

Kashy Fins Design Brief  
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## ***FORMULA WORLD CHAMPION 2008-2013***

### **OVERVIEW 2014**

Upon the arrival on the windsurfing scene the performance of Kashy fins changed the way racers viewed windsurfing fins.

- 1) Any person could get the same performance as the world's top pros that were sponsored by the big name fin companies. This leveled the playing field allowing talented sailors to instantly get to or near the top of the fleet. How was this possible you might ask? Kashy fins are built to a level of consistency that had never been achieved in windsurfing fins, such that each fin has nearly identical performance. As such racers did not have to buy many fins and pick the best one. Sailors wanting to fill out a racing quiver could just order the sizes and stiffness's they wanted and have fins equivalent to or better than the fins of the best sponsored riders from other brands.
- 2) Kashy fins showed that durability and performance could be combined into one product. Kashy fins have shown to have virtually no loss of performance due to wear and the total breakage of fins is less than 2%. What other windsurfing product is still competitive at the top level after many years of use?

Due to the quantum leap in performance, the demand for Kashy fins exceeded the availability for nearly 10 years. This inspired sailors from around the world to build their own fins. In 2007 there were 6 brands of windsurfing fins represented at the Formula World Championship. By 2013, 25 companies had fins registered. Many companies now deliver high quality fins and in 2014 the Formula World Championship was won on a different brand by one of the world best riders who is sponsored that company and he had previously won the worlds on Kashy fins. The increase in capacity of high quality fins has taken some of the load off of Kashy Fins. ***Now Kashy fins can be purchased without the 2-3 year wait that was the norm since 2006. (see below)***

### **INTRODUCTION**

Through detail engineering analysis, systematic measurements, and many prototypes and with a long windsurfing and sailing background, a line of high performance formula windsurfing fins has been developed. The design combines a low drag foil with a plan form that improves control and allows the fin to be ridden in "3d" mode. This means that while sailing upwind the rider can choose to point high and grind to weather, or to bear off and blaze below the competition. Off the wind and reaching the fin is stable, predictable and fast. Each fin is hand made and fine finished to exacting tolerances. Each fin is custom. Rake angle, stiffness and length are all variables which have been studied.

The first custom prototypes came out just before the US Nationals in 2004. At the 2005 US Nationals, Riders using K-Series fins placed First in both the Grand Masters and Senior Grand Masters Divisions.

At the 2005 Formula World Championship several racers used K-series fins; the final race was won on a K67XS fin. Numerous other National titles were won in 2006 including, Argentina, Australia, Norway, Sweden and USA. Other 2006 event results include: Numerous San Francisco regattas, The Nordic Cup (1, 2, 3, and 6), Silvaplana (1st, 3rd), Formula Europeans (3rd), Formula World Masters (1st) and Formula Worlds Korea (4th), and Brazilian Grand Prix (1<sup>st</sup>, 2<sup>nd</sup> 4<sup>th</sup>). In 2007 many national and Formula Grand Prix events were won by competitors using Kashy fins.

In the 2007 Formula Worlds in 2007 sailors using Kashy fins captured positions 2-5, only missing was the world championship.

In 2008 the good results continued and in the Worlds in Portimao 14 of the top finishers and all of the top 6 used Kashy fins. In 2009 championships were again won by sailors using Kashy Fins.

In the 2009 World championship in Santa Pola, 23 of the top 25 guys registered Kashy fins and the World champion and Vice Champion both used Kashy fins.

In 2010 the World Champion used Kashy Fins. In the top 4 positions only one fin registered was not a Kashy and in the top 10 only one sailor registered no Kashy Fins.

In 2011 the world champ used Kashy and all but one sailors in the top 10 registered at least one Kashy fin with 23 of the 30 fins registered being Kashy.

In 2012 the world champ won using a Kashy fin and Kashy was the most registered brand in the top 10 and 25 sailors. Also in 2012 Kashy fins started producing Slalom fins and they were immediately seen at the front of the PWA pack.

In 2013 the world champ won using Kashy fins, in the top 8 positions 46% of the fins registered were Kashy. And of the total of 318 registered fins in 22 brands 18% were Kashy. Again in 2013 many top PWA pros have used Kashy Slalom fins successfully.

