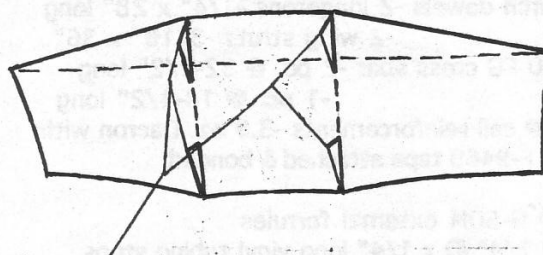


NON-SEWN GENKI WORKSHOP - Swindon, U.K. October 1996

Sam Huston (206) 631-5963

Session Objective

Construct a 28" x 80" Genki kite using 1/2 oz. Icarex polyester fabric and permanent industrial adhesives. This kite can be rolled up for stowage like a sewn one, but a sewing machine is not needed to make it.



Kite Design

Our kite is virtually the same as Nop Velthuisen's original Genki. The keels are a bit larger. This version flies in as little wind as any kite I have ever made. That is great, but does permit it to wander beyond vertical when light airs die out almost completely. Then, it's high aspect ratio (width to height) helps it turn turtle & power dive down. The only fix is to get the flying line completely slack. A pair of streamer tails helps this a bunch.

I've used 2 tails, 2-1/2 to 3" wide x 9 ft long with good results. To try this construction method from scratch, get a bit of Icarex & a roll of 1/4" Sailmakers Tape at the kite store and make yourself a pair.

Nop also made bigger Genkis, up to twice this size. Biggest ones need 3rd longeron & keels on kite centerline.

Major Materials

Icarex Polyester Fabric - makes satisfactory bonds with these adhesives - nylon does not always do that!

- CAUTIONS - static cling in Icarex can be extreme - sometimes helps you - sometimes bad news
- heating to anything above lowest clothes iron temp. setting can cause wrinkles & distortions

3M's F-9460PC Adhesive Transfer Tape - just a 2 mil layer of strongest adhesive on a backing paper
- nice to use as initial tack is not very high - and - it has very high final strength

CAUTION - must roll it firmly onto your fabric or heat it before trying to peel off the backing paper

CURING (bond strength development) - when used to bond metals or plastic films, this stuff gains 2/3rds of it's final strength in 20 minutes, and 100% in 3 days @ normal temperature - it needs heat to cure on woven fabrics - to get strong bonds, heat it to 125 degrees F - BUT, be careful - heat distorts Icarex something awful - set a clothes iron at it's lowest setting, and try to heat just the areas with adhesive on them - try out ironing techniques on throw-a-way samples to learn safe limits

3M's F-9469PC Adhesive Transfer Tape - same stuff as F-9460PC only thicker - 5 mils (0.005")
- makes stronger bonds on the coarser weave of 3.9 oz. Dacron reinforcing patches

3M's 9500PC Doublecoated Polyester Tape - a two-sided mylar tape used for 'hemming' sail edges
- the mylar film helps reinforce sail edges - it is much stronger and less stretchy than 'Seamstick'

Sailmaker's tape which can also be used for this purpose - but with worse puckering problems

- CAUTIONS - don't stretch it as you apply it - it can shrink back causing little puckers along sail edges
- do not heat sail edge hems - they're strong enough without, so don't risk fabric distortion

Sources - Kite Shops stock Icarex - Great Winds & Gasworks in Seattle and mail order houses

- 3M products - R. S. Hughes Co. 6536 5th Place So., Seattle & other cities - Gasworks Kite Shop, The Kite Studio, & Hang-em High Fabrics carry some sizes of F-9460PC tape

Basic Methods - 3 key procedures for this "non-sewn" and "no spar pocket" kite construction

- 1 - using the assembly board to join sail panels and to "hem" sail edges
- 2 - fastening down both of two parts to be joined, in correct positions relating to each other, before exposing the adhesive that will bond them together
- 3 - Bobby Stanfield's "bump" method of attaching spars to kite sails without spar pockets

Kit Contents

7 pieces 1/2oz Icarex fabric -3 parts of main sail
-4 keels

4 birch dowels -2 longerons -1/4" x 28" long
-2 wing struts -3/16" x 36"

A-20 FG cross spar -2 pc. @ 32-1/2" long
-1 pc. @ 14-1/2" long

24 @ sail reinforcements -3.9 oz. Dacron with
F-9469 tape attached & bonded

2 @ G-50M external ferrules

6 @ 1/4" ID x 1/4" long vinyl tubing stops

2 @ 1/4" ID x 1-1/4" long vinyl tube with hole

2 @ 7/32" OD x 1/2" long wood dowels

2 @ 3/16" ID x 1/2" long white poly tubing

2 @ 9/16" OD x 1/16" rubber "O" rings

50# dacron line -12 yards - for 2 pieces @ 54" long
-2 @ 20" -1 @ 10" -1 @ 100" -1 @ 106"

75# dacron line - 4 pc. @ 3-3/4" long

Other Tools & Materials Needed

48" straight edged board with assembly marks
-provided to use at workshop
-can make at home from included sketch

scissors -straight edge -pencil

12 @ 4" nylon cable ties

1 pony bead & 1 button - bow string adjustment

1 roll 1/4" 9500 two-sided polyester tape-10 yds
-for sail edge hems

1 roll 1/4" F9460 adhesive transfer tape-3 yds
-for joining parts of the main sail

1 roll 1/2" plastic transparent tape
-positioning parts for assembly

1 rub strip -1"x20-1/2" Icarex w. 9500 tape

heavy carpet thread - for making "bumps"

toothpicks - flat & round

super glue - sandpaper - beeswax

3/32" hole punch - provided to use at class

veneering roller - " " " " "

electric iron - " " " " "

templates for positioning

reinforcements - " " " " "

Kite Construction Step Summary

begin with the keels - the smallest & easiest pieces

- first, reinforce (hem) the edges using 1/4" 9500 two-sided tape & the assembly board
- then, add the corner reinforcements & finish them by punching the holes

next comes assembling & finishing the main sail in four steps

- first, join the 3 pieces using the F-9460PC adhesive transfer tape & the board
- second, position & attach the reinforcement patches to the back side of the sail
- third, hem the edges like the keels - folding to the back - and iron the corner patches
- finally, punch the spar & keel attachment holes

then prepare the spars for installation - the order of these things is tricky

- sand ends, put on vinyl tubing stops, ferrules, thread bumps & tubing connectors

next install 8 of the nylon cable ties thru holes in the sail for the ends of the spars

- this includes attaching the keels at one corner only to the sail

now install the spars

- longerons first - with completing of the keel attachments
- then the cross spar & wing struts - and the bow string stuff

finally, comes the bridling - be careful - bridles need to be "dead on" for a kite of this shape

details follow - ad-nauseam!!



