Kites for Connoisseurs

Fat Flat Rok

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WINDMAN BIEGOLMAI

Kites for Connoisseurs **is a collection of plans for kites designed by Andreas Ågren. These kites often have a unique technical twist. The plans can be found at *http://windman.se/kite-plans* and they may not be used for commercial purpose without written consent.**

Symmetric Fat Flat Rok with aspect ratio 1.13.

Symmetric Fat Flat Rok with aspect ratio 1.3.

Asymmetric Fat Flat Rok with aspect ratio 2.0.

Flat Sode.

The **Fat Flat Rok** (FFR) is not a traditional rokkaku.

Fat - A traditional rokkaku has as an aspect ratio less than 1 (i.e. it is taller than wide). The FFR has an even or slightly high aspect ratio, making it look ‘fat’.
Flat - A traditional rokkaku has backward bent cross spars. The FFR has straight cross spars. If a person doesn’t say “Well, how can that be?” you know this person is not a real kite maker.
Rok - *Rokkaku* just means ‘6 cornered’ after all.

The answer to the “flat?” question is the shape of the middle sail part: it has the shape of a bowtie, which creates an in-sail dihedral by the wind, enough to make the kite stable. However, the FFR is not suitable for rokkaku combats: the bridle can not be changed to make the kite steerable.

This brief description is not a plan for a specific kite; rather is it a description of the ***FFR concept***, and it only shows how to cut the different panels. For reinforcements and pockets for spars as well as for reinforcements for bridle, building descriptions for a standard Rokkaku and a standard Sode Dako should be consulted.

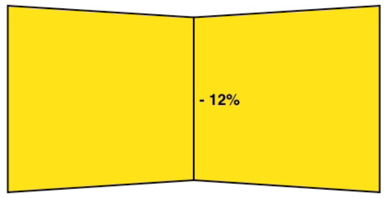
The description include plans for FFRs in different sizes and with different aspect ratios. Two of the plans are provided by Ron Spaulding.

Finally a ‘Flat’ application for a Sode Dako (kimono kite) is included: **Flat Sode**.

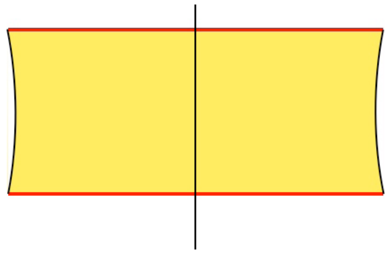
The Bowtie in-sail dihedral.
The middle section of the whole sail has the shape of a bowtie, with the centre approximately 12 -17 % shorter than the edges when one half of the sail is a square. When this shape is applied to straight sticks, the edges of the sail and all side material will get a flexure backwards by the wind and a dihedral is created along the spine.

The bowtie can also be made asymmetric with the bottom wedge cut deeper than the top wedge.

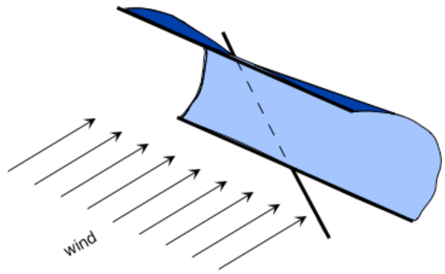
A gentleman's bowtie.



Wedges cut out in top and bottom of rectangular sail.



When straight spars (red in the figure) are applied to the wedged edges, the sides of the sail will billow backwards.



When the wind blows onto the sail a dihedral is formed along the spine.

How to make the Fat Flat Rok.
There are at least two ways of cutting the material for an FFR:

- *Six piece cut* - The two sides each consist of top and bottom triangles and a middle, main panel section, same as for a standard rokkaku. Probably best when using rip stop.
- *Two piece cut* - Each side is just one piece, joined in the middle by one seam, glue or adhesive tape. Can be used for tyvek, plastic or similar non woven material.

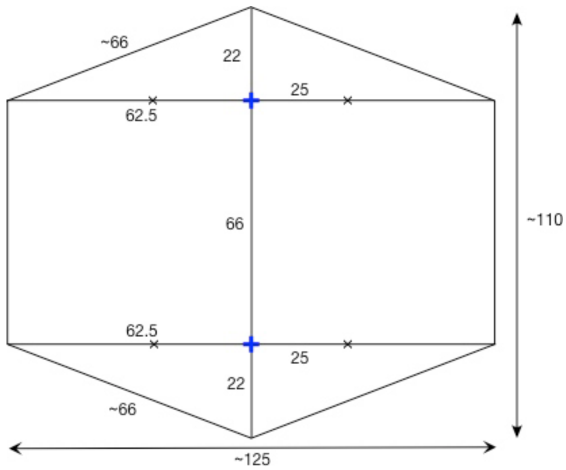
This description includes four FFR plans:
- 125 x 110 cm (AR 1.1)
- 168 x 130 cm (AR 1.2)
- 90 x 90 cm (AR 1.0)
- 180 x 90 (AR 2.0)

Dimension order for all plans is width x height. The drawings can be scaled.
The two last plans courtesy of Ron Spaulding.

