

1 Introduction

This introduction includes Exhibit 1 which is a summary of tails in earlier chapters. The rest of the chapter comprises:

2. Main Tail Types
3. Alternatives to tails
4. Tails in a hurry.

Bibliography — My only specific reference is to *Drachen* No. 3 (Fall 1999), 'Tails: Fat or Skinny?' by Ed Grauel. Most of the 'general' kite books have something. Pelham [1] is, as usual, excellent and Maxwell Eden [2] has a good section.

We can describe (define might be too strong a word) a tail as 'a flexible addition to the trailing edge of a kite'. Up to about 100 years ago 'Western' kites (e.g. English Archtop, American Barn Door) had tails and a tail of some sort is still commonly understood to be necessary — see cartoons, illustrations for children's books etc. Many 'toy' kites sold today have a tail of sorts — necessary to provide balance for imperfections in the kite and to improve its wind range as well as giving more impact in the sky.

Exhibit 1 lists some of the kites (and illustrations) found in previous chapters and comments on their tailed status. It is also a quick reference to all the kites mentioned in this chapter.

Exhibit 1

Chapter	Subject	Tails
1	Origins	Leaf kites are usually tail-less
2	Western History	Archtops were the dominant English type and require a tail. See Illustration 1 below for tassels and Illustration 2 for drogues

3	Golden Age	Eddy was jeered at for not using a tail. He and Conyne designed to avoid the operational problem of tails
4	More boxes	Box kites are tail less. Hargrave boxes are a type where a banner tail for advertising has been fitted
5	Bird Kites	Bird kites may have rigid integral bird tails — some have flowing tails. The Sri Lankan bird (Illustration 1) has a hinged tail, as do some Chinese dragonflies. Probably it is as accurate to describe them as having hinged bodies
6	Flat kites	Indian fighters at most have small fins or tassels (Illustrations 2 and 3). Paper tassels are found on tukkals (Illustration 7), Japanese Hata (Illustration 8) and some waus (Illustrations 15 and 17). Apart from Thai snakes it is remarkable how few kites in this chapter need a tail. Exceptions are USA Barn Doors and West Indian Headsticks. Chinese fish have flowing fins. The main types requiring a tail for stability are circular and hexagonal designs
7	Deltas	Don't require a tail except for some keel-less types. Tails have been added for effect e.g Frank and Christine Schwiemann's Pyrodelta
8	Sleds	Simple sleds fly better with a looped tail. Multisleds have a drogue. See also Bondestam's Fan Sled (Illustration 13)
9	Soft kites	The first commercial kite parafoils were flown with a mare's tail (Illustration 5). Many 'animal' soft kites use some form of drogue
10	Exceptional	All the kites in this chapter are tail-less. But Chinese dragons use balancers

Here is a 'recap' of why a kite might need a tail or need the existing tail changed. Tails provide drag which is required to stabilise the kite's flight. They absorb motion from the kite and damp down its movement. To the extent that they

operate on the back of the kite they may affect the angle of attack — lowering it which may require a change in the bridle. Tails vary widely in their effect; some, e.g. snake's tails providing lift and low drag for their size (thus allowing a small head and long body) others, e.g. some tassels, providing only drag and weight.

Tails usage can be classified as:

- 1) A necessary part of the shape being depicted
e.g. the tail on a 'soft' gecko or a Thai snake
- 2) Required for the kite to fly
e.g. English Archtop or a Japanese wan-wan
- 3) Added to improve flying performance.
This might be 'ex works' or by the flier
- 4) Added for impact or decoration.

But before looking at types of tail, are there any generalisations that can be made?

Firstly it bears repeating that until Eddy and Conyne, western kites required a tail to fly. By contrast a majority of the kites made which have a family link to the Indian fighter are tail-less — certainly if we ignore the little fillets found on many Indian fighters. Such kites, being made of paper and bamboo, are light and flexible — low weight and dihedral make a tail unnecessary.

General statements about Chinese and Japanese kites are less easy to make. There are many Chinese designs which represent living animals and which naturally include fish or bird tails. However their non-figurative flat designs may be provided with tails. These seem to be utilitarian e.g. hairy rope or string — but I have known silk cord and tassel.

Rope tails are found on kites where the tail is not seen as a significant part of the image but simply as a necessity i.e. the cords from which a picture hangs rather than its frame. Japanese kite designs include many abstract flat designs some of which require a tail to fly. Multi-spar flat kites may use multi-bridles for drag (Edos) or require a tail when there are fewer bridles (Tsugaru). Most Japanese kites are designed and made tail-less if possible.