Detailed Construction Steps

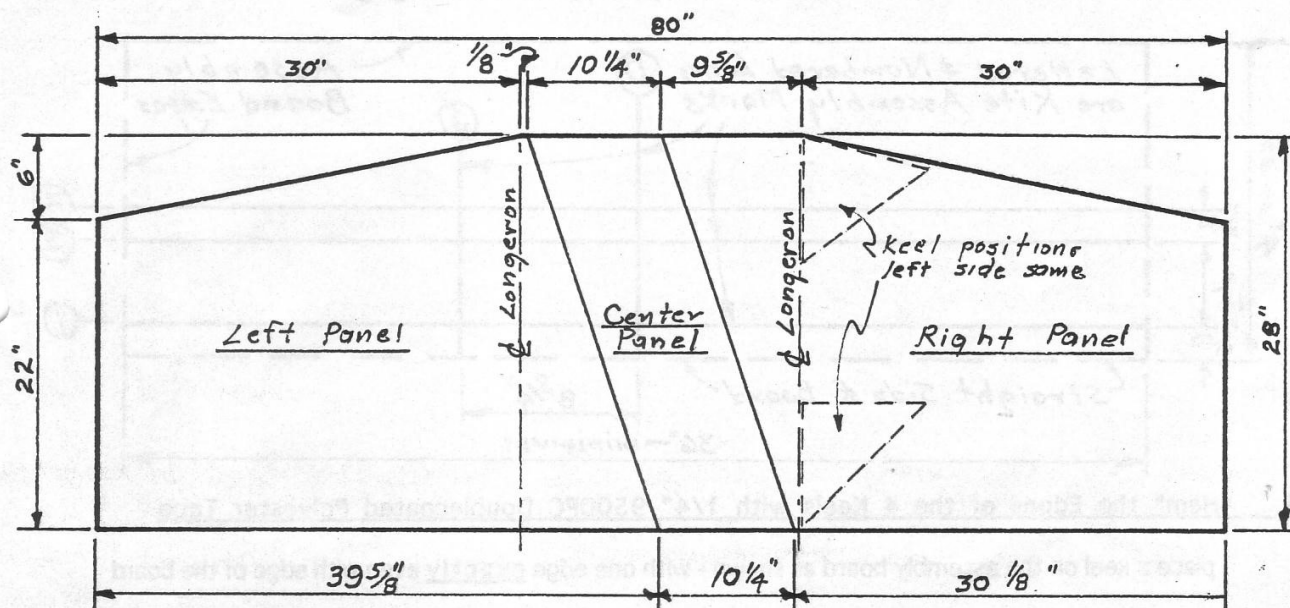
1. Sail Preparation - already done for workshop participants

sails are hot cut from 1/2 Oz. Icarex polyester fabric

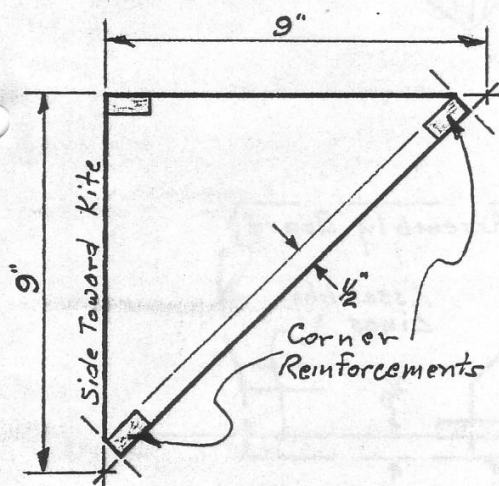
NOTICE - dimensions are "finished" sail sizes

-for cutting, add 3/8" around all edges for hem folds

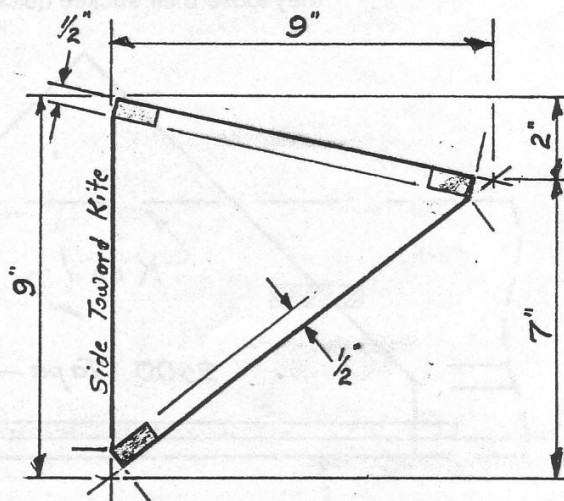
add 3/16" to both pieces where sail panels join for 3/8" overlap



MAIN SAIL



REAR KEELS - 2 Req'd

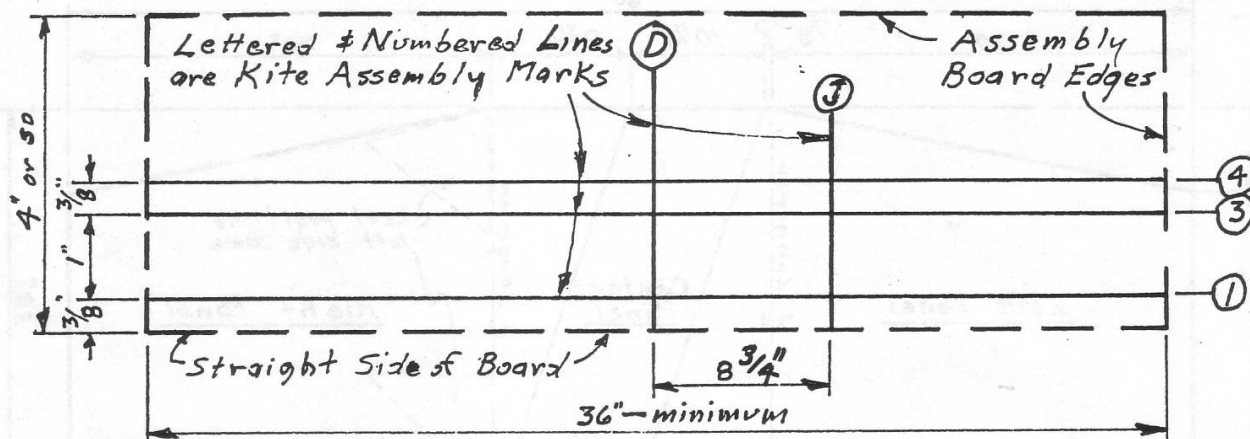


FORWARD KEELS - 2 Req'd

snip Icarex at pointed keel corners to match 1/2" wide reinforcements

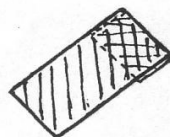
- provided for workshop participants use
- extra lines on boards are for other kites

if you use paper or poster board, cover with 2" clear packaging tape after marking it so that tapes can be stuck to the surface and removed repeatedly without damaging it

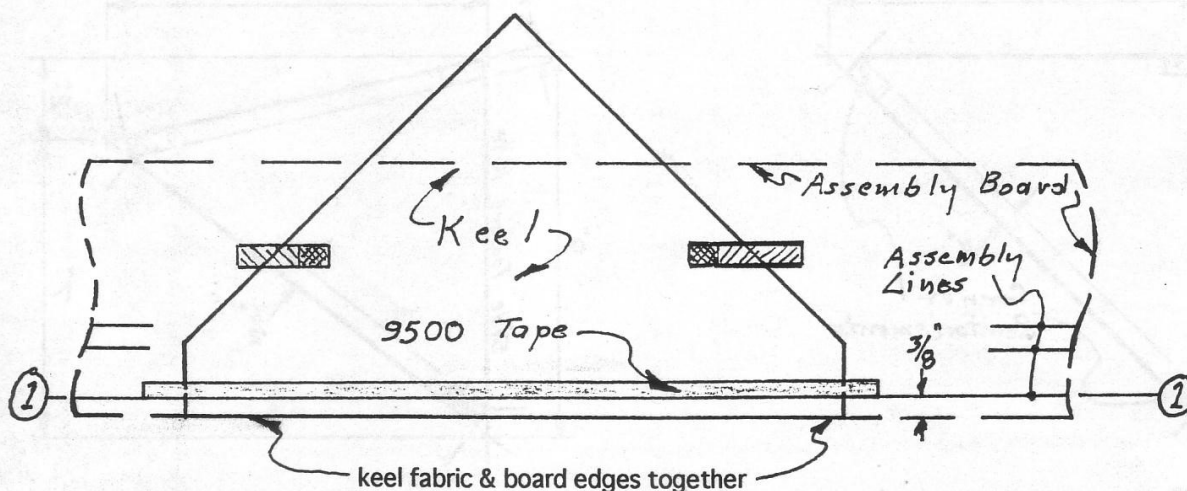


place a keel on the assembly board as shown - with one edge exactly even with edge of the board

