

KITES FOR CONNOISSEURS

TRISTEZA

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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.



Tristeza is a small single point triangular box kite for light wind (2 - 4 m/s). It flies at quite a good angle on its own, but can also be put in a throng on a branched line. However, since the kite is three-dimensional handling a big throng becomes awkward. There probably is a limit of about a dozen elements in a throng.

The sail consists of two parts: Slanted walls and a roof. The walls have two oval holes each. Both the roof and the walls have a bit of a waist to ascertain tension of the ripstop.

The frame consists of three longerons and six bowed spars for tensioning of the edges. Instead of sewed sleeves for the bowed spars these are kept in place by two holes in the ripstop.

Material.

For one kite.

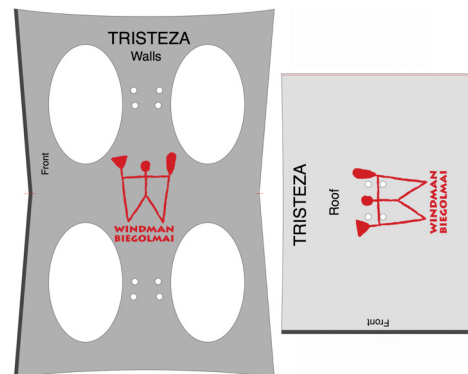
- Ripstop (preferably Icarex, but at least it should be slightly crispy)
 - Roof: 35 x 25 cm
 - Walls: 35 x 50 cm
- Dacron tape, 20 mm width: 45 cm
- Carbon fibre rod
 - 1.5 mm, length 110 cm
 - 1.0 mm, length 200 cm
- Fibre glass rod
 - 3,0 mm, length 30 cm
- 1.5 mm end caps, 4 pcs
- 3 mm end caps, 2 pcs

For a throng of 6 kites.

- 6 three-way swivels (20 - 30 kg)
- 6 snap lock swivels (10 - 20 kg)
- 20 m braided line, 20 - 50 kg (stiff)
- 15 m monofilament fishing line, 20 - 30 kg

Templates.

1. Cut out the two templates: Roof and walls.
2. Cut out the four oval holes in the wall part.
3. Punch the small double twin holes on the wall and on the roof (twelve holes altogether), preferably with punch that is 9 mm, i.e. 1 mm larger than the holes in the ripstop.



Ripstop.

It probably looks better with a lighter colour on the roof and darker on the walls. The colours can be different shades of the same colour, but also totally different colours, which can give nice effects in sunshine. For clarity in this plan different colours are used for walls (blue) and roof (yellow).

4. Cut out the two ripstop pieces according to the templates.
5. Mark on both of the ripstop pieces which end is the front/leading edge, which is important for distance to the twin holes.
6. In both sail parts punch the 8 mm holes for the bowed spars, four on the roof and eight on the wall part.

Be as accurate as possible with the twin holes: they will function as place holding “sleeves” for the carbon fibre bows to prevent them from sliding out of the pockets without adding any tension on the ripstop, and also keeping the bow tight to the sail.

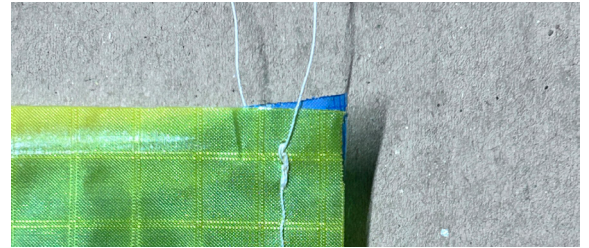


Front edge of ripstop chalked.

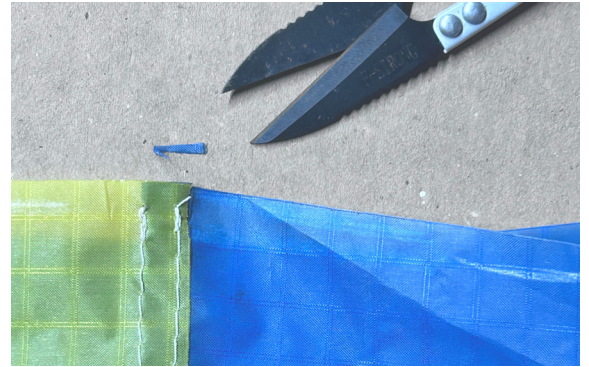


7. Sew the roof part onto the wall part, starting with the front edge of the roof part 2 mm inside the front edge of the wall part.

Note that the waist on the wall part has a slightly deeper curve than on the roof part.



8. Fold the roof ripstop over to the wall part for the second seam.
9. Trim the ripstop (wall) at all roof corners.

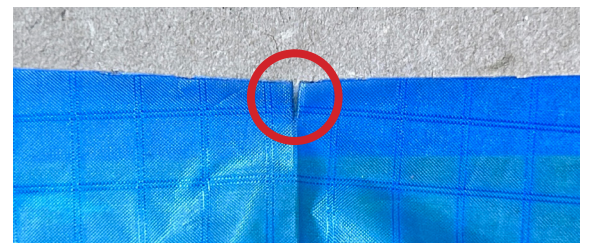


Roof part folded over wall part for second seam and corner trimmed.

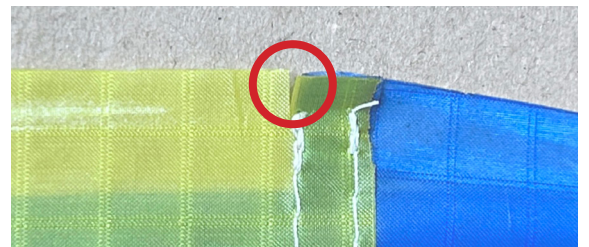
10. Find the exact middle of the leading and rear edges of the wall by folding the whole sail double with the roof corner seams perfectly aligned. Mark the middle in both the leading edge and the trailing edge with a pencil.