Flat Sode
The technique with the bowtie in-sail dihedral may very well by used also for a sode dako (kimono kite), see Flat Sode plan at the end of this document.
- 125 x ~142 cm

Measurements
The given measurements are in cm. The measurements in this description are for finished kite. The measurements within brackets (in some of the plans below) include seam and hem allowances. However, the measurements as such are not important; they can be altered according to wish. The only important measurand are the angles in the trapezium: For a symmetric bowtie they should be 86° on the longer side and 94° on the shorter side. This implies that the sharp point angle of the triangle that is cut off from the rectangular piece to make the trapezium is 4°. The longer leg in that triangle has the same length as the width of the material.

For an asymmetric bowtie the corresponding angles making the bottom wedge should instead be 82° and 98° and the sharp point angle 8°.

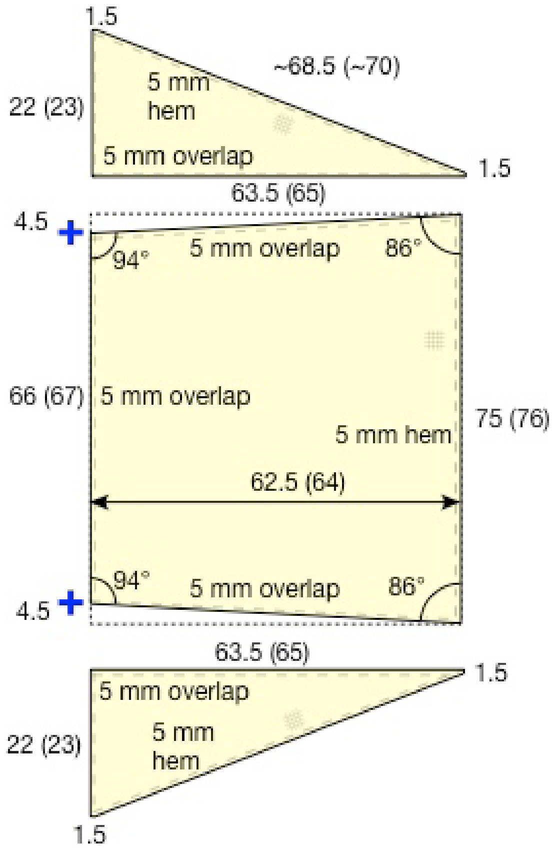


Fat Flat Rok overview.

Six piece cut of 125 x 110 cm, AR 1.1, FFR.

1. Cut out two rectangles 64 x 76 cm for the main panels and four right angled triangles with the sides at the right angle 23 x 65 cm. Note that the other two angles of the triangle are not actually sharp but have a 1.5 cm long side for hemming and seam allowance.
2. Cut away wedges symmetrically on the rectangular pieces from one 76 cm side towards the opposite side. The wedges should have a 4.5 cm side, leaving 67 cm to a trapezium.
3. Sew together two triangles and one trapezium with the right angle of the triangles at the corner of the 67 cm side and the sharpest corner at the 76 cm side.
4. Sew also the other side in the same way.
5. Trim any excess triangle material outside the 76 cm side.
6. Sew together the two sides.
7. Hem all six edges.

The blue crosses mark where the cross connectors on the spine should be fixed.

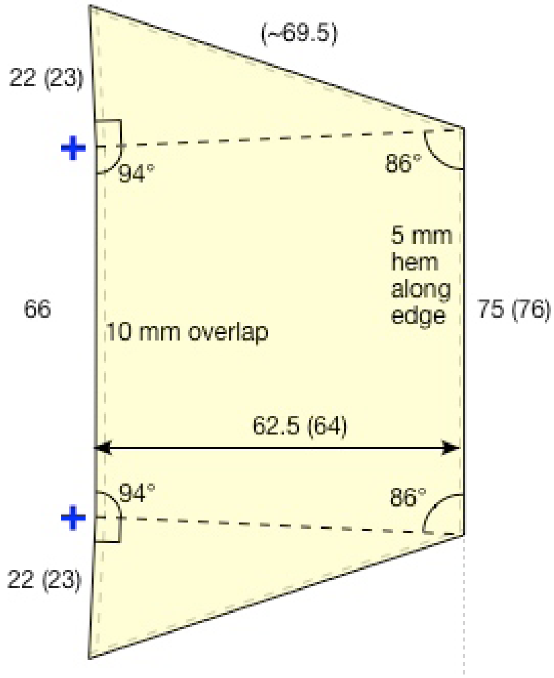


Six piece cut 125 x 110 cm

Two piece cut of 125 x 110 cm, AR 1.1, FFR.

1. Cut out two pieces of the side shape in tyvek or plastic.
2. Glue or sew or tape the two halves together with 1 cm overlap.
3. Hem all six edges.

The blue crosses mark where the cross connectors on the spine should be fixed.



Two piece cut 125 x 110 cm

Pockets etc. as for a standard rokkaku (and sode).

