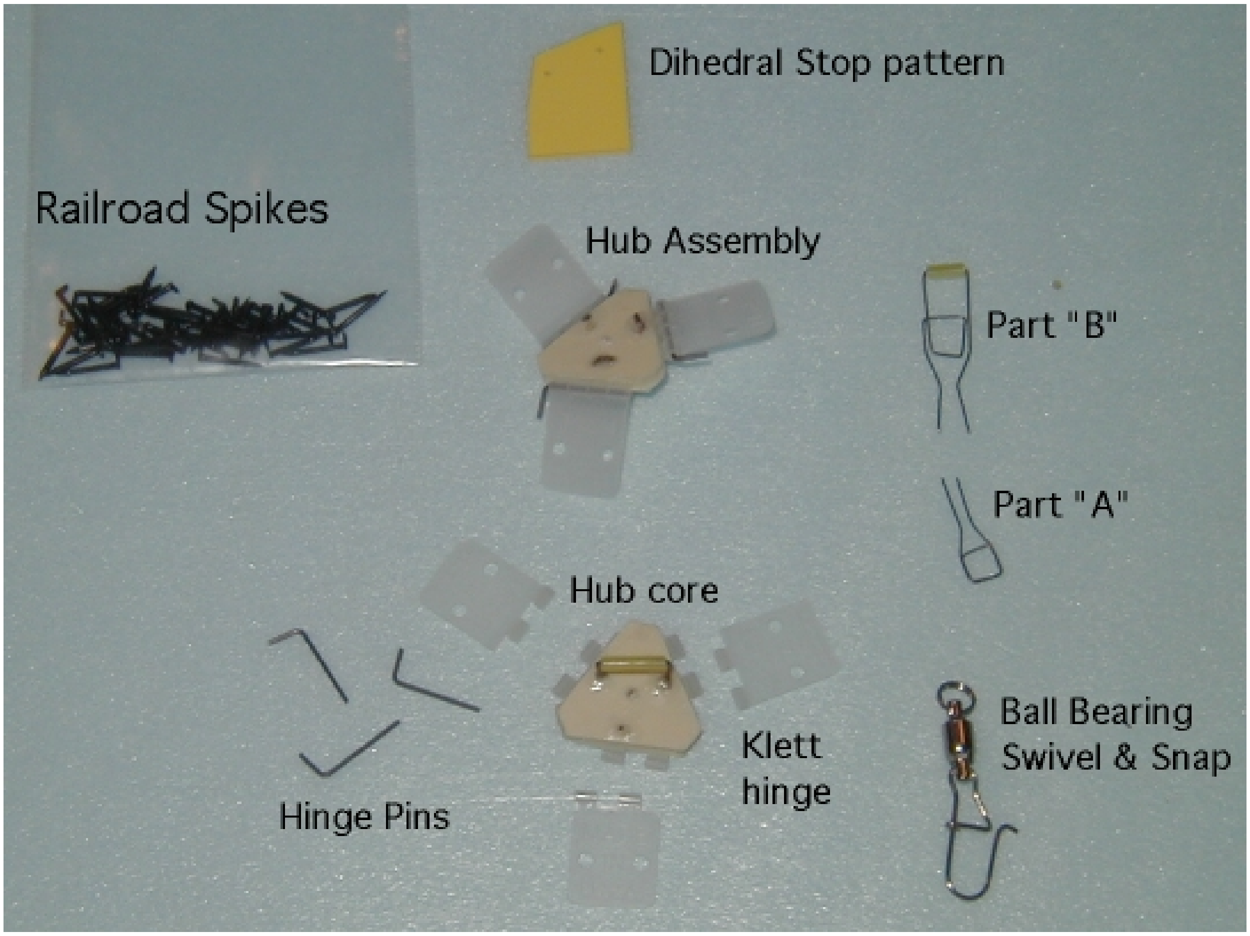


Parts enclosed:

Prototype models (1 Rotor unit, one old Kapton body, one new Kapton body)

Hub with outer Klett hinges

Elastic Zig-Zag bent wire pieces “A” and “B”

.06” Graphite Rod

Nose Cone

Pins (Model Railroad Spikes)

Dihedral stop/standoff pattern (yellow plastic)

Dihedral stop/standoff material (1/16” balsa with Skyloft vac-bagged over it)

Skyloft hinge material

Orthodontal Bands - 1/4” and 5/16”

Ball Bearing Swivel

Elastic

Kevlar cord - 100 pound

Foam plug

Glove-over nose

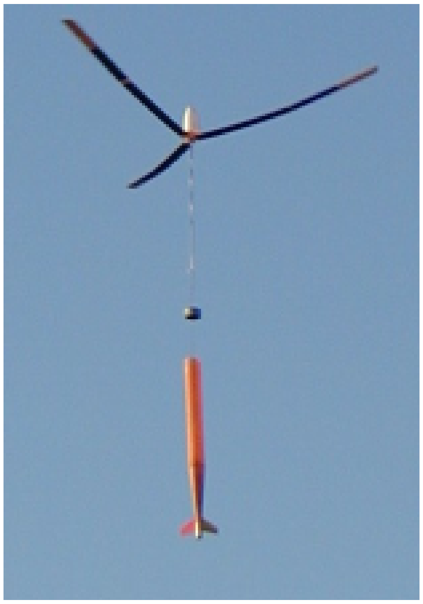
Kapton Sheet for two tubes

Foam plugs

1/64” plywood

Balsa for blades

40mm



30mm

July 23, 2002

OVERVIEW - I've done over seventy S9 flights since the May practice at Muncie. Various problems cropped up here and there. Each was addressed and a new series of flights made. The 30mm S9A versions have made about 14 flights. The S9A design is mostly scaled down version of the S9B models and using most of the same solutions (though ironically my first S9 design dating back to 1991, same basic flop rotor design, was 30mm).

There might be a temptation to make a change here or there to make something simpler or easier. I would suggesting asking me about it first, as there likely will be a specific reason something is designed as it is.

