CHAPTER 8

Sled Kites

1 Introduction

Having written about delta kites, 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 chapter. 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 outfly 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 followed by a number (e.g. Pelham [1]) it will be in the bibliography. The diagrams 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

Istvan Bodoczky is a well-known Hungarian maker of artistic asymmetric kites. He reports on a 1904 article describing a 'Jewish Buda Kite' made from pieces of paper pasted together reminiscent of children's designs still seen where the paper folds are stiff enough to function as spars. These children's kites are seen as linked to the sled but there is some doubt as to whether the Buda kite was stiff enough to qualify. The best account of all this is in *Drachen* no. 9 (Spring 2002).

However, there is general agreement 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. He was a refrigerator mechanic working for Westinghouse. 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 was such an exceptional young talent making model aircraft that at the age of 13 his craftsmanship was recognised by his being given the general run of the Wright-Patterson workshops. A retiring man, he died in 1978. He developed his 'Polymorphic Kite' in the 1940's, applied for a patent in 1950 which was granted in 1956. It would seem that one reason for the long delay was that his application and that of Rogallo seemed very similar to the Patent Office. 'Polymorphic' means 'taking several different forms' and was probably not a marketing man's first choice. The kite (Illustration 2) and also his patent drawings (Illustration 1) were 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.

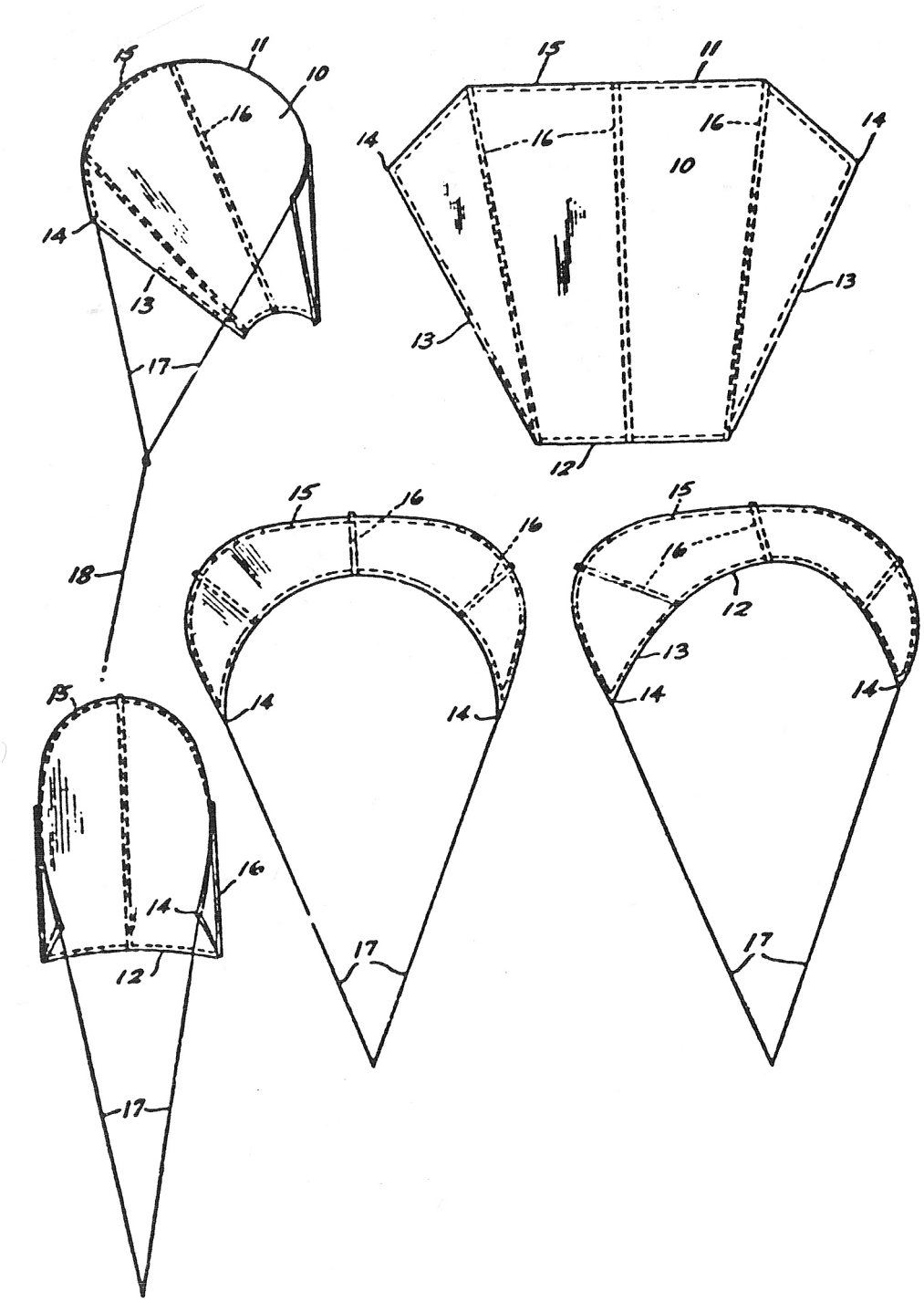

Illustration 1: Allison's patent drawings for his three-stick, non-vented semi-flexible sled kite (1950)

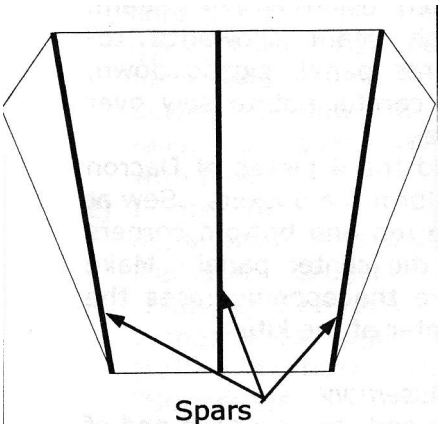

Illustration 2: Allison's Polymorphic Kite (1950)

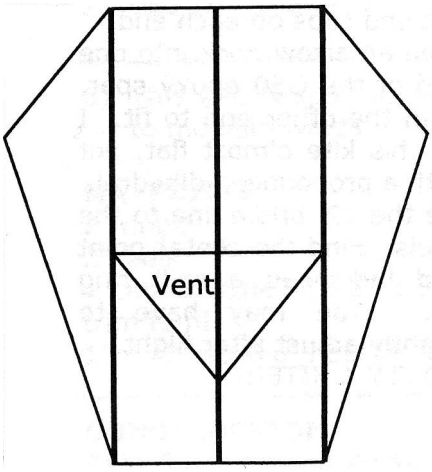

Illustration 3: the Scott Sled

Allison kites were made and sold, but undoubtedly sleds became more 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 three longerons but now parallel with a triangular hole in the canopy (Illustration 3).

