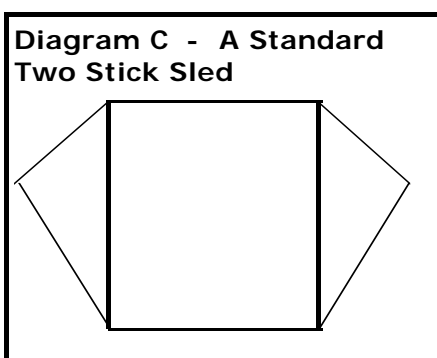
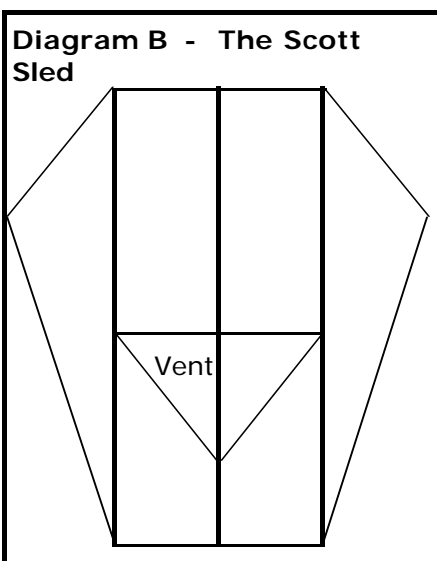
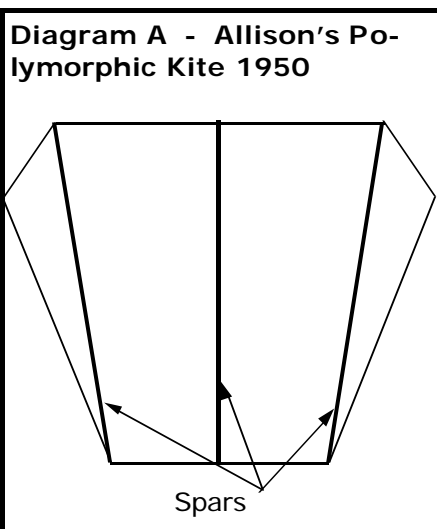


Sled Kites - George Webster

**1 Introduction**

Having written about delta kites for this magazine, I thought it would be interesting to do the same sort of thing for sleds. They are the second of the three types of kite types developed in the USA in the period 1948 – 1963 which were mentioned in that article. They are the most common single type of kite seen at the larger kite festivals because of their popularity with kite workshops, yet you rarely see a 'serious' flier having made a sled as a 'show kite'. This seems to reflect the position of the sled kite right from its inception; unlike the delta (hang gliding) or the soft foil (parachutes), sleds have had few 'non-toy' applications – yet they have an interesting place in kite development. Perhaps there is a common thread in the three kite types; all use the wind to form the flying shape of the kite – in the delta via the flexible spreader connections, in the parafoils to inflate the shape with lift and in the sled to keep the canopy open.

Again this article doesn't set out to guide someone new to kite building as to how it should be done. There are a few detailed plans and I have given a fair

number of plan shapes which would allow a reader with some experience to build the kite. Simple sleds are notorious as the kite design where a rough cut shape and clumsily stuck on spars can out fly a more carefully made example. In fact it sometimes seems that there are only four rules:

- Try for symmetry
- Make sure the bridle point is 25-30% from the leading edge
- Have each bridle leg at least 3 times the width of the kite
- Use light tails attached to the bottom of the spars to sort it all out.

I have expanded the references this time as there are more reasonably current books that cover the subject – where a name is in capitals (eg PELHAM) it will be in the bibliography. The diagrams drawn by me are not to scale.

Definition (if we must have one)

A sled kite has a canopy stiffened only from front to back. There will be a minimum of two stiffeners which may be rods, air filled tubes or even folds in the canopy material.

2 History

There is really no doubt that the sled was invented by William M. Allison, a Canadian who lived most of his life in Dayton, Ohio – home of the Wright brothers. But even though it all happened in the last 50 years there is still some confusion; the term 'Scott Sled' is found being used for sleds in general and it is even said that Frank Scott (also of Dayton) developed his kite independently. In the same City? In the same decade?

William M. Allison developed his

'Polymorphic Kite' in the 1940's, applied for a patent in 1950 which was granted in 1956. 'Polymorphic' means 'taking several different forms' and was probably not the marketing man's first choice. Allison seems to have been a retiring man, employed in maintenance, who died in 1978. The kite (Diagram A) was generally, as we know a sled except that it had three spars (nowadays it is usually two spars per unit) and the outside spars tapered the canopy front to back.

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Allison kites were made and old, but undoubtedly sleds became widely known after the intervention in 1961/62 of Frank Scott, a well known aero modeller. According to him he saw an advert in a model aircraft magazine but couldn't get an accurate view of the kite so he built his own – still 3 longerons but now parallel with a triangular hole in the canopy (Diagram B).

