he tunes it, don’t mess with it. Check it out by sailing it and measure all the elements that were tuned for you and write them down so that you can reestablish that state of tuning if it changes. Also, try to understand what the individual tuning elements are seeking to achieve. If you think you need to make changes to the tuning, do only one change at a time and keep the changes small until you get good at it. Remember that it’s not usually the boat that creates the problems, it's the guy with the controller.

BASIC BOAT TERMINOLOGY

BOW	The front of the boat.
STERN	The back of the boat.
PORT	This is the left side of the boat when viewed from the Stern.
STARBOARD	This is the right side of the boat when viewed from the Stern.
HULL	The body of the boat.
DECK	The upper surface of the Hull.
KEEL	A weighted blade that protrudes from the bottom of the hull as a means of providing lateral stability.
RUDDER	The hinged vertical blade mounted at the Stern used as a steering device.

The Rig

I snagged a copy of a DF65 instruction page that shows the elements of the rig and sails and what they are called (see below). There are a few elements that are not named that we shall need to name and explain later.

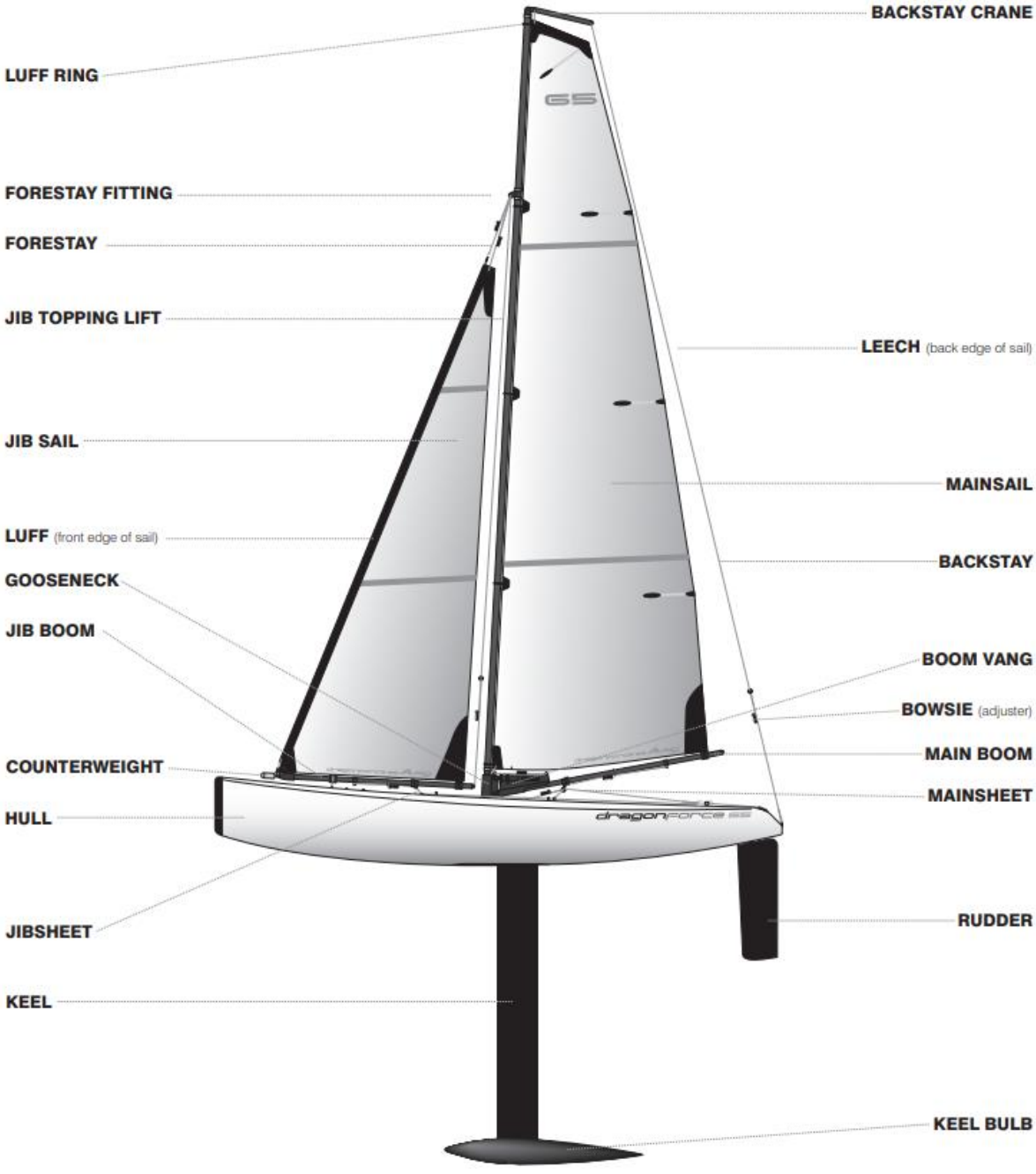
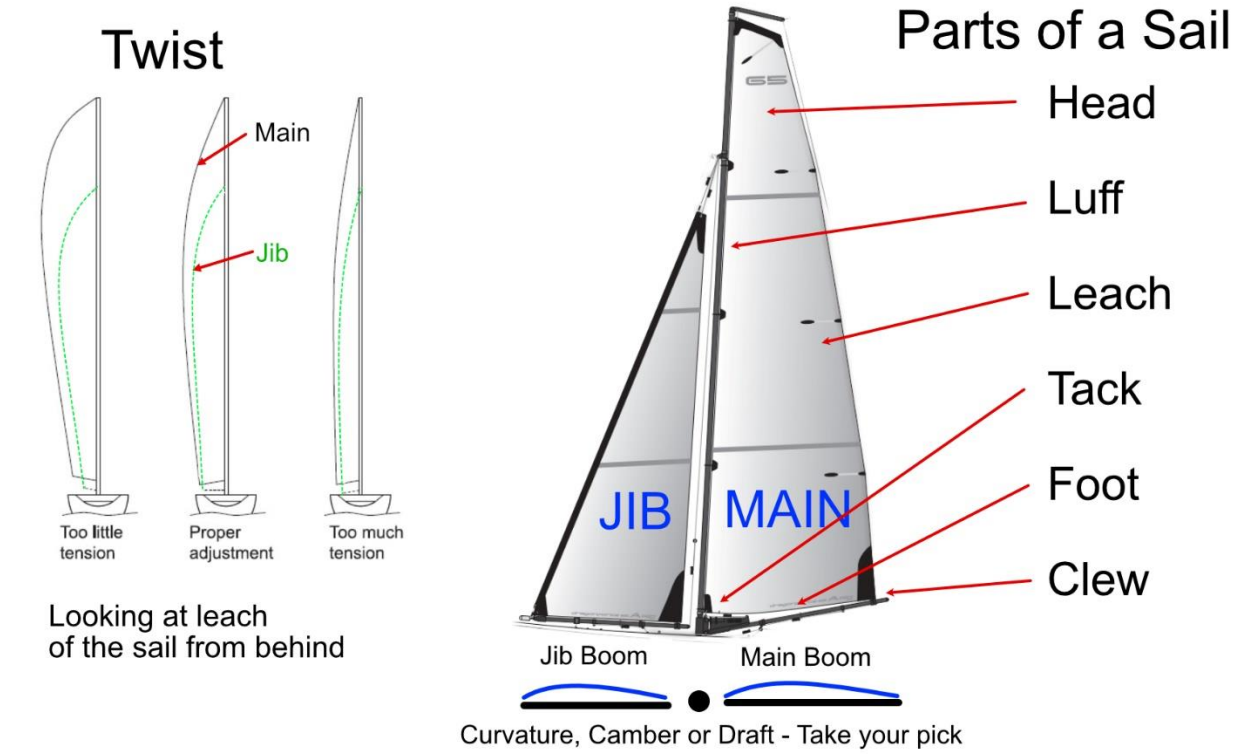


Figure 1 – Parts Terminology – *this graphic names most of the parts of your boat that you will want to become familiar with*