IMPORTANT - use each tab only once
they loose their stickee quicke



← the fold makes a "no-stick" handle

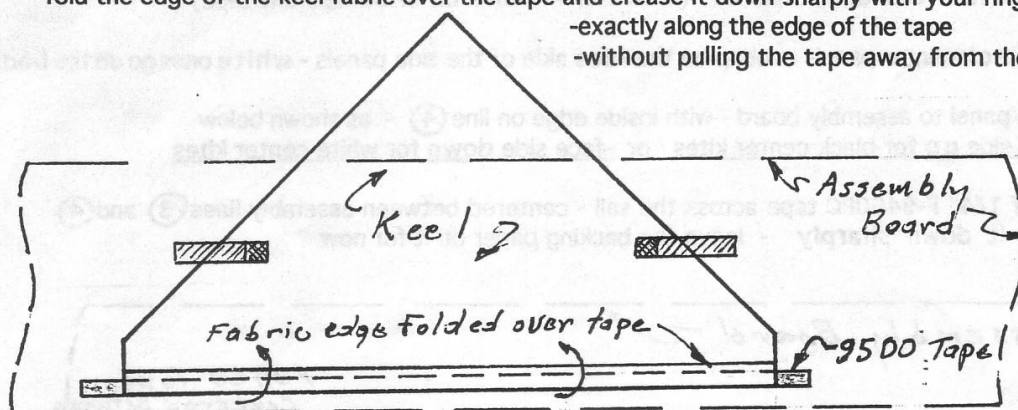


place a length of 1/4" 9500 tape across the keel, following the line ① that is 3/8" from edge of board

- don't stretch it - let the ends lap over the keel a half inch or so and stick to the board
- leave the backing paper on the tape for now

3. cont. "Hem" the Edges of the 4 Keels

fold the edge of the keel fabric over the tape and crease it down sharply with your finger nail
 -exactly along the edge of the tape
 -without pulling the tape away from the line



now, remove the backing paper from the tape & gently stick the fold down along the crease
 -start in the center & work to ends by sticking small spots at middle of each unstuck length

stick a finger tip to one overhanging end of the tape

-slip a round toothpick under the fabric & roll it under your finger tip to free tape end from the board
 -snip off the excess sticky tape & repeat at the other end

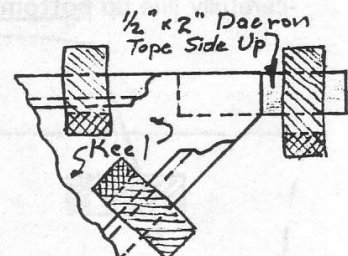
turn keel to next edge & repeat process 'till all 3 edges are hemmed on all 4 keels
 - do not hem the short corner ends

4. Put Corner Reinforcements on Keels - find 12 pc. 3.9 oz. dacron 1/2" x 2" w. 9460 tape attached - fold in center, tape side in, making 1/2" x 1", and crease

fasten a keel to the assembly board with tape tabs as shown

-place a dacron piece half way under the keel corner tape
 side up & fasten down with tape tab

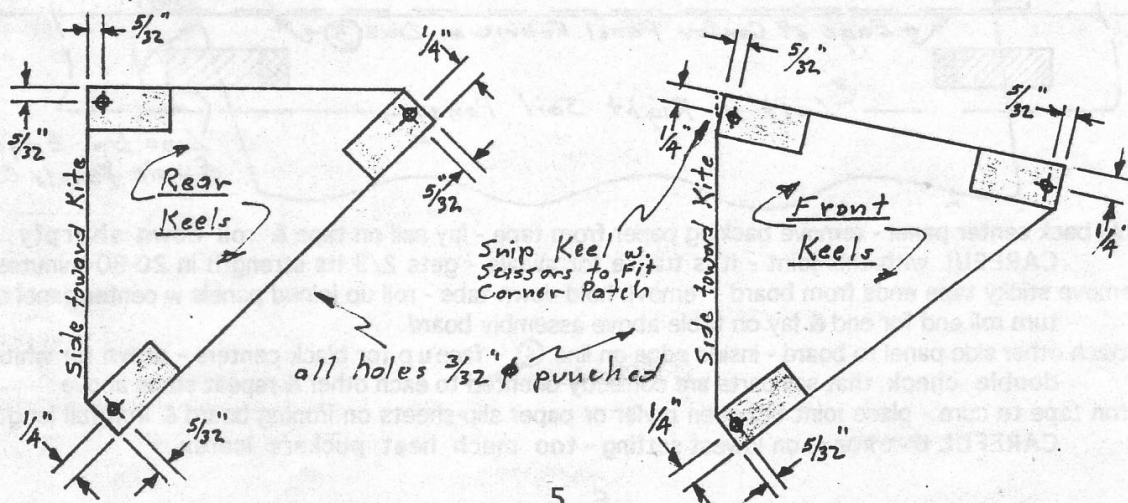
lift keel corner, remove 1/2 of backing paper & stick keel down
 -remove rest of backing paper & fold dacron over keel fabric



repeat until all 4 keels are finished

careful to point the reinforcements as shown below

finally, iron just the corner patches (on both sides)
 & punch all the holes

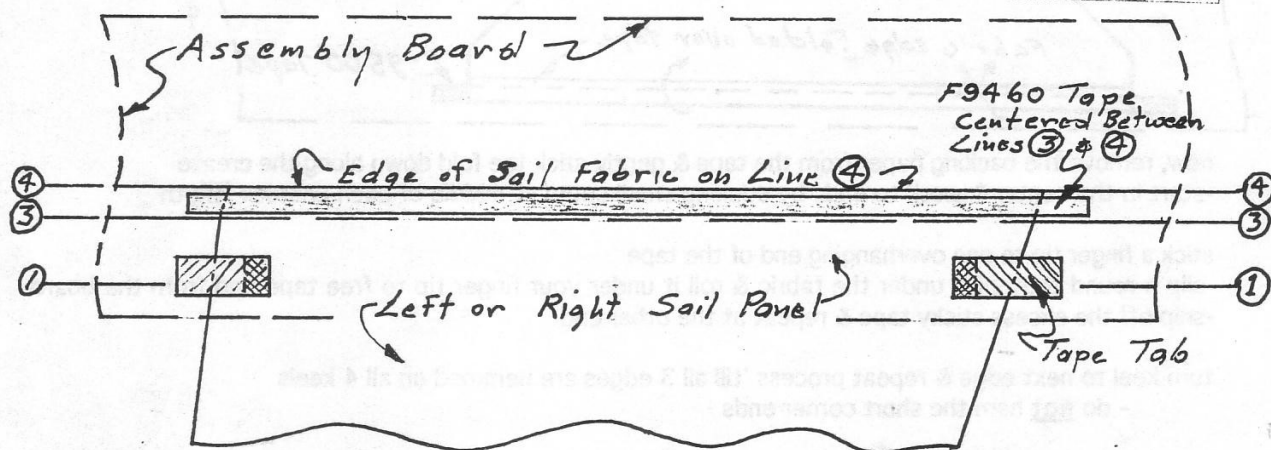


5. Join the 3 Panels of the Main Sail - with 1/4" F-9460PC Adhesive Transfer Tape
determine the 'face' side of all 3 pieces (I mark them with a bit of transparent tape)