That is the history from, for example, Eden [2]. However, in Allison's obituary in *Kitelines* vol. 3 no. 1 (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'.Interestingly *Drachen* no. 9 (Spring 2002) has an editorial article which states that Allison did get some money for patent infringement from Scott.

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, Cornwell'(?) 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 still in production — 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 — the tendency to collapse in gusts and wind shifts. Three of the main innovators were Ed Grauel, Guy Aydlett and John Loy — see Section 3.3 below. All this was done by the early 1980's. 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 –1.5 metres is unusually large– and are of such simple construction (Illustrations 5 and 6) 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. Some prefer spars with a flat section to improve location with sticky tape. 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 (see Illustration 4 from *Kiteflier* no. 24 (July 1985)— one of Mark Cottrell's funniest pieces).

Advertisement

Great Kiting Bores of our Time
No.13 The Man Who Makes Sleds.

"I have always found that my two stick, tapered, rectangularly vented sleds (you know, like the one on page 215 of the Penguin Book of Kites by David Pelham) with the Hornbeam leading edge modification to prevent leading edge collapse and a long 6ft braided line bridle with double swivels to prevent it tangling actually flys better than my friend's one made with three sticks, round vents and a single swivel probably because of my extensive tests and careful choice of materials, and did you know that I made nearly fifty different sleds while on my holidays last month making a total of nearly three hundred in the last year or so and I have found that plastic carrier bags from Supermarkets and shops are an ideal source of material for making sleds out of and they're usually free although you do have to buy the green garden canes which are very cheap although in fact I find the most expensive part of making a sled is the sticky tape although I can normally nick it from work but this can be a bit risky so I usually peel it off very carefully and transfer it from kite to kite indeed in this way I know that it is my design changes that are being evaluated and not the vagaries of the sticky tape being used to hold my sleds together given that all other things are equal and the flexibility of the garden canes I am using is within the normal tolerance level for a 3ft sled say about 1" flex with a 3oz weight applied near the end but normally this is not too limiting a factor in my designs unlike the problems associated with the stretchiness of carrier bags especially those you get from Tesco and off the Duty Free on Sealink Boats but probably the worst are the ones that the **Kite Store** gives you with a sled design already printed onto them which never work for me but then I'm probably so far ahead of them in design and fabrication that in fact I probably know more about sleds than anyone else and you may have seen some of my sleds flying at the Blackheath Kite Festival in a measured 35mph of wind on some 20lb line I picked up cheap at the local surplus store which I can recommend as being really good stuff to fly your sleds on as long as they are less than 1023 sq. inches in area although I have flown some of my large light wind sleds (you know, about 8sq feet of sail area) on it in winds up to 9.3mph without them breaking the line but you must be careful about the wind speed and should measure it using a wind speed meter like this one I got from the Yacht shop around the corner the other day so that I could evaluate my designs properly and come to proper scientific conclusions about their performance allowing me to design a sled suitable for flying in any conditions although I doubt anyone else will be able to duplicate my techniques for making sleds because it takes a lot of time and practice to make a really good one that you can just take out and toss up into the air and expect to fly well under all conditions like when I went down to Dorset on the coast one week and it did nothing but blow a gale all the time so I had to use my SW51/3/DV (Strong Wind, design no 51,3 stick, doubly vented sled - I invented this nomenclature myself and think all kite fliers should use it) which is absolutely fantastic in these conditions but then again my VSW34/2/SV sled would probably have flown as well under these conditions although I have heard reports from other members of my group whom we like to call the Sled Lovers Appreciation Group and you may have seen my cloth badge which bears the initials of our organisation on my cap next to all my other ones....."

Now you know why we do not sell sleds.

We give them away.

69 Neal Street, Covent Garden, London WC2H 9PJ.
Tel; 01-836 1666

Illustration 4: *Kiteflier*, July 1985

Many of us remember the 'Fly the Bag' sled which was pre-printed on the 1980's Kite Store bag.

I have a multisled made by Mark out of a plastic table cloth.

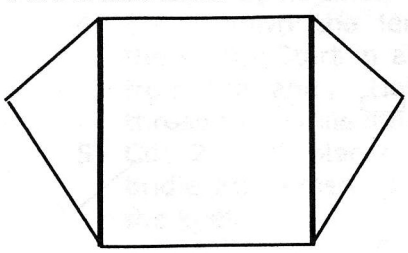

Illustration 5: A standard two stick sled

Richard Dermer's large trash bag Stars 'n' Stripes sled at Portsmouth 1998 made a big impression.