The FFR and Flat Sode have the same kind of frame as their standard counterparts: one spine and two cross spars. The difference is that the cross spars remain straight during flight, so no system for tensioning bows is necessary. The only important details in the flat frame are the two cross connectors: they must be in fixed positions along the spine at the joint between the main panel and the top/bottom triangles. The positions are marked by the blue crosses in the drawings.

- Make corner reinforcements and pockets for spars as for a standard rokkaku (or sode).
- Make reinforcements for four bridle points as for a standard rokkaku (or sode) . Bridle points should be at 40% of the cross spar length.
- Bridle with a four point bridle as a standard rokkaku (or sode).
- A two point bridle can be used if the cross spars are whole, i.e. not divided in the centre.

For both the FFR and the Flat Sode the towing point should be so far back that the kite merely gets airborne. At a good breeze (> 3ms) they will fly at a steep angle.


FFR 125 x 110 cm on two point bridle in 7 ms wind.

Calculating measurements.
The symmetric *Bowtie sail* half is basically a cut-out from a large (reclining) isosceles triangle where the sharpest angle is 8°. This angle, divided by 2, will be 4° in the rectangle around the isoceles triangle (dotted line).

1. Decide the width of the FFR: ***W***
2. Decide the aspect ratio: ***R***

There are only two important measurement in an FFR

- The angle for the 'cutting away' triangle: The angle at the sharpest corner is 4° (half of the sharpest angle mentioned in the triangle above).
- The height of the top and bottom triangles are each 20% of the total height and thus the spine side of the main panel is 60 % of the total height.

The width of the main panel, A, is half the width of the kite:

3. ***A = W/2***

The total height H is width divided by aspect ratio:

4. ***H = W/R***

This gives the inner side of the main panel B:

5. ***B = 0.6*H***

The longest leg in the triangle that should be cut away has the length A.
The shortest leg, C, opposite the angle 4° is the third side of the triangle that is going to be cut away from the rectangle to make a trapezium.

Using trigonometry C can be calculated using the angle 4°:

6. ***C = tan 4 * A***

Now the outer side of the main panel, D, (the "bottom" of the trapezium) is calculated as:

7. ***D = B + 2C***

The height of the top and bottom triangles E:

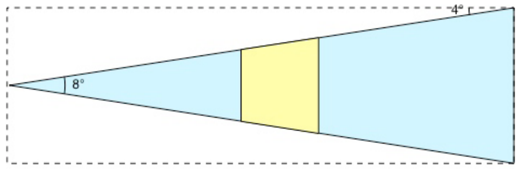
8. ***E = 0.2*H***

Example:
In this example the measurements of an FFR with the width 168 and a aspect ratio of about 1.3 is calculated (see drawings on next page):

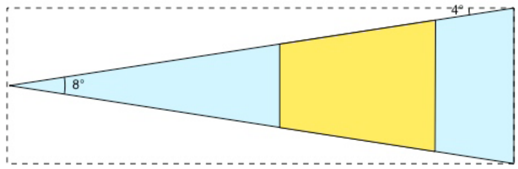
1. W = 168
2. R = 1.3
3. A = 168/2 = 84
4. H = 168/1.3 = 129 -> 130
5. B = 0.6*130 = 78
6. C = tan 4 * 84 = 5.87 -> 6
7. D = 78 + 2*6 = 78 + 12 = 90
8. E = 0.2*130 = 26

The height H is rounded off to 130 and the leg C is rounded off to 6. Basically all length measurements can be rounded off as long as the panels fit together.

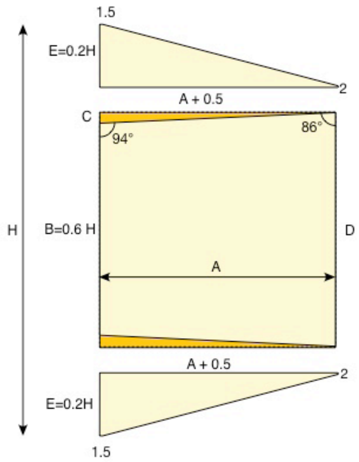
Reclining isosceles triangle with Bowtie sail half. (Not to scale.)



Smaller sail.



Larger and wider sail.



For the calculations the width and the spine height (inner edge of main sail) are the basic measurements, but when actually making the kite it is the measurements of the outer edge and the width that are used to cut the initial rectangle from which the wedges then are cut off.

In the wedge that will be cut off from the rectangle, side A is the adjacent leg to the angle 4°, and side C is the shortest leg, opposite the angle 4°.