The hard part is making the rotor units. The bodies are mostly simple, except that they need to have a 9.5" long 30mm section. The bodies I am sending are Kapton tubes with paper tailcones, for 13mm Estes motors (nearly all my testing has been with Estes 13mm motors, due to lack of suitable micro motors). The Kapton is nice and light, depending on how the real fiberglass bodies go you might consider using Kapton with a fiberglass tailcone (actually Kapton might be very good for S6. Jay Marsh is using a Kapton 40mm section with a fiberglass tailcone). I am including some extra pieces of Kapton, not made into a tube, for evaluation. For shipping I've simply rolled it inside of the body tube of the prototype body tubes. If there is interest then I can describe in E-mail a neat easy way to join the overlap (basically use double-sided tape...)

I am also sending the prototypes that I flew. They are in bad shape. The paper tailcones wore out due to handling or humidity, despite the use of CA to stiffen them. The Kapton does take a beating at ejection due to the snap-back of the elastic. Even if used with a fiberglass body, there will be some sort of damage, it depends in the tube strength as to how much. I originally used an old heavy fiberglass body, which usually got a rip in the front end of the tube due to the kevlar cord trying to "zipper" into the tube wall. I ended up adding a wrap of some yellow polyester tape that Ring Rocketry sells, to make the front of the tube less prone to that damage. I think adhesive mylar tape would work OK for that too, or adhesive trim Monokote.

The thing about these models is that they only need to fly twice at the WSMC, unless you get into a flyoffs and might need to fly one a third time for second (final) flyoff round. One of the flown prototypes I'm sending flew six times, some wrinkling to the Kapton but it popped back and was flyable again. On its 7th flight it crashed, because the paper tailcone had gotten too weak from handling and high humidity, and it jackknifed at liftoff. The other flown prototype also has a jackknifed tailcone, due to a ball bearing swivel whose snap link broke, allowing the body to fall tail first onto pavement.

When I made 7 flights on one of those Kapton bodies, the model flew several flights of about 55 seconds, one flight of 65, and one of about 75. This was all flying shortly after dawn, without thermals. Given that the flights were 1/2A, off a rod, I would estimate that the 55 second average would extrapolate to 2.5 minutes when flown on a Delta A, out of a tower, and hopefully with a piston.

So, the items enclosed are one prototype (rotor unit with new Kapton body), one old prototype Kapton body, and key parts to make one or two models. One set of parts to John Langford for Fritz, and two sets of parts to David Clark (one set for Sam and one set for Abby). If someone does not want to build this design, then I didn't want to waste the time making parts that would not be used. When I get back from NARAM, I'll make up more parts for whoever does want to build this design.

I did not have time to include it, but I do have a pattern for a paper tailcone that goes from 30mm to 11mm tubing. I can send that via E-mail as a PDF file you can print yourself.

Rotor unit 1 has balsa blades that are all 1/16". As shown in the plans and printed instructions, the inner blades should be made of 3/32", not 1/16" (I was testing out whether 1/16" seemed suitable for the inner blades of this design and decided they were not). Also, rotor unit 1's blades were broken in several places due to a crash when it only half-ejected out of the body. Rotor unit 2's blades are as in the plans, 3/32" inner main blades and 1/16" outer flop blades.

I hope you find this design to be buildable. If fliers in other countries have not figured out the flop-rotor approach, I think that our teams will have a very strong chance at scoring very well at the WSMC. Both as teams and as individuals. This event has been "on the books" for over 10 years, but it hasn't been taken that seriously until it was added as an official WSMC event. Now it seems some countries are working up designs that are not ideal, or just plain dead-ends, as was seen in NAR competition in the late 1970's and early 1980's before Copter model designs settled out.

Feel free to FLY the prototypes. I would only caution not to fly one until a model has already been built so if the prototype gets lost, there would still be an example to use as a reference.

- George Gassaway

[assembly instructions begin on next page]

ASSEMBLY NOTES - Use these notes in conjunction with looking at the prototype model, photos, and drawings.   I won't pretend that i have thoguht of everything, I'm sure there's some holes. So if something is not clear, or seems to be missing, ask me via e-mail.

Rotor blades -   See page 1 of the plans

The inner blades are 8" long and should be made from 3/32" balsa sheet that weighs about 15 grams for a 3" wide x 36" sheet.

Important - check the balsa for warps. It should be warp-free. If you have to use balsa that does have warps, arrange it so that the warp will cause twist to angle the blade DOWN as it moves out towards the tip. Better to have too much negative angle of attack, spinning too fast, than to accidentally have not enough angle or worse yet backwards rotation.

Leave the balsa sheet intact. It is easier to sand the trailing edge airfoil that way, rather than cutting up the blades into separate parts. Also if you sand the trailing edge too thin, just trim off 1/16" or so and sand again to get it right. Select the stronger/stiffer end of the wood to use for the hinge root area, and sand the trailing edge accordingly. Since the model rotates counter-clockwise (as seen from above), then this means that the root area is to the left of the trailing edge. Another way to think of it....you are building "three RIGHT wings".

For sanding airfoils, I like to use a flat sanding block. Ace Hardware has a great sanding block made out of metal that is in 2 parts. See the photo. I think it is "Red Devil" brand or something like that. The only place I have found that style in recent years is Ace Hardware, though I have not tried the big mega hardware stores like Lowe's. It uses a 1/4 of a sheet of sandpaper. Good for gliders and other models too of course.

I like to sand trailing edges by laying the wood along the edge of a hard wood board I use for this purpose (particle board shelving for about $2-3). Placing the trailing edge about 1/16" from the edge of the wood, and sanding parallel to the trailing edge. Holding the block at an angle for the rough trailing edge. The wood board prevents sanding too thin, usually, you will sand into thew wood board first.