That is the history from, for example, MAXWELL EDEN. However, in Allison's obituary in KiteLines (Winter 1979/80) his son maintains that Frank Scott found an Allison kite in the street and 'cut a hole out of it and made a very erratic kite out of a very stable kite'.

Frank Scott's father Walter Scott was a well known kite flier who, amongst other exploits, launched kites to traverse the Atlantic. They were launched from Nantucket, each towing a half filled bucket as a sea anchor, and it was claimed that one reached 'Fistral Beach, Cornwall'? He built and sent sleds as gifts to a wide range of friends several of them kite fliers. Walter Scott made sledges (called sleds in the USA) and the kite was called a 'Scott Flexible Flyer'. This was the brand name of a very popular child's sledge – and the kite was a Flexible Flier. This seems a good explanation of the name sled – arguments such as 'it has two runners like a sled' never seemed convincing.

The development of sleds has followed two paths. The first was a search for higher performance, in particular minimising the main problem with the design in the tendency to collapse in gusts and wind shifts. Three of the main innovators were Ed Grauel, Guy Aylett and John Loy – see section 3.3 below. All this was done by the early 80s. The second stream of development still continues and involves variations to the plan to create interesting new shapes, use innovative materials, go for simpler construction etc.

Also, of course, sleds became the basis for other kites – see section 4 below.

3 Sled Variables

We will look at construction, size and plan shapes.

3.1 Construction

Sleds are usually small kites – 3ft is unusually large – and are of such simple construction (Diagram C and Diagram D) that often canopies are made of plastic, spars of straws, BBQ skewers, bamboo pea sticks or similar. Using plastic rather than sewn fabric might well help avoid stretch on the leading edge which is a major cause of collapse in flight. Even apart from sleds for children's workshops where simplicity and cheapness are paramount, sleds are often designed to make use of already patterned materials. Many of us remember the 'Fly the Bag' sled which was pre-printed on the 1980s Kite Store bag. I have a multisled made by Mark Cotterell out of a plastic table cloth. Richard Dermers large trash bag Stars 'n' Stripes sled at Portsmouth '98 made a big

impression.

Construction is so simple that, having decided on the materials, the only questions are how to attached the longerons and the bridle.

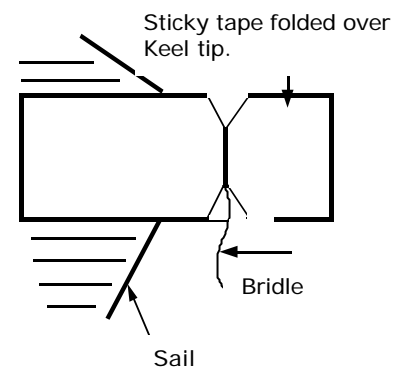
Longerons (spars) are usually sticky taped down. It is clear that continuous contact isn't necessary and the only argument is should the spars be on the front or back of the canopy.

Securing the bridle usually involves punching holes in the fins (or keels). There is an even simpler technique for use with small sleds (Diagram E).

3.2 Size

I haven't seen a very small sled (less than 2 inches) but, according to SARAH KENT, the worlds largest was Dutch, measuring 45 feet high by 75 feet wide in 1980. However, we have had a seriously large sled at the Sun-

Diagram E - A 'tie on' way of bridling a small sled



derland Kite Festival in 1995. Made by Jack Crouch and with "Jack" on its pink and yellow canopy it measures 30ft by 50ft plus a full width lattice work tail. Jack told me it was cannibalised out of his giant box which struck terror on those beneath it at York some years before. The spars are made of 1.25in by .25in wall carbon fibre – 2in by 1/8in wall fibreglass couldn't cope. It was last flown in 2000.

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John W. Loy (see his 'Sleds for all Seasons' in Kitelines Summer '89). He had worked on sleds from the late 1970's. His article identifies the problem of canopy collapse as the result of insufficient tension of the leading edge. He has two main solutions. The first is the use of a 'halter' with 50-60% of the flat width of the canopy fixed between the trailing points of the two spars. The second is the use of the swallow tail shape (Diagram J) – also used by fliers such as BONDESTAM – see below.

The problems of a flapping leading edge and collapse have been tackled in several other ways viz: -

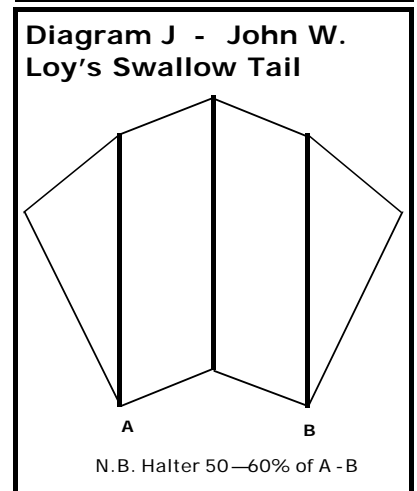
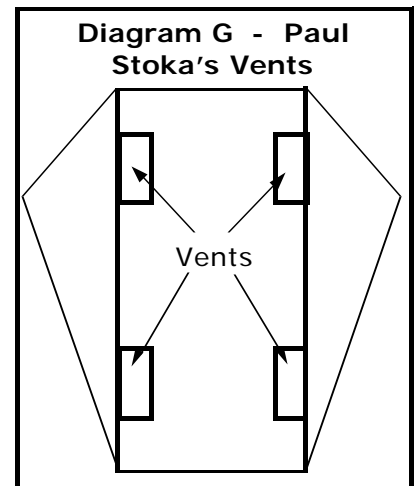
- Stiffening the leading edge eg by folding or using a thicker fabric or even a piece of thin

rattan 1 in back.

