In checking my files on this model I found a real wealth of material to share with you. I wrote two separate article for Flying Models Magazine on the little PT 19 based on the Easy Built Model kit (http://www.easybuiltmodels.com/)...one on converting old time stick-and-tissue kits for electric powered RC flying, and another on the details of using traditional silkspan and dope covering techniques. I have presented my *original, unedited* versions here, along with substantial files of photo including *many* shots the magazine simply could not make room for. If you have specific questions about any of them please get in touch with me and I'll try to include an explanation in my blog, so everybody can see it.

## CONVERTING TRADITIONAL STICK AND TISSUE DESIGNS

## FOR ELECTRIC R/C FLYING

(With thanks to Flying Models Magazine)

Just about everyone who has been around model airplanes for a while knows about those *old time* rubber powered scale models…the ones with that slick art on the box cover and a simple bundle of balsa sheet and sticks inside, wrapped in a plan and some colored tissue. It doesn't take much experience to understand that there's nothing at all *simple* about building one and getting it to fly…but…it's nothing you can't learn to do. Those of us who pass as *old timers* ourselves *had* to learn our model building skills from kits like that…they were the only game in town…but we weren't any smarter than today's new modelers. In fact, building a flying model airplane the old way, cutting out all those parts and trying to do a neat covering job with dope and tissue, makes a lot more sense now than it did when we *gray eagles* were just green fledglings ourselves.

21st Century technology in the form of sophisticated miniaturized radios and the magic carpet combination of brushless electric motors and Lithium Polymer batteries makes all the time you might spend working on an airplane the old way a pretty safe bet. It sure beats turning your beautiful new airplane loose so a wild snake of twisted rubber could jerk it up and over and down into the hard ground before you had time to figure out what was going on. You *can* fly those old model designs really well on rubber power, but it takes an artistic touch to do it right. Using electric power and tiny servos to turn your efforts into a successful flying machine is a smart alternative.

A while back I did a review of the BMJR *Miles Magister* right here on the pages of Flying Models and I suggested how well that kit design had solved the problems of combining the essence of old time structure with new technology. *Great*, I hear you saying, *but what about all those other old designs?* There are dozens of classic balsa stick and tissue scale models in production as kits, and probably *hundreds* around in the form of reproduced plans. What does it take to turn one of them into a miniature radio controlled gem of scale aeromodeling? The quick answer is, *you have to make a lot of the decisions yourself.* This article will show you how I did it when I converted the Easy Built Models Fairchild PT-19 (kit FF-06) from rubber powered free flight to electric powered radio control.

The minimum demands of re-engineering a classic *stick and tissue* rubber model so it will fly reliably are that you provide a place to mount the motor, battery and radio system and create some sort of moveable control surfaces. You can add as little as

possible to the original design, keeping weight to a minimum to permit very slow flight, or you can accept more weight and higher speed in the air and add features that increase the scale fidelity and/or esthetic appeal of the airplane. You can always count on touches like lightweight sheet balsa skins, aileron control, scale rib spacing, steerable nose/tail wheels and perhaps simple scale engine detail to add plenty of charisma. There are no clear boundaries between *simple* and *scale*…you can always find something else to eliminate and reduce weight a little more, just as you can also get inventive and find plenty of ways to add interest without increasing weight too much. As a modeler experienced enough to be doing a kit conversion, *you* have to choose just how far you want to go, and what you want the finished model to do.

The 1/12 scale Easy Built PT-19, with a wingspan of 35", is expressly designed to become a rubber powered free flight scale model. Like many other Easy Built designs I am familiar with, it is engineered to *minimalist* standards; that is, the structure is intended to be *just strong enough* for practical flying in order to help the builder create a *really light* model. I chose to go beyond basic changes like the addition of working control surfaces, building a motor mount, and finding ways to increase structural strength to deal with greater thrust and flight loads that a rubber powered airplane would have to deal with.

I knew right away that on this model I wanted to add a maximum of detail and structural modification to suggest the appearance of the full scale PT-19 without getting involved in exacting reproduction of detail…this is Scale for Fun, not for Scale Masters. Here's what I did…take a close look at the photos to see how. The

wing, horizontal tail and vertical fin were all skinned with 1/32" balsa sheet, as were portions of the fuselage nose and upper rear deck. I reinforced the nose structure and added a 1/16" ply firewall to serve as a mount for my geared Astro 01 brushless motor, and built up a scale cowl from light balsa blocks and more 1/32" sheet. This cowl is attached at the rear by two small screws and slips off easily to the front when the propeller is removed.

There are extra ribs in the control surfaces to replicate scale spacing, and I made patterns for extra parts to cut the wing rib spacing in half (twice as many ribs for a stronger, more rigid wing). I added a bottom forward spar and included sheet balsa spar webs out past the landing gear mounting area, and changed the wing leading edge to a ¼" x ½" balsa strip that was sanded to conform with the airfoil profile. The wing root fairings are built up from scrap chunks of soft balsa and finish formed using very light epoxy molding compound sanded to final shape.

