The Best Kite in the World

By Stormy Weathers

About The Drachen Foundation

The Drachen Foundation is a non-profit 501 (c) (3) corporation devoted to the increase and diffusion of knowledge about kites worldwide.

The Foundation

- Operates the Drachen Study Center in Seattle
- Sponsors national and international exhibitions, conferences and workshops
- Publishes books, journals and news letters
- Funds kite research globally
- Collects and conserves kites

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Awake! As the sun before him sets to flight,
darkness from the field of night,
so too it is a likely chance,
that reading routs dark ignorance.

(my apologies to Omar the tent maker)

Stormy Weathers Book Introduction

As we soar into the 21st century we have celebrated 100 years of the airplane and have witnessed its entire evolution through this relatively brief historical time. In this rapidly changing world of flight, one thing has stayed remarkably constant – the simple joy of flying a kite. Children and adults who flew the "new" kite inventions of the 20th century; the Eddy kite, Hargrave box kite, and Conyne aeroplane, are no different from today's who fly large Peter Lynn creations, the newest sport kite, or a soaring delta. Materials and construction techniques have changed, but joy and satisfaction of a fine-flying kite have not.

Stormy Weathers lived through much of the 20th Century and witnessed the deprivation of the Great Depression and the Second World War. There is little doubt that these events of his youth influenced his kite making philosophy, that is, to make the best flying kites with the least expensive and readily available materials. Kite flyers and kite makers of the last thirty years have depended upon the newest materials, graduating from cotton or nylon taffeta, to ripstop nylon, from wood to fiberglass and carbon fiber. Stormy challenges us to look again at common and simple materials, not just because they are available and inexpensive, but more importantly, because they work!

Stormy never seemed to worry about appearances and convention, he was set in his convictions and when it came to his kites, confident of their capabilities. This is more than a kite book in that it reveals Stormy Weathers, the man, and critics and fans alike will find passages in this book that provoke: Stormy speaks of patriotism, religion, and parenting without the modern filter of political correctness.

For the pure kite enthusiast, however, the kite designs included herein, developed and proven by hours of flight time over many years, will prove informative and worthwhile. The "bottom line" that I have witnessed dozens of times over the years, is that these kites are often the first in the air and last taken down, regardless of wind condition. They have been refined to fly beautifully over the widest possible range of wind conditions. To anyone using this book as a construction guide, I recommend Section One, Materials, and the first kite project, the Horned Allison Kite, to become familiar with techniques and nomenclature used throughout the book. Many of these kite plans look like those in other books, but I can assure you, if made properly these will out-perform all but a very few. My personal favorite is Stormy's funny paper barn door kite, refined with a single bridle so it can be flown easily in train.

Use this book as a guide for making larger versions of these designs by first making Stormy's version and then using that as a prototype for contemporary materials like carbon-fiber and ripstop polyester. Most of the designs are readily adaptable to paper and bamboo construction as well. Stormy's version can be used as the target for lightness, strength, and utility. The functional listing and drawing of knots in Section 9 is helpful to any kite flier but especially to those using line made of natural fibers; cotton, hemp, or linen.

Kite knowledge like this is the equivalent of sitting at your grandfather's knee while he shows you how to make your first kite. You won't remember everything, you won't agree with everything he says, and you'll make a few more mistakes than he does. But you'll finish with a great kite; one that flies high and steady. Consider Stormy your kite grandfather.

Scott Skinner

Stormy

Kitemakers come in many varieties: artists, engineers, inventors, tinkerers.

Stormy weathers was all of these.

I believe it was at the Long Beach Kite Festival in 1990 that I told Stormy that he must assemble "his" kites in a book. The kites range from variations of the sled to the Victory kites, singularly high-angle, light-wind fliers. All are developed and brought to near-perfection in Stormy's style, which was "test, test and test again, until you can't improve it further."

I told Stormy that he owed it to both history and the kitemakers of the future to put plans (many of which had been published in various no-longer-available newsletters over the years) between covers. As things stood, many kitebuilders had no weary of knowing where such masterpieces as the Star Victory came from and were without access to the details of construction of the various kites. These include the ingenious use of ordinary, readily available materials and Stormy's accumulated wisdom on the bridles, tails, reels and knots.

He agreed, dug out the plans and sketches which he had developed over many years and began work. I will have to say that regular nagging may have helped to keep it moving. I was not the only one urging Stormy to get his book to the printer and make it available, but a good part of the delay was his determination to re-test and perfect all the older designs.

We can be grateful for this perfectionism and for the gift of the Swift Victory, (Stormy's later version of the original Star Victory,) developed as he worked on the book. As readers build and fly his kites, Stormy's skills and passion for kitemaking excellence will live on.

Margaret Greger

Richland Washington

Summer 2003


Stormy Weathers

Dedication

This book is dedicated to the memory of Bob Ingraham, founder of American Kitefliers Association (AKA) and publisher of Kite Tales. It is also dedicated to the memory of Jack Van Gilder and Dave Checkley, who between them did so much to promote kite flying in the Pacific Northwest.

ACKNOWLEDGMENTS

No man is an island; I owe so much to so many helpful people that it is impossible to list (or even remember) them all. The following are names of people that I do remember and want to thank.

Margaret and Greg Greger who tested many of my inventions and gave me good feedback. It was Margaret (author of both 'Kites for Everyone' and 'More Kites For Everyone') who finally said, "For Pete's sake, Stormy, write a book before all your knowledge is lost". Valerie and Mel Govig also tested some of my kites and reels and published some of the stuff I wrote. To a lesser degree I also received help and advice from the following greats and near greats:

Harold B. Alexander, Guy D. Aydlett, Aime' and Olive Barsalou, Kay Buesing, Ken Conrad, Ed Grauel, Dan Kurahashi, Steve Lamb, Jo Marek, Linda Merrick, Millie Minkoff, Lisa Moskowicz, Joy Nagode, Harold "Buck" Rogers, Tom Sisson, Neil Thorburn, J.R. Tolman, Lana Wallace, and Siggy Watson.

I would also like to express my thanks to Judi Brown, Rhonda Brewer, Debra Cooley, and about half the other members of Associated Oregon Kiters (AOK), for their help to WKA at the Washington State International Kite Festival and for the way they pitch in at our Oregon events.

As for my children, I want to thank them for their encouragement and helpful suggestions and for dragging me (kicking and screaming) into the computer age.

And finally, a special thanks to Tina de Montaigne, who did the artwork, layout, and all the other nitty-gritty things that it took to put all the author's henscratches into a really decent looking and useful book.

Read; in the name of thy Lord who creates.

(The Holy Quar'an, 96:1)

FOREWORD

Several years ago I was asked to teach a kite class as part of a kite festival at the opening of the Mercantile Village in Lake Oswego, Oregon. As I was cleaning up the scraps after all the children were outside flying the Horned Allisons they had built, a girl about 12 came through the door.

She had been crying and was dragging in what at first glance appeared to be her attempt at sewing a patchwork quilt or perhaps Joseph's coat. It was about 3′ wide and 6′ high, had one vertical spine and three cross spars. "Can you help me? I built this myself and my father tells me it won't fly." This was followed by a couple of quick intakes of breath and shudders as she tried to stifle a left-over sob.

I looked over the kite, hefted it, and it was heavy. I checked the tail and bridle she had attached. I was totally unfamiliar with the design, but it appeared to me that the bridle would give an angle of attack that would be much too high. "Well, let's see what we can do about re-bridling the kite" I told her. I coached her in modifying the bridle, and when I was satisfied, we headed outside.

There obviously wasn't enough wind for a kite as heavy as hers, so I threatened old Aeolus ..told him I would tell Zeus about the gossip he, Aeolus, was spreading around. Meanwhile, the girl must have been praying to her God, because as we approached the flying field, I could see the trees start to sway and leaves skitter across the ground. I crossed my fingers.

I had the girl walk upwind about fifty feet as I held the kite. When she was in position, I let the kite go. As it started climbing, she started jumping up and down and screeching in 12-year-old girl fashion; then spotted her father approaching. "SEE DADDY! I TOLD YOU IT WOULD FLY! I HAVE THE BEST KITE IN THE WORLD!" And so she had; she had built it herself...

This book is written primarily to help adults teach children to be innovative in making good kites from inexpensive things or things that have no further use. This makes it particularly appropriate for home schooling families, Boy Scouts, Campfire Girls, etc. Some of the kites, such as the Horned Allison, are so simple to build that they can be built in 30 minutes or less. This makes them a suitable project in even the lower grades of public schools.

The projects in the book are arranged so that as the student becomes more competent in building kites, the finer points of kite design and construction are introduced. The words and terms used require that the vocabulary of the student (and possibly of the teacher) must grow. Math skills should develop to the point where the student understands graphing and some trigonometry. One of the things they will learn that they will find useful the rest of their lives is how to tie and use some easy knots.

But probably the most valuable thing the students will learn from this book is to be innovative: how to look at a soda straw and see a kite stick, how to look at a big-gulp cup and see a drogue, how to look at a plastic dinner plate and a paint roller and see a reel. Americans used to be the greatest innovators in the world; the cotton clad ships of the South during the Civil War, the iron clad Monitor of the North. (By 1867 the Monitors had developed so that a single Monitor could have whipped the entire British Navy, or so said the British themselves.)

All of the kites described herein have been engineered or re-engineered to give maximum performance at lowest materials cost. The STAR VICTORY and SWIFT VICTORY kites (which cost as low as $2.00 for materials) in particular have a world-wide reputation for flying in winds so low that few other kites can get off the ground, and are still flying high in winds so strong that many of the kites made from expensive rip-stop nylon and graphite tubing go out of control.

The comic-page Barn Door is an old design, having been around for well over a hundred years. Its outstanding performance has long made it a favorite of kite builders and fliers. The one described in this book has been re-engineered to have a better-than-average aspect ratio and to fly from a single tow point rather than from a hard-to-adjust multi-point bridle.

The total time required to build the kites described herein varies from about 30 minutes for the Horned Allison to around 4 hours for the STAR VICTORY. Since glue is used in some of the kites, there will be periods when they must be set aside until the glue hardens. This means that their construction is divided up into a few short periods. If the kite sails are made from ripstop nylon or one of the other excellent sail materials, there will be some sewing skills that have to be learned.

At the 1993 annual American Kitefliers Association convention in Seaside, Oregon, Margaret Greger (author of 'Kites for Everyone' and More Kites for Everyone') told me I must write a book before my knowledge was lost. I half-heartedly agreed. When she announced this news to the crowd, some guy yelled, "Oh Good! Old Stormy is going to write another rotten kite book!"

First, I had never written a kite book, this is my first try. Further, there were five interpretations that I could make (1) I'm going to write a rotten book about good kites, (2) I'm going to write a good book about rotten kites, (3) I'm going to write a rotten book about rotten kites, (4) the guy had poor reading comprehension, and (5) there are a lot of rotten kite books out there.

I have long believed that the Lord gives me what I need when I need it, though more often than not, I don't want it. As Reverend Spooner said many years ago "The Lord is a SHOVING LEOPARD". In the Holy Quar'an, at the top of about every second page (or so it seems) the text begins with "Allah knows your every thought". So when Margaret asked me to write a kite book and I reluctantly agreed, the Lord had that nasty guy yell out "Oh Good! Old Stormy is going to write another rotten kite book!" Perhaps the message was "Don't you dare write a ROTTEN kite book!".

To sum up, this book provides a guide for giving your children a fair knowledge of kites, aerodynamics, knots, a few manual skills, and some healthy fun while learning. It will also permit veteran kitefliers to learn about the kites that fly when there isn't enough wind for theirs. Some of the bits of poetry or quotes scattered throughout the book may be worth remembering. These bits are to provoke young readers with enticing whiffs from the laden tables of other literature.

ACHTUNG!

The "Your Notes" spots in this book fill up otherwise awkward "white space." These are not to be used if you borrowed this book from a library or friend. Use them for the names of other kiters, suppliers, your kiting adventures, etc. that you might otherwise misfile or lose.

MURPHY'S LAW:
Anything that can possibly go wrong, will; and at the most inconvenient time and place.

O'TOOLE'S COMMENTARY ON MURPHY'S LAW: Murphy was an optimist.

KITE SAFETY

The Unknown Is Always Potentially Very Dangerous!

In the late seventies a gentleman was flying a too-large box kite in Topanga Canyon in California. The wind became too strong, the box kite pulled some high-voltage power lines together, which resulted in a shower of sparks and lots of red hot globules of molten metal. The red hot metal fell into some dry grass below and the wind sent the resulting fire storming up and down the canyon and over the hills. Before that fire was controlled, a quarter BILLION dollars worth of homes and other property had been destroyed. Not much mention was made of the heartaches and lifestyle disruptions the homeowners suffered.

Also in the late seventies an aluminized-Mylar kite got across some power lines in the San Francisco area. It apparently started an arc between some high voltage lines and some lower voltage distribution lines. A sudden ten-times increase in the distribution line voltage blew up numerous lights, refrigerators, and other appliances.

The kite manufacturer denied that his kite could cause all that trouble. I had find out for myself, so I got out my ex's aluminized-Mylar dragon and my ohm meter. It measured a resistance of 20 ohms per foot. Now, if you were to hook a 1 1/2-volt D cell across that resistance, you will only get a very small current flow, but if you throw the tail of that kite across a 500,000 volt power line, the kite will instantly vaporize and you will get an instant generation of high temperature, highly conductive plasma, and a current flow as high as that in an average lightning bolt. When I saw that the kites were dangerous, I thought: "Somebody should write to Kite Lines and alert all kitefliers to this sort of danger". I decided that "somebody" might be hard to find, and the best thing was to play the role of that "somebody" and do the job myself.

But I wasn't all that familiar with the operation of power lines, so I called an engineer friend (Howard King) who worked for Bonneville Power Administration. "Howard, tell me as exactly as you can what will happen if I take a 2" diameter aluminum rod and throw it across one of your 500,000-volt lines." "Whooeee!, well, first you are going to get a lot of sparks and an extremely loud bang, then the circuit breaker will trip. The breaker will remain open for a few milliseconds, then it will reset and if the short has cleared, the line is back in operation. If the short is still there, the breaker will try a couple of more times, and if the short doesn't clear, the breaker gives up and remains open. Since we are on a power intertie, you might cause a power outage in, say, British Columbia or San Diego." "OK Howard. What happens if I throw a piece of No. 30 copper wire (not much thicker than a human hair and having only slightly better conductivity than aluminized Mylar) across the line?" "Exactly the same thing, except that the wire would instantly vaporize into plasma and the air is ionized, which will continue to conduct until the circuit breaker opens. The arc and resulting short will disappear, and when the circuit breaker closes, the flow of electricity resumes." "Will there be any damage?" "There will be melted and re-solidified spots about the size of your thumb print on the lines and some cratering. That section of the line is weakened and will likely break in an ice storm. Fortunately, we have instruments that tell us within a thousand feet or so of where the short occurred, so we don't have to hunt up and down the hundreds of miles of lines. However, the weak spot must be removed and materials and labor costs for repairing that line would cost YOU several thousands of dollars. But really, our high voltage lines are fairly well protected; it's the low voltage lines you have to worry about. You start an arc across our low voltage lines and you get highly-conductive ionized air (plasma again) that doesn't get shut off because the lines aren't as well protected as our high voltage lines, so they just sit there and fry." "What are you calling low voltage, Howard?" "Anything under 100,000 volts." (I wouldn't consider THAT exactly low voltage!!)

It goes without saying that you never fly with a wire or a cord that includes any sort of conductor of electricity, including water. It is also just common sense not to fly kites in the rain or when there is a thunderstorm within sight or hearing; you are not likely to be as lucky as Benjamin Franklin.

Let's look at one more electrical hazard where we actually fried the kiteflier. It happened in New England. A gentleman was flying his kite from a cemetery which had some 20,000-volt lines across it. It was a dry day and he was using a standard braided kite line, which, as far as anyone could tell, wasn't the least bit damp and had never been in salt water. Yet when the flying line touched one of those 20,000-volt wires, there was enough of a circuit that it badly burned his hand and both his feet. Miraculously, he wasn't killed.

A different kind of hazard is flying across a roadway. A very polite and cultured lady called me to report an unpleasant experience. She was driving to the coast, and since it was a nice warm day, she had her car window rolled down. Out of the blue, a kite line slammed across her windshield and got caught under the left outside rear view mirror. Immediately reacting, she put her arm out the window and swung her hand, palm up, to knock the line free of the mirror. She instantly got a nasty, bone deep, burn/cut across her palm. But she was comparatively lucky; a motorcycle rider would have gotten his throat cut. Never-never-never fly across a roadway where your line could be hit by a speeding, unprotected person, even one on roller skates.

A line speeding across flesh can generate a tremendous amount of concentrated heat. You can seriously damage your hands if you let your line slip too fast. Wear gloves when flying even light-pulling kites.

Big kites are dangerous. Always wear gloves when any of your kites will pull more than a couple of ounces, and this includes almost any size of box kite or parafoil. I built an 18′ X 10 1/2′ Winged Victory back when I was selling small versions as timed-altitude kites. I took the 18-footer to a kite festival in Yachats. Shortly after I put it up, the wind suddenly about tripled in velocity and that kite was dragging me towards the woods. Fortunately, the wind was very turbulent, and just before the kite dragged me into the woods, a down-draft slammed down on and broke the kite's nose, which promptly caused the tail to become an overpowering lifting surface aft. The kite dove right at me and I caught and collapsed it. It is a beautiful kite in the air, but I will gladly sell it to the highest bidder.

Federal Aviation Administration (DOT) regulations pertaining to kites less than 5 lb. in weight (as I understand them) are given below:

Subpart A - General

101.1 Applicability.

(a) This part prescribes rules governing the operation in the United State, of the following:

(1) Balloons.....

(2) Except as provided for in 101.7, any kite that weighs more than 5 pounds and is intended to be flown at the end of a rope or cable.

My interpretation: If your kite weighs 5 pounds or over, you step right in the middle of a hoorahs nest described by two closely-written pages of government regulations, which I don't care to try to sort out. Fortunately, my 10 1/2′ X18 1/2′ WINGED VICTORY weighs only about 4 pounds.

However, let's look at 101.7, (which includes ALL kites) because it is just plain, common decency:

101.7 Hazardous operations

(a) No person may operate any moored balloon, kite, unmanned rocket, or unmanned free balloon in a manner that creates a hazard to other persons, or their property.

(To me this means that I don't fly my kite in aircraft flight patterns because kite line itself poses a very remote threat to all helicopters and some small prop-driven planes. It also means that you can be cited ANY TIME you fly ANYTHING so as to endanger other people or their property; and that's just the way it should be.)

(b) No person operating... (almost anything that flies)... may allow an object to be dropped therefrom, if such action creates a hazard to other persons or their property.

There may be another part of the regulations (101.5) that applies to any kind of kite, though I can't find anything in the regulations that says that those kites weighing under 5 lb. are affected by the regulation. Be safe and talk to your local FAA office and ask if there are any local prohibited or restricted areas where you can't fly a kite weighing under the 5 pounds permitted by regulation 101.1 (a) (2).

101.5 Operations in prohibited or restricted areas.

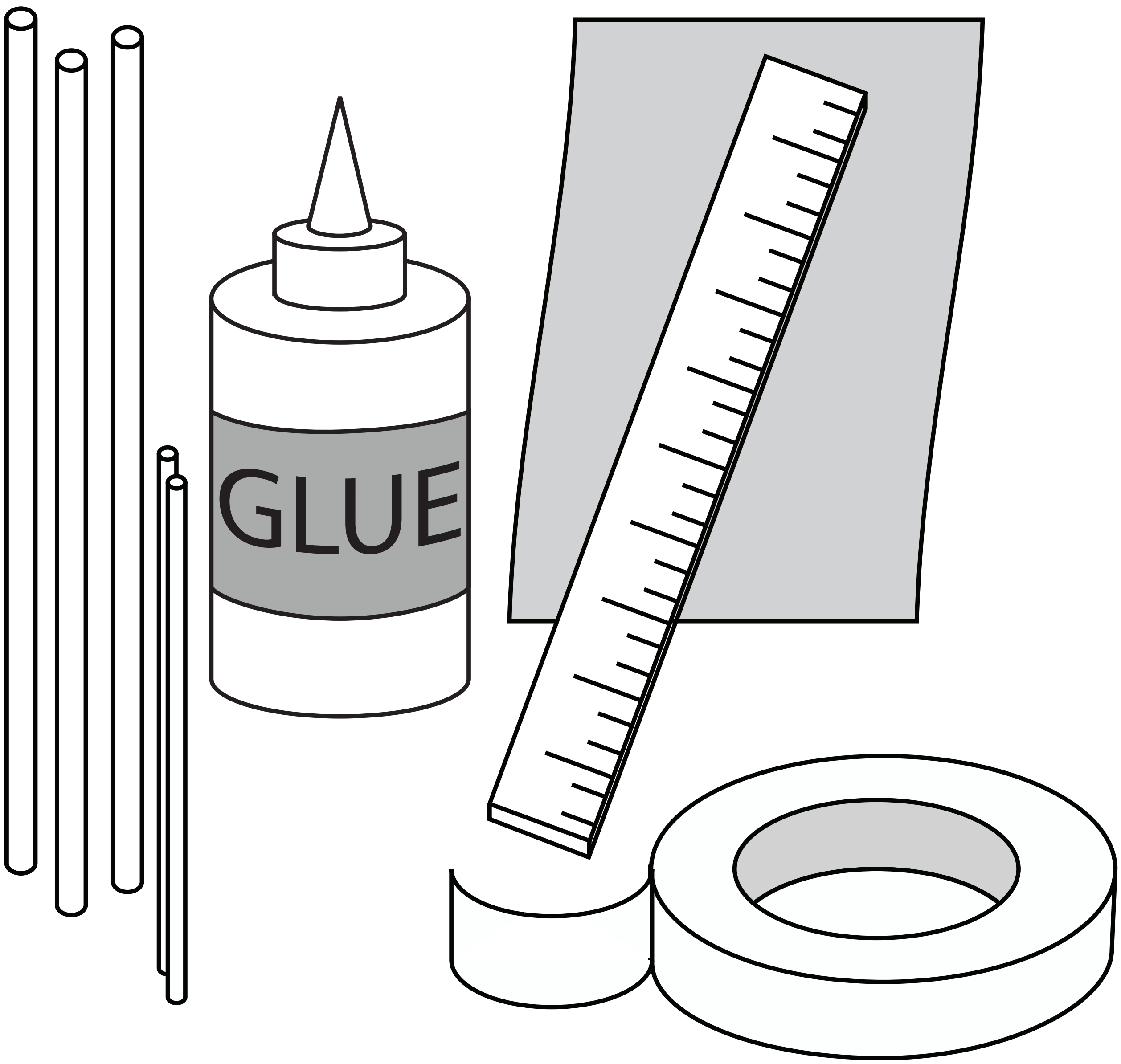
No person may operate a moored balloon, kite, unmanned rocket, or unmanned free balloon in a prohibited or restricted area unless he has permission from the using or controlling agency, as appropriate.

In case you think that the FAA people are out to spoil your fun, they aren't. The regulations covering hang-gliders, para-gliders, and ultra-light aircraft are obviously written so as not to unnecessarily impede flight experimentation.

Finally, no kite is worth personal injury, so if your kite gets into a tree, break the line and hope that it flies out or falls out. If it appears that your kite is in imminent danger of being caught in a power line, immediately break the line and let the kite pull the kite line through; this will keep you from getting electrocuted if your line is at all conductive. If it does get caught in a power line, call the power company.

Section One

Materials



The time has come, Ol' Stormy sez, to talk of many things,
of glues and tapes and meter sticks, and marking pens and strings.

(With apologies to Lewis Carroll)

Kite Materials

"I will never forget a fascinating visit to the recycling market of Nairobi, Kenya - where old telephone wire becomes jewelry, tin cans get sawed in half to be used as kerosene lamps, oil drum tops are beaten into large cooking pans, and treadless automobile tires become sturdy sandals..."

(From "Creating the Creators", by Stephen Jay Gould, in the October 1996 issue of DISCOVER magazine)

Useful Things

Since you just might become a dedicated kiteflier and kite builder/designer, here are the names of things that will be called for in the "Materials Required" lists of the various kites described. The list comprises the materials lists of all the kites. You need obtain only those items needed for the kite or kites you want to build.

1. Strong button or carpet thread and large-eyed needle

2. String holder or winder

3. Snap swivels

4. Skin material

5. Sticks, soda straws, and bar straws

6. Tape, masking, strapping, and duct

7. Marking pens, such Marks-A-Lot or Sanford SHARPIE pens

8. Sharp scissors

9. Yardsticks, meter sticks, and straight edges

10. Glue gun & hot knives

11. Glues (see WARNING! note below)

12. Carrying cases

13. 4′ X 4′ X 1/8″ tempered hardboard marked with a 6″ grid

14. A folding card table to make a work table from hardboard above; two tables if you want a 4′ X 8′ table for large kites.

WARNING!

Rubber cement (SHOE GOO, KIWI, contact cement, etc.) contain chemicals that are listed as being hazardous to your health. Be sure to read and observe the WARNINGS printed on the containers. Also, lacquer thinner and methanol for removing ink or other markings from the kite are also listed as being hazardous materials and all precautions given on their labels are to be observed.

If you are involved in a Home Schooling Association, Scout Troop, or other networking organization, pass the word that you are looking for inexpensive sources of the materials listed above. You may even assume the title of "CHIEF SCROUNGER". (In the movie "The Great Escape", Steve McQueen was the designated scrounger, the person responsible for locating items needed to prepare the escape and obtain them by hook or crook; mostly crook.) Now let's look at detailed descriptions of the items above so that if your organization is going to hold kite building classes next spring, start accumulating supplies now.

1. Needles and threads. For Horned Allison, Diamond, Barn Door, and Ben Franklin kites. Strong button or carpet thread is a suitable flying line for kites up to 30" in winds up to about 12 mph (18 kph). Some of the kites require a bit of sewing, so you need strong thread and a needle large enough to fit the thread. For longer lengths of flying line, buy a ball of crochet thread (300 to 400 yards for $2 or less). For flying the listed kites in winds stronger than about 12 mph, be safe and use stronger line with a minimum strength of 20 lb. (knots tied in the line reduce its strength to about half its rated strength). Kites scaled to sizes larger than given in the plans also require stronger flying lines.

2. String holder or winder. The most readily available thing for this purpose is a clean tin can (15 oz or larger) with both ends cut out and any sharp points filed away with a nail board or file. Mark the wind/unwind end with a bit of masking tape or paint; as long as the flying line is wound and unwound from the same end, the line will not get snarls from excessive twisting in one direction. (Kitefliers are quite opinionated about which line winder is best, so there are too many varieties to list here. My own versions are shown in Fig. 2-1 and described in Section 10.)

3. Snap Swivels. For attaching the flying line to the towing loop and tails to the tail yoke or towing line. Size 5 suggested for the size of the kites given in this book; scaling the kites up means buying larger snap swivels.

4. Skin Material. The kite "skin" comprises keels, canopy, wings, sails, etc. In this book the skins for flat kites are designated as being sails. For three dimensional kites such as the Horned Allison, the parts that come forward from the sticks are called keels, the rest of the cover is called a canopy (see drawing in Section 2). In the Victory series of kites, the flat surfaces attached to the sides are called wings.

Skin materials for the kites in this book are inexpensive (prices given are 1996 prices). Tall Kitchen bags (about 10 cents each), Space blankets (available in sporting goods stores for about $3.00, ask your local fire and rescue team where they get theirs), and sheet polyethylene from Bland Bag Co., Warren, Michigan (10 lb. roll of 71" wide in brilliant colors of your choice, about $15 per roll plus about $15 for shipping). During the Christmas season, some stores carry 30" wide X 10' long rolls of metal-coated Mylar made by Filcas of Nashua, NH. The label says that the material is "Postal Approved" for wrapping packages and that no outer wrap is needed. One roll is enough to build one 5′ Star Victory kite. If you wait until the "After Christmas" sales, you can find it for 75 cents per roll. Space blankets and some of the "Postal Approved" wraps are aluminum coated and are thus highly conductive of electricity, so never fly a kite made from these materials where some disaster could put it in a power line. Newspaper (particularly the colorful comic pages) makes reasonably good skins for smaller kites. If the paper is wrinkled, you can iron it with an ordinary clothes iron set for very low heat and no steam.

Other, more expensive, choices are Tyvek (the stuff used to wrap new houses before the siding is applied), Icarex, rip-stop Nylon, and Orcon (sort of a rip-stop Mylar). New materials suitable for making kite skins are being developed as time goes by, so keep your eyes open for new skin materials.

The skin material for the Ben Franklin kite is a woman's square head-scarf or a Japanese furoshiki... both frequently available at garage sales or in thrift stores at prices under $1.00.

5. Sticks. Birch and spruce dowels and flat sticks are available in most kite shops. If you have the straight-grained wood and a suitable saw, you can make your own flat sticks. However, wooden dowels are readily available as described below.

It sounds crazy, but in the various properly-designed Allison-Polymorphic-based kites, bar straws and soda straws stuck on with masking tape make excellent sticks. If you look at the cross section of a large dandelion leaf cut off close to the stalk, or the cross section of a feather cut about its midpoint, you will see how Mother Nature gets maximum strength for a minimum weight of material. Both cross-sectional views will be almost identical to what you see when you tape down a straw onto a flat surface. (Bird wing feathers are particularly interesting because they are designed for maximum stiffness in three directions, yet must be quite flexible in the fourth direction.)

If there is an IGA outlet in your area where the Mom & Pop stores buy their stock, it is likely that they carry bulk quantities of what you need in the way of plastic bags, bar straws, and soda straws. If their sign says "Businesses Only", shop anyway. If they question you, tell them that you are buying materials for a school kite-building project.

Bar straws come in a variety of shapes, sizes, and materials. I am currently using Sweetheart "SPARKLES" - Crystal Clear Bar Straws. These are 1/8" OD (outside diameter) and about 1/10 ID X 7 3/4" long. They don't split when you flare them and force a second straw into the flared end. Coupled together, these straws make excellent sleeves for match-stick bamboo if you ever need more stiffness than the straw/tape/skin provides. However, sleeves for 1/8″ wooden dowels are a little hard to find. The local IGA supply has some generic ones from Bar Supply Brokerage (in Portland, OR) that are quite tough and don't split when you flare the ends. Cello-Core makes almost an identical straw, but it splits when you try to flare it (you can bell them with a 16-penny nail, fitted with a wooden handle, heated to 212 degrees in boiling water). The easy way of getting a mix of bar straws is to ask someone who frequents the bars in fraternal organizations or regular taverns to bring you a few from the bars. If you find something suitable, give the person a couple of dollars to buy half a box on their next visit to the bar.

Soda straws also come in a variety of diameters, lengths, and materials. Ask for a few freebies from your local fast-food establishment and check them for brittleness, etc. I bought a bulk pack of 250 Sweetheart jumbo 10″ clear plastic drinking straws (for under $2.00) that make excellent "sticks". They are tough enough to not split when you flare them to couple them together. These make excellent taped-on sleeves for 3/16″ dowels. Bar straws can be satisfactorily taped down with 3/4″ wide tape, but 1/4″ OD soda straws require 1″ wide tape. If you use 1/4″ straws for wing leading edge stiffeners, 1″ tape is barely wide enough...practice on scraps before you try taping them down as leading-edge stiffeners.

Roll-up match-stick bamboo window shades are another good source of sticks for smaller kites. I paid $15 for a new 4′ X 6′ shade; since there are 750 individual sticks in it, the sticks cost 2 cents each (beats the heck out of paying 33 cents for a 1/8″ X 48″ wooden dowel at a builders supply). These shades sometimes appear in thrift stores or at garage sales, as do bamboo place mats and wall hangings; the latter two providing shorter sticks for smaller kites. For kites about 8″ and under, I sometimes use broom straws taped down with transparent tape. Bamboo skewer sticks can be used for wing leading-edge stiffeners in the smaller VICTORY-series kites if you can't find bar straws.

For larger kites requiring stiffer sticks, wooden dowels (encased in soda straws for kites taped together) are available in the builders supply stores, craft and hobby shops, even kite stores if there is one in your area. Some well-stocked kite stores also carry fiberglass rod in diameters down to 1 mm (about 1/16″) and lengths to 6′. These stores might also carry rods and tubing of graphite, which is lighter and stiffer than fiberglass. Graphite is a very good electrical conductor, so you don't dare fly a graphite-framed kite anywhere near a power line.

6. Tape. Some plastic sheeting (particularly blue polyethylene) is not all that willing to bond with the adhesive in most tapes. In this case, heating the kite helps, so after you have taped the kite together, store it in a hot attic or a closed car for a couple of sunny days and the tape bond will be much stronger. (In the days when I was manufacturing kites for sale, I heated them to 160 degrees in my 4′ fruit drier). Not all masking tapes are the same; some of it is designed with poor adhesion so that when it is used by painters, it doesn't peel the paint off when removed. Buy packaging grade tape such as Shurtape or Gould QUICKSTIK.

Duct tape is excellent where you need tear-resistance, such as around a string hole through the sail. However, if you leave duct tape under tension, the stuff creeps, so if you use it to stick down the spar sockets on a bowed kite, loosen the bow string before storing the kite.

Over the years, masking tape turns to powder. If you are building a taped-together kite that you want to keep for many years, tape it together with "Frost King" tape from the plastic storm windows section of your local builders supply. It comes in 2″ widths, which means you should split the roll in half by rolling it under a sharp knife or carefully bandsaw it in two. Another good tape is the clear package tape sold in your local post office. It too should be split into 1″ widths. Some materials, particularly aluminized Mylar space/emergency blankets, just love being taped together, so make darn sure your tape is carefully aligned BEFORE you stick it down, because probably you can't get it loose afterwards. For smaller kites, you might try 1/2″ wide clear office tape from a tape dispenser. (I now see it in 3/4″ wide widths, but I haven't tried it on larger kites yet.

Finally, strapping tape. This is a translucent tape that is reinforced with fiberglass strands and is extremely strong (so is filament tape, but filament tape is impossible to split into narrow widths). Strapping tape, split into 3/16″ widths, is excellent for outlining the kite after you have marked the outline. Not only does it reinforce the edges of the kite so that it is less likely to tear on the local rose bush, but it provides an excellent guide when you are slitting the kite out with sharp scissors. With a hole held open by a bit of soda straw or bar straw, it is an excellent way to make bridle attachment points.

7. Marking pens. Again, there are many suitable pens on the market, but I choose Sanford's Sharpie fine point pens in colors that contrast with the material being marked. The individual marks are invisible when the kite is in the sky but they are quite visible close up, which could cost you points in a "Most Beautiful" kite contest. If you want to remove ink marks from polyethylene, moisten a napkin with lacquer thinner (be sure to read the warnings on the thinner can) and rub the unwanted marks with that.

The ink from Sanford's Sharpie pens will eventually rub off some plastic skins. The only pen I have found that makes really permanent marks on Tall Kitchen Bags, etc., is "Marks-A-Lot" by Avery/Dennison in Framingham, MA. The pen I found has a 1/4" wide chisel point; apparently wider points aren't made.

8. Sharp Scissors. Schools now use plastic scissors with rounded points so that the little monsters won't cut themselves and can't stab their enemies. Parents (and teachers) should permit children to work with real-life tools and be told of the dangers involved. If they then cut themselves, they have proof that their parent/teacher cared enough to give them some valuable instruction. ADVERSITY BEGETS INTELLIGENCE!!

Real scissors used to be stamped from high-quality steel and the blades were pointed. After being tempered, the cutting edges were ground at a very precise angle. Not many people knew how to re-sharpen scissors, so people who could find no other source of income made the rounds sharpening scissors.

Today, good quality scissors have plastic handles and stainless steel blades. Some of them are merely stamped out and no effort made to slope the cutting edges at a precise angle. Before you buy the newer plastic handled stainless steel scissors, look to see if they have the cutting edges ground to a precise slope instead of 90 degrees. If they have, they just might be good scissors.

9. Yardsticks, Meter sticks and Straight Edges. No need to buy expensive ones; you are going to be using them for straight edges when marking, and they will soon become ink stained. For plastic welding and hot-cutting you will need a metal straight-edge of some sort. I picked up some aluminum channel used for snap-in shelf brackets to make book shelves or other utility shelves. I was able to get various lengths from 3′ to 6′ at thrift stores and garage sales. They are available new at somewhat higher prices in building supply stores.

10. Glue Guns & Hot Knives. Glue guns are nice when you want to weld a seam in plastic sheeting rather than tape it. I use a miniature Parker glue gun. To weld, you hold the material in position with bits of masking tape, then place wax paper over the lines to be welded. When welding a straight line, use a metal straight edge. For circles, find a pot lid or something the same size as the circle and use that to steady the glue gun. For cutting plastic, use the wax paper as if you were going to weld, but use a soldering iron instead to get the needed extra heat. You may also use a soldering iron for hot-cutting nylon and other fabrics if you file a sharp chisel point on the soldering iron tip. Dan Kurahashi, who builds fantastic miniature kites and beautiful kite trains, uses a lamp dimmer control to adjust the heat on his soldering iron, thus he can use it for both welding and cutting.

11. Glues. The best all-purpose glues I have found are SHOE GOO II shoe patch cement and KIWI, which is just as good. Both of these cements can be found in the shoe department of your local supermarket. These glues have a wide range of uses; such as holding tiny electronic assemblies together or sticking a sign on the tailgate of your pickup. Read and heed the WARNING information on the containers before using the glue.

12. Carrying Cases. The kites described in this book can be rolled up for transportation and storage. At kite festivals and in the kite magazines you will see some very fancy cloth carrying cases. But sooner or later Murphy's law is going to put your kite in the way of a slammed door, or be the target of an anvil dropped by an eagle flying overhead. The solution? Use plastic water pipe with suitable end caps. Your local plumbing supply house sells it at reasonable prices in lengths up to 20′.

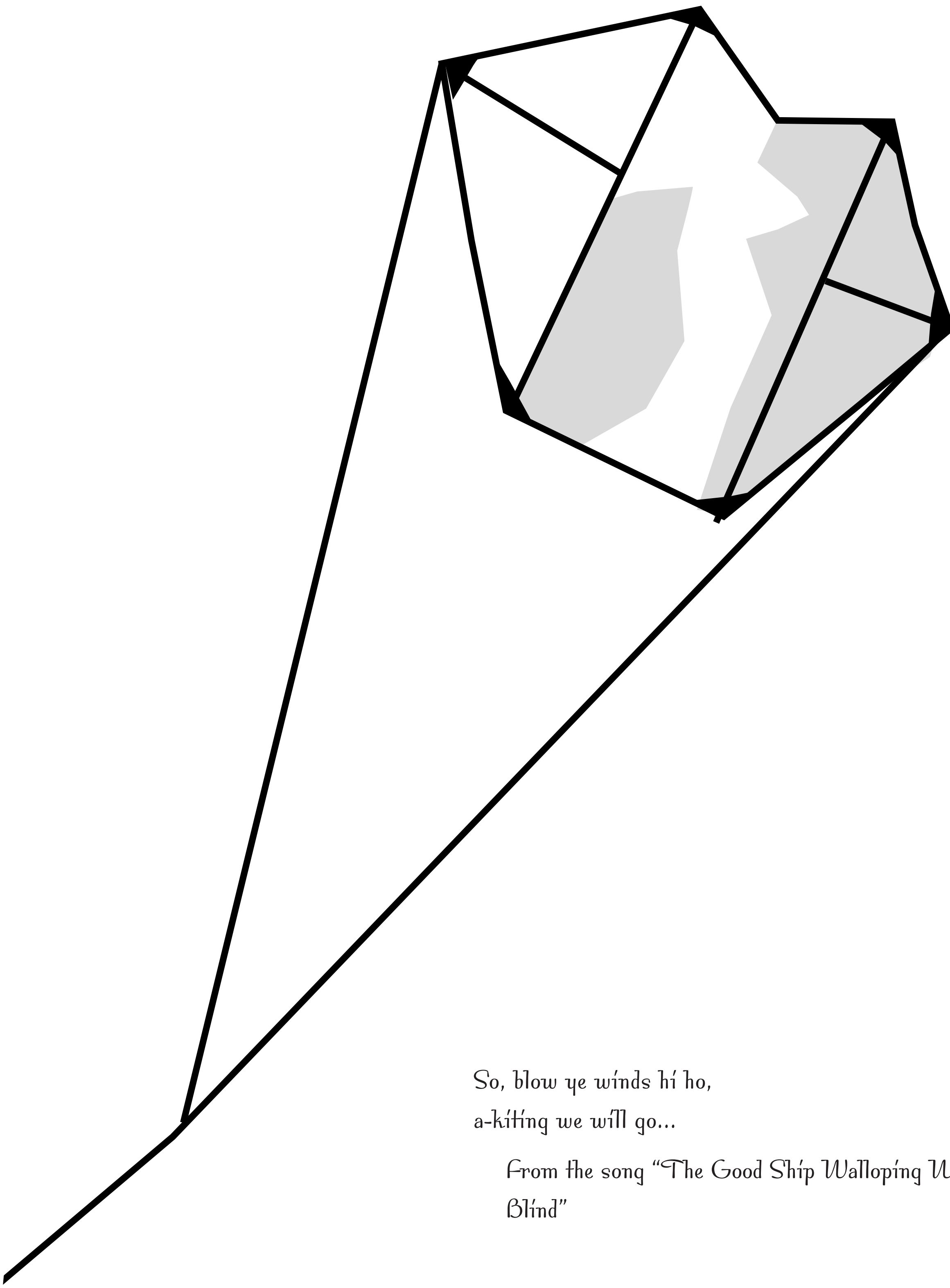
13. Tempered hardboard. A 4′ X 4′ X 1/8″ section of this material from your local builders supply establishment makes an excellent cutting board for kites 4′ to 6′ in the maximum dimension. Marking the cutting surface into 6″ squares will save a lot of time when you are trying to align things.