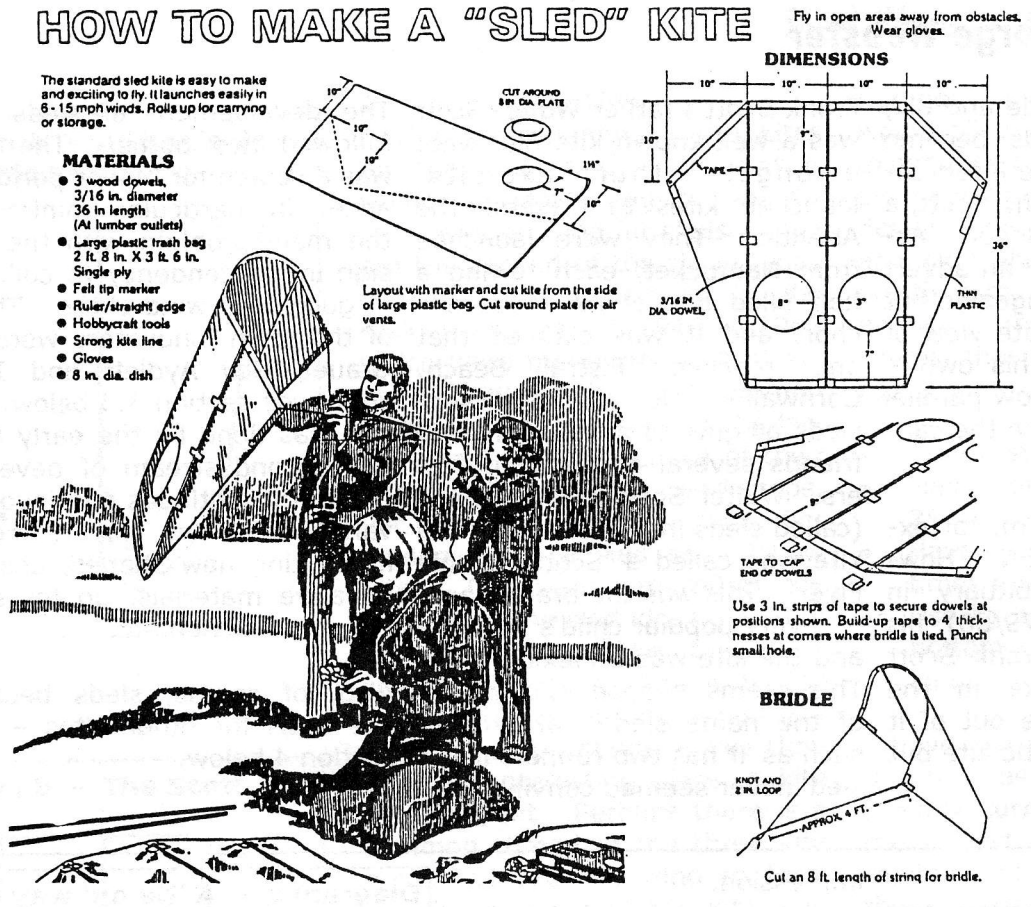

Illustration 6: How to make a Sled Kite

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 (Illustration 7).

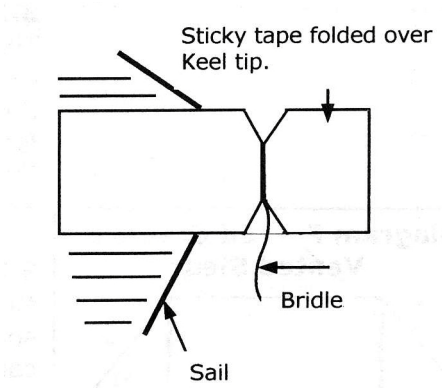

Illustration 7: A 'tie on' way of bridling a small sled

3.2 Size

I hadn't seen a very small sled (less than 5cm.) until, having read a previous version of this article, Nick Wadsworth sent me one 8mm. long. According to Kent [3], the worlds largest was Dutch, measuring 15m. high by 25m. feet wide in 1980. However, we have had a seriously large sled at the Sunderland Kite Festival in 1995. Made by Jack Crouch and with "Jack" on its pink and yellow canopy it measures 10m. by 16m. 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 30mm. by 6mm. wall carbon fibre — 25mm. by 3mm. wall fibreglass couldn't cope. Legend has it that it was originally made for hip replacement operations. The kite was last flown in 2000.

3.3 Plan Shapes

There are three main types of canopies. The single canopy or double canopy both use some form of spar, the third type, which I've called the fluted sled uses an air filled tube.

3.3.1 Single Canopy

Most sleds made today have two spars, sometimes with a complete canopy Allison style (Illustration 5); often with vent(s) cut out of the canopy. Books such as Pelham [1], Greger [4], Eden [2], Kent [3] and Morgan [5] have plans of various styles — note that Pelham seems to have got it wrong and incorrectly shows Scott's triangular vent (Illustration 3) as a pyramid shaped and not fan shaped (i.e. point down as shown here). Two other vent patterns were well known: Ed Grauel's trapezoidal vents (Illustration 8) and Paul Sroka (Illustration 9). Venting with circular holes has also been widely used and is easy to do with a plastic canopy (Illustration 6). By chance both sled photos have hole vents. Illustration 10 shows a commercial Zammo sled of about 1976, a polythene two-stick vented type designed by Ambrose Lloyd in 1974.

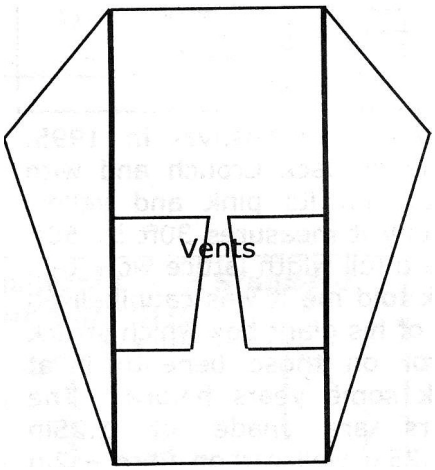

Illustration 8: Ed Grauel's Vented Sled

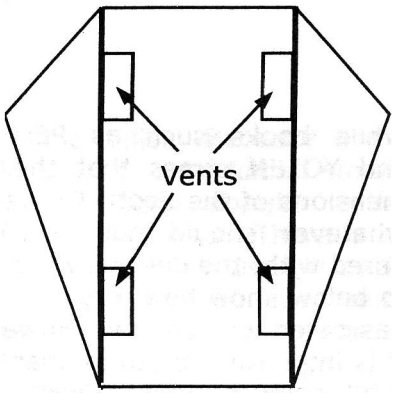

Illustration 9: Paul Sroka's Vents

Illustration 10: Zammo Sled

The claimed advantage of venting is to reduce pressure on the canopy to smooth out the airflow and thus reduce fluttering. The worst form of fluttering is a flapping leading edge. In 1976 Guy Aydlett of the Piney Mountain Air Force found

that cutting a crescent from the leading edge 'provides for a diverging air flow which tends to hold the canopy open'. The kite is known as the Hornbeam (Illustration 11). A simpler version replaces the curve with a shallow V on the leading edge with the point of the V 10-15% of the canopy length.

