

Definition: *A delta is a kite with two wings, swept back leading edges, each stiffened along at least part of its leading edge. There is a keel or spine that results in each wing having a conical section in flight. The distance between the outside edges of the wings is determined by a spreader bar.*

## 1 Introduction

[Note: this chapter was originally the first article which I wrote for *The Kiteflier*. I have updated it but deliberately not changed the first four paragraphs so that you can get the flavour of my original intention.]

I have decided to write about deltas because the first kite I made as an adult in 1979 was a Delta and since then they have given me hours of pleasure. They are graceful and they usually fly best in the light winds that I most enjoy. Easy to assemble, just insert one spar. Easy to make too. This article is not written to allow someone who has never made a kite to go out and buy the materials and make one. Rather it hopes, without being “too scientific”, to tell most fliers a little more about a kite type which many of us own; and perhaps also to get builders interested in new configurations and new types which they could try.

There are references, listed at the end, and a set of kite plans chosen to illustrate points made, particularly Section 3. I suggest you look at them now as I haven't made detailed references to the appropriate plan as the point arises — too complicated. There is also an annotated bibliography and a gallery of delta kites.

This is a modified version of an article originally published in *The Highflier*. Thanks to Harry Peart of the North East Kite Fliers. I sent the history section to Valerie Govig of *Kitelines* —she said she enjoyed it— so at least she didn't disagree.

I wouldn't have been able to write much of this without reference to old copies of *The Kiteflier* and *Kitelines*<sup>1</sup>.

I'm only concerned with single-line kites.

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1. *Kitelines* vol. 3 no. 1 (Winter/Spring 1981). A good account of the history and development of deltas up to that point. Plans for six deltas. Also the basis of a definition of delta kites.

The origins of the Delta kite are not entirely clear, which is odd for a kite which is less than 60 years old. Most fliers probably think of Deltas simply as one of the kites which have come to us from 1948-63, that amazingly fertile period for kites in America, being a descendant of Rogallo's Flexikite (1948). Other radically new kites were the Allison Sled (1950) and Jalbert's Parafoil (1963). Where would our children's workshops be without sleds? And where would our kite festivals be without soft kites?

Books usually say that the Delta is descended from the Flexikite and that hang gliders also developed from Rogallo's work – which advocated that wings should be flexible and allowed to have their shape influenced by airflow, not the rigid structures of traditional aeronautics. I believe that the first modern hang glider flight was that of Richard Miller's 'Bamboo Butterfly' on 16 January 1966 at Dockweiler State Park, California.

Mind you a true Eddy kite has a very curved aerofoil, but that is a different story.

The Rogallos built the first totally flexible kite in 1941, patenting it in 1951 (Illustration 1). It was sold largely as a specialist toy in the 1960s. But unlike Deltas as we know them it had no stiffening by struts at all, just a crease in the plastic along the centre line and it used multiple bridles to hold the fabric in shape (originally 28 lines, later reduced to 4). So don't look at the definition above, because unlike our Deltas it had no keel, no spreader bar and required a tail, probably because of the shiny plastic used.

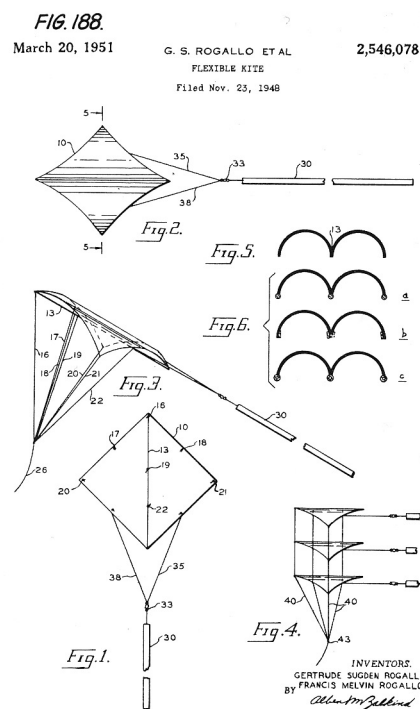


Illustration 1: from Rogallo's patent application

The closest descendant of the Flexikite was the Glite, based on Cleveland's 1966 patent which is shown as Illustration 2, a commercial plastic kite on sale in the 1970s.

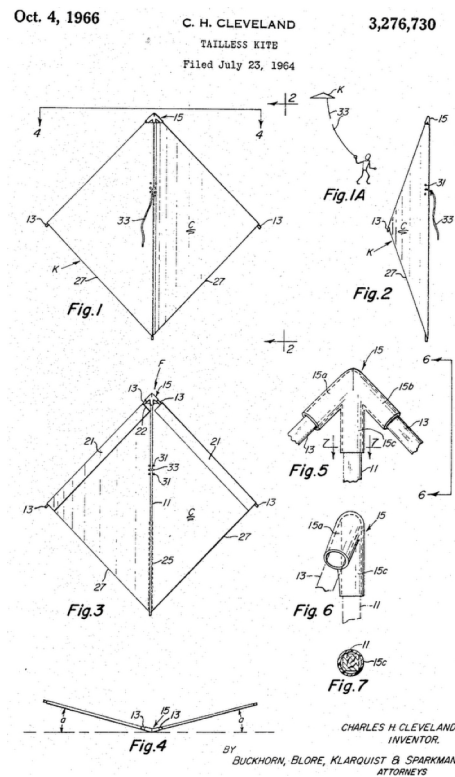


Illustration 2: from Cleveland's patent application

It used a solid nosepiece to fix the angle between the keel and the wing leading edges.

Instructions were given for two-line flying — clearly predating Peter Powell. A nose-fitting to pre-form the dihedral was also used later with Peter Powell and Rainbow stunters. Dunford made a delta with a sprung nosepiece and no spreader. In 1991 Ed Grauel designed a 'delta' with 3 wings each  $120^\circ$  from each other. The line was attached to the leading edge of one which then became the keel so that the colour scheme could be changed by rotating the choice of keel. The legendary Russell Hall (1964) (see Illustration 3) is a low aspect ratio kite which allows slack wings to take up a conic section and thus has a similarity to a delta and a hang glider. But it requires a considerable tail, and in my experience a locksmith's delicacy to set the bridle correctly.

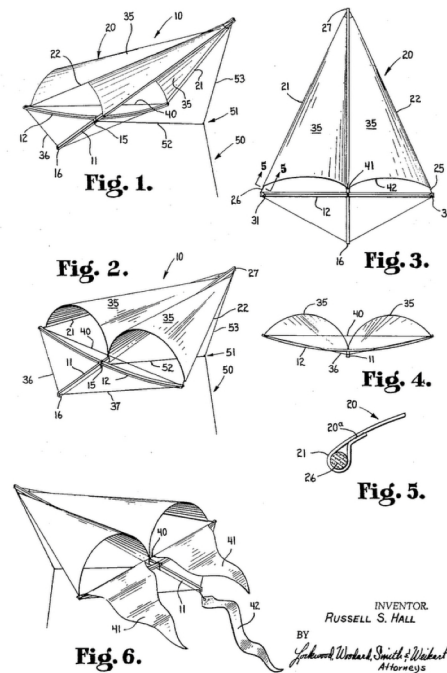


Illustration 3: from Russell Hall's patent application

On now to what I think is the real origin of the delta — which is very similar to Dan Leigh's 'The History of the Delta' on his website ([www.deltas.freeserve.co.uk](http://www.deltas.freeserve.co.uk)). He is a world expert on deltas, an American who is a longtime resident of Wales. He is clear that deltas did not evolve from the Rogallo wing.