In 2014 this was the first worlds that the world champ in Formula did not use Kashy fins since 2007. And indeed the top 4 riders were all sponsored by other brands. This was the first year since 2007 that team riders sponsored by fins companies won a world championship. Proving that several companies have been able to build good fins for their top riders and guys on good product can win at the top level. Also in 2014 Kashy fins were used by a host of riders on the PWA and two of the three PWA podium positions were taken by racers on Kashy fins.

Kashy fins are in a continuous state of development:

In 2007 is a slight modification of the construction to give more control and better angle upwind while enhancing speed on all points of sail.

In 2008 several improvements and developments were implemented. The first was to increase the durability of the fins to reduce wear and breakage. Another was the shaping of the tips to reduce drag and finally a set of new rakes was developed.

In 2009 strength and finish work were focused on

For 2010 the development continues with more focus on relative stiffness between the tip and the base of the fin.

In 2010 Kashy started producing Slalom fins for PWA professionals and in 2011 several top pros were using them

In 2012 more strength improvements were made and significant durability improvements were made in the trailing edge strength and durability.

Also in 2012 for formula fins there was a refinement of the available stiffness with many guys choosing to go for a new option sXS standing for soft Extra Soft.

And in summer 2012 a second option for slalom fins was developed that allows the nose of the slalom boards to ride higher. This is called Nose Lift. (for more see the section on slalom fins)

Finally in 2012 several very very soft fins have been tested for the very wide boards. The tests are on-going. But the new stiffness include XXXS and sXXXS.

In 2013 minor changes in construction allowed even stronger fins will remaining highly flexible and even greater attention to fine tuning the finish has been incorporated

## **STIFFNESS**

Designing and building wing sections (fins) to ride fast in conditions that are constantly changing while maintaining low drag requires consideration to not only foil section choice but also the construction of the fin. Riding in flat water with steady wind the fin can have a very constant load, but as the water gets rougher the load on the fin begins to pulse with periods of relatively constant loads followed by low and high load spikes. The overall stiffness, flex and twist pattern will affect the load on the fin and the load on the rider; a rider using a very stiff fin may get tired early and thus start to sail slower. A fin that is overloaded may go into a stall or into a load range that increases the drag and thus reduces speed. The following standard flexes are available:

XXS	Extra-Extra Soft
sXS	soft Extra Soft
XS	Extra Soft
S	Soft
M	Medium
M+	Medium +

Measurements of these standard constructions show that the maximum variance between fins of each stiffness range about +/-5% maximum from the nominal goal and each stiffness designation is about 20% stiffer than the next lower stiffness. To explain the Medium fin is 1.2 times as stiff as the Soft. The span-wise flexibility has been measured for all models, and the tip of the fins is more flexible than the base. This is a natural phenomenon, one can see this type flex pattern in many things in nature, and a simple example is a tree. If a tree were as stiff near the top as at the bottom many more would be pulled up by the roots when the winds gusted. The ability for the top of a tree to flex great distances helps to keep it rooted during severe winds. Similarly when the fin tip flexes the load on the base is reduced, thus keeping the fin from breaking and minimizing the rolling of the board on the surface of the water.

As stated above tip flexibility has been studied in late 2009 and continues in 2010. With the newer boards that have very wide tails the tip flex really affects the power and control of the fin. A standard 70 with standard tip flexibility is very good in all conditions; fins with both more and less tip flexibility