14. If you have a card table or two, you can use them to make 8′ long sheet of hardboard into a larger table that takes up very little storage space when folded up.

Check the "Required Materials" list of the kites you want to build and use the above information as a guide. Be innovative, and enjoy a nice, clean hobby.

Section Two

Horned Allison Kite



So, blow ye winds hi ho,
a-kiting we will go...

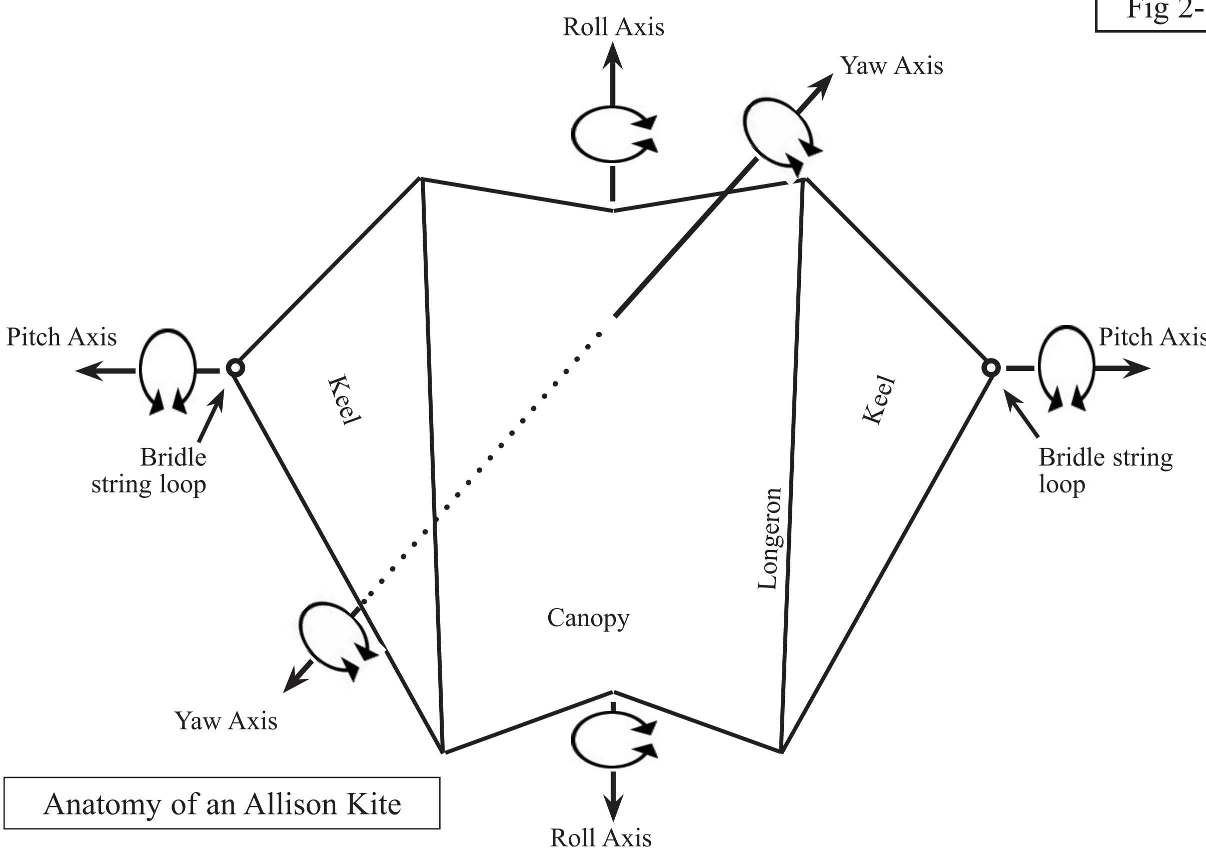
From the song "The Good Ship Walloping Window Blind"

Building a 24" x 30" Horned Alison Kite

This kite has been tested in winds ranging from 3.5 mph to 33 mph, giving it a maximum/minimum wind range of 9 to 1 (not bad for a kite whose materials cost less than 30 cents). Higher gusts folded one of the leading-edge points (horns) back, kinking the soda-straw longeron (stick). The kite was mended by slipping a slightly smaller diameter straw inside the kinked one. The kite has three disadvantages: (1). It will not normally launch itself from the ground, (2) When it is flying at an angle of about 70 degrees in strong turbulent winds, it will sometimes collapse (the two sides suddenly snap together) in flight and not always recover before it hits the ground, and (3) it sometimes pulls to one side or other in high winds unless the tow line is moved slightly off-center on the bridle in the direction towards which the kite pulls.

In spite of the shortcomings listed above, the kite is probably the best kite for the beginner. The materials required are readily available, it is quite a reliable flyer, and it can be built in about 30 minutes. Figure. 2-1 gives an introduction to kite terminology for the beginner and Fig. 2-2 gives the actual construction plans. If you want more details on modifying and flying this kite, it is suggested you read “Bridles & Tails” in Section 7.

Fig 2-1



Anatomy of an Allison Kite

Materials:

- One 24” X 30” Generic tall kitchen bag (preferably colored) or other light-weight plastic bag that will yield a skin of 24” X 30”
- One roll of 1”-wide masking tape
- One roll of STRAPPING tape that you can split into 1/4” widths (filament tape won’t split)
- Seven or more 1/4” ID soda straws or 1/8” ID bar straws (see Construction below).
- One 300 to 400 yard ball of crochet thread or one spool of heavy button thread or carpet thread.
- One clean tin can with both ends cut out, 15 oz or larger.
- Work surface (cleared kitchen table or floor) 3’10” long or larger
- Sharp scissors.
- Sanford’s Sharpie fine point black marking pen.
- Yardstick or Meter stick.

Note that most of these materials are either already in the home or will have future uses within the home, so don’t hesitate to buy any items not already on hand.

Construction

After studying the drawing in Fig. 2-2, start construction by making your longerons (sticks) from soda straws (I use either “Sweetheart” Drinking Straws or “Bar-Pak” Premium Quality Beverage Straws). Use a sharp pointed object such as a pencil or ball-point pen to flare one end of a straw so that the end of another straw can be forced about 3/16” or more into the flared straw. If flaring the straw causes it to split, see the information about sticks and straws given in section 1.

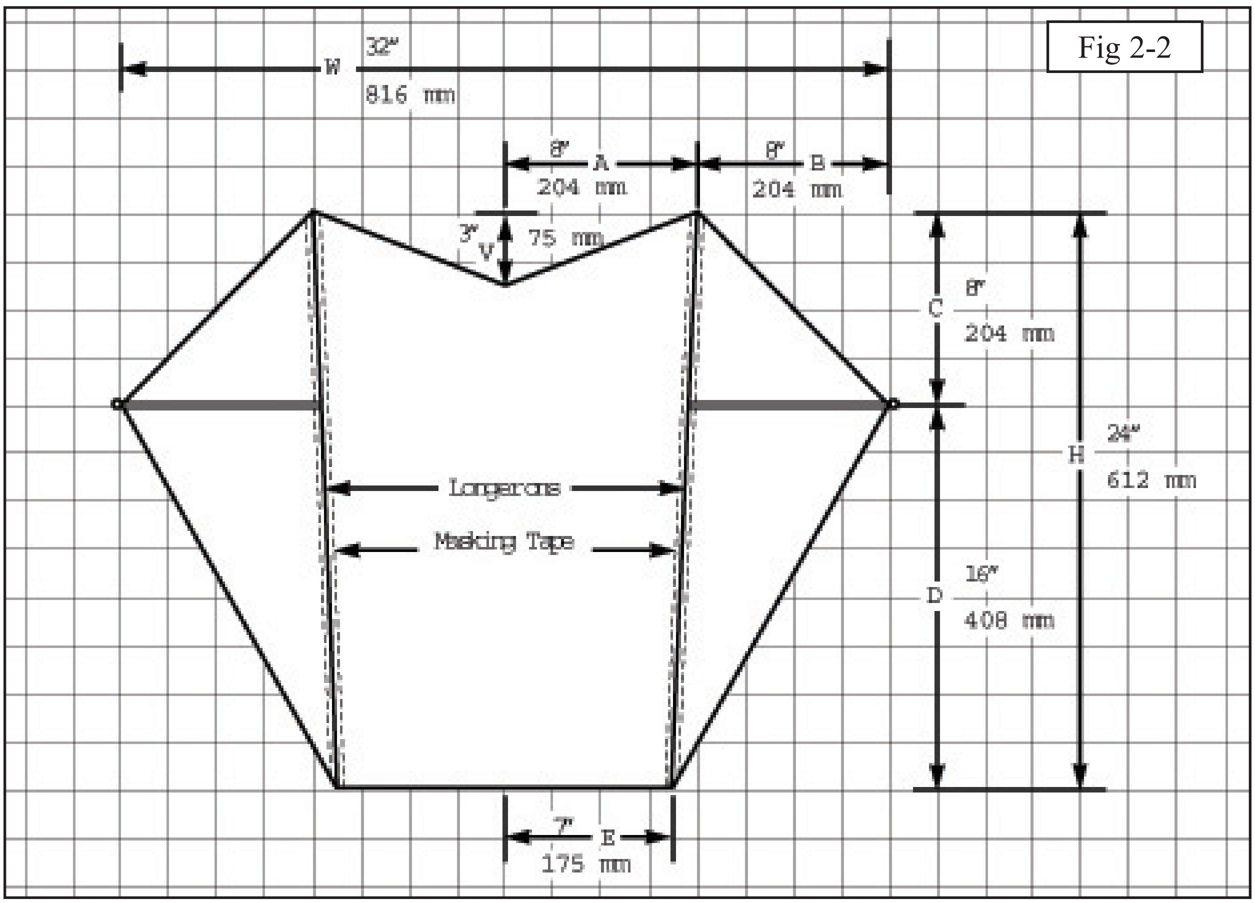
1. Cut the bag open and lay it out flat; smooth out the wrinkles as is reasonably possible and stick the bag down with bits of masking tape around the edges to keep the bag flat and stationary.

2. If the bag has an identifiable straight vertical crease centered between the two sides, use this as your centerline and use it as your reference for making lateral measurements. Use the bag open end edge for your bottom reference (make your vertical measurements from the bottom upwards).

3. Draw out the canopy pattern (the “sail” of the kite; see Fig. 2-2), draw the lines where the straws (sticks) will be taped down from the bottom corners to the top points. Note that the sticks converge towards the bottom a bit. Draw a line straight across the kite between the bridle points. This reference line is for positioning the strapping tape that holds the bits of soda straw for the bridle loops.

4. Split a 3/16” wide X 1’ long section loose on the roll of strapping tape. Stick down the end of this strapping tape onto the start of one of the lines outlining the sail of the kite, then very carefully outline the sail with the strapping tape laid down so that the outer edge just touches the sail outline. This is primarily to give you a guideline when cutting the sail out, but it also reinforces the edges to prevent tears and stretching.

5. Shorten the sticks (coupled together straws) to 24” so they are the same length as the lines running from the points at the top of the kite to the bottom corners. Using bits of masking tape about every 6”, tape the sticks directly on these lines so that the sticks will stay in position as you tape them down with a continuous run of masking tape from top to bottom. Keep the tape centered on the sticks as you tape. The tape is somewhat translucent, so you can see the stick through the tape if you hold the tape at a very shallow angle before sticking it down (if you are using clear or light-colored straws,



NOTE: If 1/8” ID bar straws are used for longerons, tape them down with 3/4” wide masking tape.

You Pick Dimensions

W	A	B	C	D	E	V	H

NOTE: If 1/4” ID bar straws are used for longerons, tape them down with 1” wide masking tape.

Horned Allison Kite

mark a line down them with the side of the point on your marking pen). Rub the tape down firmly when you finish.

6. Once the sticks are on, use your sharpest scissors to cut out the kite sail. Stick 2″ lengths of masking tape over the ends of the sticks so that they are not only held more securely in place, but are less dangerous if they should accidentally poke someone in the eye.

7. Peel off a 12″ long by 1/4″ wide strip of strapping tape from the roll. Lay a piece of soda straw straight across the middle of the strapping tape, stick it firmly to the tape, and trim the straw to where it just reaches across the tape.

8. Hold one end of the tape in one hand while you position that section of soda straw outside of, but barely touching, the bridle point. Now rub the tape down along that horizontal line across the kite between the bridle points. Turn the keel over, and put the other half of the tape on the back side of the keel.

9. Take a 14′ long section of your kite line and fold it back on itself about 3″ from one end. Tie an overhand knot in this section (bight) of line to form a loop. Slip the other end of the line through one of the bits of soda straw on the keel tips, then slip it through the loop formed by the overhand knot in the other end. Pull the line tight so that the loop and overhand knot are tightly cinched up (you have just tied a larks-head knot)

10. Next, take the still-free end of that 14′ piece of line and run it through the other bridle point twice, forming a complete round turn. Now secure it by tying two half-hitches into it (see “Knots” in Section 9).

11. Now we come to the most critical part of building this kite. You must tie a loop to which you attach the kite line. This loop must be in the exact center of the bridle string. Fold the kite in half and match the two keels together so that one keel precisely overlaps the other. Hold the two keels together firmly between thumb and forefinger on one hand while you slide your other hand along the bridle line until you reach the center of the line. Mark the exact center with that black making pen.

12. Take another piece of kite line about 1′ long. Hold the two ends side-by-side and tie an overhand knot about 1″ from the ends, forming a loop. Fold this loop in half and wrap it around the bridle line, then pull one side of the loop through the other side, forming a larks-head knot around the bridle line. Pull the knot snug right at the center mark, then pull strongly on the two sides of the loop to make the larks-head jump from the towing loop into the bridle line. Pulling on opposite sides of the loop locks the larks-head so that it will no longer slide along the bridle. To unlock the larks-head, pull hard on the bridle line on each side of the knot. The knot will again jump back into the towing loop to permit you to make side-to-side adjustments should that become necessary.

There is really no back or front to this kite; it flies equally well facing either way. However, if one of the sticks is slightly warped or there is any other asymmetry in the kite, it may pull to one side or other. If this happens, turn the kite inside out and put it up again. This will usually straighten things out. If it continues to pull to one side, shorten the bridle string on the side towards which the kite pulls. Merely unlock the larks-head by pulling on the bridle line on both sides of the larks-head simultaneously to put the larks-head back into the towing loop, which permits you to slide the towing loop to one side or other of the center mark. Once you have found the right adjustment, again lock the larks-head in position by pulling on the two sides of the towing loop.

When you have finished your kite, take the two sticks parallel in your hands with the keels hanging down, roll the kite up, and wrap the bridle line around it. Keep the kite safe from breakage by storing it in a plastic golf-club tube or a 2′ length of 1″ plastic water pipe.

Scaling The Kite Up or Down

The above described kite can be scaled up to at least 4′ high without changes except that you will probably have to put dowels inside the soda straws. It appears (though not enough testing has been done) that the kite should be narrowed a bit in kites over 4′ tall. The kite can be scaled down to 16″ X 20″ and still fly reliably, but kites smaller than this will develop wobble and frequently spin. The solution is to attach a 3/4″ X 20″ light weight plastic streamer to each of the bottom corners. When I build really small ones, I go to a 7 1/4″ X 11″ size (using broom straws for sticks). You may want to experiment with your own versions of the Allison; I have this feeling that the ultimate Allison design is still eluding us.

Design Rationale

To begin with, the V in the leading edge puts points at the upper end of the sticks. These points dig into the wind and pull in opposite directions, thereby putting the leading edge under tension and widening the canopy. The sticks converge towards the bottom to increase the angle at which the points gouge into the wind. Also, the keels are narrower than usual, which puts the points a little farther down on the sides of the kite, again increasing the gouging into the wind.

There is a slight problem with the upper two points gouging into the wind, and that is that the wind forces on the two points are seldom exactly balanced, which means that the kite tends to wobble in flight. This problem is taken care of by putting a V in the trailing edge of the canopy. The two points of the lower V act like turbine blades pulling in opposite directions. If the kite tries to yaw (wobble about the Z axis), the wind forces on the bottom points become unbalanced so that the point with the most force corrects the yawing motion. The two points also tend to pull apart, just as the points in the leading edge do. The result is that the bottom ends of the sticks are pulled in opposite directions so that the sticks appear to be almost parallel when the kite is flying. Finally, an extra-long bridle is used so that the canopy and keels can spread out a bit more than is usual in the Scott Sled derivatives.

Other Allison Designs

Be careful if you decide to purchase your Allison kite from a store. There are many versions based on the "Scott Sled" design, most of them rotten kites that collapse in flight anytime they get above about 45 degrees. There are two exceptions: The Hornbeam Sled by Guy Aydlett, and the Ed Grauel trapezoidal-vented sled.

These two kites are listed in other kite books, but I have never seen either one in a store.

Guy Aydlett corrected the collapse problem by cutting an arc in the leading edge of the kite. What this does is give a couple of points in the leading edge that gouge into the wind and pull in opposite directions, thus putting quite a lot of tension on the leading edge and spreading the sticks apart a bit in front so that they now converged towards the bottom of the kite (the original Allison had sticks that converged towards the bottom).

I asked Ed Grauel why he used those vents in the bottom half of his kites. His reply was that he did it to cure the wobble of the sled, and that it was ineffective in kites less than 30" tall. I don't know whether it cures the wobble in any-sized kite, but it sure as heck helps the collapse problem. Here's why: The sideways pressure is reduced by those vents, which means that the center of the canopy between the vents pulls up and pulls the bottom ends of the sticks closer together, thus changing the angle at which the upper ends of the sticks dig into the wind and thus increase the tension on the leading edge. Those vents also effectively lower the bridle points, which increases the angle of attack (the angle the kite makes to the horizontal) and therefore the drag, so the kite doesn't fly to a high enough angle to cause collapse.

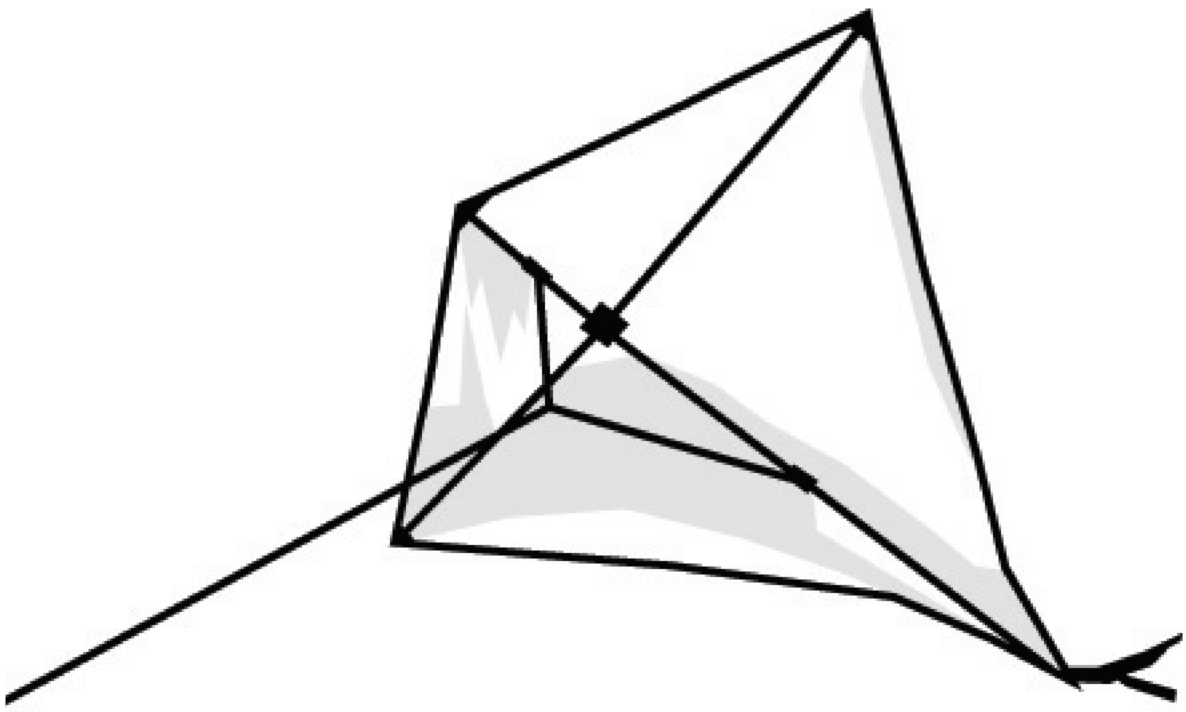
To sum up the Allison design and its derivatives, the final word in their design probably hasn't been said. Try making some versions of your own.

"We have always done it that way." Why??

YOUR NOTES

Section Three

Diamond Kites



Oh sleeket soaring papered beastie,
what a black heart is in thye breastie.
Couldst thou not fly from weste to eastie,
or easte to westie, as suits thee bestie,
and stay out of trees?

Bobby Burns

Diamond Kite

Background

When people started putting pressure on me to write this book, I decided to write a "cookbook" covering only those kites that I had developed, but in thinking things over, I came to the conclusion that every book on how to build kites should include a traditional diamond kite. Now, my experiences with traditional diamond kites were what made me such a booster of the Allison Polymorphic. I was convinced that the diamond kite was a "rotten kite" and the few diamond kites I had built or bought made me think thus. Only a few times in my life had I been able to get a diamond kite to fly really well.

So, being convinced that the diamond kite was a rotten kite, I wasn't going to put it in the book; but the diamond kites at the 1993 Washington State International Kite festival changed my opinion. The Washington Kitefliers Association (WKA) logo kite, an eight-foot Eddy (the most famous of all diamond kites), flew beautifully stable in 20 mph winds. I found out why when the wind dropped a bit and the kite came down. I swear that kite's spine and spar were made from 1-inch X 1-inch oak - you measured the weight of that kite in pounds, not ounces. In addition to the weight, the lower part of the sail draped around the spine in such a fashion that a quite effective keel was formed that kept the kite wonderfully stable in the strong winds needed to get that heavy kite off the ground.

But when the wind was light, the Conover Eddy kite trains were among the first to fly, so I inspected them and each 2-foot kite weighed no more than 1/2-ounce, including the 4- or 5-foot ribbon tail. Obviously I was going to have to research diamond kites before writing a book.

Research convinced me that the old two-stick diamond-shaped Hi Flyers (which in my boyhood years we could buy for 15 cents) were more reliable than a small Eddy. The aerodynamics aren't quite as good, but when flown without a tail, the difference in aspect ratio (width to height ratio) makes it more resistant to spinning (resulting from instability in the yaw axis) than an Eddy of the same sail area.

Since most of our population lives in areas where the winds are usually light, I wasn't interested in building a kite that would handle hurricanes. A kite built from the Sunday Comic pages should do. The dimensions of a comic strip sheet turned out to be 21" X 25" and, guess what? That equals 46" total, so just one 1/8" X 48" dowel is needed for sticks.

If the following instructions are followed faithfully and if the kite is bowed, it will fly without a tail. It will also launch itself from the ground in light

Materials:	Tools Needs:
• 1 Sunday comic strip sheet, 21" X 25"	• SHARP scissors
• 1 dowel 1/8" X 21"	• Black marking pen (e.g. Sanford's Sharpie)
• 1 dowel 1/8" X 25"	• Yardstick or meter stick
• 4 stick sockets described below	• Large needle and carpet or button thread
• 4 two-inch squares of duct tape.	• Miniature glue gun or metal knitting needle (optional)
• 1 one-inch square of duct tape	• Pencil sharpener or nail board
• a roll of 3/4" masking tape.	
• a roll of strapping tape.	
• a roll of 20 lb. test kite line or ball of crochet thread	
• 1 shirt button, 4-hole.	

winds if launched from a clean beach or well maintained lawn. The secret for self-launching is to point the nose of the kite about 45 degrees from what wind is blowing, then winding in line quickly. Usually the kite skids along for only a few feet before it becomes airborne.

The anatomy of a diamond and a few technical terms are given in Fig. 3-1. It is suggested that you study this figure if you are new to kite building and flying.

Construction

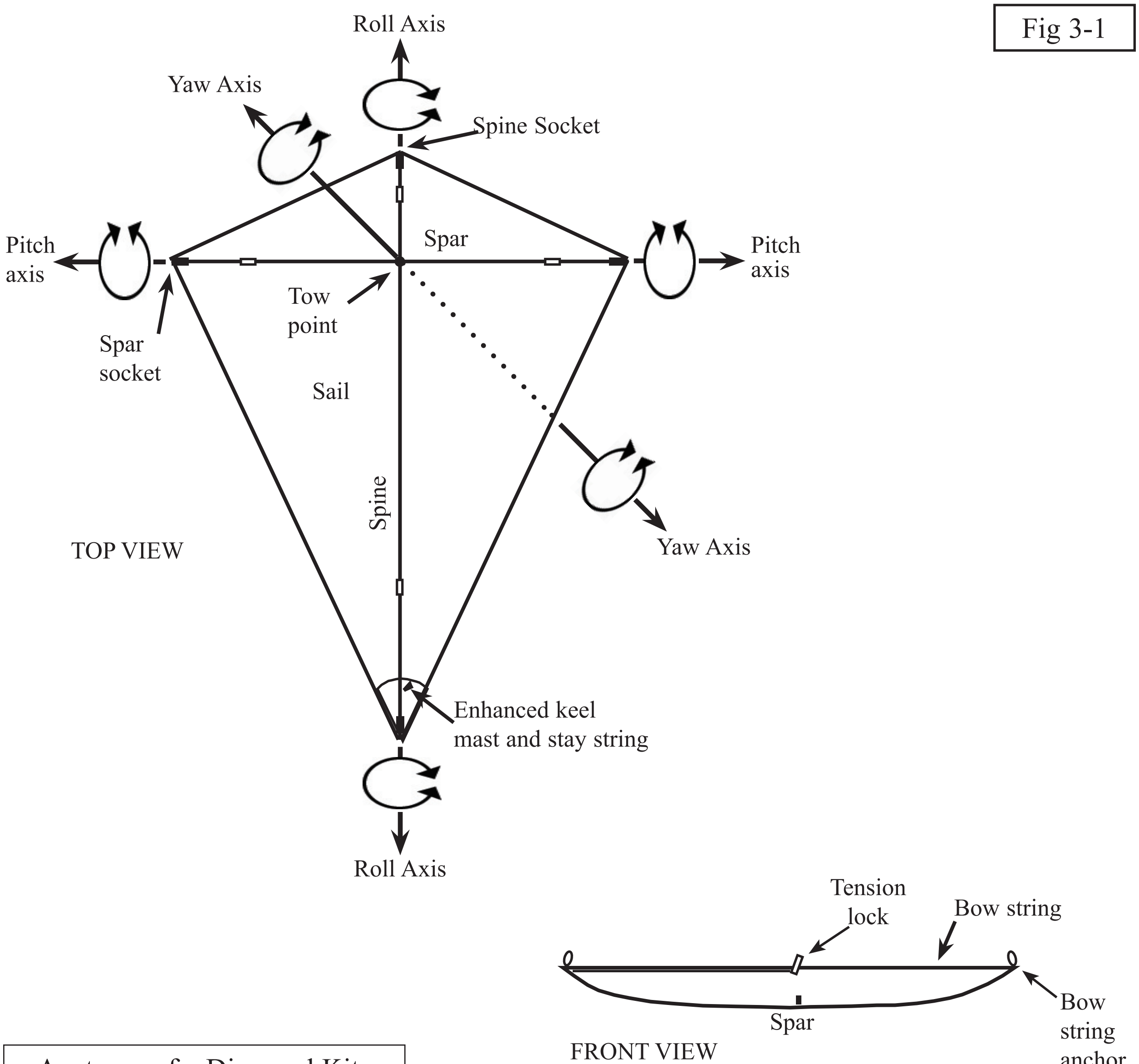
1. Before drawing the sail pattern on the sail (Sunday comics in this case), first lay the paper on the work surface and smooth out the wrinkles (a clothes iron set for low heat may be used to remove most of the wrinkles). I try to position the paper at the corner of the work surface, thus making available another reference line in case I need one. I tape the sides and corners under slight tension so that the wrinkles are flattened somewhat. I tape the one corner that is away from the edges of the work surface last, then re-tape as needed until the paper has a reasonably smooth surface. Try not to use so much tension that the paper becomes distorted.

2. With a black marking pen, draw a 25″ line right down the middle of the 25″ length of the paper (see Fig. 3-2). This is the spine position. Now measure down 5″ from the top edge of the paper on each side and draw a 21″ line across the paper. This line marks the position the spar is to take. Put a 1/4″ dot where the two lines cross. This marks the position of the tow point (the point where a short length of kite line will be attached to the short piece of soda straw that couples the sticks together).

3. Next, draw diagonal lines connecting the ends of the spar and spine lines, winding up with a diamond-shaped outline of your kite sail. Don't cut it out just yet. First, you split off a 3/16" or narrower strip of strapping tape and outline the kite sail by sticking the tape down so that its outer edge just touches the lines outlining the diamond. Roll the tape down with a round glass bottle such as a vitamin pill bottle or rolling pin to make sure the tape sticks securely to the sail. NOW you may cut the sail out, making sure as you cut that you cut neatly just outside the reinforcing strapping tape.

4. Prepare the stick sockets by taking 1" long pieces of 1/8" ID bar straw or whatever soda straw you have on hand. Using 1 1/2" lengths of 3/16" wide strapping tape, tape one end of these bits of straw closed; run the tape down one

Fig 3-1



Anatomy of a Dimaond Kite

side of the straw, across the open end, then up the other side, being careful not to pinch the end shut. Turn the straw a quarter turn and again apply tape as before. When you finish, you have one end securely taped shut so that when you insert the 1/8″ wooden sticks into the sockets, the stick reaches the strapping tape sealing the ends.

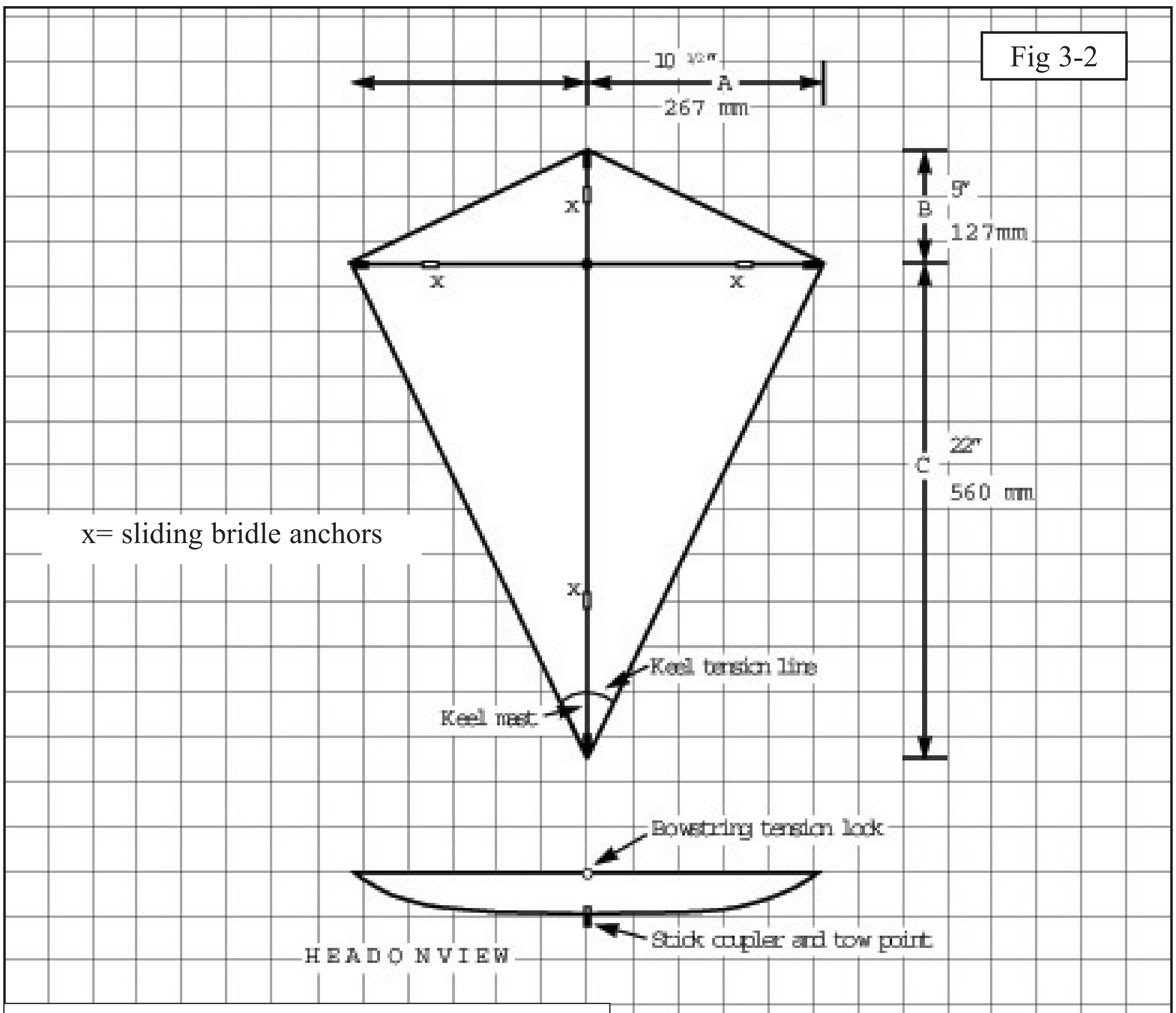
5. Attach the sockets to the sail with care. Slip the sockets on the ends of the sticks and lay the spar and its sockets on the sail, reaching from one corner to the other on opposite sides of the kite. Cut a 2″ square of duct tape, lay half its diagonal width on the stick socket and tape the socket down carefully along the spar line. Fold the other half of the tape over the corner of the sail and stick it firmly to the other side. Use scissors to trim the tabs of tape sticking out on either side of the sockets, cutting about 1/8″ outside the edges of the sail. Rub the tape down firmly with your fingers. Make sure the sticks with sockets on their ends are positioned right along the spine and spar reference lines, stick down the other three stick sockets. When you finish, the sockets should be right on the corners of the sail and the sticks should fit in the sockets with no more than 1/8″ of end play.

6. An alternative to taping the stick sockets to the sail is to use SHOE GOO or KIWI shoe patch cement to glue them on. Lay a 1/4″ wide bead of cement along the stick lines right at each corner, put the socket into the glue, then roll it slightly from side to side to distribute the glue up the socket sides a bit. Let it dry for about six hours before attaching the anchor loops as described below.

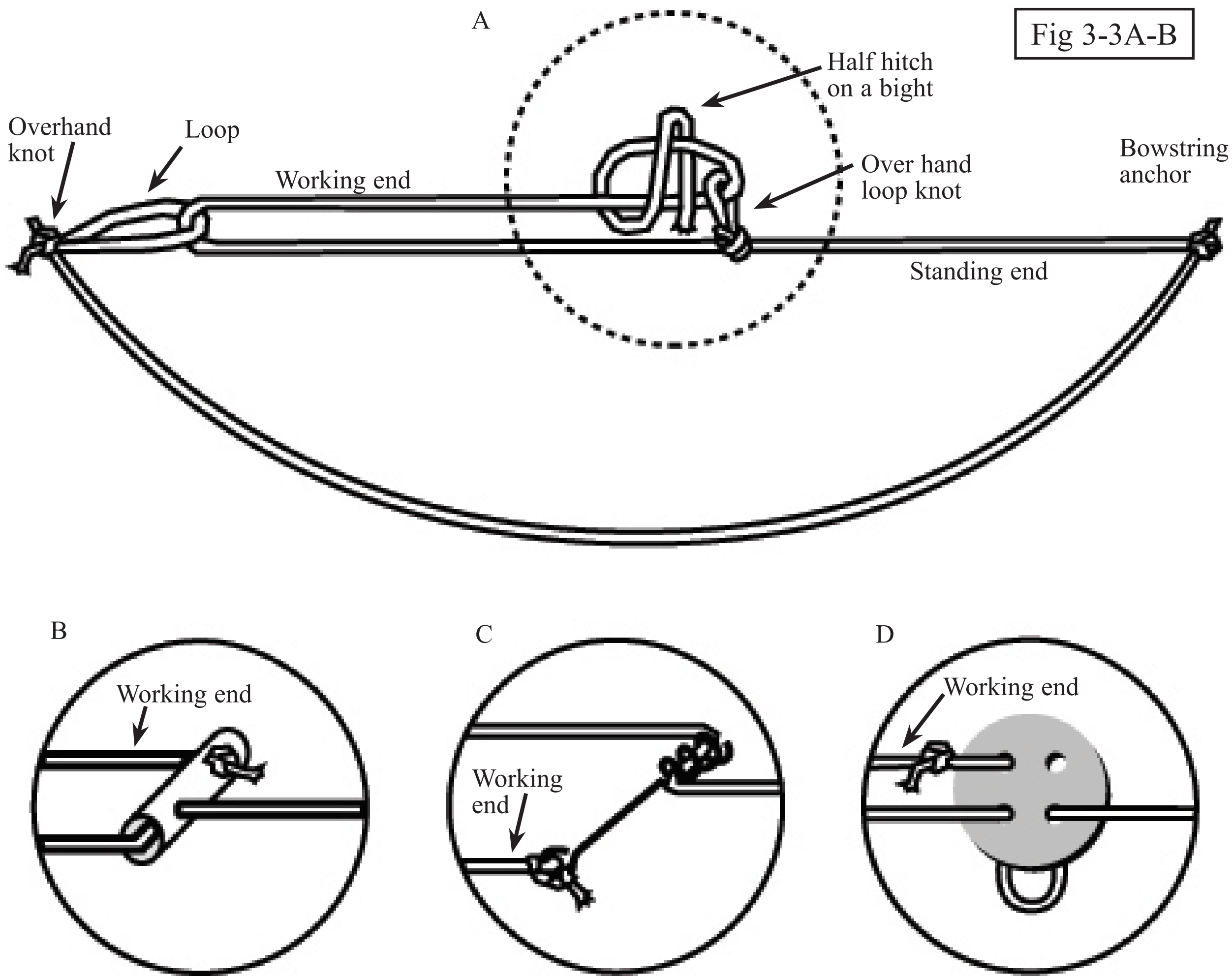
7. The bow string anchors and the tail yoke anchor loops come next. Take a piece of strong thread and tie an overhand knot on a bight in one end to form a loop about 1″ in diameter. Sewing through the outer 1/8″ of a spar socket, attach this loop to the corner of the kite. Make sure you sew through both the strapping tape on the stick socket and the strapping tape outlining the kite. Make five or six stitches, all from a different angle around the spar socket. Attach similar loops to the other spar socket and to the bottom end spine sockets. If the sticks are so long that you have difficulty sewing 1/8″ from the outer end of the stick socket, remove the stick and shorten it by about 1/4″. If, when the kite is completed, the sticks are a bit too short, you can stuff a paper wad down inside the socket to take up the slack.

8. Prepare a stick coupler from a 1″ length of soda straw by melting a 1/8″ hole directly through both sides close to the middle of the straw section. Turn the straw a quarter turn and melt another hole at right angles to the first hole and offset from it about 1/8″. About 1/4″ from the end of the straw section, again melt a hole through both sides of the straw; this last hole is where a short length of kite line (tow line) will be tied. Stick down a 1″ square of duct tape on the sail right on that dot you made where the sticks cross. Carefully make a 1/4″ hole through the tape and sail at this point. Remove the sticks from their sockets, slip them through the holes in the stick coupler, centering it on the spar and putting it 5″ down from the top end of the spine. Now return the sticks to their sockets and push the stick coupler through that hole in the sail (towing holes down).

