

Origami Folio

by Paul McKay, July 2023

The Origami Method is a simplified and easy way to make cambered sails from flat pieces of cloth without complex cutting and sewing.

Nomenclature

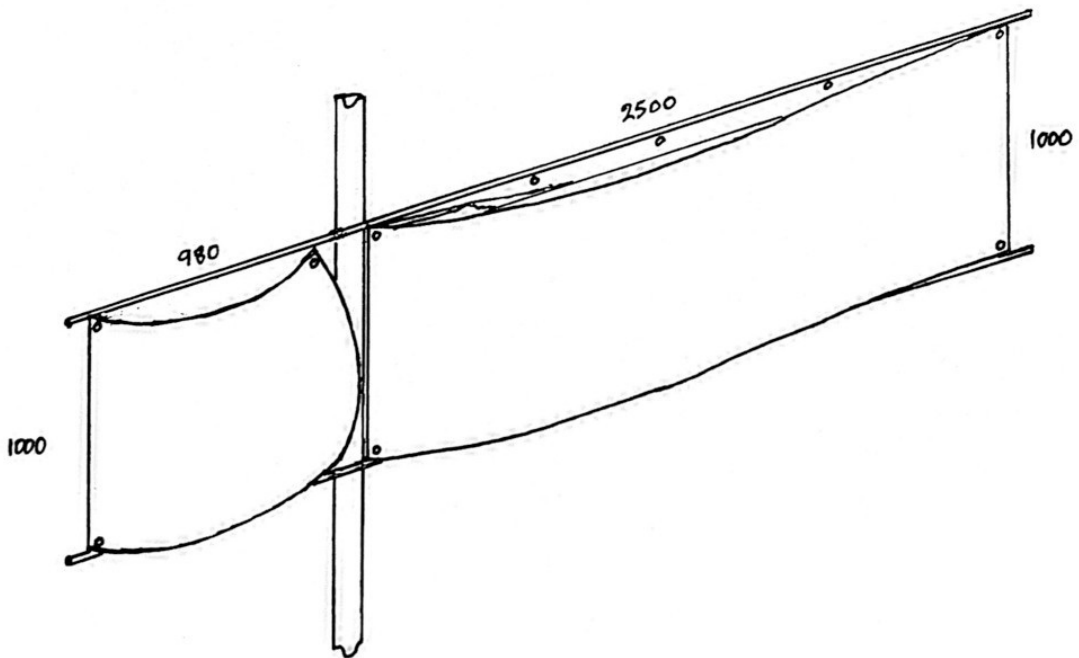
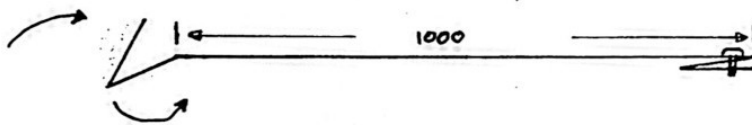
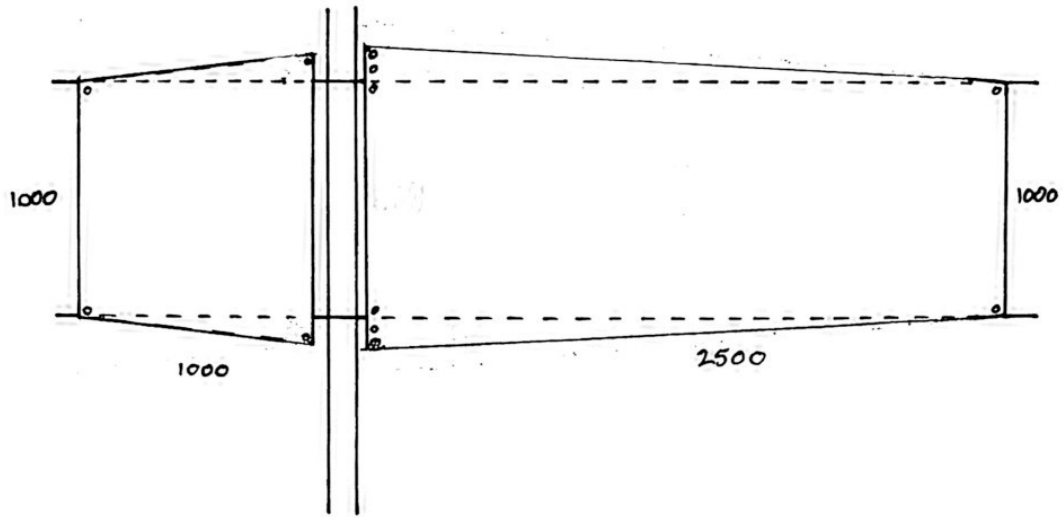
When I introduced it I called it an Origami Rig but quickly decided that was misleading as it can be applied to all mainsails, even 3-sided Bermudan or 4-sided Gaff sails. Like Original Flat, Cambered and Split Junk sails, Origami Junk sails can be fitted to single straight battens.