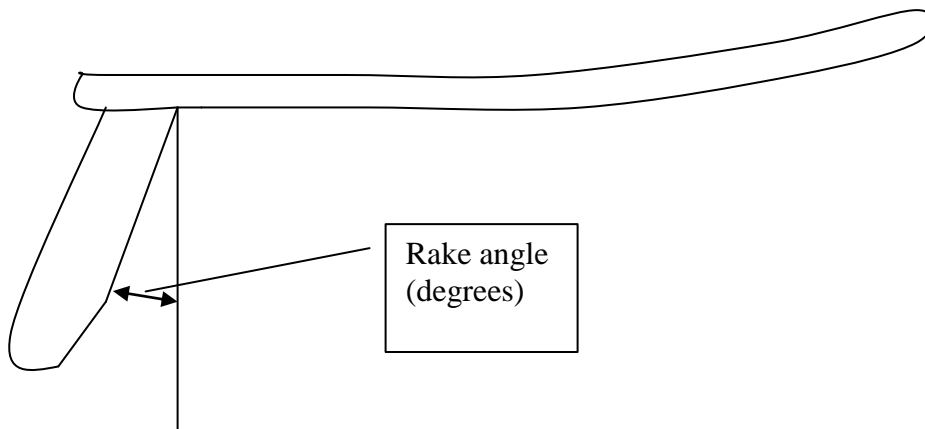
have been developed. The fins with more tips flex work better in light winds when control is not an issue, and fins with hard tips have more control and thus more speed in overpowered conditions.

One of the major contributors to tip stiffness is the size/thickness. Size of the tip will be discussed below under Fin Size, but I will discuss the effect on stiffness here. When the chord gets longer the fin thickness for a foil of a certain % thickness gets bigger. This can radically change the stiffness, to keep the fin tip a reasonable stiffness the structural lay-up is changed. In the big cut fins (see below) there are limits to the flexibility of the tip. Through additional design, prototyping and testing, fins are now available with increased and decreased tip flexibility from the models of 2008/2009. This is a relative change and also fin tip stiffness is related to fin size as described above.

### **RAKE**

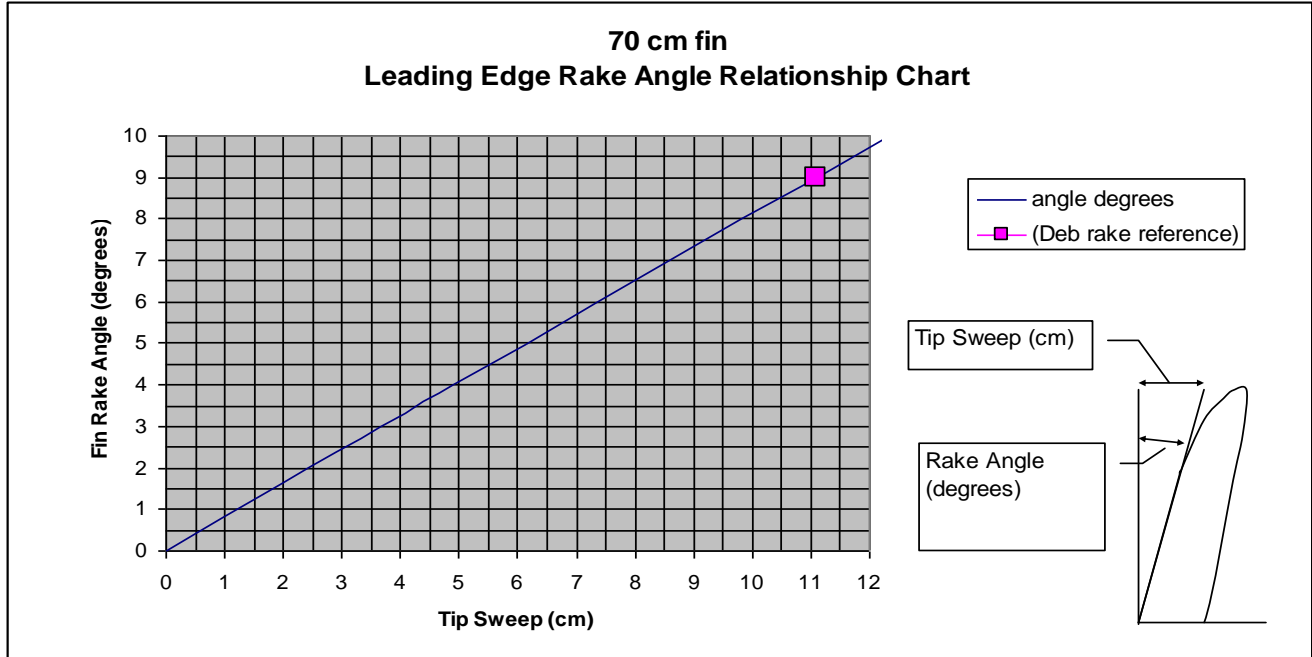
Optimum rake depends on the rider skill, board setup and design. In general it seems that the more vertical the fin the more lift it creates, the more swept back it is the easier it is to control and the more the board will sit down on the water. As an example a weed fin is easy to control and the board sits on the water even in overpowered conditions, but even large weed fins don't provide the lift of a much smaller standard vertical type fin.