When sanding, do not sand too thin of an airfoil. Especially for the first 2-3" of the root area, do not sand it as much, so the wood will be a bit stronger there. After the trailing edge is done, then mark and trim off the balsa blade from the rest of the sheet. Mark 15/16" for the chord, then cut it. After that, continue on to sand the trailing edge of the next rotor, making sure that again the stronger-stiffer end of the balsa sheet is to the left. You can get 3 blades out of 3" wide wood. A 4" width of wood leaves balsa over for a 4th blade. That can either be a spare or a source for the blade for another model.

After sanding the trailing edges for those blades and cutting them, sand the leading edges. After sanding the leading edges, the chord might be a bit smaller, down to 7/8" chord. If so don't worry about it. But try not to let it get less than 7/8".

Repeat the same steps for the outer flop blades. Those should be made from 1/16" light balsa, 7.5" long. A balsa sheet weighing 10-12 grams for a 3 x 36" sheet is about right

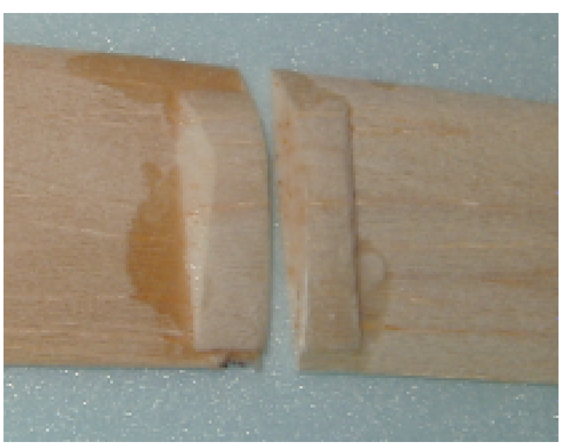
Mark the blades as to which are the root areas. Again remember the model will rotate counter-clockwise as seen from above.

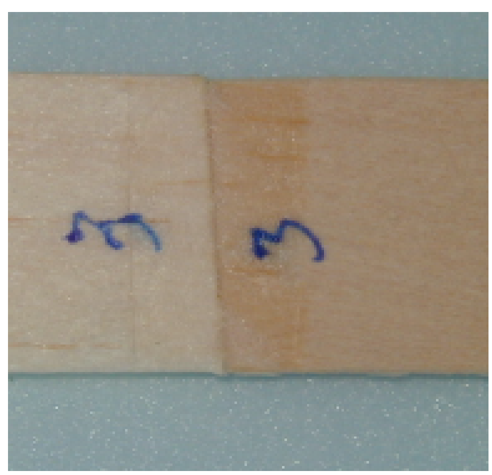
Weigh all the blades one by one, main and flop. Put the lightest flop blade with the heaviest main blade, that will help balance it out. Do not bother later adding any weight to balance anything, and if you do not have a really accurate scale do not sweat this.

Flop hinges - You will need to rely heavily on looking at the prototype.

The flop hinges need to have some stops made up out of 1/16" balsa. Cut them to 3/4" long, by 1/2" wide, and sanded into a rough airfoil. After sanding, cut them in half (using a fresh blade so the wood will not rip) so you have two 1/4" wide pieces. Pre-bend (curl) them to match the top of the curvature of the blades they will be glued to. I do not mean precisely, just to get them already curled somewhat. Be careful not to crack them. Use CA to glue those to the tops of the blades, making sure you are gluing the correct stop to the correct end of the blade. Try to have the ends of the stops dead even with the ends of the blades, where the hinge will be.

After the stops are on, pretend there is a hinge joining them already, and fold them back. Do the ends line up parallel with each other, or are they a bit angled relative to one another? If angled, you need to do some sanding to the end of at least one of them to square it up.





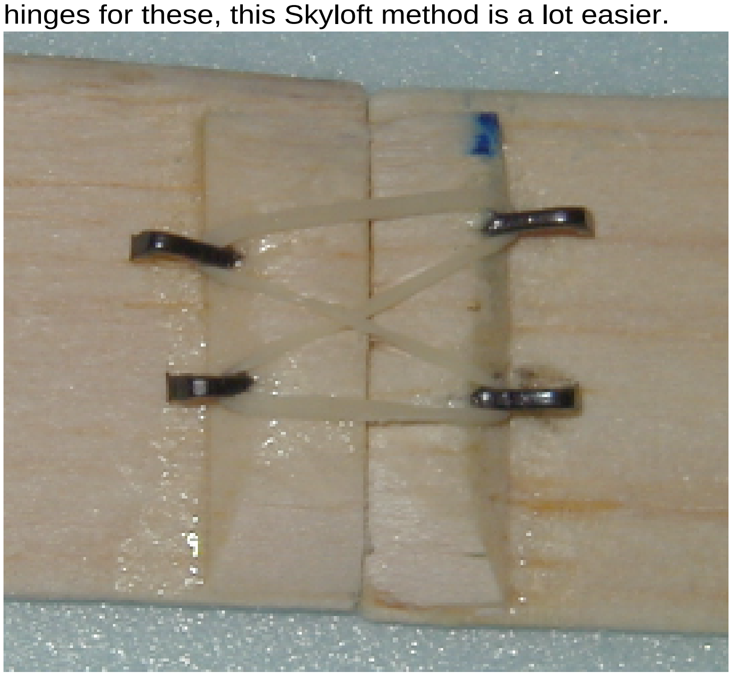
The blades are hinged using "Skyloft", a random fiber material used for model airplane covering (a piece is included in the bag of parts, and has its name written on it). Kevin Kuczek came up with this for hinging flop rotors.

Prepare to do the hinging by getting hold of a wax candle. Rub the candle onto the ends of the balsa blades, including the stops. This is so the wax will get into the end of the wood grain to prevent the wood ends from being glued together by CA. So, the wax candle is acting like a mold release. Only use the wax on the ends, do not get wax on the bottom of the blades since that is a high stress area that needs the CA to bond well to the hinge.