- Using a slotted leading edge. Mike Ware removed 10% from the leading edge, replacing it with a slightly wider strip arranged to overlap the main leading edge by 1 in.
- Alternatively, in a kite 2 ft wide slit the canopy right across 4 in from the leading edge. Then cut the top strip and insert a 4 in by 4 in piece.

More drastic responses to the problem are double canopies (coming up at 3.3.2 below) and using a spreader bar (4.3 below).

All the variations on a single canopy given above were designed to improve the sled's performance. However, before looking at the 'second strand' of development we should consider bridle points.



NOTES:

The drawing is dimensioned in arbitrary modules. Choose your own value for a module and multiply it by the numbers shown. Example: If you chose 10" for your module, the kite would be 40" high and 50" wide.

Make your longerons of any light weight, moderately flexible material. Small kites will fly well if a stapled or taped crease is made in the covering material at each longeron location. Allow extra material for the self-creases or pleats.

Make a two-branched V-bridle of stretch resistant braided line. Each branch should be about three modules in length. If your kite leans in flight, shorten the low-side branch.

Bridle points can be loops of line —or grommets— fixed to reinforced or hemmed covering at the corners.

HORNBEAM MARK I

As flown by Piney Mountain Air Force

Area = A = 0.83 x H²

Aspect ratio = $\frac{S^2}{A} = 1.88$

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While books such as PELHAM and YOLEN stress that the dimensions of the Scott, Grauel or whatever should not be tampered with, the designs we come to below show how forgiving the basic sled idea can be. However it is important to stress that the bridle point is often critical. By point I'm concerned not so much with the depth of the wing or keel (usually each is 25-30% of the total width) but with the bridle point's distance from the leading edge. The original Alison appears to be 20%+, the classic Scott 28%, the Hornbeam 31% - others vary up to 33%. Loy uses a different approach and states that 28% (or as low as 25%) of the canopy area should be before the bridle point.

Lastly on bridles – it is important that they be long enough. A rough guide seems to be that each leg should be x3 to x5 the width of the kite.

Now we turn to the 'second strand' of designing sleds to look different, making use of available materials, be easy to make etc – here the variety is overwhelming, even ignoring mass produced designs and those used in childrens's workshops (sorry!).

I've seen sled designs with Hal-loween cut-outs, canopies cut into horizontal strips etc. I've seen full width waterfall tails, long pointed tails as well as the familiar looped strip or 2 strips (particularly when Dad has stepped on the loop). Anything

goes so long as:

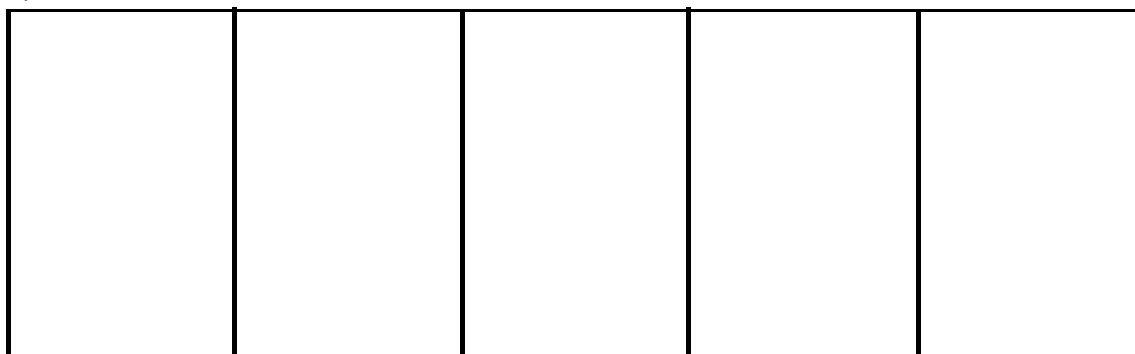
- Firstly the tail is either evenly attached over the trailing edge or is fixed to the two spars.
- Secondly it is remembered that sleds don't produce much lift and can't cope with much drag.

A looped tail is particularly good as it tends to pull in the back and thus adds tension to the leading edge.

To get an idea of what can be done imaginatively with the sled idea consult MARTEN BONDESTAM. He has at least 14 sled designs. At his very simplest he simply bridles a sheet of the shaped plastic used for packing apples (1/3 from top) then adds

Diagram K - Marten Bondestam's Fan Kite

The Kite may be fitted with 6 keels or use 6 x 2 point bridles to a point < 30% from leading edge (not shown).