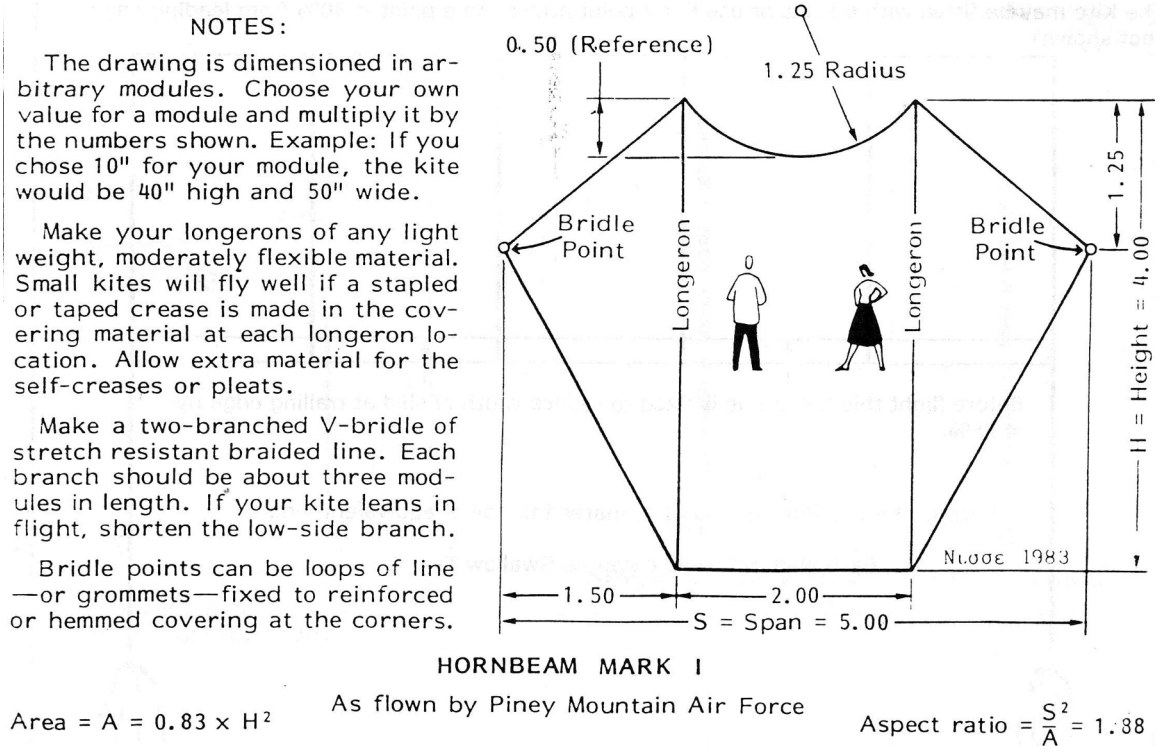

Illustration 11: the Hornbeam kite

The last innovator of single canopy design to be mentioned is John W. Loy (see his 'Sleds for all Seasons' in *Kitelines* vol. 7 no. 3 (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 (Illustration 12) –also used by fliers such as Bondestam [6]– see below.

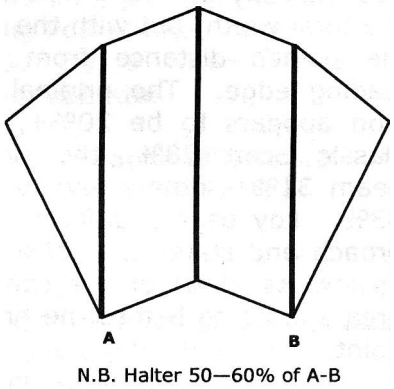

Illustration 12: John W. Loy's Swallow Tail

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

Stiffening the leading edge e.g. by folding or using a thicker fabric or even a piece of thin rattan 2.5cm. 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 2.5cm.

Alternatively, in a kite 60 cm. wide, slit the canopy right across 10cm. from the leading edge. Then cut the top strip and insert a 10cm. by 10cm. piece so as to have a leading edge strip 80cm. wide.

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. While books such as Pelham [1] and Yolen [7] 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. Grauel argued for 30%.

Lastly on bridles — it is important that they be long enough. A rough guide seems to be that each leg should be three to five times 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' workshops.

I've seen sled designs with Halloween 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 two 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, acting like the 'halters' of Loy and Bondestam.

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 twenty, but giving the lie to the necessity of accurate balanced vents in the canopy.

To get an idea of what can be done imaginatively with the sled idea consult Bondestam [6]. He has at least fourteen 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 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 (Illustration 13). He has many other good designs; the lyre kite looks good and the 'two spars but no tape' sled is ingenious.