Cut out a piece of Skyloft the same chord of the blade, and about 3/4" long. Lay half of it onto one of the blades (held bottom side up), and carefully press the tip of the CA bottle onto the Skyloft so that CA will spread out along the Skyloft and the balsa blade underneath. Allow the CA to cure, without using any accelerator. While it is curing, lay out a piece of waxed paper onto a flat working surface. Lay the blade that now has the hinge onto the waxed paper, bottom side down. With the other blade ready, apply some CA to the Skyloft hinge that is sticking out from the other blade, laying flat onto the waxed paper, and then promptly place the other rotor into place, so the CA will bond the Skyloft to the other rotor blade. You do not have a lot of time to do this and it needs to be as accurate as possible the first time. Be sure you have the other blade butted up against the other when you do this, or you will end up with extra dihedral for the flop-blades.

Now you can hit it with accelerator. Once it is cured, carefully peel it from the waxed paper. Flip the blade over, bottom side up, and apply some more CA to the areas of Skyloft that did not have a lot of CA applied to it. When done, use more accelerator. Then flex the hinge in the flop direction, it ought to "pop" free pretty easily thanks to the candle wax.

This might sound a lot harder than it really is. And in any case, it is easy to test and practice. Just use some scrap balsa to try it out till you get the hang of it. I used to use Monokote type hinges for these, this Skyloft method is a lot easier.



With the hinge done, then the hooks for the orthodontal bands. I like using model railroad spikes for the hooks, and have provided enough for one or two models. Use needle nose pliers and press the hooks into place. Note the angles used, so it is not likely the hooks will snag anything. Also note the distances between the hooks, both horizontally and vertically. Do yours the same way, otherwise the bands may either not be stretched enough (hooks closer together) or stretched too much (hooks farther apart). Apply CA to anchor the hooks permanently.

Use a 1/4" band, attached in a figure 8 pattern as you see on the prototype and in photos. That figure-8 is important to achieve the proper amount of tension to pull the flop blades out, you get 4 strands pulling, not just two.

ROTOR UNIT - See page 2 of the drawings, and the model.

The backbone of the rotor unit is a .06” graphite rod. And the heart of it is the hub assembly. The hub is made of two cast parts, three cut-down Klett hinges, and a shock cord attachment piece made from .025” music wire. It’s already assembled. It also includes three regular Klett hinges and three hinge pins. If you lose a hinge pin, which is .026” diameter, some .025” music wire can be used to replace it. The Klett hinges are not made anymore, so if you can find any at local hobby shops, please get some. I do not mean you have to get them, I will provide what the juniors need to, but I only have a limited number to use from now on so replacement would be appreciated. No, the Du-Bro hinges are not good as direct replacements.

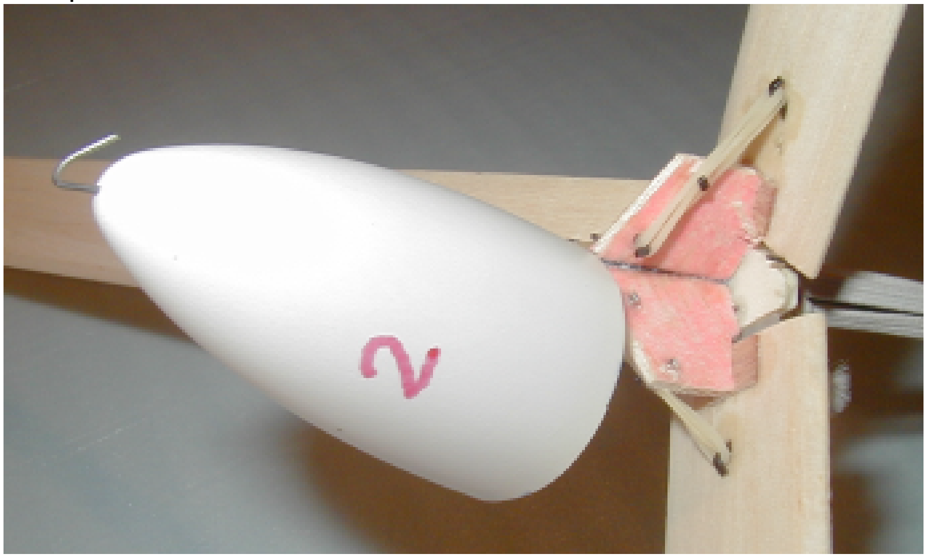
Measure out 7.5” from the end of the graphite rod, and slide the hub (without hinges) into place. Be sure the music wire used for the elastic attachment faces “down”, in the direction of the 7.5” portion. Apply a tiny drop of CA to tack-glue the hub to the rod. Rotate the rod and look edge-on at the hub assembly to see if it wobbles, or turns true. If it wobbles, it is not perpendicular to the rod, so tweak it and repeat until it turns true. When sure it is true, apply more CA. Be careful not to let the CA get to any of the hinge lugs.

Attach the music wire parts “A” and “B” used for the Zig-Zag elastic. See page 2 of the plans, and the prototype. Attach part “B” first, the one at the bottom that acts as an eyelet for the elastic with the swivel. Lay in place, and wrap with fine thread (not the big button thread often used for Estes type chutes). Be sure it is aligned with the shock cord attachment on the hub. Apply CA to the thread to make the joint permanent, and hit with accelerator. Repeat with part “A”.

Dihedral stops - Use the yellow plastic pattern as a guide. Cut out of 1/16” balsa that is reinforced by Skyloft, or 1/16” balsa with some light glass cloth. I am including some 1/16” balsa with Skyloft that was vac-bagged. It has a pinkish appearance due to dye used in the epoxy.

Glue the stops in place, perpendicular to the edge of each hinge facet of the hub (as seen in a top view). See the prototype. Carefully use CA here to avoid any running to the hinge lugs. I did not try to make the pattern show the notches that need to be cut on the bottom, make then notches later to achieve the dihedral needed for the blades.