Before flight this halter line is fixed to reduce width of sled at trailing edge by < 25%.

Each of the two long spars has a 'mares tail' tail of equivalent length.

Each sled cell could have the Swallow Tail plan.

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a tail. His fan kite makes use of Loy sleds (3 spars and a forward pointed leading edge, i.e. swallow tails without the swallow tail) or standard sleds all bowed with a halter and with long tails on long spars (Diagram K). He has many other good designs; the lyre kite looks good and the '2 spars but no tape' sled is ingenious.

3.3.2 Double Canopies

One of the first double canopy sleds was a 1973 design by Ed Grauel – already known for his vented sled. The Bullet kite is a patented design and the general idea is shown (Diagram L). The kites' 2 cells may be formed by a hem or a central spar. The back canopy is approximately 30% wider than the front.

A similar idea is found in Nishibayashi's book (diagram M).

This is often shown with a straight leading edge. The example in M seems to have a rear canopy about 40% wider than the front. Nishi's designs were influential – another pattern has a rear canopy tapering from +55% to +25%.

The most sophisticated double canopy sled – I saw flying recently – is Helen Bushells Fluted Sled (see plan in MAXWELL EDEN). The 42in wide front canopy has 6 rows of 7 circular vents, sewn to give flutes on 2 longerons. And then the original version had curved keels!

3.3.3 Fluted Sleds

This is the third and final type of sled where the fore and aft stiffening is provided by tubes inflated by air flow so that some kites in the sky can resemble a 2 celled parafoil with a canopy be-

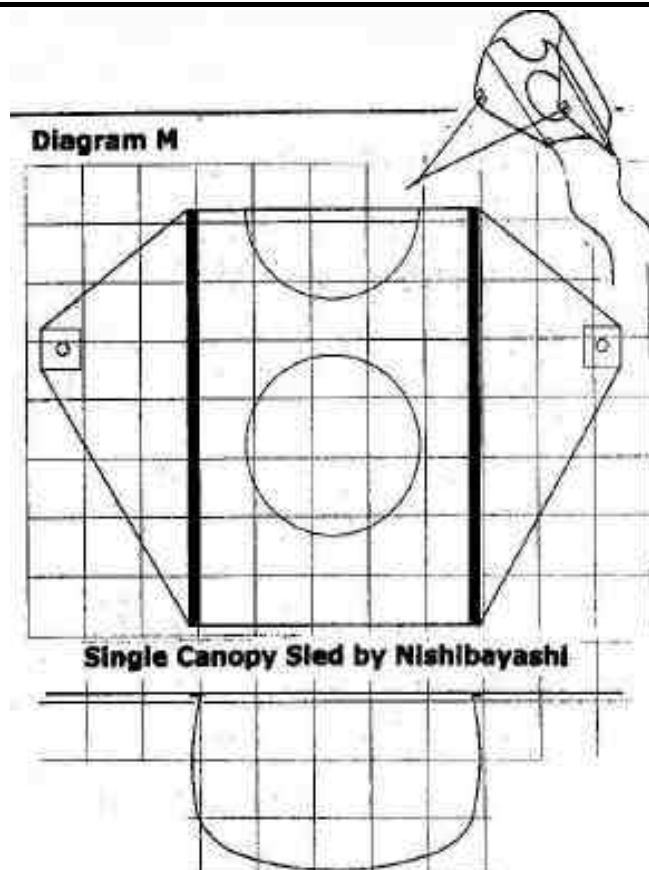
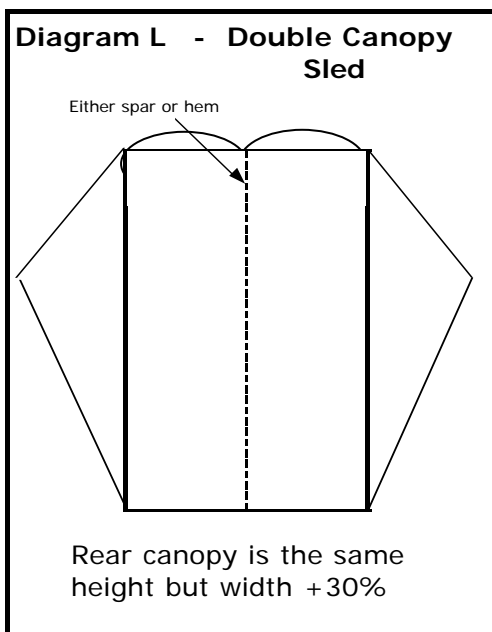
tween the cells. Because they allow the kite to be folded small they have been popular with mass manufacturers. There is a range of such kites, usually sold for walkers and those who want to 'never be far from their kite'.