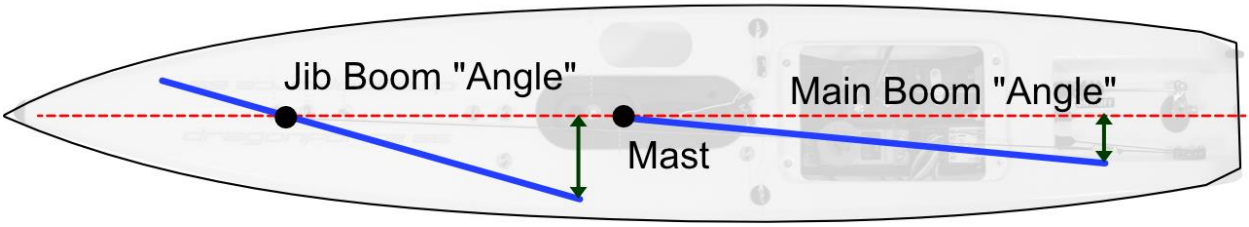


Figure 2 -- Major Tuning Elements *-- This graphic shows the three main tuning elements, sail camber (also called draft and curvature), boom angles, and sail twist.*

Tuning Elements

Mast Gate: On the Dragons the mast gate is the fore/aft position of the foot of the mast. In strong winds the mast foot is moved aft, in lighter winds it is moved forward. This movement is achieved by loosening the hex screw to line up the mast step with the lines on the holder.

Mast Rake: Mast rake is the angle of the mast in the fore and aft direction. Raking is achieved by adjusting the jib stay and backstay tensions to move the top of the mast fore and aft to the required position. With the rudder centered, if your boat tends to turn into the wind it is said to have weather helm. If it turns leeward, it has lee helm. A little weather helm is preferred. With too much weather helm, incline the mast forward. With too much lee helm, incline the mast backward.

Backstay Tension: The backstay is tightened to increase the mainsail twist in stronger winds and to bend the mast aft. In light winds, the backstay is tensioned lightly with increasing tension applied as the winds increase. If your mainsail has a significant luff curve, you may want to tension the backstay to match it in moderate winds.

Sail Shape: The sail shape is controlled by the amount of camber set into the foot of the sail. To get maximum power from the sails you want them to have a full shape with a large camber. However, to avoid being overpowered and being rounded up, the camber needs to be reduced. The sails act like airplane wings and there is a maximum camber that is effective. As the wind picks up, reduce the camber of the sails, and increase the downhaul tension to maintain the sail shape. Even in low wind conditions it is easy to have too much camber in your sails.

Downhaul Tension: The jib downhaul should be tensioned to allow the jib luff to slide up and down the jib stay between ⅛ and ¼ inch, in average winds. As the wind speed picks up, the tension can be increased. The same rule applies to the mainsail downhaul. It should be set to allow the mainsail luff to slide up and down the mast by ⅛ and ¼ of an inch.

Boom Vang: For a Victoria, once the initial position of the vang is found that gives the required twist in light air, it is rarely adjusted unless the required twist cannot be achieved with backstay tension alone. For Dragons, mainsail twist is usually adjusted using the vang rather than the backstay, although a combination of both is typical.

Main Boom Angle: Typically, the required angles of the main boom are translated into distance measurements that are marked on the deck. This angle is the minimum angle of the boom when fully sheeted in. In light winds the boom is set at a small angle and is let out as the winds increase. If your boat is heeling over more than its companions on the water, you may need to increase your main boom angle a bit to keep your boat more upright and thus faster.

Jib Boom Angle: Again, the jib boom able is translated to distance measurements. Mine are marked on the deck. In light winds the angle is kept small. As the wind increases that angle is increased with it. For the best results you want the jib to luff just before the main as your boat heads up into the wind.

Jib Topping Lift: The jib topping lift adds twist to the jib sail. In light winds the tension should be only enough to slightly open the slot between the jib and the main. As the wind increases the topping lift tension is increased to open up the slot and to twist the jib to match the main's twist and to depower the jib up high in the sail. As you turn the boat's head to wind watch the luffing of the leading edge of the jib. Ideally both the top of the sail and the bottom should luff together.

Tuning Your Boat

Each class of boat has its own tuning requirements. Within each class, the type and source of the sails being used have their own tuning requirements. For example, the Victoria has shrouds that are subject to tuning needs depending on wind conditions to slope or bend the mast fore or aft in conjunction with the backstay and jib-stay tension. The Dragons don't have shrouds and depend only on the backstay and jib-stay tensions to tilt or bend the mast fore and aft.