The rake is measured with a simple protractor, in degrees, using the leading edge at the base of the fin. Some manufacturers use distance of sweep in cm for the tip, in some cases with a reference which is not zero centimeters of sweep. Using leading edge angle gives a measurement that is independent of history. It can be used for any fin length and for fins with curved leading edges. Positive rake is for fins swept back of perpendicular to the board. See sketch below

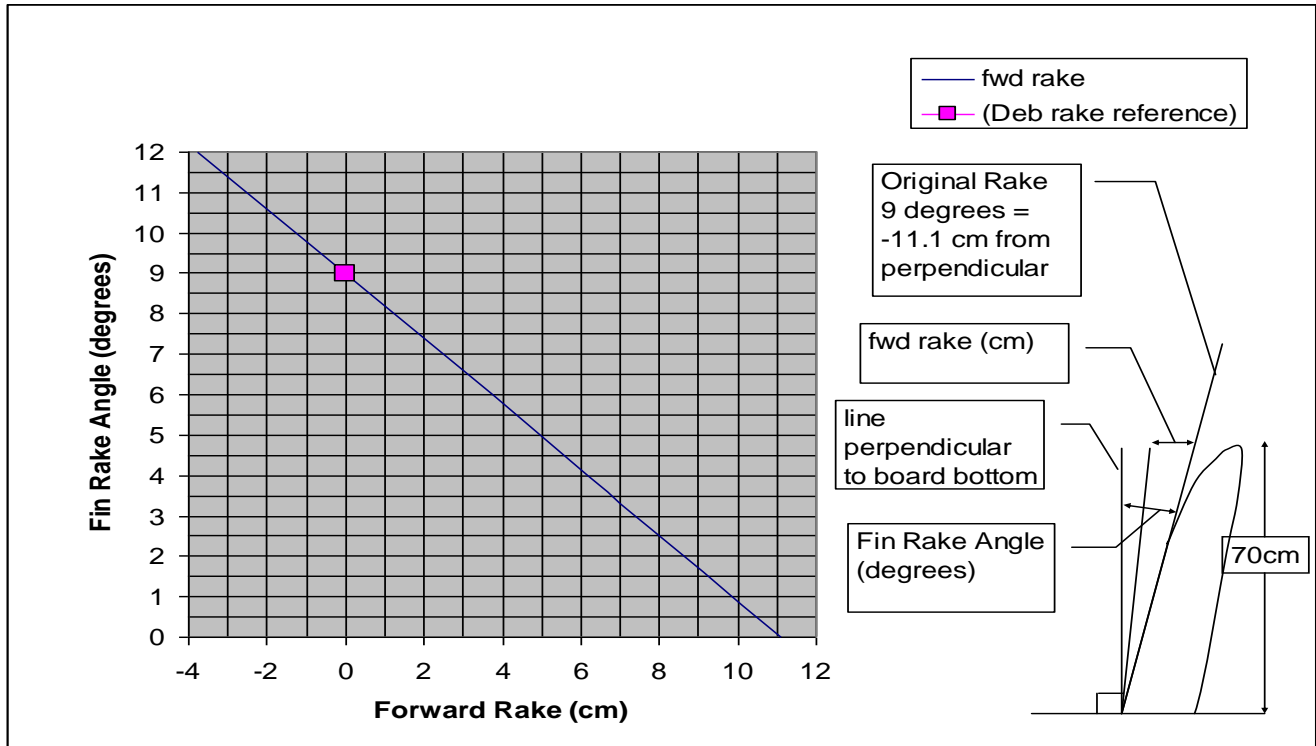


The most requested rakes are 4.0 and 4.5 degrees. The 4.0 degree fins give a bit more low end, while the 4.5 degree rake gives a freer ride.