Three favourites of mine are:

- The Radical Wrist Kite
- Worlds Apart—Mickey Amazing Pocket Kite
- Go Fly a Kite—The Konvertible Kite'

There is a range of soft sleds in MARTEN BONDESTRAM.

And of course there is the kite which surprised us when we opened the pack containing Jeremy Boyce's book 'How to Make and Fly Stunt Kites'.



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4 Variations

This section, after recognising one-off 'keeled' design, looks at variations on the 2/3 spar, 2 keel sled – firstly multi-sleds and secondly sled hybrids.

4.1 The Keeled Sled

I know of only one, Harry Sauls 'American Sportsman Kite' (diagram N). As you see, it is great fun with 2 spars, 1 keel, each wing with a bridle spar and 6 vents. I have a good friend who intends to make one. Mine needed a strong breeze and flew at a low angle working away like a set of bellows. Perhaps if it had flown better I wouldn't have the feeling that this kite is an over complication of an essentially simple idea.

4.2 Multi Sleds

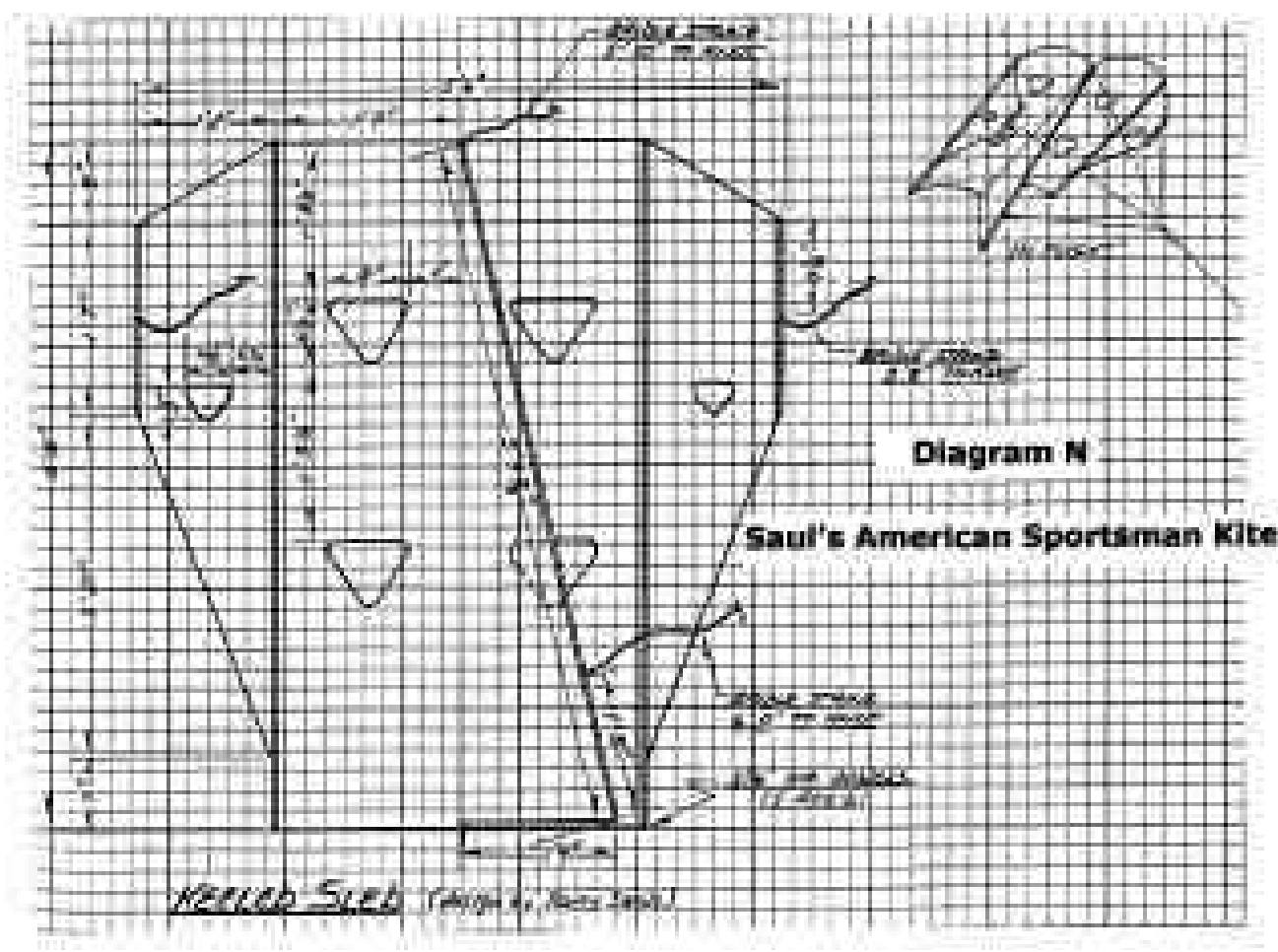
Certainly from the '70's designers have joined two 2 spar sleds side by side and have saved 1 spar and 1 bridle fin (see PELHAM). Photo 2 shows the very successful Skybums Rainbow Sled (the small drogue required is out of shot). Each of the seven cells is 100 cm x 25 cm and in a strong wind it is hard to hold. Managing the bridles is good work for an apprentice Edo flier.