Victoria Tuning

On my Victoria I typically use paneled sails made by Sirius. These sails have a built-in camber that maintains the sail curvature from the foot to the head, unlike single panel flat sails as used on the Dragons where the camber set in at the foot rapidly reduces higher in the sail. When I bought these sails, I received a tuning instruction sheet from Sirius. This sheet explained that the design sail camber was 8%, thus, given a mainsail foot length of 14 inches (355 mm), the camber at the foot should be set to 1.12 inches (28.5 mm). The Sirius jib-sail foot is 11 inches (280 mm), giving a required camber of 0.9 inches (22.3 mm). If you have Victoria sails from another supplier, you should check the tuning instructions that should have been supplied with their sails.

Victoria					
Quick Reference Tuning Chart					
Wind	**Speed**	**0-5 mph**	**5-10 mph**	**10-15mph**	**>15 mph**
Mast Rake	**Inch (mm)**	**43 ¾ (1111)**	**44 5/8 (1133)**	**45 (1143)**	**45 ½ (1155)**
Backstay	**Tension**	**light**	**snug**	**tight**	**tightest**
Camber (mm)	**Jib**	**25**	**23**	**20**	**18**
	Main	**35**	**30**	**27**	**24**
Boom (mm)	**Jib**	**50 - 63**	**63 - 76**	**76 - 88**	**88 - 100**
	Main	**25 - 38**	**38 - 63**	**63 - 76**	**76 - 100**
Twist (mm)	**Jib**	**50**	**57**	**62**	**70**
	Main	**55**	**50**	**45**	**40**

Table 1-- Victoria Tuning Chart -- *Once you have sailed your boat and have achieved a performance you are happy with, edit this chart to match your boat's tuning.*

The tuning instructions for my Sirius sails also included values to use for the boom angles and the sail twists. The recommended jib boom angle is 10 degrees. I measured this angle with a protractor using the jib tie-down point as the center and marked the deck with a Sharpie. The main boom should point either to the near notch on the cockpit for low winds or to the join of the cockpit and transom for higher winds.

My Sirius instructions give an optimum value for the jib twist of 10 degrees, measured half-way up the leech of the sail. I marked this spot with a Sharpie and measured its distance from the topping lift as a reference. Sirius recommends setting the main twist to match the lower half of the jib twist. As the wind gets stronger, Sirius recommends that the backstay tension and jib-stay tension be adjusted to increase the main's twist and reduce the jib's twist.

As said above, tuning a Victoria depends very much on the kind and source of the sails being used. Here I've shown the values I use to tune my Sirius sails. If you have Sirius sails too, these values should work for you. If you have sails from a different source, these values may be helpful but may differ from those recommended by your sail supplier. I'm also going to use the values and recommendations presented in Ray Seta's tuning document – "Time to get Serious with Tuning" -- http://www.rugeleymodelclub.org.uk/Victoria_Tuning.pdf.

You can also find many videos on the Internet about tuning a Victoria, including this one by our own Mike Biggs -- https://www.youtube.com/watch?v=roytVZ5GOO8.

To set the **Mast Rake**, the first thing to do is to measure 40 1/8th inches (1019 mm) up the mast and put a Sharpie mark there, close to the back of the mast. To set the mast rake, measure from this mark to the edge of the transom on the boat centerline, put a mark here also. Depending on the wind speed, using the tuning table shown above, set the distance as required by adjusting the forestay and jib halyard while maintaining the chosen backstay tension. Check the shroud tension after setting the mask rake. Personally, I never change the mask rake on my boat.

The **Backstay Tension** will affect the twist in the main. In light winds you want very little backstay tension. As the wind speed increases you will want to increase the tension. It's not possible to quantify the backstay tension as a number but you do want to match the required twist while keeping the tension low to high, depending on wind speed.

To set the **Sail Camber**, set the sheeting to bring the sails fully in. Measure the distance from the sail boom to the sail at its foot and adjust to achieve the required value. Do not distort the sail shape while making this measurement. As you will see in the chart, as the wind increases, the camber is reduced. To make is easy, this value is measured at the middle of the boom although you want the maximum camber to be at between 35% and 45% of the foot from the tack.