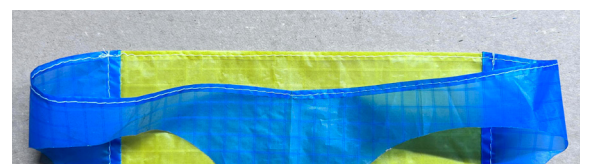
11. Cut a 5 mm slit at the middle mark in leading edge.



12. Cut 5 mm slits in the leading edge at the joins of the roof and wall parts, i.e. the box' top corners, for a smoother hem.



13. Hem the leading edge with a 5 mm hem.

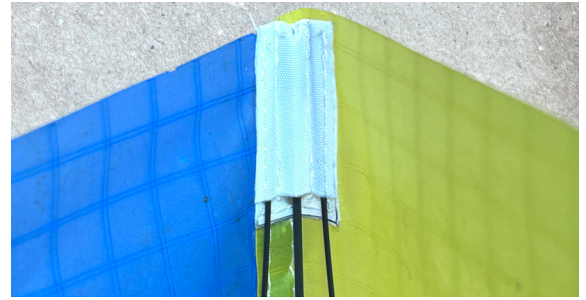


Pockets.

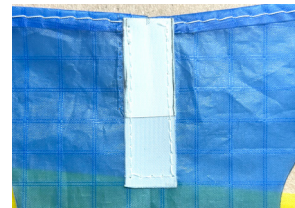
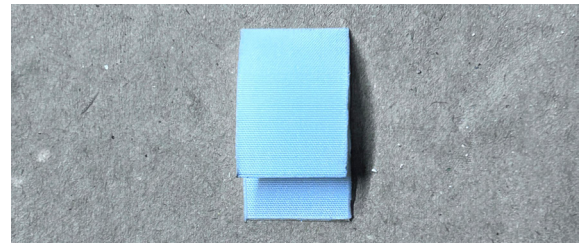
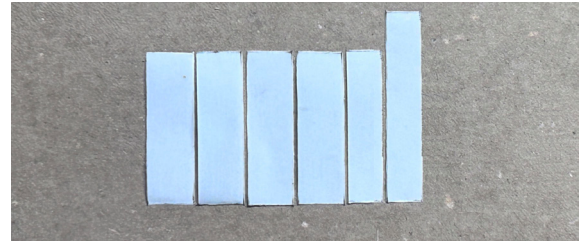
There are pockets in each of the six corners of the box kite. Each pocket is for three spar ends: a 1.5 mm long-iron spar in the middle and two 1.0 mm (1.5 mm for roof front) bow spars at the sides.

The pockets are quite deep, 3 cm, just to prevent the bowed spars from accidentally slipping out.

14. Cut 6 pieces of dacron for pockets:
 - Four pieces 6.5 x 2 cm for the triple pockets at the roof corners.
 - One piece 6.5 x 1.5 cm for the single pocket at the bottom rear corner.
 - One piece 8.0 x 1.5 cm for the single pocket at the bottom front corner. (The extra length is to provide reinforcement for the tow point holes.)
15. Fold each piece so one part is 3 cm long (3 + 3.5 cm and 3 + 5 cm).
16. For the wall bottom sew the 1.5 cm wide pockets with the middle of the pocket aligned with the made marks on the front and rear edges.
 - a. Sew the piece with the longer protruding part on the front edge.
 - b. Sew the piece with the shorter protruding part on the rear edge.
17. For the four 2 cm wide roof pockets: mark the middle of the crease and make also marks 4 mm on each side of the middle mark.
18. Sew the four 2 cm wide pockets in the roof corners, aligning the middle mark on the pocket with the exact corner of the sail. Use three seams: one around the edges and one on each of the marks 4 mm from the middle mark.



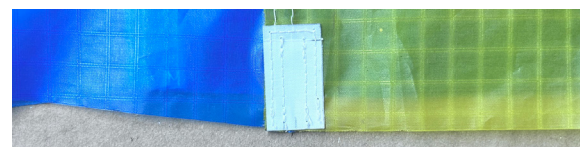
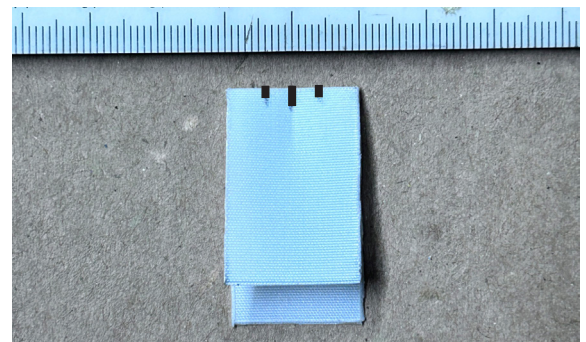
Triple pocket.



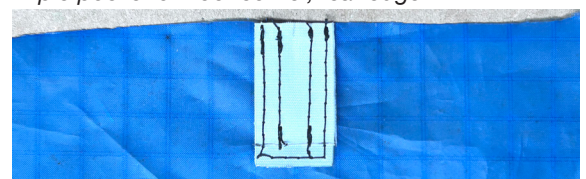
Front edge single pocket on the middle of the wall.



Rear edge single pocket on the middle of the wall.