9. Take a piece of string (or strong thread) about 5′ long and tie a small loop in one end with an overhand knot. Slip this loop through one of the loops sewn to the spar sockets. Now slip the free end (the bitter end) of the string through the loop in the other end (working end) to form a larks-head knot, thus attaching the bow string to its spar end anchor. Push the string through two



Comic Strip Diamond with enhanced keel



1.8” Plastic or metal tube swing left to lock

1” Paper clip made into 1/8”- 4 turn coil, 1/2” straight section then eye-let for string working end. Swing left to lock.

4-Hole button turn counter clockwise to lock.

adjacent holes in the shirt button (see Fig 3-3). Slip the free end of the string through the bow string anchor at the other spar end, then bring it back and slip it through one of the remaining open holes in the button. Pull the string tight enough to barely remove the slack, slide the button to the point where the sticks cross, and using a round turn and two half hitches, tie the bowstring to the button. At this point you will see one string coming from one side of the button and two strings leaving it. Bow the spar to where there is about 3” of bow and slide the button along the single string until the bow string is just tight. Slowly release the pressure you are putting on the spar and the button should hold the tension in the bow string.

10. With the kite bowed as described above, all you have to do is attach your tow line to the tow point on the stick coupler and the kite will fly in light to moderate winds without a tail. If the kite is unstable you may hook a tail to that loop at the bottom end of the spine or you can enhance the keel as described below.

11. If necessary, the keel is enhanced by putting a soda straw mast about 3″ long on the spine about 4″ from the bottom end of the kite. Sew one end of a heavy thread through the strapping tape that outlines the kite, also positioned about 4″ from the bottom end of the kite. Run this thread up and through a slit in the top of the soda straw mast (keel enhance mast), then through the strapping tape on the opposite side of the kite. Make the keel enhance mast just long enough that the lines running from the top of the mast down to the sides form a right angle and the sides of the sail also make something close to a right angle at the spine. This keel will extend the wind range upward a bit.

12. If you want to use a 2-legged bridle so that you can change the kite's angle of attack (raising it for high winds, lowering it for a higher rate of climb), remove the spine and put 1″ squares of duct tape on the centerline of the kite about 1/2 the distance from the top of the kite to the stick coupler. Put another square of tape about 1/2 the distance from the stick coupler to the bottom end of the kite. Cut two 1″ lengths of soda straw to serve as anchors for the bridle. Get out your needle and button thread, tie one end of the thread around one of the stick anchors with two round turns and two half-hitches and pull the knot tight. Poke the needle through the top square of duct tape from the stick side of the kite, pull the thread tight so that the soda straw is snug up against the duct tape. Poke the needle through the front side of the kite right in the middle of the bottom square of duct tape and tie on the other stick anchor, leaving enough slack in the line so that you can form the bridle string in an approximate right angle with its apex right above the stick coupler. Tie your towing line to this with a larks-head. Now return the spine to the kite, passing it through the two bridle anchors. See Section 7 for information about adjusting the bridle.

13. Newspapers kites do not survive well when flown in humid air (e.g., fog). Their survival can be improved if they are lightly sprayed front and back with a clear Krylon spray or a fixative such as artists use.

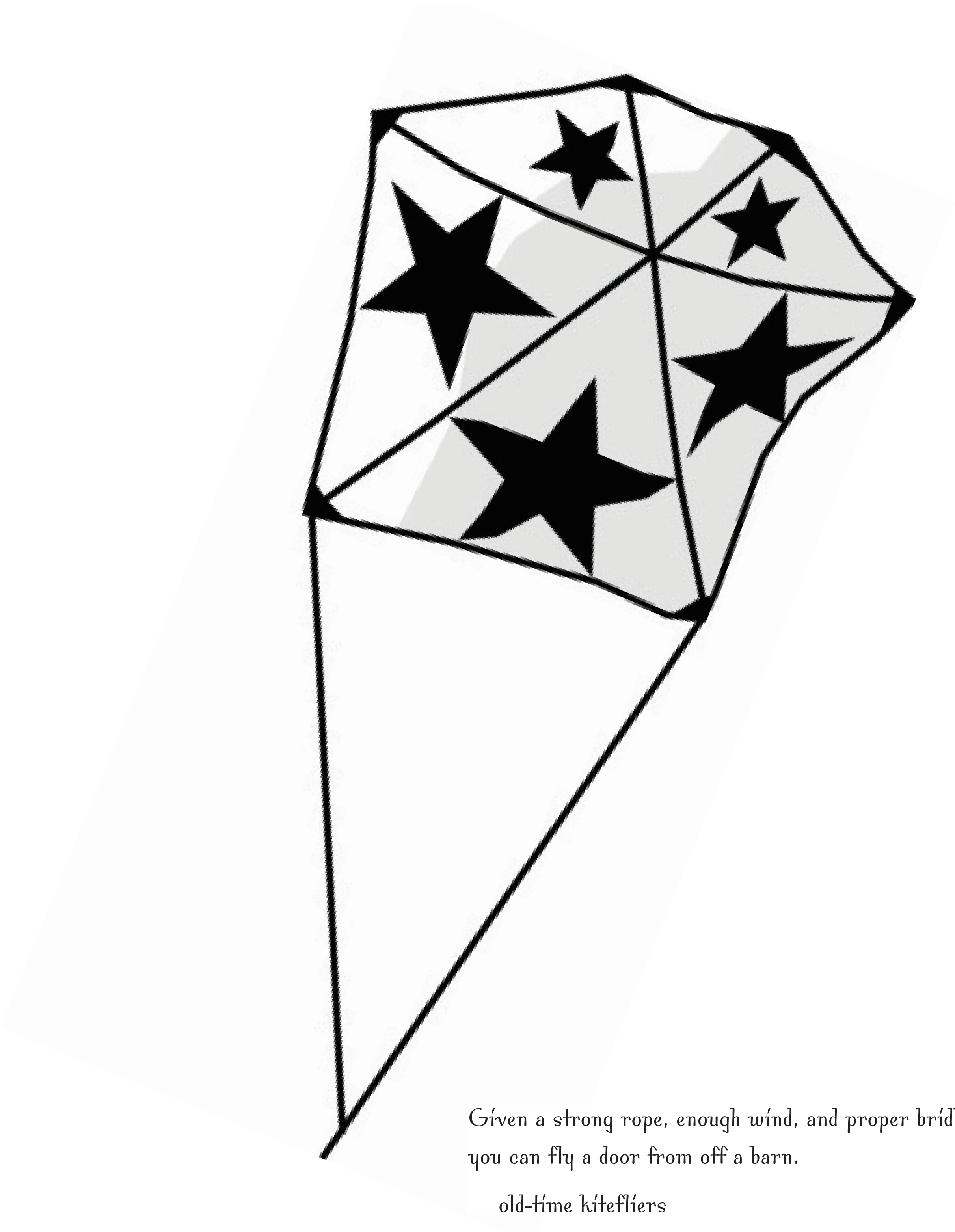
14. Newspaper also tends to distort with time and it is possible that the kite will become asymmetrical to the point where an enhanced keel isn't enough to keep the kite stable. There are two solutions to this problem: (1) add a tail to the bottom of the spine, or, in really turbulent air, add a hi-torque tail yoked to the spar ends, or, (2) BUILD A NEW SAIL

FROM A TALL KITCHEN BAG!

"Unless I occasionally use different approaches
to the tasks of life, I never learn anything new."
Bob Webb

Section Four

Barn Door Kite



Given a strong rope, enough wind, and proper bridling,
you can fly a door from off a barn.

old-time kitefliers

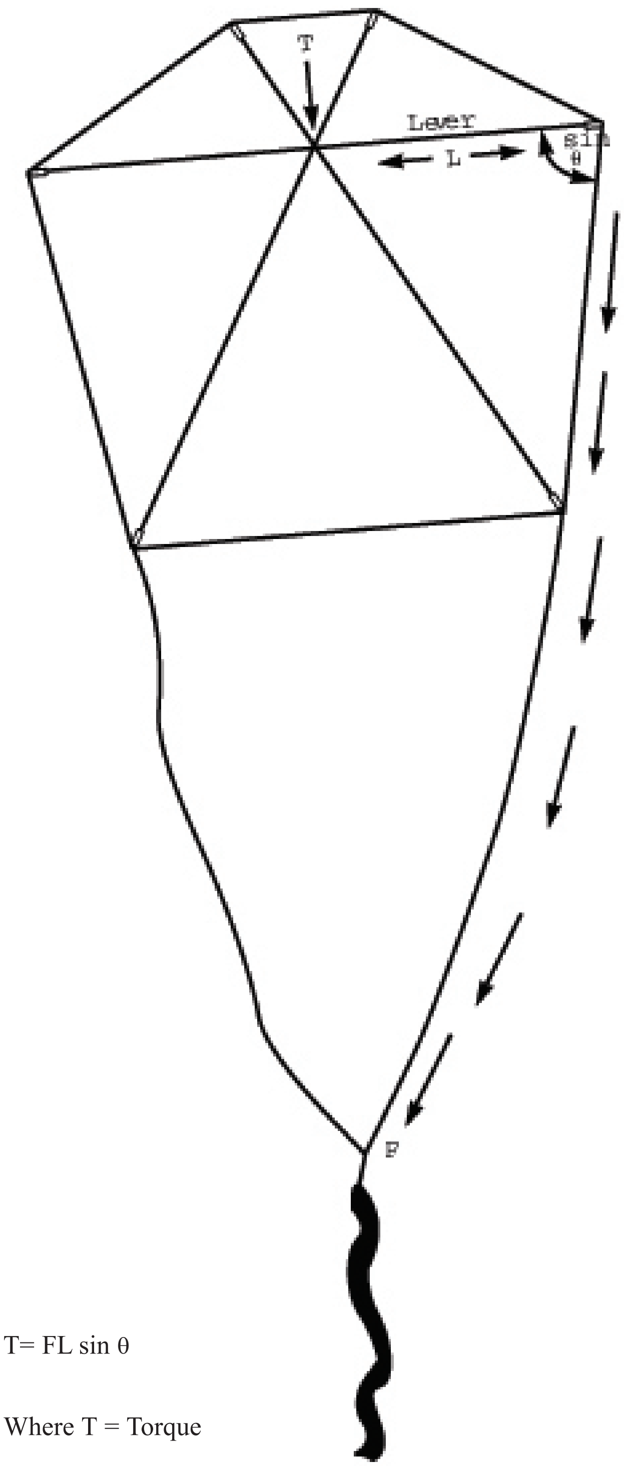
The Barn Door Kite

Background

If I were restricted to building and flying just one design of kite for the rest of my life, it would be the three-stick, comic page barn door. If there really is a “best kite” in the world, the Barn Door is it. The basic design has been around for 100 years or more, but as far as I can find out, no standard “best” design existed. If you had three kite sticks, some sail material, some string, and some strips of cloth for a tail, you could make up your own variation and the kite would probably fly very well. But you couldn’t find a Barn Door in the kite stores.

There are several noteworthy features of the Barn Door described here: (1) all the sticks are the same length (2) the sticks cross high up, (3) it can be flown without a bridle, and (4) the spar is bowed. This particular design uses 24” sticks so that three 1/8” X 48” dowels will make two kites. The sticks are crossed high up so that 20% of the sail surface is above the tow point, which is also the fulcrum point. This means that it will fly without a bridle if it is bowed to stabilize it in the roll axis. The placement of the sticks results in a wider than normal aspect ratio for better aerodynamic efficiency. It also makes maximum use of the sail material, which in turn gives the lightest sail loading and a very low-wind liftoff. The kite described above weighs

Fig 4-1



T= FL sin θ

Where T = Torque

F = Force applied by tail

L = Length of lever

sin θ = Angle at which force is applied to lever

Materials:

- Three 1/8” X 24” wooden dowels
- One 21” X 27” sheet of the Sunday Comics or other newspaper
- One roll of 3/4” masking tape
- One roll of strapping tape.
- One roll of duct tape
- Seven 1/4” X 1” lengths of soda straw
- One 4-hole shirt button
- One black marking pen
- Yardstick or meter stick
- Sharp
- A tube of SHOE GOO or KIWI shoe patch cement.

out at 1 ounce, which gives a sail loading of about 0.4 ounce per square foot. Equipping it with a 4-legged compound bridle (see Fig. 4-2) permits moving the tow point up or down (moving it down makes the kite climb like a scalded cat, great for timed-altitude contests). Fitting it with a 6-legged bridle about doubles the maximum wind the kite will stand before the sticks break.

As is obvious to the most casual observer, the secret of the Barn Doors performance is the way the tail is yoked to the two bottom corners of the kite. In the Barn Door, when one side tries to pull ahead, the full force of the tail is immediately applied to that side. Contrast this to a diamond kite where the tail is normally tied to the bottom end of the spine. A diamond kite must turn a full 30 degrees before just half the drag of the tail is applied as corrective force.

Consider a kite as having a lever that extends from the fulcrum point out to where the tail is connected. In a diamond kite, this lever extends down from the fulcrum point to the bottom of the kite and is directly in line with the spine of the kite. In the Barn Door, this lever extends from the fulcrum point at a 90 degree angle out to the side of the kite. Now, the mathematical equation for the torque (turning effort, designated T) is as given below and illustrated in Fig 4-1:

$$\mathbf{T = FL\sin\theta}$$

Where T = torque, F = force applied by the tail, L = the length of the lever, and $\sin\theta$ = the angle at which the force is applied to the lever.

Auto mechanics, among others, have a neat little mechanical computer that solves for T in the above equation; it's called a torque wrench.

In the case of the diamond, the angle between the spine and the tail is zero, or some small angle, so the turning effort starts out at zero and increases sinusoidally to 1 at 90 degrees; thus the full force of the tail (torque) is not applied until the spine is parallel to the horizon. In the case of a Barn Door, the force of the tail is divided equally between the two sides of the kite until the kite tries to yaw. The instant the kite tries to yaw, the full force of the tail is applied to the side that is trying to pull ahead.

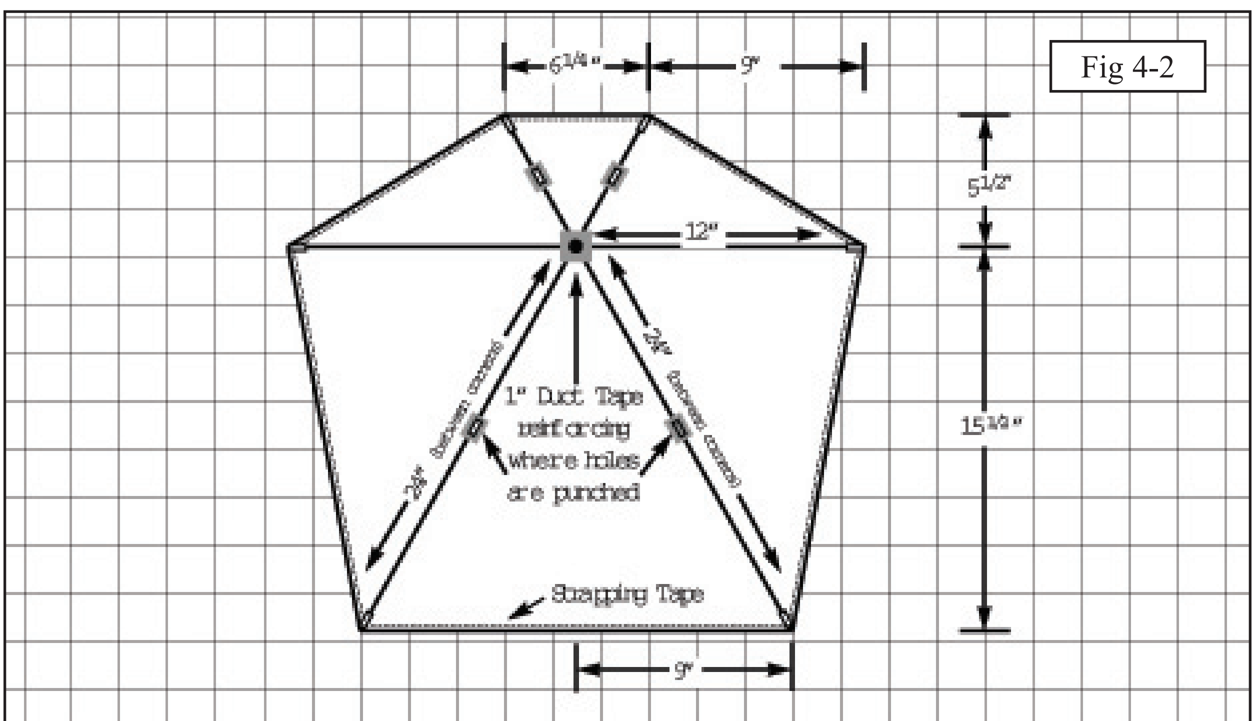
And that, boys and girls, is what makes the Barn Door such a stable flyer and what makes it handle turbulence so well.

Procedure

1. Laying Out The Sail (see Fig 4-2).

A. Use the yardstick to measure the paper to make sure it is 21" high X at least 25" wide (the width may vary from newspaper to newspaper). Lay the paper on the work surface and remove the wrinkles. The finished kite is going to be wider than it is tall. Stick the paper down with bits of masking tape on each corner, working out the wrinkles by rubbing them and by applying a little tension between diagonally opposite corners as you tape the paper down (a clothes iron set for low heat can also be

Fig 4-2



21" x 24" Funny Paper Barn Door (Three Sticker) used to remove wrinkles from paper).

B. Locate the center crease where the paper was folded. Measure in from the sides and make sure this crease is the same distance in from the side at both top and bottom. If it is, and it likely will be, put small dots where this crease reaches the top and bottom edges of the paper. Now mark a line across the newspaper from edge to edge just 5 1/2″ from the top. Measure along this line and put dots on each end of the line 12 1/8″ from the center crease. This marks the line where the spar will be placed.

C. At the top edge of the paper, put two dots exactly 6 1/4″ apart, each dot being 3 1/8″ from the center crease . Put two more dots 18″ apart on the bottom edge of the paper, each dot exactly 9″ from the centerline.

D. Lay the yardstick on the paper so that it reaches from the dot on the lower left to the dot on the upper right. The yardstick should cross that horizontal line right at the point where the line crosses that center crease. Further, the distance between the upper and lower dots should be exactly 24 1/4″. Using the yardstick as a straight edge, mark a line between the two dots. Now measure from the dot on the upper left to the dot on the lower right. Again this distance should be 24 1/4″ and the yardstick should cross the crease exactly 5 1/2″ from the top. Mark a line between the dot on the upper left and the one on the lower right. The slanted lines mark the positions that the longerons will take in the finished kite.

E. Next connect the dots. Using a straight edge on the left side of the kite, mark straight lines from the top of the longeron line out to the dot on the spar line, and thence to the bottom of the other longeron line. Now do the same on the right side of the kite, but don’t cut the sail out just yet.

2. Reinforcing The Sail.

A. Strip a 1/4″ wide strip of strapping tape 8″ long from the roll of tape. Very carefully lay this tape along that 6 1/4″ paper edge between the top ends of the longeron lines, making sure the outer edge of the tape is flush with the edge of the paper and that the tape extends beyond the longeron lines about 1″ on each side. Now use a 20″ X 1/4″ piece of strapping tape along the bottom of the paper. Use 18″ long strips of tape to reach from the bottom of the paper up to the spar line, sticking the bottom 1″ of tape to the work surface and the top ends crossing over the spar line and about 1″ past it. Again, make sure that the outer edge of the tape just touches the lines. Now put 1/4″ wide tape along those lines reaching from the top ends of the longeron lines down to the spar line. Lastly, cut a 1″ square piece of duct tape, center it over the intersection of the stick lines, and press it down. This is the reinforcing for the stick coupler hole edges.

B. Rub all the tape down with the your fingers or the blunt end of your marking pen, then cut out the sail. Cut off the excess tape where it crosses at the corners, but try not to cut it otherwise. Also try not to leave excess paper outside the tape that outlines the sail.

3. Putting On The Stick Sockets

A. Take six of the 1″ lengths of soda straw and make them into stick sockets by running 1 1/2″ lengths of strapping tape down one side of the straw, across the end, and up the other side. Turn the straw a quarter turn, and put on a second piece of strapping tape. Roll the finished sockets between thumb and forefinger to stick the tape tightly to the straw.

B. Using a rubber cement (such as SHOE GOO or KIWI), lay a 1/4″ wide X 3/4″ long bead of cement on one corner of the kite. Quickly (the cement looses its tackiness quite rapidly) stick on one of the stick sockets, align it so that it is centered on the stick line with the closed end just touching the corner. Rock the socket from side to side a bit to spread the cement up the sides of the socket. Again check the alignment of the socket, then glue on the remaining sockets. Now go have lunch, mow the lawn, clear the mud off the driveway, or otherwise occupy yourself for about six hours while the glue sets up a bit; it will be 24 hours before it is completely dry.

C. When the glue holding the sockets to the sail has set up enough, carefully insert the spar and longerons into their sockets and try sliding them back and forth to check the clearance in the sockets. If there is no end play, remove the stick and trim about 1/8″ from the end of the stick to make room for sewing in the anchors for the tail yoke at the bottom and the bow string across the spar.

D. Take a piece of strong thread, fold the end back on itself about 3 inches, then tie an overhand knot to form a loop. Cut the thread so that there is about 1 foot of thread attached to the loop. Thread this into a needle and sew it into the last 1/8″ of the very end of the socket and through the reinforcing tape around the edge of the sail. Use three or four stitches, each from a different angle around the straw circumference. Sew similar loops into the bottom two longeron sockets and through the ends of both spar sockets. When you have finished attaching the loops, smear the ends of the sockets with SHOE GOO and go have lunch or otherwise occupy 30 minutes until the glue is not tacky to the touch.

4. Making The Stick Coupler

A. Take a 1″ length of 1/4″ or larger soda straw and melt a 1/8″ hole straight through both sides about 1/4″ from each end (heat a piece of coat-hanger wire or a 16 penny nail held in pliers to melt the holes in the straw). Turn the soda straw 90 degrees and melt another hole about 3/8″ in from either end and elongate this hole to about 3/16″ long x 1/8″. This elongated hole is to take the two longerons and the adjacent hole is to take the spar.

B. Cut a 1/4″ hole through that 1″ square of duct tape you put on the sail right at the point where longerons and spar cross (center horizontally, 5 1/2″ down from the top of the sail). Push the two longerons through the elongated hole and the spar through the adjacent hole. Slip the stick coupler through the hole in the sail and adjust the sticks so that they fit in the sockets. When you finish, none of the sticks should fit so tightly that they have even the least amount of bow or warping. However, up to 1/8″ of end play (stick slightly short) is acceptable.

5. Putting On The Bow String And Tail Yoke

A. Take another piece of strong thread about 4′ long and again tie a loop in one end. Slip this loop (working end) through the loop on either one of the spar sockets, then put the free (bitter) end through the loop and pull it tight, thus forming a larks-head tying the bow string to the bow string anchor. Thread the bow string through two adjacent holes in the shirt button, run the bitter end through the other bow string anchor on the opposite side of the sail. Thread the bitter end of the bow string through one of the vacant holes in the button, take the slack out of the bow string, and position the button right over the stick coupler. Now, bow the spar so that it is about 3″ above the sail at the center and secure the bitter end of the bow string to the button with a round turn (passing the bow string through the button twice) and two half hitches. Now release the tension on the spar and the button should hold the bow string about 3″ above the stick coupler. Turn the kite over and tie a 6″ or longer piece of strong thread through the hole in the stick coupler...this is your tow line.

B. Take another piece of strong thread 6′ long and tie a loop in one end. Use this loop to tie a larks-head knot in one of the tail anchors at the bottom ends of the longerons. Tie the bitter end to the other tail yoke anchor with a round turn and two half hitches. You have just completed the tail yoke where the tail is to be attached. Mark the exact center of the yoke (the point where the two sides are of equal length) and attach another line to this point, again with a larks-head knot. Tie on a suitable tail (about 8′ of 2″ wide plastic or cloth ribbon) and your kite is ready to fly.

6. Flying The Barn Door

When flying the kite in strong winds, sometimes the kite becomes unstable in the pitch axis and the kite nose rocks up and down. If you find this action undesirable, you can go to a 4-legged bridle as described in Section 7 and put in a 3/16” diameter dowel for the spar.

You will find that this kite will take off in winds between 3 1/4 and 3 1/2 mph (around 5 Kph), long before the Codys, Conynes, and other box kites or diamond kites will fly. Not many Rokakus or Allison Polymorphic descendants will fly in as little wind.

Further, if the sail is made of something stronger than newspaper and if a 4-legged bridle is used, the kite will still be flying in winds so strong that a lot of other kites are unmanageable.

Notes: If you live in a high humidity area or expect that you just might fly the kite in fog, lightly mist the front and back of a newspaper sail with clear Krylon acrylic or similar vapor barrier. If you wish to make the kite from a sewable skin, you will find that making the stick sockets is as simple as sewing a sleeve or triangular patch at each corner. Though I haven’t built this kite in larger sizes, I see no reason why it can’t be scaled up if you use stronger sticks.

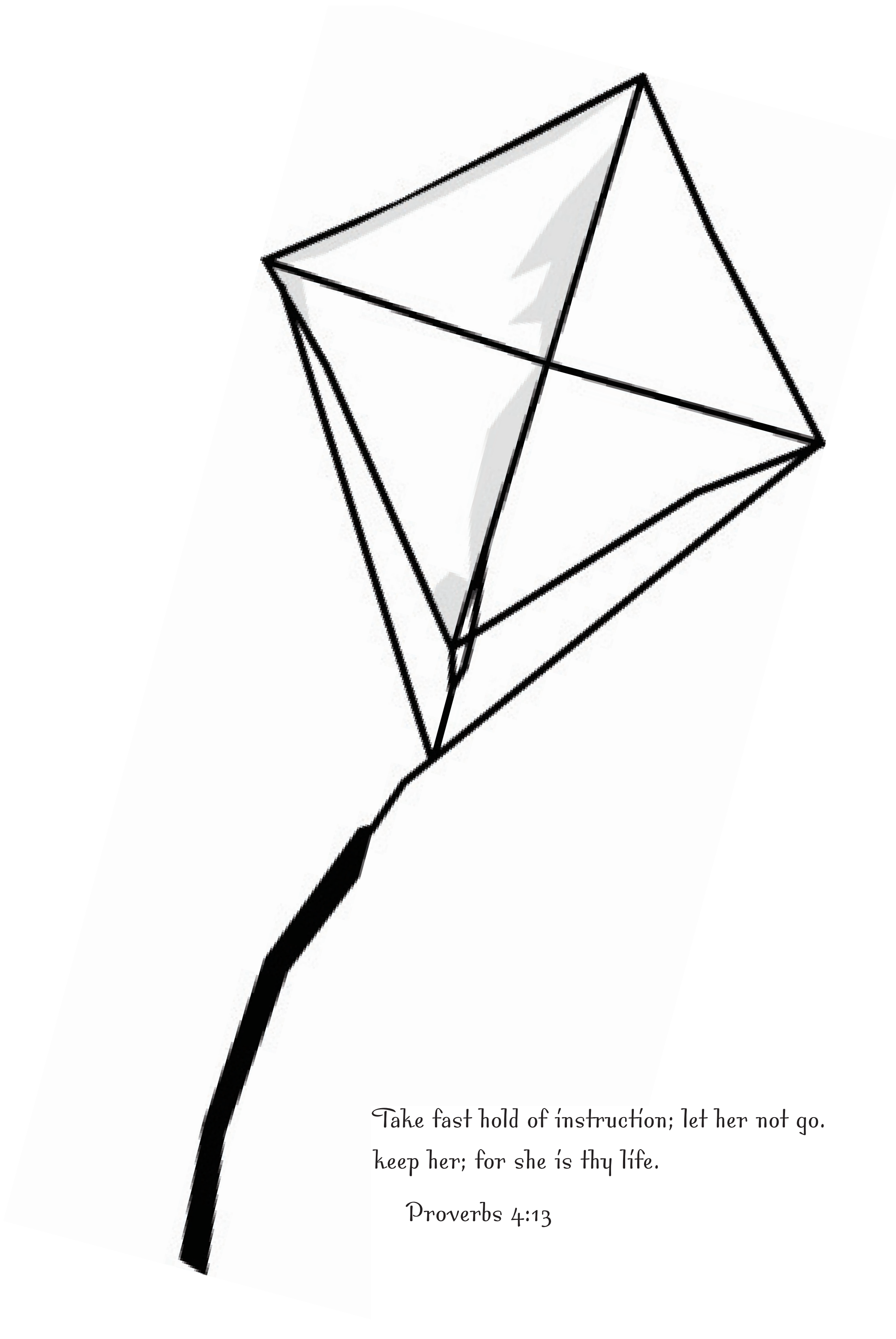
Now go decorate the sky!

Gee. We have almost a full page of “white space” to fill with “Your Notes”, but please save the crayon artwork for the refrigerator. It really doesn’t belong in this book.

YOUR NOTES

Section Five

Head Scarf Kites-Ben Frankin's Kite?



Take fast hold of instruction; let her not go.
keep her; for she is thy life.

Proverbs 4:13

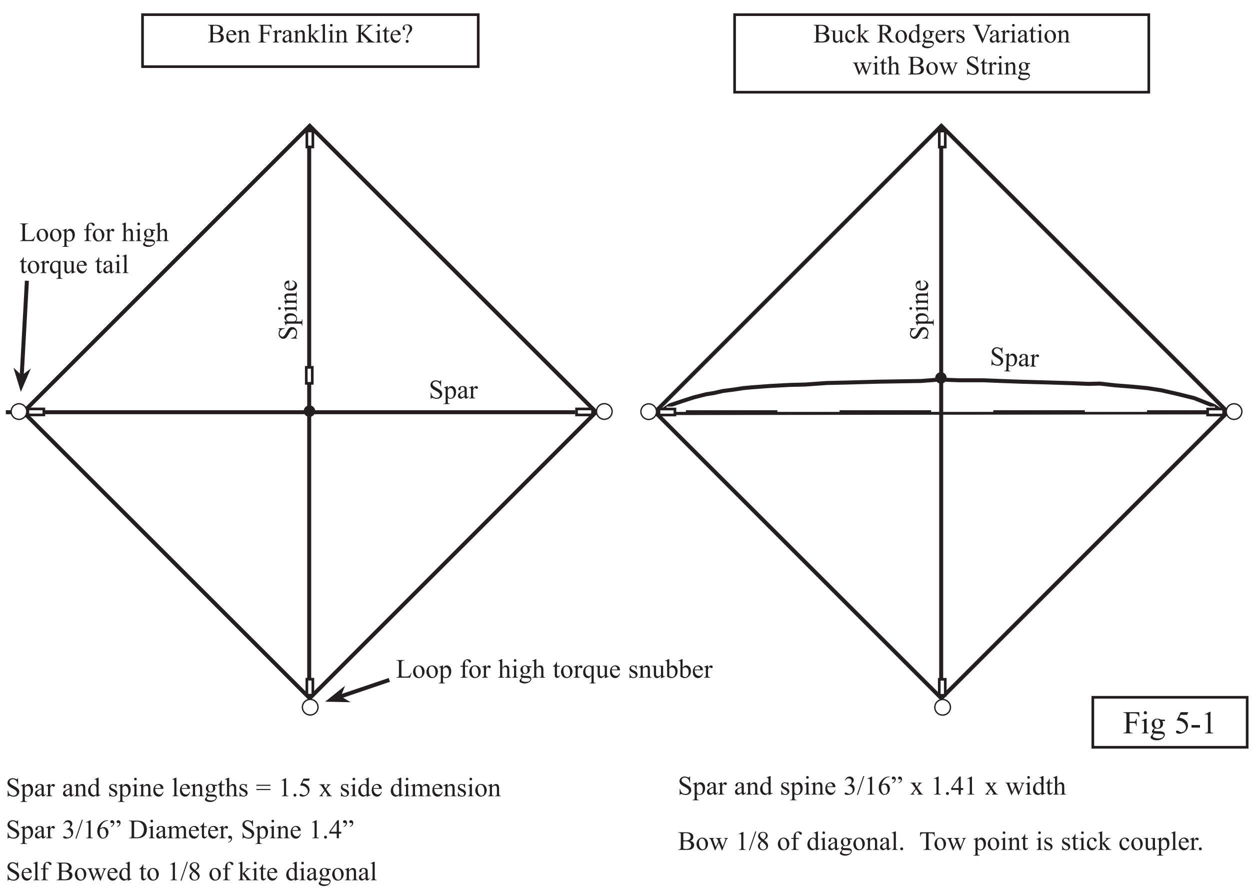
Head Scarf Kites

Background

At the 1994 Mothers' Day Lincoln City (Oregon) Spring Kite Festival, I saw three beautifully decorated square kites flying; one point up. The kites were bowed in both directions and one of them was flying without a tail. Their maker/flier was "Buck" Rogers from Monroe, Oregon. He explained that he found some beautiful silk scarves for $0.75 each at a garage sale and decided to make kites from them. He didn't mention it, and I wasn't sure until I checked my references, but what he had made from them was a modern version of the kite described by Ben Franklin.

Let's have Ben Franklin himself tell us how to make them.

"Make a small cross of two light strips of cedar, the arms so long as to reach to the four corners of a large thin silk handkerchief when extended; tie the corners of the handkerchief to the extremities of the cross, so you have the body of a kite; which being properly accommodated with a tail, loop, and string, will rise in the air, like those made of paper; but this being of silk is better to bear the wet and wind of a thunder gust without



Materials:

- Skin/sail, square head scarf or similar 20" or larger on each side
- Four 2" right triangles of heavy cloth or four 1 1/2" lengths of 1/4" soda straw.
- Two wooden dowels 3/16" diameter of one 3/16" and one 1/4", as specified for each type of kite.
- Sewing machine or SHOE GOO, your choice.
- One 1 1/2" long x 1/4" ID Section of soda straw for stick coupler
- One 2" wide x 10' long plastic ribbon or other material for tail
- Kite line, 20 lb. test or stronger

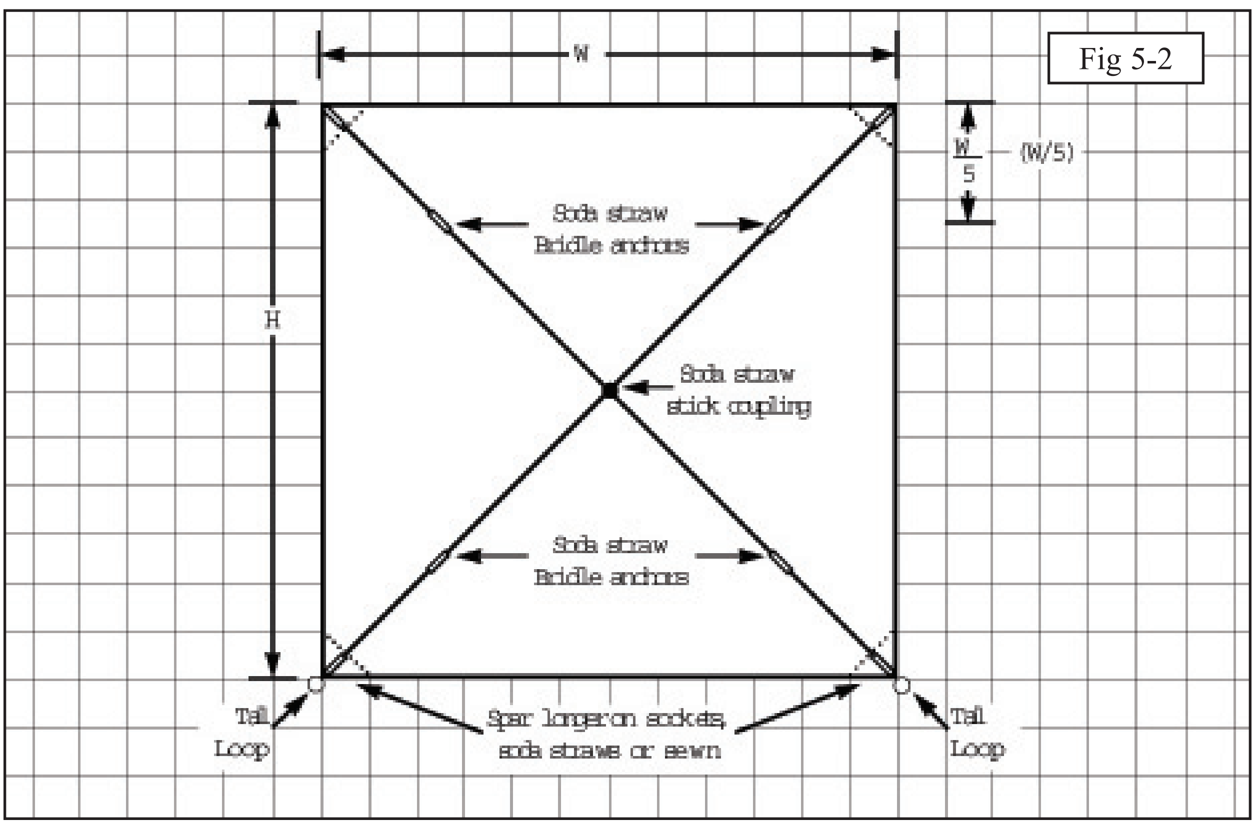
tearing...”

Note that the word “loop” is used but “bridle” is not. Ben Franklin’s kite possibly used a single tow point, though “loop” could be interpreted as “bridle”. The kite was likely bowed in both directions because when you TIE the corners of a square piece of cloth to a cross, you can’t help but shorten the perimeter, which leaves the center slack UNLESS you bow the kite. But I had to actually build Ben’s kite before these things became obvious. The use of the word “loop” instead of “bridle” threw me, so I put a two-legged bridle on the kite to start with, but after observing the kite in flight, I could see about where a single tow point should be (about 40% of the length of the spine down from the nose of the kite). I tied a single “loop” at that point, and the kite flew without a tail, though it tended to yaw and/or pitch a bit at some wind speeds. But it appears that the bowed kite (at least a self-bowed kite) antedates Eddy by at least 100 years.

But let’s read about what Ben was using the kite for:

“To the top of the upright stick of the cross is to be fixed a very sharp pointed wire, rising a foot or more above the wood. To the end of the twine, next the hand, is to be tied a silk ribbon, and where the silk and twine join, a key may be fastened. This kite is to be raised when a thunder-gust appears to be coming on, and the person who holds the string must stand within a door or window, or under some cover, so that the silk ribbon may not be wet; and care must be taken that the twine does not touch the frame of the door or window. As soon as any of the thunder clouds come over the kite, the pointed wire will draw the electric fire from them, and the kite, with all the twine, will be electrified, and the loose filaments of the twine will stand out every way, and be attracted by an approaching finger. And when the rain has wet the kite and twine, so that it can conduct the electric fire freely, you will find it stream out plentifully from the key on the approach of your knuckle. At this key the phial (Leyden jar, a capacitor) may be charged; and from electric fire thus obtained, spirits may be kindled, and all the other electric experiments be performed, which are usually done by the help of a rubbed glass globe or tube, and thereby the sameness of the electric matter with that of lightning completely demonstrated...”

The average person today probably does not know as much about electricity as Ben Franklin did. However, Ben was lucky that no lightning bolts ever actually struck his kite and followed the wet string down. A couple of people who tried to duplicate his experiment did get electrocuted. One account that I read claimed that one fellow, towing his wet kite string, ran into a restaurant or tavern to get out of the downpour. Lightning actually struck the kite and followed the wet string into the restaurant. I have forgotten whether the kite-flier was killed by the lightning or the suddenly charged-up patrons.



Square Varitation of Franklin Kite

Bridle Anchors at W/ 5 from corners

Stick length = 1.4 x side length

Stick diameter = 3/16” for 30” x 30” scarf

Building The Kite

Advance planning is required for building this kite, but it can be put together even by those with a busy schedule because the individual steps can be done in periods of a few minutes each, but separated by hours or days. Since the Ben Franklin kite is quite similar to the Diamond kite described in Section 2, refer to that section if the following procedures aren't absolutely clear to you.

Shopping for the Sail

You can find scarves at garage sales and in thrift stores. Thrift store prices run from $0.50 up (I had to pay $1.00 each for a Givenchy and a Simone). Pick any pattern that pleases you, but check that the size is 20″ square or larger, that it is reasonably lightweight, but not so porous that the wind blows straight through. Check that it is square, or nearly so. (After I built my Ben Franklin kite, I discovered I had used a water repellent Japanese Furoshiki (fur - OH - shiki), which is used not only to cover the head, but as a tote/shopping bag, etc.)