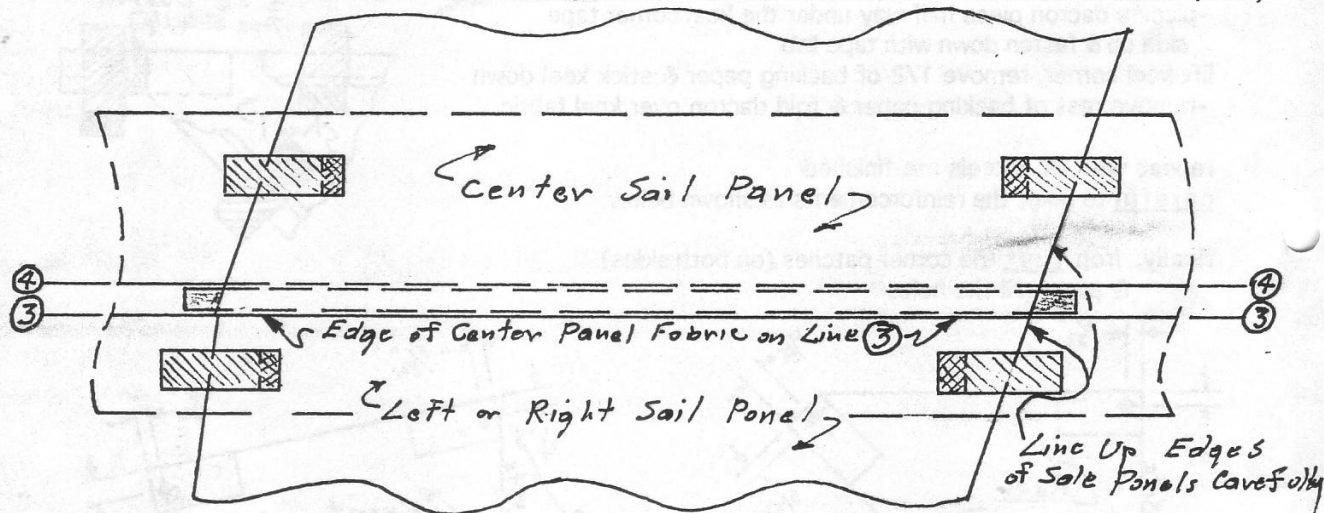
NOTICE -black center panels overlap on the face side of the side panels - white ones go on the back

fasten a side panel to assembly board - with inside edge on line ④ - as shown below
-face side up for black center kites or -face side down for white center kites

place strip of 1/4" F-9460PC tape across the sail - centered between assembly lines ③ and ④
- roll it down sharply - leave the backing paper on it for now



fasten the center panel to board - overlapping the tape - with the edge on line 3 - shown below
-carefully line up bottom edge of both panels (a tiny snip is needed on 1 top corner of center panel)



fold back center panel - remove backing paper from tape - lay sail on tape & roll down sharply
CAREFUL with this joint - it is fragile for awhile - gets 2/3 its strength in 20-30 minutes
remove sticky tape ends from board - remove hold down tabs - roll up joined panels w center panel out
turn roll end for end & lay on table above assembly board
attach other side panel to board - inside edge on line ④ - face up for black centers - down for white
double check that sail parts are correctly oriented to each other & repeat steps above
iron tape to cure - place joint between mylar or paper slip sheets on ironing board & iron full length
CAREFUL that iron is on lowest setting - too much heat puckers Icarex

6. Finish the Main Sail - Reinforcing Pieces & Edge Hems

find remaining 12 pieces of 3.9 oz. dacron w. 9469 tape & the 1"x20-1/2" Icarex rub strip w. 9500
some of these little things are almost (not quite) the same - some left & right hand too
- use the full size sketches on the next page to sort them out & find their positions

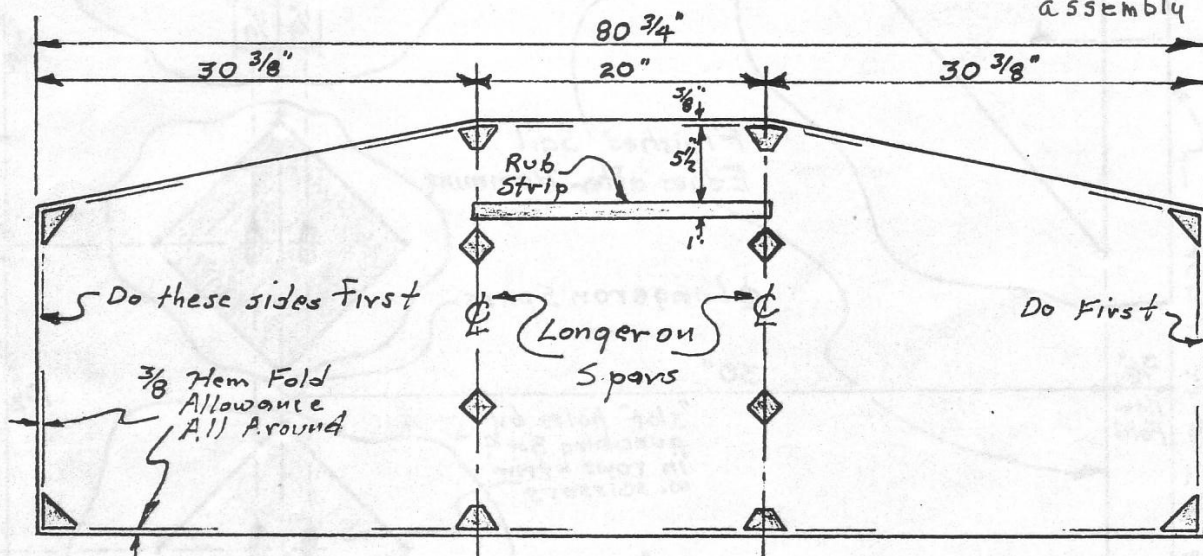
Reinforcement Preparation (already done for workshop participants)

- each piece hot cut from 3.9 oz. dacron using formica patterns
- 9469PC Adhesive Transfer Tape put on one side from a 1" wide tape roll - trimmed w scissors
- tape placed on side of dacron with ridges from hot cutting
- ironed with lowest permanent press fabric setting on the iron to cure adhesive



Positioning Reinforcements

lightly pencil mark the centerlines (CL) of the longeron spars on the face side of sail
- so you can erase them after the reinforcements are put on the back side



- Important - maintain an accurate 3/8" hem fold allowance from the edges of the dacron pieces
- use the mylar template sets to mark their positions & hole punching on face side of kite with pencil
- can lay kite corners on full size sketches (p 8) as templates if no mylar ones are handy
- place reinforcements & rub strip on back of sail - fasten sail to board to locate inside ones per p. 9
- don't iron reinforcements until after hemming the sail edges

'Hem' Sail Edges - like the keels back in step #3 - except folding Icarex over the reinforcements