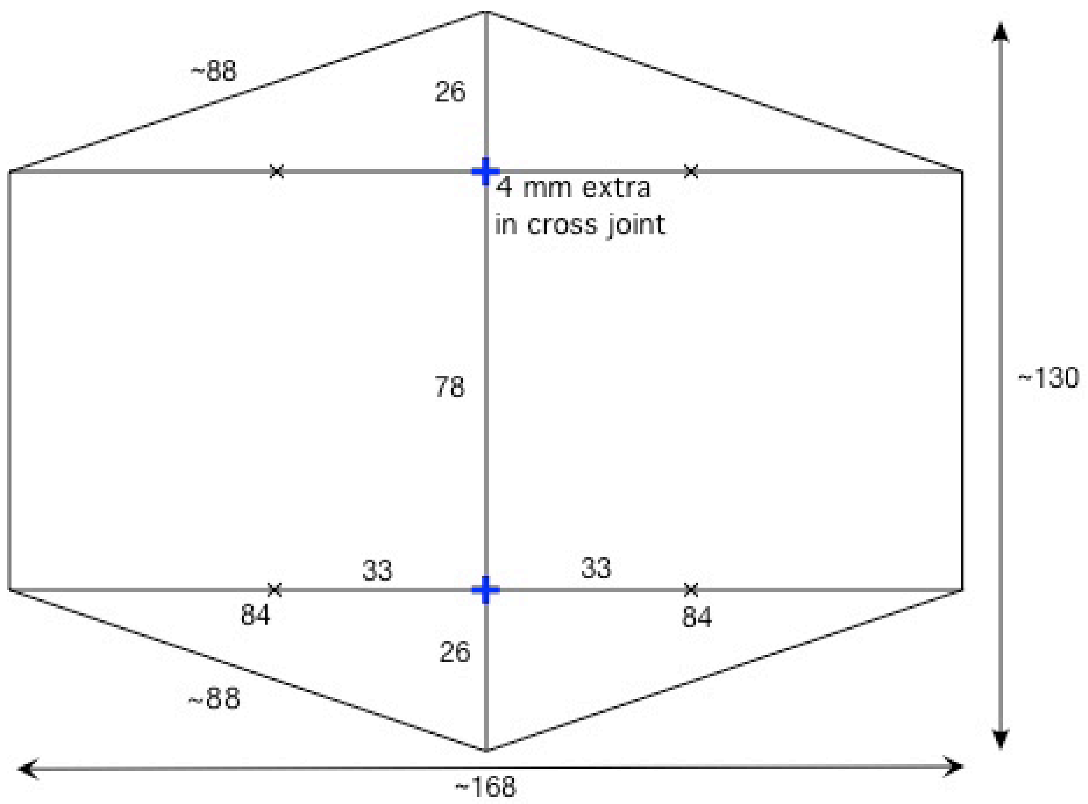
Trigonometry:
C = tan 4 * A

In an asymmetric bowtie the bottom wedge that will be cut off from the rectangle, side A is the adjacent leg to the angle 8°, and side C is the shortest leg, opposite the angle 8°.

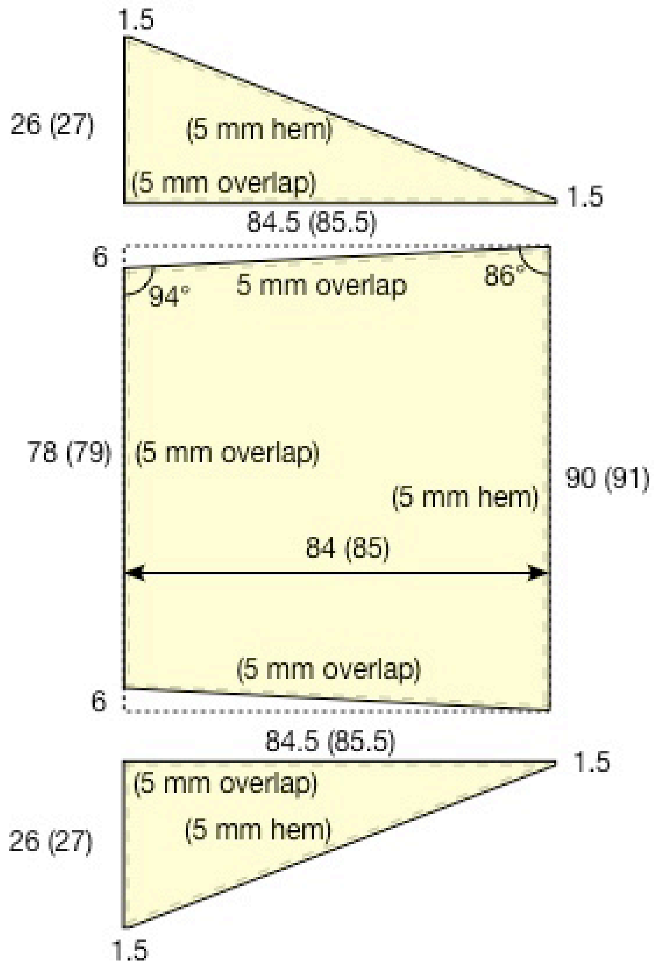
Trigonometry:
C = tan 8 * A

*The bottom triangle panel in an asymmetric bowtie should be cut slightly longer than the top wedge because the hypothenuse is longer; i.e. instead of **A + 0.5** it should be **A + 1.***