Making Sockets For The Sticks

If you can use a sewing machine, merely sew triangular pockets (about 2″ on a side) onto each corner. Otherwise, make soda straw sockets. Cut four 1-inch long pieces from a 1/4″ ID (inside diameter) soda straw (McDonalds straws are of larger diameter than the usual ones you find). Glue a 1/4′ long plug cut from a 1/4″ dowel into one end of each soda straw section with rubber cement or glue (Shoe Goo or Kiwi shoe patch cement work very well). Smear the plug with glue, push the plug into the straw so that its outer end is about 1/8″ inside the straw, then fill in behind it with more glue.

Let the glue dry for an hour our so, then run a 3/16″ wide piece of strapping tape down the side of the soda straw section, across the wooden plug, and up the other side of the straw. Now spread the scarf out flat onto the work surface. Next, smear a strip of glue about 1/4″ wide the length of the straw section. Stick the straw section to one corner of the scarf and position it so that it points directly towards the diagonally opposite corner. Put a straw section thus on each corner and let the glue dry for about four hours.

Next, take a needle and some strong thread and put attachment loops at each corner of the kite. Make the loops by tying an overhand knot in a bight of heavy thread whose other end is threaded through a needle. Now poke the needle through the cloth and a soda straw stick socket about 1/8″ from the outer end of the socket just beyond the end of the wooden plug. You will need to use a thimble to force the needle through the glue and a pair of pliers to pull the needle completely through. Pull the thread over the end of the socket and again force the needle through the socket as before. Repeat this procedure until you have sewed the end of the socket so that the sticks can't force the plug and glue out. Sew such loops to each of the four stick sockets; they provide an easy way of attaching the three-legged tail yoke in case you have to use one. Now let the glue dry another ten hours or so before you proceed.

Fitting The Sticks

Measure the diagonal width of the scarf from one corner to the corner diagonally opposite, then measure the other diagonal width to make sure they are close to equal. Cut one 1/4" diameter wooden dowel and one 3/16" dowel to a length 2" greater than the diagonals you measured above. The 1/4" dowel will be the spine or vertical member (longeron) of your kite, the 3/16" will be the cross piece (spar), and the scarf completes the sail.

Use the 3/16" diameter dowel for the cross stick or spar (the smaller diameter permits the kite to bow more). Slip the ends of the spar into the spar sockets and one end of the 1/4" spine into the upper spine socket. Grasp the bottom point of the kite, pull out the slack, and attempt to put the other end of the spine into the bottom spine socket. At this point you may discover that the fabric is no longer square, that the 1/4" dowel is too long and is distorting the fabric and that it will be necessary to shorten the 1/4" dowel. Shorten both dowels by 1/4" and again try to fit the dowels into the sail.

Continue to shorten the dowels in 1/4" increments until you can fit them into the scarf by bowing them. The correct amount of bow is about 1 1/2" per foot of width or about 3" for a 28" wide scarf. When you finish, the spar, being thinner, will have quite a lot more bow than the spine. If you cut the sticks too short and not enough bow is present, add a bow string across the spar and bow the kite until the distance between the bow string and the spar center is 10% to 15% of the width of the kite.

Make the Stick Coupler

The stick coupler holds the two sticks together at their intersection. Again use a 1/4" ID soda straw. Using a soldering iron, glue-gun tip, or heated nail, melt one set of holes straight through the soda straw about 1/4" from the end. Now turn the straw a quarter turn (90 degrees) and melt a second set of holes centered 1/4" away from the centers of the first set of holes. Make the holes just large enough that the dowels can be forced through them. Remove the sticks from the kite, mark a ring around them at their exact centers, then shove them through the stick coupler, sliding them until the stick-center marks are centered in the stick coupler. Now take a 1” long section of that 1/4” ID soda straw and slip it over the longeron (spine) of the kite above the stick coupler; the tow loop will be anchored to this section of straw. Reassemble the kite.

Attaching the Towing Loop

On the spine of the kite, measure down from the top end a distance of 40% of the length of the spine and mark the spine at this point. Take a 1-foot length of kite line and, using two turns and a slip knot, tie it around the loose section of soda straw on the spine. (Tug on the line to make sure the knot doesn’t slip. If it does, tie an overhand knot in the short length of line coming out of the slip knot.) Thread the free end through a needle and poke it through the kite covering exactly at the 40% point you marked on the spine. Pull the string out of the needle eye and tie an overhand knot on a bight of line to make the towing loop. Smear a little of that rubber cement on the bit of soda straw to which the towing line is anchored to secure the knot to the anchor.

Your kite is now ready to test fly. If it gives you too much trouble, add a 10-foot tail. If the pitching and yawing is excessive, use a two-point bridle. Two-point bridles need two anchors (two 1” lengths of soda straw). Mark the top end of the spine 10% of the length of the spine down from the top point. Mark the spine’s other end 20% up from the bottom. The bridle should be made from strong thread or 20 lb. test kite line. Anchor the two ends of the bridle to the straw anchors as described above. When stretched tight, the bridle apex should be about half the width of the kite away from the kite face.

Setting the Towing Loop on the Bridle

To make a towing line with a larks-head knot, take a piece of kite line about 1 foot long. Tie overhand knots on bights of line at each end so that you have a loop in each end of the short piece of line. Wrap one of the loops around the bridle line and thread the other loop through it, then pull the second loop through until the first loop is pulled tightly around the bridle line; this is a larks-head knot. Slide the larks-head along the bridle line to the desired tow point. With the larks-head at this point, grasp the two sides of the larks-head and pull them firmly in opposite directions; you will feel the line click when the larks-head jumps into the bridle string. The loop in the outer end of the short piece of line is your towing loop where you hook the flying line.

Setting the attack angle

Grasp the kite in one hand and the towing loop in the other. Hold the kite and line up in front of a window with square corners. Align the kite in the window so that the horizontal distance from window corner to kite is the same as the vertical distance from corner to kite. This is the kite at a 45 degree angle. Holding the kite thus, pull the towing line out to where both legs of the bridle are taut and the towing line is parallel with the top of the window. At this point, the two legs of the bridle should diverge from the tow line at equal angles. When these conditions are met, the kite has a 45-degree attack angle. In theory, a kite develops its maximum lift when the attack angle is exactly 45 degrees, but in real life the angle for maximum lift depends somewhat on the design of the kite, thus the proper attack angle is usually somewhere between 38 and 42 degrees. Be sure to mark the tow point on the bridle with a marking pen just in case the towing line slips on the bridle. For more information on bridles, see Section 7.

If you decide the kite needs a tail, try attaching one to the anchor at the bottom corner, which you so thoughtfully provided when you sewed the stick socket to the sail. If the kite is still unruly, fit it with a hi-torque tail as described in Section 7

FLYING THE BEN FRANKLIN AS A SQUARE KITE.

If the decoration on the scarf is parallel to the side of the scarf, the depicted scene will be at a 45-degree angle when the kite is flown. Since this makes the kite look crooked in the sky, you may want to make the kite fly square instead of as a diamond. Proceed as follows:

1. Prepare the sail, stick sockets, and stick coupler as described earlier in this section. However, in this kite, sticks of the same diameter are used.

2. Preparing the bridle anchors.

In this design, you will be using a 4-point, compound bridle, so slip 1” sections of soda straw 10% of the stick length from the top ends and 20% up from the bottom ends. Attach two bridle strings, one between the top two anchors and the other between the bottom two anchors. These strings should be of equal length and about three fourth the width of the sail. Mark the exact centers of the two bridle strings.

3. Making a compound bridle.

Tie a 3” loop in one end of a piece of string as long as the sail is wide. Wrap this loop around the upper bridle string and pull the free end of this latter piece of string through the loop. Pull the string tight to put a larks-head attaching the new string (compounding string) to the bridle string right at the center mark on the crosswise bridle string.

Next, take a 6” piece of string, fold it in half, and tie an overhand knot close to the ends of the string, making a loop about 2 1/2” long. Wrap this loop around the bottom bridle string, slip one side of the loop through the other side and pull that tight, again forming a larks-head around the bridle string. Now, take the free end of the string you attached to the upper bridle string and thread it through that loop around the bottom bridle string exactly on that center mark. Pass the string through the loop two or three times, then tie two half-hitches around the string coming from the upper bridle string. You have just made a compound bridle. Lastly, take a piece of flying line about 18” long and tie loops in each end. Wrap one of the loops around the compounding string connecting the two cross-wise bridle strings together and pull it tight, again forming a larks-head knot. The loop in the end of this last line is the tow point.

4. Adjusting the compound bridle.

The centers of the upper and lower bridle strings were marked as explained above in the discussion of the diamond version of this kite. Slide the larks-heads in the compounding string to these marks, grasp the sides of the larks-head loops, and pull sideways until you feel a “click” as the larks-head jumps into the bridle string. This locks the larks-head so that it can’t slide along the bridle string. Now using a window or something with a square corner as a reference, again set the angle of attack. Slide the larks-head in the towing line along the bridle string until the kite is at about 40 degrees when all the bridle strings are taut and the tow line is parallel to the top of the window opening or other reference. At this point, the two legs of the compounding string should diverge from the tow line at equal angles. Now lock the larks-head in the towing line to the compounding string.

I have heard some people deride compound bridles, but by using larks-head knots as described above, you can save hours and hours of untying and tying knots. All you have to do to unlock them is pull on both sides of the line being locked, and the larks head will jump into the other line.

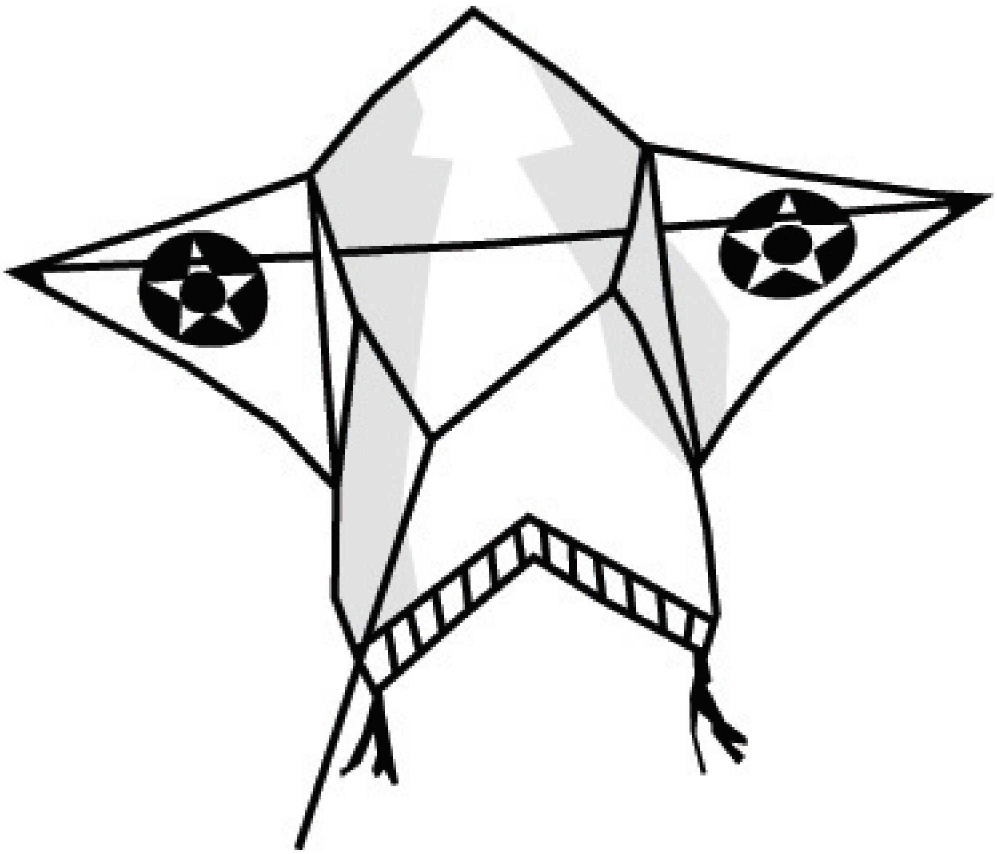
This kite will not fly without a tail, so tie a tail yoke, whose legs are each about as tall as the kite, between the bottom two corners of the kite in those tail anchors you so thoughtfully sewed to the corners. Mark the exact center of the yoke and attach a short tail-tow string at this point. Attach the tow string to the tail with a larks-head knot.

So, pick out a spectacular head scarf and build a Ben Franklin kite that can be highly competitive in a “Most Beautiful” kite contest.

“A man can hold many a post
if he will only hold his tongue.”
From Pink Dominoes, by Rudyard Kipling

Section Six

Building The Vitctory-Series Kites



We know why, there are STARS up in the sky,

STORMY WEATHERS!

On a Sunday, the last day of the Washington State International Kite Festival of 1993, a 4′ STAR VICTORY was the only kite flying from 8:00 AM until about 9:30 AM. There wasn't enough wind for any of the other 3,000-plus kites at the festival to lift off. This came to the attention of the visiting Japanese team, so today there is a 6′ STAR VICTORY hanging in the Japanese National Kite Museum in Shirone, Japan. They consider the STAR VICTORY to be one of the five outstanding western kites.

At the Kitemakers Conference in March of 1995 I taught a class how to build a 2′ STAR VICTORY, then sold kits to build a 4′ version. At the conclusion of the class, one of my students gloated, "Never again will you be the only one flying a kite at a WSIKF or any other festival when the wind is too light for anything but a Star." My response was, "Maybe".

But having let the cat out of the bag, it is time to let everyone in on the design secrets of the VICTORY-series of kites. Besides, I promised Margaret Greger (author of "More Kites For Everyone") at the 1993 AKA Convention that I would write this book. I have delayed publication because I wanted to thoroughly wring out the VICTORY-series designs to be sure that I hadn't overlooked any possible major improvements, but I have found none so far. The plans given here can be used to build great kites. Construction procedures for the three kites are so similar that the following procedures can be used for the Winged Victory, Star Victory, and Swift Victory kites.

Building The SWIFT VICTORY

This kite is the latest development in the VICTORY-series of kites. The design permits the use of a lighter spine than that used in the STAR VICTORY and has slightly less drag. Thus, the kite has a slightly lower liftoff wind speed and a somewhat higher angle of flight. It is a very mean competitor in single-line flight contests. While it doesn't have the eye appeal of the STAR VICTORY, it better lends itself to creative decorations. Built as directed here, its wind range is from 3 1/4 mph or slightly less to around 24 mph. The kite has been tested in winds gusting to 33 mph, but tail flutter developed, which was so severe that it whipped the strapping tape border off the kitchen-bag skin right at the edges of the bottom V. /This in turn permitted the pressure on the two bottom points to split the kite upwards from the apex of the V.

Materials

This size was selected because the pattern fits nicely onto a standard newspaper so that, if you are teaching a class, you can lay the patterns out ahead of time. If time permits, have the students lay out their own patterns on newspaper first, then transfer the dimensions to the

Materials:

- Full sheet of newspaper for laying out the pattern.
- One 30” Tall Kitchen Bag.
- Tape (strapping, 3/4” wide masking, and duct tape).
- One 36” dowel, 1/8” or 3/16” diameter for the spar.
- One 10” bamboo skewer stick.
- Twelve 7 3/4” X 1/8” bar straws (Sweetheart Sparkles).
- One 16D (16-penny) nail (box nail?) for belling above straws.
- Two 10” X 1/4” spoon straws for canopy mast and spar sockets.
- Strong button thread or carpet thread or 30 lb. Kevlar kite line.
- Yardstick or meter stick.
- Black marking pen (Sanford’s Sharpie fine point).
- SHARP scissors.
- One #12 rubber band.

skin material. This size is also nice if you want to make a 54″ X 72″ version from ripstop nylon or other material that comes in 54″ wide rolls. In this case, you merely double the dimensions given for the skin and canopy mast, put in a stronger spine (1/4″ soda straws) and a stronger spar.

Permitted Design Modifications

The reasons for using the bar straws for sticks are to keep the weight down and to provide sleeves for sticks in case you break a straw (an unlikely event). If taped-on 1/8″ wooden dowels are used for the spine and longerons (the sticks that run from top to bottom), broken ones are difficult to remove without destroying the kite. When straws are used, it is easy to slip a length of match-stick bamboo inside the straw. If you must use taped-on dowels and break one of them, it is suggested that you merely tape a splint alongside the break. If you are unable to obtain the bar straws, use soda straws (clear Sweetheart Jumbo 10″ recommended) instead. (If 1/4″ soda straws are used, tape them down with 1″ wide masking tape.) While a spoon straw is recommended for the canopy mast and spar sockets, almost any 1/4″ diameter soda straw will work.

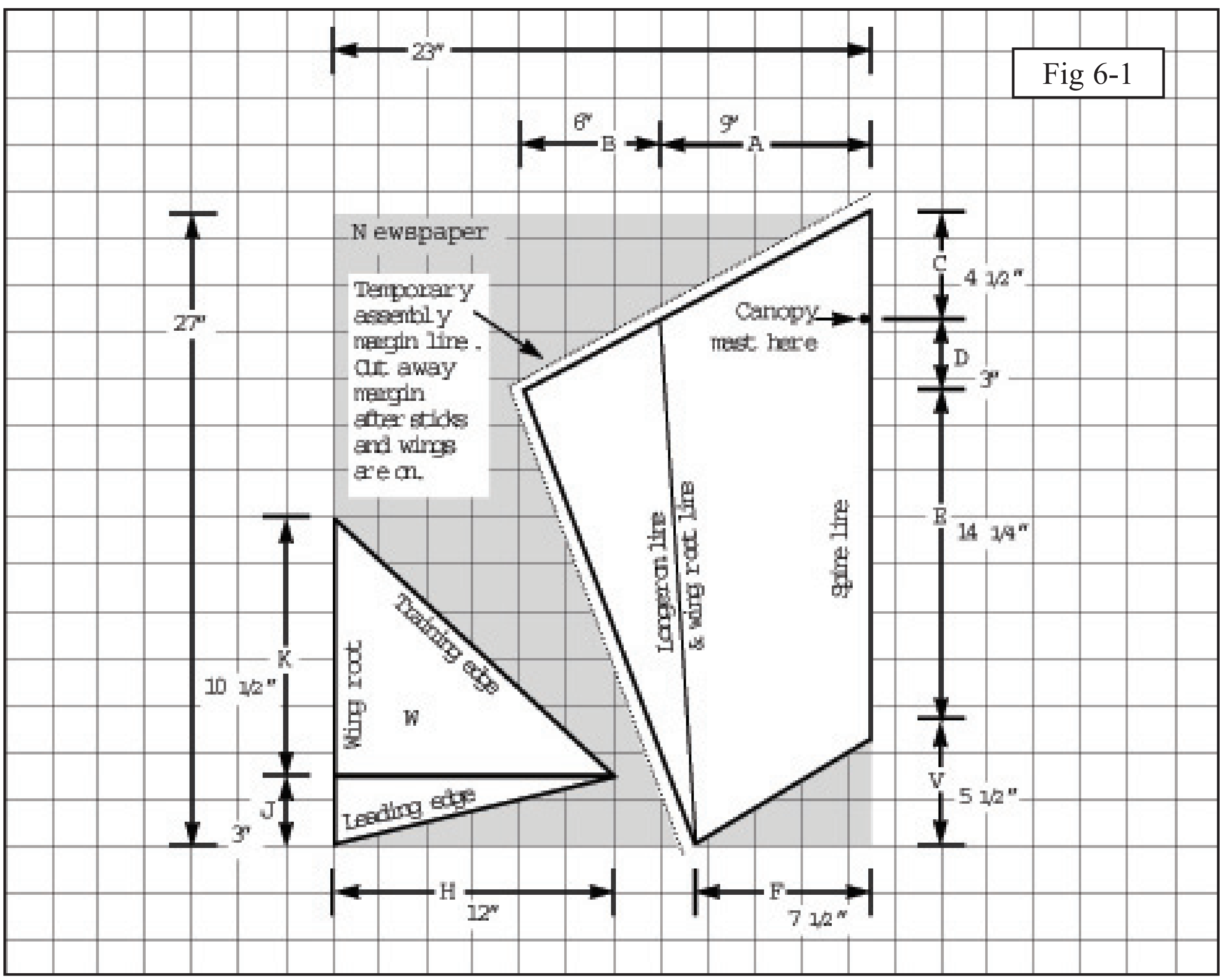
Step 1. Lay out the pattern (see Fig. 6-1) for half the canopy and one wing onto newspaper with the spine at one edge, then lay out the pattern for one wing with the wing root being on the other edge. Cut out the pattern.

Step 2. Skin material: one 30″ Tall Kitchen bag. Mark straight across the bottom 3/4″ up from the very bottom. Cut off the 3/4″ portion marked. Carefully unfold the bag without stretching any part of it and wrinkling it as little as possible. Do not cut down the side just yet. Lay the unfolded bag on the work surface and smooth the wrinkles out.

Step 3. With the bag smoothed out on the table, lay the canopy pattern on the bag so that the spine is at the right-hand edge (if you are right-handed; left edge if you are left handed, this makes slitting the wing roots easier) and leaving about equal margins top and bottom. Lay the root edge of the wing pattern flush with the opposite edge of the bag and up about 2 1/2” from the bottom of the bag.

Step 4. Put dots at all the points and corners of the patterns, plus an additional dot at the top end of the “longeron line”. Remove the patterns. Using a yardstick and marking pen, connect all the dots, then draw a line marking the longeron line. Measure 7 1/2” down from the nose of the canopy and put a dot on the edge at this point. Draw a line from this dot to the point of the keel (bridle point).

Once the canopy/keel section is marked out, lay your yardstick alongside the outline and draw a 1 1/4” margin outside the side and top of the canopy/keel section. This margin permits you to



27” x 36” Swift Victory Pattern

Use to lay out both wings and sides on Newspaper or directly on plastic bag, heavy lines indicate 3/16”-wide strapping tape edging.

tape the skin to the work surface without sticking tape on the kite skin itself. This margin will be cut away after the spine, longerons, and wings are taped on.

Step 5. Put a 3/16” wide length of strapping tape right along the long side (trailing edge) of the wing skin with the tape just touching the line on the inside of the triangle. This will be used as a guide when cutting the wing out and will provide reinforcement for the finished wing. Rub the tape down.

Step 6. Turn the bag over and again smooth it out. You can see the dark pen marks through the bag, so using a yardstick as a guide, neatly trace over all the lines visible through the bag. Put 3/16” strapping tape on the wing trailing edge as you did on the other surface of the bag.

Step 7. This step requires great care, so take it slowly and watch very carefully. Take your very sharp scissors and slit along the crease in the plastic bag that you have marked “wing root”. This must be cut as straight as possible or you will have a mess when it comes time to tape the wing to the canopy. It is necessary to slit the length of the “wing root” line only. Be sure this edge is clearly identified so that you don’t get “wing root” and “leading edge” mixed up when taping the wings to the canopy. Now cut along the wing leading edge line, again being very careful. Finally, cut the wing trailing edge right alongside the reinforcing tape. Set the wings aside.

Step 8. Once the wings are cut out, cut out the canopy/keels sail along the margin lines. NOW you can open the sail up and smooth it out on the work surface. There should be a crease running from the center of the V in the bottom to the nose (top) of the canopy/keels sail. (This crease marks the location of the spine.)

Step 9. Tape the skin to the work surface with several bits of masking tape. Stick the tape in the margin areas only.

Do not, repeat not, stick the tape to the outlined canopy/keels sail. Gently pull out the wrinkles as you work; you want the skin to be as wrinkle-free as is reasonably possible. Once you have finished taping the sail to the work surface, draw a line along that crease mentioned in Step 8 above. Run the line from the very nose of the kite down to the apex of the V at the bottom. This marks the centerline of the canopy as well as the location of the spine. Mark the spot for the canopy mast 5 inches down from the nose.

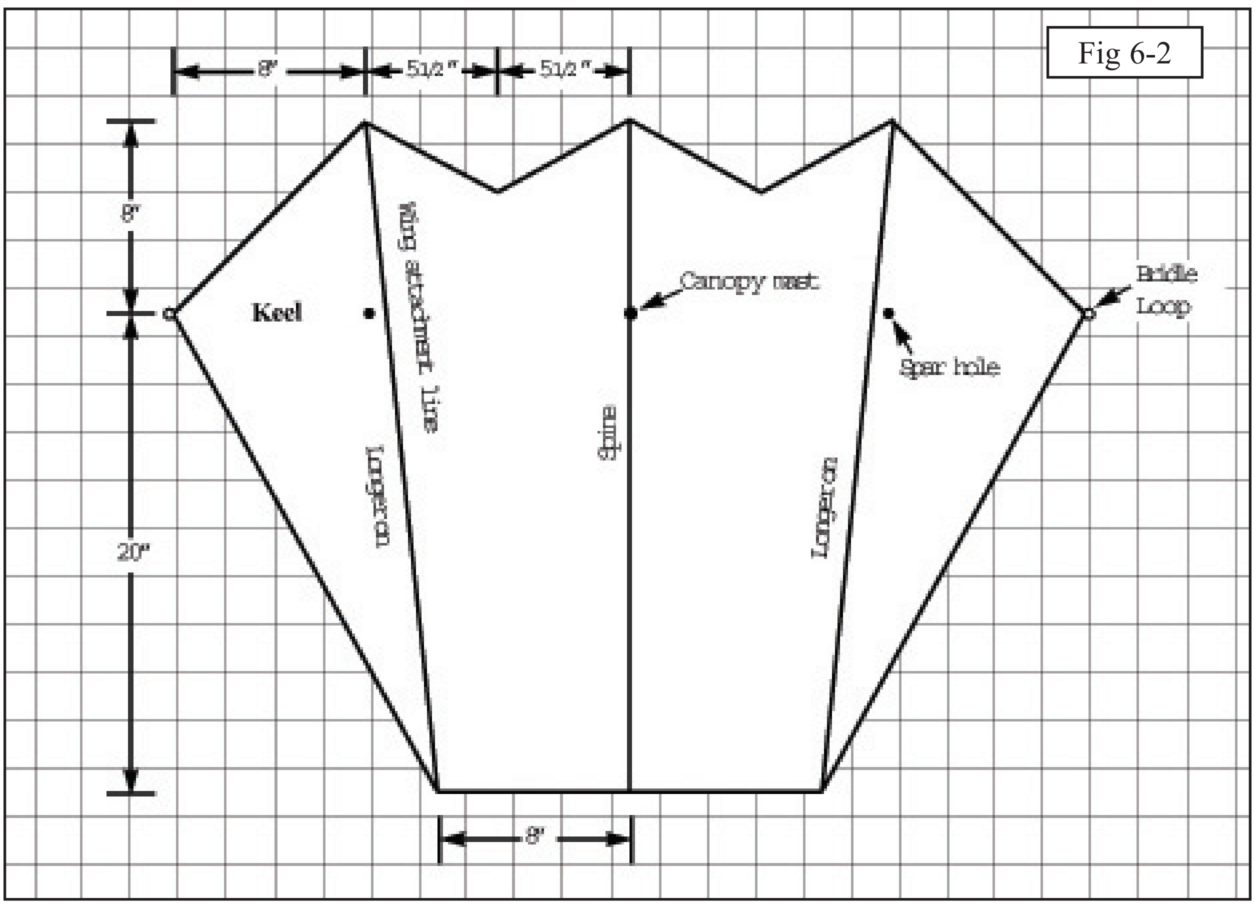
Step 10. Outline the canopy/keels sail with 3/16” strips of strapping tape stuck down just inside, but touching, the lines outlining the canopy/keels sail. Be neat. When you have finished, rub the tape down with the end of the marking pen or roll it down with a small glass bottle.

Unless the tape is rubbed down firmly, it is liable to shake loose in high (25 mph) winds.

Step 11. Prepare the longerons and spine by belling one end each of 9 bar straws with a 16D nail (or something else of the right diameter). Make three 22 1/2″ long tubes of 3 straws each by forcing the unbelled ends into the belled ends. (My preference is to use Sweetheart Crystal Clear bar belled straws with one end of each with a 16D nail. It would have saved some trouble if I had selected black instead of the beautiful red because black is more visible through masking tape than red.)

Step 12. Tape on the spine. Lay one of the tubes assembled in the step above along the centerline (spine line). Carefully tape it down with 3/4″ square bits of masking tape at each of the belled joints and then midway between joints. When you finish, strip off enough masking tape to reach the length of the spine plus about 6 inches. Grip the ends tightly with thumb and forefinger of each and stretch it tight right over the spine. Slowly, and checking the alignment constantly, lower the tape until you can make out the straws forming the spine

Fig 6-2

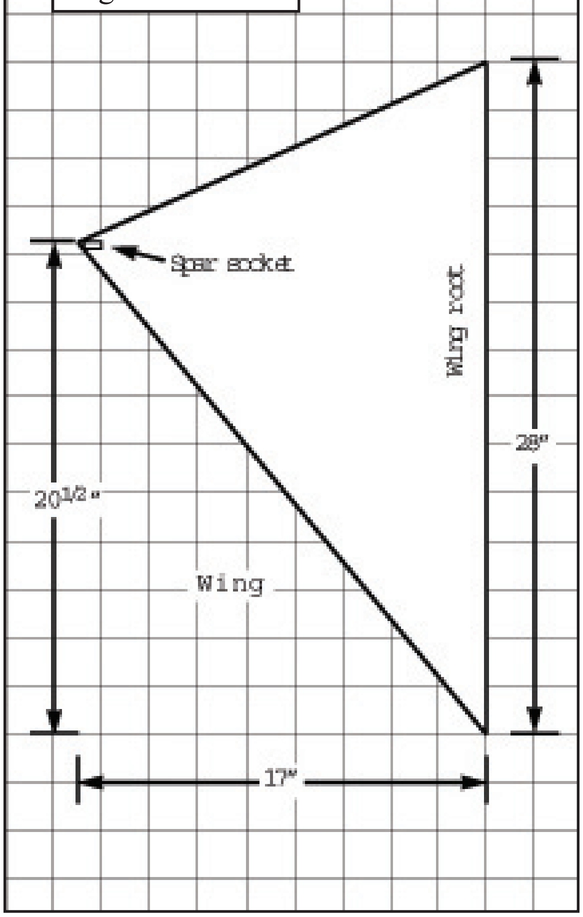


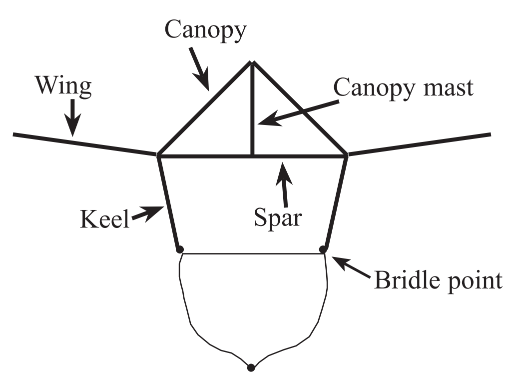
Winged Victory (minus wings)

through the tape. (It may be necessary to blacken a line down the straws with the side of your marking pen before you can see where the straws are.) Keeping the tape centered over the straws, slowly lower the tape until one end touches the straw. If it is properly aligned, stick down that end of the tape to the work surface and use your free hand to slowly press down the rest of the tape, keeping the tape centered on the straw. When the full length of the tape has been stuck to the straw, straddle the tape with your thumb and forefinger and rub the full length of the tape down onto the canopy. Rub the tape down with the end of the marking pen, then trim off the excess straw (if any) and tape at the nose and at the apex of the V.

Step 13. Tape on the wings next. Lay one of the wings with its root side along a longeron line with the wing tip towards the center of the kite and the trailing edge reinforcing tape on the underside. Make sure that you have the "wing root" edge precisely along the longeron line with the leading edge corner right on the tape that outlines the canopy.

Fig 6-2 continued





Head on View

Spar= 48" x 3/16" wooden dowel

Spine and Longerons= 28"x 1/8" wooden dowels encased in 10 1/8" bar straws.

Wing leading edge stiffeners are 18" x 1/8" wooden dowels encased in 10 1/8" bar straws.

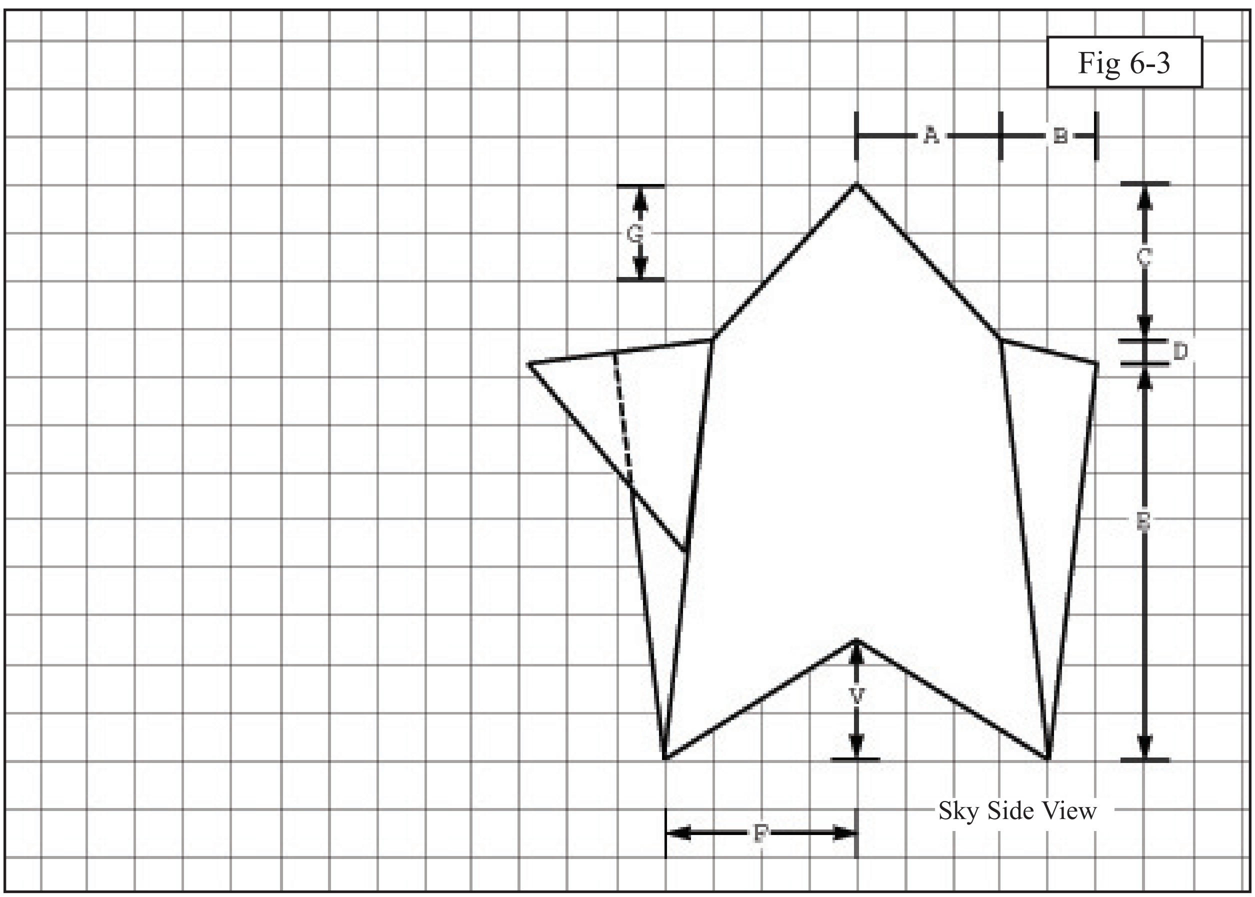
Canopy Mast= 10" x 1/4" soda straw

Note: Longerons and wing leading edge stiffeners may be matchstick bomboo or just the bar straws alone.

Again, stick it down with 3/4" square bits of tape about every 4 inches. It helps alignment greatly if the bits are centered on the wing/keel intersection line so that you can use them as guides when you run masking tape the entire length of the wing root. Strip off about 16" of masking tape and make a continuous run from the top corner of the wing to the wing bottom corner. Carefully pull up the tape covering the wing bottom corner and snip about 1/4" diagonally along the trailing edge line to remove the tape extending beyond the wing area. Do the same at the top corner of the wing. This frees up the wing so that it can be hinged in the following step.

Step 14. Attaching the longerons. Fold the wing outward and hold the tip under a little tension as you put a crease in the tape that attaches the wing to the canopy. Make sure the crease is straight down the middle of the tape, then rub it down to set the crease. Use a weight of some sort (e.g. a can of Mrs. Murphy's Chowder) out towards the wing tip to hold the crease under a little tension. Lay the longeron right along the crease and use the same procedure to stick it to the canopy as you used to stick down

Fig 6-3



Star Victory Kites - 1995 Model

the spine. When you have finished, very carefully snip the tape at the bottom and top corners of the wing so that the wing can hinge freely. OK, now attach the other wing and longeron in the same manner.

Step 15. NOW cut away that margin along the sides of the canopy/keels section. Cut out the V in the bottom (trailing edge) of the kite. Remove the margin and tape from the work surface, ball it all up, and ash-can it.