- hem sides of kite before before the leading edge - so overlap is correct under tips of cross spar
- cut thru hem allowance of the Icarex at both ends of the longeron spars per next page sketch
- hem long edges (top & bottom of kite) in 3 sections each - with joints on spar end reinforcements

Finish the Reinforcements

- iron just the reinforcements w. the point of the iron - don't iron sail edge hems or the rub strip

finally, punch the 3/32" holes thru the reinforcements

note - the 2 holes in each pair are quite close together

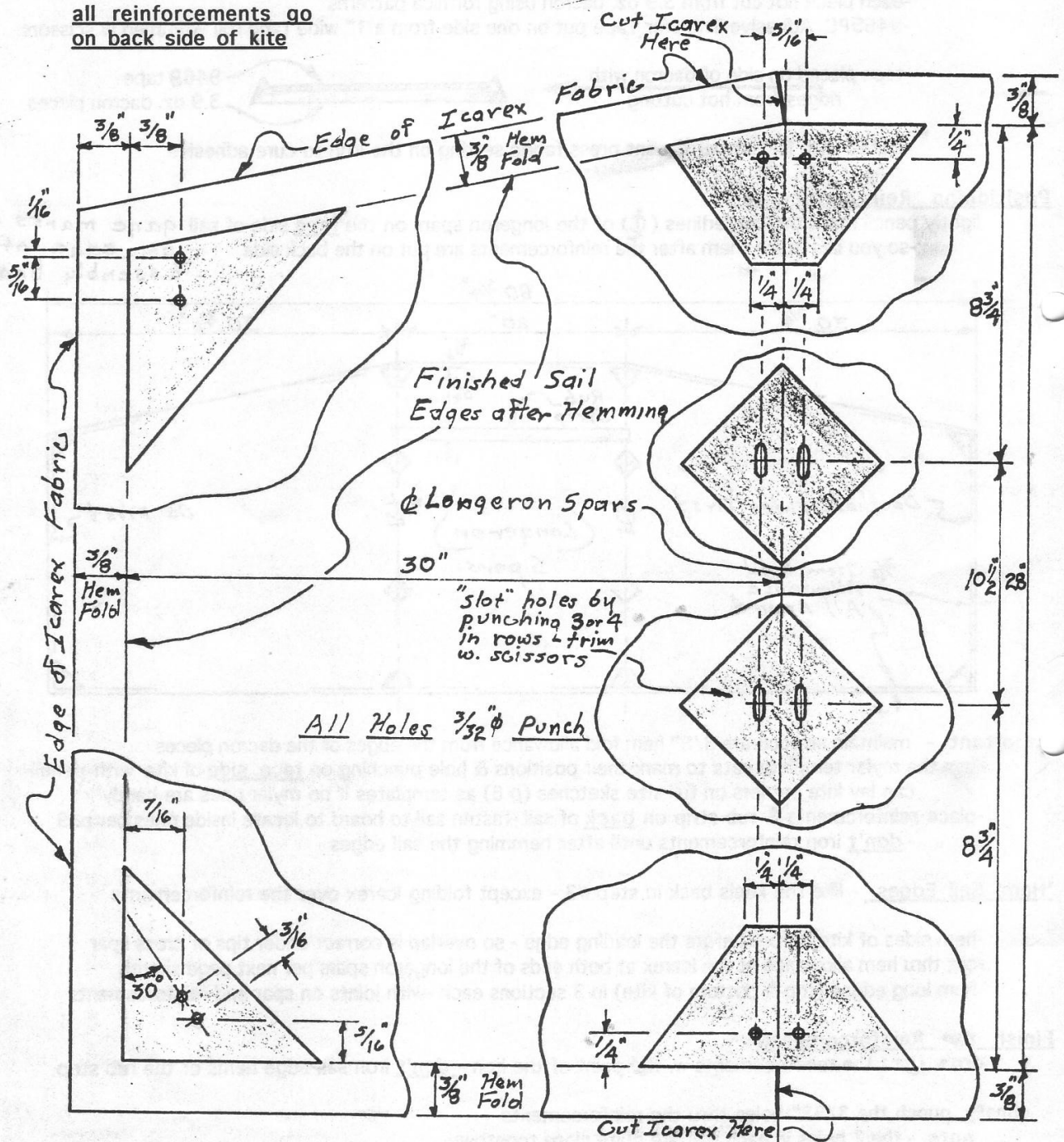
if they are any further apart, the cable ties cause the sails to wrap around the spars too much

6. cont. Attach Reinforcing Pieces to Sail

do the pieces around the edges of the sail first - be careful to keep the $\frac{3}{8}$ " edge distance accurate

then locate the 4 pieces in the center part of the sail as shown on next page

all reinforcements go on back side of kite

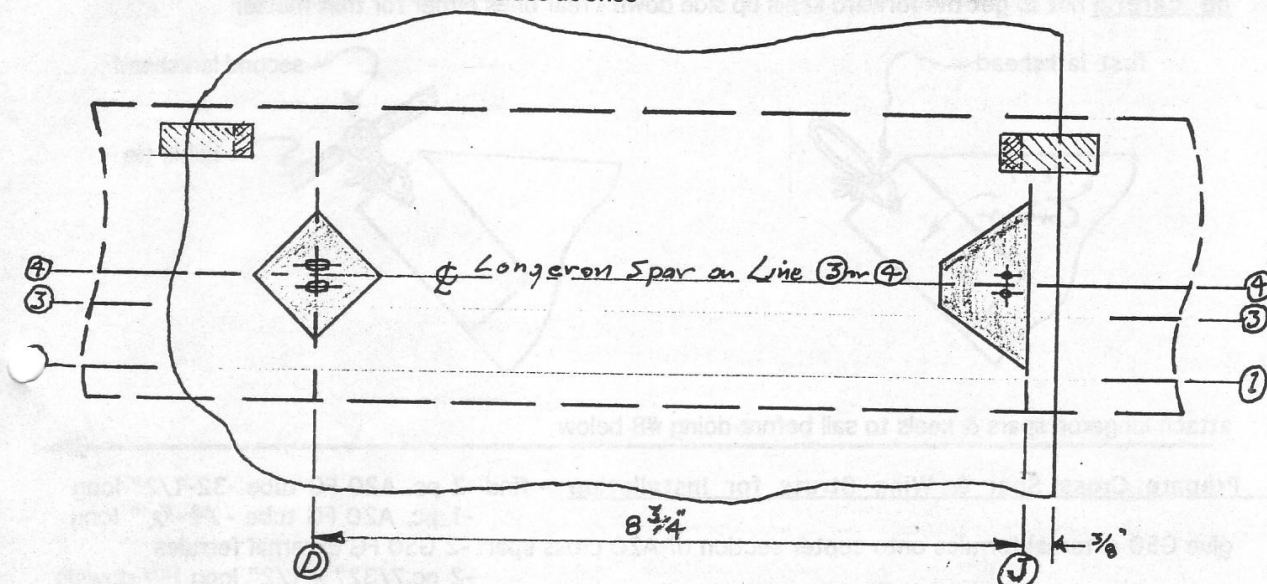


Right Side of Sail - shown from the back - Left Side is Opposite Hand

6. cont. Attach Reinforcing Pieces to Sail

attach sail to assembly board with a longeron spar ϕ on line ④ and the outside edge of a spar end patch on either line ① or line ⑤ as shown below
position a 1" sq. patch on the spar ϕ and the other of lines ① or ⑤ - repeat 4 times