To compare the rake measured in degrees to the sweep measurement in cm one can use plot 1 for 70 cm fins. To relate Deboichet terminology of rake to rake angle one can use plot 2, be aware that the standard is based on an original rake of 9 degrees which is a sweep of 11.1 cm.



Plot 1. Rake angle vs. tip Sweep (exact!)



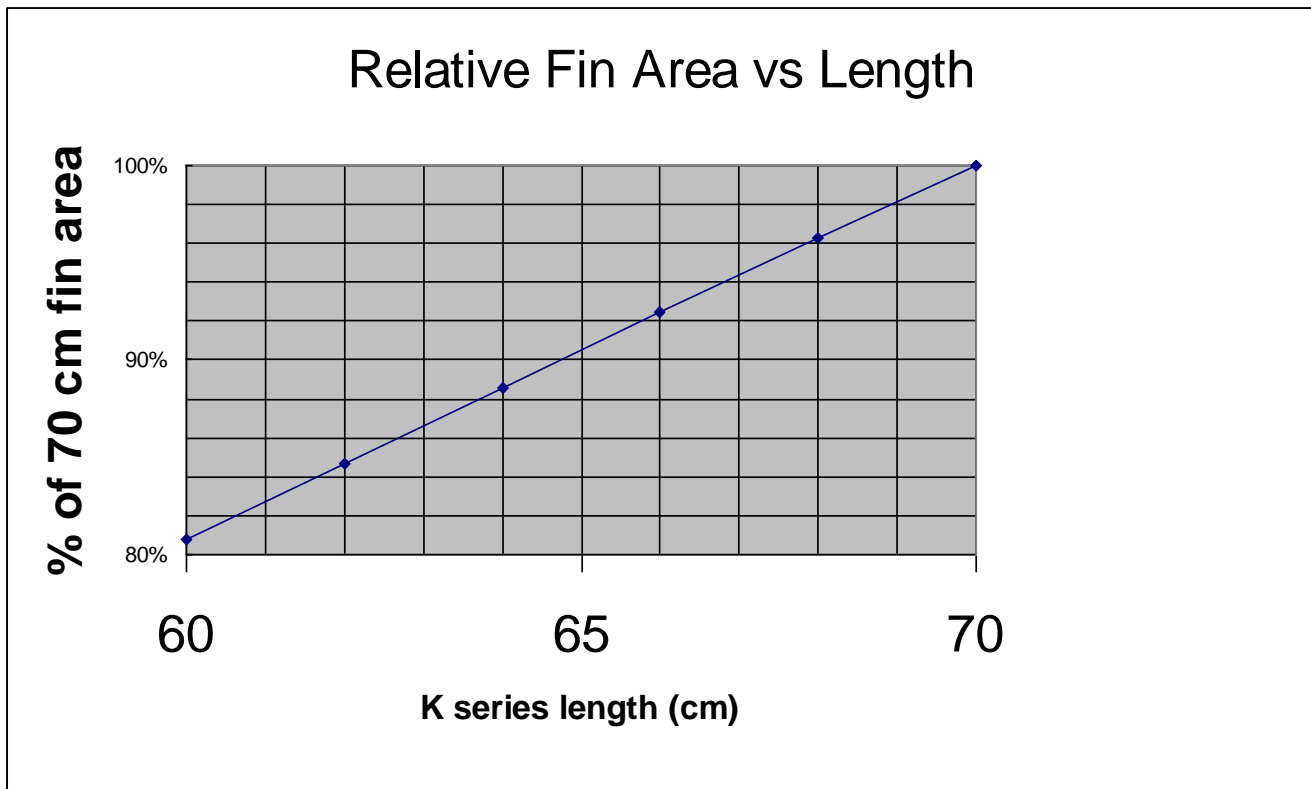
Plot 2. Rake angle vs. Forward Rake

In 2008 rake was studied again, with a better understanding of the problem, new structures developed that now allow building of fins with more rake. Fins with rakes of 5.5 and 7.0 degrees are now available in all models. Many prototypes were built with very good results. The reaching capability for the more raked fins is greatly improved. They are easier to sail and give more control in high wind with very little in any loss of upwind angle. Upwind and on deep reaches downwind the added rake helps keep the board down on the water and reduces the chance of it flying up or tail-walking.