Step 16. Assemble two 11 1/4″ bar straw tubes for the wing leading-edge stiffeners. Turn the kite sail over so that the keels are on the upward side. Strip off a piece of masking tape about 3″ longer than the distance from the longeron to the wing tip. Cut 1″ lengths of masking tape and stick them to the longer piece of tape on the sticky side so that you can stick that long piece of tape to the work surface with its sticky side up. Stick one of the leading edge stiffeners lengthwise on the tape so that it is about 1/16″ off the tape center. The narrower side of the exposed tape should be closest to the wing and the inner end of the stiffener should be about 1/4″ outside the wing/canopy junction. Now, very carefully, take the slack out of the lead-

Fig 6-3 continued

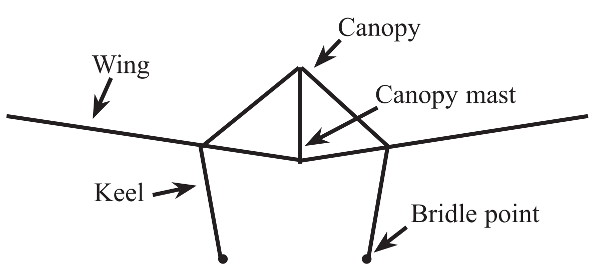
Dimension Table

Kite Size	A	B	C	D	E	F	G	H	J	K	V
4’	12	8	13	2	33	16	8	15	4	14	10
6’	18	12	20	3	49	24	13	23	6	21	15
8’	24	16	26	4	66	32	18	30	8	28	20
10’	32	20	33	5	82	40	20	37	10	35	25

Rod Lengths*

L	M	N	O	P	Kite Size
48	38	35	11	13	4’
72	57	52	15	20	6’
96	76	70	20	26	8’
120	95	87	26	34	10’

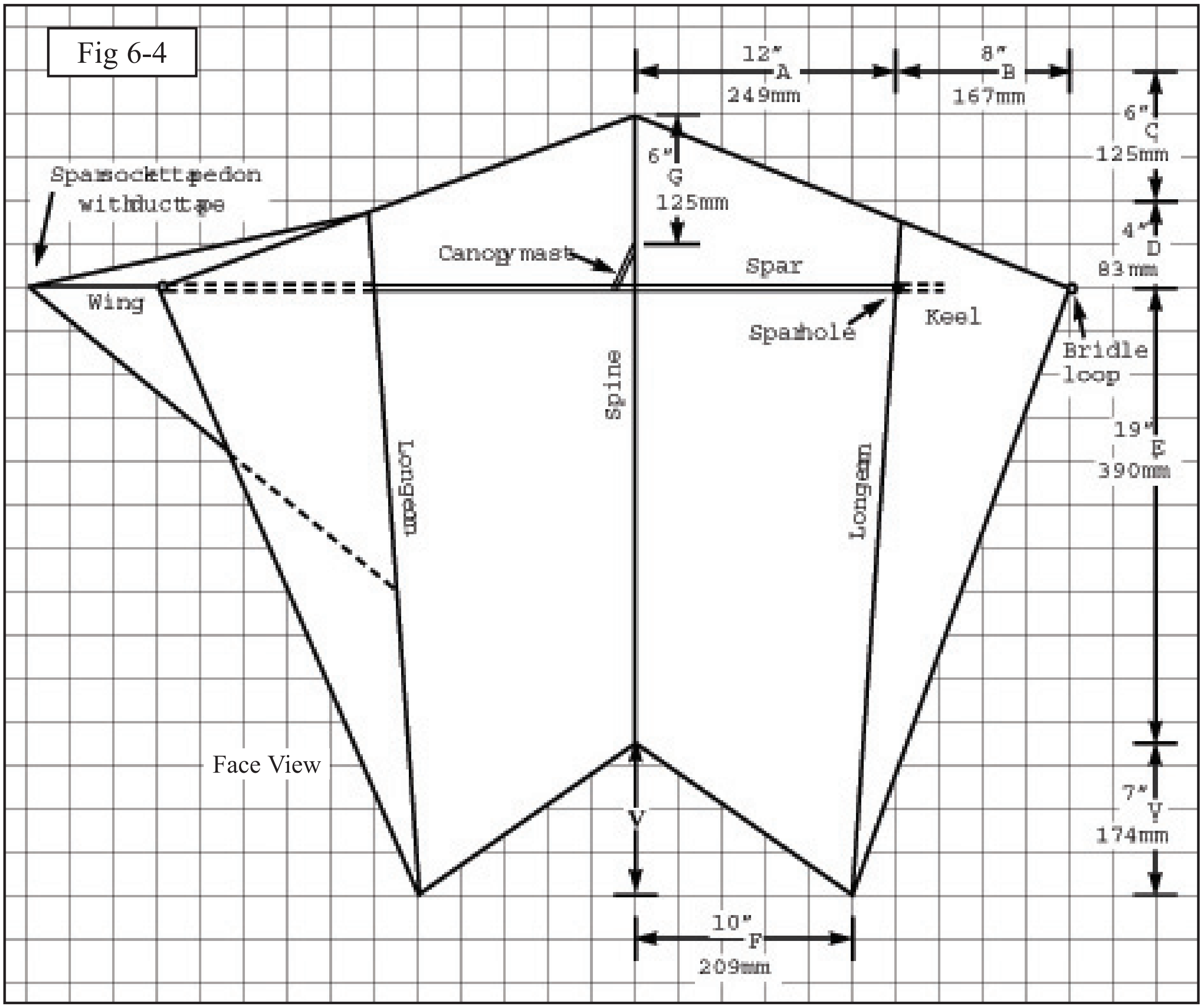
All dimensions in inches unless otherwise indicated
*L= Spar M= Spine N= Longerons O= Mast P= Wing leading edge stiffeners



Front View

ing edge of the wing and very carefully lower it so that it just touches the stiffener...full length. When everything is perfectly aligned, lower the wing onto the sticky side of the masking tape and rub it down onto the tape. On the inner corner of the wing, very carefully snip the tape so that its end is right at the wing/canopy junction. On the outer end, snip the tape off right at the wing tip. Slowly, working back and forth from one end of the stiffener to the other, fold the masking tape around the stiffener and stick it to the top surface of the wing. Repeat for

Fig 6-4



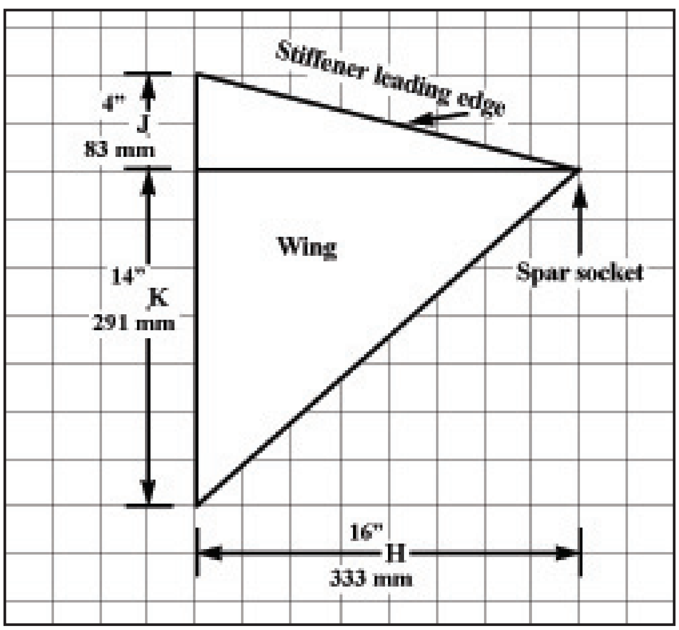
4' Swift Victory - 1996 version

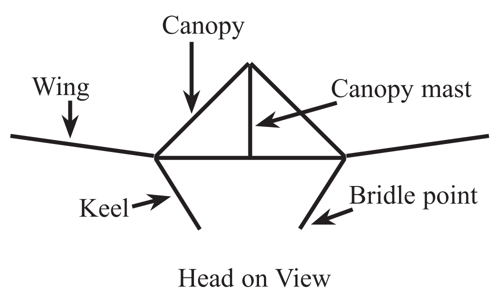
πL= Spar 48"x $^{3}/_{16}$" (1k x 3) wooden dowel
M= Spine 29" x $^{1}/_{4}$" (600 x 8) 500K straw
N= Longerons 30" x $^{1}/_{8}$" I0 (623 x 3) bar straws
O= canopy mast 10" x $^{1}/_{4}$" soda straw
P= wing leading edge stiffeners 16 x $^{1}/_{8}$" I0 (333 x 3) bar straws.
Spar socket 1$^{1}/_{2}$"x 1/4" I0 (40 x 6) soda straw section
Bridle loops. $^{1}/_{4}$" (6) wide strapping tape from point of keel to wing/keel junction - each side of keel.
Loop held open $^{1}/_{4}$" at keel point bridle length - same as E, each leg.

the other wing.

Step 17. Putting on the bridle points and the spar hole reinforcing. Measure down 3″ from the top of the longerons and draw a line from these points out to the tips of the keels. Put 3/4″ squares of duct tape centered on these lines and just touching the wing/keel junctions. Strip off a 12″ length of strapping tape 1/4″ wide. Hold the strapping tape exactly in the middle with one hand and an end in the other hand. Stick down the tape midpoint right on the tip of the keel, pull the slack out of the keel, then stick down the end on that 3/4″ square of duct tape. The strapping tape should be centered on that line you drew from the duct tape to the keel tip. Now, place a short section of soda or bar straw right at the keel tip. Fold the tape around the straw, then run it up the other side of the keel towards that piece of duct tape. Cut away the straw on either side of the strapping tape. The bit of straw makes an opening through which the bridle string is to be tied. Using that 16D nail, force a hole right through the center of that 3/4″ square of duct tape at the keel/

Fig 6-4 continued





Swift Victory Dimension Tables

HGT	A	B	C	D	E	F	G	H	J	K	V		L	M	N	O	P		W
27	9	6	4/2	3	14 1/65	7 1/2	5	12	3	10 1/2	5 1/2		36	22 1/2	23	1/4	1/8		36
30	10	6 1/2	5	3 1/3	16	8 1/2	5	13 1/2	3 1/3	11 1/2	6								40
36	12	8	6	4	19	10	6	16	4	14	7								48
54	18	12	9	6	38	15	10	24	6	21	11 1/2								72

wing junction. This is the hole through which the spar will pass.

Step 18. Put on the spar sockets. Cut two 1 1/2″ lengths of 1/4″ soda straw. Close one end by running a short length of 1/4″ wide strapping tape up one side, over the open end, and down the other side. Turn the straw 90 degrees (1/4 turn) and run a second piece of tape in similar fashion. Stick a spar end into the socket and lay the spar and socket at the wing tip so that the socket is snug up against the leading edge stiffener and extends to within 1/2″ of the wing tip. Lay the spar on the longeron at the point where the pass-through hole was punched in the keel. Tape the spar socket to the wing tip with 2″ wide duct tape. Rub the tape down with your fingers, trip the trailing edge so that it has about 1/4″ margin beyond the trailing edge of the wing, then fold this margin to the back side of the wing. Repeat for the excess duct tape on the leading side of the wing tip. Now put a spar socket on the other wing tip.

Step 19. The canopy mast is sewn on next. To prevent damage to the spine when sewing, take that bamboo skewer and break off about 1/2″ of the point. On the other end, wrap one turn of a 1/8″ wide bit of duct tape. Force the skewer down the spine until that bit of duct tape keeps it from going any farther. The skewer is to be left in place when the kite is finished.

Next, if you don't have a spoon straw, flatten 3/4″ at the end of a standard soda straw with the bowl of a spoon heated in boiling water. Lay the kite on the work surface keels up. Lay the flattened end of the straw on the spine at that mark 5″ down from the nose of the kite with the unflattened end pointing towards the bottom of the kite. Using strong thread or kite line, sew through the flattened end, around the spine to the sky side of the kite, then back through the tape, sail, and straw (use a thimble and some pliers if you have trouble with this step). Repeat until you have about 5 turns holding the straw to the spine, then tie the thread off.

Step 20. Slip one end of the 36″ spar through those spar holes in both keels and put the ends of the spar into the spar sockets. Holding the spar at its center (previously marked, I hope), push the canopy erect with the canopy mast. Hold the kite up to a window or doorway and check that the canopy sides make a right angle to each other. If the angle is less than 90 degrees, stuff a few paper wads into the spar sockets to effectively lengthen the spar. If the angle is over 100 degrees, the spar is too long and should be trimmed in 1/4″ increments until the angle between the two sides of the canopy is not more than 100 degrees.

Step 21. Once the canopy angle has been established, tie your bridle string into the bridle loops. The bridle legs should be between 10″ and 14″ in length, the exact length is not critical as long as it is between these limits. Mark the exact center of the bridle string with the black marking pen. Attach a 6′ flying line to the exact center of the bridle string with a larks-head knot.

Step 22. Lay the kite on the work surface, sky side down. Pull up on the tow line at the same time you push down on the canopy mast. When you have everything under slight tension, note how far it is from where the spar crosses the canopy mast to the end of the mast. Now take that 16D nail and poke a hole through the mast so that you can push the spar through the mast at the position indicated above. Remove the spar from the kite, then reassemble the kite; this time pushing the spar through a keel, then the canopy mast, and then the other keel. Put the ends of the spar into the spar sockets.

Step 23. Trim the end of the soda straw canopy mast back to within 3/8″ of the spar. Take that #12 rubber band and use 1/8″ wide strapping tape to tape it to the canopy mast just 1″ below the spar hole. Wind the rubber band around the canopy mast a turn or two, then slip it over the stub extending below the spar. Now the mast won't slide from side to side along the spar.

Step 24. If you have carefully followed all the steps given above, your kite is finished. Go test fly it.

When you have finished flying, remove the spar from the kite. Grasp the kite by the spine on the sky side. Lay the spar alongside the spine. Feel through the canopy until you locate the canopy mast, then slide that upwards and back until it also is alongside the spine.

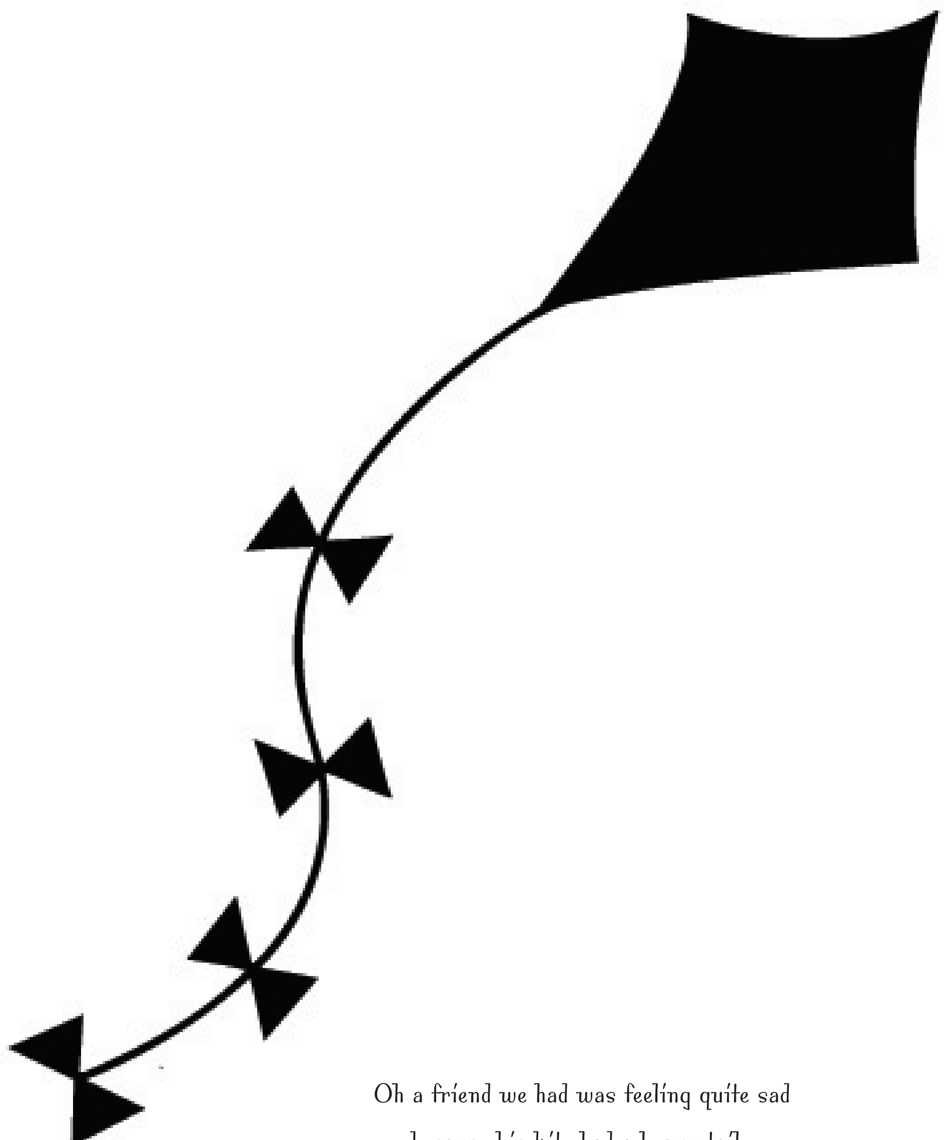
Roll the kite up around the spine until you come to the wing roots. Fold the wing tips up alongside the rolled up canopy so that the leading edge stiffeners are also parallel to the spine. Continue rolling until the keels have also been rolled up, then wrap the bridle and tow line around the kite and secure things with a single half-hitch.

Building Other VICTORY-Series Kites.

The drawings and dimensions for all the VICTORY kites are given in Figures 6-2, 6-3, and 6-4. Construction techniques are the same as for the SWIFT VICTORY.

Section Seven

Bridles and Tails

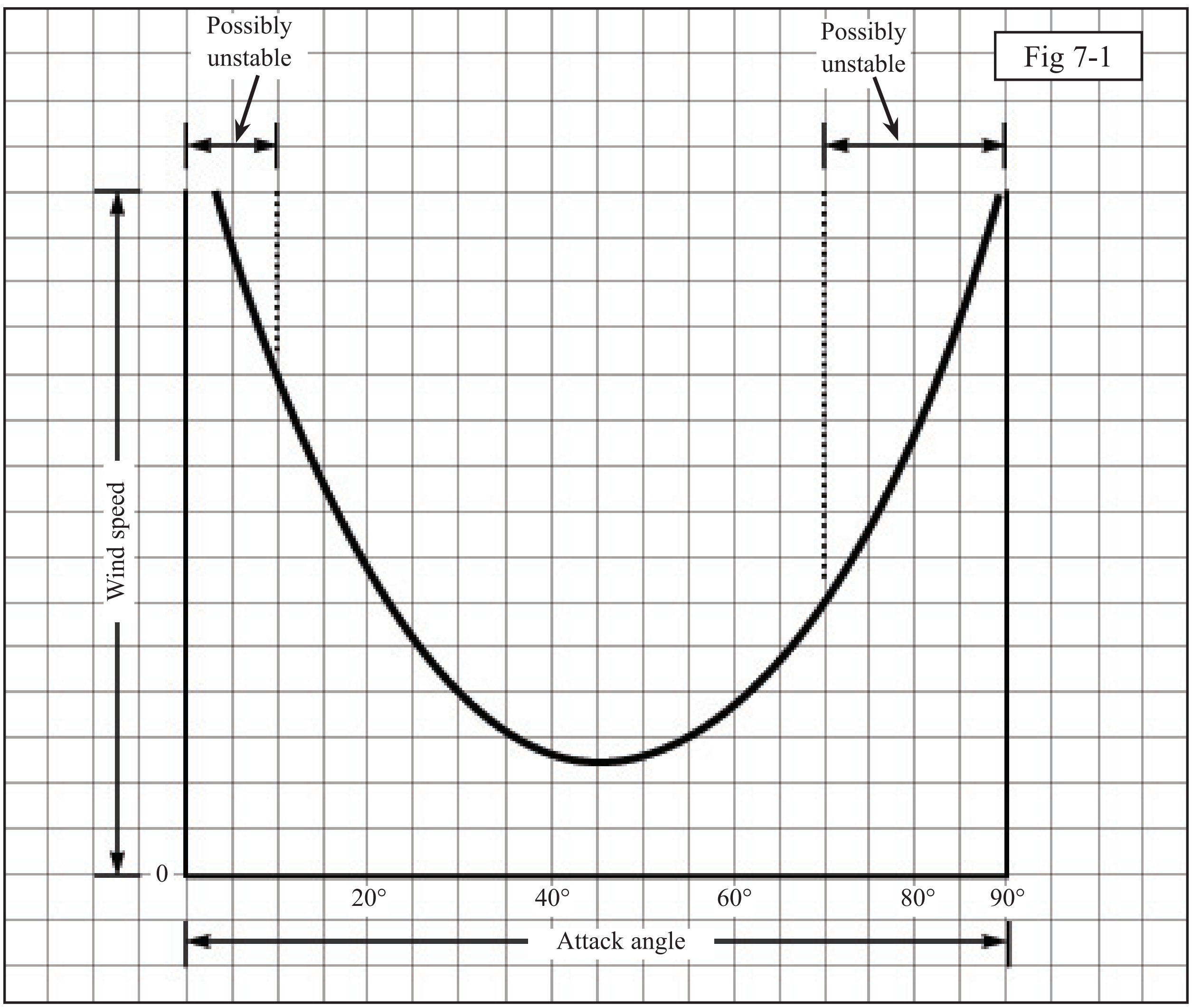


Oh a friend we had was feeling quite sad
because his kite had a heavy tail,
but he flew that kite from morn til night
in the teeth of a howling gale.

Bridles and Tails

General Considerations

The primary fulcrum point in kites with multi-legged bridles (and this includes ALL Allison derivatives) is right at your hand. Thus, when you set the attack angle for 40 degrees at liftoff, the attack angle constantly decreases as the elevation angle increases. The wind forces acting on a kite with a higher angle of attack are primarily Newton's third law, but as the kite climbs, the angle of attack decreases as the kite climbs. The Bernoulli effect comes into play when the angle of attack decreases to less than about 25 degrees. This is what leads people to believe that they need to "get their kites up into the wind" when winds are light. There may or may not be more wind up higher; what they may be experiencing is an increase in aerodynamic efficiency once the kite rises high enough to achieve the optimum angle of



Attack angle vs minimum lift off wind speed and high wind instability (Guesstimated!).

attack. They may have set the angle of attack a bit too high.

Reviewing the above, we can see that, while the primary fulcrum point in the kite and line system is right at the kite-flier's hand, there is a secondary fulcrum point about which the kite rotates due to the Bernoulli effect (Newton's first and second laws of motion). The Bernoulli effect is greatest immediately above and downwind from the sail leading edge, thus lifting the leading edge of the kite upward and increasing the angle of attack so that it is greater than the angle of attack established by the bridle at lift-off minus the elevation angle.

In a bridle-less bowed diamond, the major fulcrum point is again at the kiteflier's hand, but there seems to be a minor fulcrum point where the flying line attaches to the kite. If a bowed diamond kite is configured so that 20% of total area is above the spar, then the correct tow point is right where the spar and spine cross. The attack angle at takeoff is about 40 degrees, but as the kite rises, the angle of attack decreases and is about 15 degrees when the kite is flying at about 55 degrees elevation angle.

In kites with a multi-legged bridle, if you move the bridle point down to increase the angle of attack at takeoff to above 45 degrees, things change a bit. First, the kite will require more wind to lift off (See Fig. 7-1). Second, the kite will usually climb faster and reach a higher angle, and third, the kite may become unstable. Increasing the angle of attack to about 60 degrees is a secret weapon when the winds are light. You pump the kite up until the kite reaches an angle of about 40 degrees, then let it settle back until its angle of attack reaches its angle of maximum lift (40 degrees) at about 30 degrees elevation angle.

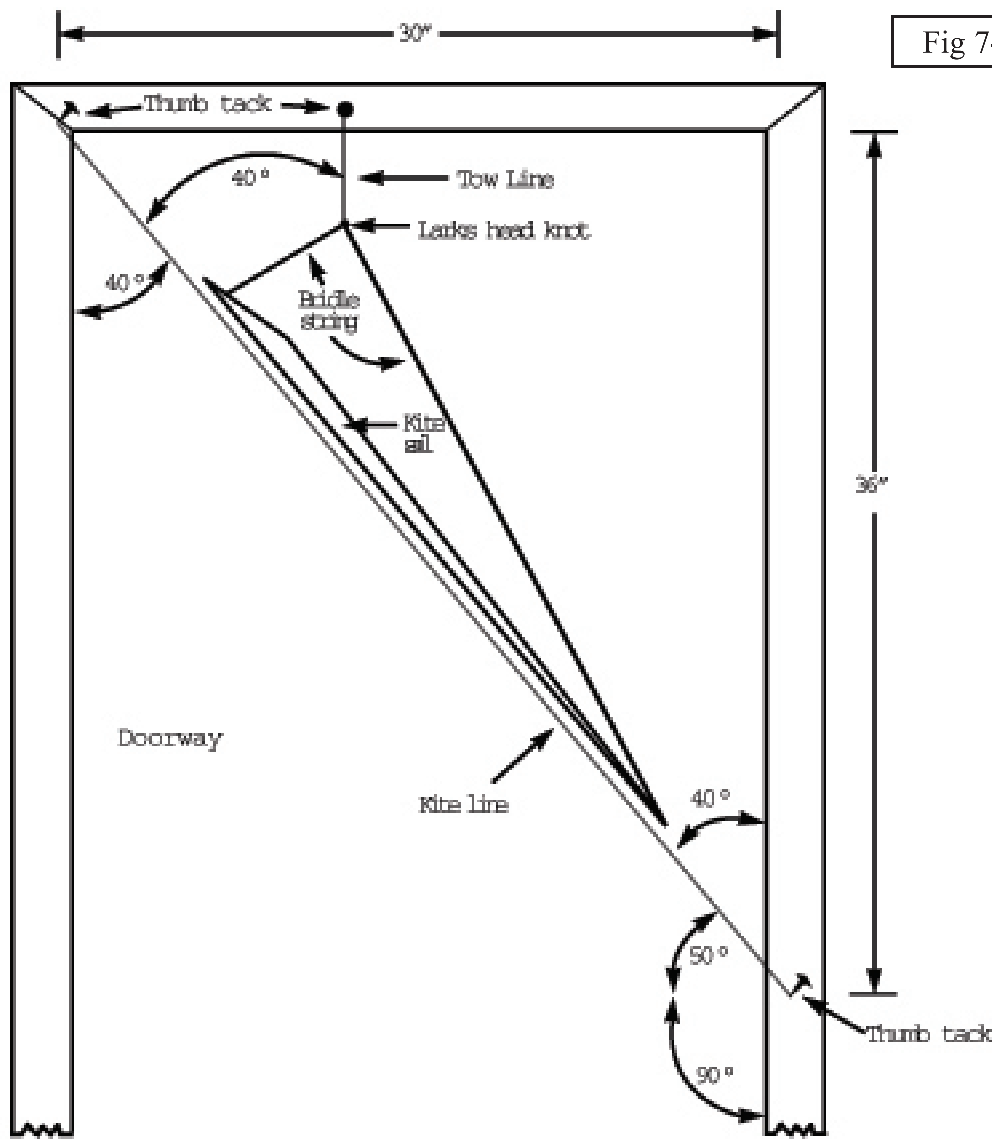
If you raise the bridle point to where the attack angle at takeoff is about 30 degrees, the kite will again require more wind for liftoff, but it will not climb as fast nor reach as high an angle. However, the stability is better in high winds.

Bridling The Allison.

This is a very simple kite to bridle. Take a piece of bridle string 5 or 6 times as long as the kite is high. Tie the string into the kite bridle loops on the keels. Use either a round turn and two half-hitches or a bowline knot. Hold the bridle loops on the tips of the keels in one hand, matching them face to face carefully. Slide your other hand along both legs of the bridle string until you find the exact center. Mark this center with a marking pen.

To make a towing line, take a piece of line about 1-foot long and tie overhand loop knots in both ends. Fold one of the loops around the bridle string, then pass the loop in the other end of the line through the first loop to form a larks-head knot around the bridle string. Slide the larks-head to the center point, indicated by that black mark you put on the bridle string, then grasp the two sides of the larks-head and pull them simultaneously in opposite directions. You will feel a "click" as the larks-head jumps from the tow line into the bridle string. The larks-head is now locked and won't slide along the bridle string. To unlock the knot, grasp the bridle string at the sides of the larks-head and pull the bridle legs simultaneously in opposite directions. Again you will feel a "click" as the larks-head jumps back into the towing line. This unlocks the

Fig 7-2



System for accurately setting attack angle of Diamond Kite Two point bridle for 40. The Kite may be held above the reference line as shown here or below. Adjust tow point so the kite sail is parallel to reference line.

larks-head so that you can make minor adjustments if the kite wants to pull to one side or other in flight.

Bridling The Diamond

In a properly constructed bowed diamond kite where 20% of the sail area is above the spar, the kite will fly stably without a tail if the flying line is tied directly to where the sticks cross. This is true also of a few other types of kites (e.g. Ben Franklin's and Barn Doors), which will also fly stably (with a tail) if the kite line is connected directly at the point where 20% of the total lifting area is above the tow point. As the elevation angle increases, the angle of attack of a kite flying from a single tow point without a bridle usually changes less rapidly than that of a kite with a multi-legged bridle. However, as the wind picks up, the kite may start "pitching" about the pitch axis.

When the angle of attack is somewhere between 38 degrees and 42 degrees (theoretically 45 degrees, but the Bernoulli effect reduces the angle) the kite develops maximum lift. This determines the bridle adjustment for lowest wind liftoff. In winds greater than required to lift the kite off the ground, you can speed up the rate of climb by increasing the angle of attack. You can also slow down the speed of climb by lowering the angle of attack. Raising the angle of attack destabilizes the kite in high winds, but decreasing the angle of attack a bit usually improves high wind stability.

The above information describes the relationships between angle of attack, minimum wind for liftoff, rate of climb, and kite stability. Since we really can't change the angle of attack in a kite with a single tow point, a multi-point bridle is needed if we want to make a more versatile kite.

Bowing eliminates the need for a lateral bridle string when putting a multi-legged bridle on a diamond kite. The bottom end of the bridle string is attached to a point about 1/3 the distance from the bottom of the spine to where the sticks cross. The upper leg of the bridle string should be attached about 1/2 the distance between where the sticks cross and the top of the spine. This method of spacing the bridle legs lends better support to the spine, permitting the use of a lighter weight spine.

The ends of the bridle legs should be anchored, not to the spine itself, but to a short length of soda straw slipped over the spine and slid to the point where the bridle string must pass through a duct-tape reinforced hole in the sail. This permits easy removal of the spine if it breaks.

The length of the bridle string should be such that the string forms an angle of about 90 degrees (when pulled tight) at a point at right angles to the intersection of the sticks. Use a larks-head to tie your tow line to the bridle string. Hold the kite up to a window, doorway, or other square opening and position it so the top end of the spine appears to touch one of the top corners of your window reference and the spine runs down diagonally at 45 degrees. Pull the spine bottom towards the other side of the opening to angle it to 40 degrees.

As for the tow point; that larks-head will slide along the bridle. With the kite positioned for an attack angle of 40 degrees, slide the larks-head so when you pull the tow line and bridle tight, the tow line is parallel to the top of the reference opening and the two legs of the bridle diverge from the tow line. Mark the larks-head position on the bridle string so you may return to it later if you want to try raising or lowering the bridle points when you go flying.

For more accuracy in setting the angle of attack, turn a doorway into a protractor. Measure across the doorway and divide the measurement by 0.835 (the tangent of 40 degrees). Let's say the doorway is 30" wide, so dividing 30" by 0.835 gives 36". On one side of the doorway, measure down 36" from the top and put a thumbtack right on the corner where the doorway meets the wall. Now put a thumbtack in the upper corner of the other side of the doorway. Run a piece of kite line stretched tightly between the thumbtacks. This makes a reference line of 40/50 degrees. What you have made is a right triangle whose base and altitude are known. That piece of kite line stretched diagonally between the ends of the two known sides is the hypotenuse. We are not particularly interested in the length of the string, what we ARE interested in are accurate angles (40 and 50 degrees).

Put a 4' tow line on the bridle string with a larks-head knot. Remove the tail from the kite if one is attached. Hold the kite upside down by the tow line. If the kite is a diamond kite equipped with a two-legged bridle, hold the kite just above that reference line across the doorway. Unlock the larks-head on the tow line and slide it to where the spine of the kite is perfectly parallel to the reference line. Re-lock the larks-head and mark its position on the bridle line.

Bridling The Barn Door

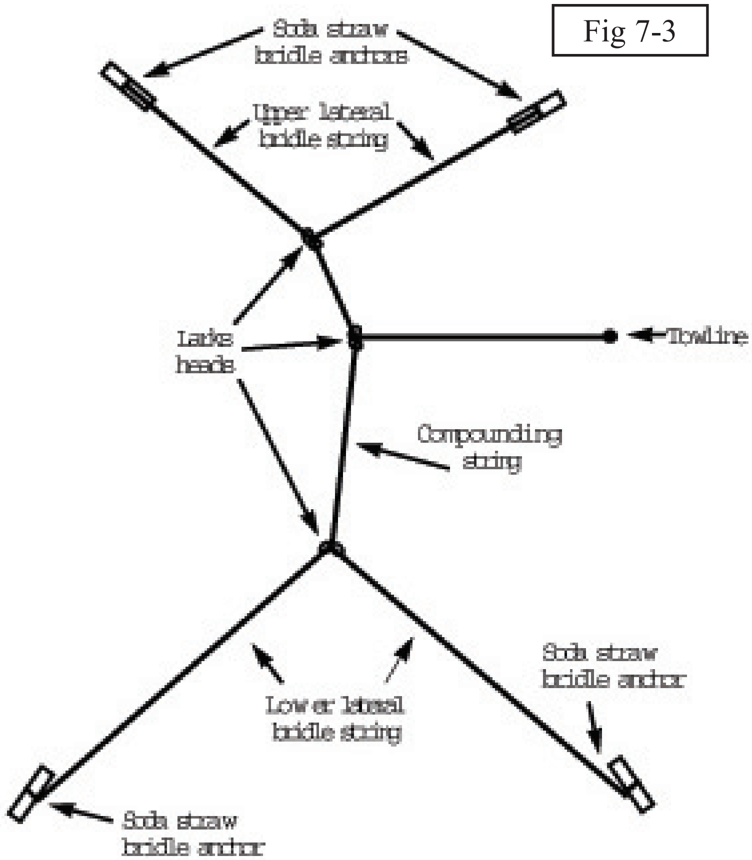
The Barn Door three-sticker described in this book is also a bowed kite. Bowing the kite not only makes a more stable kite, but permits the use of a single tow point or a 4-legged compound bridle instead of a 6-legged. The bridle legs are not attached to the sticks themselves, but to soda straw sections that can be slid off the sticks to replace a broken stick.

The points at which the bridle strings must pass through the sail of the kite are reinforced with a 1" square of duct tape. The bottom two soda straw bridle

4-Point Compound Bridle

Used on the three-stick bowed Barn Door. The upper and lower larks head knots are centered on the lateral strings and locked. The center larks. head remains unlocked until the bridle has been adjusted to form angle of attack, then it is also locked.

Fig 7-3



anchors and duct tape reinforcing should be about 1/4 the length of the longerons up from the two lower corners. The top two anchor points are about 1/2 the distance between where the sticks cross and the top of the kite. Spacing the bridle points inward from the ends gives better support for the longerons, permitting them to be lighter in weight than the bowed spar. Tying the bridle strings to the ends of the sticks is not recommended. In strong winds the kite might be forced into a concave shape with unpredictable results.

A compound bridle is used, compound meaning separate strings run across the kite, one between the upper part of the longerons and another between the lower parts. A third vertical (compounding) string to which the tow line is connected is run between the two lateral strings (see Fig. 7- 3).

Again, larks-head knots are used to connect the strings. This means that you have to make a separate loop for connecting one end of the vertical (compounding) string to one of the lateral strings. Merely tie an overhand loop knot, trim the excess line neatly, and fold the loop around the lateral string. Pull one side of the loop through the other to form a larks-head knot, then tie the remaining end of the compounding (vertical) string through the larks-head and secure it with a round turn and two half-hitches.

Find the exact centers of both the top and bottom lateral strings. Mark these spots with a pen, then slide the larks-heads onto these marks and lock them as described above. Again holding the kite up to a square corner in a window or doorway, set the attack angle at about 40 degrees and lock the towing line larks-head into the compounding string.

Accurately setting the tow point on a barn door with a 4-point compound bridle is much the same as described above for the diamonds. However, the lateral strings used in the bridle make it necessary to hold the kite (sky side down) above the reference line. Again slide the larks-head along the bridle compounding string until the kite sail is parallel to the reference line. Mark the knot's position and relock it. If you have done everything precisely, your kite now has an attack angle of 40 degrees.

Bridling The Ben Franklin. Use the procedures given for the Diamond.

Bridling The Victory Kites. Use the procedure given for the Allison, but make the overall bridle string length equal to (or slightly less than) the height of the kite (each leg 1/3 to 1/2 the height of the kite).

TAILS

Tails on a Horned Allison?

It should not be necessary to put a tail on the Horned Allison and Allison derivatives (i.e., the VICTORY-series kites) described in this book. There are exceptions: If you scale the Allisons down to below about 16" high, they tend to spin if there is ANY asymmetry. However, some people like to see streamers coming from the kite, so you can attach identical 3/4" wide streamers, twice as long as the kite is high, to the bottom two corners.

The soda-straw stiffened Tall Kitchen Bag Horned Allison described in this book is so light that flying it in high winds can be tricky. The problem is that gravity doesn't apply enough corrective force if the kite gets knocked off course so that it no longer heads directly into the wind. It will continue to fly in whatever direction it is pointed until it reaches an angle to the wind that causes it to collapse. Fortunately, the cure is fairly simple: just add two 1" X 2' streamers (cut from denim or similar-weight cloth) to the bottom two corners. This will add some drag and weight to the bottom of the kite.

If you build an unstable Allison kite that really needs a tail, use a Hi-torque tail (see Diamond kite below) on a tail yoke whose legs are each as long as the width of the kite between the bridle loops. Left to its own devices, the tail will probably twist the yoke, pull the bottom two corners of the kite together, and make the kite fly even worse than before. The cure for keeping the yoke from twisting is to use a 1/8" diameter spreader bar whose length is just 4/5ths the distance between the bottom two corners when the kite is laid out flat. Attach this spreader bar with 1' long strings tied from the ends of the bar up to the bottom corners of the kite. Also attach the yoke strings to the ends of this bar. Unlock the larks-head knot that holds the tail tow line to the apex of the tail yoke, re-center the larks-head, and relock it. The kite should now fly stably.

Another way to attach a Hi-torque tail to an Allison derivative is to attach the tail yoke and spreader bar about half way down the bridle. I haven't tried using a drogue instead of a tail with this system, but it would probably work quite well.

Tailed Diamond Kites

The usual method of putting a tail on this kite is to tie something right on the bottom end of the spine. If you use something heavy and compact, such as a fishing weight, you will have an inertia problem and the kite will behave like a pendulum, except that kite and wind make a powered closed loop system whose loop gain is greater than unity. (Any explanation I could give about the things I have just said would be long and laborious and probably wrong.) In short, the kite-cum-pendulum will overshoot at the ends of its swings and soon become unflyable. If you feel you must use a heavy tail, cut a long 2" wide strip of heavy cloth so the weight is distributed evenly along the length of the tail.

A lightweight tail, such as a 2" wide strip of 1-mil thick polyethylene garbage bag, gives a different sort of problem with a wild kite. A wild kite can flip that tail ahead on one side or other and is then unencumbered by any corrective force from the tail, with disastrous results.

With a heavy tail on a diamond kite, when the tail is streaming directly behind and the kite is not yawing, no corrective force is applied and a heavy tail just decreases the lift-to-drag ratio. However, when the kite tries to yaw, then the weight starts to do what it was intended to do, which is to bring the kite back on course. Unfortunately, the corrective force starts increasing very slowly and does not reach its maximum until the kite has yawed 90 degrees and the spine is parallel to the horizon.

What to do? Change to a Hi-torque tail. Make a tail yoke whose two legs are each about twice the height of the kite in length. In the center of this piece of string, attach a tow line about 1' long with overhand loop knots in each end.

Use a larks-head to attach the tow line to the yoke. Attach the legs of the yoke to the ends of the spar. The apex of the V-shaped yoke and the tow line should be about 1′ or more directly below the bottom of the spine.

Once you have the yoke attached and the tow line centered, lock that larks-head. Attach another piece of string about 2′ long to the bottom of the spine and tie the other end into the larks-head loop. You have just made a yoke snubber. When you finish, you should be able to swing the tail tow line up about 30 degrees before the legs of the yoke and the snubber are all pulled tight. Now attach the tail to the tail tow line and you are ready to fly.

As described above, the Hi-torque tail has one great advantage in that any time the kite tries to yaw, the corrective force of the tail is immediately applied to the end of the spar that is trying to pull ahead. In other words, the tail has maximum torque when the torque is applied to the spar ends at a 90 degree angle. The equation below explains the situation very well:

T = FLSin0

Where T = torque, F = the force applied, L = the length of the lever to which force F is applied, and Sin0 = the angle at which the force is applied to the lever.

Those with a little knowledge of trigonometry know that at zero degrees angle the value of Sin0 is zero, and at an angle of 90 degrees the value is one. Auto mechanics, among others, use a very neat mechanical computer to solve for T in the above equation; it's called a torque wrench.

I once built a beautiful 4′ red diamond that gave me all kinds of trouble in turbulent winds. In desperation, I decided to try yoking the tail to the ends of the spar. When I finished, I went to a local school athletic field and lofted the kite to about 800′. It flew steady as a rock, except that ever so slowly it started to move laterally down towards the ground. What to do? I finally remembered how they get Asian fighting kites to shoot off in different directions by giving slack line. I was willing to try anything, so I let the line go absolutely slack, and sure enough, the kite started twisting in the sky. When it finally pointed towards the zenith, I immediately tightened the flying line; the kite slowly crept towards the zenith again. I still have that kite someplace; the label on its storage tube reads: "Bull-headed Eddy".