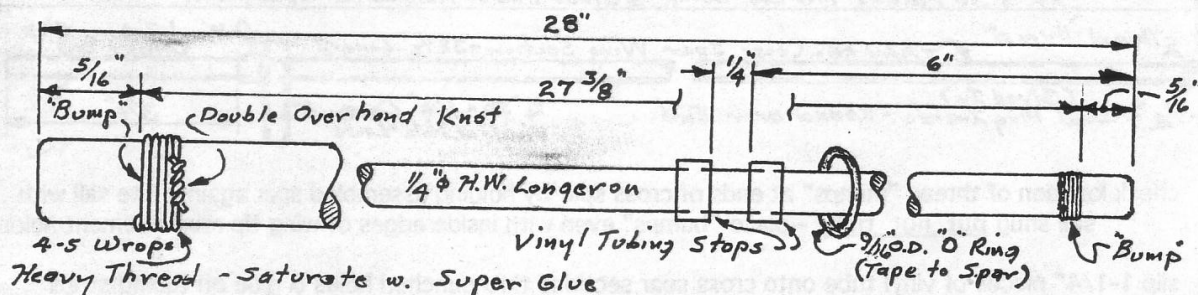
after hemming edges & ironing patches, crease these 4 middle reinforcements along spar ϕ , and punch the slotted holes thru both sides at once



7. Prepare Longeron Spars & Keels for Installation - find round both ends of hardwood spars slightly w sandpaper

glue 2 vinyl tubing stops onto each 1/4" x 28" longeron where shown below to position cross spar
slip "O" ring over each spar & tape to vinyl stops so they will be where you want them when you want 'em there

- 2 @ 1/4" x 28" HW dowels
- 4pc. 75# dacron line 3-3/4" long
- 2 @ 9/16" OD rubber "O" rings
- 4 @ 1/4" ID x 1/4" vinyl tubing stops
- carpet thread & super glue

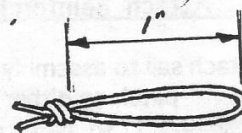


check location shown for thread "bumps" at ends of spars by holding spars against kite sail with sail pulled tight - end of bump must be even with inside edge of holes punched for cable ties
(see longeron installation sketch on page 11)

put "bumps" of 4-5 wraps carpet thread on spars - one wrap high is enough - don't pile up thread
-saturate thread w super glue - set aside to cure completely or spritz w glue accelerator
careful not to put uncured glue against sails - things get stuck forever

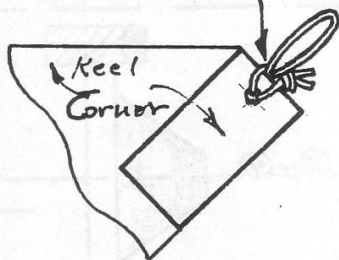
7. cont. Prepare Keels for Installation

tie the 3-3/4" long pieces of line (4) into 1" long loops →

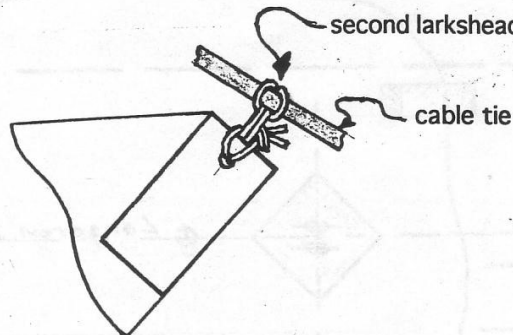


larkshead a loop onto the forward corner of each front keel and the back corner of each rear keel as shown - the second larkshead in each loop is threaded onto a cable tie as the tie is attached to the kite be careful not to get the forward keels up side down - rear ones either for that matter

first larkshead



second larkshead



attach longeron spars & keels to sail before doing #8 below →

8. Prepare Cross Spar & Wing Struts for Installation - find -2 pc. A20 FG tube -32-1/2" long

-1 pc. A20 FG tube -14-1/2" long

glue G50 external ferrules onto center section of A20 cross spar -2 G50 FG external ferrules

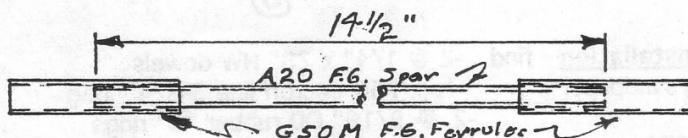
-2 pc. 7/32" x 1/2" long HW dowels

-2 @ 1/4" ID x 1/4" vinyl tube stops

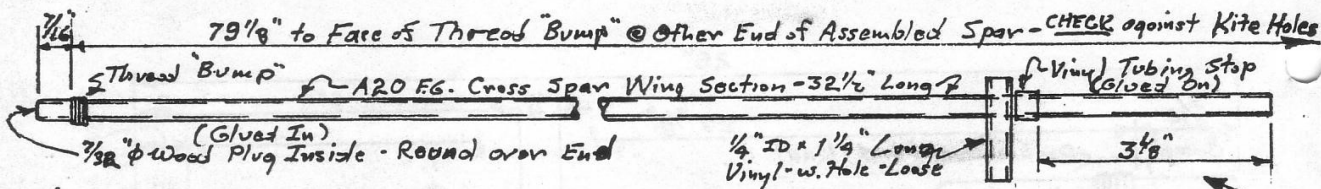
-2 @ 1/4" ID x 1-1/4" vinyl w holes

-2 @ 3/16" ID x 1/2" poly tubing

-2 @ 3/16" x 36" HW dowels

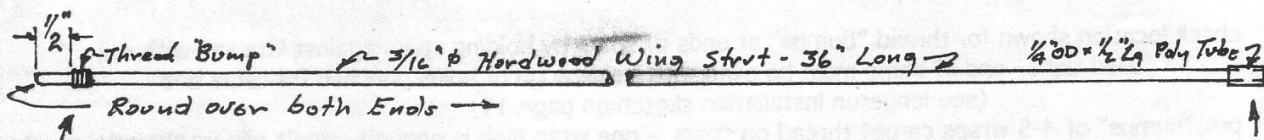


glue 7/32" dowel plugs into outside ends of side pieces of A20 FG cross spar - sand ends off round



check location of thread "bumps" at ends of cross spar by holding assembled spar against kite sail with sail snug but not tight - place "bumps" even with inside edges of wing tip reinforcement holes

slip 1-1/4" pieces of vinyl tube onto cross spar sections thru punched holes & glue on tubing stops