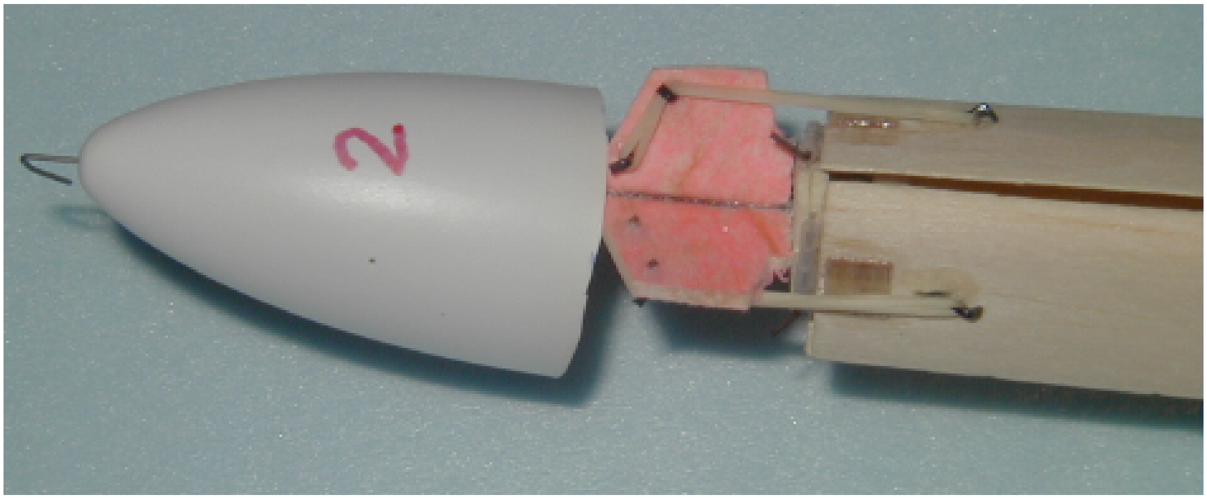
Using the holes in the pattern (and prototype) as a guide, use needle nose pliers to press railroad spikes into the stops so that they will be used as hooks for the orthodontal bands that deploy the main blades. Put the hooks on the side shown in the drawing (and model), not the other side. I had some inconsistent rotationss with the hooks attached the other way, the bands tended to pull “up” on the angle of attack in certain models so it really does matter which side the hooks are on. Have the hooks pointing in the correct directions. When the spikes are in place, use CA to secure them. After the CA cures, use diagonal cutters to snip off the sharp end of the spikes that stick thru the other side.



HINGING MAIN BLADE - Temporarily place a Klett hinge half onto the hub, using the hinge pin. Mark the rotor blade root with two marks 5/16" apart, in the middle of the chord (Marks should have the same distance from one mark to the leading edge and the other mark to the trailing edge). Lay the rotor in place over the hinge, and using one hand, "pinch" the blade to the hinge to hold the two together. With the blade closed (launch mode), visually look down to see that the blade is aligned with the graphite rod. If not, make adjustments until it is. When it is, carefully (very carefully) apply a single drop of CA to the side of the hinge and hit it with accelerator (a second person can be helpful for that step). That tack-glues the hinge to the blade. Now remove the hinge pin so the blade can be removed. After the blade is removed, apply more CA to the hinge edges to glue it to the blade. Be careful not to let any CA get to the hinge lugs. As a final gluing step, use either a piece of Skyloft, or a piece of light fiberglass cloth to externally reinforce the glue joint. This should help assure that the hinge will not peel up. That polypropelyne plastic the hinge is made from does not bond great using CA (or with hardly any glue for that matter), so it is important to do that. Repeat with the other two blades.

Next, attach the hook or pin to the blade that the orthodontal bands hook onto to pull the main blade out. Drill a 1/32" hole at about 45 degrees, starting it from the bottom of the blade about 1/16" from where the Klett hinge ends, so the Klett hinge carries some of the stress. Use needle nosed pliers to press a model railroad spike into place, leaving only enough of a gap at the hook end to slip the bands underneath (see model). Apply CA to make it permanent. Be careful not to let CA fill in the hook area.

Cut out some 1/4" squares of 1/64" plywood. These are needed to harden the area where the dihedral stops touch the tops of the blades. I have had some blades have the balsa indented by the stops. Glue the plywood with the grain at 90 degrees to the grain of the blades. See the model and drawing page 1.



Finally, you can put the blades onto the rotor unit, using the hinge pins. Now, you can trim the bottoms of the dihedral stops for the dihedral angle. Use a single edged razor blade or model knife with a fresh new blade to trim them. Better to not trim enough and keep whittling away than chop out a lot and go too far. The dihedral angle is 17.5 degrees, or 2.4" as measured at the flop-hingeline of the main blade.   I found that less angle than this, the models sometimes would not transition well, sometimes falling sideways awhile, losing valuable altitude and time. And worst-case, all the way to the ground. More angle than that, and you are wasting performance. Not to say it has to be dead perfect, but that's the angle to shoot for, anything significantly less will run a risk.

NOSE CONE - The nose cone is permanently attached only in one place, to a piece of bent music wire that the nose slides along. The nose is done this way so that the nose can be slid forward to easily attach the orthodontal bands. See page 2 of the plans. Also, the nose is attached at the back for launch by slipping over the body tube, a glove-fit.

As I type this, I'm not sure what noses you may have for the WSMC models. For right now., I have a few old Wayne Hendricks nose cones that were not trimmed, which happen to glove fit well. He sent me a copy of the mold recently but the copy is a bit smaller, the noses are just aobut a perfect fit for 30mm but will not glove fit. Andy Tomasch has sent me some Apogee 30mm cones that he says glove-fit, but I have not received them so I do not know if they are suitable. One way or another I'll see to it there are enough cones for these S9 models for the WSMC, but right now I'm not sure which it'll be

So, this is why I do not specify a length for the graphite rod from the top end to the hinge hub. I am ending them longer than need be, you need to trim the graphite rod so that the nose bottom will be even with the bottom of the hub when the nose touches the top of the graphite rod.

Cut a 3.5" length of .025" music wire. Use a moto-tool with cut off wheel to lightly rough up the lower 3/4" of the wire so it that CA will be able to grab onto it well (if you do not have one, then use a file). I actually had one model lose its nose cone at ejection due to the wire itself coming out. Use thread and CA to secure it to the side of the graphite rod. Allow for about 3/4" of overlap or so.