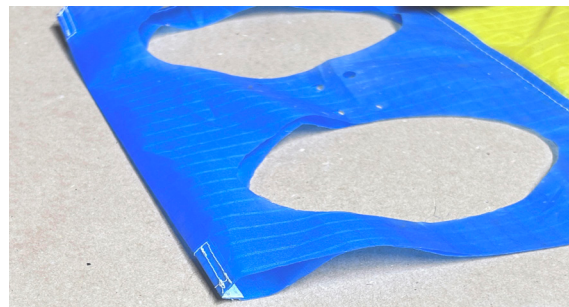


Triple pocket on roof corner, rear edge.



The three seams for the triple pockets here sewn with black thread for clarity only.

19. Turn the box sail outside in (so the pockets are inside) and made a sharp crease along the box edges from pocket to pocket to define the three long edges of the box.



Sharp crease on wall pocket and long edge.



Sharp crease on roof pocket and long edge.

Spars.

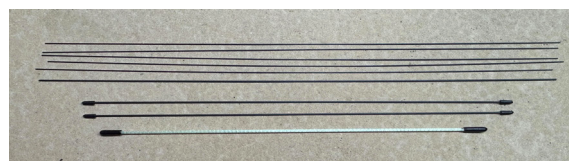
All spars, except one longeron, are carbon fibre rods, either 1.0 mm or 1.5 mm.

Bow spars: Six pieces carbon fibre rods all 40.0 cm long:

- 5 pcs of 1.0 mm.
- 1 pcs of 1.5 mm for the leading edge of the roof.

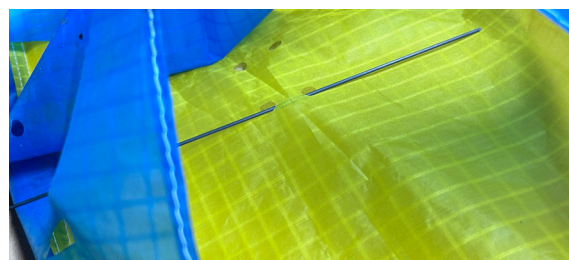
Longerons: Three pieces:

- 2 pcs 1.5 mm carbon rod approximately 33 cm for the roof.
- 1 pcs 3 mm fibreglass rod approximately 29.5 cm for the bottom.

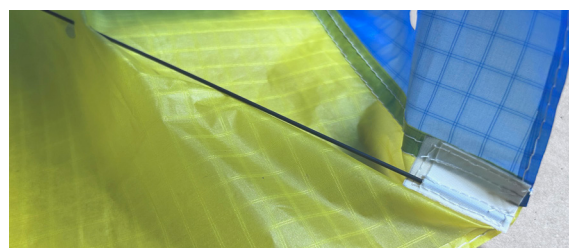


The longerons need end caps but the bows spars not; the bow spar ends only need to be rounded off.

20. Insert the 1.5 mm 40.0 cm bow rod through the twin holes nearest the roof's leading edge, from the inside so it comes back on the inside.



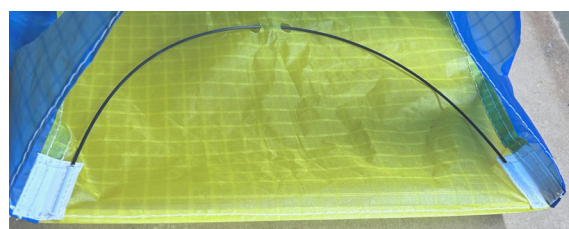
21. Insert one end in the nearest outer part of one triple pocket.



22. To prevent that the stiffer 1.5 mm rod accidentally rips the twin holes when bending the rod to insert in the second pocket, slide down the ripstop towards the first pocket. This makes it easier to insert the other end of the rod in the second pocket with less tension on the roof ripstop. When the rod is inserted in the second pocket carefully slide back the ripstop.

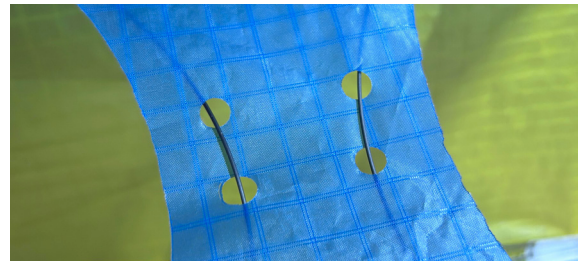


Use the oval holes in the wall to get easier access to the pockets.



23. Insert the 1.0 mm bow rods through the twin holes for all other corners in the same way but without necessarily sliding down the ripstop towards the first pocket.

In the bottom corners all spars (the two bow rods and the longeron) will get along in the same single pocket.



All the bow rods should be passing freely through the holes without adding tension to the sail in any direction.

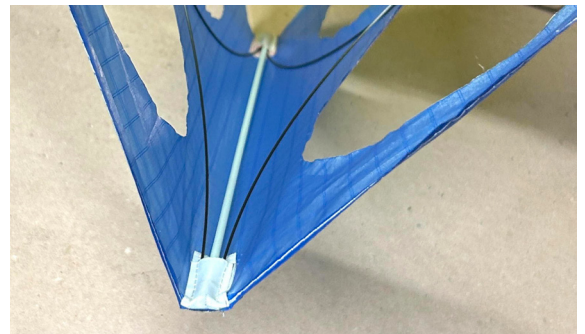
24. Put end caps on the 1.5 mm 33 cm longeron rods and insert the rods in the middle of the pockets in the roof corners. The rod should have a slight upwards bend to give a springiness that tensions the ripstop. Shorten the rod if it bends too much. Normally the length is a little less than 33 cm, depending on how the pockets are sewn and what kind of end caps are used.



25. The bottom edge of the triangular box has no waist; no curve, so the longeron must be straight and stiff to provide a well defined bottom edge. Thus the length of the 3 mm fibre glass, including the end caps, must be trimmed to an exact length that stretches the ripstop without having any upwards bow. Normally the length is around 29.5 cm, depending on how the pockets are sewn and what kind of end caps are used.