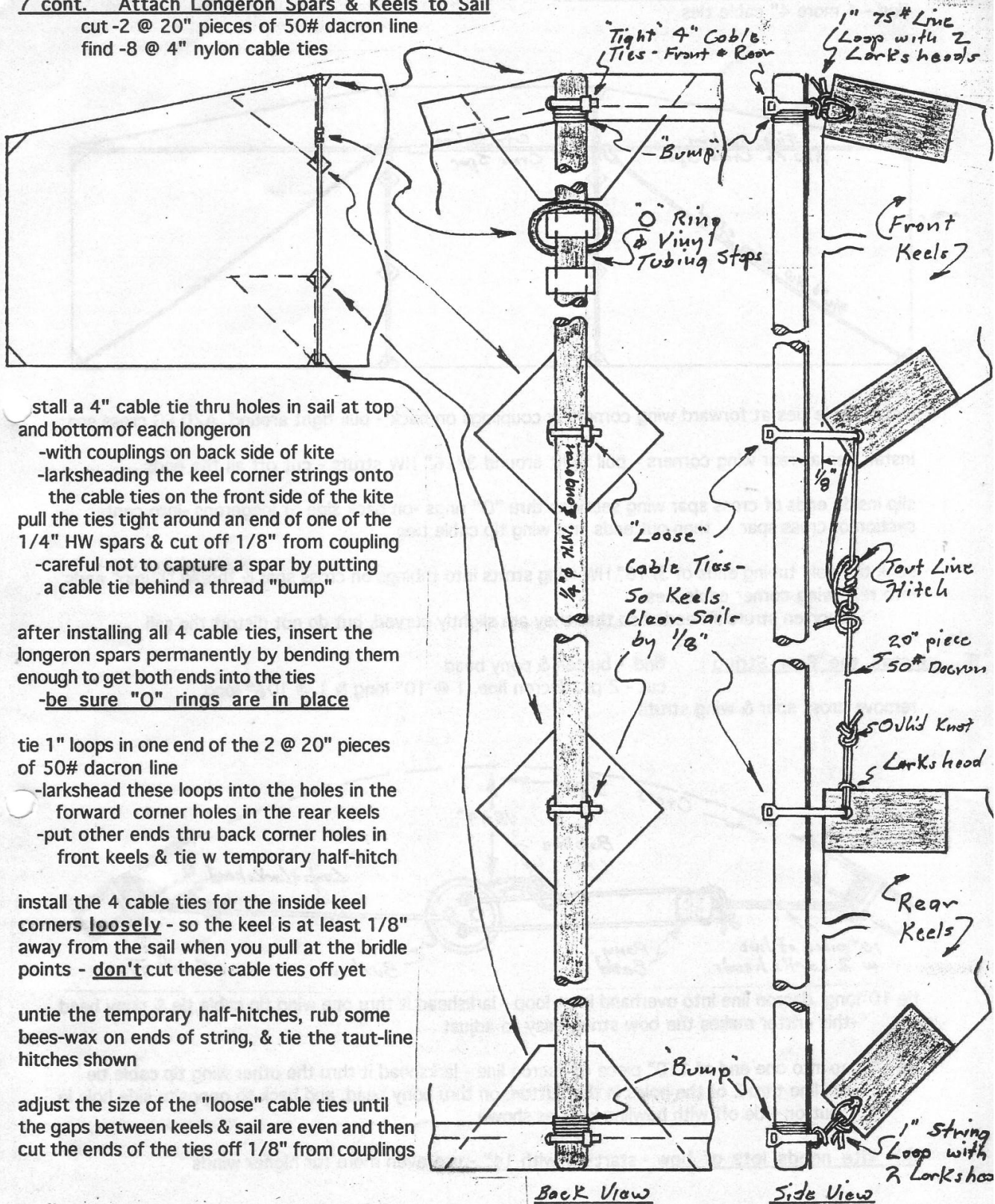


round off both ends of 3/16" x 36" hardwood wing struts slightly

place the thread "bumps" where shown & push the 1/4" OD poly tubing spacers on the other ends

7 cont. Attach Longerons Spars & Keels to Sail

cut -2 @ 20" pieces of 50# dacron line
find -8 @ 4" nylon cable ties



install a 4" cable tie thru holes in sail at top and bottom of each longeron
-with couplings on back side of kite
-larksheading the keel corner strings onto the cable ties on the front side of the kite
pull the ties tight around an end of one of the 1/4" HW spars & cut off 1/8" from coupling
-careful not to capture a spar by putting a cable tie behind a thread "bump"

after installing all 4 cable ties, insert the longeron spars permanently by bending them enough to get both ends into the ties
-be sure "O" rings are in place

tie 1" loops in one end of the 2 @ 20" pieces of 50# dacron line
-larkshead these loops into the holes in the forward corner holes in the rear keels
-put other ends thru back corner holes in front keels & tie w temporary half-hitch

install the 4 cable ties for the inside keel corners loosely - so the keel is at least 1/8" away from the sail when you pull at the bridle points - don't cut these cable ties off yet

untie the temporary half-hitches, rub some bees-wax on ends of string, & tie the taut-line hitches shown

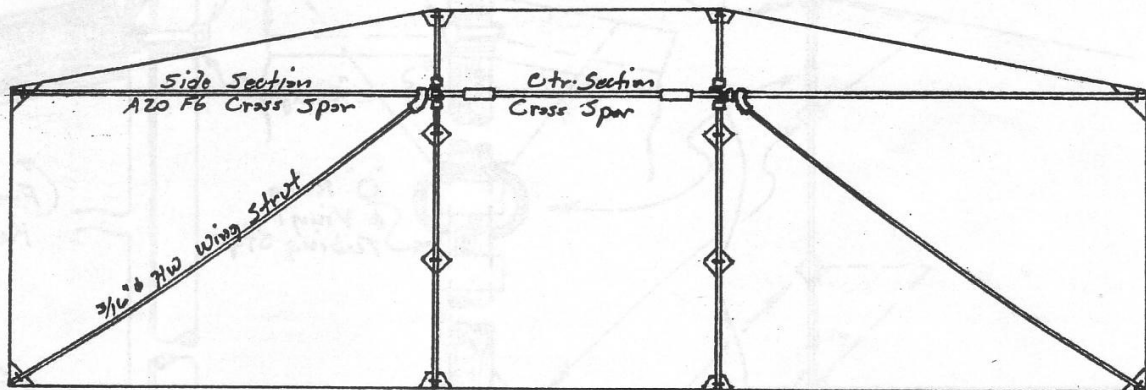
adjust the size of the "loose" cable ties until the gaps between keels & sail are even and then cut the ends of the ties off 1/8" from couplings

Back View

Side View

Longeron & Keel Details

8 cont. Attach Cross Spar & wing Struts
find - 4 more 4" cable ties



install cable ties at forward wing corners w couplings on back - pull tight around A20 FG cross spar

install ties at rear wing corners - pull tight around 3/16" HW struts - cut off all the ends

slip inside ends of cross spar wing sections thru "O" rings -on back side of longerons -into center section of cross spar - then put ends into wing tip cable ties

stick the poly tubing ends of 3/16" HW wing struts into tubings on cross spar & thread "bump" ends into rear wing corner cable ties

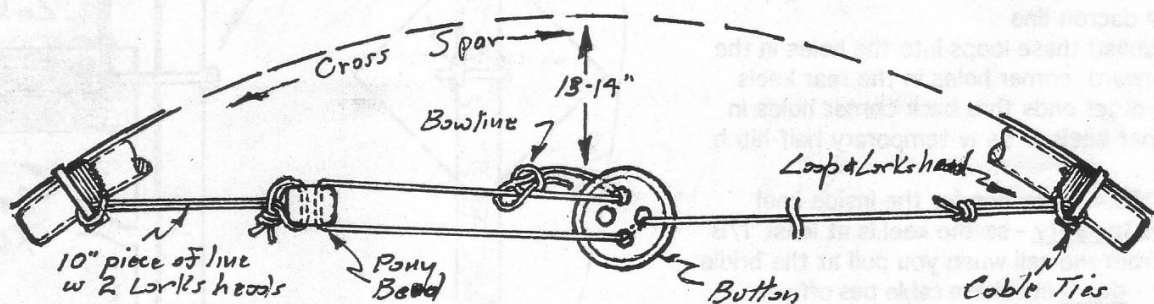
-shorten struts if needed so that they are slightly curved, but do not distort the sail