Undoubtedly the first commercial Deltas were manufactured and sold by Fantastic Kites (which became Gayla Kites in 1961). Wilbur Green of Fantastic Kites was the patentee in 1945/6 and the main part patented was the keel. He had started in kites by designing Western versions of Oriental kites and saw an illustration of a Chinese bird kite with a keel.

In 1963 Al Hartig (known as 'The Nantucket Kiteman') made a Red Baron, a cloth version of a modified red Gayla kite. Soon one of his friends used rip-stop nylon. Hartig obtained a patent in 1967 and his cloth Deltas became the basis for the kite we know today. I have a cloth Hartig (Illustration 4). (Thank you Paul and Natalie.) The details are fascinating. You can't lose the spreader as one end is drilled to allow a cotton thread connection to the wing spar. The same system of sewing loops through drilled holes anchors spars to pockets. (Illustration 5).



Illustration 5: Hartig

Oct. 17, 1967

A. E. HARTIG  
KITE

3,347,500

Filed June 30, 1966

2 Sheets-Sheet 1

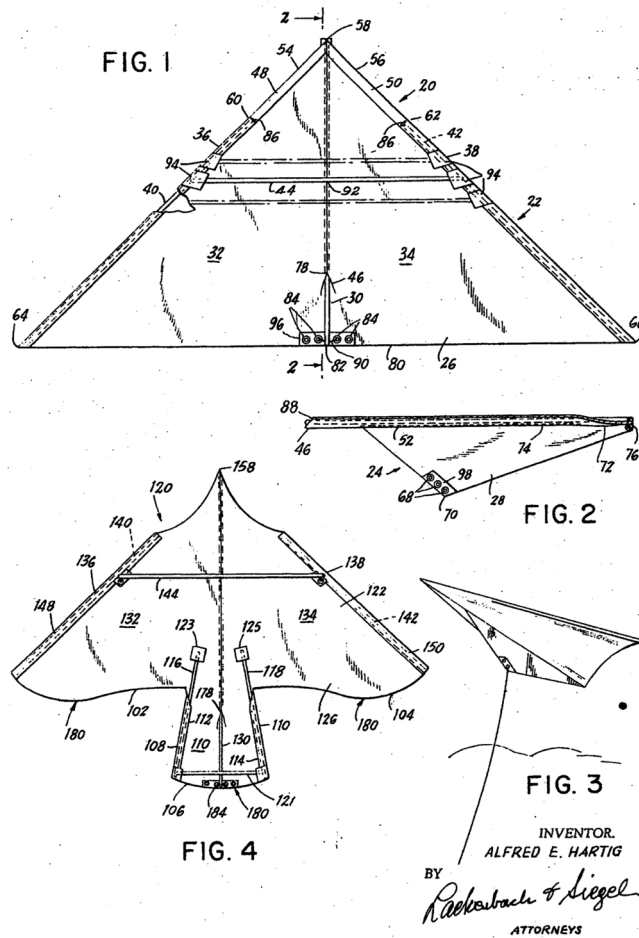


Illustration 5: Hartig detail

The name “Delta” seems to have been coined for one of his kites by 1966<sup>2</sup>. So of the three ‘essential’ features of a Delta; the **flexible wing** doesn’t seem to have been derived from Rogallo, and Wilbur Green has claimed that Gayla kites were sent to the USAF before military work on the Rogallo wing and hang gliders. The **keel** came from a rather unusual feature on an Oriental kite (some Thai kites also have keels) and the **spreader being loose** enough to allow the wing to respond to the airflow might have been no more than the result of requiring a ‘push fit’ way of setting up a kite which had to be collapsed into a long narrow packet for marketing.

This account has tried to explain the development of the Delta in America, but the world wide range and antiquity of kiting means that inevitably it can be shown that features of the Delta exist elsewhere. The most similar kite is the Japanese Tosa Dako<sup>3</sup> which is basically a square plan flown on a corner, multi-bridled down the centre line. No keel, and with two or three spreaders set at about the point found on a Delta. The design has the Delta advantage of being easily rolled up with the spreaders removed, unusual for a Japanese kite, but shared by the Rokkaku. Two spreaders might seem odd, but Nishibyashi’s aeroplane Delta uses this method. Keels go back to the 19<sup>th</sup> century in the USA where the Boynton ‘Fin’ kite was known in 1896 (see forward to Marvin [1]), as was the Clayton Keel Kite. Keels were also known to European fliers before 1946. I am not sure when Brookite first used a keel on a kite (the well-know cutter kite) but I remember seeing a plan for a Malay type kite with a keel in a pre 1914 model maker’s magazine (an old copy). Woglam’s (1884) pleat down the centre line of a slack covered Eddy-type kite produces a keel in flight.

Delta kites were being experimented with and developed, initially by American fliers, through the 1970s and perhaps the most fruitful time when Delta variants emerged was the decade from the mid-70s. But it is interesting to note that Wagenvoord’s well known book of 1968 [2] doesn’t mention Deltas by name despite having a photograph of a Hartig Delta in Central Park, New York, but it does refer to ‘dart shaped floaters’. Newman [3] emphasises the keel as an important feature. Delta kites are briefly in Pelham [4] where it is recommended that they should have an aluminium spine to cope with them being temperamental in tricky ground winds. And I have met a flier who tried to build a Delta from Pelham in the 70s, didn’t notice that the wing spars did not extend to the nose and found it wouldn’t fly. Two articles in the AKA’s magazine *Kite Tales*, Spring and Winter 1974 issues, give an account of the impact of ‘The Beautiful Delta Wing’. For those of us who got into kites post-delta, it is difficult to imagine the effect on kitefliers who could now fly in light winds and thus expand greatly the number of

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2. *Kitelines* vol. 7 no. 4 (Winter 1989/90). More on the role of Wilbur Green and friends producing the delta.

3. *Kitelines* vol. 12 no. 3 (Spring/Summer 1997). ‘Tosa Dako. The ancestor of the delta.’

days they could enjoy their hobby. There are very detailed plans for a delta with a fringed training edge, justified by comparison with an aircraft's flaps. There is also a comment on the difficulty of getting 1/8" dowel in 48" lengths (so some materials at least were easier in the UK).

## 2 Materials and construction methods

A few thoughts about materials and construction methods. The first (Gayla) Deltas were, of course, made of plastic while the first Hartig didn't use Ripstop nylon because it wasn't generally available. Many Delta designs still use plastic, partly because it is cheap (free, when reusing plastic carrier bags) and partly because it can be light and colourful. Ultralight designs can be made using aeromodeller's materials or even silver survival blankets. Another advantage of plastic is that both wings can be cut at the same time ensuring symmetry.

Delta designs now use rip-stop nylon or similar which enables wonderful patterns to be created, however, life can get complicated with a material which has two different surfaces, but where in order to control stretch each wing must be cut with the grain at right angles to the leading edges. There are some good printed fabrics, rarely used nowadays, which would make interesting kites.