The covering is medium weight (GM) silkspan dyed with RIT fabric dye and applied wet...finish is *many* coats of thinned, non-tautening nitrate clear dope. All the markings were done using tissue cutouts doped in place. I gave the finished airplane a very light coat of matte clear Stits Polytone…the Stits product line is my preferred finishing material for all my larger scale models. *(And just so you'll know…I have a complete article detailing the use of silkspan already written, for FM to present as a complement to this material.)*

Flying weight is about 15 ounces using the a 1500 mAh 3S1P Kokam LiPo battery that would give me nearly half an hour of duration *if* I wanted to use it. A plane of this size with scale landing gear placement is happiest on really smooth surfaces, and as with all my scale taildraggers, I pay plenty of attention to keeping takeoffs and landing lined up into the wind.

PHOTO CAPTIONS

1. This airplane is going to fly *faster* than her rubber powered sisters, so Bob added ribs to the wing for extra stiffness. The ribs marked in green are the new ones.
2. The very light kit leading edge gets replaced by a strip of firm ¼" x ½" balsa that is slotted to accept the ribs. This is the underside of the wing…you can see the cutouts for the top spar.
3. The leading edge is shaped to permit the sheet balsa wing skins to fit smoothly.
4. Here are the left wing panel and horizontal tail surfaces with the *bottom* 1/32" sheet balsa skins in place.
5. Bob gets plenty of help keeping mice out of his balsa supply.

6&7. The fuselage gets *lots* of work in the process of conversion…here you can see the 1/16" balsa sheet doublers that extend behind the wing trailing edge as well as the 1/8" sheet inserts between the leading edge and the nose former/motor mount. The balsa sheet *wing saddle* is part of the original design and Bob retained the original longerons as well.

8. Here's the tail *as designed*, but with balsa sheet inserts added to reinforce the horizontal tail and tailwheel mountings.

9. The rubber powered kit fuselage is one piece from tail to nose and Bob elected to retain the original fuselage framework. He added reinforcement at the nose and built a removable cowl around it. The oval former servers as the firewall/cowl base and is part of the fixed fuselage structure.
10. The horizontal stabilizer and vertical fin are fully sheeted with 1/32" balsa and glued in place.

11. The rear top deck of the PT-19 fuselage was skinned with light plywood…on our model 1/32" balsa sheet does the job. It's easiest to attach at the top center and then pull the sides into final shape (with the help of a little warm water) after the top seam is dry.

12&13. Here's the complete wing in place with 3/32" inset to replicate sheet metal on the full size airplane. The quarter circle pieces define the wing fairing aft of the trailing edge and soft 3/32" sheet completes the job. Holding soft balsa in place with masking tape while glue dries is a good way to avoid the damage that can be caused by pins.

14& 15. Here you can see the complete top deck sheet in place and the tail group fairings partly installed. They'll be pulled together at the top and glued after the lower edge seams are dry. Don't use *filler* in places like this…it's heavy and clunky and will shrink and crack. The fairings on the full size PT-19 were light sheet metal and showed a distinct lapped edge when fastened in place.1/32" balsa does the same job here.

16. Making *cut & fit* patterns for "new" parts from card stock is easy…transfer to balsa when you've got it fitting right.

17. The cowl begins life as a pair of sheet balsa inner skins that match the fuselage sides and are taped in place during construction.
18. Some of the existing nose formers from the kit get used here, along with a few new ones. The *nose bowl* outline has been traced on a balsa block for cutting.

19& 20. Don't try to sheet those compound curves all at once…cut and taper narrow planks to fit, use warm water to make them bend readily and take your time. Use tape, not pins. You can see that the results are worth the effort.

21. Here's the finished cowl with the prop shaft hole cut and the various air intake openings marked. That's the *Paul Matt* drawing Bob used as a reference in the background.

22. Bob hand made control horns from 1/16" phenolic sheet (micarta). On light models like this one, aircraft quality plywood will work OK, too, or you can adapt appropriate hobby shop hardware to fit your project.

23& 24. Bob made a simple, strong landing gear that reproduces the *look* of the PT-19 using hobby shop steel wire, bits of carbon fiber, aluminum, and brass tube, and a scrap of mild steel sheet for the tailwheel bracket. This is the kind of detail that you have to work out on your own for *your* model…there are no shortcuts, but the results are worth the effort.

25/26/27. Bob made windshield frames from .007" lithoplate (printing plate aluminum) You can find comparable sheet metal at your local friendly hobby shop. Silkspan doped in place provides color to match the rest of the airplane. Light clear plastic sheet will be trimmed and installed on the inside of each frame using water based *tacky craft glue*.

28/29/30 The cowl gets a few final details…an exhaust cutout is formed from a piece of lithoplate and a scrap of balsa becomes a cooling air exit. Those exhaust pipes are just hobby shop aluminum tubing carefully bent and flared at the ends.

31. Here's the tailwheel assembly in place with a pushrod connection to drive the rudder.

32. Bob made a simple jig to align the main landing gear assemblies while they were being epoxied in place in holes drilled in the gear mount blocks built into the wing.