9. Install the Bow String

find - button & pony bead

cut - 2 pc. dacron line, 1 @ 10" long & 1 @ 106" long

remove cross spar & wing struts



tie 10" long dacron line into overhand knot loop - larkshead it thru one wing tip cable tie & pony bead -this critter makes the bow string easy to adjust

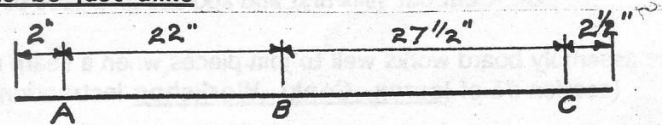
tie 1" loop into one end of 110" piece of dacron line - larkshead it thru the other wing tip cable tie -run line thru 2 of the holes in the button, on thru pony bead, and back to opposite side hole in button - tie off with bowline knot as shown

this kite needs lots of bow - start off with 14" - use even more for higher winds

10. Bridles cut -2 @ 54" long pieces & 1 @ 100" long piece of 50# dacron line

take care with bridling - both sides need to be just alike

mark the 2 @ 54" pieces as shown →

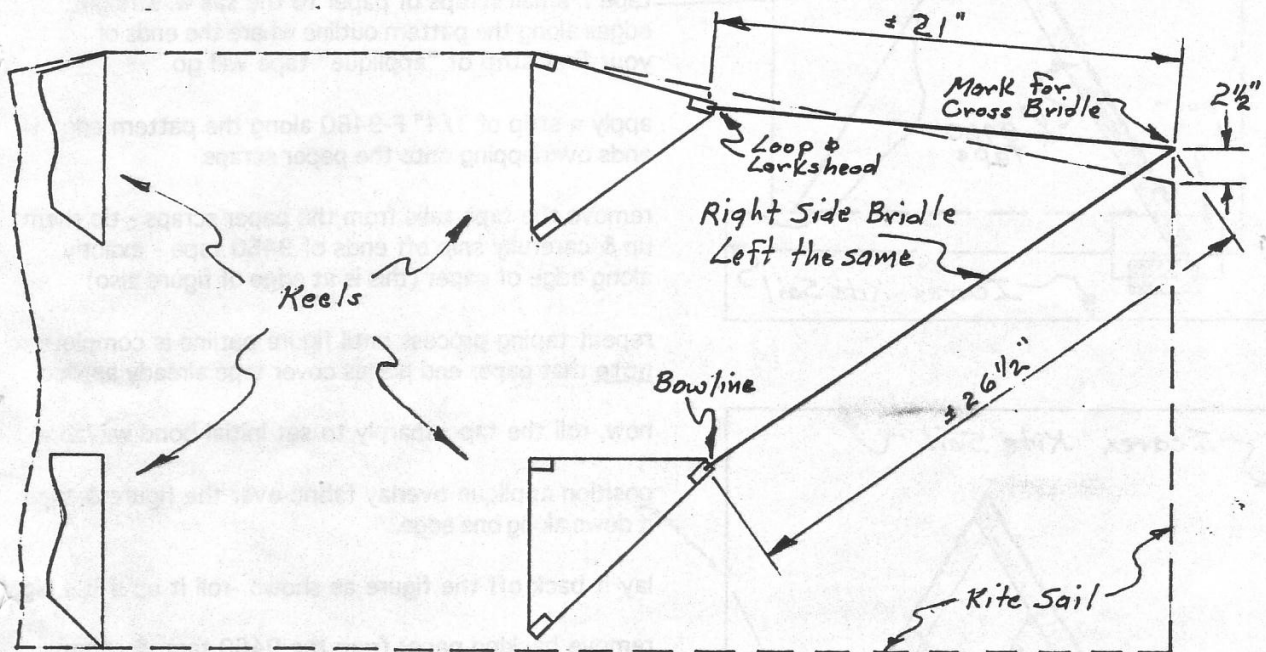


put all spars into the kite - but let it lay flat without any bow in cross spar

tie loops centered at marks A & larkshead onto forward keels - see below

tie other ends into rear keel bridle tie on holes - bowline knots - with marks C in the rear keel holes

marks B should be 2-1/2" above fwd. sail corners w bridles pulled tight to the sides of kite
if they are not - make new marks



Cross Bridle - see small sketch on page 1 of this outline

tie a small loop in one end of the 100" piece of line for the cross bridle

- larkshead it onto one side bridle at mark B

pull a larkshead into the other side bridle at it's mark B - put free end of cross bridle thru this larkshead - tie off with bowline knot

locate exact center of cross bridle & mark it - tie small overhand loop centered at mark for flying line

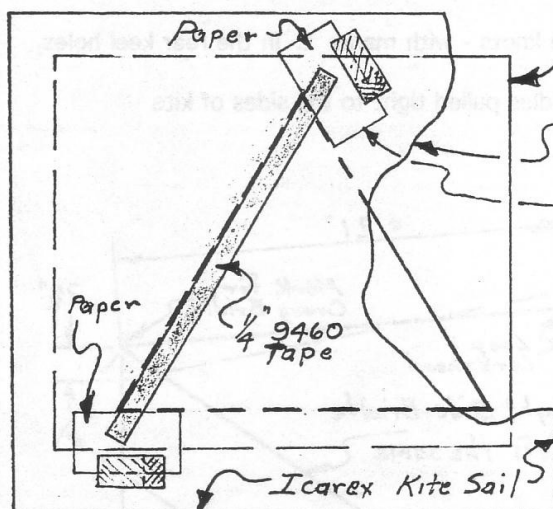
if adjustments are needed, make small ones - 1/4" at a time - up or down or sideways

By Golly, I think we are done!! Lets go fly some kites!!!

Graphic Designs on Non-Sewn Kites - your first shot at this just might ought to be something simple
maybe do a trial figure with scrap material B/4 trying a kite
 you can either - join fabric pieces to form designs first and then cut out sails
 or - cut out sails first and add design pieces to them

the assembly board works well to join pieces when a seam runs completely across a sail
 (section #5 of Icarex Genki Workshop instructions titled, Join the 3 Panels of the Main Sail)

"applying" a straight line figure is shown in the following sketches using a triangle () as the figure



fasten a full size pattern of the shape desired to a smooth, flat work surface w. tape tabs - or - draw the figure directly on the Icarex kite sail

tape the kite sail over the pattern to locate it where you want it on the kite

tape 2 small scraps of paper to the sail w. straight edges along the pattern outline where the ends of your first strip of "applique" tape will go

apply a strip of 1/4" F-9460 along the pattern edge w. ends overlapping onto the paper scraps

remove the tape tabs from the paper scraps - tip them up & carefully snip off ends of 9460 tape - exactly along edge of paper (this is at edge of figure also)

repeat taping process until figure outline is complete
note that paper end pieces cover tape already applied

now, roll the tape sharply to set initial bond w. fabric

position applique overlay fabric over the figure & tape it down along one edge

lay it back off the figure as shown - roll it up if it's big

remove backing paper from the 9460 tape & return the overlay gently to the taped figure - don't press it into the tape until you are happy that it lays flat w/o bulges or puckers - then roll sharply again

iron taped areas to get tough bond before trimming off excess fabric as with sewn applique

Curved Line Figures - can be made by similar steps using 3M's #926 Adhesive Transfer Tape & Model 752 tape applicator - but with more difficulty -

-visibility of pattern lines with this set up is marginal
 -the applicator puts down tape without backing paper
 -#926 tape is initially lots more tacky than #9460, which makes handling the overlay fabric tougher