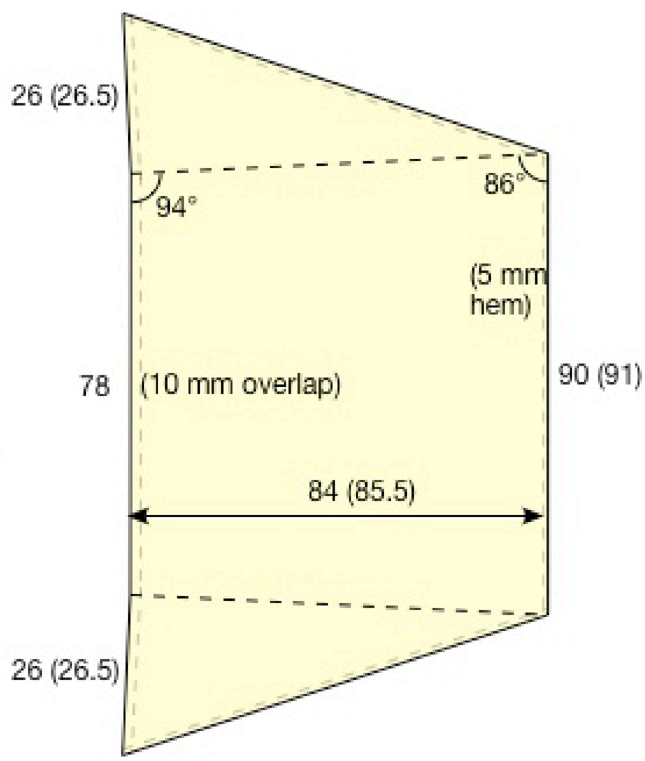
Flat Fat Rok 168 x 130 cm, AR 1.3.
The width is suitable for two 82.5 cm tubes (like Skyshark) with a few mm extra for flexibility.