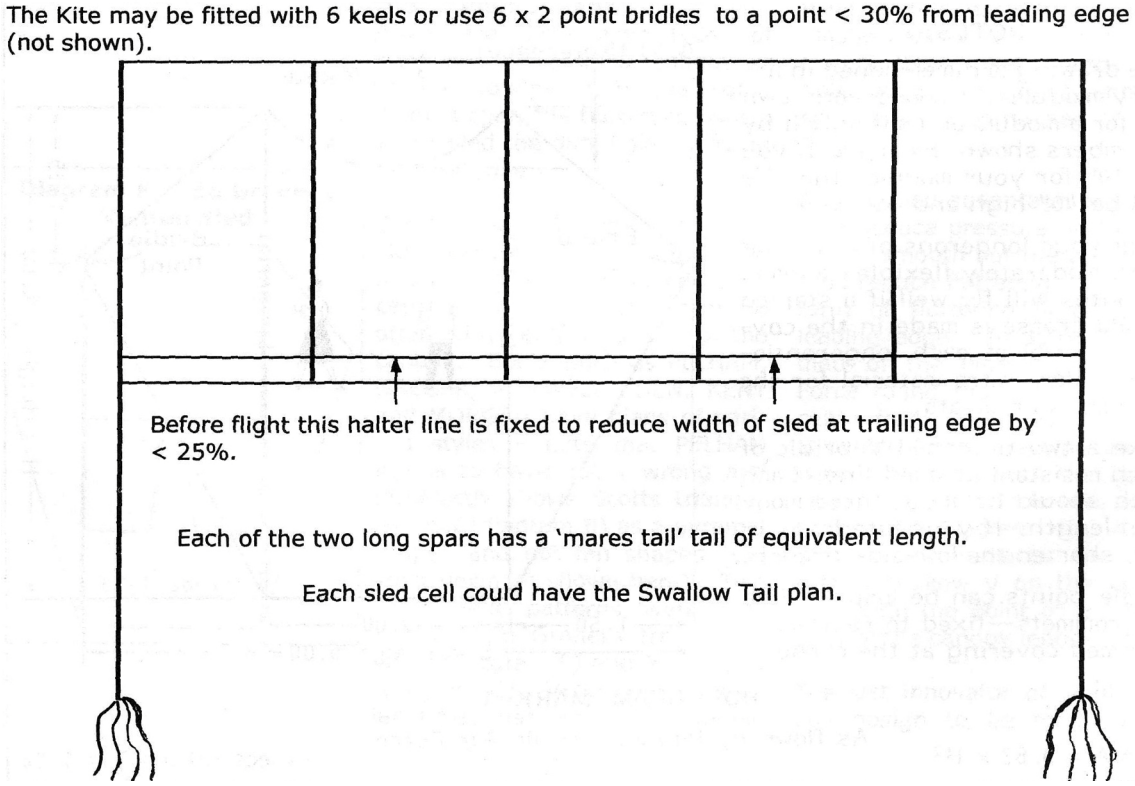

Illustration 13: Marten Bondestam's Fan Kite

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 (Illustration 14). The kite's two cells may be formed by a hem or a central spar. The back canopy is approximately 30% wider than the front.

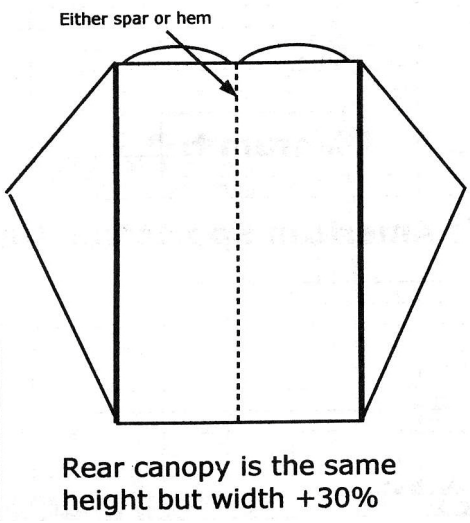

Illustration 14: Double Canopy Sled

A similar idea is found in Nishibayashi's book (entirely in Japanese, no translation available) (Illustration 15). This is often shown with a straight leading edge. The example in Illustration 15 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 one flying recently – is Helen Bushell's Fluted Sled (see plan in Eden [2]). The 1.1m. wide front canopy has 6 rows of 7 circular vents, sewn to give flutes on two longerons. And then the original version had curved keels, just to add to the fun.

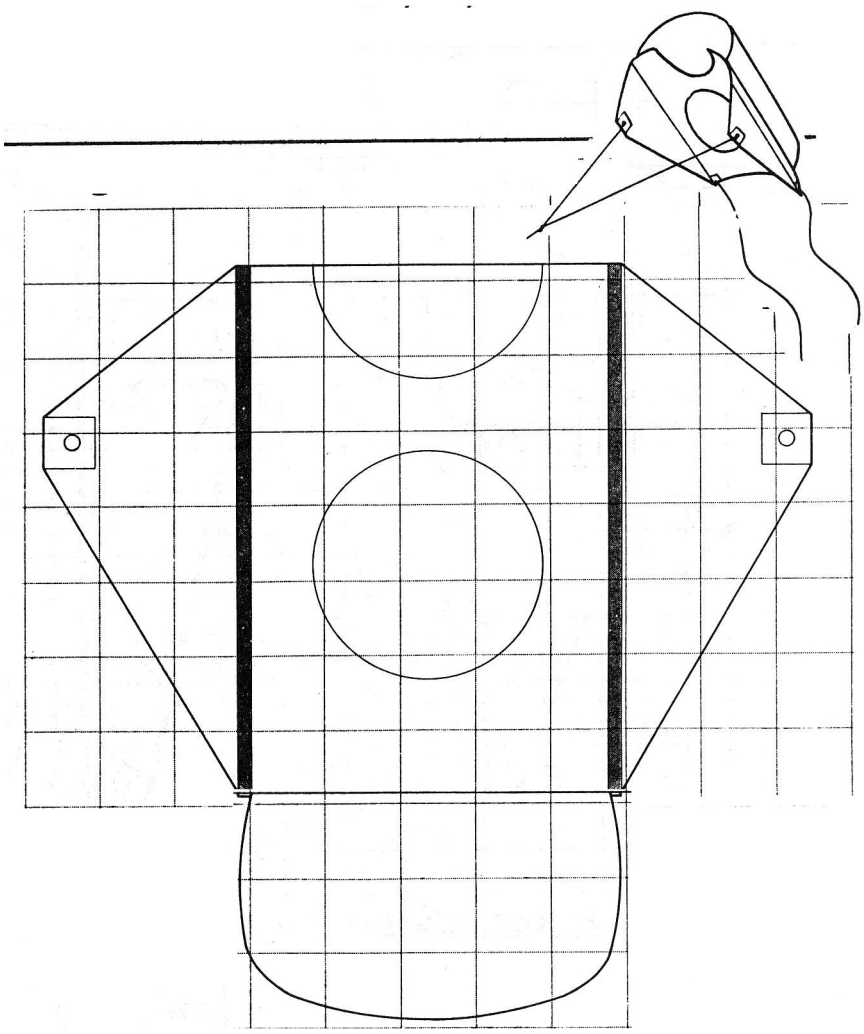

Illustration 15: Double Canopy Sled by Nishibayashi

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 two celled parafoil with a canopy between 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 Bondestam [6].

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'.