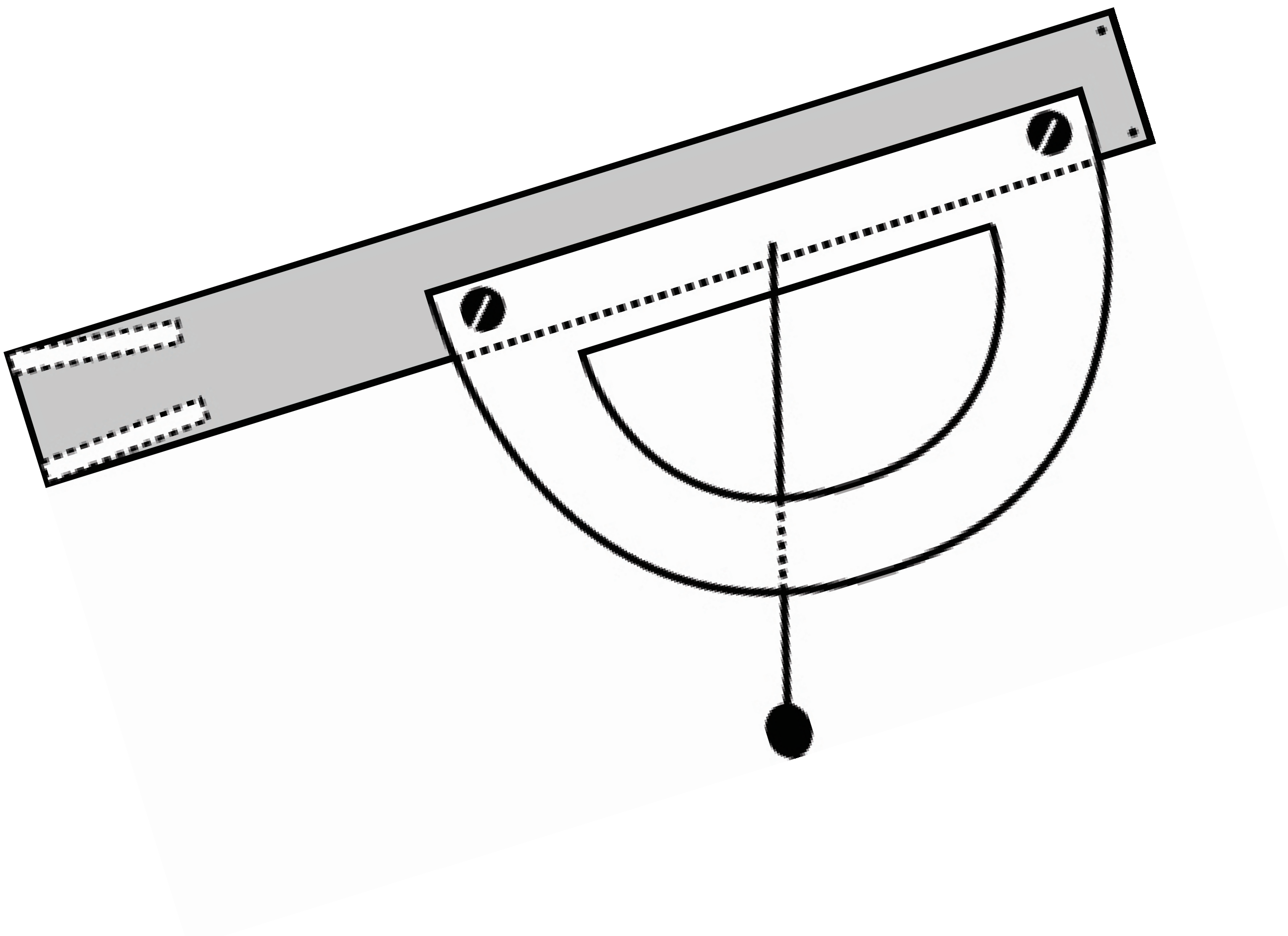
Drogues

A drogue is the kiteflier equivalent of a sea anchor, which is something like a canvas bucket with the bottom cut out. Kitefliers use them in lieu of tails when they are ashamed to admit that their kite needs a tail. I haven't to this day been able to build a drogue that didn't spin and wind up the tail yoke. That's why I started hooking the tail yokes to spreader bars when putting tails or banners on Allisons. Anyway, if you don't have the time and patience to sew up a fancy drogue, just punch the bottom out of a paper or plastic cup and fly it big-end forward.

And that, boys and girls, gives you the basics of bridles and tails.

Section Eight

Mathematics in Kite Design



"We go about our daily lives understanding almost nothing of the world"

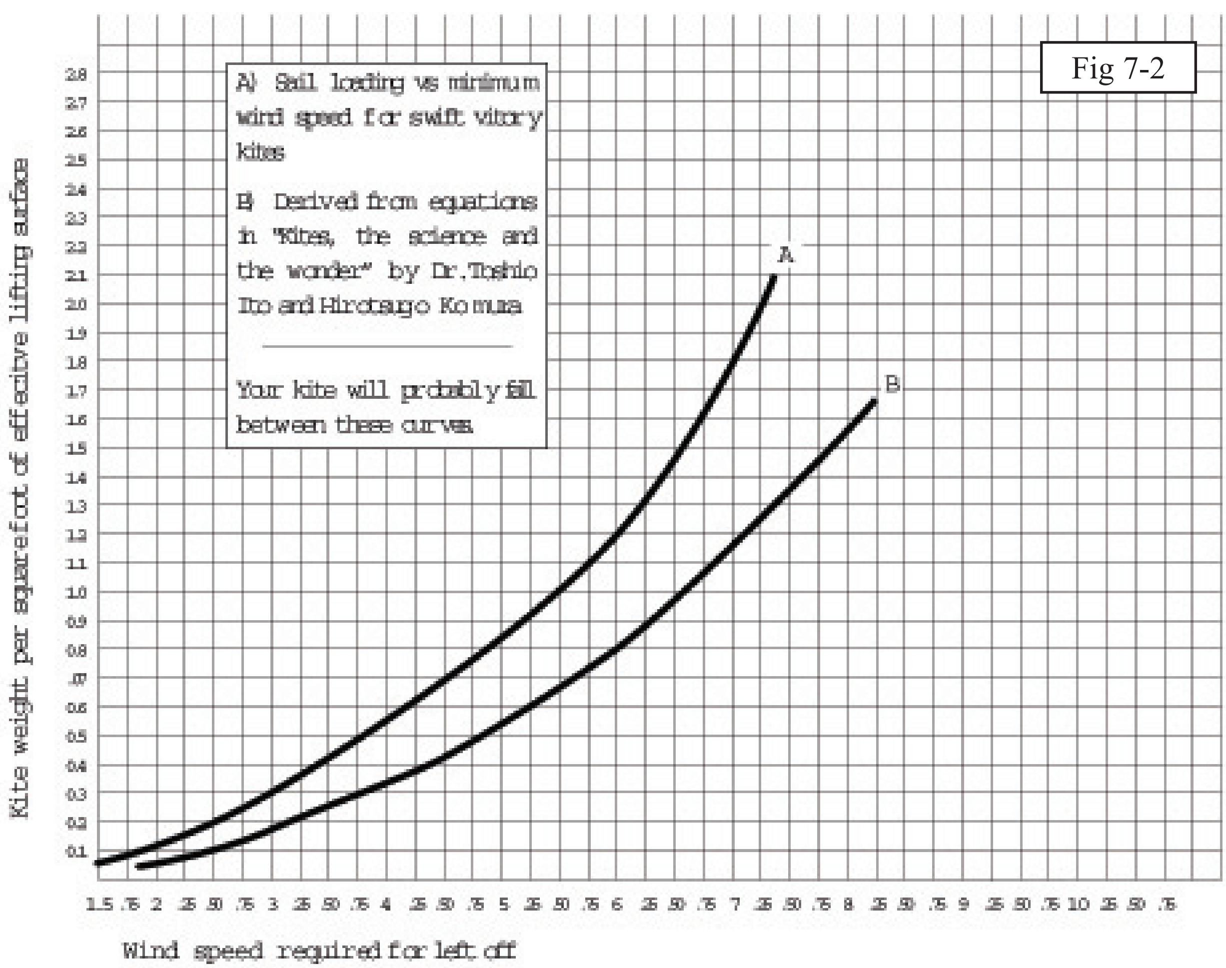
from "A Brief History of Time" by Stephen W. Hawking

Mathematics in Kite Design

Designing Your Own

Tom Sisson of Washington Kitefliers Association (WKA) was an even bigger kite nut than I am. He actually built a wind tunnel out of squirrel cage blowers, toilet paper cores and paper towel cores...you name it. He reported that about 20' downstream from those toilet paper cores the air stream was absolutely free from turbulence. I have a reservation about the use of a home-made wind tunnel, and that is: How accurate is your wind gauge?

At kite festivals when the wind was minimal, I asked a few owners of wind gauges what the wind speed was, and no two of them seemed to agree or the gauges wouldn't give any low-wind readings at all. The Beaufort Scale (devised in 1805 by Sir Francis Beaufort, RN as a standard for logging wind speeds at sea) is not very useful for judging wind speed over land. Since I generally design my kites for minimum wind, I needed a precise way of measuring wind speed. I turned to relative wind vs. distance traveled as explained below.



Creating Relative Wind

Take a piece of 1” plastic pipe 12’ long. Mark 2’6” from one end. On the other end tie a safety pin to hook to your kite line. Now, hook your kite to the pipe, get out on the lawn on a calm day, hold that pipe so that the 2’6” mark is right on your belt buckle, and whirl in a circle. The kite will rise. Adjust your whirling speed until the kite flies at about 10 degrees, very slightly above its liftoff speed. Now let’s find the liftoff speed.

The length of the pipe from your belt buckle to the end is 9’6”, therefore the circumference of the circle the kite is describing is 60’. If, while you are whirling, you count; one-thousand-one, one-thousand-two, etc. to get the time in seconds, then you can get feet-per-second, which you can translate into miles (or kilometers) per hour. Any slight breeze blowing during this exercise is added to the speed when you are flying upwind and subtracted from the speed when you are flying downwind, so if your method of measuring time by counting is accurate, you can skip buying a wind gauge.

When I first started testing my kites in this manner, the neighbors reacted as you might expect...they started walking on the other side of the street when they saw me coming. OK. The next time I decided to test some kites, I put the stereo loudspeakers on the front lawn and put “Zorba’s Dance” (from Zorba The Greek) on the turntable and turned the volume up LOUD. When the music was in the slow parts, I swung the kite at just above its takeoff speed and tried to count. When the music speeded up, I started hopping and skipping. You can imagine the effect on the neighbors to see a 74-year-old man performing such antics in front of God and everybody. But, have you ever tried to dance to a random beat and keep time by counting at the same time? Forget it.

Using that piece of pipe, I tested scale models and built larger versions of those that flew respectably. But I still wasn’t satisfied that I was getting absolute accuracy because I couldn’t watch the second hand on my watch and the kite at the same time. Finally, when cold weather set in, I went to the Clackamas Town Center and started walking the kites a measured distance and using my watch to time the walks. Again, I flew the kites so that the kite line was sloping up to the kite at about a 10 degree angle. However, there were still some variables I had to take into account.

Located about 600’ from where I was walking my kites was the ice rink. This set up convection currents all through the mall, so I had to make two-way walks and average the time. I had to go early in the morning before many people arrived because their walking generated following winds and turbulence. I finally figured out that the best time to test my kites was before the mall opened on Sunday mornings. I found a single door that wasn't locked early on Sundays and sneaked in that way. This brought me to the attention of the security guards, who, when I explained to them what I was up to, considered me to be a harmless nut and let me run my tests.

Let's Talk About Wind
Who has seen the wind?
Neither you nor I,
But when the night goes wailing so,
The wind is passing by.

Eugene Fields

If your kite weighs 0.3 oz per square foot and will lift off in 3 mph winds, how much wind would it take to lift off the same kite if it weighed 1.2 oz per foot? (see Fig. 8-1.) The answer is 6 mph. Twice as much wind will lift four times the weight. Why? Well, at 6 mph each air molecule is traveling at 6 mph, so it has twice the energy it would have at 3 mph. At 6 mph, twice as many molecules strike your kite as at 3 mph. So, 2 X 2 = 4. A wind of 6 mph has four times as much energy as one at 3 mph.

Given the above, how much more energy does a 12 mph breeze have as compared to a 3 mph breeze?

Math Time.

My experiments showed that a kite with a sail loading of 0.3 ounces per square foot will fly in a wind of about 3 mph. Figuring the sail area of the diamond kite shown in this book is easy; multiply width X height (in inches) and divide by two, then divide the answer by 144 (the number of inches per square foot). To measure the area of a barn door, again take width times height, then subtract the sum of the areas of the triangular pieces you cut away to give the kite its shape.

Figuring the lifting area of the Horned Allison is a little harder. However, you can get an approximation by calculating the area between the sticks only, then multiplying that by 0.66. However, you may find that the 0.3 ounce loading per square foot rule is inaccurate. Allisons aren't quite as aerodynamically efficient as the diamond or the barn door.

Calculating the lifting area of the VICTORY-series kites is more difficult yet. Start by multiplying width X height of one wing and your answer will be the total area for both wings. Treat this area as if it were one flat kite. Next, calculate the area of one side of the canopy by multiplying its width X height, then subtracting the areas cut away to form the nose and the V in the bottom. Now multiply by 1.41 to get the effective lifting area of the whole canopy, which, when added to the lifting area of the wings, gives you the overall lifting area.

69

A Little Trigonometry Lesson.

Measuring angle of flight requires some sort of clinometer - a gunner's quadrant, theodolite, or other. The clinometer described below is a simplified version of a Gunners Quadrant, an instrument the cannon cockers used to set the elevation angle of cannons on frigates and other men-o-war in the days when Britannia ruled the waves.

To build the clinometer described here, you will need:

1. a 50-cent protractor

2. a coping saw blade (preferably used, dull, and with 15 or more teeth per inch)

3. a 1′ plumb line (consisting of strong thread and a 6-32 nut, split shot fishing sinker, or other small weight)

4. a tube of KIWI or SHOE GOO shoe patch cement

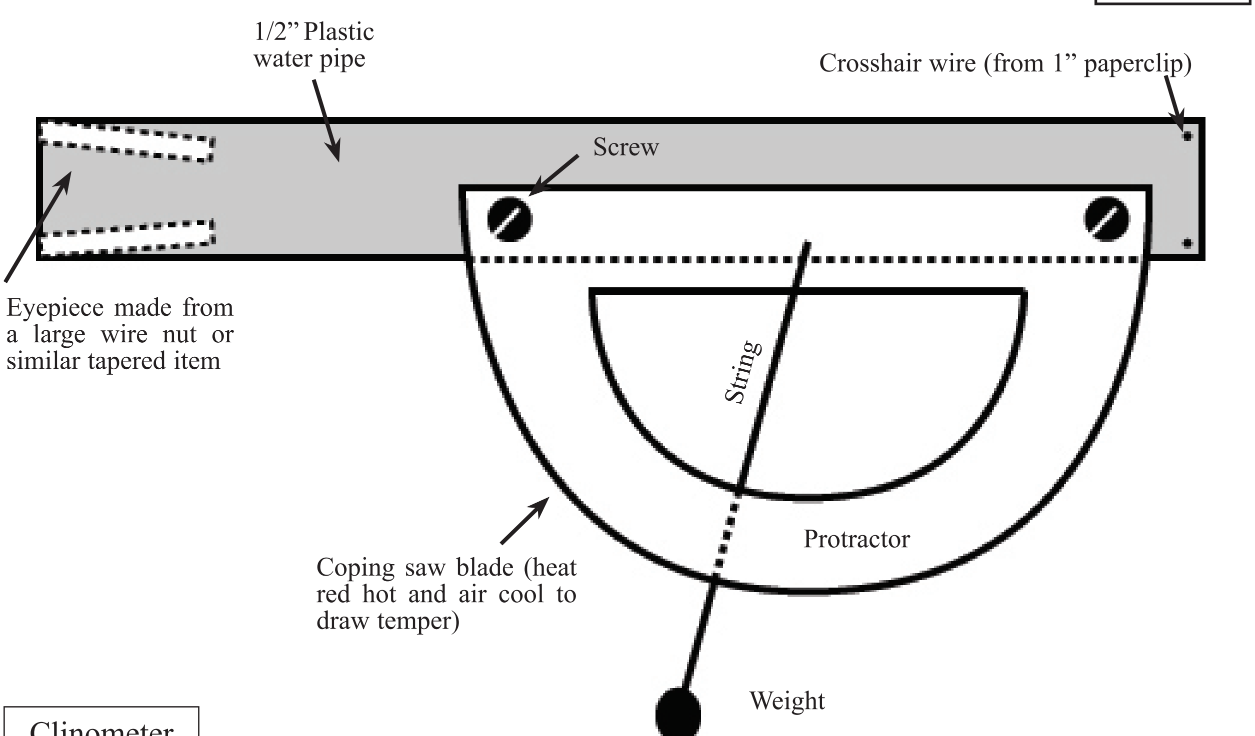
5. a 10″ long piece of 1/2″ or 3/4″ plastic water pipe

6. an eyepiece made from a large wire nut (or similar tapered item) with a 1/4″ diameter hole drilled lengthwise.

7. a 1″ paper clip

Start by breaking off the end of the saw blade right at the first tooth, counting from the end where the teeth are tilted towards the other end (see Fig. 8-2). Remove the small pin from the other end. Put the blade on the stove and heat it red hot to draw the temper; let it cool

Fig 7-3



Clinometer

in the air, don't cool it with water or the blade will be re-tempered.

Drawing the temper removes some of the brittleness and lets you bend the blade into an arc that will fit snugly around at least 90 degrees of the protractor. Hold the blade from the end where the blank piece was broken off and make sure the teeth are on the right hand side and pointing away from you. Start bending the other end down and continue until the arc fits snugly around at least 90 degrees of the protractor.

Once you have the saw blade shaped to the protractor, lash the saw blade to the protractor with heavy thread. Put the blank end of the blade at about the middle of the protractor arc and the end where the teeth start right on the protractor corner. Center the protractor on the blade so that equal amounts of the blade width stick out on the two sides of the protractor. Make sure the lashings keep things in alignment as you apply the shoe patch cement to the protractor and saw blade on the non-toothed side of the saw blade.

While the glue is curing (about 8 hours), prepare the sighting tube from the piece of plastic water pipe. Draw four lines 90 degrees apart straight down the length of the tube. Using a 1/16″ diameter drill, drill two holes 90 degrees apart and straight through the tube about 1/2″ from one end. These holes permit you to put in wire cross hairs (wire from a 1″ paper clip is fine).

When the glue holding the saw blade has cured, glue the protractor to the tube so that the part without the blade is 1″ in from the end with the cross-hair holes. Spread the cement about 1/4″ wide and 6″ long, align the straight part of the protractor and the sight tube so that they are absolutely parallel. When the glue has cured (about 24 hours), drill a 1/16″ hole right through the origin hole at the 3″ mark on the protractor. Glue a 3/16″ section cut from a straight pin (or something similar) into this hole. When the glue has set up a bit, pull out about 1/16″ of the pin so that you will have an anchor for the plumb line.

The next item is the plumb line. Tie overhand loop knots in a piece of kite line or strong thread about 1′ long. Put a larks-head around that pin at the origin point at the middle of the protractor. Attach the split shot or other weight on the line about 6″ from the origin point; if the line is longer than this, the weight will hit you in the face when you try to measure high angles.

Straighten a 1″ paper clip and use the wire to put in the cross hairs, gluing them into the holes. Drill a 1/4″ diameter hole concentric and collinear straight through something that can be used as an eyepiece, such as the cap of a KIWI or SHOE GOO or toothpaste tube, nail polish bottle cap, or large wire nut......whatever. Your clinometer is now finished. Its resolving power is about plus or minus 1/2 degree, but if you use a 32 teeth per inch hacksaw blade instead of the coping saw blade, you can increase the resolution to 1/4 degree.

To use the clinometer, align the kite in the cross hairs, making sure the plumb line is hanging free and not swinging. Once you have the kite in the cross hairs, rotate the clinometer to the left so that the plumb line is trapped between two saw teeth. Continue to rotate the clinometer left another few degrees, holding it at a constant angle as you remove it for reading.

How accurate is your clinometer? Find out what your latitude is, then on a night when the sky is clear, take a reading on the North polar star (Polaris). The 45th parallel is just at the north edge of Salem, Oregon. I live 30 miles north from there. One degree of latitude equals 60 miles, so my clinometer should read 45 or 46 degrees. If, after taking several readings on Polaris you find a consistent error, just remember what the error is and add or subtract it from the readings taken thereafter.

Now that we can measure the angle, how can we possibly calculate the altitude if the line is bowed? Well, how much more line does it take to put 20′ of bow in a 1000′ line? Possibly 3′. So, if you know the length of your line and you have measured your elevation angle carefully, you can use trigonometry to get the altitude.

If you want to prove your work, make two clinometers and give your buddy one to read at exactly the same time you make your reading. Have your buddy stand directly downwind (towards the kite) from you at some measured distance. When you have these three facts (the distance from you to your buddy and the kite elevation angle from each of you) you can graph the problem.

Put a dot on the left end of your baseline on the graph paper to mark your position. Count off the distance along the base line (bottom line) on the graph and mark off the distance from you to your buddy. From the dot representing your position, draw a straight line slanting upwards at the angle that you measured. Next, draw a straight line from your buddy's position and at the angle he measured. Where the two lines cross marks the altitude of the kite. All you have to do now is measure the distance from where the two lines cross straight down to the base line. (you may have to re-scale things a couple of times before you can keep all three positions on the graph). Note that we didn't need to know the length of the kite line.

What other information can be determined from the graph?

1. How far is it from you to the kite?

2. How far is it from your buddy to the kite?

3. How far is it to a point on the ground directly below the kite?

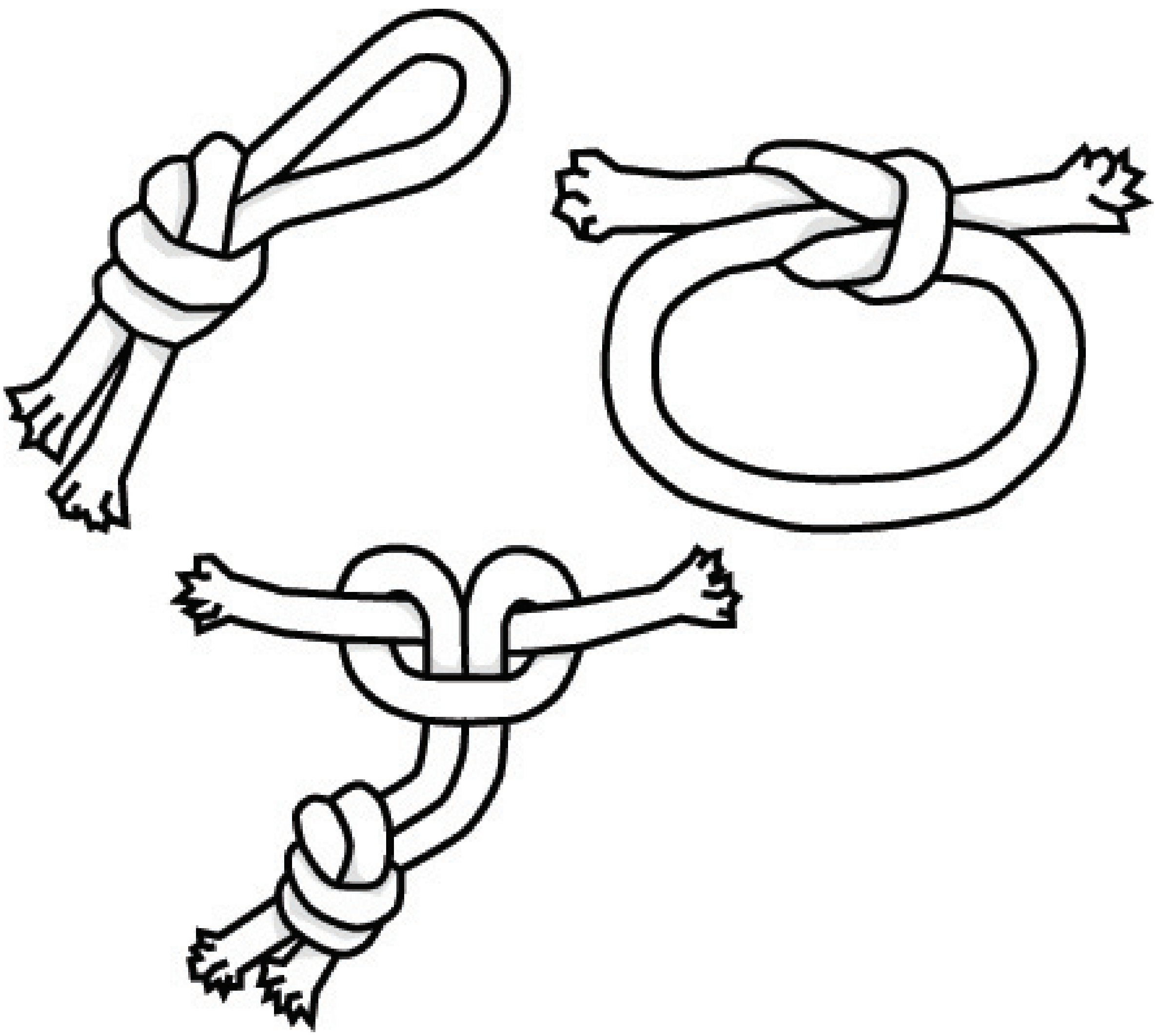
4. Which angles give the greatest accu racy?

Try making up trigonometric equations to get the answers to these questions and solve them with your scientific calculator, slide rule, or trig tables.

See what a powerful tool trigonometry is? Using similar techniques a couple of centuries back, British surveyors determined within a few feet the height of Mt. Everest without being anywhere close to the top. You will need to know your trigonometry when you build that plastic water-pipe cross staff for measuring angles between stars as part of your astronomy class. As a matter of fact, you will need trigonometry in practically all of the solid sciences.

Section Nine

Knots



String is thin
Rope is thicker
Rope is strong
String is quicker

Spike Marline

Knots

Before we get into knots, let's talk about that long skinny stuff we use to tie things together and hopefully hold our kite in the sky.

In the Navy they taught us that there was only one ROPE in the whole Navy; the MAN ROPE. Everything else that was long and round and made of lots of fibers twisted together, or even a long, round, single plastic extrusion, was a LINE, and don't you dare forget it. I have forgotten what a MAN ROPE is, but I remember long, skinny, fibrous things running from the flag bags up to the yard arms; they were called HALYARDS.

Definitions

In this book, the word STRING usually means something relatively small and not very strong, but readily available. Thus the STRING used for bridles and lines on the smaller kites may be crochet THREAD because it looks like STRING instead of THREAD. When attached to the kite tow point, it is called LINE. The STRING that keeps the spar bowed is usually a piece of strong kite LINE or button THREAD.

Websters defines a KNOT as any tie or fastening formed in a flexible CORD and includes bends, hitches, and splices.. etc. The Knot books categorize things you tie into lines as being knots, bends, and hitches. A BEND is a KNOT by which one piece of cordage is fastened to another. So, a fisherman uses a fisherman's KNOT to BEND his broken line back together. Likewise, he uses a fisherman's BEND to KNOT the line to the hook. Now that I have made things perfectly clear, go cut yourself a 2′ long piece of CORD from the venetian blind (or a 2′ piece of binder twine) and we will walk through some KNOTS; or perhaps some new variations of Cat's Cradle.

A word of caution about knots: Most weaken the line into which they are tied. Some modern synthetic lines, such as Kevlar, are so tough that they are difficult to cut unless your blade is really sharp. However, an overhand knot that sneaks unnoticed into a 30-lb. test line promptly reduces its breaking strength to 12 lbs. The line will cut cleanly right through itself at the knot the first time you put a heavy strain on the line. Thus, you want to wrap things up neatly and secure the end of your flying line when you finish flying lest an unnoticed overhand knot sneaks into it.

Getting Acquainted

Count the knots on page...How many do you see? Are you sure?

The knot that turns a bight of line into an overhand loop is still an overhand knot. Take a piece of line and take a turn around your finger and tie a half-

A Bight of Line

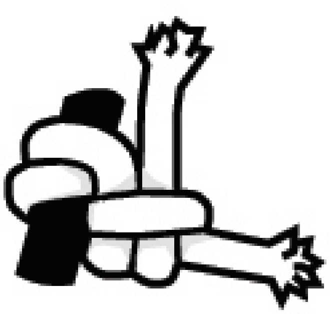
An Overhand Knot

An Overhand Loop Knot on a Bight of Line

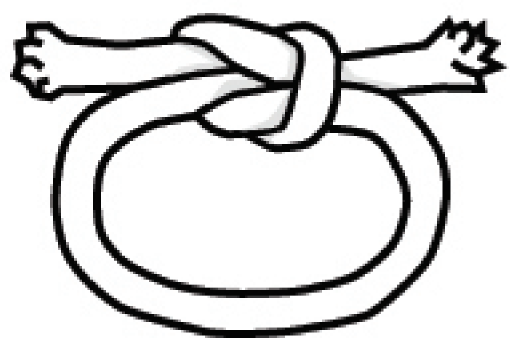
A Turn and a Half Hitch

A Round Turn and a Half Hitch

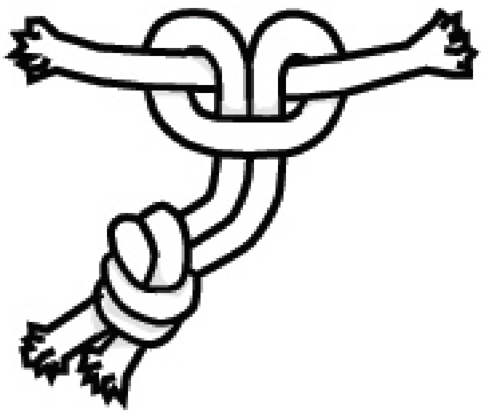
Bowline



A Round Turn and Two Half Hitches

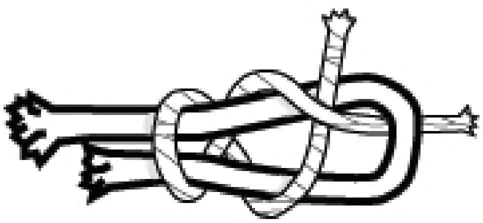


A Square Knot (AKA Reef Knot)

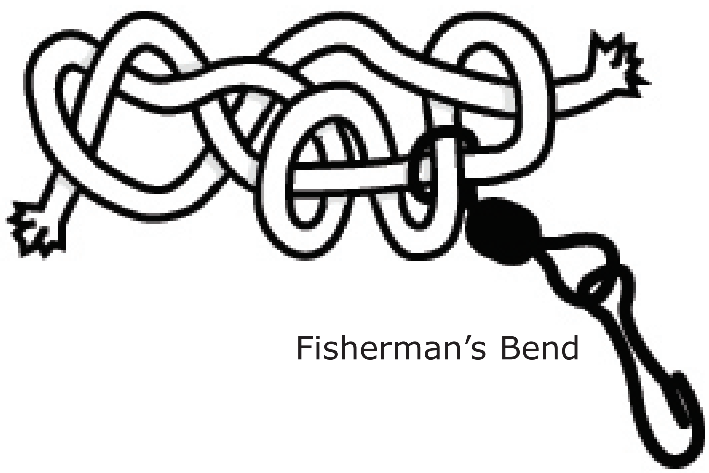


A Larks-Head Around a Line

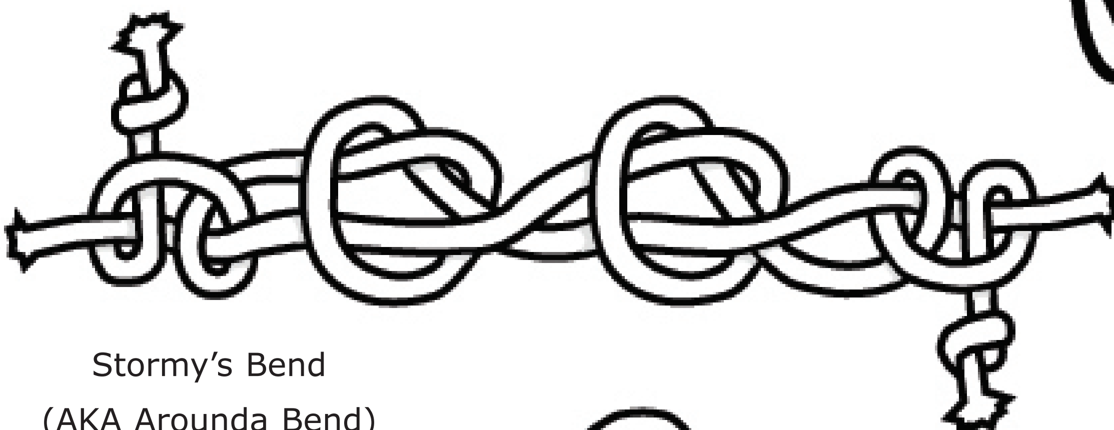
A Larks-Head Through a Ring



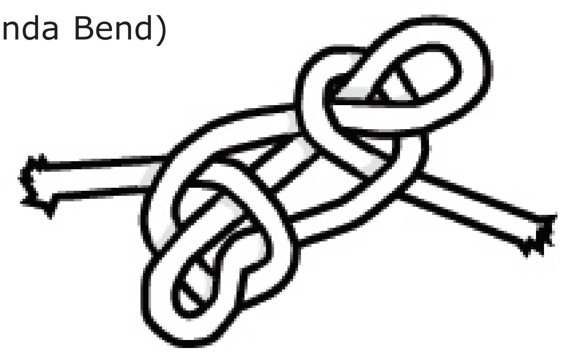
A Single Beckett Bend



Fisherman's Bend



Stormy's Bend
(AKA Arounda Bend)



Sheep Shank

hitch, the same as shown in "Turn and a half-hitch". Slip the string from your finger and pull on the two ends. What do you have now? Another overhand knot. Now wrap the string completely around your finger and again tie a half-hitch as shown in "Round Turn and a half-hitch". Again slip the string from your finger and pull on the two ends. Another overhand knot.

The bowline knot is about 65% as strong as the line into which it is tied. It grips most line very securely and is easy to untie once the strain is removed. With synthetic lines, the knot may slip under extreme loads, so it is recommended that the working end be secured with a half-hitch.

This is a bight in the end of a line. Slip the free end through the loop and it becomes a slip knot. This is an overhand knot. This is a half-hitch in a piece tied in the bight of a line. of line wrapped around your Good for putting a loop in finger. Remove your finger at the end of a line. and pull on the two ends of the line (see overhand knot).

Wrap the loop around another This is a square knot. Pull points piece of line, then put other end a and b apart and change it to of the looped line through the loop. a larks-head on a piece of line.

Pull the line tight to make a larks-head knot.

With the exception of the fisherman's bend and the arounda bend, knots add a weak point into the line. This weak point can vary from around 40% up to about 65% for a bowline. The fisherman's bend and the arounda bend (when tied as shown) showed no reduction in line strength. Six tests were run, and only once did the line break at the bend.

Knotting Monofilament Line

Most kitefliers look down upon those of us who use monofilament fishing line for kite line. Monofilament resists abrasion and it is a lot less likely to become electrically conductive when dunked in water a few times. But, in spite of the fact some manufacturers tout their line as being extra limp, all brands are about as limp as spring steel wire and it is hard to tie non-slipping knots into it.

If you use monofilament to attach to bridle loops, spines, spars, longerons, etc., use two round turns and two half-hitches, then tie an overhand knot as a stopper on the working end. To BEND two monofilament lines together, lay the lines parallel with the working ends pointing in opposite directions. Take one of the working ends and tie two half hitches around the other line, and outside the half hitches, tie an overhand stopper knot. Now do the same thing with the other working end. Pull everything tight and you will find that those half hitches will grip very tightly without cutting through the line itself. Properly tied, this knot appears to be as strong as the rated strength of the monofilament.

Polymorphic Knots

Dan Kurahashi, a Canadian Isei from British Columbia, makes some of the most beautiful kite trains I have ever seen. He also builds many other kites, including some 3" bird kites that fly very stably and at a very high angle. I once asked Dan what sort of knots he used in his kites. The hint of a smile came on his face and he replied: "I use a round turn and two half-hitches, that is the only knot I use." The slight smile tipped me off that maybe he wasn't telling the whole story, and then it hit me, he knew all about the polymorphic knot. Polymorphic means that the thing you are talking about can assume many shapes (e.g., the Allison polymorphic kite).

Many people are aware that the larks-head is merely a spilled square knot; so is a turn and two half hitches. To illustrate, do this: Take that piece of venetian blind cord, wrap it twice around your finger, and secure it with two half hitches as shown in Fig. 9-... Remove the cord from your finger and shake out the round turn. Grasp the two lines that come through the crossed-over piece and pull on them. You now have a larks-head (see Fig....). Grasp the two lines coming from the larks head in your right hand. Take the two sides of the line that pass through the loops in the larks head in your left hand, pinch them together, and pull them moderately tight. Now take your right thumb nail and push that crossed-over piece onto the two lines in your left hand. Pull everything tight and you will see a beautiful square knot (see Fig....).

To convert the square knot back to a larks-head, grasp both of the lines coming from one side of the square knot and pull them apart. This spills the square knot back into a larks-head. Take the piece of line that the larks-head slides on, put some slack in the loop, and wrap the line in the loop around your finger twice. Now pull on the line that slips and pull the larks-head snug up to your finger. You are back to where you started, a round turn and two half-hitches and you haven't untied a thing. Are there any more forms the polymorphic knot can take? I don't know. Maybe Dan does.

Knots For Synthetic Lines

Putting any old time knot in modern synthetic line (such as Kevlar) is not recommended. An overhand knot tied anywhere in the line, whether you deliberately tie it or it creeps in by itself, results in a 30 lb. test line that now has a breaking strength of 12 lbs. An overhand knot will cut right through itself the moment 50% of the rated strain is applied.

Synthetic line is so slick that bowlines, Beckett bends, etc. will slip apart under strain. Bowlines, if they don't slip, break at about 65% of the rated strength of the line. Stunt kite fliers either use knotless splices or sleeve the line before they tie knots in it. Where can you buy kite line sleeving? Where can you find the tools and time to make knotless splices? These are tough questions, so let's play around with tying some knots in a piece of line and see if we can find some alternatives by combining some of the knots already described.

Let's start with a fisherman's knot in synthetic line. As generally tied, it slips apart when strain is applied, so let's back up the fishermans knot by tying two half-hitches on each side of the fisherman's knot. Tie one of the half-hitches one direction around the standing line and tie the other one around the other direction so that the half-hitches face each other. The two half-hitches now look much like a larks-head tied on a line right next to the fisherman's knot. Watch those half-hitches closely as you tie them; they are sneaky little devils and will turn into overhand knots if you let them. Once you have a larks-head on each side of the fisherman's knot, tie an overhand knot in both of the working ends as stopper knots. Tighten the knot by pulling on both sides of it until all parts of the knot are obviously tight. It works. Six tests were run and only once did the line break at the knot. So now we can use a relatively simple 30 lb.-test knot to BEND (splice) two 30 lb.-test lines together.

We also need a strong knot to tie a snap swivel onto the kite end of the flying line. This one is even simpler. With the working end of the line, make two round turns (three passes through) the eye of the snap swivel. Pass the working end of the line around the standing end four or five times, then thread the working end of the line back through one of the round turns that you put in the eye. Pull everything tight. Again I found that this knot has as much breaking strength as the line itself. However, the first snap swivel I used was too small and it literally exploded when strain was applied.

There is one more knot that I want to cover: the sheepshank. This knot has very little application in kiting (or in TV watching either, for that matter), but in the everyday world, you will find many times when knowing how to tie this knot will save a lot of time and grief trying to untie a jammed knot. Since this book is for home schoolers, for goodness sake teach the sheepshank to your children. The advantages of the knot are as follows: (1) It doesn't jam no matter how much strain is put on it; a few shakes on the line will shake it right out. (2) It provides two loops and can be used to shorten the line if it is longer than necessary. (3) By anchoring the standing end of the line around something you want to move, then passing the working end around a firm anchor and then back through the first loop in the sheepshank, you now have a reasonable substitute for a block and tackle. As a matter of fact, this arrangement doubles your pulling power, enabling you to lift a 100 lb. load with a 50 lb. pull (I know why; can you figure it out?).

BOWSTRING TENSION LOCKS (see illustration on page.....).

Since the bowstring puts a lot of pressure on the spar sockets, the tape or glue holding the sockets to the sail will sometimes creep. Another thing that sometimes happens is that the spar will actually force its way through the strapping tape that seals the outer ends of the spar sockets. Also, you probably want to store your kite flat or with the sail rolled around the spar or spine.

Whatever your reason for letting the bow out of the spar by loosening the bowstring, it is nice to have some easy means of locking the bowstring in position when it is time to re-bow the spar. Now let's take the illustrations one by one.

In Fig3-3A, an overhand loop knot is tied approximately where the tight bowstring will pass over the spar, about halfway between the bowstring anchor and the loop on the other end of the spar. Merely run the bowstring across the kite, thread it through the loop on the end of the spar, then back through the overhand loop knot. Pull the working end of the string until the spar is bowed the proper amount. Pinch the loop knot and the working end tightly together to hold the bow in the spar, then tie a half-hitch on a bight of string around the standing part of the bowstring. Pull the bight through the half hitch and let it slip between your finger and your thumb until it is snug up against the loop knot. That's all. Now when it comes time to release the tension on the bowstring, merely pull on the working end of the bight of string sticking out from the half-hitch. Just like tying a simple knot (single bow) in your shoelace.

There are can be problems with the above method. First, holding the loop knot and the working end together so that they don't slip takes a little practice. Secondly, if the working end of the string is inadvertently pulled, the knot becomes untied. Let's look at some other possibilities.

Figure 3-3B shows a tension lock made from a rather sturdy, oval shaped, red and white coffee stirrer that I picked up in a donut shop (Winchells). I haven't seen anything like them anywhere else, but possibly other establishments use the same design. To make this one, thread your bowstring through a needle after you have tied it to your bowstring anchor. Force the needle through the side of the stirrer about 1/4” from the end, then out the nearest open end, across to and through that loop at the spar end, then back through both sides of the soda straw about 1/2” from where you poked the bowstring through the first time. Now, with the free end of the stirrer pointing towards the bowstring anchor, pull the stirrer along the string until the spar is bowed the right amount. Play with the position of the stirrer on the bowstring until you have the stirrer approximately centered. Now swing the stirrer until it points in the direction of the loop on the other end of the spar and tie the bowstring firmly to the stirrer. All you have to remember is that you lean the stirrer towards the loop when you want to lock the tension and lean it towards the anchor when you want unlock it. You always want to unlock it as you pull the bow into the spar. The big problem with this tension lock is that if the bow is too large and stiff, the bowstring cuts right through the plastic, but read on.