To set the **Boom Angle**, measure from the tip of the boom to the center of the mast for the jib boom and to the boat's centerline for the main boom. Adding Sharpie marks to the deck at the appropriate positions will greatly help with rapid tuning. As wind speeds increase, boom angles can be increased to prevent overpowering of the boat.

To set the **Sail Twist**, firstly place a Sharpie mark halfway up the sail leech on each sail. This will be used as the measuring point. To set the jib twist, measure from the measuring point to the topping lift halyard and adjust the topping lift to get the required value. To set the main twist, hold the main boom along the center line without lifting it or forcing it down. Measure from the measuring point to the backstay and adjust the vang and/or backstay to get the required value. I rarely need to adjust the vang on my Victoria, getting the setting I need via the backstay tension. As the wind increases, increase the twist of the main and decrease the twist of the jib to prevent rounding up of the boat.

Dragon Tuning

The Dragons use flat sails with no paneling and no built-in camber. With these boats there's any number of instruction videos and tuning tables available on the Internet. Suffice it to say that the tuning of a DF65 or a DF95 follows the same procedures as used with a Victoria, albeit with quite different values.

The DF65 and DF95 tuning guides shown below give data that will provide a good baseline tune for your boats. If you have a particularly good day, it is wise to record the wind speed and the tuning values of your boat on the day. In this way you can always recover the tune for similar wind conditions.

DF65 Tuning

In the DF65 tuning guide the **Mast Gate** is shown as the line at the bottom of the mast that the mast should line up with. This setting is not particularly critical. I leave mine in the middle setting and don't mess with it.

The **Mast Rake** for the A+ sail is the distance measurement from the backstay hole in the crane to the backstay hook on the transom. For the A, B and C sails, the measurement is taken from the top of the forestay tang to the backstay hook.

Dragonforce 65 Tuning Guide					
RIG >		A+	A	B	C
Wind speed >		0 – 10 kts	8 – 15 kts	> 15 kts	> 20 kts
Mast Gate	use indicator at mast bottom	3rd line	4th line	5th line	Max aft
Mast Rake	A+ A, B, C	951 mm	785 mm	698 mm	620 mm
Mast Bend	adjust with backstay	soft	match luff	match luff	match luff
Sail Camber	Jib	20 – 25 mm	15 – 20 mm	15 – 20 mm	10 – 15 mm
	Main	25 – 30 mm	15 – 25 mm	15 – 20 mm	10 – 20 mm
Boom Angle	Jib	38 – 43 mm	40 – 45 mm	40 – 45 mm	40 – 45 mm
	Main	8 – 15 mm	10 – 20 mm	15 – 25 mm	15 – 25 mm
Sail Twist	Jib	50 – 60 mm	40 – 50 mm	30 – 45 mm	35 – 45 mm
	Main	40 – 55 mm	65 – 75 mm	55 mm	45 mm

The **Mast Bend** is the amount of bend induced into the mast by adding tension to the backstay without loosening the forestay. If you examine the main sail carefully you will discover that the luff has a small amount of curvature from foot to head built into it. By tightening the backstay, it is possible to bend the mast aft so that its bend matches the main sail luff curve. Again, I don't do this much as it contributes a marginal improvement to my sailing.

For the DF65, the **Sail Camber** is measured from the center of the sail boom to the sail itself at the foot of the sail. Do not distort the shape of the sail when you make this measurement. For the A+ sails, as the wind speed increases the camber is reduced by about 40% for the jib and 50% for the main. Sail Camber is a critical tuning value for good sail performance.