Fliers who design their own Deltas might well encounter the two main problems. Deltas with long leading edge spars and with spreaders near the nose tend to glide and over fly. Deltas with a high-aspect ratio are prone to slide off the wind. Both might be helped by using a porous material.

Regarding the size of Deltas, I have never seen a Delta of below 15cm. wingspan flying well without a tail. I've seen a 13m. span high aspect ratio delta conyne (or Hardec). I've seen plans for an American 9m. in plastic and bamboo (terrifying) and I have understood from *The Kiteflier*, October 2000 that the world single kite altitude record was broken by a 9m. span, 6m. high Delta.

For a long time spars in Deltas were exclusively wood, except for drinking straws etc in the small/lightweight versions. The only spar which usually comes under great strain is the spreader bar and it has to flex evenly. Some designers claim that a wooden spar which flexes and breaks in heavy winds is a safety feature. Apart from safety problems caused by a shower of broken spreaders under a flock of Deltas caught in a sudden burst of wind there are ways of reducing problems from wildly flexing spreaders.

If you have designed the kite so that normally there is, say, 15cm. between the centre of the spreader and the top of the spine, then you can incorporate a 15cm. loop into the top of the spine sleeve to control how that spar bends. This still allows the spreader to flex fore and aft. If required this also can be controlled by fixing a fin to the top of the spine with a hole to take the spreader at 15cm.. (A

possibility would be to develop this “dorsal fin” to provide the directional stability needed, to omit the usual keel and to bridle directly to the spine).

You might, of course, decide to move to fibre glass or carbon fibre, the latter with little flex removes the compensation of a flexed spar in high winds, but it will save weight in kites where performance is worth achieving even at considerable extra cost. (This was originally written in 2001; when did you last see a wooden spreader?)

### **Construction**

Apart from getting the grain right, the only interesting construction method for Deltas has been how to attach the spreader bar to the wing edges. Recently, purpose built fittings have become available which have rather spoiled the fun and are considered by some to hold the wings too firmly and to interfere with flexibility. You will get some idea of the variety of methods used if you look at the plans available. I have fond memories of Jon Bloom’s Stacked Delta (a Neil Thorburn design) which used curtain hooks pushed through punched brass eyelets, and also Ernest Barton’s aluminium tubing beaten out flat at one end, pierced and sewn via a leather patch.

## **3 Components**

In this section I’ll look at the components of a delta: keels and plan shapes.

### **3.1 Keel**

The keel of a Delta is seen as providing both directional stability and the appropriate tow point. It is thus determined by the size and form of the wings. Keels also serve to spread the pull of the kite across part of the length of the spine (so if it was decided not to have a keel because directional stability was being gained in some other way, then a stronger spine spar would be needed). It is generally accepted that keels should be 8-10% of the sail area, probably less if the spreader is quite slack, more if the kite is to fly in string winds and so some Deltas have keels that extend aft of the sails.

If you are sure of the bridle point then the keel is usually made to have a 90 degree angle at the bridle point (bottom point). The keel is made of two pieces to allow the grain of the fabric to be at right angles to each edge (B in Illustration 6). It is possible to calculate precisely the best size of keel for any Delta plan<sup>4</sup> but if you are doing it by trial and error you might find (C in Illustration 6) of value as this enables the tow point to be varied while still keeping the keel taut. Although the

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4. See the book by Cottrell[3]. Pages 34-36 deal with determining the tow point and the layout of a standard delta. Pages 8-9 for a swept wing delta.

effect of moving between predetermined tow points on the same keel (customarily three) found on some kites to allow for different wind conditions may be useful, an unsightly, flapping keel can result. Anyway, one of the great advantages of the delta to its early users was the fact that many deltas never needed bridle point adjustment. For an interesting and relatively new design incorporating variable bridling and spreader lengths, see Fred Broadhead's 'Mi-Delt' in *Kiteflier* no. 79 (April 1999) and R.Martin's 'Delta developments — the delta keel' in *Kiteflier* 91 (April 2002).

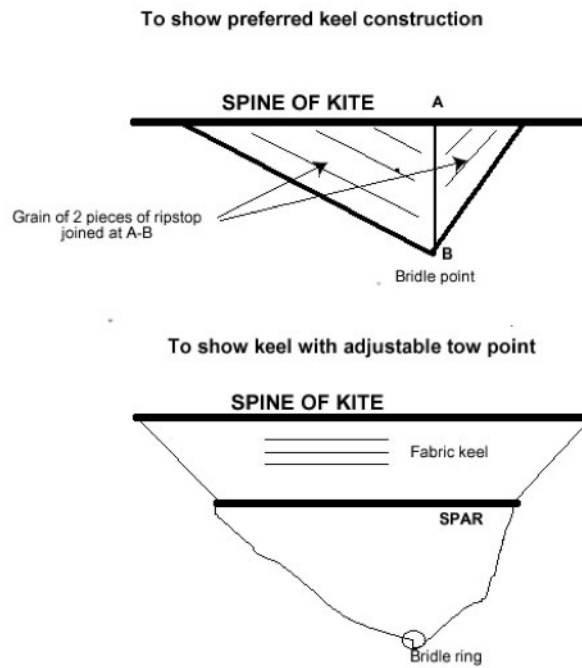


Illustration 6: the Delta keel

Variations of the standard single keel include:

- Helen Bushell's Tre-foil Delta (1978) (Illustration 7). The bottom line of the keel has a straight spar with a single tow point (A). In some versions the top of the keel (E) is formed by stitching to provide an aerofoil shape to the wings.

[54] **MANEUVERABLE GLIDER KITE**  
 [76] **Inventor:** Helen Bushell, 10 Elm Grove, North Kew, Victoria 3102, Australia  
 [21] **Appl. No.:** 664,455  
 [22] **Filed:** Apr. 1, 1976

[30] **Foreign Application Priority Data**  
 Apr. 9, 1975 [AU] Australia ..... 83667/75  
 [51] **Int. Cl.<sup>2</sup>** ..... **B64C 31/06**  
 [52] **U.S. Cl.** ..... **244/153 R**  
 [58] **Field of Search** ..... 244/153 R, 154, DIG. 1; D34/15 AF; 46/76 R, 77, 79

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 28 of 1926 Australia ..... 46/79

*Primary Examiner*—Stephen G. Kunin

*Assistant Examiner*—Galen L. Barefoot  
 [57] **ABSTRACT**  
 A kite is disclosed having a main body portion fabricated of a flexible material consisting of two substantially triangular panels joined along one edge, and joined again, in an aerodynamic curve, adjacent to, and roughly parallel with, the original join, forming a keel foil enclosing roughly one quarter of the sail area. This keel foil, being double fabric, forms a pocket to hold the mast which maintains it stiffened along its length for the whole of its length. The two remaining wing foils are stiffened with spars for roughly three-quarters of their length being unsupported towards the nose of the kite. The cross-stay is disposed across the back of the kite and is pivotally secured to the wing-spars ahead of half of their length. A single fulcrum on the mast holds the line. There is no central stiffening member so the kite is flexible. The aerodynamic curve to the top of the keel also reforms the shape of the wings, giving lift from both the front and the side of the kite, causing the wings to oscillate in the air, or flap to the manipulated tension on the line.