Method

Cambered sail panels for Junk Rigs are usually made by cutting out two aeroplane-wing-profile-shapes then sewing the curved edges to the edges of complimentary shaped sailcloth. (See Arne's Barrel Cut Cambered Sails or Slieve's Shelf Foot sails). That produces a sculptural cambered sail panel. When full of wind these designs tend to belly outwards producing a series of symmetrical aerodynamic bulges to leeward when viewed from deck, and a cambered profile when viewed from above.

An Origami sail panel starts off as a trapezoid shape in flat cloth but produces exactly the same effect and camber when the luff corners are folded, without complex cutting and sewing.

See drawing on next page



How it works

Mainsail

Example: Take a Junk Rig sail panel measuring 2.5 metres (2500mm) in length by 1 metre (1000mm) in height. Mark the 4 grommet positions in the four corners (A). Now decide the amount of camber you need. For example a camber of 1:10 or 10% means the sailcloth will bulge outwards by 250 mm or 25 cm at the position of maximum camber halfway between the battens. (10% of 2.5 Metres) So we add that figure to the luff which now measures 1250mm. (cambers of 1:7 = 14.28%; 1:8 = 12.5%; 1:10 = 10%; 1:12 = 8.33%)

We could add the camber figure at the luff to either the foot or the head of the panel but for symmetry divide it by 2 and add 125mm at the head and 125mm at the foot. Now draw lines from this extended luff back to the leech producing a trapezoidal shape. Add 25 or 30mm for hems all round then cut out this trapezoid. Fold the cloth over, sew the hems then add 4 grommets to the marked positions (A). At the luff add 2 more grommets to the new corners (B). Finally add two more grommets (C) half way between the first 2 (A) and the corner 2 (B).

Each origami mainsail panel has 8 grommets plus the usual ones for fixing to the battens - 6 at the luff, 2 at the leech and a few on the head and foot; perhaps 14 grommets per panel.

Lastly fold the luff into 'W' or 'M' shapes at the corners so that the 3 grommets lie on top of each other then fasten to the batten through all 3.

Then the leech is lightly stretched out and fastened by its single grommets, keeping the outhauls loose at this stage. Finally the tapered loose edges at the head and foot are fastened to the batten. The folds of cloth at the luff allow the panel to bulge outwards into a cambered profile when full of wind. The point of maximum camber is decided by the shape itself but occurs naturally between 1/4 and 1/3rd chord. (25-33%) It will look untidy compared with a sewn Sculptured Panel but is faster and simpler to make.

Note: the aerodynamic bulge in the sailcloth might cause the panel to 'shrink' in length by up to 2% for a 1:8 camber; slightly less for smaller cambers, slightly more for 1:7.

Jibs

Making jib panels or 'jiblets' for an Origami Rig, Split-Junk or an AeroJunk is even simpler. Once again it involves trapezoidal pieces of cloth and again they will fit to single straight battens.

Mark out the basic shape for a jiblet to fit between the battens. Now extend a line from luff to leech at 5.5 degrees above and below the batten (The horizontal). Add the allowance for hems then cut out this trapezoidal shape. Sew the hems then add grommets to all four corners.

The leech is now fastened to the battens in front of the mast. The luff is stretched forward and the position of the fastenings is marked on the batten. Finally subtract 1.5-2% of the leech-to-luff length and mark again. This is where the luff is fastened to the batten. Example: the stretched distance between grommets is 1000mm. Subtract 1.5/2% (15/20mm) = 985/980mm. Mark and fix here.