Slide the nose into place, guiding the .025" wire thru the predrilled hole. Determine where to put in the 45 degree swept back bend. To determine where, let the nose be angled diagonally, and allow for 1/8-1/4" above the dihedral stop root so there will be enough clearance (see the prototype). Make the 45 degree swept-back bend, doing so in a manner that the curve of the bend does not deduct any from the length of the wire that the nose slides along. After bending, trim off the excess wire, leaving about 1/4”

ELASTIC and SWIVEL - I suggest not using any elastic other than exactly what I have tested out. I have used BRAIDED 1/8” elastic made by StretchRite. I have bought it at Wal-Mart. I have not tested anything using soft-stretch, but universally avoid soft-stretch for rocketry as I have had some breakage. I will include some of the braided elastic.

Use the prototype as a guide for how to tie and route the elastic for the “zig-zag” layout.

COLORS & finish - For visibility of the blades in flight, use black magic marker on the bottoms of the blades. Leave the last 4” (tips) of the blades bare balsa, both on top and bottom, to color by a fluorescent magenta magic marker. These markers are very hard to find now, I do not mean highlighters, but real fluorescent permanent markers. I have some on order that I will send to each of you when I get them, so just leave the blades bare for now. The reason it is preferable to use that color for the tips is that it is easy to see on the ground. And to put it at the tips because when a copter model lands, one of the blades usually sticks up like a flag.

I do not suggest dope or any other finish for the rotors. They will tend to add more mass than they are worth, and worst yet can promote warpage. Some of use are using vac-bagged Japanese tissue for our S9B models, at least for parts of the blades, but the trade-offs work out a little better for that size and strength needs.

BODY & FINS - I do not know what is going on regarding fiberglass bodies. As long as those bodies have 9.5” of 30mm section and are not too heavy, then fiberglass would be good. Fins, well, I just used raw 1/16” balsa since these are prototypes. I do suggest using the fins at this size, so the models will be plenty stable. Whatever you are doing for fins on S3 and S6 type models (material and finish), that should fine for these too, just use the fin area of these S9A prototypes

I do not know what the length of the tailcone is for the 30mm mandrels, or how much length will be used for the engine tube section. These S9A prototypes use about 2.7” longer 30mm section than minimum. So, that 2.7” extra helps keep the model legal regarding the nose length, as that music wire sticking out of the front works against you. I THINK the models ought to be legal regarding the 50% rule, but not knowing the dimensions of your mandrels and how much is used for the 10.5-11mm diameter motor mount portion, I cannot say that for certain. Obviously with a 9.5” 30mm body, the longest the model could be is 19”. **John, please check on this.**

FOAM PLUG - See page 3 of drawings. These models use a foam plug that is attached to the shock cord and is meant to be a permanent part of the model. The plug has to be protected from ejection burning damage at the back, and from other damage at the front. For burnproofing, I lay a piece of regular paper over the foam plug, and apply thin foam friendly CA to the paper, which soaked thru the paper and bonds the paper to the foam plug. After it is bonded, and accelerator used to make sure the CA has cured, I flip the foam plug over and cut around the edge of the plug to remove the excess paper. After the paper is removed, any remainder that sticks out is removed by razor blade and them by sanding. Careful to sand off the paper and not make the diameter smaller. The CA-soaked paper provides plenty of burnproofing to the plug.

The top end of the plug is protected by a 3/4” diameter disc of 1/64” plywood. Sometimes the graphite rod has snapped back into the top of the plug, ramming thru the foam. And sometimes the kevlar cord loop has been yanked thru the plug, so the ply disc also acts like a washer in this case. A 3/64 or 1/16” hole is drilled thru the plug, starting from the center of the ply disc, to prepare it for attaching the kevlar shock cord.

KEVLAR SHOCK CORD

I am providing some 100 pound kevlar I have, but only as a default.

The Ring Rocketry 100# Kevlar tends not to bunch up when stuffing thru the 1/16" hole in the tailcone. It might be waxed. The kevlar I have been using bunches up and can be tricky to stuff thru the hole. I do not have enough Ring Rocketry kevlar to supply.

Sequence for attaching Kevlar shock cord:

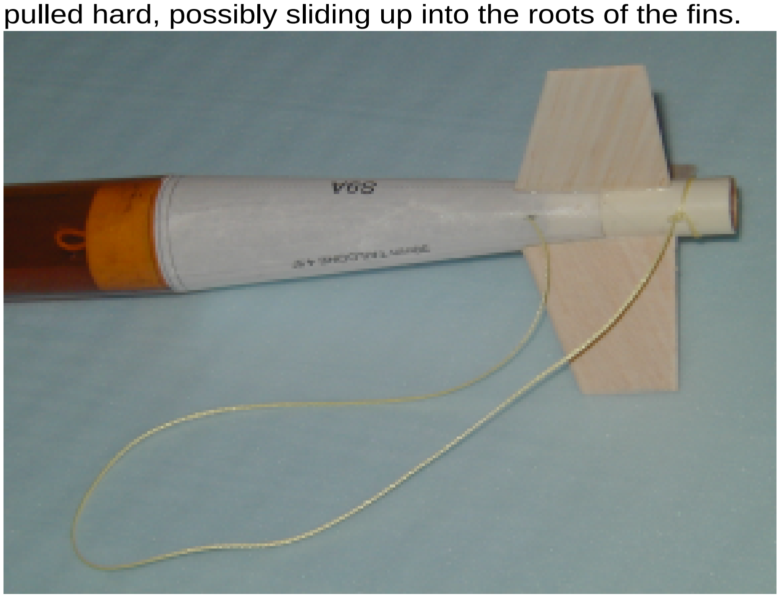
1 - Apply some Skyloft or a bit of fiberglass cloth to the area of the body tube tailcone that the hole will be drilled for the kevlar cord. This will help reinforce that area so the hole will not rip larger from the ejection forces, and applies whether the tailcone is paper or fiberglass.