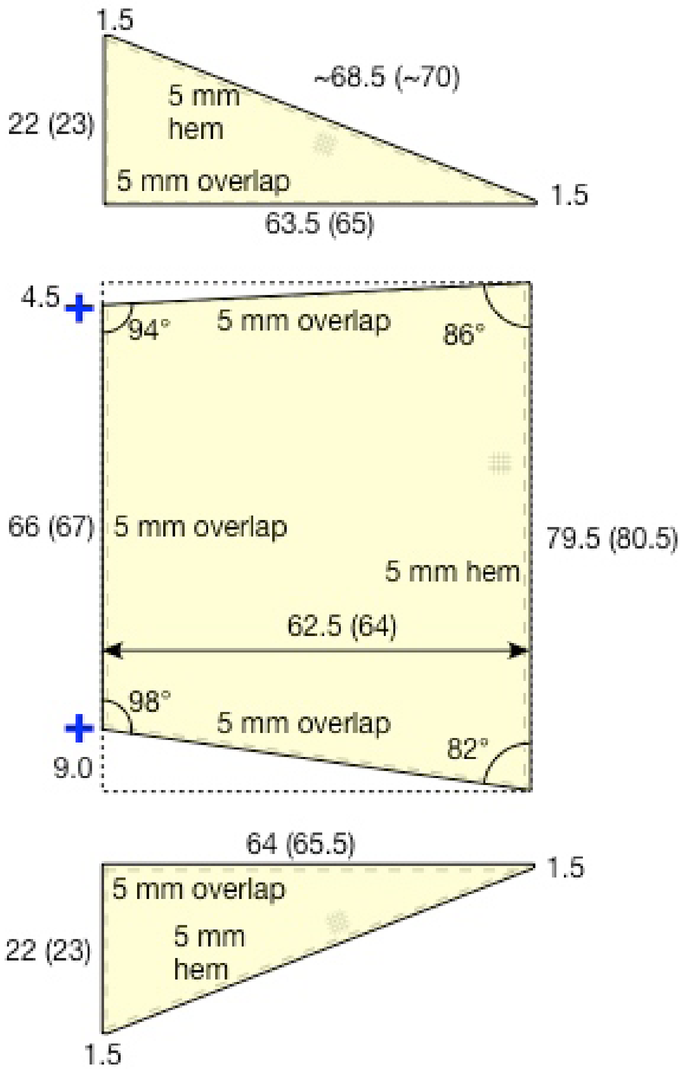
Six piece cut 168 x 130 cm

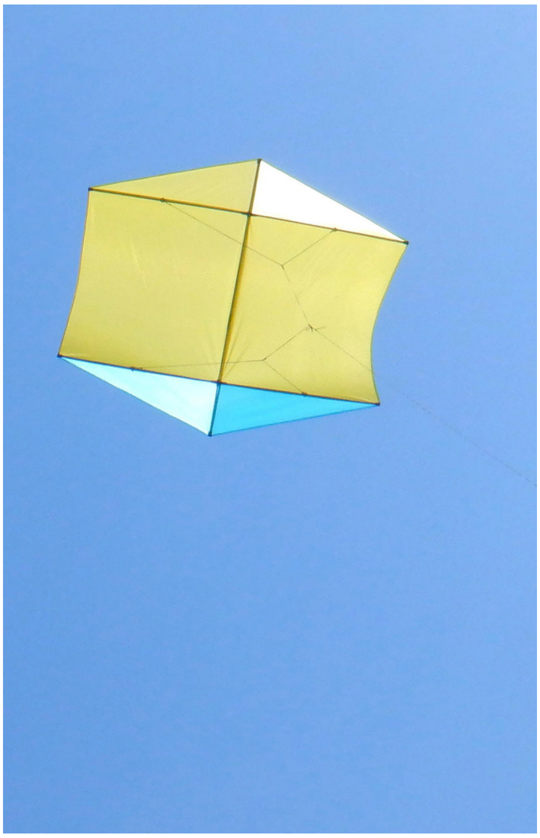


Two piece cut 168 x 130 cm



Asymmetric cut FFR six piece 125 x 110 cm.
Bottom wedge cut deeper.

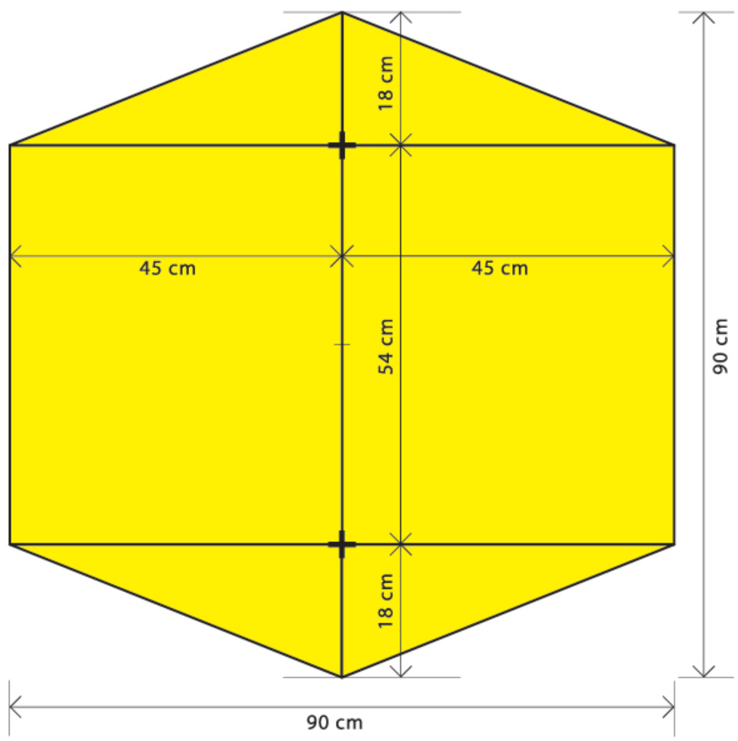




Asymmetric FFR 125 x 110 cm.

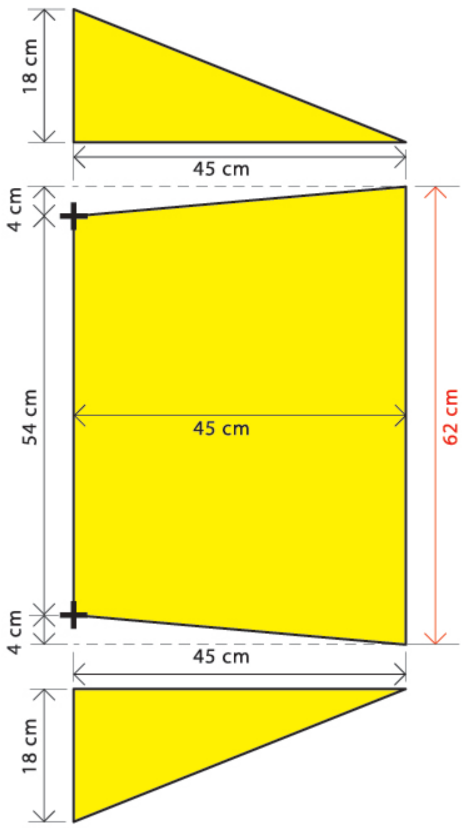
Note that the bottom triangle should have a sligthly longer side than the top triangle.

Small (90x90) FFR with AR=1.0.
Courtesy *Ron Spaulding*.



