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BACK TO PADDLES

Conventional paddles work by taking a grip on the water and the paddler pulls his kayak along as if he had taken hold of a pole that was wedged on the sea floor - essentially the paddle must be of sufficient size and/or shape to hold its position while the paddler pulls his canoe up to it. This is done by making the paddle grip the water by creating drag. In newsletter number 2 we discussed paddle blade size which is the most important aspect of this drag, but there are other factors worthy of consideration too. As the paddle blade enters the water it can splash and make small waves - either is wasteful of energy and it appears that a blade that is curved from tip to shaft will enter the water with less splash or wave-making. Once the blade is in the water any air that is around the blade will also lessen its grip and make it less efficient. As the paddle blade enters the water air can be dragged in with the blade, particularly at the back of the blade, again, a curved blade will do this less than a flat blade. In scientific terms, the action of air bubbles being dragged down with the blade is known as cavitation - as the blade moves through the water these air bubbles will move about on the surface of the blade and in some cases the bubbles will burst, creating more expenditure of energy. So a blade that is curved along its length is better than a flat blade.

Once the blade is in the water it is important that it takes a good grip on the water and that any movement is reduced - drag is what keeps the blade in the one spot. We know that spooned blades are far better at creating drag than flat blades, they hold the water best, but the ideal amount of spoon curve is so great that it would create excessive cavitation when it enters the water - so as in most aspects of design - a compromise must be made, reducing the curve so that both entry and drag effects are reasonably well catered for. There is another aspect of drag that is important in blade design - the blade should stay as still as possible. As a paddle is dragged through the water some blades, particularly thin blades will want to flutter and perhaps dive towards the canoe, or away from the canoe - this is undesirable in that the paddler has to use force to resist this; force that could have been used in more efficient paddling. It seems that as the paddle blade is pulled through the water small eddies form behind the blade and from the blade edges. If these eddies vary in strength, particularly those on one blade side from those on the other blade side, you get this flutter effect. One way to reduce this is to prevent water currents from moving across the face of the paddle blade - you can do this by having a rib down the face of the blade, or down the back of the blade. An alternative is to allow water to leak through the blade surface in order to reduce the amount of water wanting to work its way around the edge of the paddle - you can do this by having small holes down the centre of the paddle blade - this is not seen in paddles often as it reduces the blade strength, but from time to time it has been a fashion in paddle design.

All this talk about drag and cavitation is similar to aircraft wing design, or to sail-making, so the science of aerofoils is very relevant to paddle-making. What we are trying to achieve is a blade with maximum drag - this is achieved by having our aerofoil in a 'stalled' position in the water. Well that is certainly what everybody thought until recently when the science of paddle making was re-examined by a number of people. Firstly, the action of the paddle blade entering the water was thought about much more closely. In order to reduce cavitation it is important that the paddle should enter the water, not in a state of stall, but as smoothly as possible. If the blade cross-section and curve was altered to a foil shape then lift might be created that would assist in helping the paddler. In fact this has been proven to be benificial - the lengthwise curve of the paddle blade is best if shaped to an aerofoil-efficient shape with the blade tip thought of as the leading edge. However, before you rush off and examine your paddle, there are two points to consider that might reduce your need for an aerofoil shaped blade:

Some years ago North American open canoe marathon racing paddlers descovered that the most efficient and powerful part of their paddling came when their upper hand was slightly forward of their lower hand on the paddle, and the blade had passed the middle of their paddle stroke. At this stage they could put far more power in the upper arm but at this very time the paddle blade was begining to face the surface and most of their power was being used up in actually trying to pull the canoe down into the water. The solution was simple - have the paddle blade at an angle to the paddle shaft. By tial and error it was discovered that 8^o was about the minimum angle before the advantage became apparent, and 15^o was about maximum. Usually the amount of angle is 10^o and these paddles have become known as 'bent-shaft' paddles. The problem with these paddles, apart from rudder strokes being a bit complicated, is that the paddle blade enters the water at a very stalled angle and no amount of curve is going to reduce cavitation - so don't bother making curved blades on paddles that have much bend, or rake to them (see newsletter No.2 for diagram showing rake on a paddle blade). Secondly, if you are going to have any lift at all from a curved blade, then the water must move from tip to shaft along the blade - this will only happen if you have a high paddling style. A low paddling style will more than likely have water passing across the blade rather than along it.