The three spars in the same single pocket.

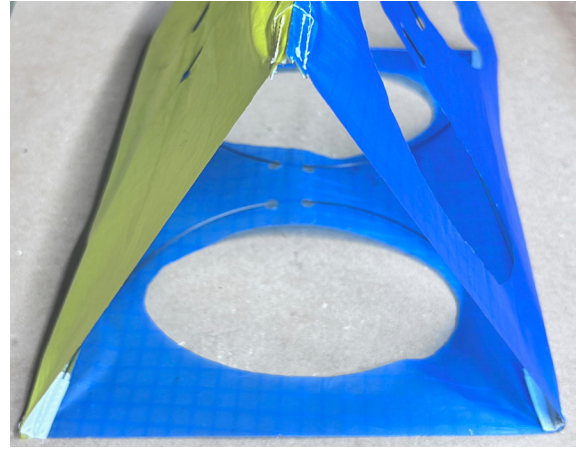


The 3 mm fibre glass rod with an exact length to stretch out the bottom edge.



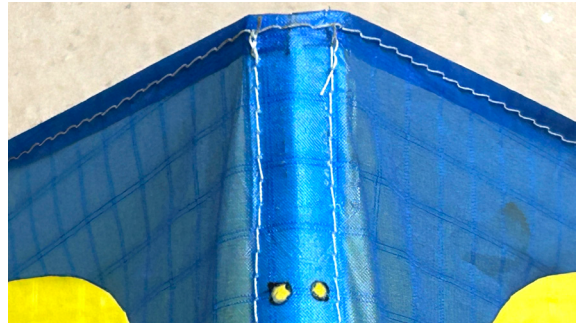
Straight and well defined bottom edge of triangular box.

26. Bend/fold the six pockets along the longerons to make the corners of the box as sharp and well defined as possible.



27. Punch or burn a small double hole for the single point tow line 4 cm from the front edge at the wall bottom.

Tie the flying line through the holes and around the glass fibre rod (see also step 40).



28. Test fly each kite individually before making the throng. If the kite tends to pull to one side the pockets for the bottom longeron are maybe not absolutely centered.

The name.

- Tri - The box has three walls.
- Tristeza - Although the Portuguese word 'tristeza' means 'sadness' there is a beautiful Bossa Nova sung by *Astrud Gilberto* entitled "Tristeza - Good-bye sadness" with lyrics of leaving sadness behind. That's why there is a black/grey box in the bottom of the throng and then the rest of the boxes in vivid colours.

<https://youtu.be/cwPgtzqNN-U?si=t0qb-ZzBUimKQtFJ>

Making a Tristeza throng.

Marriam-Webster: **Throng** - a large number of animate or inanimate things massed together and usually in motion.

Tristeza is intended to fly in a throng, which is achieved by each kite flying on a branch line from a main line.

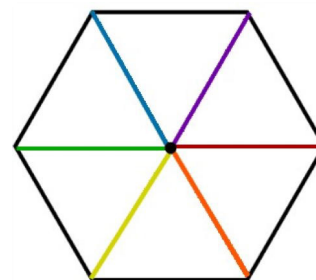
To launch a throng of Tristezas one would need at least four hands, so having a team mate assisting with the launching is a big help. But it is also possible to do the launch as a single person using some special made equipment: the *Sate Layangan* system, see the **Appendix** below.

The main line has *three-way swivels* on regular intervals that the branch lines are connected to. The lines should be both fine and, to avoid tangling, somewhat stiff.

The interval between the three-way swivels should be at least 50 cm bigger than the length of the branch lines to avoid tangling between the elements.

The branch lines are connected to the three-way swivels on the main line by *snap lock swivels*.

Since the shape of *Tristeza* is an equilateral triangle, six kites can be put together to create a hexagon. Therefore this plan describes a throng of six *Tristezas*.



Lines.

Tristeza does not have a lot of pull so very fine lines could be used, but to avoid the risk of branch lines tangling with other branch lines or the main line and making complex knots, they should be rather stiff and not too fine. The lines should also have a thickness that is comfortable to handle.

- Main line.

- Strength 20 - 50 kg. Can be braided or monofilament (fishing line).

- Branch lines.

- Strength same or less than the main line, preferably monofilament (fishing line) in a colour different from the main line. Thickness 0.5 - 0.6 mm.



Examples of suitable main line:

A braided PE ("dyneema") with 8 strands. Thickness is 0,6 mm and strength is 46 kg. These PE lines come in different colours.

PROTEC is a long life line from Ockert with high abrasion resistance. The 50 kg line has a thickness of about 0.6 mm and is quite stiff.

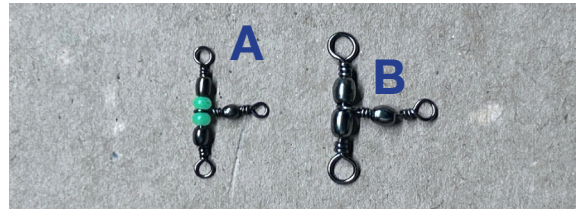


An example of a suitable branch line: a monofilament line with 0.55 mm thickness. The strength is 21 kg, which is unnecessary, but a thinner line is less comfortable to handle. This example is in blue colour.

Connectors.

Line connectors used for fishing are used for the throng. As the pull from the *Tristeza* kites is quite small the connectors could also be quite small, but in order to be able to handle them with more ease it might be good to step up the size to a comfortable size. There is of course a small difference in weight, but only less than a gram, and that bigger weight does not have any visible impact on the flying.

- *Main line three-way swivel.*
 - Recommended size 20 - 30 mm, 20 - 30 kg.



Examples of three-way swivels.