The **Boom Angle** is given as a distance measurement for the DF65. For the jib boom, the measurement is taken from the tip of the boom to the center of the mast at the sheeted-in position. It's best to put Sharpie marks on the deck (both sides) to record these positions. For the main sail boom, the measurement is taken from the end of the boom to the boat's centerline, again in the sheeted-in condition. Once again, a few Sharpie marks on the deck will aid in the recovery of these positions quickly. The Boom Angle adjustment is also a critical tuning value for good sailing performance. As the wind speed increases the boom angles can be increased. The adjustment of the jib boom angle controls the size of the slot between the leech of the jib and the luff of the main. A smaller slot suits low wind conditions while a larger slot is preferred for high wind speeds. Exactly what size suits what speed is the result of trial and error. Boom angles and slot size are also critical tuning values to be retained and reproduced to get the most from your boat.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Sail Twist may be a mystery to some newcomers to sailboats (it was to me), but it is also an important factor in tuning your sails. For the DF65 the Sail Twist is given as a linear measurement rather than an

angle. Place a Sharpie mark halfway up the jib's leech. To set the jib twist, bring the sails into the sheeted-in position, and measure the distance between the Sharpie mark and the topping lift halyard. Without disturbing the sail shape, adjust the topping lift bowsie until you achieve the desired value. To set the twist in the main sail, bring the boom into line with the centerline of the boat and measure the distance from the backstay to the main's leech at the middle batten. Be careful not to lift or drop the boom while doing this. Assuming that the backstay tension has already been set, adjust the vang to achieve the desired value. You may note that increasing backstay tension will increase the twist of the main, and vice versa. You can use the main sail twist to adjust for rounding. Reduce if bearing away, increase if rounding up.

DF95 Tuning

DF95 tuning proceeds along the same lines as the DF65 tuning, so I apologize if this part seems like a repetition of the above – it mostly is.

In the DF95 tuning guide the **Mast Gate** is shown as the line at the bottom of the mast that the mast should line up with. This setting is not particularly critical. I leave mine in the middle setting and don't mess with it.

For the DF95 the **Mast Rake** is the given as the distance measurement from the bow bumper/hull joint to the front crane hole.

Dragonflite 95 Tuning Guide					
RIG >		A	B	C	D
Wind speed >		0 – 10 kts	8 – 15 kts	> 15 kts	> 20 kts
Mast Gate	use indicator at mast bottom	5th line	5th line	8th line	8th line
Mast Rake	A, B, C, D	1135 mm	980 mm	780 mm	710 mm
Sail Camber	Jib	25 mm	30 mm	15 mm	15 mm
	Main	30 mm	30 mm	35 mm	35 mm
Boom Angle	Jib	55 mm	40 mm	60 mm	60 mm
	Main	35 mm	20 mm	20 mm	20 mm
Sail Twist	Jib	70 mm	45 mm	65 mm	65 mm
	Main	60 mm	55 mm	45 mm	45 mm

Table 3 – *DF65 Tuning Chart by Phil Burgess – January 1st 2020*

The DF95 tuning guide does not have values for mast bend.

For the DF95, the **Sail Camber** is measured from the center of the sail boom to the sail itself at the foot of the sail. Do not distort the shape of the sail when you make this measurement. As the wind speed increases, the camber can be reduced by a few mm. When the wind speed falls, the camber can be increased, again by a few mm. Sail Camber is a critical tuning value for good sail performance.

The **Boom Angle** is given as a distance measurement for the DF95. For the jib boom, the measurement is taken from the tip of the boom to the center of the mast at the sheeted-in position. It's best to put Sharpie marks on the deck (both sides) to record these positions. For the main sail boom, the measurement is taken from the end of the boom to the boat's centerline, again in the sheeted-in condition. Once again, a few Sharpie marks on the deck will aid in the recovery of these positions quickly. The Boom Angle adjustment is also a critical tuning value for good sailing performance. As the wind speed increases the boom angles can be increased. The adjustment of the jib boom angle controls the size of the slot between the leech of the jib and the luff of the main. A smaller slot suits low wind conditions while a larger slot is preferred for high wind speeds. Exactly what size suits what speed is the result of trial and error. Boom angles and slot size are also critical tuning values to be retained and reproduced to get the most from your boat.

For the DF95 the **Sail Twist** is given as a linear measurement rather than an angle. Place a Sharpie mark halfway up the jib's leech. To set the jib twist, bring the sails into the sheeted-in position, and measure the distance between the Sharpie mark and the topping lift halyard. Without disturbing the sail shape, adjust the topping lift bowsie until you achieve the desired value. To set the twist in the main sail, bring the boom into line with the centerline of the boat and measure the distance from the backstay to the main's leech at the middle batten. Be careful not to lift or drop the boom while doing this. Assuming that the backstay tension has already been set, adjust the vang to achieve the desired value. You may note that increasing backstay tension will increase the twist of the main, and vice versa. You can use the main sail twist to adjust for rounding. Reduce if bearing away, increase if rounding up.