However, Brazilian fighter kites, which it would seem are lightweight bamboo and paper descendants of rokakkus, fight with tails. For details on tailoring the tail to the kite, see Gomes [3].

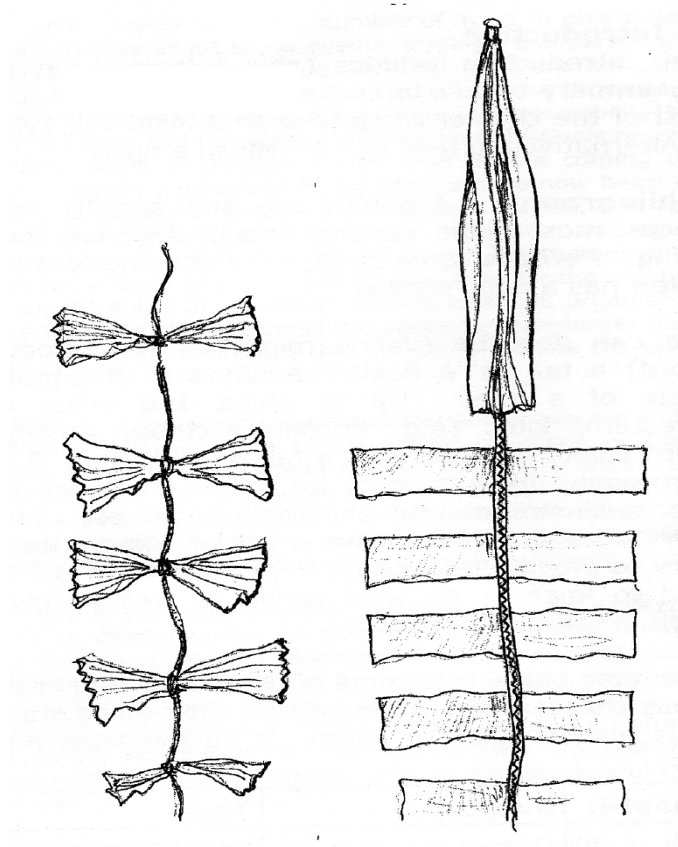
The design which is right at the margin of tail/tail-less is the Malay/Diamond/Eddy. Malays may fall into either class. Diamonds usually have tails and Eddy's big contribution was to produce a tail-less kite. All these kites are roughly diamond shaped and there is a view amongst many kite fliers that such a kite without a tail is somehow superior to those that have a tail fitted.

Large size doesn't seem to affect whether a tail is needed — the world's largest kite (2010) is tail-less and large soft kites need tails as part of their design not their

size. The nearest to a general proposition is that small kites (10cm. and below) invariably are unstable without a tail.

2 Main tail types

Illustrations 1 and 2 and the key are by Ernest Barton. They illustrate several of the common tail types and show how they might relate to the kite design. They will be referred to as we look at categories of tails.



PAPER bow tail & FABRIC /TAPE tail

The paper tail consists of small rectangles of stiff paper knotted into a cord or thin tape about ten times the length of the kite.

These bows are often known as Chickens.

The fabric tail is made by sewing small rectangles of fabric onto a cotton tape at regular intervals. The size of the rectangles is often graded with medium at the top, the longest about 1/3 of the way down, and the smallest at the end.

Frequently the tail is sewn with a Three Step Zig-Zag stitch because this has less tendency to unravel.