The ultimate in multi sleds known to me is found in NEIL THORBURN who has a 'photo of 18 Allison sleds in 3 rows of 6. Each is made from a Safeway's shopping bag and they are fitted to a bamboo frame and have 21 x 10 ft bridles.

Finally we come again to MARTEN BONDESTAM and the Fan (diagram K).

4.3 Sled Hybrids

We know that the problem with sleds is that they are prone to collapse in gusty winds – see 3.3.1 above for 'improvements'. One obvious way is to use a cross spreader and fit it to wings, designed to add lift to compensate for the spreaders weight. SARAH KENT shows one and points out that the spreader is designed to be too short to stretch the canopy but allows it to take up its usual curved shape. So the spreader should be behind the wings and in front of the canopy (diagram O). I've never seen one but have seen



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1970's adverts for a USA commercial Firebird Winged Sled.

The greatest exponent of the winged sled must be Stormy Weathers, who since 1978 has produced a series of very precisely designed kites made from very cheap materials (Star Victory, Swift Victory and Winged Victory). Photo 3 shows a Dan Leigh made Winged Victory. The plan of the latter is diagram P, diagram Q is the detail to show a simple way of producing the thin fibreglass spar at 90 degrees to the centre spar which

holds the centre sled section into a V or U profile and reduces flap.

For highly complicated, but not over elaborate, sled hybrids consult NEIL THORBURN who has:

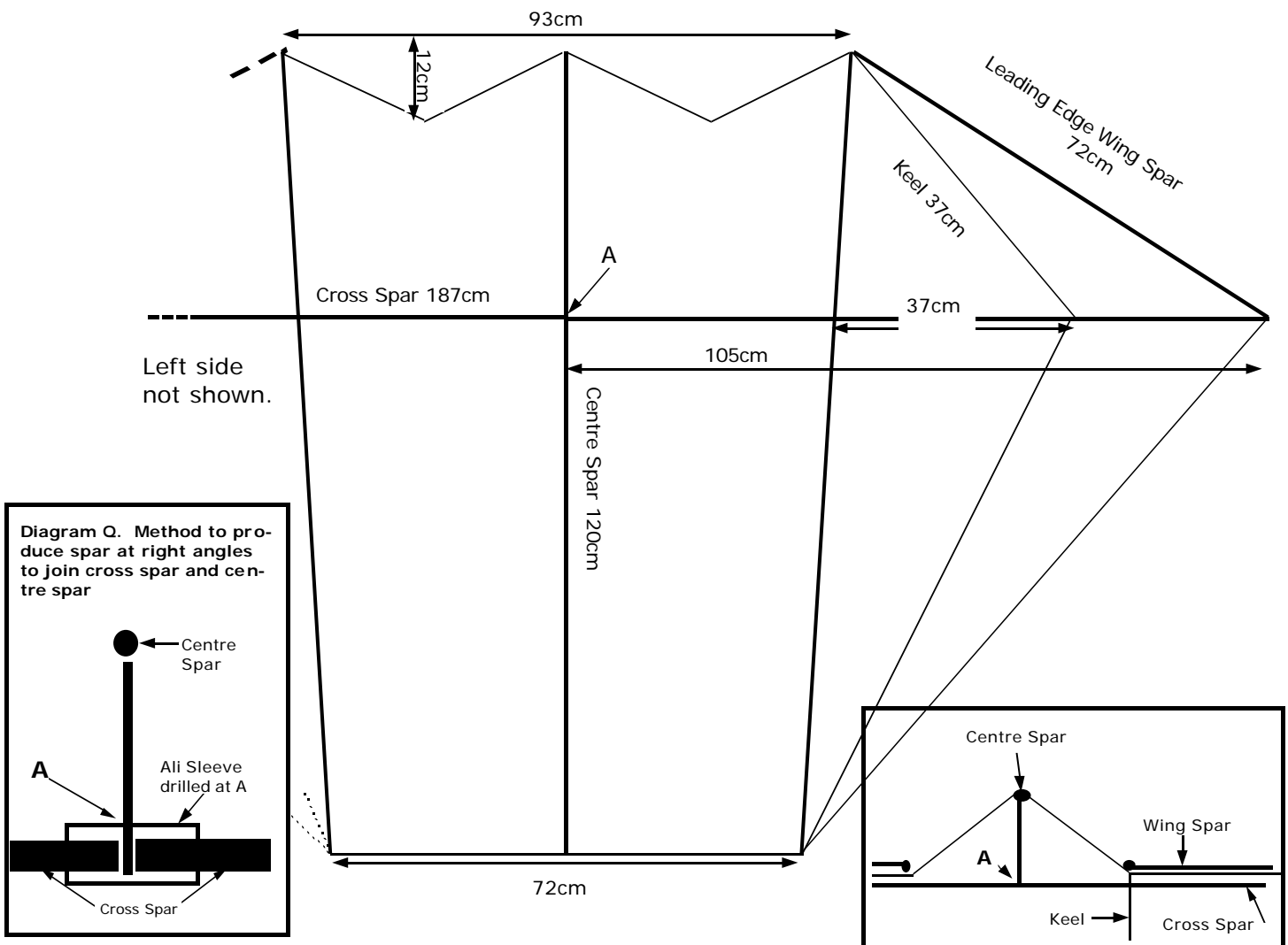
- A sandwich sled delta, i.e. a twin spar delta where the centre section is a double canopied multi-vented sled.
- A stacked Deltas sled which is really complicated and leads on to
- A bird kite with a vented double canopy sled centre section with a bird face su-