2- Drill 1/16" diameter hole into tailcone of body tube. After drilling directly, angle the bit to make the hole a bit oval, parallel to the length of the model. Apply some CA to the hole and re-drill to get rid of any fuzzing.

3 - Cut Kevlar cord at least 24" long (Ring Rocketry 100# kevlar preferred). Tie simple slip knot into Kevlar cord (Lariat Loop)

4 - Apply CA to other end of Kevlar cord, for about 1", to harden it so it can be started easily thru the hole in the body tube. Insert cord into hole and keep on until it comes out the front end.

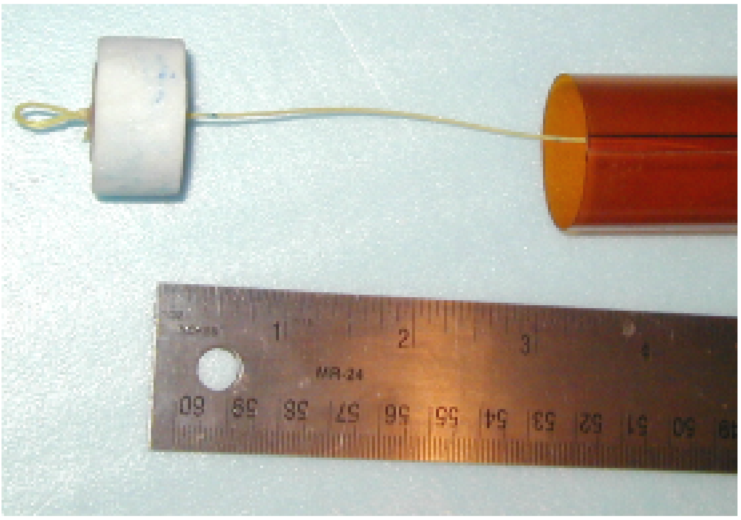
5 - Slide slip knot/Lariat loop over end of motor tube and pull it tight. Leave plenty of room on the tube below the cord so you can use tape to secure the motor later. Align the know with the hole. Carefully apply a little bit of thin CA to the kevlar loop to glue it to the motor tube, avoiding the knot. This gluing is to help make sure the loop will not easily slide upwards when pulled hard, possibly sliding up into the roots of the fins.



6 - Thread kevlar cord into hole in the foam plug. Put a mark on the kevlar cord 3" from the top end of the tube, as 3" is the ideal length for the kevlar cord distance form tube end to plug base.

7 - Make a loop and knot into the kevlar, on the top end of the plug. Try to make the loop and knot so that the loop is 1/2-3/4" tall and the 3" distance from tube end to foam plug is achieved. Use foam friendly CA to attach kevlar knot to the plug, and to make the kevlar loop

rigid.



KEY PROBLEMS TO AVOID –

Excess shock cord - this counts both for kevlar and for elastic. A number of flights got tangled up at ejection. The only way to solve the tangling was to make the total distance of kevlar shock cord and elastic from the top of the tube to the bottom of the rotor unit as short as practical. This is why the ballpark for the kevlar from top of tube to bottom of foam plug is 3”, and why the elastic should not have any excess extending out at all from the bottom of the rotor unit, just the knot and the swivel.

Band Tension - If the orthodontal bands do not have enough pull, the blades will not deploy consistently. I use two 5/16” bands side by side to deploy the main blades, and one 1/4” band for the flop blade.

Dihedral angle - If there is not enough dihedral angle, the rotor unit might fall sideways for awhile, before the model hopefully finally stabilizes. The dihedral should be about 2.4” as measured at the flop-hinge joint, or 17.5 degrees.

Kevlar Jammed with piston - It is possible for the kevlar cord to become trapped between the foam plug and body tube. Worst yet, the kevlar can move up higher, looping over the top of the foam plug, so that at ejection the kevlar jams and stops the foam plug, preventing the rotor unit from coming out. I had a model crash due to this, and found it happen in test prepping a number of times. This is why the models use the Lariat Loop method, so if need be the kevlar cord can be pulled rearwards in prepping, so that the kevlar can’t get trapped. Now, with a VERY transparent fiberglass body tube, or a Kapton tube, it is possible to visually look for the kevlar getting between the foam plug and tube wall, so if it is not jammed then there’s no need to pull the kevlar out the back. The crash I had was when using a tube that I could not see through.

Swivel breakage - I only had this happen once, but that was enough. The swivel itself was fine. The snap portion broke. I have replaced the original snaps of the swivels with stronger ones, so these should be OK. I will provide those, and they are included with the special parts enclosed. I mention this so that you know it’s not a good idea to just add any old swivel.

FLYING NOTES –

I flew these on 1/2A3-4T and 1/4A3-3T motors. Due to the performance potential of these models, if you make any 13mm flights, there will be a risk of losing it on a 1/2A if there is any chance of a thermal around. 1/4A3-3 will not take it up very high, but it does take it high enough to test out ejection, deployment, and rotation, with very little risk of loss unless you boost into a thermal. If you have any Apogee motors, then an Apogee 1/2A2-2 and 1/4A2-2 would be the ones to go with. If you tried an A in them, it is a big risk of losing them unless you are flying in pretty calm air with no lift, and on a pretty big field. I would suggest for a "full power" A flight in S9, that the model be rigged in some way so that it will not rotate properly. That way you can check out the boost for aerodynamics and strength, and a few other things, but you do not have to see how well it transitions and rotates since low power testing covers that aspect.

Also note if you fly on A power, and have Apogee motors, use an A2-3. If you use a Delta motor, which would be a good idea to do at least once to test the boost dynamics, expect the model to eject after apogee. A2-5 will be at least 1 second too late. And Delta motors tend to have longer delays as they get older. So if you have or can get hold of any from the 2000 WSMC, use those. I have some from 1994, and they eject very late.