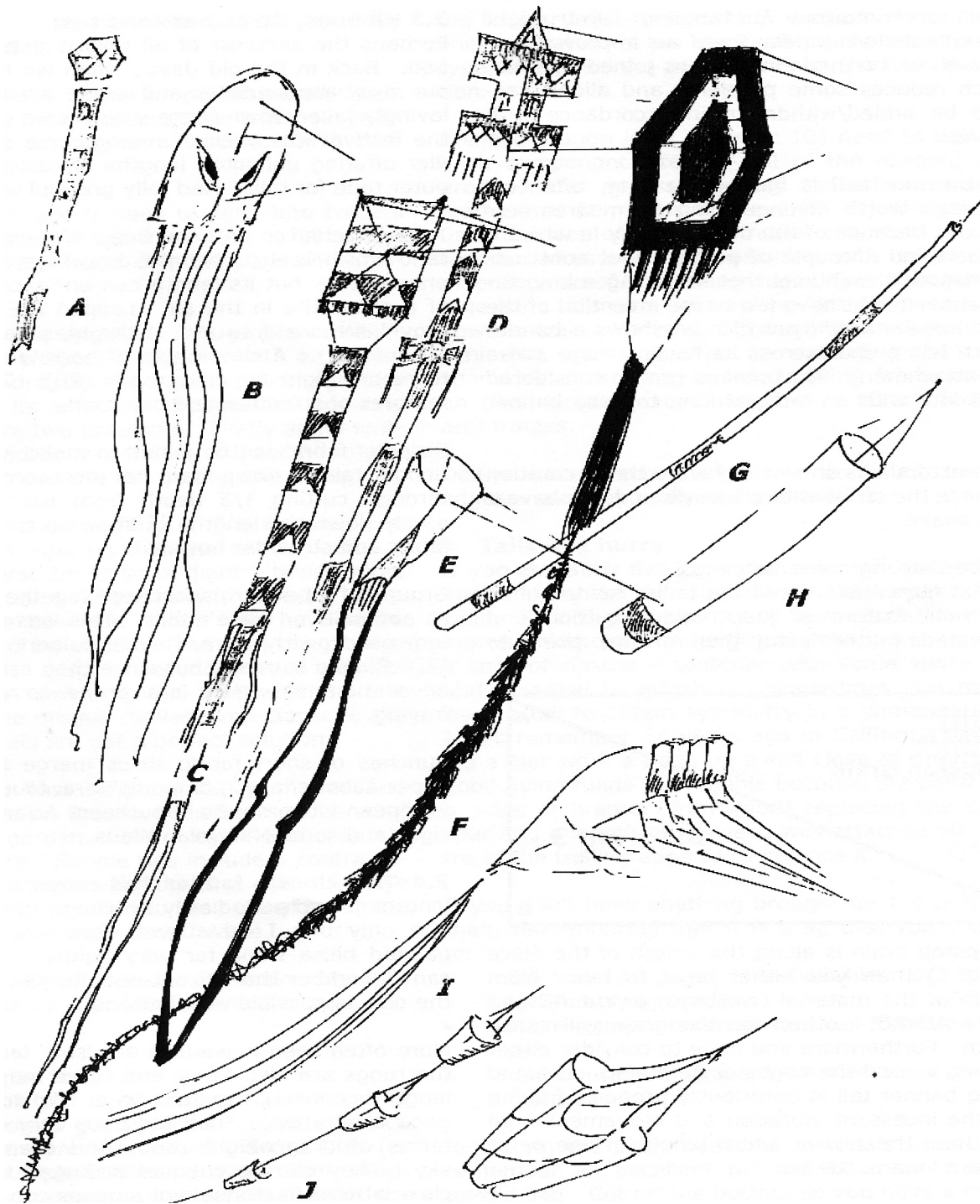
The top tassel shown here is not always used but has the advantage of stabilising a flat kite at the moment of launch before the whole tail has begun to lift.

These tails are often multi - section and swivels are used to connect them. Varying the length of the tail is usually the only adjustment needed for different wind strengths. Once adjusted the kite bridle is not touched.

Illustration 1 (a and b): types of tail: bow tail and banner tail

The main types of tail are:

- 2.1 Bow Tail (see Illustration 1)
- 2.2 Banner (Illustration 2A)
- 2.3 Ribbons, streamers and tassels (Illustration 2 B C D E F and I)
- 2.4 Ladder tails
- 2.5 Tubular tails (Illustration 2G)
- 2.6 Drogues (Illustration 2 H J and K)



A Wide Banner Tail on a Hexagon Kite.

B Eight streamer tail on an Octopus Kite.

C Graded Streamer on a Della Porta Kite.

D Batten stiffened tail on a Totemic Kite.

E Looped ribbon tail on a Sled Kite.

F Graded ribbon sewn pieces with upper streamer on a Barn Door Kite—designed for very high winds.

G Parallel narrow tube streamer.

H Fat parallel streamer – or windsock on the line.

I Horsetail streamer ribbons on a Parafoil.

J Line of bucket drogues. Can easily be made too big for the kite.

K Quatrefoil drogue – harder to make, easier to connect in line.

Illustration 2: more types of tail

2.1 The bow tail is traditional in England, it is invariably found in 18th and 19th century pictures of archtop and similar kites. The traditional brown paper diamond of my youth was equipped with newspaper bows on a string tail (see Illustration 1a). In its simplest form it is a length of line tied round zigzags of 10cm. wide newspaper at 30cm. intervals on a total length of 7-10 times the length of the kite. Just how long depends on the size of the paper bows (once called ‘chickens’) and windspeed. In my case it depended primarily on the inaccuracies of the kite maker. Remember the objective is to damp down oscillations of the kite so that it is drag not weight which is desired. A simple test for such a tail is that it should be weaving slightly behind a stable kite, flying dead straight shows that it is longer than is needed for performance.