1 Claim, 4 Drawing Figures

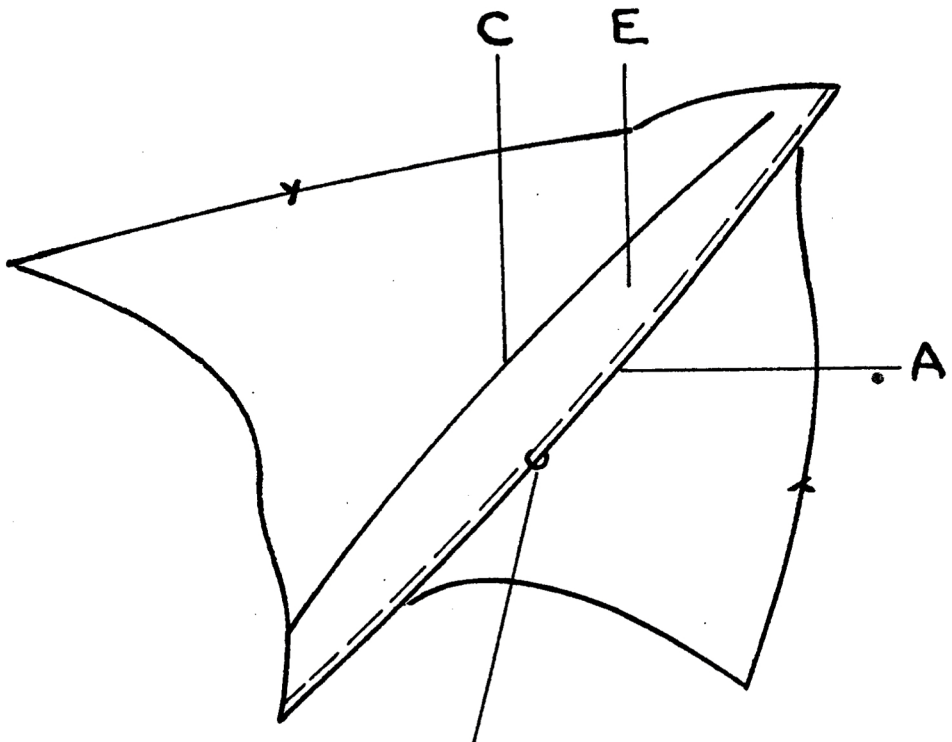


Illustration 7: Tre-foil Delta

- Having no keel: The Owl Kite is keel less and gets directional stability from the central arch and slotted apron.

- Having a double thickness keel: Invented by Dan Leigh and now called, I think, a Pop Fin, the keel has an open front edge which gapes when the wind drops, fills with air and reduces the kite's tendency to glide.
- Twin Fins: I found my Owl kite's stability much improved by adding two fins along the lines of the V central spars.
- Tunnel Keels: Various designs of tunnel keel have been produced, some rather like sewing together the two fins above. Others are tunnels which may taper to the front or aft.

Some early delta makers had problems with getting the kite to fly straight — either inaccurate construction or differential fabric stretch. A solution was to cut the last few centimetres of the keel along the line of the spine and use some device to curve the 'flap' to the left or right to correct the flight. The arrangement is shown in Hartig's 1967 patent (Illustration 5).

It is possible to provide directional stability without using a keel, e.g. by the use of a drogue, a tail or by using a swept wing plan, but only the last solution avoids lost efficiency through increased drag.

### 3.2 Plan

The plan of a Delta includes not only the wing shape but also the length of the wing spars and the position and tightness of the spreader bar. It is possible to set out the range of different dimensions of a Delta with a nose angle of about 90 degrees (see Brummitt [5]). Briefly the wing spars should be about 70 – 80% of the wing length and the spreader should be set 35 – 40% of the distance from the nose along the wing leading edge.

There is an almost bewildering array of plan shapes which have been used at one time or another for one purpose or another. Bi-plane and even quadraplane Deltas have been built. A good collection of plan types, with notes concerning their characteristics can be seen on Dan Leigh's internet site [www.deltakites.com](http://www.deltakites.com).

Generally, high aspect ratio kites are slower and provide more lift than low aspect ratio kites. (Here I am using aspect ratio in the crudest sense of: Width (height) of the wing centre line divided by the distance from wing tip to the centre line).

Wings with swept forward trailing edges use less spar length for a given wing area, but I'm not sure about lift. Many American Deltas use wings with trailing edge flaps and wings with concave cut trailing edges. Kites can also be found with 'frilled' edges, V cuts from the spine to give a butterfly look, slotted trailing edges and even random small V cuts. Almost all have their advocates as ways of improving the airflow. 'Roughening' by V cuts reminds me of the non-smooth surfaces of the latest speed swimming suits. But remember that even in rip-stop the trailing edge needs to be finished if it is going to do a lot of flying.

The range of wing shapes seems to be endless. I'll say a little about two of them. Firstly there is a very rarely seen swept wing Delta design (see [5]). Secondly there was at one time an unofficial competition for the highest aspect ratio Delta (early kites were about 1-1). My best was 2-1 but I have seen 3-1 with a batten in the wings. More than that would, I think, need a drogue. Finally a Delta can be rectangular. Illustration 8 shows my version of Bob Quinlivet's Squared Delta. My version won't fly without the drogue fitted to the training edge of each wing spar..

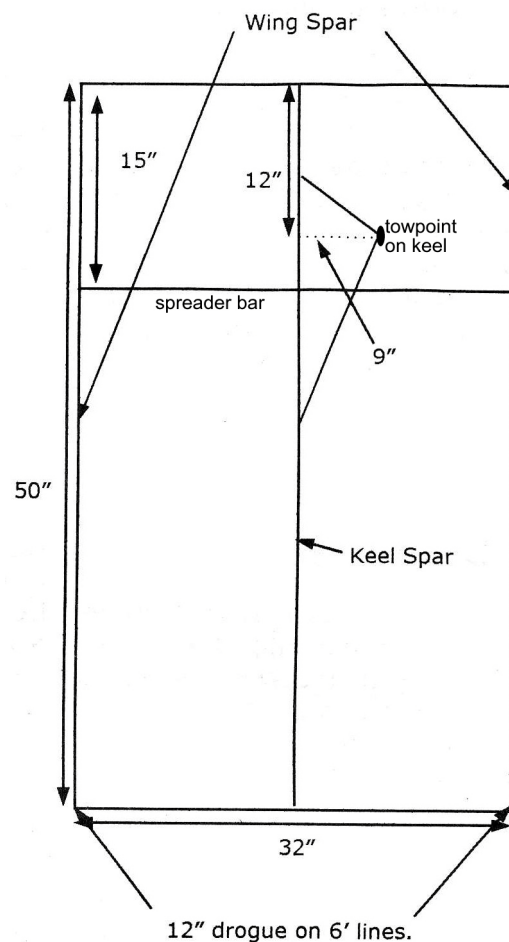


Illustration 8

## 4 Later Variants of Deltas

From the mid-1970's designers combined the Delta characteristics of a spreader, which allows wing flexibility with older 'Kite Body' designs: Here are some of them.

### 4.1 Delta Conynes

Why triangular Conyne centre sections work so well with Delta wings I don't know; but they do, even though Conynes were developed to fly at a different angle in stronger winds. The Marshall Delta Conyne was a famous high performance American kite of the late 1970s. (See *AKA News*, Aug. 1981 and Illustration 9.)