It was only a matter of time that, with a bit of lateral thinking, someone was going to investigate what happens if you use a low paddling style and convert the spoon curve of a paddle blade into an aerofoil shape and use the movement of water across the blade of the paddle to create lift - eureka! the wing paddle is born! But, and this is a big but; to have an efficient foil to create sufficient lift to be of any help during the major part of the paddling action, you can only do so at the expense of losing drag and the paddle blade becomes most inefficient if you attempt to use it in a conventional way. With the previously discussed lift with water moving across the blade from tip to shaft, the lift is only created when the paddle is plunged into the water, after which the drag aspect takes over and paddling is conventional. With across the blade lift drag never comes into the scene at all. The degree of foil-shape needed to create sufficient lift to be helpful will be so great as to spoil any drag type of use that paddlers might also use a blade for - support strokes and rudder strokes included. Or put another way, until a whole new range of paddle techniques are invented, wing paddles are at their best in flat water straight-line paddling. Some people would claim that they are not much use for support strokes, but they seem to work okay provided you keep them moving, once they stop, the lift drops off and they are less effective. Wing paddles must be used in a sweeping motion with the outside edge of the blades as the leading edge, therefore a low paddling angle with a swinging paddling style, using a twist from the waist as much as actual arm actions seems to be the way to operate these paddles. But are they that much of an advantage? From the opinions of most flat-water racing paddlers it seems that if you have an efficient paddling style with conventional paddles, the wing paddles do not offer much increase in speed, but if you have not perfected your padddling style, wing paddles are a fast route to fast paddling. It also seems apparent that once you have developed paddling muscles with conventional paddles, wing paddles take a bit of getting used to and many people find muscle soreness at first to the point that they might claim that winged paddles are harder to use. For sea canoeists it would seem that in the long run wing paddles do not offer a great advantage and the ideal would be to opt for a set of conventional paddles with a curved blade with some degree of spoon to the face. There are two disadvantages with wing paddles: they seem to hook up a fair amount of water and because the blade thickness is best kept thin, they have had a problem with the blades breaking off at the shaft. Secondly, with a cross wind, or beam wind, they catch the wind. Both these problems can be reduced by reducing the blade area; and I therefore suggest that sea paddlers looking at wing paddles for use on a trip should opt for the smallest blade areas available. The wind-snatch problem has been sufficient for one well known canoeist and manufacturer suggesting that perhaps these paddles are best unfeathered. If this is so, then those of us who have trained our muscles and reflex actions to conventional paddles would be well advised to stay away from wing paddles.

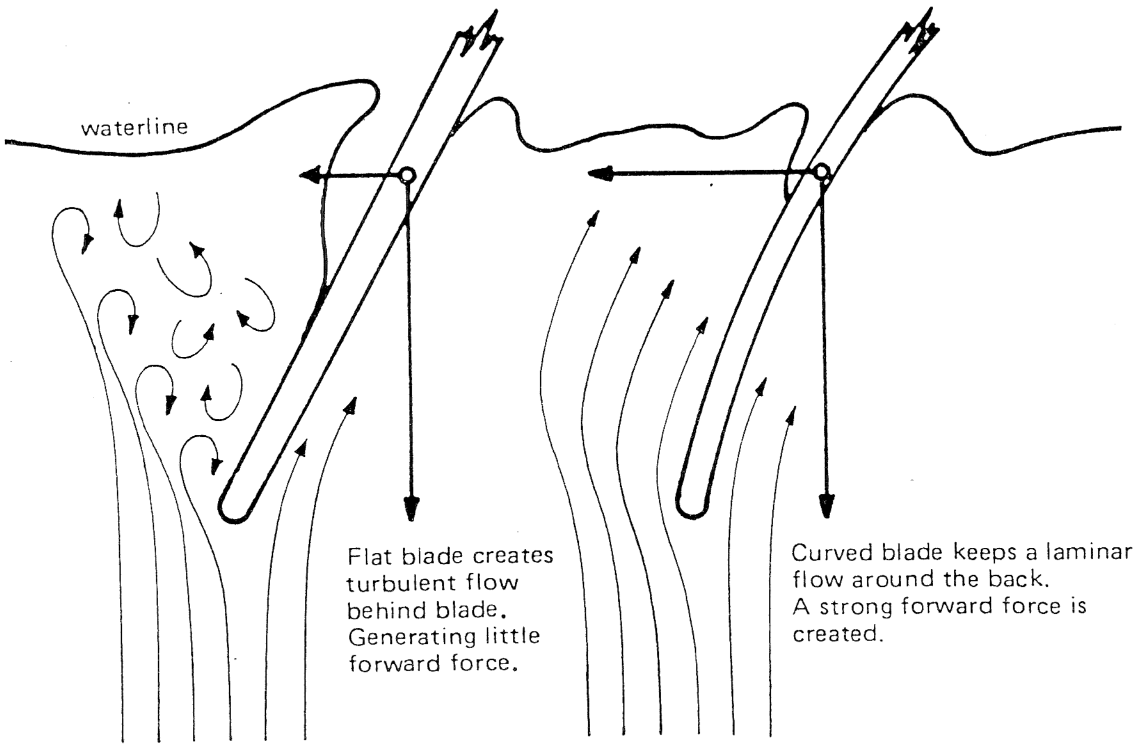
When you boil all this down, it seems to me that the serious sea paddler has a choice between two extremes - large blade area paddles as manufactured for river whitewater paddlers which have a fair amount of curve lengthwise to the blade and a lot of spoon curve. I would be tempted to opt for these if the trip were either a short one or if it involved a run through heavy surf. I prefer a blade with a fairly thick cross-section rather than a thin glass-fibre blade. The other extreme is a fairly flat blade of high aspect ratio - that is, long and thin. These would be a better choice for a long trip, particularly if wind from abeam might be encountered. Probably what is most important is that you have had as much experience using a set of paddles that you have, that you find reliable and are at ease using. In the long run paddling in rough water is very much a state of mind and you paddle best when you are at ease with equipment you are familiar with. Most people will use paddles made for river canoeing because that is all they have, or all they were able to get. We have yet to see specialist sea canoeing paddles manufactured apart from some surf-ski racing blades which tend on the long narrow side, but otherwise are much like standard river paddles.

The diagrams below illustrate some aspects of paddles mentioned in this article.

Flat blade causes large cavitation on entry.

Curved blade reduces cavitation to a minimum.

This diagram shows the difference between a flat blade and a curved blade as they enter the water. Cavitation and wave-making are greater with the flat blade.



As paddle blades submerge in the water at the beginning of the paddle stroke the downward movement of the curved blade creates greater lift than a flat blade, which pulls the canoe forward to some extent. The wing paddles use a similar effect across the paddle.