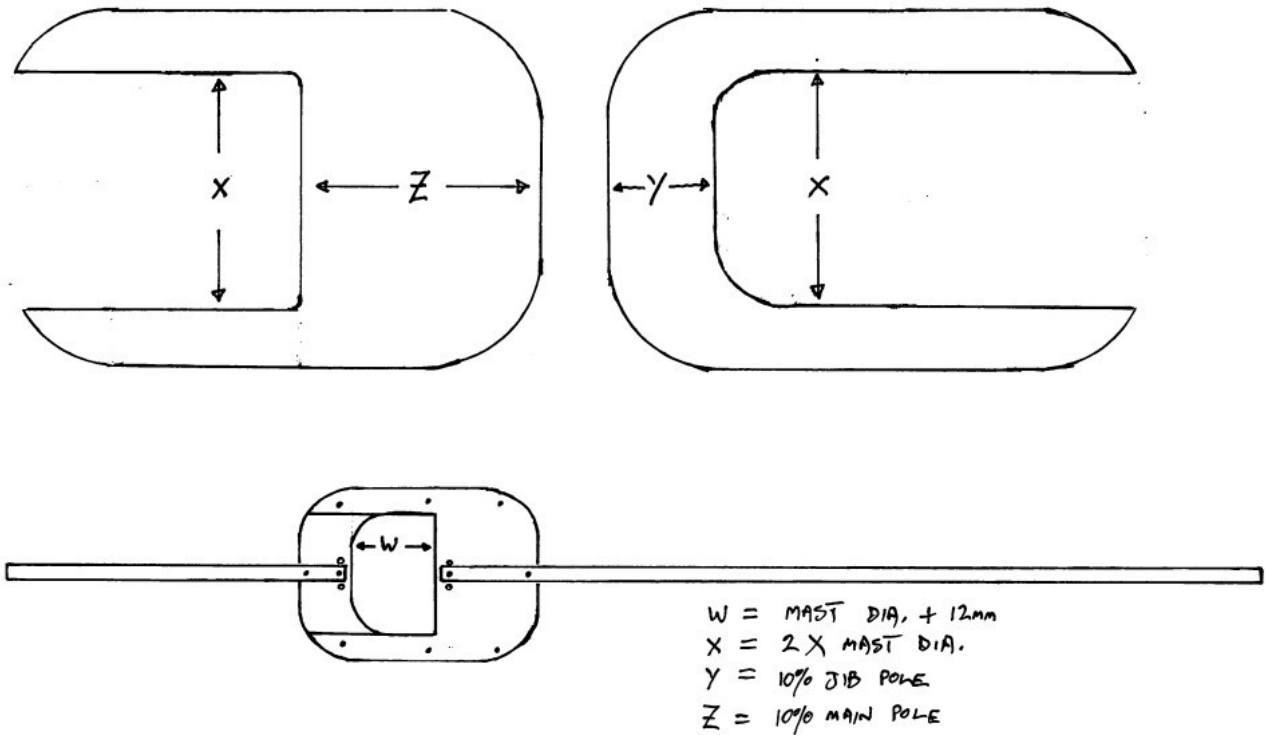
The jiblet ends up loose with a tight luff and a slack leech. When full of wind it curves to form a 'nose' camber of about 1:10/1:8 and also bellies at the leech to give the necessary offset to the mainsail, about 17 degrees. Measurement has shown that 6 degrees above and below gives an offset of 18 degrees. 5 degrees above and below gives 16 degrees of offset. 5 degrees above and 6 degrees below gives 17 degree offset.

Adding 2 extra grommets above and below the original leech grommets allows the offset to be reduced in stages. (Fold the leech corner (corners) over and fasten through both grommets)

Offset refers to the jib angle compared to the mainsail. In a Bermudan rigged boat tacking hard to windward the ideal set of the sails is 17 degrees for the jib and 11 degrees for the main to the boat centreline. Generally speaking, larger cambers in the mainsail will require larger offsets in the jiblet.

Using 'D' formers at the mast allows the rig to move over to Lee-ward on each tack giving a clean flow of air and negating the turbulent effect of the mast.

See drawing next page



Bermudan and Gaff trial mainsails can also be made using the Origami system. (You could use plastic tarpaulin for the sailcloth) Because the Bermudan 'Head' comes to a point, all the camber figure is added at the foot of the luff so a Bermudan sail has 5 grommets.

A Gaff sail might have 75% of the camber figure applied at the Foot of the luff and 25% added at the Head. An Origami Gaff sail would have 8 grommets.

Both Bermudan and Gaff sails can have a 'Cunningham Eye' fitted to flatten the camber in stronger winds.

Table of jib offsets

7 degrees + 7degrees = 20 degree Offset

7 + 6 = 19 deg.

6 + 6 = 18 deg.

6 + 5 = 17 deg.

5 + 5 = 16 deg.