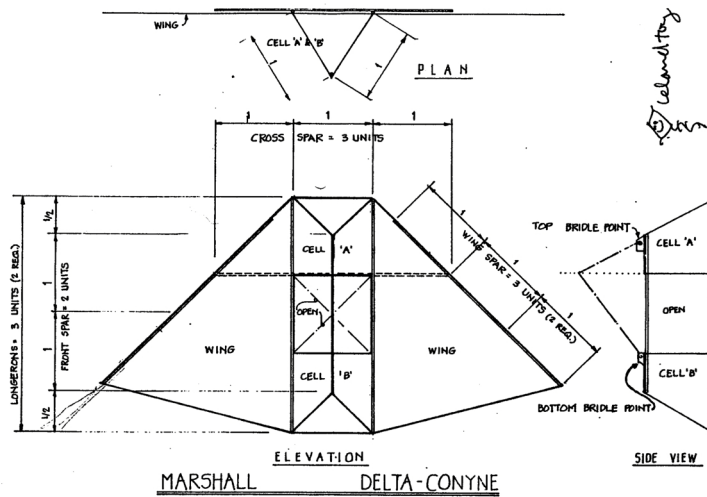


Illustration 9: Delta Conyne

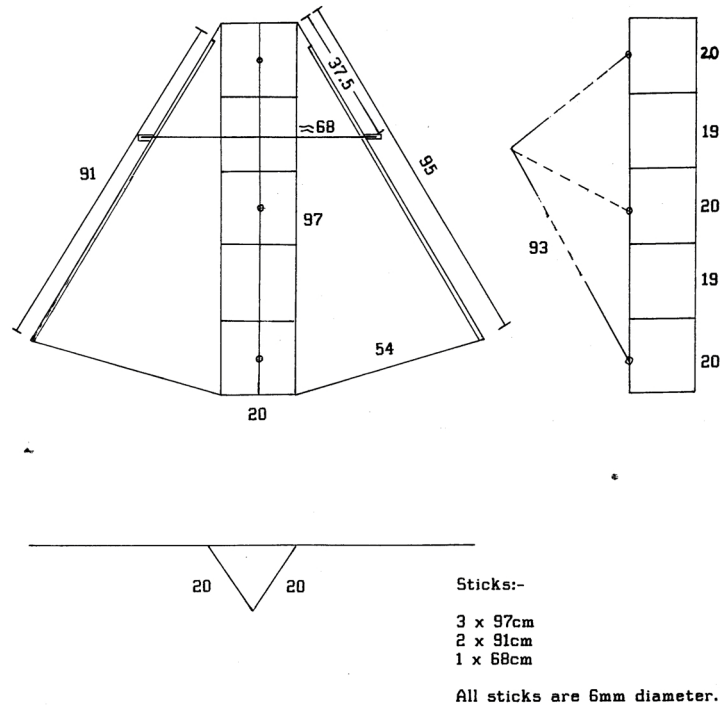
Instead of the usual two cells the Dunton Delta Conyne has a single open ended triangular centre section. It has an excellent record in altitude sprints. There is a good account of the 'Dunton Delta-Box' in *Kitelines* vol. 5 no. 4 (Summer-Fall 1985). Even better is Charlie Dunton's (the son) useful plans for a modern materials version which he uses for indoor flying. He describes his father coming across plans for a Hod Taylor Box Delta. they were large with a 4–6m. trailing edge as Hod Taylor's eyesight was failing. He describes his father as "a tyvek, tape and hardwood dowel kind of guy", hence the scaling down. There is a good account of the other modifications in *Kiteflier* 115 (April 2008).

For an unusually low aspect ratio Delta-Conyne, see Illustration 10.

## THE ARROW DELTA

Jean Latour

(This plan has been reproduced from the Cerf Volant Club de France magazine "La Lucane" issue number 42)



All measurements are in centimetres.

Illustration 10: Arrow Delta

### 4.2 Stacked Deltas

Perhaps the most inventive combiner of deltas, boxes and sleds is Neil Thorburn [5] whose Stacked Deltas used a Conyne centre section. These have become a classic and have been modified to be many things, from a Christmas Tree (graduated wings from small to large) to weird monsters.

### 4.3 Delta Boxes

These are not often seen but there have been boxes flown from one corner with Delta wings added, so looking rather similar to Edwardian jibbed wing boxes.

### 4.4 Delta Sleds

Again, Thorburn has done it but the most sophisticated combination of (just?) Delta wings with sled is Stormy Weather's "Winged Victory" also with a fine sprinting record (see Chapter 7).

### 4.5 Yacht Delta

Before we come to kites where the Delta principle is used with a modified plan and wing shape we should mention this kite. Think of a Delta triangle as being a side

view if a yacht hull and sails then add a fringe across the whole trailing edge width to suggest the sea.

#### 4.6 Bird Kites

While even in the west “Bird Kites” pre-date the development of the Delta, it is true that the abilities of delta wings to flex and move are admirable qualities for a good bird kite (see Chapter 5). Stan Swanson’s 3m. Condor remains on the edge of Delta design. Joel Schultz’s Parrot kites are wonderfully colourful yet simple and easy to fly. More than one design of Seagull claims to have fooled the real birds. George Peters’ birds somehow manage to combine vibrant colour, grace and being massive.

#### 4.7 Aeroplane Kites

There have been one or two aeroplane kites based on Deltas. A plan by Nishibayashi (Illustration 11) is included. I scaled mine up to 1.3m. long by 2.2m. span and am still waiting for there to be an ‘ugliest kite in show’ competition for me to win.