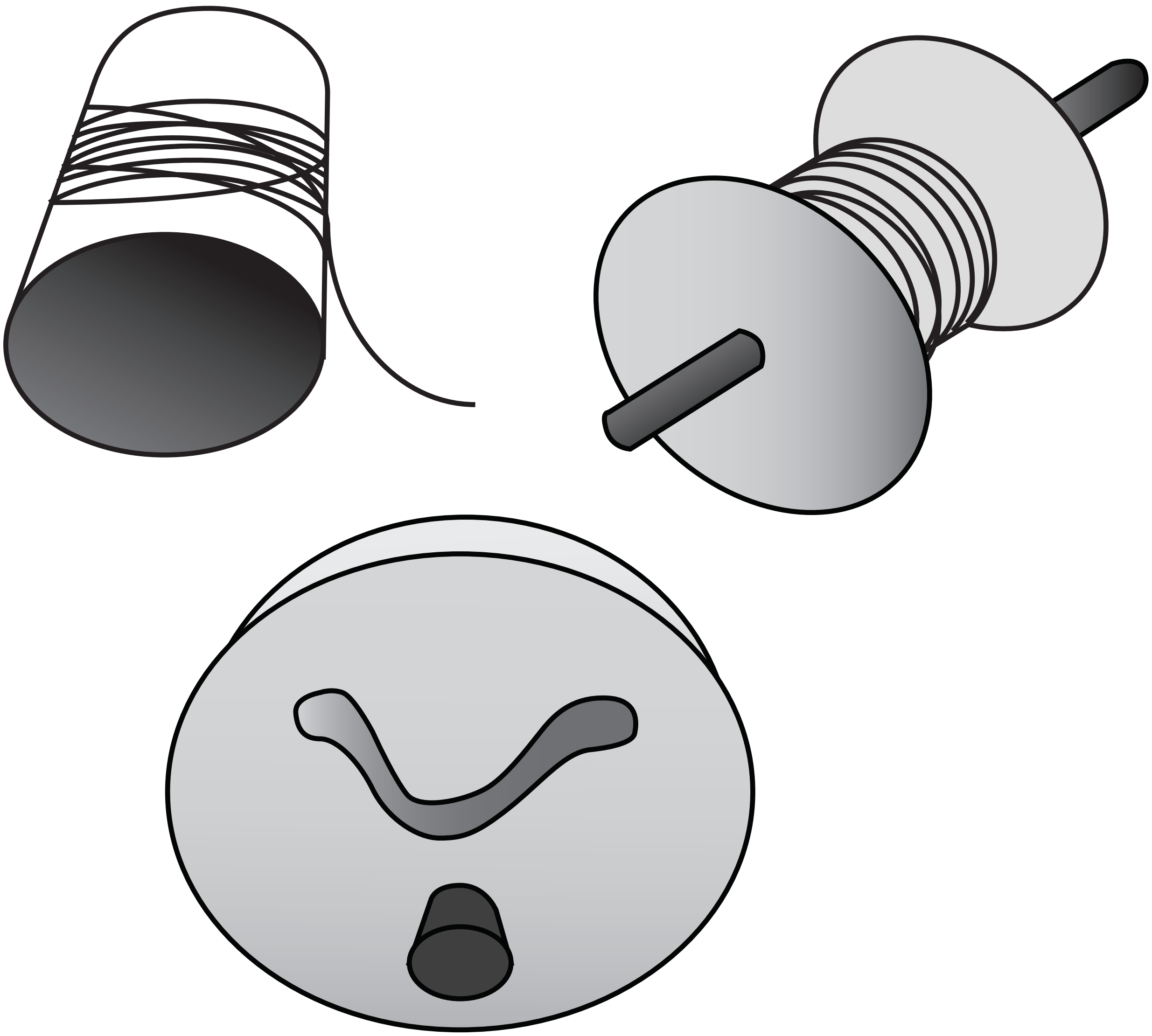
A sturdier version could be made from a piece of 1/8” X 1 1/4” metal tubing cut from a telescoping antenna taken from a junk radio, rabbit ears, or cordless phone base. Save the tubing you have left; you may want to make spar couplings from it later.

Fig 3-3C is essentially the same as Fig 3-3B, but in this case the tension lock is made from the wire from a 1” paper clip. Straighten two paper clips. Using one of the paper clips as a mandrel, coil the other paper clip tightly about the mandrel for four or five turns, each turn snug up against its neighbor. Cut off the coiled paper clip about 1” from the end of the coil on one side and flush up against the coil on the other. Bend an eye in the end of the straight section and rig things as shown. For really big kites with a lot of strain on the bowstring, use a 2” paper clip, and if that isn’t strong enough, go to the sporting goods store and buy a really monstrous version.. they are used to lock the tension into tent guy lines.

Fig 3-3D is a 4-hole shirt button with the bowstring from the anchor running through two adjacent holes, thence to the loop on the end of the spar, then back to one of the empty holes. You will have to play with sliding the button back and forth for a short while, but eventually you can secure the working end of the bowstring to the button with a couple of half-hitches. This lock is harder to adjust than the locks in Fig3-3B and 3-3C.

Section Ten

Winders and Reels



And though I know that we are bound,
you to my hand, I to the ground...

from *SYMBIOSIS* by H.B. Alexander

Winders and Reels

Introduction

When Neil Thorburn (author of the SUPER KITES books) gets his hands on a Volkswagen Beetle engine, he takes it into the machine shop and when he finishes with it, he has a kite winch that could probably be used to raise the Titanic. Neil also haunts the trash bins of plant, tree, and shrub nurseries and gloms onto all their discarded bamboo stakes, which he uses to make kite sticks. His stapled-together plastic grocery-bag kites are wild and wonderful and fly very well indeed. When it comes to being a scrounger/innovator, he has me beat hands down.

Neil sometimes shows up at kite festivals and AKA conventions. You will know when he is present, because if you stray within 100 yards of him, clods of conversation start landing about you. Talking to him is easy; the only words you have to know are uhhuh, yeahbut, surebut, and WOW! Neil generously insists on providing all the rest. But listen carefully, he has an awful lot of good, solid information to impart.

Tin Can Winders

Tin cans beat the heck out of sticks or other small-diameter winders. (I generally use 15 oz. to 20 oz. cans at kid kite classes.) Cut both ends out and remove

Fig 10-1

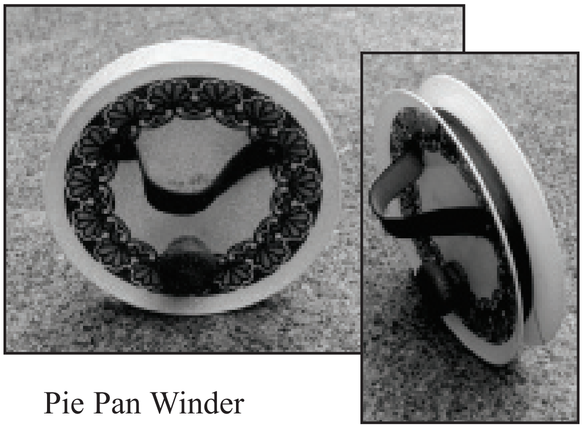
TIn Can Winders

any sharp points or burrs the opener leaves behind. Remove the label. On one end stick a strip of masking tape that has the words "Wind/unwind from this end" written on it. Tie an overhand loop knot in the end of your kite line, form it into a larks-head, and tighten the larks-head around the can. Now wind on the line.

Hand winding kite line onto any sort of line holder puts twist into the line, and this is one of the reasons you should look for something other than a stick or a small diameter spool. If you wind in from one direction, then reverse the ends of the winder, you put more twist in the line when you let it out. This is the reason for marking the end you use to let out/wind in from. To sum up, if you want to keep twists and snarls out of your kite line, use a fairly large diameter winder and always wind and unwind from the same end.

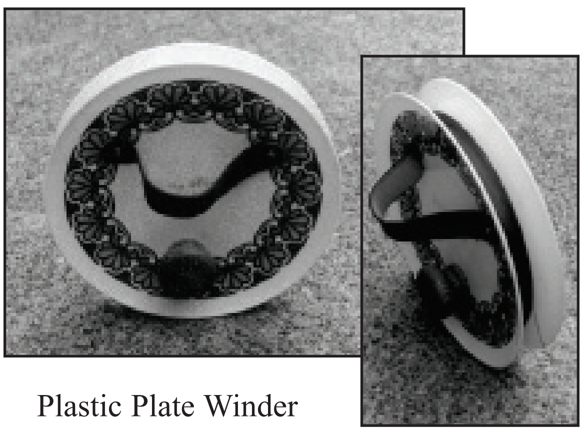
Plastic Or Metal Pie Plate Winders

Fig 10-2



Pie Pan Winder

Fig 10-3



Plastic Plate Winder

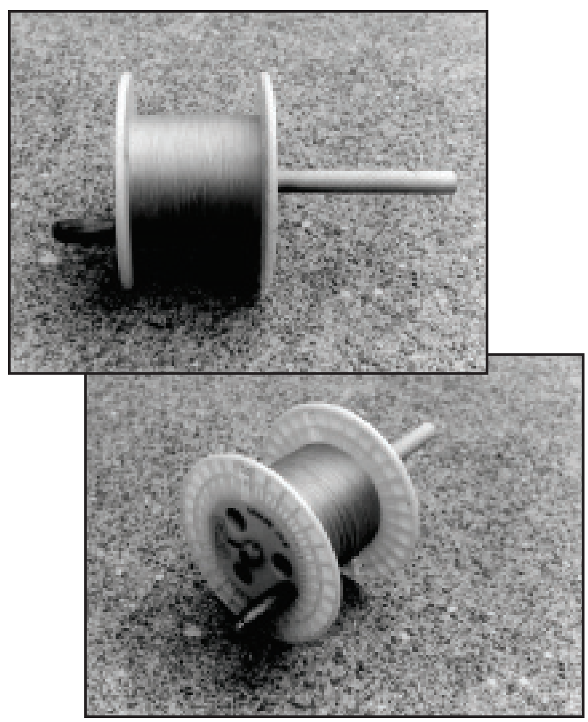
Figures 10-2 and 10-3 show three line holders/winders. One of them is made from two tin-plated steel pie pans that I picked up in a thrift store. After bolting the pans together, I fitted the assembly with a leather wrist strap and a wooden drawer pull knob to hold onto. A second holder/winder was made from two tough plastic dinner plates bolted together and fitted with a leather wrist strap and holding knob.

The holders/winders hold about 1/2 mile of 30 lb. test Kevlar line. Their 8″ to 9″ diameter winding area takes in about 2′ of line per turn, so their retrieval speed is rather good. The only thing that bothers me is that the pull as felt by the kite is not constant; the kite nods vigorously as you pull it in. Letting out is easy; put on your gloves and spill the line over the side. This, of course, puts twist in the line, but the twist will be removed when you wind back in.

Reels From Wire Spools

In days past, copper wire used for winding transformers, motors, etc. came from the wire factories wrapped on sturdy wooden spools that made excellent kite reels. Today the wire is wound on

Fig 10-4



Wire Spool Winders

plastic spools, which are smoother than wooden spools, but probably not as durable.

The smaller of the reels (shown in Fig. 10-4), is made from a 5″ diameter plastic spool that has been equipped with a winding knob made from a wire nut. Wire nuts are also used for bearing cones that have been drilled to take the shank of a longish screwdriver that serves as the axle and holding handle. These wire nut cum/bearing cones adapt the 1/4″ diameter of the screwdriver shank to the 5/8″ diameter hole at the spool axis.

The offset-handle reels shown are made from rugged 6″ wire spools. The wooden frame one with the snap-on handle holds 500′ of 300 lb. test line. It is equipped with both a winding knob for rapid retrieval and a snap on crank for additional leverage when pulling in the big ones (this is the one I use to fly my 10′ X 18′ WINGED VICTORY). The other reel uses a paint roller for a handle and is equipped with a swinging line guide to keep the line from rim hopping.

Other Types Of Line Holders/Winders

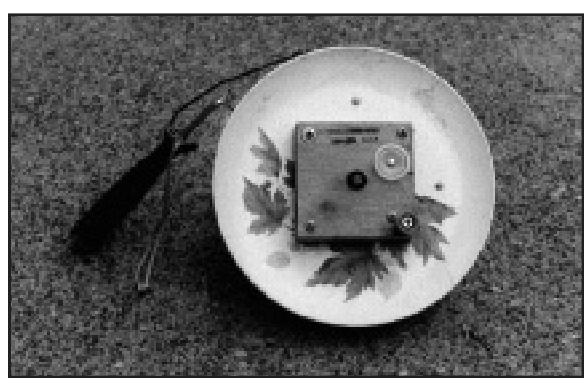
If nothing else is available, you can store your line on an 18″ X 4″ X 3/4″ board with notches cut in the ends. You can buy fancy versions of this in the kite stores at prices ranging from reasonable to awful. For hauling in big kites, it is suggested that you build one from a 2″ X 4″ X 24″ that is notched on the ends. For handles, drill 3/4″ holes close to the ends on the narrow dimension (2″), one hole on one side, the other on the other. Glue 8″ lengths of 3/4″ dowels into the holes for handles. This type of winder/holder permits the user to utilize his own strength to the fullest.

Design Considerations

My latest reels (Fig. 10-5) are made from 9″ plastic plates mounted on a frame made from a much-distorted paint roller handle. It was absolutely necessary to put on a line guide to keep the line from rim hopping. When filled with 30-lb. Kevlar line wound in under considerable tension, the hard plastic plates (such as Rubbermaid) crack because the winding area is V shaped.

Your reel should have smooth rims about 1 1/2″ high and the bottom of the winding area should be straight across rather than V shaped. Instead of using

Fig 10-5



Winders

plastic plates for flanges, tin-plated steel pie pans are suggested. Use a 3/4″ plywood disc as a spacer between the pans. This would give enough winding area to hold hundreds of feet of line, yet most of the tension would be on that plywood core.

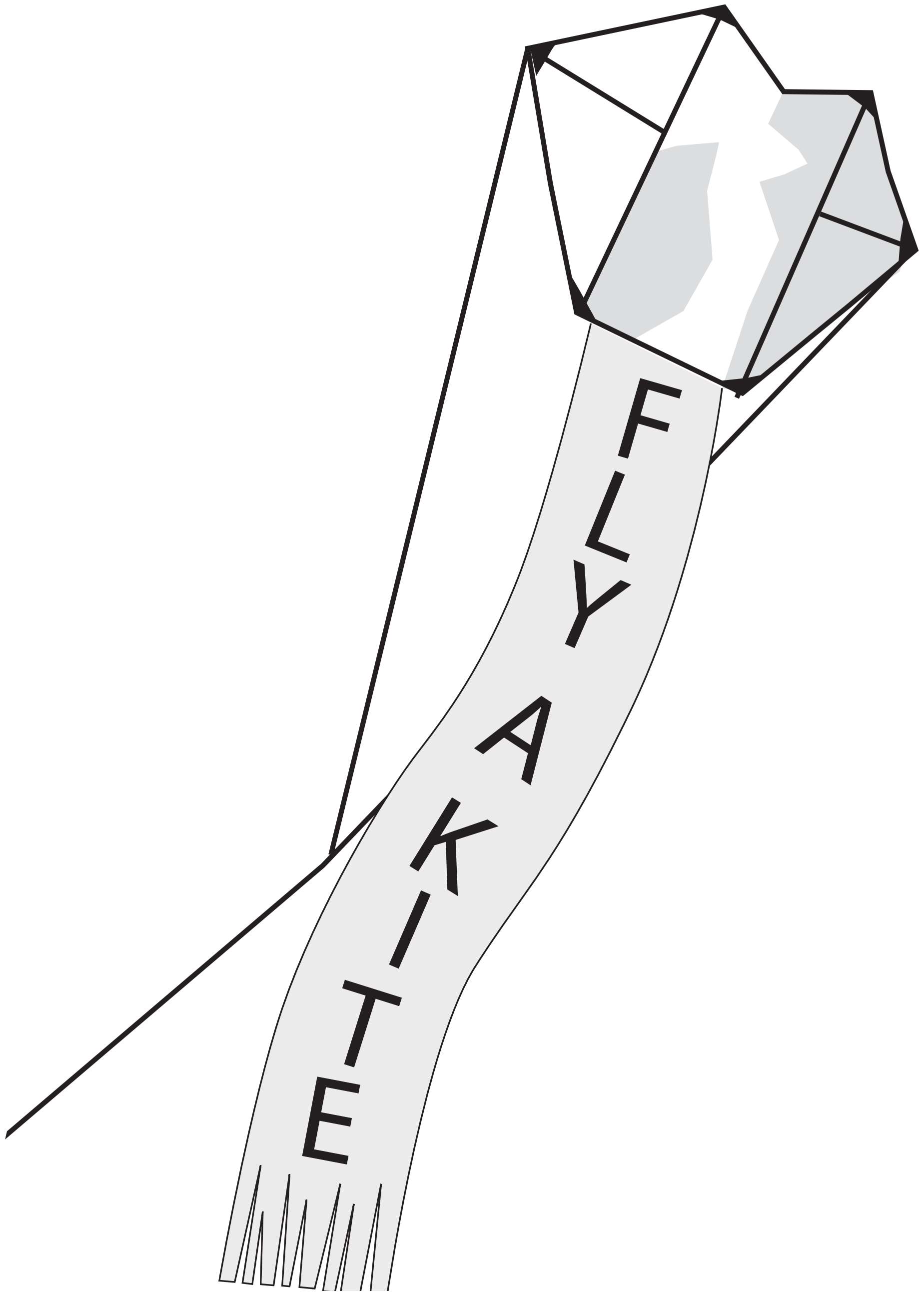
Since sloping rims are a source of trouble when the line is wound in under tension, you could make straight-sided flanges by using 10″ discs cut from 1/4″ marine plywood. Instead of using a solid core, you could use 1/2″ wooden dowels glued into holes spaced about 2″ apart in a 7″ diameter circle concentric with the discs. For a handle, you can strip the cage from an inexpensive paint roller and bend the paint roller frame so that you can use it as an axle and hand-hold. A line guide made from coat-hanger wire is suggested.

Now, after all that, let's take another look at a tin can. Cut both ends from a 46 oz juice can. Remove any burrs left by the can opener. Cut a 4″ length of 1″ diameter dowel. If 1″ dowel is not readily available, use a section of old wooden broom handle or a section cut from a tree branch (as I did). Put the dowel inside the can about 1 1/2″ from one end, reaching from side to side of the can. Using a couple of #4 nails or big-headed roofing nails, nail the wooden handle into place. Cover the nail heads with a bit of duct tape so that they don't snag your line.

To use this winder, slip your hand through the can and grasp the wooden handle inside. There is no need to mark the wind/unwind end unless you happen to be some kind of contortionist. Winding line on the can takes in a foot or slightly more per wrap, which gives you quite a good retrieval speed. Don't be self conscious about using this winder; it works a lot better than most of the small plastic imported ones and it is built from re-cycled materials.

Section Eleven

Sky Advertising



Uniformity in time, space, or color, is tantamount to non-existence; only changes and contrasts stimulate the mind.

from an old geology book

Sky Advertising

Kite And Banner System

While any stable-flying kite can be used to lift a banner, the Allison Polymorphic kites are probably the easiest to build. Tying a banner horizontally between the bridle strings makes these kites extremely stable flyers. I have used a scaled-up Horned Allison (see Section 2) and a 10′ STAR VICTORY. While the STAR VICTORY towing a banner is quite an attention getter, you really don't need that much kite. The kite needs only enough lift to get the leading edge of the banner off the ground and enough stability to keep the banner flying steadily. The banner described below provides its own lift.

Building The Kite

Scale up the dimensions of the Horned Allison kite described in Section 2. When you have finished the kite and have balanced the bridle, take two #5 metal split rings out of your fishing tackle box and use a larks-head knot (see Section 9) to attach one each halfway between the bridle tow point and the bridle loop in each bridle leg. These split rings are the tow points for the banner.

Building The Banner

By building your banner out of clear Visqueen or other clear plastic of 4 mil or less thickness, the banner will pretty well lift its own weight if it has a kite to keep the front end up. However, 3′ wide banners are hard to roll up if they are long enough to hold the twenty four letters

Kite Materials:

• One 2'9" X 3'8" or larger trash bag (e.g. GLAD Sheer Strength Lawn Bag)

• One roll of 1" wide masking tape

• One roll of STRAPPING tape that you can split into 1/4" widths (filament tape won't split)

• One dozen 1/4" diameter soda straws.

• One 300' or longer spool of 30 lb. test braided kite line or fishing line.

• Two 3/16" x 4' wooden dowels (inspect them carefully before buying to pick those with as straight grain as possible; many manufacturers make dowels out of wood that isn't fit for anything else).

Costs: About $10.00 for the first one if you don't already have any of the required materials, $0.75 apiece for the next 50 kites (line extra).

Other Items Needed

• Work table, 3'10" long or larger and some sharp scissors.

Banner Materials:

- 18” wide clear plastic (Visqueen clear polyethylene suggested) or your choice of other materials.
- Colored or black plastic for the letters...1.5 mil thick or less (garbage bag material).
- 1/8” dowels for stiffeners, you will need one every three feet along the banner, plus an 18” length between the tow points on the kite.
- 1 roll duct tape, preferably 3/4 wide if you can find it.

Costs: less than $10.00

Other items required

- Work table, covered with several layers of newspaper or a layer of cardboard.
- Scissors
- Miniature glue gun (e.g. Parker model GR 30 k)
- Clothes iron
- 1 roll of wax paper
- Duct tape (or Duck tape)

in “PARENTS WITHOUT PARTNERS” and a telephone number. So, settle for an 18″ wide banner and fly it about 300′ high maximum.

Construction

1. Cut your letters out of the colored plastic. It is suggested that the letters run vertically from the leading edge of the banner, that way you always read from the kite down. If a letter is used more than once, draw out the letter on one layer of plastic, then slip extra layers for each additional letter desired under the outline. Plug in the glue gun, and when it is hot, lay wax paper over the letter and spot-weld the layers of plastic together outside the cutting lines of the letter. If you are only cutting two identical letters, it is OK to tap the glue gun within the letter outlines three or four times, but when it comes time to separate the two, there will be tiny holes where you put the spot-welds.

2. Position the letters one at a time on the banner material. Place wax paper over them and spot-weld them in place. Set the clothes iron for low heat and fuse the letters to the banner.

3. When you have finished the banner, tape a stiffener across the leading edge of the banner, covering the full length of the stiffener in one fell swoop. Tape a 3/4″ X 2″ piece of duct tape over the ends of the stiffener so that the tape is equally divided front and back. Put stiffeners every 3′ along the banner’s length, on the back side of the banner.

4. Leave about 6′ of unlettered banner without stiffeners at the end of your message. Put slits in this section about 3 inches apart and various lengths running from the end of the banner towards the kite. The resulting ribbons do a lot of flapping in the wind and act as a drogue to keep the banner taut.

FLYING THE KITE AND BANNER

WARNING! NEVER FLY WHERE THERE IS A POSSIBILITY OF YOUR KITE OR BANNER GETTING INTO POWER LINES! NEVER FLY WHEN THERE IS A THUNDERSTORM IN HEARING DISTANCE! Further, don't fly across roadways where a cyclist might pass or where your line might possibly snag on a moving vehicle with disastrous results to your hands or the hands of the vehicle occupants if they try to clear the line while the vehicle is moving. Don't climb trees or other high objects on which you might entangle your kite or banner. Kites and banners are inexpensive; doctor bills and funerals aren't. Be a responsible flier.

With the above conditions observed, you can fly from beaches, parks, open meadows, athletic fields and (if permission of the owner is obtained) from unoccupied areas in parking lots. Since you are advertising, you want to fly where many people will see your banner, but fly safely.

Rigging up.

Tie a 5′ length of kite line to each end of the banner leading edge stiffener. Put snap swivels on each end of the two lines so that you can easily connect/disconnect the banner from those split rings in the kite bridle legs. Attach your flying line to the towing loop at the center of the bridle and you are ready to fly. Pay out about 20 feet of line and have someone hold the line or tie it to some heavy object. Launch your kite into the air. When you see that everything appears "GO", let out more line until kite and banner reach the desired altitude.

Kite Arches System

This system requires that the letters and spaces be printed or sewn onto the individual kites in the arch. Kites in arches do not use a spar, the kites are kept laterally extended by sewing the kite line directly across the spar line from side to side, thus the kite line itself serves as the spar. A bit of space is left between the kites. The big advantage of arches is that the construction process can be divided into parts and parts assigned to different members of the arch building team.

The kite line itself is anchored at each end; thus the longer the banner and the larger the individual kites, the stronger the kite line must be. Larger diameter lines are easier to sew to the kites on a sewing machine, so a good minimum size would be a roll of 100 lb. test nylon seine line available in the housewares departments of most large grocery stores.

Two types of kites are normally used in arches; flat diamonds and flat 5-pointed stars.

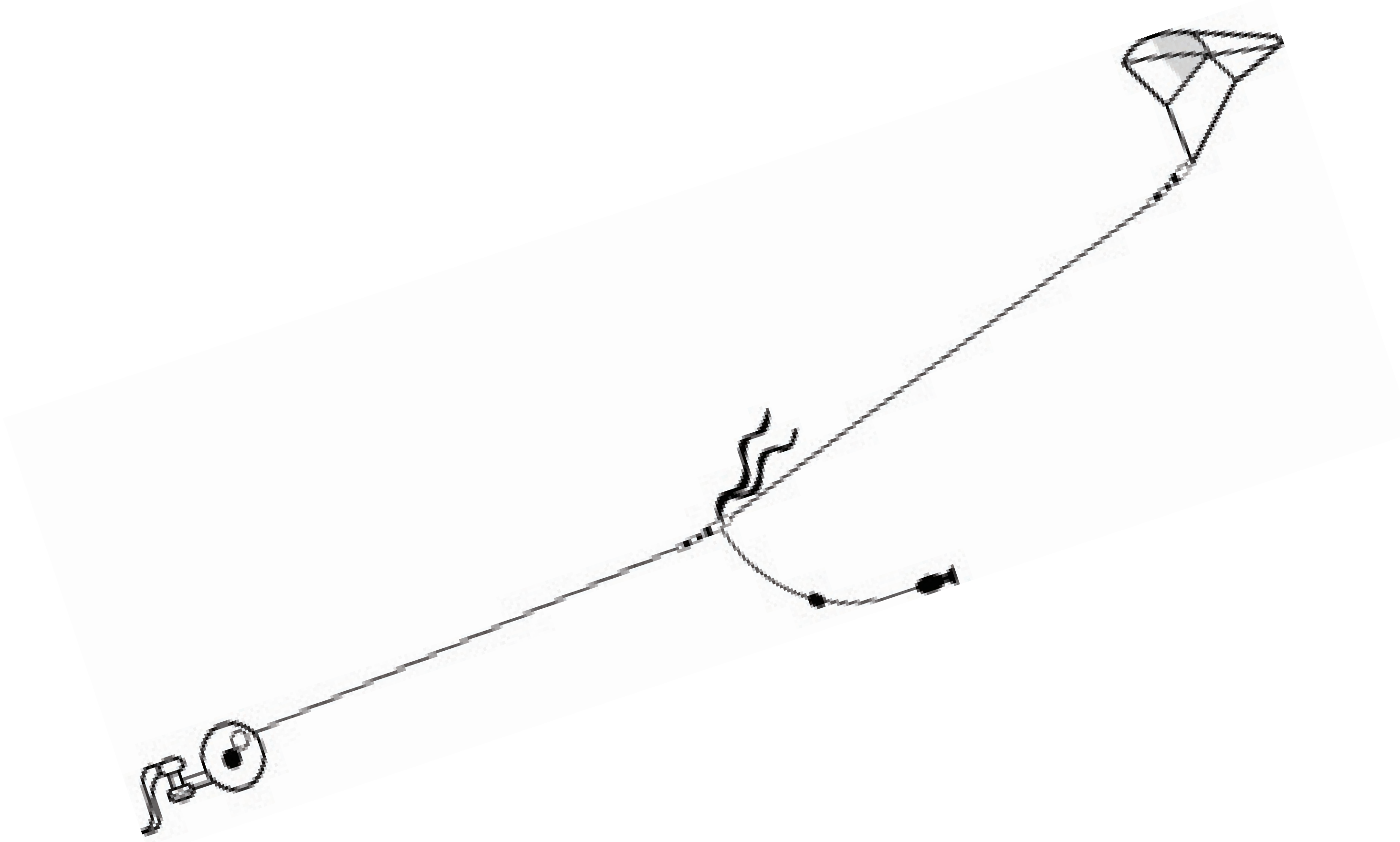
The diamonds are a little different than those described in Section 3 in that they are 24” X 24” with the spar line 5” down from the nose of the kite. The tails are 5’ X 2” streamers.

The 5-pointed stars are also flat kites. Two sticks are used, one from each of the two bottom points up to the top point. Pockets are sewn into the points to receive the sticks. The sticks can be bamboo skewer sticks, 1/8” wooden dowels, etc. Again, the kite line is sewn straight across the kite between the two side points. Streamers (5’ X 1-2”) are sewn to each of the bottom two points.

Flying the arches usually requires two (or more) people, one person to hold the outermost end of the line and one to hold the innermost end of the line and unload the kites from the box.

Section Twelve

Kite Fishing



A man kneels near a coral reef,
his kite a pliant breadfruit leaf....

from *Apologia* by Neil Thorburn

Kite Fishing

Background

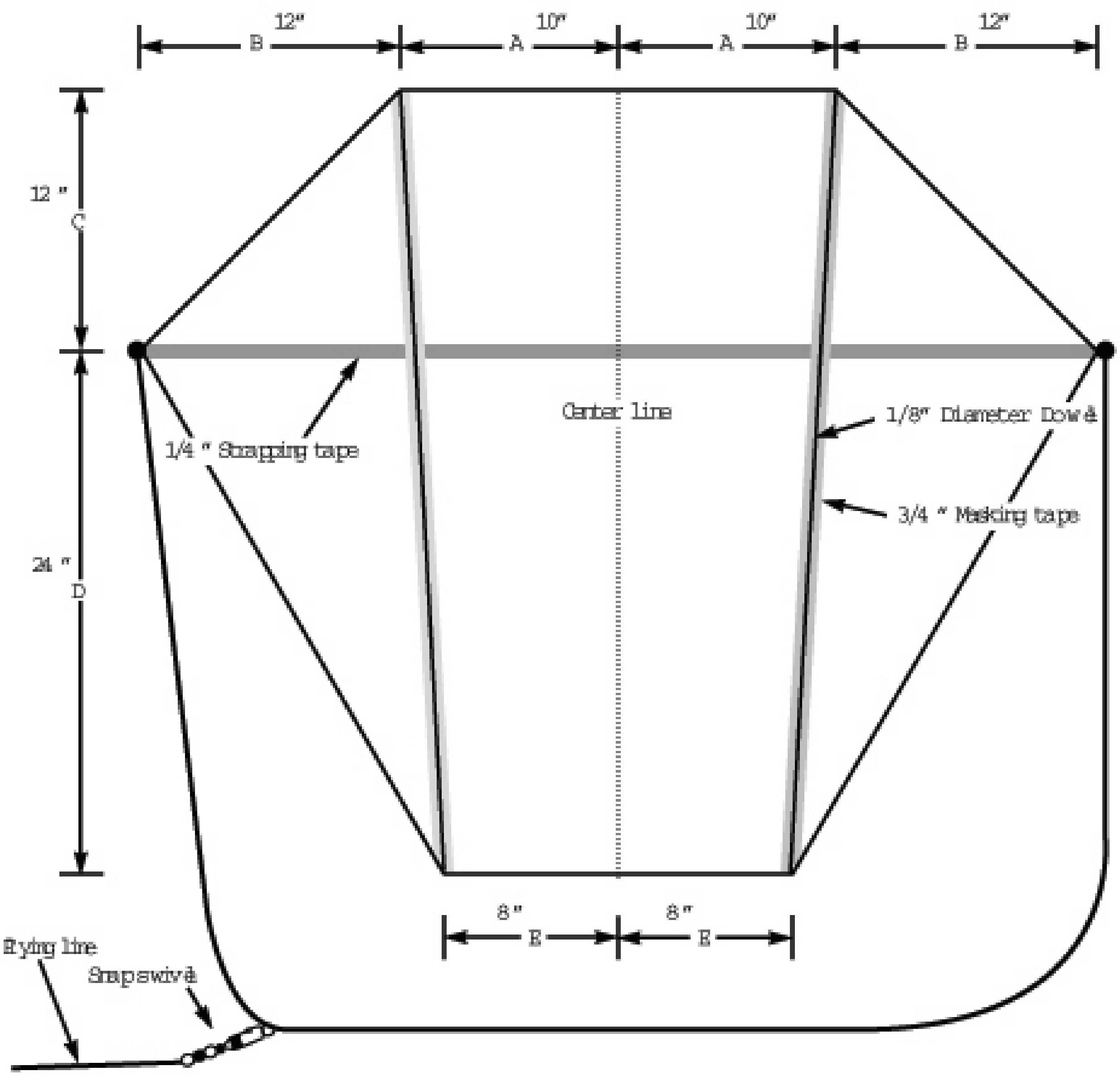
Kites have been used for centuries to haul fishing lines and lures out to where the "Big Ones" might be lurking. British lighthouse keepers have used kites for fishing for at least 200 years. A long time ago I corresponded with one of the lighthouse keepers; he used a 6' diamond kite with an 8-pound shot tied to the end of a long tail to keep the kite from flying off with the bait. As you can probably guess, such a method took a lot of trial and error to get the bait where you wanted it.

Have you ever gone deep sea fishing? A few years ago, five of my coworkers and I would sometimes charter a boat out of Warrenton, Oregon, for a day of deep sea fishing. In those days it only cost us $45 each for the whole day. It would take about 45 minutes to get out to where the "Big Ones" were, and if we were lucky, we would catch our limit of three salmon each. Usually we were lucky to get three fish of about 10 lb. average weight for the six of us. On one occasion, I got to learn how much gasoline the boat took for the days fishing; 60 gallons. Had we spent the day's fishing with kites from the South Jetty of the Columbia, we would probably have done as well, not burned up all that fuel, wouldn't have gotten seasick, and have been $45.00 richer.

Had we taken kites along on the boat, we could have merely stopped the boat and trolled with the kites. That wouldn't have saved us the charter fees, but it would have saved about half that 60 gallons of gasoline. Further, we could have sent our kites into rocky areas too dangerous to approach with the boat. Legend has it that author Zane Grey used a kite to fish in some rocky areas where he caught prize-winning tuna. Since my article on kitefishing appeared in Kite Lines Magazine in 1978, I have received a few reports where people have used kites to fish areas too dangerous for a boat. Now, I know that all fishermen are reputed to be liars, but they reported catching some very nice ling cod. Not only were they fishermen, they were also kitefliers, who have a reputation for always telling the truth, so a cross between a kiteflier and a fisherman should tell the truth at least half the time.

At the 1996 Washington State International Kite Festival at Long Beach, Washington, a fellow named Phillipe from France looked me up, very thrilled that the great Stormy Weathers was present. Seems as though he had read my article on kite fishing, had gotten permission from Kite Lines to re-publish the article in France, and swore that half the fishermen in France were using the systems and kite that I had described in the article. But, not only was he a fisher-

Fig 12-1



Alison

Dimension Table

Height	A	B	C	D	E
4’	$13\frac{1}{2}$	16	16	32	$10\frac{1}{2}$
3’	10	12	12	24	8
$2\frac{1}{2}$’	$8\frac{1}{2}$	10	10	20	$6\frac{1}{2}$
2’	$6\frac{3}{4}$	8	8	16	$5\frac{1}{4}$
X	.28x	.33x	.33x	.67x	.22x

man; he was also a kiteflier, so there is at least a 50% chance that his story was true.

The Kite

For kite fishing, you can use the kite of your choice, but I like the Allison version described here (See Fig. 12-1). It is simple to build and pulls hard for its size. It is also quite active in flight, which keeps the bait or lure moving about so that the fish are more likely to think that they see something live, and therefore edible.

Build the kite from tall kitchen bags in 24" or 30" size. Soda straw sticks are adequate for the 24" size, but you may have to slip wooden dowels inside the straws if the wind gets too strong. You need only reinforce the leading edges with strapping tape, and even that may not be necessary since you aren't likely to be encountering any trees, rosebushes, or other kite destroyers. Construction techniques are the same as the Horned Allison described in Section 2.

Lastly, if the kite wants to pull to one side or other, turn the kite backside so that it faces you. If this doesn't correct the problem, unlock the larks-head connecting the towing line to the bridle string and slide the knot about 1/2" towards the side to which the kite is pulling and re-lock the knot. If you are fishing from a boat and want to keep the kites separated in the sky, you can

Fig 12-2 A

Setup for Light Boat Traffic

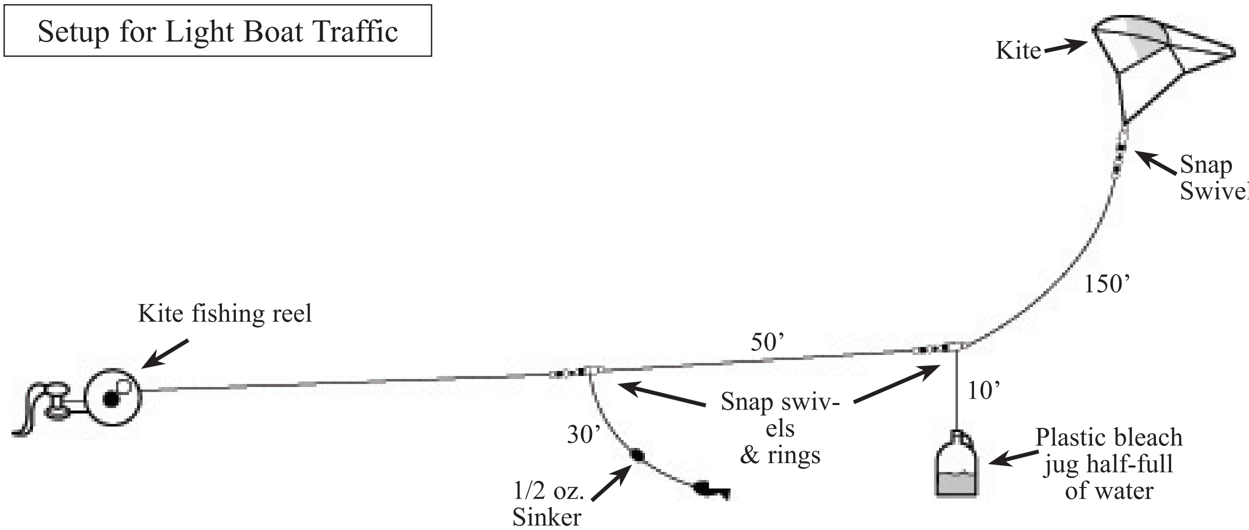
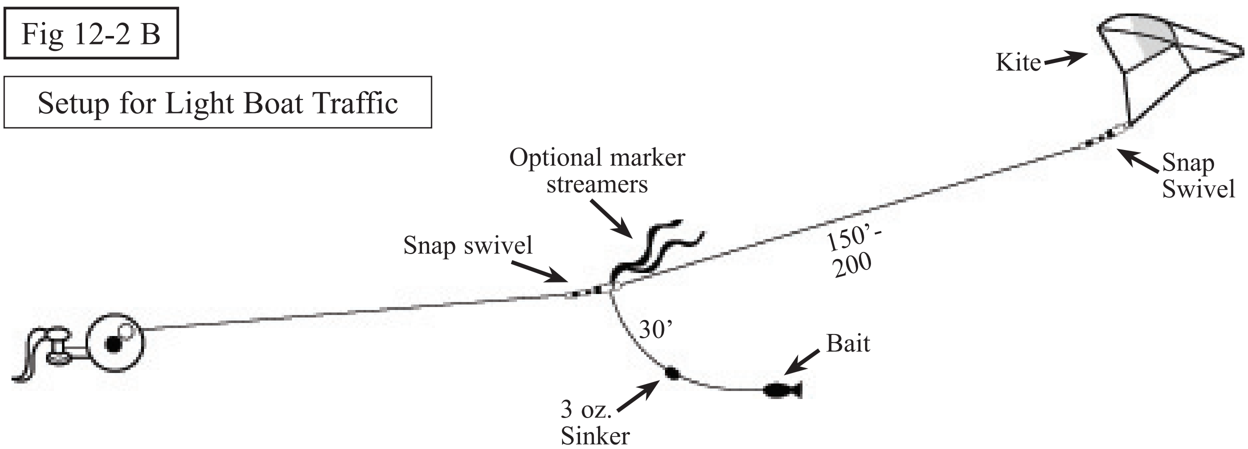


Fig 12-2 B

Setup for Light Boat Traffic



deliberately make them pull to one side or other by shifting the position of the tow line on the bridle string.