**FIN SIZE**

Fin sizes are limited to a maximum length below the board to 70 cm for Formula racing. As board speed goes up area requirements go down to provide equivalent lift. Many sailors have found they can go faster with smaller fins for two reasons. The first is a smaller fin if operating in its design range will have less drag, and the second a smaller fin is easier to control. K-series fins have been built and raced for Formula racing 60cm to 70cm. One 46cm was even tested for big slalom boards. The surface area of the standard fin when cut off from the base is shown relative to the full 70 cm area in plot 3. Using this plot it can be found that a fin that is 66 cm has only 92.5% of the area of the K70 fin. This is similar to a 9.0 sail has 90% of the area of a 10.0.

Photo 1, shows 5 sizes of fins. The four fins on the right are 70, 67, 64 and 62 cm. The fin on the left is an 85 cut to 70 and will be discussed below in the larger fin section. Notice that the tips of each of the four on the right are all the same, that is the area is cut from the base.



Plot 3. Relative fin area for cut K70 fins



Photo 1a. Different size fins

### **LARGER FINS**

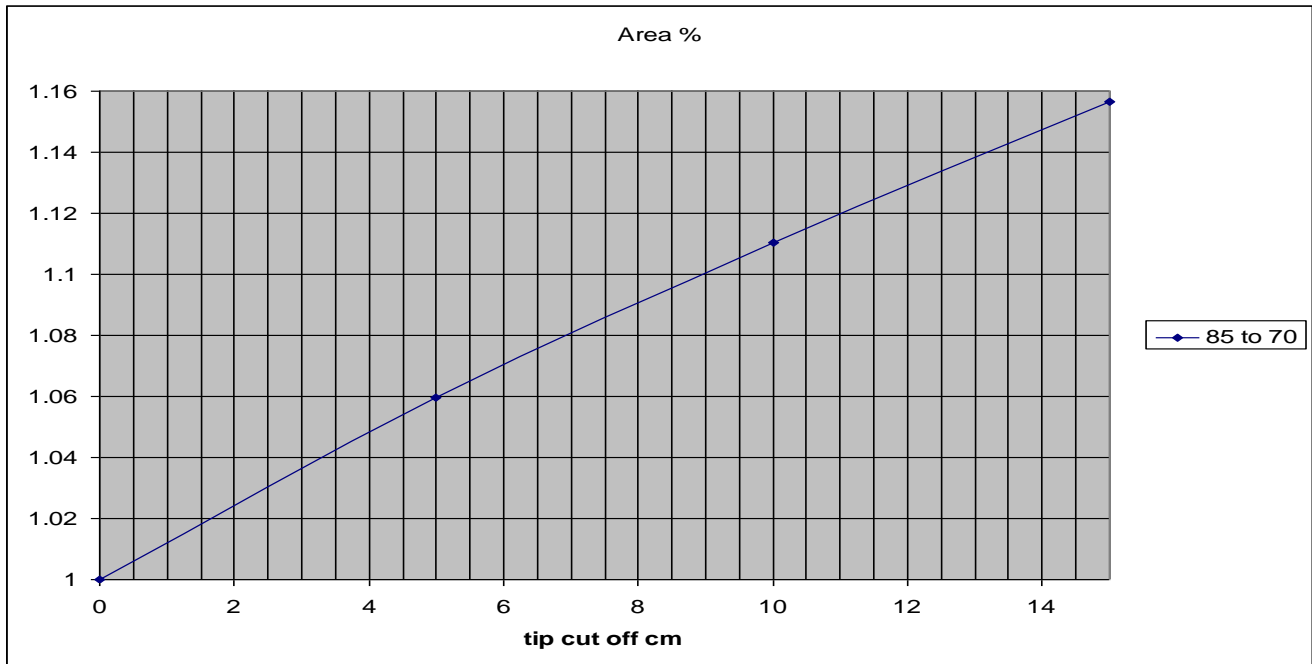
Construction of a new mold has made it possible to build fins with larger areas than the standard 70 cm fin. The new mold is identical to the original for the tip 70 cm but the cavity has been extended another 15 cm. This allows the foil to be made to 85 cm and then the final fin to be cut from any portion of this length. If 15 cm is cut from the tip the fin has almost 116% of the original 70 cm fin area (see plot 4), it also has a much greater tip chord. If the 15 cm is cut from the base then the fin has 100% of the original area or stated another way, “it is the original fin”. Any variation is possible. As boards have gotten wider, the “Cut” fins have become more popular. At the Formula Europeans in 2008 one sailor used a K83-13XS and really dominated the light air races. Another example fin is a K78-8XXS which has 109% of the area and a stiffness of XXS! This was not simple because as the fin grows in chord and area, the stiffness grows quickly. In Photo 1a the biggest fin that is available is shown on the left. Photo 1b shows just two unfinished fins the one on the right is the standard K70 the one on the left is an 85 cut to 70 cm. In 2008 the shaping of the tip was refined to lower the tip drag and the new shape is shown in photo 1c.