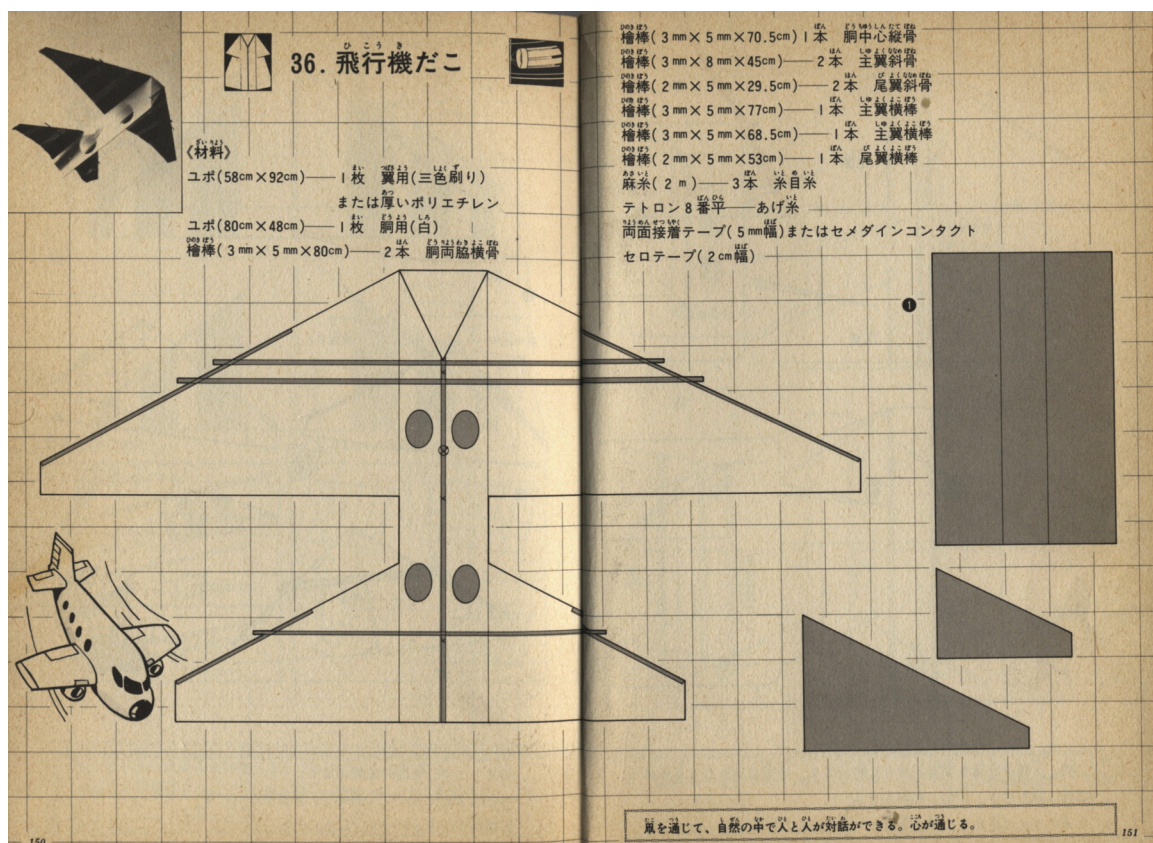


Illustration 11: Nishibayashi's Aeroplane Kite

## 5 Flying Deltas

Somehow it seems that more than any other type of kite Deltas lend themselves to being ‘messed around with’. I am a founder member of SPCD (Society for the Prevention of Cruelty to Deltas,) the main form of cruelty being to fly them in high winds. In America, from my limited experience, Deltas also have spinning drogues

added (one off the spine and one off each wing tip). However, one of the most effective changes of recent years has been French, when Frank Schwiemann and Christine Schwarting added a long floating white 'tail' to each trailing edge of a white delta with black leading edges. The resulting Pyrodelta has been much imitated but for me must be white and the tails must float.

Carl Robershaw's Serpent Delta is a very successful design (Illustration 12); this has a single floating tail. There are also three- and five-tail versions of the Pyrodelta.



Illustration 12: Serpent Deltas

Deltas can be flown in train, this is slightly complicated as unless a no-keel design is chosen there needs to be a slot in the spine to allow the line to go from one keel point to another.

You can also fly several small Deltas as a 'flock'. I have done this with six small (1m.) kites attached by 4m. lines at 8m. intervals on a main line with a 2m. Delta leader kite.

You can also piggyback. Done correctly, you need the slot arrangement required for a train but if the difference in size is large enough (e.g. from 1m. to 2.5m.) you can simply attach a short line from a small kite's keel to the centre of the spreader bar of the large kite. It reduces the flying angle but it can look interesting.

## 6 Using Deltas

- 1 Kite workshops for children quite often use simple deltas although it has to be said that getting symmetry can be a problem and sleds do now seem to be more popular.

- 2 Lifting. Although soft kites can be more powerful in anything more than a light wind and a high flight angle can be a problem, the fact that big Deltas are easy to use and deal with a wide range means that they have been widely used for lifting cameras and fauna drops.
- 3 Fishing. Using kites for fishing is widespread throughout the Pacific. “Benny’s Kites” of Auckland, New Zealand make a fishing Delta. It has plugged hollow spars so that it floats. Users are advised how to get the kite to fly at an angle to allow the hooks to be pulled out to sea even with a wind parallel to the beach (attach a shopping bag on a line to one end of the spreader bar). See the chapter on Kite Fishing.
- 4 Stunting. While I’m not dealing with the whole line of sports (or stunt) kites which are said to be Delta based it should be mentioned that 10 years or so ago there were specially configured and bridled deltas (e.g. Gryphons) which were slow and graceful two line fliers. Glites could also be set up for two line flying.
- 5 Falcon training. This is the most unusual use of Deltas known to me. The birds are kept fit and learn how to fly higher following a lure fixed below the kite.<sup>5</sup> Dan Leigh makes these kites.
- 6 Highflying. According to the *Kiteflier* no. 85 (October 2000), Richard Synergy on 12 August 2000 flew his Delta to ‘not less than 13,600ft.’ breaking a disputed record that has stood since 1898. Not bad for Wagenwoord’s ‘dart shaped floater’.

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5. *American Kite*, Fall 1988. An interview with Francis M Rogallo, the man who invented the flexible wing, the hang glider and succeeded in making a jet with a parachute.

## 7 Bibliography

Pelham [2] has little to say about deltas, despite showing one on the cover, and there are only three plans, one of which is for a very low aspect ratio kite.

Moulton [8] not only has more to say about deltas but also has a range of drawings and plans including the Tom Van Sant ‘concorde’ kites that caused such interest when they were first flown in the UK.

Yolen [9] doesn’t have much material on deltas but refers to them as “the best known of the modern innovations in kite design”. One of the two plans given is attributed to Mr G.H. Pilch of Nottinghamshire, England — does anyone know him?

Brummitt [6] refers to commercial deltas.

Newman and Newman [3] emphasises deltas as a type of keel kite.

- [1] Marvin, C.F. (1897) *A Monograph on the Mechanics and Equilibrium of Kites.*
- [2] Wagenvoort, J. (1969) *Flying Kites.*
- [3] Newman, L. S. and Newman, J. H. (1974) *Kitecraft.*
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- [4] Cottrell, M. (1988) *The Kite Store Book of Kites.*
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## 8 Delta Gallery

Having revised the chapter, I now include a gallery of kites in the sequence that they appear in the text.