A has a strength of 20 kg, is 24 mm high and weighs 0.4 grams.

B has a strength of 28 kg, is 29 mm high and weighs 1.3 grams.

Both are of course unnecessarily strong, but **B**, with its larger eyes, is more comfortable to handle.



Packages of the above **A** and **B** examples.

- *Branch line snap lock swivels.*
 - The snap lock should be easy to open and close. There are several different types of snap locks that are closed in different ways.
 - Recommended size 30 - 40 mm, (> 20 kg), see pictures to the right.
 - The snap lock should always be closed; if left open it easily gets hooked on other lines parts.



Snap lock swivels come with different solutions of the snap lock and in different sizes.

D and **E** are maybe a little bit easier to lock and unlock.

C has a strength of 15 kg, is 30 mm high and weighs 0.4 grams.

D has a strength of 12 kg, is 28 mm high and weighs 0.3 grams.

E has a strength of 28 kg, is 34 mm high and weighs 0.4 grams.

All are of course over dimensioned, but for comfortable use **E** is recommended.



Packages of the above **C**, **D** and **E** examples.

Knots.

Knots should be kept as small and slim as possible to not be “line catchers”; i.e. catching a branch line from a neighbouring kite and start a tangle. The knots should also be slip knots, that can be slipped to direct contact with the connectors. As connectors used for fishing are used for the throng lines, it makes sense to use fishing knots. The *Uni Knot* can be used on thin (≤ 0.6 mm) monofilament line and the *Slip Knot*, which is just a smaller version of the *Uni Knot*, can be used on braided line.

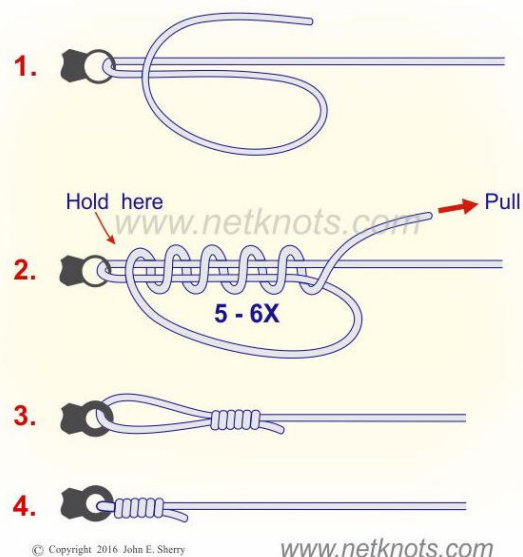
Tying a Uni knot.

29. Follow the procedure in the figure to the right. At step 1 have 25 - 30 cm of line to tie the knot.
30. At step 2, after making the 5 - 6 rounds and before pulling the knot tight, lubricate the line by moistening the rounds slightly, e.g. by licking the line.
31. When the knot is pulled tight and even, pull the main part of the line so the knot slides nicely to the swivel.
32. Trim the excess part of the short end.

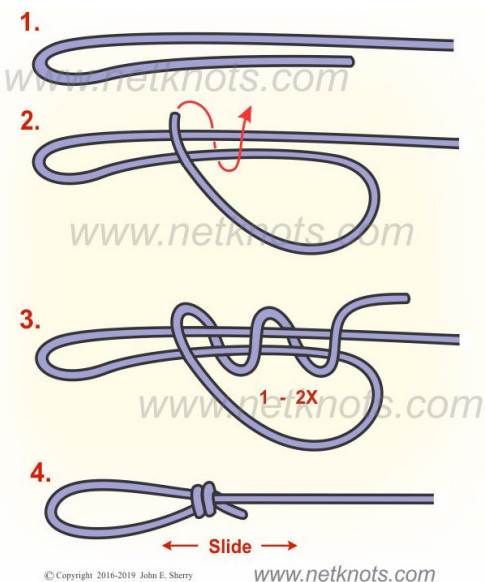
Tying a Slip knot.

The Slip knot is just a smaller version of the Uni knot with less turns: two instead of five.

33. Follow the procedure in the figure to the right.
34. At step 2 make only two rounds but lubricate the line in the same way. Then continue as for the Uni knot.



Uni knot for ≤ 0.6 mm monofilament line.



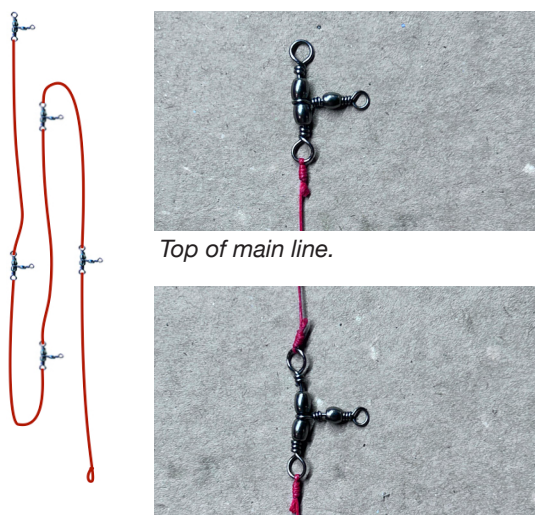
Slip knot for thin braided line.

Main line for a throng of six elements.

35. Cut 5 pcs of stiff braided 30 - 40 kg line, 3.3 m each.

(There is one piece less than the number of elements in the throng since there are two elements connected to the top three-way swivel.)

36. Using *Slip knots* (or other preferred small knot) tie the line pieces to five three-way swivels to a long “chain” of five segments with a three way swivel on top.
37. At the open end of the 5th piece of line tie a loop for connecting the flying line.