Tuning Tools

Many skippers use their fingers or knuckles as measuring instruments to tune their boats – two fingers or two knuckles for the main's camber, for example. For

the rest of us a six-inch ruler marked in inches and millimeters is the most useful tool to help with tuning. Another tool used to replace the humble ruler is the SailGauge. This is a plastic tool with notches along each side that is used to measure the sail cambers, the boom angles, and the twist distances.

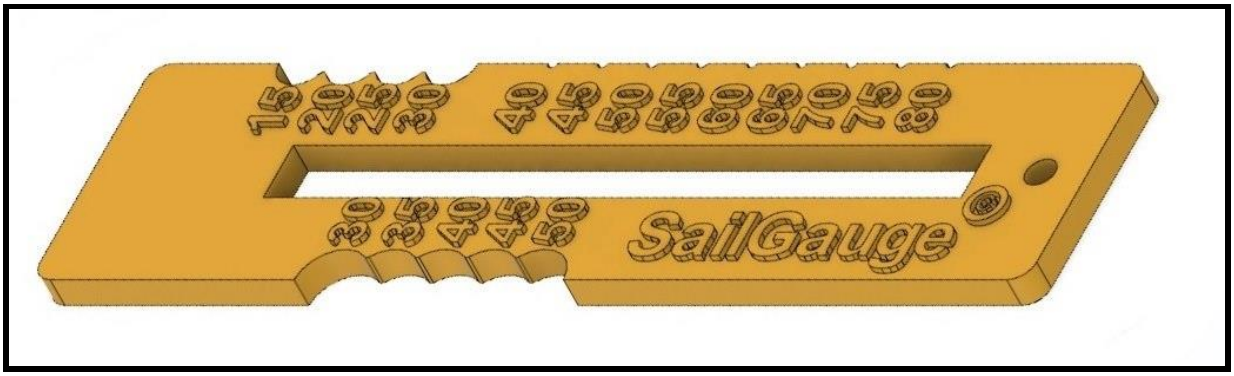

Table 4 -- ***This is the SailGauge used to measure the cambers, boom angles and twists. It is available for purchase at various Internet sites*** -- ***https://www.tmrcboatyard.com/manufacturer/sailgauge-productions/.***

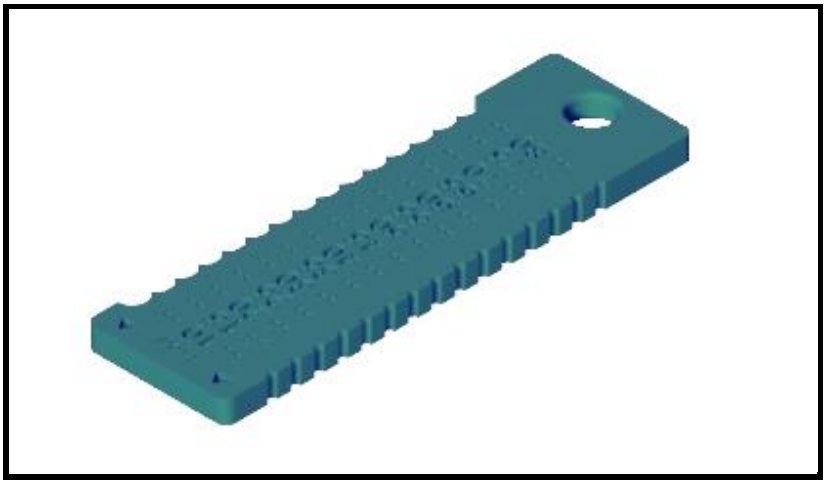

Table 5 -- ***This is a 3D printed trim block that performs the same functions as the SailGauge and is made by, and available from the author.***

Whether you get one of the expert sailors to tune your boat, or you use your fingers, a ruler, or a specialized gauge, whenever you see your boat performing well, be sure to record the trim values so you can use them the next time.

Good luck with your tuning and sailing. I hope to see you at the pond soon.

SUN CITY SAILING