Rogallo Flexikite — the 'toy' version



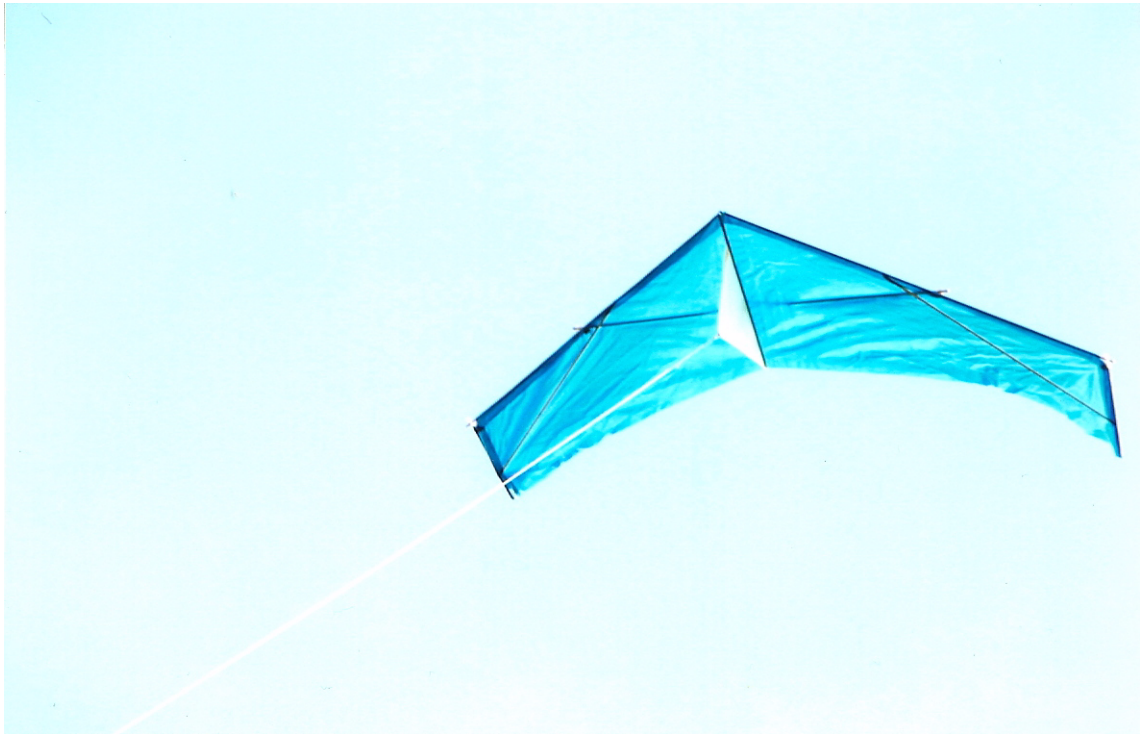
Glite



Classic Delta – this is the first kite bought by me in 1979



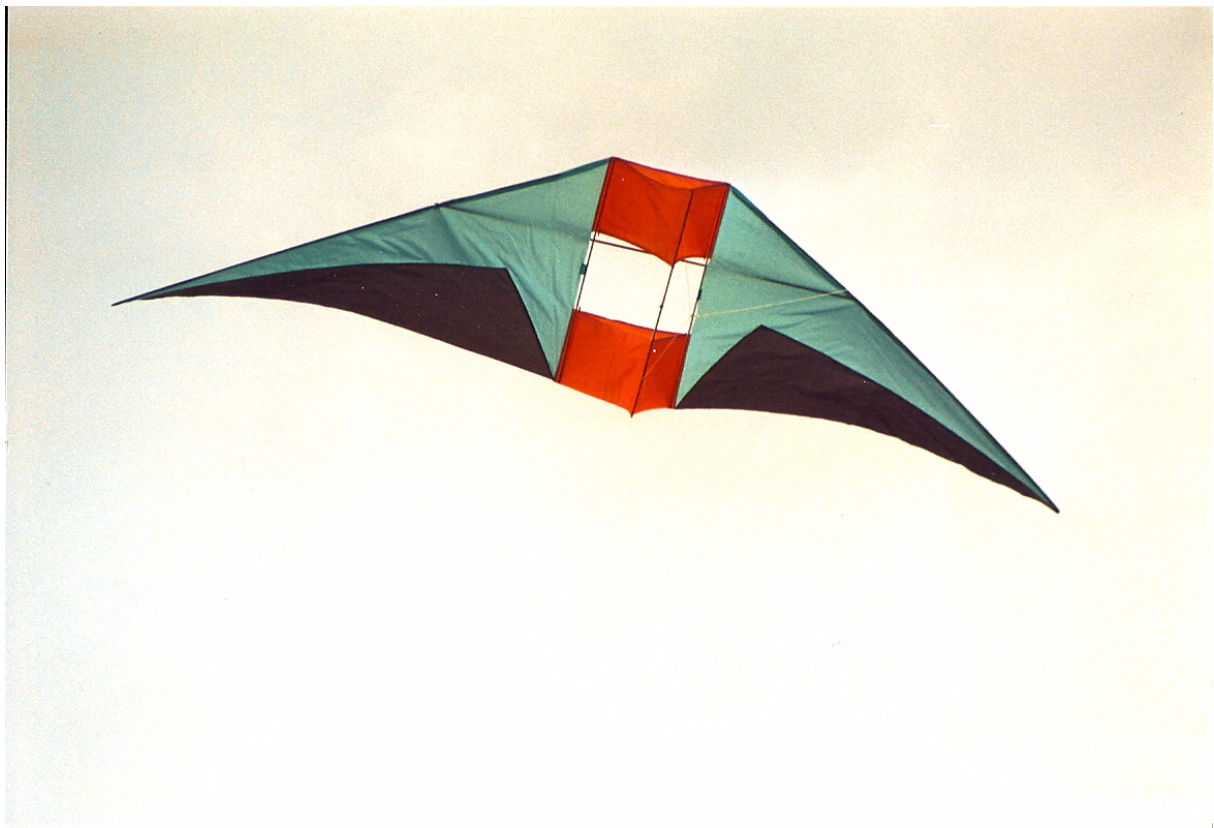
Dunford 'spreaderless' kite — tail required