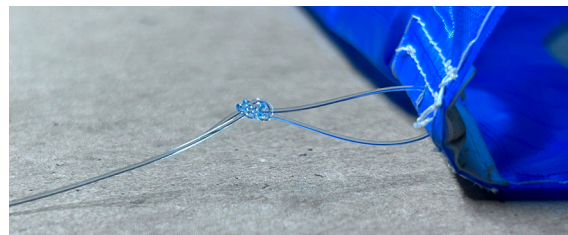


Main line in five segments.

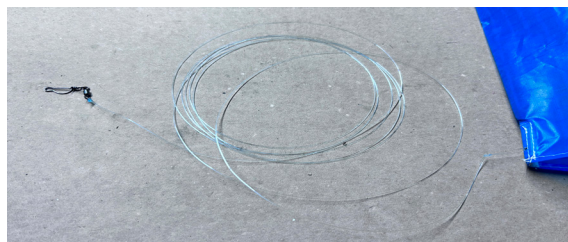
Segments in main line.

Branch lines for a throng of six elements.

38. Cut one 5 m piece of the monofilament line for the top kite.
39. Cut 5 pcs of the monofilament line, each 2.3 m.
40. Tie one end of the monofilament line directly to the kite, with the line through the tow point holes, using an overhand knot so there is a fix loop that gives some flexibility at the tow point.
41. At the other end of each monofilament line tie a snap lock swivel.

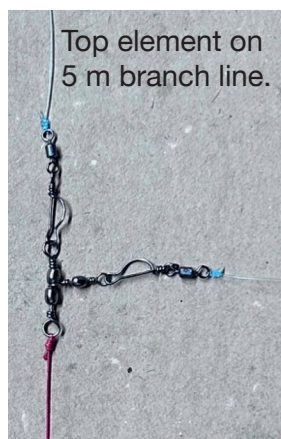


Fix loop at tow point.



Attaching branch lines to the main line.

42. At the top three-way swivel, snap the 5 m branch line in the free vertical eye and a 2 m branch line in the branch eye.
43. Snap the remaining 4 branch lines into the remaining three-way swivels.



The top of the main line with the top element hooked to the top eye of the three-way swivel on a 5 m branch line and the second element hooked on the side eye of the three-way swivel.



A segment of the main line with an element hooked on the side eye of the three-way swivel.

The Throng Line Winders.

Two line winders are required to handle the main line and the branch lines: The *Wu Winder* with main line and branch lines separated for launching, and a *Pre Winder* that is used to store the main line till launching of a Tristeza throng is going to be being prepared.

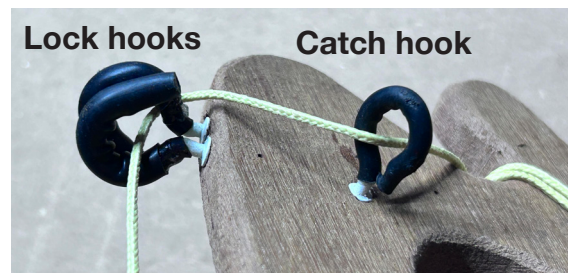
Any standard line winder can be used as Pre Winder, but the Wu Winder must be specially made. The drawing for the Wu Winder is included in the templates.

The name **Wu** in the Wu Winder is derived from the Chinese character 吳, which to some extent resembles the shape of the winder.



Pre Winder and Wu Dual Line Winder (where the main line and the branch lines are wound in an X).

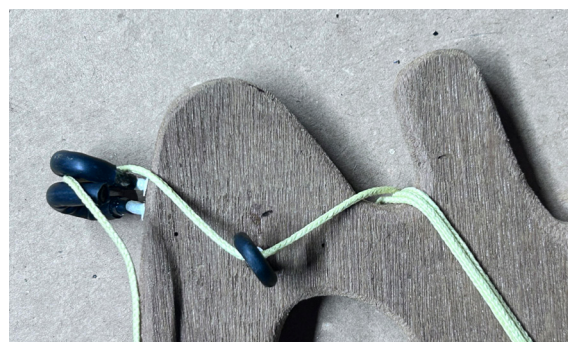
The Wu Winder has actually two purposes: in addition to winding up the main line and the branch lines separately, it must secure the top of the branch lines (the line part from the winder to the kite threaded on the rod, see the Appendix) in an orderly way (first in - last out) so it doesn't tangle with other branch lines. Two sets of eye hooks are used to secure the branch line: a single eye hook that catches the top of branch line, and two counter directional eye hooks close to each other that lock the line.



Principle of the hooks for the branch lines:

The hooks are half ring eye hooks, both covered with heat shrinking tube.

- *The Catch hook catches the branch line as it leaves the winder.*
- *The Lock hooks (two opposing hooks close to each other) lock the branch lines together near the winder.*

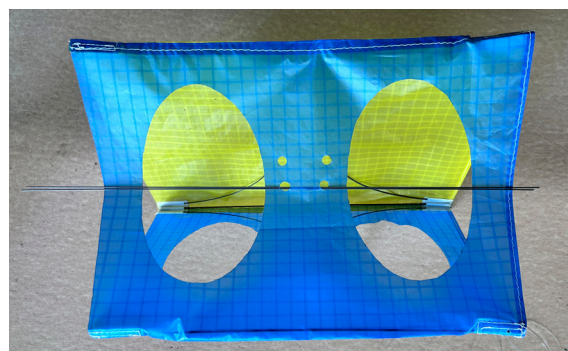


When winding up the top of the branch line it is first slipped into the Catch hook, then slipped from behind between the Lock hooks.

Transportation.

For transportation the 1.0 mm bowed spars in one of the walls can be removed to make a transportable flat package.