4 Variations

This section, after recognising one-off 'keeled' design, looks at variations on the two or three spar, two keel sled — firstly multi-sleds and secondly sled hybrids.

4.1 The Keeled Sled

I know of only one, Harry Sauls 'American Sportsman Kite' (Illustration 16). As you see, it is great fun with two spars, one keel, each wing with a bridle spar and six vents. Years ago I made one and Ernest Barton had a go. Mine needed a strong breeze and flew at a low angle working away like a set of bellows. I was left with the feeling that this kite is an over complication of an essentially simple idea. Ernest Barton agrees.

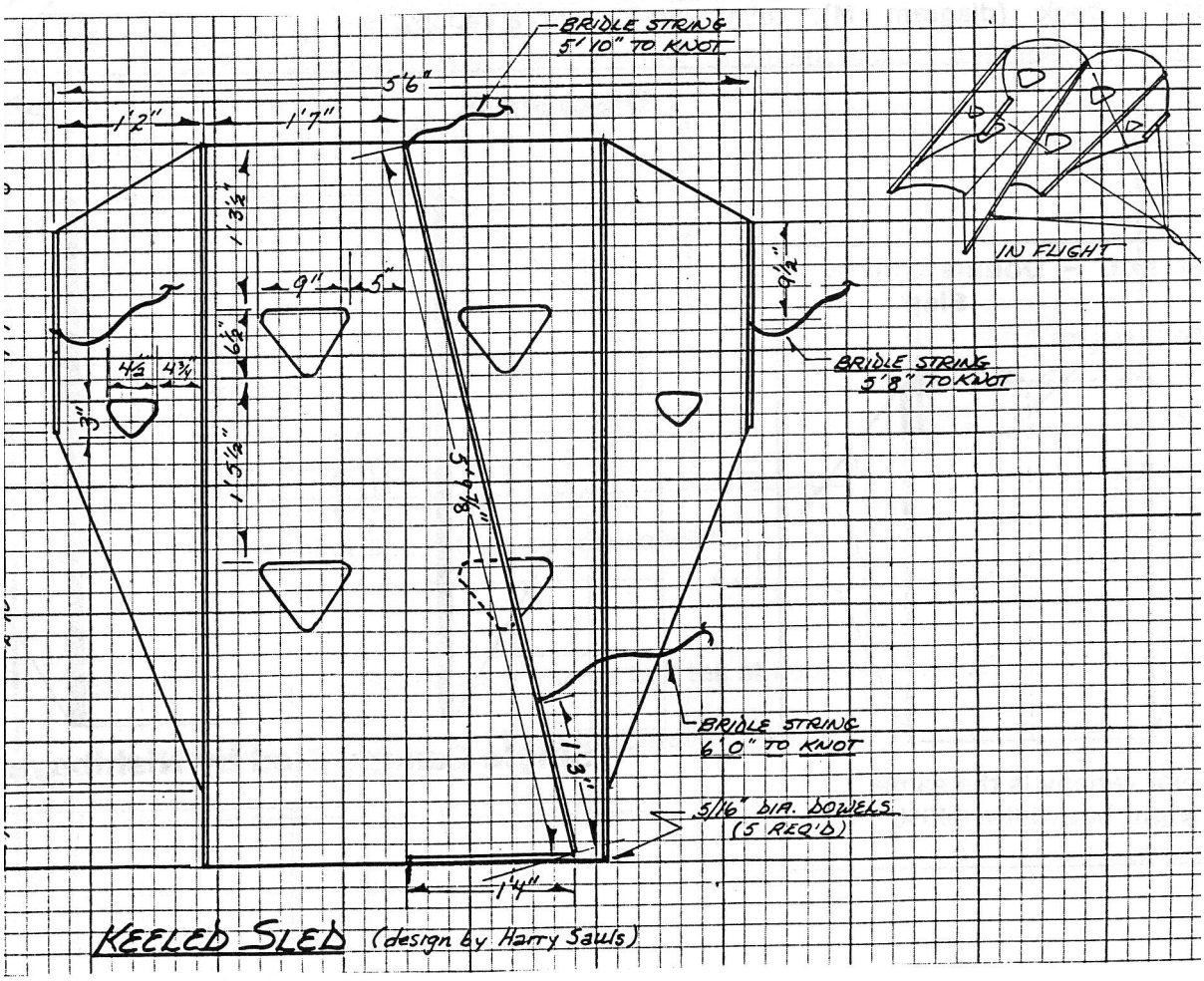

Illustration 16: Saul's American Sportsman Kite

4.2 Multi Sleds

Certainly from the 1970's designers have joined a couple of two-spar sleds side by side and have saved one spar and one bridle fin (see Pelham [1]). Illustration 17 shows the very successful Skybums Rainbow Sled (the small drogue required is out

of shot). Each of the seven cells is 100cm. x 25cm. and in a strong wind it is hard to hold. Managing the bridles is good work for an apprentice Edo flier.

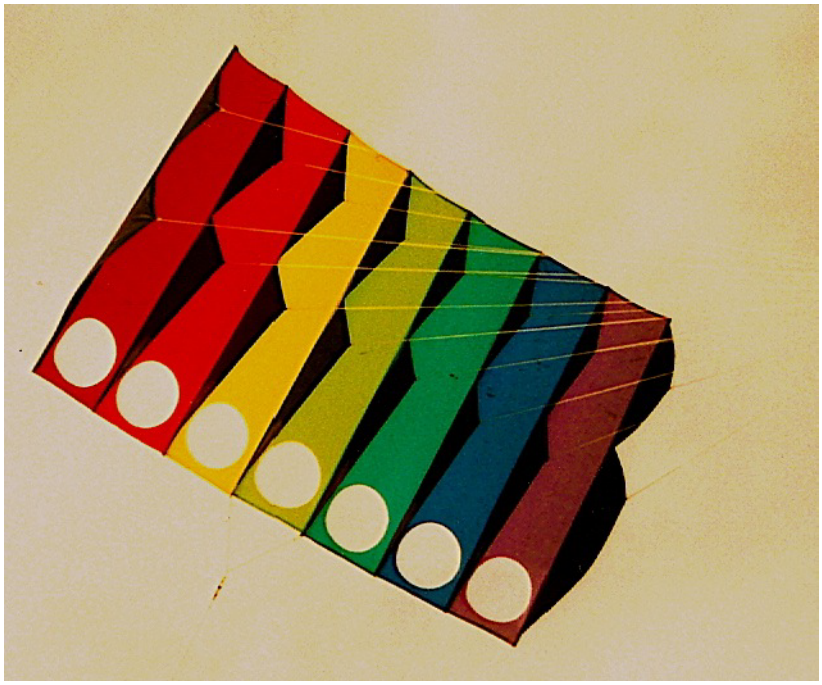

Illustration 17: Skybums Rainbow sled. (Required drogue is out of shot.)