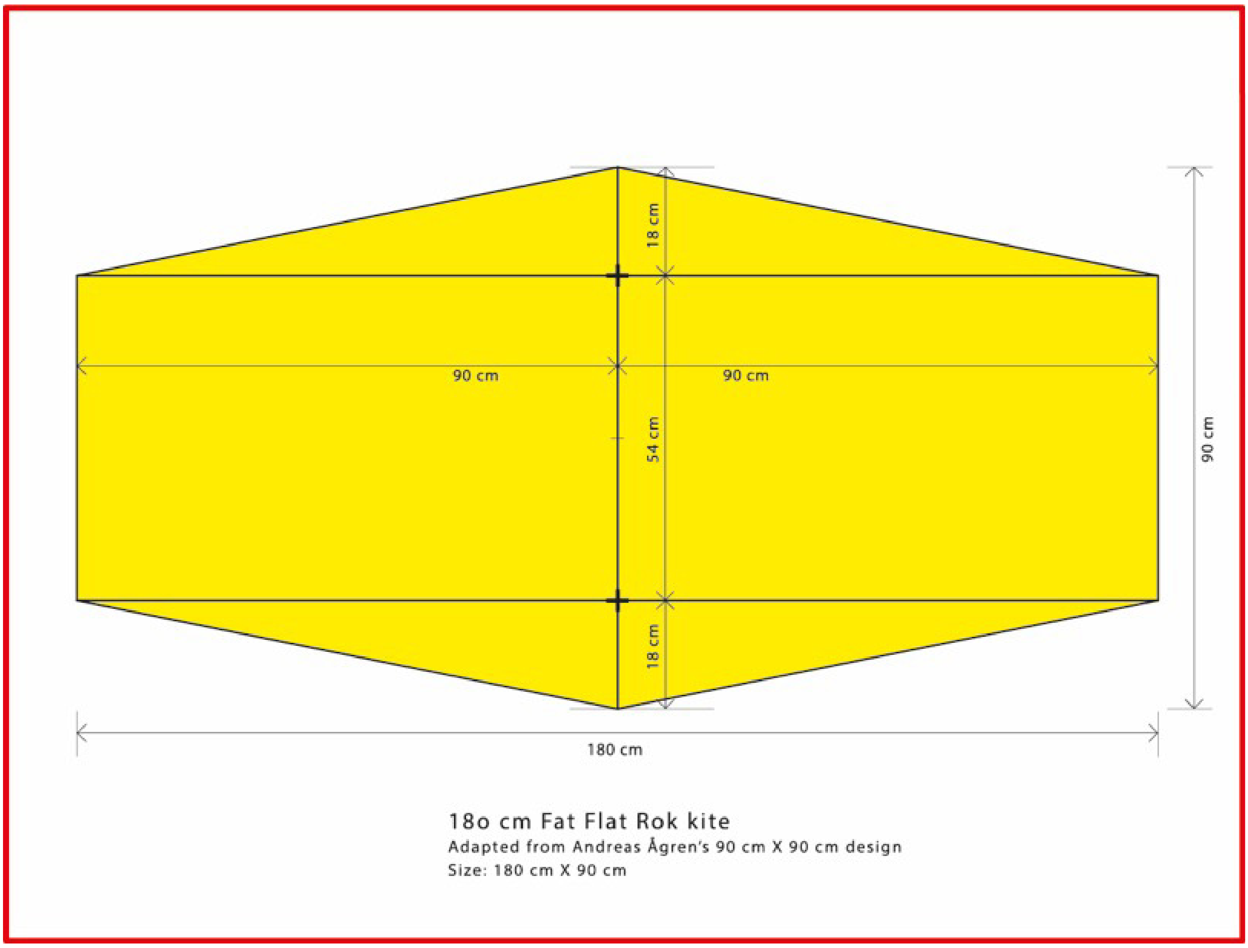
Fat Flat Rok kite
Design by Andreas Ågren
Size: 90 cm X 90 cm

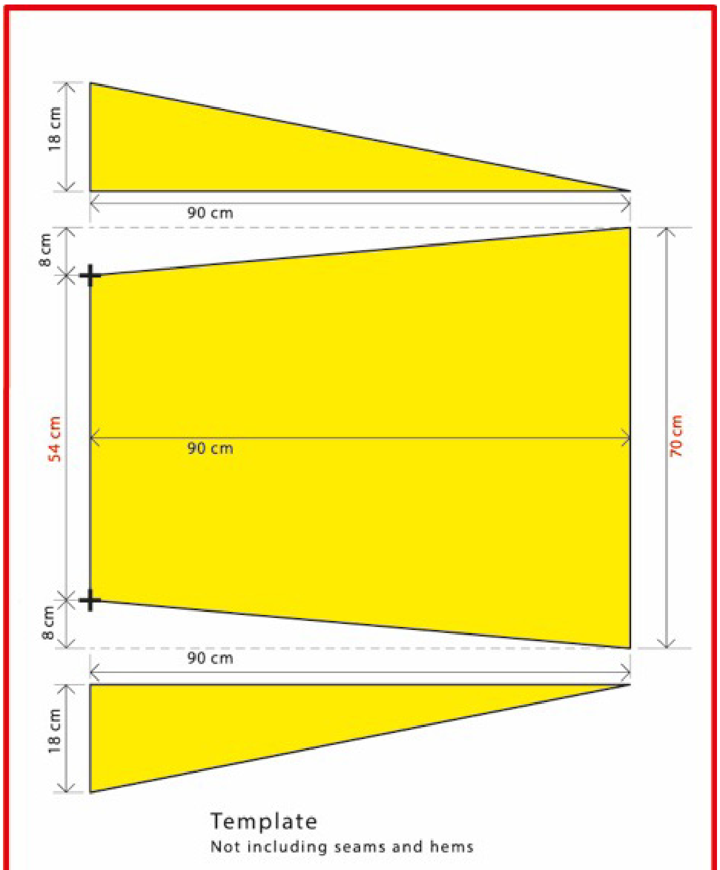
Plan by Ron Spaulding



Template
Not including seams and hems

VFFR (Very Fat Flat Rok) with AR=2.0.
Courtesy *Ron Spaulding*.