There are many variations on the basic idea. The bows could be lengths of fabric (a well known kite book reminded you that the line should be tied round the fabric, not the fabric round the line, for then they could slip down to the end of the tail. Thought you needed to know that). Using fabric leads on to tape, or a streamer, with the bows sewn across (Illustration 1b).

Long tails are notorious for tangling — you might find a separate winder for them an improvement. Fabric tails can be made in sections joined by swivels which reduces some problems and allows sections to be added/withdrawn in accordance with conditions.

2.2 A banner tail is basically a long, often tapered, strip, worth distinguishing from streamers and ribbons because of the different way in which it is attached and a couple of points about construction. Chapter 2 mentions that stiffening a long tapered banner might have led to the invention of the kite in Europe — *might not did*. Drawing 2A shows a banner tail which has a spar across its leading edge and a two-point attachment. Thai snakes can be considered as a flat kite with an integral long tapered banner tail.

2B is an octopus as shown — change the decoration and replace the strips with a banner and you have a western snake.

To reduce twisting some banners have stiffeners or battens at intervals. When the tail is made out of plastic, manufacture is just tedious cutting and joining. Made out of ripstop there are two points to watch.

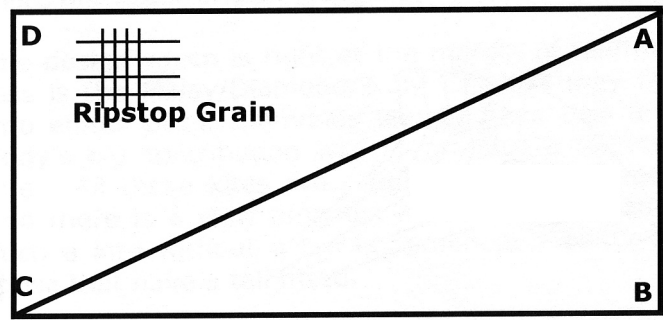


Illustration 3

If the ripstop grain is along the length of the piece (Illustration 3) then you either have to taper from each side of the material (wastage) or cut AC and then join AD-BC — otherwise the grain will cause distortion. Furthermore you have to consider either hot cutting to seal the edges or hemming. The end of a long banner tail is notoriously prone to fraying due to the incessant vibration and movement — so at least hem the end or add a length of line *or* at least add a loop to the tip.

Secondly your ripstop needs to be flexible and not too stiff — otherwise the dampening effect is spoilt. The Schwiemann's pyro delta is a delta with two tapered banner tails — the trick being that a comparatively light 'floating' fabric is used. Other designers, such as Carl Robertshaw have used a single width tapered tail — looks great but for me two is preferable.

2.3 Ribbons, streamers and tassels

Perhaps the simplest of all tails is a length of ribbon. Back in the 'old days', when we had to make our own amusements and when arena tape was lovingly taken down for re-use as tails (often before the festival was over), I remember a distinguished flier offering unlimited lengths of reel-to-reel computer tape for tails. And jolly grateful we were too.

Tape attached at one end has a low drag to weight ratio which is a problem if drag to stabilise is the prime aim — but its length can enhance the impact of a small kite in the air. Looped (2E) the ribbon provides more drag and is the ideal tail for a sled (Chapter 8). A classic use of narrow streamers is to mount eight for an octopus (2B). 2C combines features of streamer and banner.

Strips of fabric can be joined to make wider, lighter ribbon tails. Drag can be increased by frilling through cutting 1/3 depth from each side alternately down the length. 2F shows a combination of fabric and streamer bows.

Groups of fabric strips fastened together are known as horsetails or mare's tails. This was the tail system used on the (small) first Jalbert parafoil kite (see 2I). Simple to make but since they are in practice never hemmed, they are prone to considerable fraying.

Bunches of short fabric strips merge into tassels. Paper tassels and pompoms are found on older European kites, several Southeast Asian fighter designs and some Malaysian Waus.

2.4 The classic ladder tail consists of two rope lengths joined periodically by ‘rungs’ of bamboo etc. The only one I have ever seen live used black painted balsa wood for very lightweight rungs. I can remember the tail but not the kite. Illustration 2D shows the effects possible with battens.