perimposed.

Seriously, if you can get hold of the book there are some great designs.

Now let's go back to the winged sled (diagram O). Does it remind you of a flare? Admittedly flares usually have a second spreader bar near the trailing edge and have the wing shape elongated to provide a fixing point but once the spreader is long enough to stretch the centre panel we no longer have a sled. Was this how the flare was

Diagram P - Sketch plan of a Stormy Weathers Winged Victory built by Dan Leigh.



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designed? I think it first appeared in PELHAM. Can anybody help this speculation. Of course flares are not often seen nowadays being superseded by the Genki – an extended wing plan which is a Dutch development of about 1983.

Another sled/flare hybrid is the Brandes Flare designed by Ray Brandes and winner of the Best

Patriotic Kite competition at the 1986 Smithsonian Kite Festival (for plans see MAXWELL EDEN). Essentially it is a large Hornbeam Sled surrounded on each side by a smaller Allison sled extending to a flare wing. I've never seen one.

My final candidate for inclusion as a sled hybrid is the Skybow. If you think this farfetched,

look at diagram C. Now multiply the centre section by 50, omit the intermediate fins and bridles but keep the spars between each section, finally make each bridle equal to the width. I haven't asked George Peters or Peter Dolphin – both of whom are credited with it's invention – but a skybow certainly fits within this definition.

5 Using Sleds

As I wrote in the History section the sled was never associated with glamorous uses such as hang gliding or parachuting. No lifting and no powering. Certainly in the UK their main use has been to introduce children to the delights of helping to make and then flying their own kite. Which is not such a bad claim to fame.

They have been used for other things. Stormy Weathers used them in kite fishing. His Winged Victory used to be advertised in Kitelines by an attractive lady flier who had won sprints. I've never seen one in a sprint in the UK (Winged Victory I mean).

Years ago – I think at Brighton – I saw a set of black sleds

with circular vents in the canopies to imitate dominoes. Not a full set, I remember maybe 20, but giving the lie to the necessity of accurate balanced vents in the canopy.

Finally we have a group of fliers whose only kite is a pocket sled.

6 Conclusion

This article was written with the same aims as the one on deltas. While people have said nice things about that article I haven't really had the sort of comments which would make me want to change something.

If you have information about either article which you want to add or things that you disagree with please contact me directly or via the magazine. I'd be happy to do an amendment.

Next topic should be foils and

soft kites but that has certain problems. I think I'll do something different – bird kites – because there is such enormous variety I'll have to be more selective and it involves trying to analyse Asian kites in a way I've not seen done before.

Will Yolen	'The Complete Book of Kites' 1975. An American Classic. Has the first reference to Saul's sled.
David Pelham	'The Penguin Book of Kites', Penguin Books 1976. The 'Bible' – but beware of the Scott design.
Margaret Greger	'More Kites for Everyone'. Self Published 1990. Well known for clear practical plans
Neil Thorburn	'Super Kites III'. Self Published 1991. Not often seen. Best known for the stacked deltas. Jon Bloom won 2 prizes with his Pagoda (it says)
Paul and Helene Morgan	'The Book of Kites'. Dorling Kindersley 1992. The first of the beautifully produced UK books with good pictures and plans.
Wayne Hosking	'Kite to Touch the Sky'. World of Kites, Washington 1993. Has 7 sleds including the winged sled and the pocket sled.
Sarah Kent	'The Creative Book of Kites'. Smithmark Publishers 1997. The second beautifully designed UK book, often with something different.
Maxwell Eden	'The Magnificent Book of Kites', Sterling Publishing 1998. Good range of sled plans including the Bullet, Brandes Flare and Helen Bushells Fluted Sled
Martin Bondestam	'Better Kites'. Self published, Finland 2000. Who can forget his earlier book 'Lenna, Lenna Leijani'? In Finnish, curious pen and ink illustrations and a dangerous fascination with Russell Hals. When I last checked this book was available and is easily the most interesting I have read for years. Largely in English it is a throw back to the style of kite making which emphasises families making often small kites and not just sleds – from plastic, natural materials etc. Who can resist a book with a plan for a 'streamlined trouser kite' or one with a colour photo of a star shaped box 'on the endless ice in Finland'. Cools the reader on the hottest day.