The ultimate in multi sleds known to me is found in Thorburn [8] 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 7m. x 10m. bridles.

Finally we come again to Bondestam [6] and the Fan (Illustration 13 above).

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. Kent [3] 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. I've never seen one but have seen 1970's adverts for a USA commercial Firebird Winged Sled.

The greatest exponent of the winged sled must be Stormy Weathers, who since 1978 produced a series of very precisely designed kites made from very cheap materials (Star Victory, Swift Victory and Winged Victory). Illustration 18 shows a Winged Victory made by Dan Leigh. The plan of the latter is Illustration 19. Illustration 20 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[1].

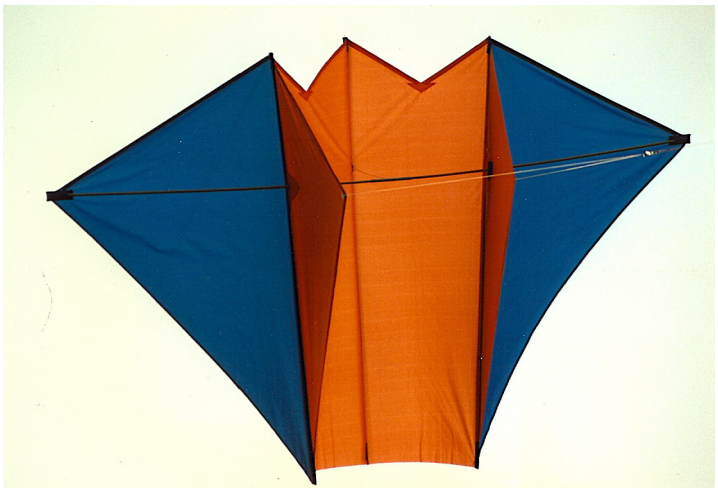

Illustration 18: A Stormy Weathers Winged Victory. Made by Dan Leigh

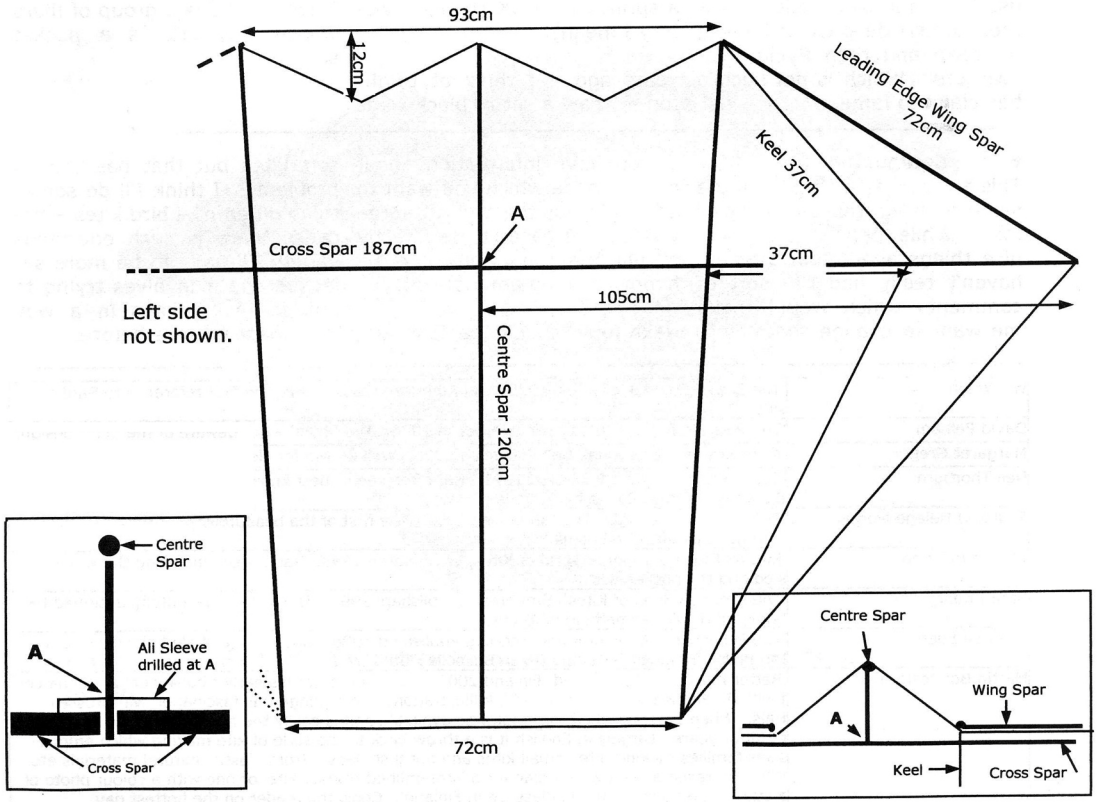

Illustration 19: Sketch plan of a Stormy Weathers Winged Victory built by Dan Leigh

1. Since I first wrote this section I have been able to handle some Stormy Weather originals now in the collection of Malcolm Goodman. They are made using thin plastic and drinking straws and are coloured in USAF WW II style. Models of ingenuity, they show how modest was the master's statement "As far as my artistry is concerned, I don't have any. My kites are designed for performance, timed altitude and highest angle of flight" (See *American Kite*, Fall 1996.) For a Star Victory plan, see *Kiteflier* no. 71 (April 1997).