Photo 1b. K85-15 on left, K70 on right (prior to finish sanding!)



Photo 1c. Two "cut" fins with the 2008 tip shaping.



Plot 4. Area ratio of a "Cut" fin to a K70 fin vs how much cut off the tip .



## **PURCHASING**

Fins are labeled as follows

K67XS-T0 where K is for K-series, 67 is the length, and XS is for extra soft, and T0 means that 0 cm is cut from the tip. Each fin now has the rake and a serial number also engraved.

The larger fins were labeled K78-8S, now they are labeled K70S-T8, for K series, 78cm fin less 8 cm from the tip, and S for soft.

Due to the high demand and the fact that this is not Dave's full time job, delivery times are hard to estimate accurately. There is only a single list called Regular order and fins are \$800 each. Regular orders for 2014 are forecast to be 3-6 months. For customers needing immediate service there is an expedite option that adds \$300 and the fins can be delivered in 3-8 weeks. Shipping and wire transfer or paypal fees are added.

Contact [kashyr@cox.net](mailto:kashyr@cox.net) to get current delivery times, and specify length, stiffness, and leading edge rake angle with your order. Shipping will commence when fin is finished and payment has been received. When a request for fins is received it is put on that list when production comes near then the purchaser is contacted to confirm details.

## **CONSISTANCY and CUSTOMER SATISFACTION**

Each Kashy fin is made personally by Dave Kashy and is checked for all aspects of quality prior to shipping. Assistance with selection of the proper fin or quiver is one of the services provided.

While there have been some breakages, the number is very small. Most Kashy fins even the 4-5 year old ones are still in service which is a rarity for Formula Windsurfing equipment. Thus far only one fin out of over 400 has been returned for "lack of performance" and a replacement was sent out prior to verification of the customers claim.