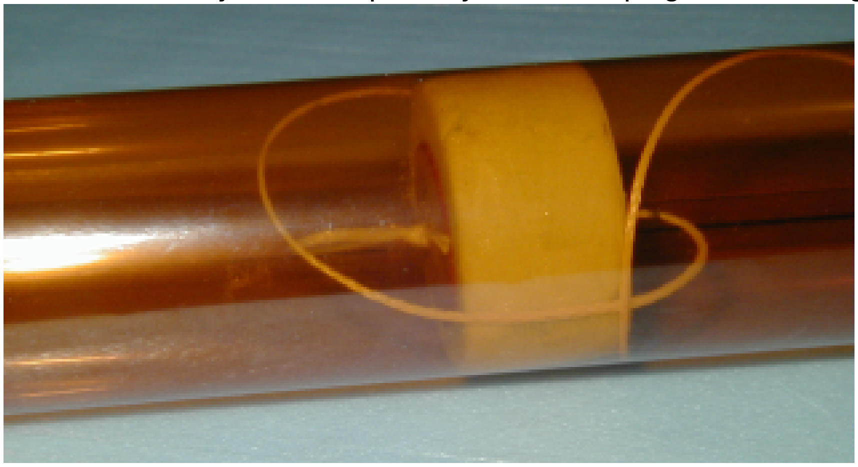
PREPPING NOTES –

Make sure swivel is attached properly to the kevlar cord of the main body.

If orthodontal bands are old, or have been left attached under tension for a long period of time, replace them.

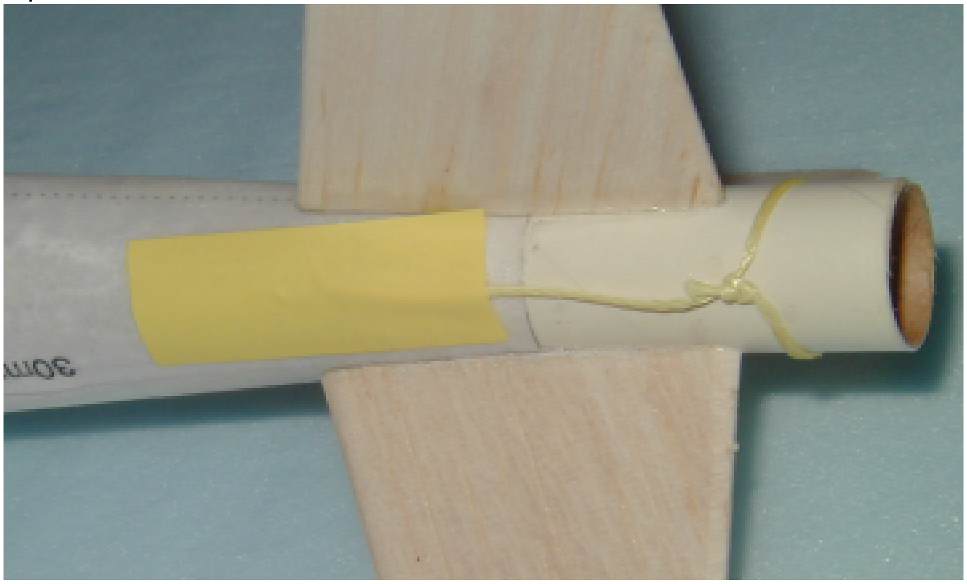
Hook up all bands and check that the tension is good. Two 5/16" bands for the main blades, one 1/4" band for the flop blades. If the flop tension does not feel quite right, add a second 1/4" band.

Fold up rotors. Place foam plug into body tube. Press rotor unit down against the foam plug, pushing it all down into the body tube. The kevlar cord needs to stay below the foam plug. If it get jammed in any way, you have to pull it out and start over. Repeat until the rotor unit and plug are all the way down, but only if you can be sure visually that they are. You have to be sure that the kevlar is not jammed or possibly above the plug, or else it might crash.



<-Jammed kevlar

If you cannot get the rotor unit and plug to go down all the way and be visually sure that the Kevlar is all below the plug, pull the kevlar down thru the 1/16" hole in the tailcone. If there is tape over the hole, remove the tape. Pull out all the kevlar while pushing the rotor unit and plug down. Once they are down, then stuff the kevlar back into the hole. As I said before, the Ring Rocketry kevlar is easier to stuff thru the hole than he spool of kevlar I have (what I'm providing is what I have from the spool). After the kevlar is all back inside, apply a piece of tape over the hole.



I have been prepping my models by doing the rotor unit first, and engine last. I did not have the Lariat Loop method, and the foam plugs tended to get very sticky, so I needed to be able to blow into the engine mount to force the rotor unit and piston back out. I still think it may be best to stick with that approach. However, I do not recommend leaving the rotor blades folded up over a really long period of time, so it would not be good to fold up the blades and then lave the model that way for awhile before getting around to prepping the motor and then flying.

I purposely arranged the Lariat Loop system on these models so that the loop is a permanent part of the body, and far enough above the engine mount that it does not interfere with using tape to externally hold the engine, as opposed to just a friction fit. Also, to make interfacing with a piston easier, I would suggest allowing the engine to stick out rearwards more than you might do normally. On a regular contest rocket you might risk an unstable flight, but this is one of the reasons for making these very stable.

The last thing I do is to put the nose cone on. I do not do it after putting the rotor unit on because it is possible the nose will come off while installing the engine. It can take awhile to get the knack of getting the nose to fit over the end of the body tube. What I do is to tilt the nose a little bit, get most of the tube into the nose a bit, and then for the portion of tube that is not inside the nose, compress the tube wall inwards till the nose can be slid down, then let go so the tube pops back outwards. That is easier to do with the Kapton than fiberglass, but I have done it with fiberglass too.

When sliding the model into the tower, use care or else the top ends of the rails will hit the nose base and push the nose off. If that happens then you have to take the model out of the tower and get the nose back in place.

Also, since the nose fits over the tube, if you have a tower that had very little tolerance between the rails and body, this might be a problem. I doubt it though.

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