44. Release one branch line at a time from the main line. Always close the snap lock to prevent it from getting stuck in unwanted places.
45. Remove the bowed spars in one wall.
46. Insert the pair of spars through the small bow spar holes on the wall in the longeron direction.
47. Fold the wall inwards to make a flat package.
48. Wrap the branch line around the flat kite and secure the snap lock swivel by inserting the two released 1.0 mm spars through the snap lock.



Appendix.

Sate Layangan - system for single person launch of a throng of 3-dimensional kites.

The whole purpose of the *Sate Layangan* system is to allow a hassle free launch of a throng of 3-dimensional kites without the kites having a chance of branch lines tangling.

The system consists of three parts:

- A rod of 160 - 180 cm length. For portability a sectioned fishing rod should be used. The total length depends of the height (and arm length) of the kite flier.
- A 'quiver' to hold the fishing rod in place with a little distance from the body.
- A pair of line winders (Wu Winder and Pre Winder) to wind up the throng lines (see pages 11-12).

The rod ("skewer").

On the rod the *Tristeza* kites are threaded on through both of the front oval holes. This keeps the kites firmly in launching order and prevents them from coming in disorder and tangle the branch lines. At the top of the rod there is a T-connector with short carbon tubes across to prevent kites accidentally blowing off the rod prematurely. The lengths of the carbon tubes are different and are optimized to barely pass through the oval holes. The shorter is 13 cm and the longer is 20 cm.

With the kites threaded on the rod it looks like a satay. In Balinese language *Sate Layangan* - Kite Satay.

The 'quiver'.

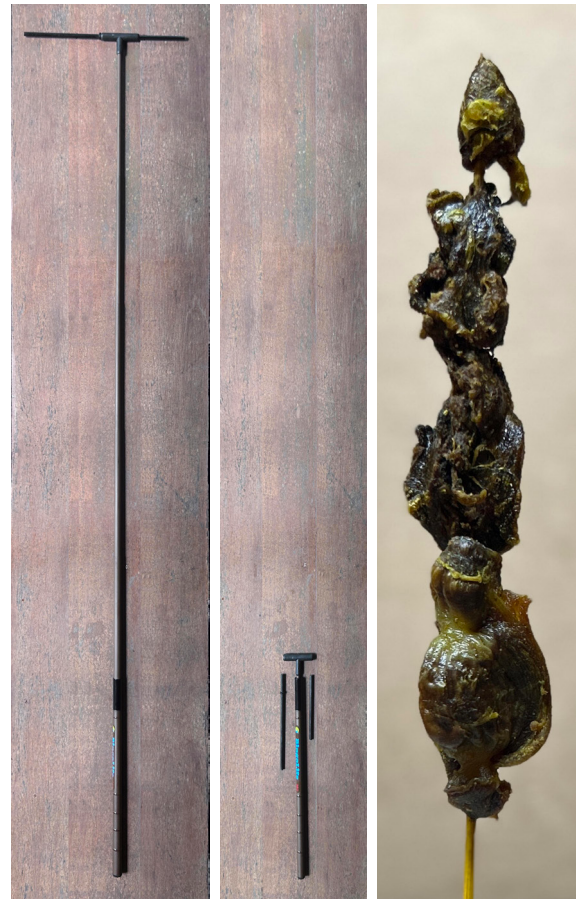
The 'quiver' is a piece of PVC pipe that has been modified for the purpose.

The inner diameter of the pipe should be enough to insert the rod, and the length before cutting is approximately 80 cm.

It is fixed to the body of the kite flier in two places: below the knee (with a strap) and at the waist (with a hook around the belt).

Using a hot air gun the PVC material can be made flexible to be bent in desired shape.

- a. Cut 80 cm of a suitable PVC pipe.
- b. From one end saw off half of the pipe, approximately down the middle 20 cm.
- c. Heat up the remaining 'half pipe' and press it flat.
- d. Heat up the area where the 'half pipe' begins and bend the flattened part in a right angle out from the pipe.
- e. Bend the last 10 cm part downwards to an angle that is about 75° towards the already bent part.
- f. Heat up the other end (bottom end) of the pipe and flatten about 3 cm of the whole pipe so this flattened part is aligned with the flattened part in the top.
- g. Fix a short strap to the bottom flattened part with a pop rivet or a screw and nut. The strap is to tie around the leg below the knee.



Collapsable fishing rod with T connector in top. There are removable carbon tubes inserted in the top T connector to prevent kites accidentally blowing off the rod prematurely.

Sate Ati Ayam - Chicken liver satay.



Since PVC material is rather flexible, the hook has been reinforced with the flattened 'half pipe' sawed off in step b.



Preparation for launch.

Prerequisites.

- The main line is wound in reverse order on the Pre Winder: the line end with the loop for attaching the flying line is outermost.
- The rod is in a secured vertical (or horizontal) position.
- The Tristeza kites should be assembled and their branch lines wound up around the kite.



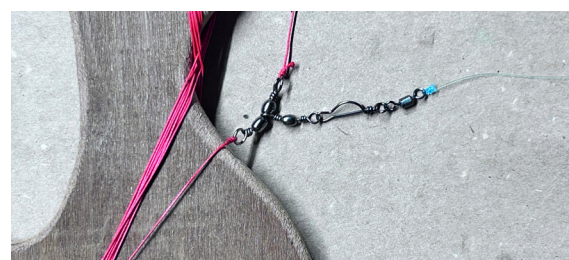
Pre Winder with the main line wound in reverse order, the bottom loop ready to be attached to the Wu Winder.

1. Slip the loop of the main line from the Pre Winder around a bottom 'finger' of the Wu Winder and wind up the bottom line segment in a figure of 8 in the / ("slash") diagonal on Wu Winder till the first three-way swivel.



Use the indicated winder indents for the main line.