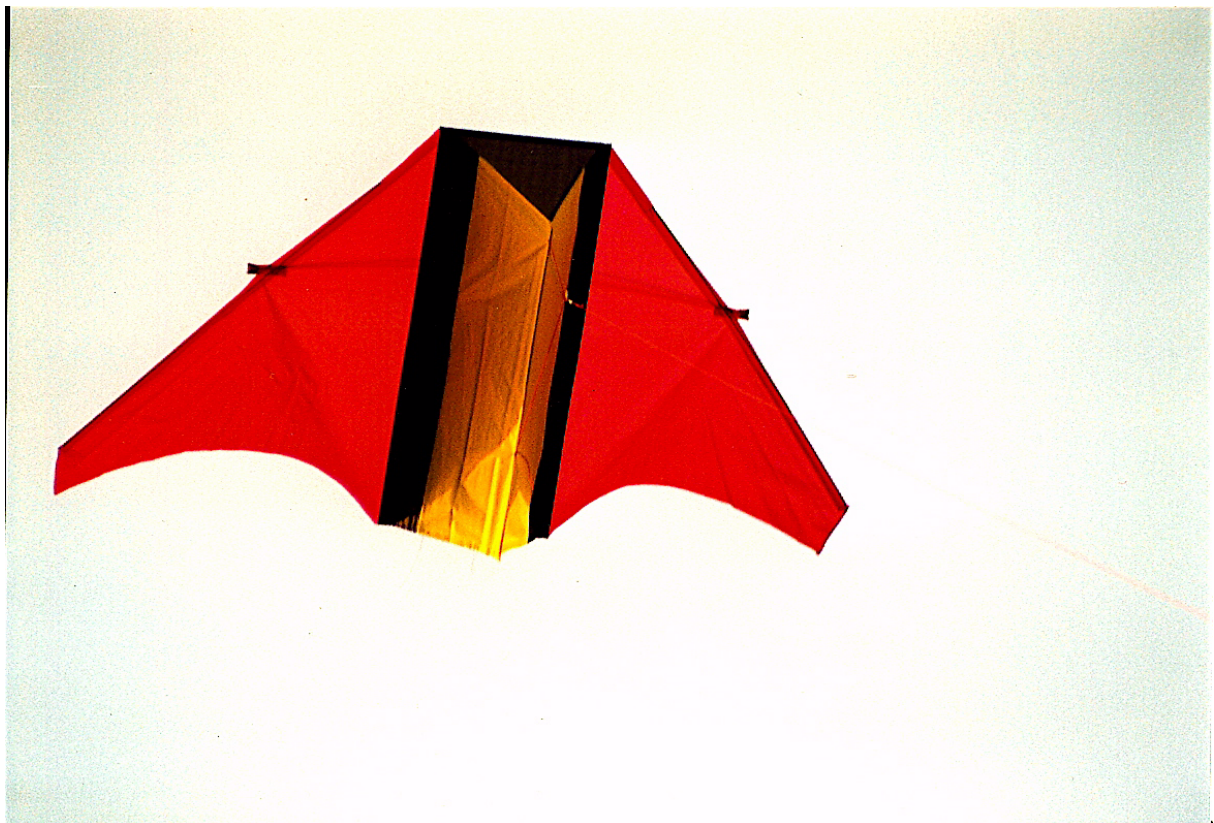
Swept Wing Delta by Mark Cottrell



Belier— ultra high aspect ratio



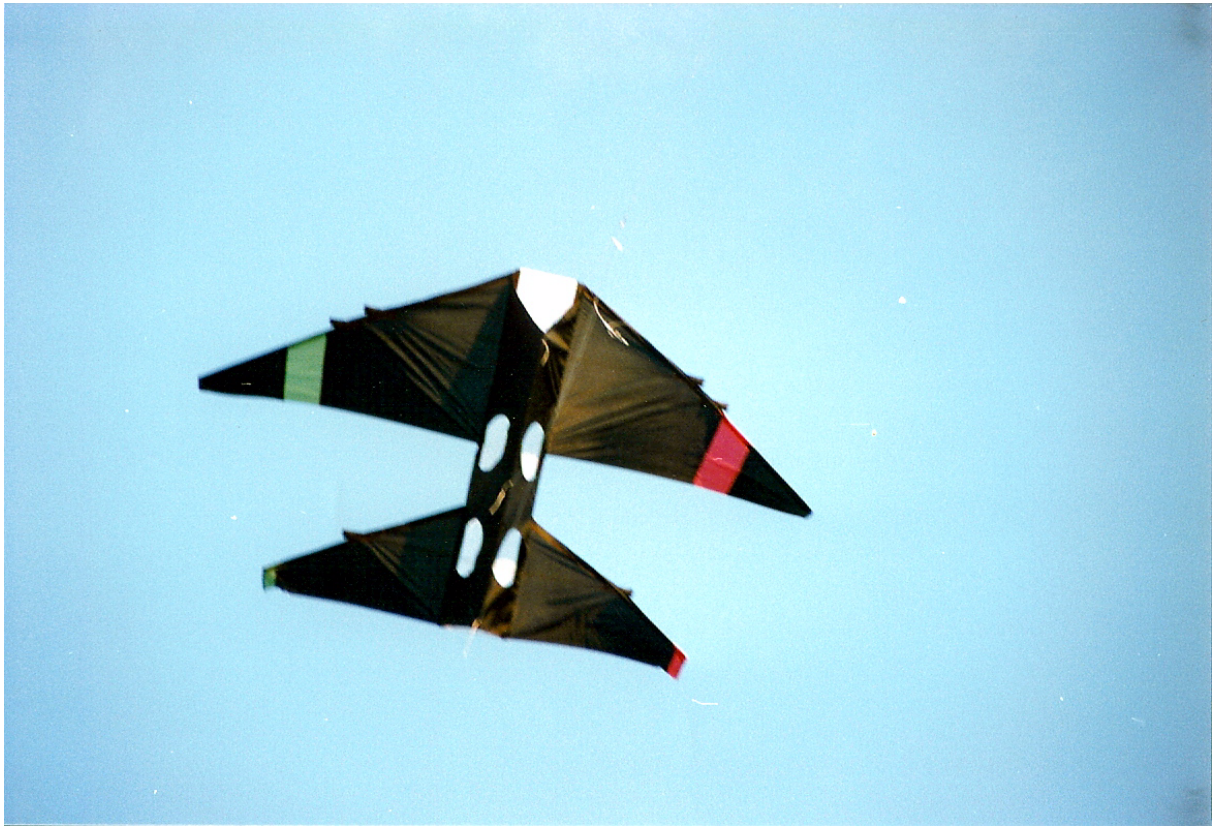
HARDEC (High Aspect Ratio Delta Conyne)



Dunton Delta Conyne (or Box)



Stacked Delta by Raindrop Kites



Nishibyashi Aeroplane



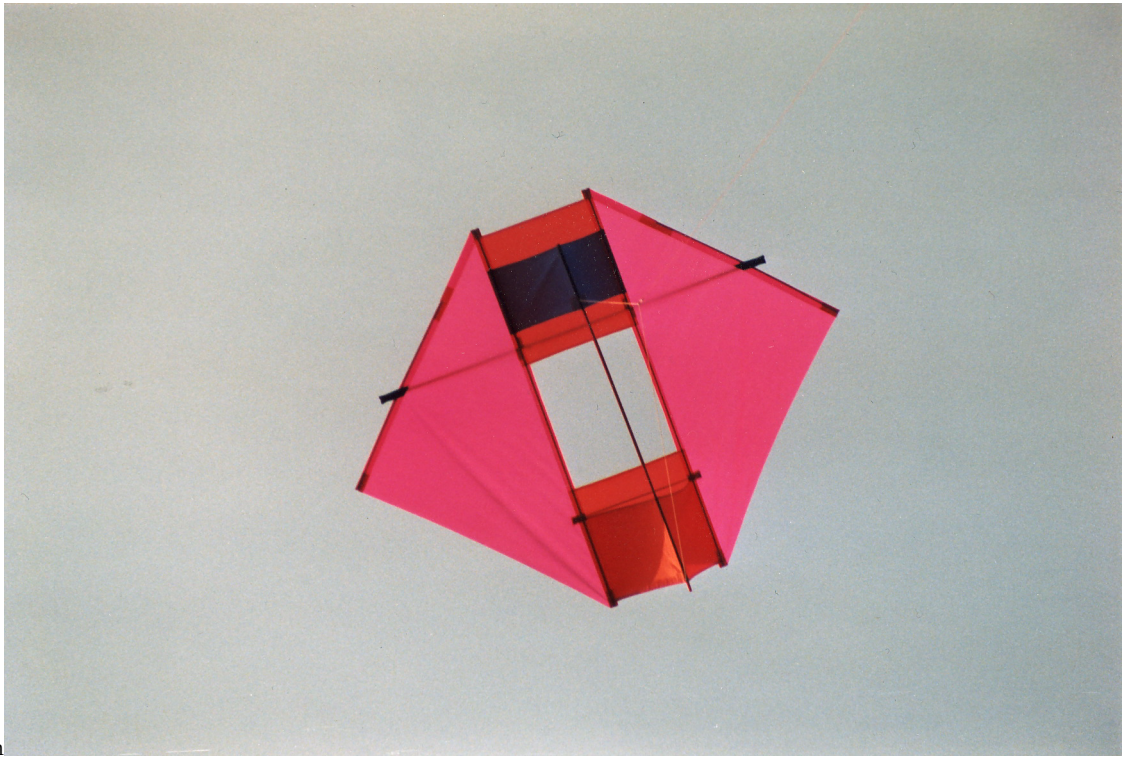
Star by Vacuum — it's a delta with the spreader extended



Delta Conyne variant by Ernest Barton



Double Delta Conyne variant by Ernest Barton



ton

Mule by Dan Leigh