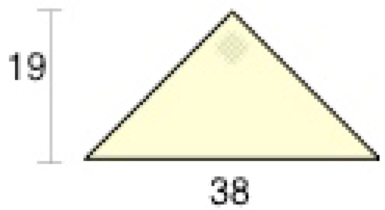


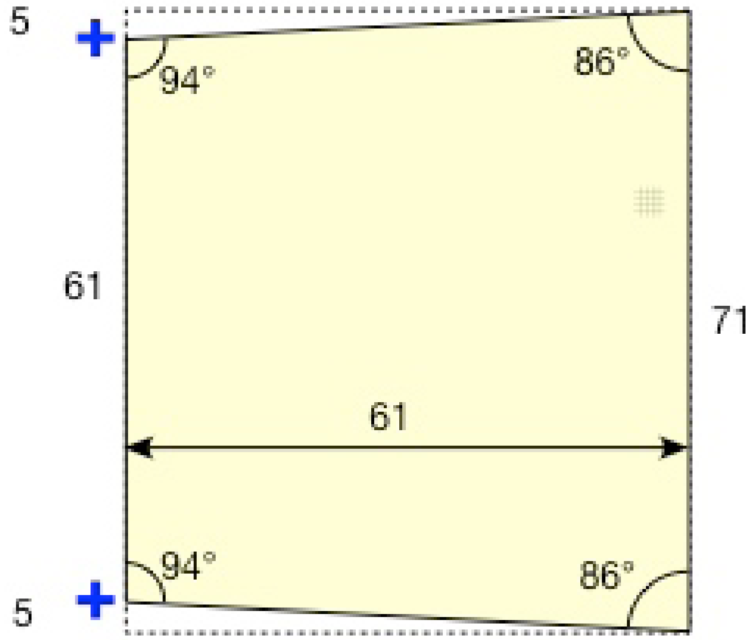
Plan by Ron Spaulding

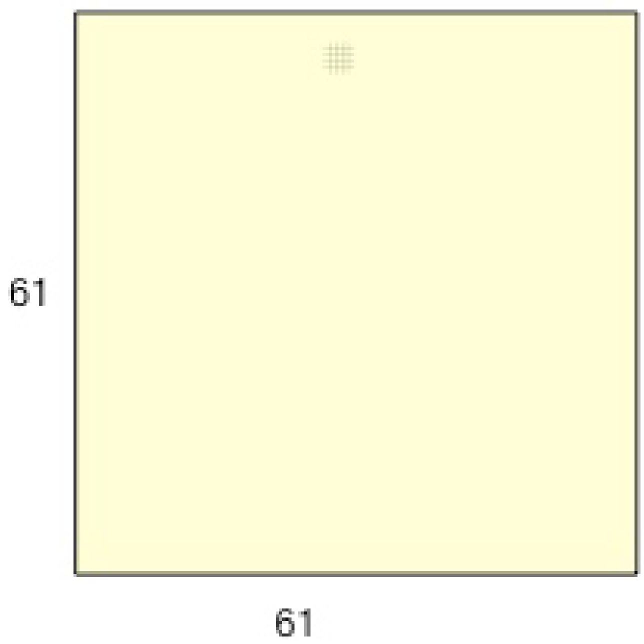
Note 1:The plan to the left shows a symmetric bowtie. For an asymmetric bowtie (like in the picture above) the 70 cm side should be extended ***down-wards*** with 8 cm while retaining all other sides; thus the measurements are at the outer edge 78 cm and at the spine (from top) 8 cm, 54 cm and ***16*** cm.

Note 2: For a VFFR like this the spine needs to be very stiff to prevent the rear cross spar from wobbling, as the spine might start to "hula-hula". Suggestion: Excel 10 mm tube or Excel 8 mm tube with a 6 mm tube inside.

Flat Sode (kimono kite) ~122 x ~141 cm with Bowtie sail.







Note 3: The cross spar should be sturdy, like 8 mm carbon or Skyshark P400.

To avoid bending of especially the upper cross spar it is best that the cross spars are not split to meet at a cross connector in the middle; at least the middle section of the cross spar should be whole. That means the separator wall in the middle of the cross connector (cross spar/spine) should be drilled up to let the cross spar go through.

If Skyshark P400 is used, the centre piece can be a whole Skyshark tube with 1/4 of a second Skyshark tube on each side, each maybe with a split end nock in the end.

Revision 1: *Notes on spine stiffness added for VFFR, page 8, and on cross spars/cross spar connector for Flat Sode, page 9. Measurements of Flat Sode also adjusted to fit Skyshark tubes.*

2022-10-10