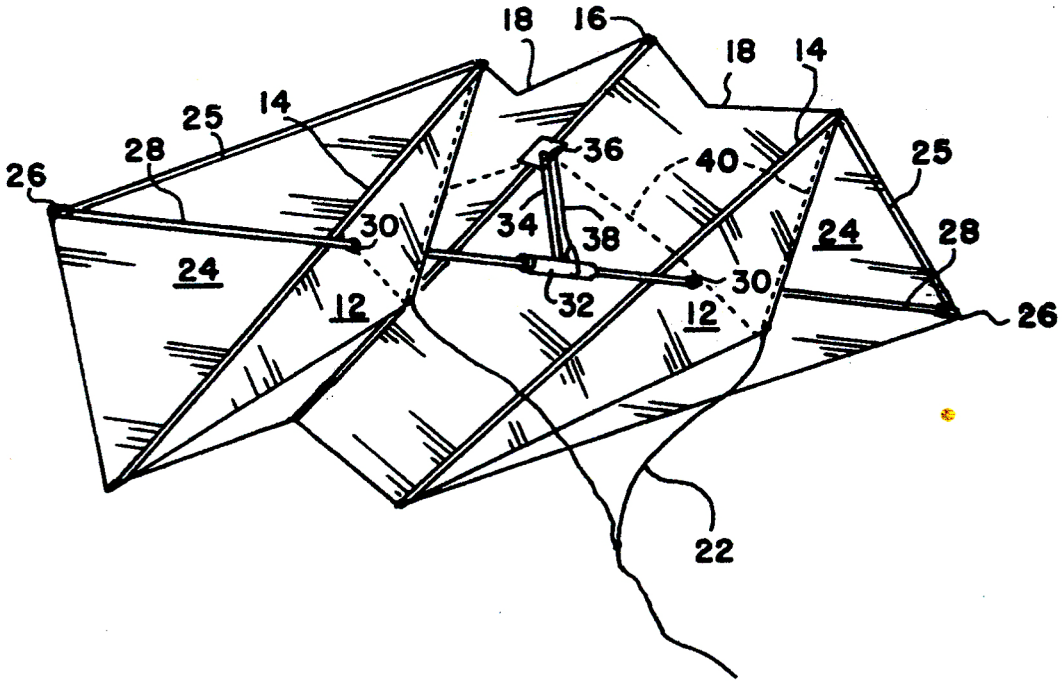

Illustration 20: Winged Victory detail (from Stormy Weathers patent application)

For highly complicated, but not over elaborate, sled hybrids consult Thorburn [8] 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 superimposed.

Seriously, if you can get hold of the book, which I think may be available from online secondhand booksellers, there are some great designs.

Now let's go back to the winged sled , using Illustration 19 and ignoring the keel. 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 designed? I think it first appeared in Pelham [1]. Can anybody help this speculation?[2]. Of course flares are not often seen nowadays being superseded by the Genki (see Chapter 6 on Flat Kites).

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

2. No-one had by the end of 2008.

(for plans see Eden [2]). Essentially it is a large Hornbeam Sled surrounded on each side by a smaller Allison sled extending to a flare wing.

My final candidate for inclusion as a sled hybrid is the Skybow (Illustration 21), invented in 1988 by Etienne Veyres and Alain Chevalier (see *Kitelines* vol. 9 no. 3 (Fall 1992)). If you think this farfetched, look at Illustration 6. 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 have made great examples — but a Skybow certainly fits within this definition.

Illustration 21: a Skybow

5 Using Sleds

We have walkers whose only kite is a pocket sled.

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). Star Victory plans can be found in *Kiteflier* 71 and 72 (April and July 1997). As I wrote in Chapter 2 the sled was never associated with glamorous uses such as hang gliding or parachuting.

Recently, UK kite festivals have seen the widespread use of Power Sleds (Illustration 22) –a commercial kite– used for lifting line laundry, various rigs, and even as a lifter for soft kites. The original Double Parasled was invented by John Verheij in 1985 (see his article which includes plans in *Kitelines* vol. 11 no. 1 (Fall 1994)). There is also a smaller version by Michael Graves in the same article who is clearly terrified at dealing with the 3m. by 5m. original. Power sleds are made in a range of sizes and rather brutal colour schemes. They have very flexible fibreglass stiffeners in each of their tubes and may need the edge of the outside cells stiffened

in light winds. They are a relatively low cost '£paid for lb. lifted' solution and fly at a good angle in a wide range of wind speeds.

Certainly in the UK the sled's 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.

Illustration 22: a Power Sled

6 Bibliography

[1] Pelham, D. (1976) *Kites.*
The 'Bible' — but beware of the Scott design.
[2] Eden, M. (1998) *The Magnificent Book of Kites.*
Good range of sled plans including the Bullet, Brandes Flare and Helen Bushell's Fluted Sled.
[3] Kent, S. (1997) *The Creative Book of Kites.*
The second beautifully designed UK book, often with something different.
[4] Greger, M. (1984) *Kites for Everyone.*
Not often seen. Best known for clear practical plans.
[5] Morgan, P. and Morgan, H. (1992) *The Book of Kites.*
The first of the beautifully produced UK books with good pictures and plans.
[6] Bondestam, M. (2000) *Better Kites.*
Who can forget his earlier book, *Lenna, Lenna Leijant*? In Finnish, curious pen and ink illustrations and a dangerous fascination with Russell Halls. When last I checked, this later book was still available and is easily the most interesting I have read for years. Largely in English it is a throwback to the style of kitemaking 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.[3]
[7] Yolen, W. (1975) *The Complete Book of Kites.*
An American classic. Has the first reference to Saul's sled.
[8] Thorburn, N. (1991) *Super Kites III.*

3. Since I wrote the article I met and corresponded with Marten (and hopefully helped to sell some of his books). The wonderful designs include The Lyre, which has a deep wedge cut from the canopy, and the No Tape Sledge (now out of patent) which is cut from a shopping bag and has spars inserted but (as you've guessed) no tape.

   He has a great story of a prototype fan sled breaking looses and escaping out to sea. Two weeks later his brother saw from a boat the kite 'flying' perfectly half a metre below the surface from the line caught on the sea bottom 80 metres below. Nothing was broken (plastic and tape) and the kite flew again in the sky.