More often seen nowadays are ‘soft’ ladders where the rungs are also fabric and there may be several lengths connected in this way (see Illustration 4). Such tails are very effective (in terms of drag/weight ratio) and dramatic in the sky. They can be cut and arranged to give very clear lattice effects, nets or sinuous cobwebs.



Illustration 4: delta kite with ladder tail

2.5 Tubular tails are the tails which have been most rapidly developed in recent years — originally linked with the availability of lightweight plastic tubing. They first came to prominence as the yellow tails fitted to Peter Powell’s famous blue ‘stunters’ and contributed greatly to the effect — the kite was by modern standards quite slow but would leave a memory in the sky of its last two spins by the shape of the tail.

Minimum alterations to the proportions and shape of the standard tube can produce a pencil (with black line as the writing) or adverts for birth control. See Illustrations 2G & H.

Long tubular tails are tedious to sew, kite traders usually have a good range from 10m. to 30m. long which are cheap and leave only the problem of colour matching.

2.6 Drogues. The origin of drogues (Nares Windcups) is given in Chapter 2 together with a plan for a simple classic drogue. The great advantage of a drogue is that its effect is proportional to windspeed. There are two problems.

Firstly some writers hold that a drogue acts as a lever — so the longer the line to the kite the greater the effect.

BUT the drogue does nothing until it is flying and for some kites it may be that the critical factor is stability in the first 2m. or so of flight — hence some of the complex tail arrangements in Ernest's drawings. Of course bow and ribbon tails have to be fully extended to be effective but they do provide more immediate drag.

Secondly even regular drogues spin. A swivel is vital otherwise the line twists so that the drogue moves ever closer to the kite — even swivels are not a perfect solution.

There is now a vast range of fancy shaped and spinning drogues on the market often sold as wind things for the garden. Many can be simply attached to the kite. Simple rigs include a contra-rotating drogue at each wing tip of a delta, a large one (see Illustration 2J or K) attached to the back of the spine and perhaps a matching set on the line.

3 Alternatives to tails

The purpose of a tail is primarily to provide drag which it does from a good position i.e. at the back of the kite. There are alternatives. Some kites (e.g. Edo's) use multiple bridles partly for their drag. Very recently I have seen a low-aspect ratio or columnar kite where the last few bridle points have slack bridles acting not to fix the kites angle of attack but to provide drag.

I have seen deliberately induced drag on the flying line by using a loose woven core-less line with triangles of ripstop sewn on at frequent intervals — Carl Robertshaw. This is the latest variation of what Americans have called 'line garbage' i.e. adding tubular tails, flags, sets of drogues etc to flying lines so that often the kite is simply a plain parafoil-type 'lifter' and the attention is on the line decoration.

Chinese dragon kites (Chapter 10) need to balance each component kite (or cell of the dragon) and produce the necessary drag by balancers with feathers or pompoms at the end. Eiji Ohashi has used the idea of balancers rather than tails on rectangular kites where the balancer with tufted ends extends wide of the trailing edge. The main advantage is no tails on a light-pulling kite designed to be flown in train. Years ago I bought a small diamond achieving the same effect by extending

the cross spar wide of the wing tips and having fabric fringes on their length — reminiscent of a biker's leather arm fringes.

Deltas have been designed with frilled trailing edges — are they really multiple tails?

4 Tails in a hurry

If you fly tailed flat kites then you will quite often need to vary the tail — usually to add drag in a high wind. So it is good practice to have some spare tail material with you — a length of ribbon, a drogue or a strip of ripstop — together with some spare line and a swivel to attach it. Sometimes you might want a tail to obtain symmetry in a damaged kite. I well remember 25 years ago in California watching a flier work a delta up a cliff close to the face — good flying made memorable because the delta had a piece of branch (?driftwood) replacing the cross spar and a length of seaweed was attached off centre of the trailing edge to re-balance it.

If you don't have anything brought for the purpose then, remembering that it is drag that you are after:

- tie on a paper handkerchief or tissue (preferably unused)
- make a paper tassel or bow tail from newspaper
- use bunches of grass, leaves or other natural materials

Reflecting the likely available materials nowadays, remember an excellent tail can be made from a plastic bag. Cut off the bottom so you have a circular band of plastic. Cut round and round the bag producing a single long strip — width your choice. This is easy to do with scissors. Hold them open and pull the bag past the blades.

5 Bibliography

- [1] Pelham, D. (1976) *Kites*.
- [2] Eden, M. (1998) *The Magnificent Book of Kites*.
- [3] Gomes, E. de G. (2005) *The Traditional Brazilian Fighter Kite*.