Photo 1. Zammo Sled.
A polythene two stick vented semi-flexible sled kite designed by Ambrose Lloyd in 1974.

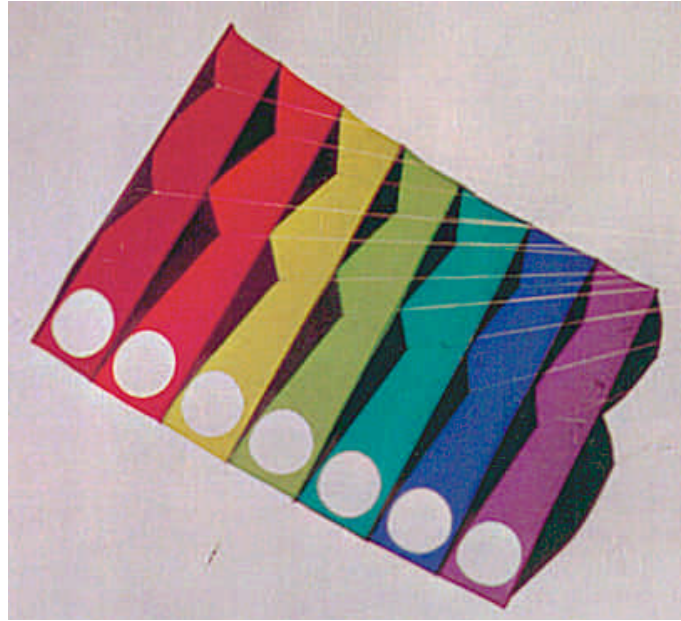


Photo 2. Skybums Rainbow sled.
Required drogue is out of shot.

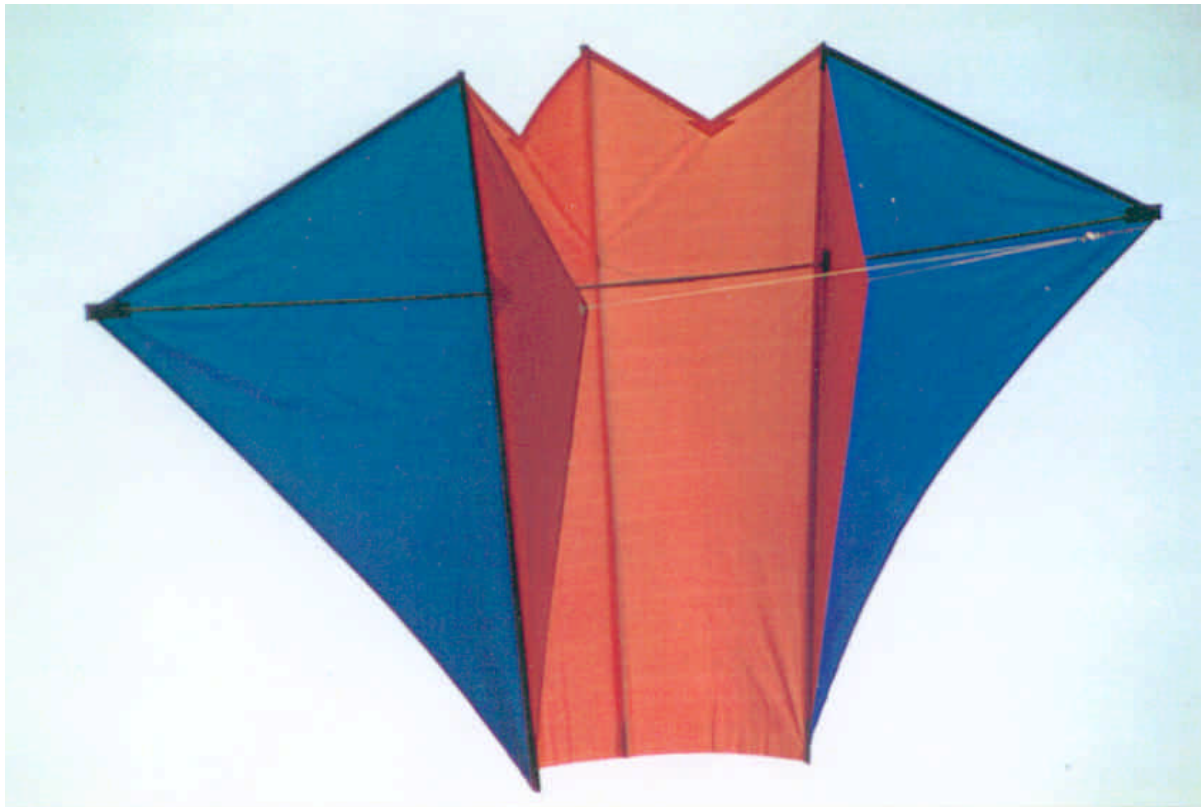


Photo 3. A Stormy Weather Winged Victory. Made by Dan Leigh.