2. Snap the hook on the branch line of one Tristeza kite to the three-way swivel.



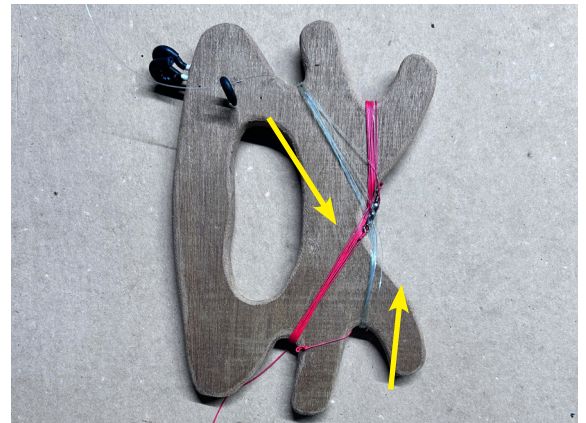
3. Thread the kite on the rod through the front oval holes.

Hold the kite at the towing point and thread it over the longer of the carbon tubes through the front oval holes. As the bottom of the holes reach the rod: fold down the kite over the shorter rod.



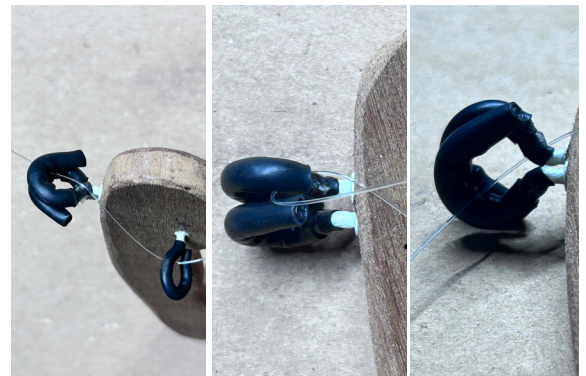
The length of the cross carbon tubes is optimized to precisely pass through the oval holes: 13 cm and 20 cm.

4. Wind up the branch line in a figure of 8 in the other diagonal, \ ("back slash"), on the Wu Winder.
5. When there is 0.5 - 1 m left of the line, pass the line through the single catch hook on the winder.



Wind the branch line in the indicated direction so it easily can continue to the catch hook, coming from the back side of the upper indent.

6. After the catch hook, pass the branch line between the double lock hooks from behind.



Pass the branch line behind the opening of the upper hook.

Pull the branch line so it slips fully between the two hooks...

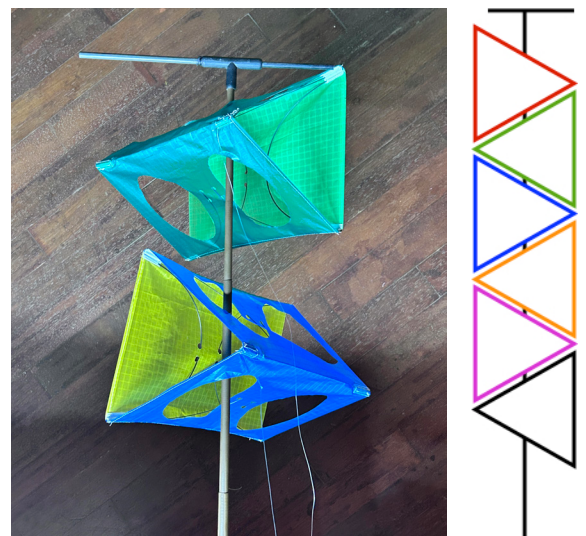
... and becomes locked inside the two lock hooks.

7. Wind up the next segment line till the next three-way swivel.
8. Snap the hook on the branch line of the next Tristeza kite to the three-way swivel.



9. Thread the second kite on the rod through the front oval holes but from the other side of the kite so the elements get efficiently packed:

Swing the rod 180° so the longer tube points in the opposite direction. Again: hold the kite at the towing point and thread it over the longer of the carbon tubes through the front oval holes. As the bottom of the holes reach the rod: fold down the kite over the shorter rod.



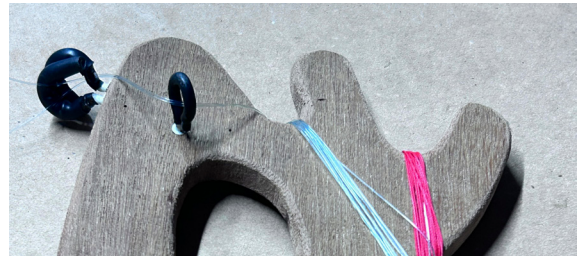
Rod swung 180° for second kite to pack the Tristeza kites efficiently to a Sate Layangan.

10. Secure the branch line in the same way.
11. Continue with the rest of the Tristeza elements in the same way, alternating how they are threaded on the rod.
12. It is crucial that until launching the Wu Winder is kept in an orderly way so the short branch lines to the kites don't get messed up. It may be tied to the rod using e.g. double sided velcro.

Launching.

When the Sate Layangan is prepared: dress up in the rod quiver and insert the Sate Layangan in the quiver.

- Release the branch line of the kite in top from the lock hooks and the catch hook and wind off the branch line.
- Release the top kite from the rod by first threading it back over the shorter carbon tube and then off the longer carbon tube and let the kite get airborne.
- Then release the next kites in the same way, alternating releasing main line and branch line.



Sate Layangan System. The quiver hooked to the belt and strapped to the leg. A rod with 9 Tristezas inserted in the quiver. The Wu Winder in one hand and the other free to operate the launching.



If making a Sate Layangan system for a throng of 6 Tristezas (or more) feels too ambitious, also just a pair of Tristezas looks nice, dancing in the sky.

2025-06-26