Various Fishing Rigs

Pick any of the fishing rigs described below that are suited to your fishing area. The big requirement is that you have your fishing area downwind from where you want to fish. If you have access to a boat, just go out to where you think the big ones are and drift or drop anchor. The wind generally isn't a problem unless it is too strong for the boat.

The setup shown in Fig. 12-2A is the most versatile. If you are going to be fishing where boat traffic is heavy, increase the downleads from the kiteline to the jug and lure to 50′ to keep your kite line above boat antennae. The wind should be offshore and 4 mph or greater. Troll by giving the kite line just fast enough to maintain about 100′ of altitude. How far can you troll out? Maybe half a mile.

When it comes time to wind in, don't wind in so fast that the jug and your bait or lure are hauled out of the water. What happens if you get a fish on? Note that when you reel in, the first thing you get to is the downlead to the bait; just wind that in along with the kite line and the fish comes in before the jug.

Suppose there is a tide rip offshore where you wish to troll. Just send the kite out to the tide rip and walk back and forth up and down the beach; the kite will fly parallel to you.

Suppose boat traffic is heavy. Just leave off the jug and its downlead (see Fig 12-2B). You can troll by giving the kite line fast enough to where the lure

Fig 12-3 A

Setup for Light Boat Traffic

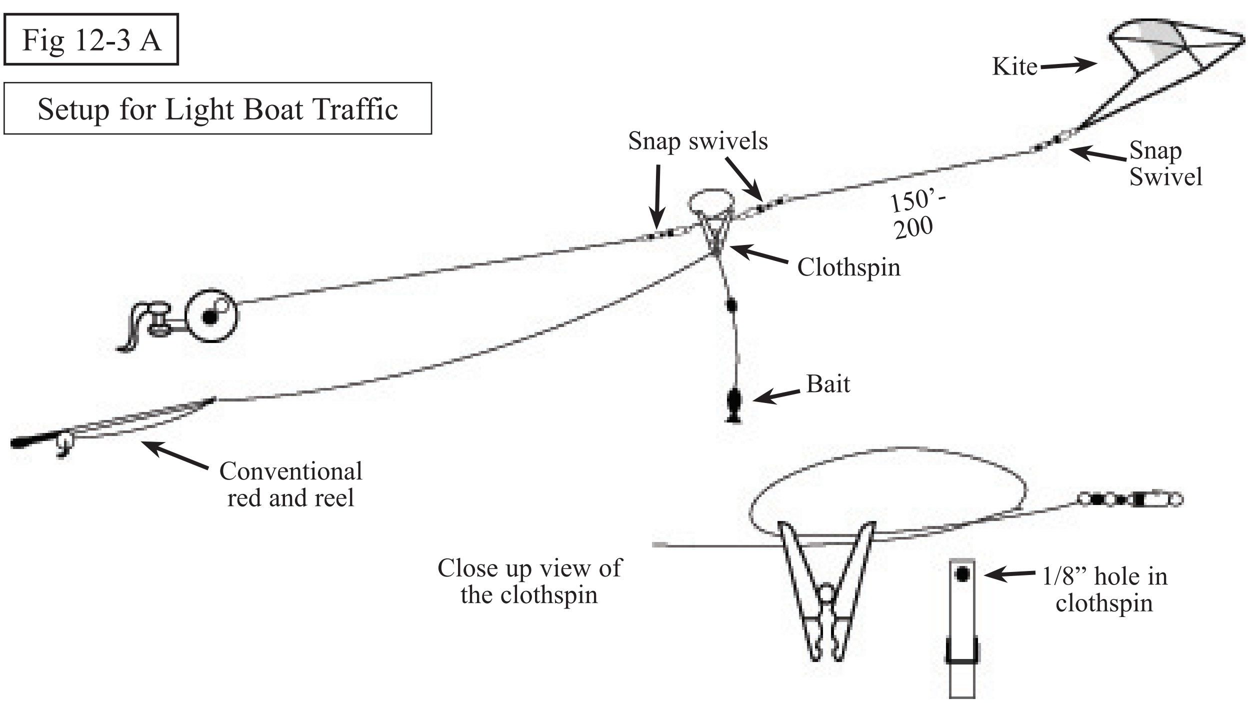
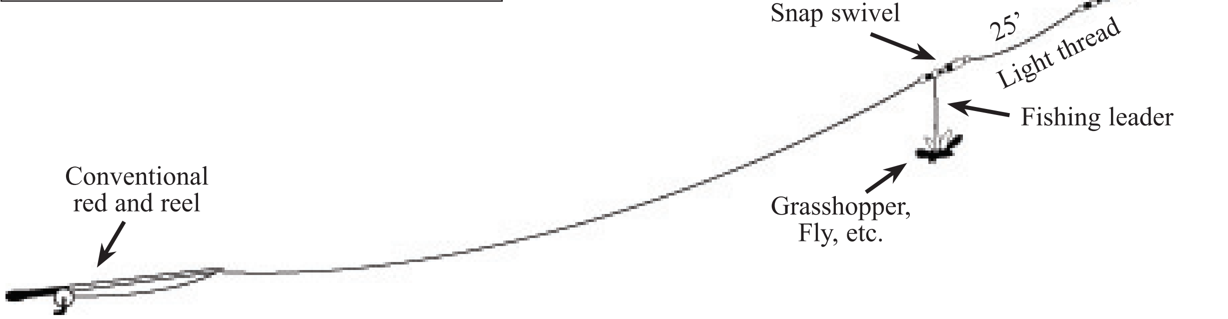


Fig 12-2 D

Setup for Fly Fishing or Popping



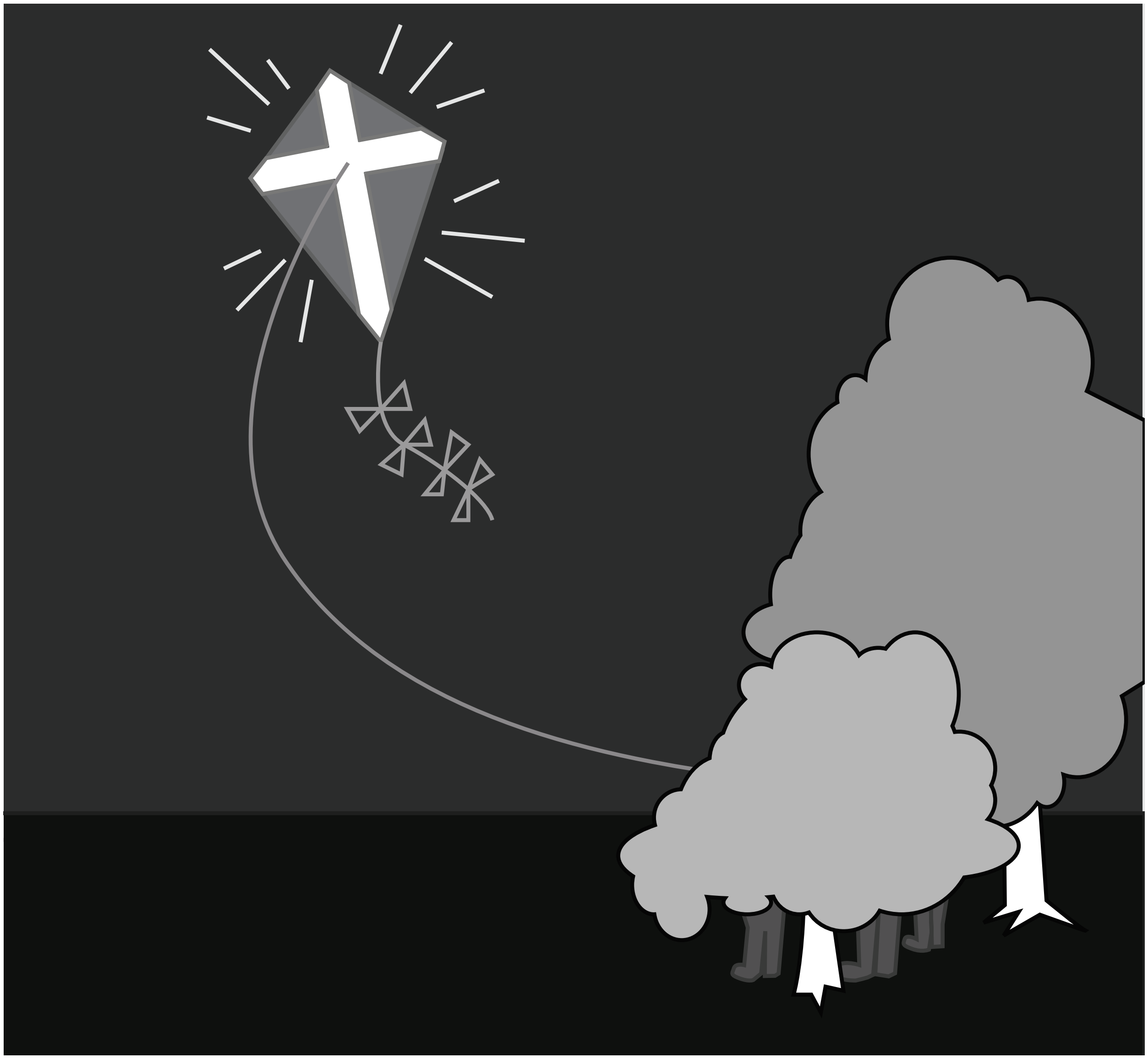
doesn't come out of the water. If a boat approaches your line or your kite is beyond where you want to fish, reel back in. The lure will rise into the air as the kite rises, so you won't catch anything on the way back in.

For bottom fishing, use a clothes pin release to snap onto your fishing line (See Fig 12-2C). Let the kite carry the line to where you want to drop it, and give a sharp tug on the kite line. This opens the clothes pin and drops the bait rig.

Lake fishing for pan fish is also possible if you build a smaller version of the kite (See Fig. 12-2D) The big problem here is that winds across lakes less than about 320 acres are usually so turbulent that you may have to fish your kite out of the water occasionally. Also, kites smaller than about 18" tend to spin, so you will probably have to tie a light plastic streamer from each of the bottom corners to act as tails.

Section Thirteen

Fat Albert and the Christmas Kite



From ghoulies and ghosties and four leggedy beasties,
and things that go BOOMP in the night,
deliver us O Lord.

old Scottish prayer

Fat Albert

It was Christmas Season 1978. My sons Ward and Ben were 9 and 6 respectively and enjoyed our frequent trips to the flying field. I was becoming fairly good at building and flying kites and at long last I had learned how to build, bridle, and fly diamond-shaped kites.

Wishing to impress the townsfolks with my newly-acquired talents, I started to think of various ways of working kiteflying into the Christmas season. I finally settled on putting a lighted cross over Gladstone, Oregon, on Christmas Eve. This project, along with most of the idiotic things I undertake, proved to be easier said than done.

Eventually, I built a 5' diamond-shaped kite from clear polyethylene. Along the spar and spine I put 2"-wide white reflective tape that I could illuminate with a 40,000-candlepower spotlight bulb that I had removed from an old 1947 Hudson car spotlight. I fitted the bulb into a standard hand lantern. To make the cross softly glow when I was not illuminating it with the spotlight, I put 1/2" diameter clear plastic tubing on top of the reflective tape. Those plastic tubes that glow when you break the capsule inside (LumaGlow?) had just come on the market, and I could empty the LumaGlow chemicals into those plastic tubes on the kite.

Construction proceeded smoothly except that I had to hunt all over town to find those LumaGlows. However, we were ready to go by Christmas Eve, but old Aeolus was apparently feeling out of sorts from having consumed too much fermented nectar. No wind, period.

On Christmas Day old Aeolus was feeling better and sent us a very nice breeze that held. When it was dark, the boys and I got out the kite, put on warm clothing, and went out on the front porch and started transferring the LumaGlow into the tubes on the kite.

Young boys can't seem to concentrate on the job at hand very well, so it was in the house for a drink of water, another trip to go to the bathroom, and on and on. Every time they opened the front door, a blast of 24-degree air would enter and chill the boys' mother. This finally resulted in some language that scorched my US Navy (Retired) ears and a promise that she was going to kill the next person that came through that door.

Ben, always curious, got to playing with the incompletely drained LumaGlow tubes and soon had his glove-less hands glowing nicely. I was afraid the LumaGlow might be dangerous if absorbed through the skin, but there hadn't been any warning labels on the tubes, and the few drops I had spilled on my own hands didn't seem to be making me itch or burn. But I was still concerned for Ben's hands and he seemed to be a little concerned also.

"Dad, can I go to the bathroom and wash my hands?" Ben finally asked. "Ben, you heard your mother's promise that she was going to kill the next person that came through that door. I believe her. A while ago I heard her whistle to her broom to command it to report front and center. Let's see if we can find something to wipe your hands on besides your pants."

Fat Albert was the neighborhood tomcat. He scrounged food from dog dishes around the neighborhood and I suspect that some kindly little old ladies also were making sure that Fat Albert didn't go hungry. Fat Albert also pretended to just love being petted, which endeared him to more people who might give him more FOOD. Fat Albert, hearing the activity on our front porch, figured there might be some FOOD involved, so Fat Albert came to see, just as Ben and I were trying to find something for Ben to wipe his hands on.

"Ben, pet Fat Albert!" I suggested enthusiastically. Ben rubbed his hand down Fat Alert's spine. Fat Albert's spine arched up and his tail stood straight up. Ben grasped the tail at its base, curled his fingers around it, and slid his hand from base to tip. "Ooooh such petting!" Fat Albert's expression said. "See if you can make his ears glow too" I suggested.

Before too long, Ben had transferred most of the LumaGlow from his hands onto Fat Albert, but Fat Albert had figured out that there probably wouldn't be any FOOD forthcoming. Glowing from the petting he had received and from the LumaGlow, Albert left and wandered casually across the street to where he knew there was a dog dish that sometimes contained FOOD. There was one slight problem; the dog was chained to his doghouse within reach of the dog dish.

Fat Albert could frequently get at the dog food without waking the dog, but the night was cold and Aski, the dog, wasn't sleeping very well. When the dog heard Fat Albert crunching on the dog food, he came roaring out to kill the intruder. He got about halfway to the dog dish when it dawned on him that whatever was eating his dog food was definitely not your usual cat; this one appeared to be a glowing ghost cat or something else equally dangerous. Aski put on the brakes, whirled around and returned to the safety of his dog house, half whining, half barking, and shivering from the cold and an ecstasy of fright.

In a few more minutes the kite was ready, glowing cross, Hi-torque tail, bowstring, two point bridle, and 30 lb. test line. We loaded the kite and ourselves into the VW transporter and went to the Gladstone High School athletic field, close to the heart of Gladstone.

We put up the kite and the cross was glowing just brightly enough to be spotted with one's peripheral vision. Once the kite was up about 400′, we moved in amongst some small evergreens to get somewhat out of the wind and to conceal ourselves. But conceal ourselves from what? It was Christmas Day night, 24 degrees, and the wind was blowing. Only kitefliers and other fools would be out on a night like this.

About 20 minutes passed, and finally someone approached from the heart of town. He was walking his dog and both he and the dog were big. When he got to the market directly across the street from where the kite was flying and moving around in the turbulence, its motion caught his eye. When I could see that he was looking at the dimly lit cross, I hit it with a beam from the 40,000 candlepower spotlight. The white cross flared brilliantly in the night sky. The man immediately turned and started running back to town. His dog, very sensitive to his master's emotions, sensed the extreme fear and was straining at the leash to outrun his master.

Naturally, the boys enjoyed the whole thing immensely, but I started having a few doubts. I had planned to put up something that people would appreciate.

Nothing more happened for about 15 minutes, then two cars jammed full of teen-age boys pulled into the market parking lot across the street. The boys got out of their cars and started talking about whatever teen-agers talk about. After a couple of minutes, they suddenly became quiet, and I could see that they were looking in the direction of the kite with its dimly lighted cross. Spotlight time.

I pointed the spotlight at the kite and switched it on. It was as if somebody had thrown a stick of dynamite with a lit fuse into the assemblage of boys; they couldn't get into their cars fast enough. Doors slammed, engines roared to life, tires squalled as the cars went into reverse, and squalled again as they roared for the street. Things definitely were not as I expected them to be.

I started winding in the kite. "What are you doing, Dad?" "I'm bringing in the kite." "Why?" Ward asked. "I'm sorry, boys, but what we are doing might be very dangerous." "What do you mean, Dad?" "What I expected was for that lighted cross to fill people with awe and wonderment. Instead we are filling them with sheer terror. Suppose a superstitious or deeply religious person with a dirty conscience and a weak heart comes along. We just might trigger a heart attack. Some of my fundamentalist friends assure me that on Judgment Day all those who haven't confessed their sins and accepted Christ as their Savior will be eternally damned to hell. That takes in about nine out of ten of all the people on earth. Very few people are ready to stand up and be judged for their past sins, though according to my friends, accepting Christ as your savior fixes everything. But from what we have seen here tonight, very few people are ready to stand up and be judged. I suspect that a second coming of Christ would cause world-wide pandemonium. Let's go home."

Adversity begets intelligence and that is why the Inuit and Yuits have a higher capacity for learning than any other ethnic group; over the ages the stupid ones either froze or starved. Nature is a harsh weeder.

author

When I was eight, my family moved from an isolated farm to the big city of Clayton (pop. 3000), New Mexico. It was there that I saw my first kite, a diamond-shaped one. When the kite came down, I went to the owner (a boy about 10) and asked if I could look at it. Having built it himself, he was flattered that someone appreciated his work and let me look at it. He then told me how he had built it and that I could probably build one also. I decided to try.

For Christmas I had received a ten-cent Solingen jackknife (imitation bone handles made of stamped metal and a soft stainless steel blade that stayed sharp just long enough for me to cut my finger). I re-sharpened the knife and split kite sticks from an orange crate, tied them together, put the string around the outside, and papered it with something, tied a cloth tail to the bottom, and bridled it somehow. I then took it out to the open area behind the town and made futile attempts to fly it.

Older kids observed my attempts and came to look. A few of them knew something about kites and pointed out that the sticks didn't cross at right angles and that one side of the spar stuck out about two inches farther from the spine than did the other. But they were just full of constructive criticism such as how you can use a sheet of tablet paper as a square and to measure length (though not in inches) by counting how many lines on the tablet paper it takes to reach from one point to another, and how the sticks should be lighter than what I had made, etc.

My second attempt flew fine. I had found an old board that had been out in the weather for so long that you could easily split out the hard grain, which gave me some nice thin wood to split sticks from. I salvaged some nice green-and-white striped wrapping paper to cover the kite with. It was bridled right and the tail wasn't too heavy. The breezes around Clayton are relatively free of turbulence, so I spent many happy hours flying my kite.

From Clayton we moved to Mt. Dora, which at that time had a hotel, barber shop (the barber also acted as the town stitcher-upper when you got a wound that needed stitching), school through the eighth grade, a general store, a building supply and hardware store, a railroad depot and watering tank for the locomotives, a windmill that supplied water to the townspeople for free, and a population of about 200, about 10 of whom were kids about my age. (In 1946, when I last drove through Mt. Dora, only the post office and a service station remained.)

Eventually I suggested to my buddies that we build a kite. We couldn't get enough string together, so we went to the building supply store to see if we could get some there. When we told the owner/manager what we were up to, he said: "Why don't WE build a BIG kite?"

Now this was in the early days of the "Great Depression" and the beginning of the drought that made that area of the country known as the "Dust Bowl". Not many people I knew had more than just enough money to feed themselves, and some folks didn't have that. (But it should also be pointed out that our national debt at that time was a mere 33 billion dollars, mostly from the cost of fighting WWI. WWII cost us 300 billion, but today the debt increases by about that same amount each year and is now over 20 times what it was at the end of WWII.) There was no welfare, no crop insurance, no unemployment insurance. Few people could afford to build anything, so the owner of the building supply store was going bankrupt. He really had no better use for anything in his store or his time than to help us build a big kite.

So, he got out some beautifully straight-grained molding for sticks, wrapping paper, glue, and a brand-new large cone of wrapping string that must have had over two miles on it. From this we built a 6 foot diamond kite, bridled it, put a tail on it, and launched it into a nice, smooth breeze. The wind was such that it went right in the direction of the mountain for which the town was named. Higher and higher it went and smaller and smaller it got until it was caught in the strong updraft from the mountaintop itself. The kite started climbing faster and faster, then the string broke at a weak spot about a half-mile from us, and the kite went out of sight over the mountain. The store owner, having had an enjoyable day for a change, said; “Wind in your string, boys.”

Eventually, we starved out in New Mexico and came to Oregon where there is always an unharvested fruit tree or a berry patch that you can glean (pick for free) with permission of the owner, thus providing a diet that includes something besides biscuits and beans. There were also crop-harvesting jobs available where you could make enough money to buy school clothes and help with the family expenses.

When I was 11, we moved to the Willamette Valley. On summer days between crop harvests, I sometimes built kites. The winds in the Willamette Valley are such that you either give up kite flying or you turn into a very resourceful flier. For days there won’t be any noticeable breeze, then comes a very turbulent wind that is strong enough to make any asymmetry in the kite overcome the corrective force of gravity and send the kite out of control. Diamond kites gave me so much trouble that I built a three-sticker, which thanks to its two-point tail attachment, behaved much better. But even the three sticker gave me troubles (due to improper bridling I think) unless I put on a heavy tail. On one occasion I tied my father’s claw hammer on the end of the tail to make the kite behave. That came to an end when my father needed his hammer, couldn’t find it, asked my brother about it, and was told “Oh yeah; old mush-for-brains has it tied to the tail of his kite!”

In my mid-teen years I finally built a box kite, which flew fairly reliably but that is about all you could say for it. It wouldn’t pump up worth a darn, took too much wind, and didn’t look like something that was meant to fly. And that was the last time I built and flew kites for 38 years.

In 1975 I took my son Ward, who was then 5, to a kite fly. I discovered that there were now kites besides diamonds and boxes and three-stickers. I also noted that no one had come up with a decent reel. I had built a reel as a teenager so I knew how to build one. I also was working at a place where I could get some beautiful plastic wire spools for a reasonable price. So, I started building reels and selling them. I needed to fly some kites with the reels to test them and uncover any shortcomings, so I started building kites again. But, I was once more living in the Willamette Valley with its awful wind conditions, so I needed something more reliable than the kites I was familiar with. Fortunately, William Allison had invented the polymorphic kite, which anyone can build and fly, so I began using polymorphic kites. Two years later, after watching me build kite after kite, 7-year-old Ward went into the business of building Allisons and selling them at $1.00 each to his classmates in second grade.

Those of you who are familiar with the original polymorphic kites know that they sometimes collapse at the most unfortunate times, so I had to find a cure for that. I finally found a cure and started designing kites based on the polymorphic principles. The end result of my experiments is the Star Victory, one of which the Japanese bought to display in their Japanese National Kite Museum in Shirone as one of the five outstanding Western World kite designs.

My designs and building techniques have caused noted kite people to encourage me to write a book on my designs before the knowledge gets lost, so this book is the result. I hope that this book helps children learn to innovate and do things for themselves, rather than have their parents look for some expensive government program to draw upon. I would like to leave everyone with the following thought : (I don't remember the author.)

"Government is NEVER a source of goods; only people produce goods, so anything the government gives TO the people, it first must take FROM the people."

Post Script

Some of the reviewers of this book have complained that the foregoing statement and the following material is political.

My response is that this book is primarily intended for those who are teaching children, thus current problems are appropriate for discussions for those old enough to understand. Further, politics are largely lies and deceit; two things that I have tried to avoid in this book. Truth is non-political.

When my two youngest sons were 9 and 11 (in 1981) my wife divorced me and took the boys. I looked for a support group and found one in an all-volunteer international educational organization for single parents.

The preamble to the constitution for the organization said that their primary endeavor was to raise their children to be healthy, productive, and responsible citizens, which is a worth-while endeavor for all parents, single or not. But, like most all-volunteer organizations, the underlying thought is: "From each according to his ability; to each according to his needs". And that is the tenet of socialism.

Over a few years I noticed that the number of people with needs grew larger than the number of people with abilities and that the children grew up while their parents didn't. The parents stayed around after the children were grown and the emphasis shifted from educational to social activities. Further, the majority of the parents who hung around after their children were grown were those with few abilities; other than to complain loudly if the few with more ability didn't provide enough adult social activities for them.

At long last, I realized that I was in a socialist organization and that I was a political commissar (I had risen to the position of Associate Administrator with Oregon and Southwest Washington as my territory). I still retain my membership because some chapters still have enough members with ability to put on worth-while family activities programs.

Look at what has happened to the organizations that depend upon volunteer help. The PTA, Red Cross, Veteran's organizations, Boy Scouts, etc. are all hurting, as are many of the respected fraternal organizations. We have seen what has happened in the communist/socialist countries...Russia, Poland, Albania, East Germany, etc. (The Russians used to joke "The Government pretends to pay us, so we pretend to work").

As for the United States, our President and Congress are fighting over a balanced budget amendment. If we don't get such an amendment; how long will it be before the interest on our national debt exceeds our income? Will the world banks then tell us that our socialistic society has maxed out our credit card?

God bless Canada: Canada gave the Inuit back their land, snow, and ice and broke all the apron strings that bound them.

Section Fifteen

Sources of Kite Materials

While the kites in this book are designed to be built from materials readily available in grocery stores, fast-food restaurants and builders supply houses, there may be times when you want to purchase more exotic things such as ripstop nylon, fiberglass rod or graphite tubing. A few of the many outlets are listed below for your convenience.

1. Bland Bag Company, Warren, Michigan. These friendly folks normally make brightly colored garbage bags, but will sell rolls of 1 mil sheet plastic that comes in 25 1/2" wide rolls. The plastic is folded before rolling, so the plastic is actually 71" wide. The purchase price is quite reasonable, but the shipping costs, which they don't control, are something else.

2. Hang-em High Fabrics, 1420 Yale Ave., Richmond, VA 23224. Phone/Fax: (804)233-6155. Write or call for a catalog.

3. BFK Sports, 2600 E. Imperial Highway, Unit #122, Brea, CA 92621. Phone: (714) 529-6589. Fax: (714) 529-6152. Their catalog not only lists a pretty complete line of kites and kite materials, but also includes recumbent bikes, kite buggies, magic-trick items, etc.

4. Catch The Wind Kite Shop, 266 S.E. Highway 101 Lincoln City, OR 97367. Phone: (503) 994-9500. One of the many things they carry is a kit for teaching kites to groups of small children that features a small, stickless, Tyvek kite that flies like a dream. They also carry a pretty good selection of fabrics and framing materials.

5. Goodwinds Kites, 3333 Wallingford Ave. North, Seattle, WA 98103. Phone: (206) 632-6151. Fax: 633-0301. A good source of patterns and materials for advanced kites.

6. Kite Studio, 5555 Hamilton Blvd, Wescosville, PA 18106. Phone/fax: (610) 395-3560. A good source of rip stop nylon.

7. The Kite Store, 1201 16th St. Tabor Center, Denver, CO 80202. Phone: (303) 595-8800.

Most of the merchants listed above give discounts to members of the American Kitefliers Association. Membership in this organization is recommended because part of your membership includes some insurance coverage. You never know . . . . Write to American Kitefliers Association, 1559 Rockville Pike, Rockville, MD 20852-1651.

NOTE

In researching the kites for this book I needed to test out fiberglass rod and tapered graphite spars. For the reels and line I needed plastic spools and Kevlar line (touted to be 5 times as strong as and equivalent weight of steel).

Getting these materials meant that I had to send minimum orders of $250-$300. Since I now have more of these materials than I will ever use, I would like to sell off the surplus. The tapered graphite spars are very nice for the Victory-series kites with wingspans between 4′ and 10′. The fiberglass rod comes in 6′ lengths and diameters up to 3/16″. The 30 lb. test Kevlar line is on 150 and 300 yard spools. I have quite a good supply of plastic wire spools for making reels and many brass couplings for 3/16″ wooden dowels.

If you need any of the above items, please send a self-addressed and stamped envelope (SASE) to Stormy Weathers, 17707 S.E. Howard St., Milwaukie, OR 97267 for a price and availability list. Since all the above items should go very quickly, this offer expires on the first of January, 1998.

Section Sixteen

Glossary of Terms

Introduction

Since the meanings of words used in the kite vocabulary are sometimes open to argument, the definitions in the following list will be used in this book. Other kitefolks may use different definitions.

Arc A bent line segment of given radius. (The curve in the leading edge of Guy Aydlett's Hornbeam Sled.)

Anchor A heavy object attached to your kite line to hold it in place while you go for coffee. A strong attachment point for bow strings, bridles, or tail yokes. (see Sections 3 & 7)

Angle of Attack The mean angle a kite makes to the wind and to level ground. While in theory the kite gets the most lift from the wind when the angle of attack is 45 degrees, various forces acting on the kite usually reduce the angle of greatest lift to somewhere between 38 and 42 degrees. If the angle of attack is less than given above, the kite not only requires more wind for liftoff, but rises more slowly. Increasing the angle above 45 degrees also requires more wind, but in stronger winds, increasing the angle of attack greatly increases the rate of climb, something to remember if you take part in a timed-altitude contest.

Beaufort's Scale Named after Rear Admiral Sir Francis Beaufort, who invented the scale in 1806 as a standard to be used when entering wind data into a ship's log book at sea. The scale is not very helpful to a kiteflier. For your purposes, if your kite will lift off, the wind is strong enough. If a normally well-behaved kite drags you into the bushes, breaks its flying line, or starts spinning and diving out of control, the wind may be TOO strong.

Bend (Nautical) A knot used to attach one rope or line to another or to some object (see Section 9).

Bernoulli Effect A partial vacuum that forms above and behind the leading edge of an airfoil whose angle of attack is greater than zero and less than 90 degrees. If you look this up in an encyclopedia or dictionary you will find a classical description written by some postdoc to show off his education. Memorizing Newton's three laws of motion and then making sketches of airflow around a kite sail or wing set for various shallow angles of attack makes understanding a lot easier. It's good mental exercise, but not quite as challenging and time consuming as working jigsaw puzzles.

Bight What you get when you fold a

short section of the working end of line back alongside the standing end (see Section 9).

Bowline A non-jamming, easy-to-tie knot with about 65% the strength of the line into which it is tied. (see Section 9).

Bow String The string that keeps the spar ends pulled towards each other, resulting in the spar assuming the shape of a shallow arc.

Bow String Tension Lock A 4-hole button, section of coffee stirrer, or specially configured paper clip. (see Section 9).

Bridle One (square diamond, sled, snake etc.) or more strings that attach the kite to the tow line or flying line, usually at a fixed angle of attack. Compound bridles usually have sliding adjustments that make it easy to change the angle of attack. (see Section 7)

Canopy. That portion of the kite skin rising above the keels, longerons, or wings.

Canopy Mast A rigid section of rod or tubing that connects the spine to the spar center.

Clothespin An easy drop release (see Section 12).

Compound Bridle See Bridle above.

Compounding String The string to which the tow line is tied in a compound bridle (see Sections 4 & 7).

Coupling A contrivance for attaching two devices, such as railroad cars, together. Where two-piece spars or longerons are used, they are held together by couplings, usually tubular, made from hollow knitting needles or other metal tubing, or strong plastic tubing.

Downdraft A gust of wind (usually momentary) that blows strongly towards the ground.

Downwind The direction from the kiteflier to the flying kite.

Drogue Usually a truncated conic section (a paper or plastic cup with the bottom poked out and flown large end forward) used in lieu of a tail. (many are made of fabric)

Duct (or Duck) Tape A fiber reinforced tape with adhesive on one surface. It has a weather-proof plastic covering that detaches after about 1 year in the weather.

Elevation Angle The angle between the ground and the kite as observed from the kiteflier or kite-line anchor.

Fulcrum Point That point on or within the kite where the vector sum of all the forces (lift, drag, line tension, and gravity) acting on the kite equals zero. (Actually, this is the secondary fulcrum point, the primary point being the kiteflier's hand or other anchor).

Glue (1) SHOE GOO, KIWI, or other shoe patch rubber cement; good for sticking sockets to the sail, etc. (2) Rubber contact cement. Thinner and messier than the shoe patch cement. Sometimes used for holding wrappings in place. (3) Igloo. Any of various adhesives used in the manufacture and repair of Igs.

Glue Gun A hand-held electrically heated device for melting and applying hot glue. While I don't use hot glue, the heated gun is excellent for welding plastic sheeting together.

Half Hitch See Section 9.

Hot Knife An electrically heated knife for cutting fabrics made of synthetics. If cutting is done with a hot knife, hemming is usually unnecessary.

Keel A stabilizer which keeps a kite pointed into the wind. The keel may or may not contribute to the lift.

Larks-head See Section 9.

Leading Edge Stiffener A semi-rigid, elongated structural member in the leading edge of wings.

Longeron A stick or other stiffener running from top to bottom of a kite. If one main vertical stick is used, it is called the spine. In the Allison Polymorphic kite where two sticks are used, they are both longerons. In kites where there are three longerons, the center one is usually designated as the spine.

Long Line Launch Launching the kite into the sky from the end of a long line previously laid upon the ground.

Mandrel An axle, spindle, or arbor; usually cylindrical or tapered. Used for forming something, such as a spring.

Newton's Three Laws of Motion (1) A particle at rest, if left to itself, will remain at rest. If it is in motion, and left to itself, it will stay in motion. (2) A change in motion indicates a force due to the presence and effect of another body, and the change due to one force is the same even if there are other forces acting. (3) To every force there is an action equal and opposite reaction. Kitefliers are particularly interested in (3). This means that the angle of incidence is equal to the angle of reflection, or simply put, if an air molecule strikes the sail of a kite at a 45 degree angle, it will rebound at a 45 degree angle from the sail, a total of 90 degrees and the "equal and opposite reaction" lifts the kite. Laws (2) and (3) are of particular interest to kite designers.

Pitch Rotation about the transverse (side to side) axis. Indicated by the kite nose "pitching" up and down.

Pumping Up Causing the kite to gain altitude by alternately pulling in line quickly and then letting it back out slowly.

Relative Wind The wind direction and velocity acting upon the kite when the kiteflier winds in, lets out, or moves laterally on the ground. Thus if the wind velocity is 3 mph and you walk rapidly upwind at 3 mph, the relative wind at the kite is 6 mph. If the flier walks directly cross wind, the relative wind at the kite is 1.41 times the actual wind.

Roll Rotation about the fore and aft (longitudinal) axis.

Round Turn One complete turn of line around a second line, cleat, spine, spar, longeron, stick, etc. before the knot is tied. See Section 9.

Sail The lifting surface for flat or slightly bowed kites.

Skin The skin comprises the covering for all lifting, steering, and other surfaces.

Snap Swivel A device somewhat similar to a safety pin with an integral rotatable joint for connecting two lines together.

Spar. A stick or stiffener running across the kite.

Split Ring A tightly coiled metal ring that can be inserted into a line without cutting the line.

Square Knot See Section 9.

Tail A strip or strips of fabric or plastic sheeting used primarily to stabilize the kite in the yaw and/or pitch axes.

Tail Yoke A line attached to two bottom corners and forming a V shape back to the point where the tow line for the tail attaches.

Thermal A rising column of air heated by something on the earth surface, such as a sun-heated asphalt parking lot, an open field, or a forest fire.

Tow line A short piece of line attached to the tow point or bridle of a kite to connect to the flying line. Also that piece of line connecting the tail yoke to the tail.

Updraft A usually short-lived upward motion of the air in turbulent winds. Updrafts resulting from the wind blowing up a hill or mountain last as long as the wind continues. They are responsible for lenticular clouds forming above and slightly downwind from a mountain peak.

Wing Usually a flat (or nearly so) lifting surface.

Yaw Rotation about the vertical axis. Zigzagging from side to side along the line of flight.

Big Z, Little z; What begins with Z?..ZizzerzazzerZuzz?? (see The ABC Book by Dr. Suess).

Section Seventeen

Bibliography

Kites, A Golden Guide book by Wyatt Brummit. Western Publishing Co., 1220 Mound Avenue, Racine, Wisconsin 53404; 1978. LCN 70-134439. A very comprehensive book on kite designs prior to 1978 (out of print).

More Kites For Everyone by Margaret Greger, 1425 Marshall Ave, Richland, WA 99352. 1992 excellent books for "committing kites in the classroom" and for kiting newcomers in general.

Japanese Kites, Concepts & Construction (self published), by Dan Kurahashi, 1870 Kensington Ave, Burnaby, BC V5B 4E1, Canada. This book is very well done and the drawings are quite clear and easy to follow.

Kiting to Record Altitudes by Richard P. Synergy. Fly Write Publications, 280 Augusta Ave #207, Toronto, Ontario M5T 2L9 Canada. LCN 94-72108 ISBN 0-9696954-0-4. Tells the story of one man's attempt to break the single-kite altitude record. Many tables of wind vs. altitude, wind resistance of various kitelines, etc. make this a valuable reference book for those who wonder "Why?"

25 Kites That Fly by Leslie L. Hunt. Dover Publications Inc. 180 Varick St. New York, NY 10014. ISBN 0-486-22550-X, LCN card Number 74-140229. This book was originally published in 1929. Some of the kites are shaped like people, animals, etc.

Super Kites III by Neil Thorburn, 4738 Elmhurst Drive, San Jose, CA 95129. Self published 1991. ISBN 0-9629354-3-3, LCN 84-164133. Contains many designs for award-winning kites built from salvaged materials. A great guide for teaching young people to innovate.

KITES: The Science and the Wonder by Dr. Toshio Ito and Hirotsugu Komura, 1983. ISBN 8-87040-526-8. Distributed by Harper & Row, 10 East 53rd St. New York, NY 10022. The authors made a very serious study of the aerodynamics of kiting, only to have their work made questionable with a transcription or translation error in the third sentence of the first paragraph in Chapter 1. However, the error is corrected in Diagram 1-9 on page 22. There are a couple of other places where I would quarrel with them, but I have been building entirely different kites than the ones they studied. This would make an excellent textbook for Kite Designing 201.

The Complete Book of Kites And Kite Flying by Will Yolen. Simon & Shuster, copyright 1976 ISBN 0-6771-22191-4. Contains a lot of kite history and a number of enjoyable personal experience stories.

The following books are for general family education.

Endangered Minds: Why children don't think and what we can do about it. By Jane M. Healy; ISBN 0-67167-349-1. Printed by Simon & Shuster 1990.

Making of a Mind by Kathleen McAuliffe, OMNI, October 1985. Development never ceases, but early learning may tend to overshadow later experiences. Scientists now believe periods in neurologic development for language and personality exist before the first year of life. Published in the 1988/89 eighth edition of Personal Growth and Behavior by The Duskin Publishing Group, Guilford, Connecticut, 06437; ISBN 0-87967-726-0

Little Stories For Little Folks, by Nancy Nicholson, 1996. This set of 45 amusing stories provides a complete, step-by-step phonics reading program. It starts with alphabet flashcards, then progresses through pre-reading sound-blend exercises, phonic stories, and written exercises in booklet form. All 1st level stories use only short vowel sounds. Long vowel sounds are added at the 2nd level, then consonant blends in the 3rd and 4th levels. All 4 levels are included in the set. By the time a child has finished the set, they will have learned phonics without realizing it. They will also be reading at mid-second grade level or above, depending on which public schools you are using for comparison. The set is designed primarily for Catholic families who are home schooling, but make valuable supplements to the sight reading programs of many public schools. They are starting to catch on in foreign lands where schools and families are teaching English as a second language. Author Nicholson is being pressured to write non-sectarian versions for us infidels, prickly atheists, and people of other faiths who also want to augment the public school reading programs. Call CHC at 1-800-490-7713 for ordering information.

Transformations of Myths Through Time. Joseph Campbell. ISBN 0-06-096463-4.

GOD, A Biography by Jack Miles, Vintage Press, 1996. ISBN 0-679-41833-4. WARNING! This Pulitzer Prize winning book is not for everyone. However, it is quite helpful to those like myself who are trying to make sense out of the Holy Bible.

Section Eighteen

My moving fingers writ, and having writ, move on.
And neither all my piety nor all my wit,
will call it back to cancel half a line,
nor all my tears erase a word of it.

(With apologies to Omar Khyyam, 11th century Persian poet)