## **SLALOM FINS**

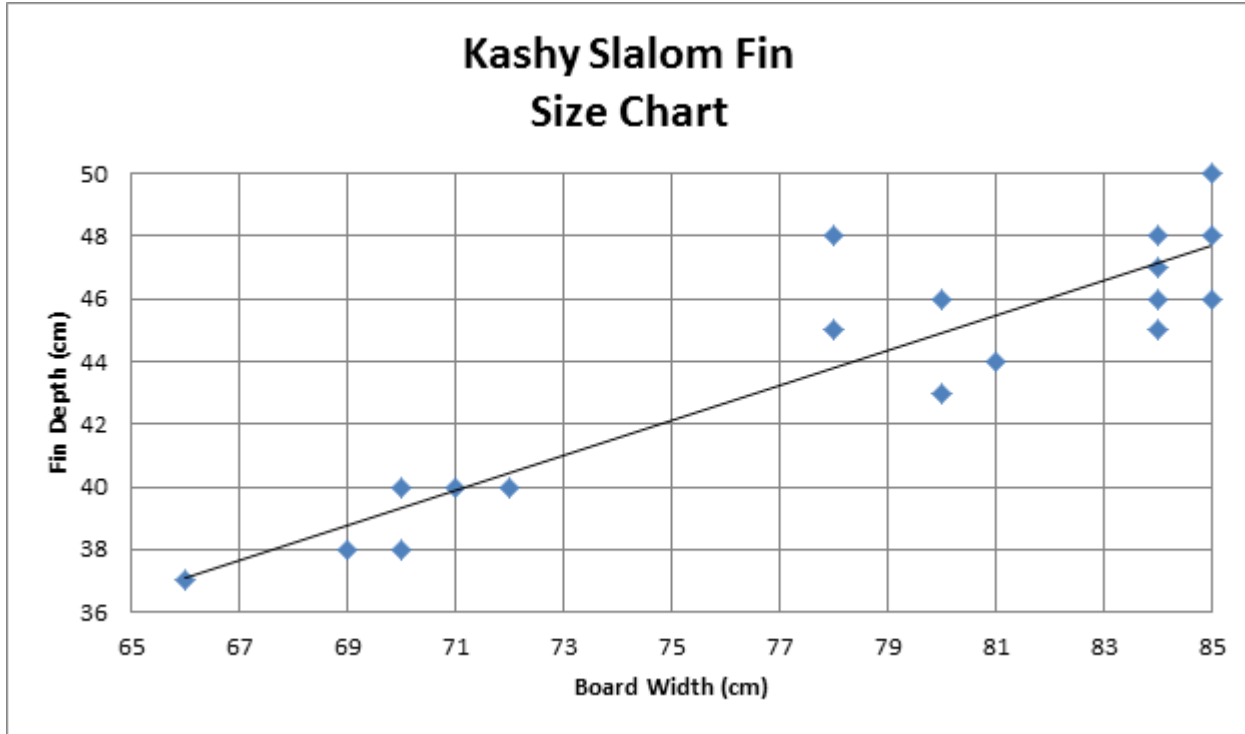
Slalom fins are based on the same foil and planform as the formula fins. The layups are significantly different. The tip is not cut off and the rakes are based on the size of the fins and range from 7.0 degrees to 9.5 degrees with the smaller fins having more rake.

Typically you can use a 1-2 cm smaller Kashy than typical slalom fins. Stiffness's come in Soft, soft Medium and Medium. Since lots of slalom racing is downwind a version with less lift and less pointing is also available. It tends to increase the control in way overpowered conditions, but the penalty is the loss of pointing. The designation for this option is NL1.

Both the original and the NL1 fins come in Soft, soft Medium, or Medium.

As far as NL1. I will currently only recommend this in Medium for biggest sizes but in small sizes it works well for Soft and sMedium.

Here is a plot of sizes vs board width that have been successfully used.



Standard rakes are

49.0 cm and bigger = 7.0 degrees

47-48.9cm = 7.5

44-46.9 = 8.0

38-43.9 = 8.5

34-37.9 = 9.0

33.9 and smaller = 9.5

Customers that want to expedite their order can pay the expedite fee of \$300 more for each fin and they will get priority fabrication.

### **WARRANTEE**

K series fins are labeled with serial numbers, and come with a 6 month replacement warrantee. All remaining parts of broken fins must be returned to Dave for autopsy, to improve quality and help develop structural improvements.

### **ACKNOWLEDGMENTS**

I am indebted to Curtis Hesselgrave for his assistance in early phases with the plan-form design and foil selection, and to Bill Kline who was involved in the early stages of this project. A special thanks to Steve Sylvester, he tested early models, and gave useful and positive feedback, and lots of encouragement for this project! In 2007 and 2008 several of the Worlds top pros also contributed to advancement of the product including Jesper Vesterstrom and Gonzalo Costa Hovel. In 2009, with many of the worlds best sailors choosing to ride Kashy fins I have received lots of feedback and this

keeps me interested in building fins and focused on making them better for everyone to “ENJOY THE RIDE” !

Thanks  
Dave