33/34/35 The finished elevator is slipped into place on tabs of CyA hinge material cut to size and then the tabs are glued when it all fits perfectly.

36/37. Here's the finished aileron…this horn was made from a cut down mini servo output. The little opening in the wingtip replicates a handhold on the big PT-19.

38. The aileron servo drives a common push-pull rod through a micro servo connector. The solder joints at either side allowed individual adjustment of the ailerons without the use of heavy clevis hardware.

39/40. The receiver and servos are mounted in the front and rear cockpits in turn, with the master switch happily camoflaged with a little flat black acrylic paint at the top left.

41. Here's the whole internal radio setup from the bottom with the wing off…those tiny nylon cable ties help keep it all neat.
42. Cowl off…a 1500 mAh 3S1P Kokam LiPo pack will nestle against the Velcro on the inside right nose structure, and will connect to the red Deans Ultra plug.
43. Finally…a look at the whole airplane complete and ready for flight.
44. Bob provides a sense of scale.
45. 45/46/47. Here's a fly-past across the open sky, a low pass along the strip with distant trees for a background, and finally the instant that the tires kiss pavement.

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## COVERING WITH SILKSPAN

(With thanks to Flying Models Magazine)

Once upon a time there were no *one step coverings* for model airplanes…the taut, shiny finish and often the *color* you chose for your model as well came *in a can*. The covering material may have appeared across the hobby shop counter in a roll, but that's as close as it came to the pre-finished, heat activated products we all know about today. Covering was either paper or cloth…*tissue*, in the case of most small models and occasionally *silk*

for the bigger jobs, if you could afford it. Many of the kits you'd find on the hobby shop shelves…larger rubber powered jobs with wingspans of perhaps three feet or more, and nearly all the *gas jobs*, free flight and control line alike, came with the covering already included in the box. What you got with those kits was a kind of paper called *silkspan.* It wasn't expensive, even by old time standards…a sheet might cost you only fifteen cents…but there was nothing *cheap* about it. A good modeler could do a silkspan job and finish it with dope so there were *no* wrinkles, *no* seams, and it looked like the balsa structure and the covering had somehow been *molded together*...it was beautiful.

So, what happened to silkspan? Someone told you it became *obsolete* when plastic film coverings came along, and no one even bothers with it anymore, right? WRONG! Silkspan is alive and well and is still one of the best materials for covering small flying models that you can get anywhere. You can still buy it at many local hobby shops and from any number of specialized mail order suppliers, and it's still really inexpensive. What's the catch? It's no big deal…you have to *learn* to use it and *practice* to get good results, and it *takes time*…*way* more than any of the iron- on film products.

So, what *is* it? Silkspan is a lightweight paper with the characteristic ability to tolerate handling while it is wet and to shrink substantially as it dries. In the world of aeromodeling, *tissue* is generally considered to be an even lighter weight paper of very fine weave that may or may not exhibit *wet strength*. Tissue yields a very smooth surface with minimal dope application (and weight ) and is ideally suited for models such as small rubber power scale jobs for this reason. Silkspan is thicker and requires more dope

to seal the surface and achieve a gloss…it's heavier but also more durable and easier to work with. You have almost certainly handled silkspan already…it's the stuff teabags are made from.

Silkspan is supplied for model airplane use in sheets approximately two by three feet. We get it in three different weights, referred to as OO (light), GM (medium) and SGM (heavy). A bit of modeling history trivia…GM stands for *gas model* and SGM for *super gas model* …this gives you a good idea how long the stuff has been around. It used to be available in a wide selection of colors, the idea being to cover your model in the color you wanted and finish it with a half dozen or so coats of *clear* dope. This produced a translucent finish with a subtle intensity that most agree is better looking than the various see-through plastic coverings, without the weight of pigmented dope. Several informal studies carried out by experienced modelers over the years have shown that colored silkspan, skillfully applied with clear dope, is equivalent to or *lighter* in weight than similar plastic film. Getting that color is really no big deal. You can order colored silkspan from one of the mail order free flight specialty dealers who advertise in FM, or you can dye the white stuff from your local hobby dealer with ordinary fabric dye.

Silkspan offers other characteristics that we consider to be advantages in comparison to plastic film products. Silkspan is relatively inexpensive…about a dollar per sheet…and when your dope is purchased in economical quantities, perhaps a quart at a time for several models, it costs appreciably less than *iron on* film.

Doped silkspan is comparable in puncture resistance to very light film, *but* when it bonds to balsa and shrinks tight with dope it imparts a rigid stability to model structure that is nearly impossible to get with plastic covering. Patching little holes with a small piece of silkspan and a bit of clear dope is easy…you can even do it out at the field. Even better, silkspan is *stable*… it will not slip, bubble, wrinkle or sag, ever, once it has been applied correctly.

There are many ways to adhere silkspan to the structure of your model, but the classic method is to use *clear dope* as an adhesive and then apply more dope over the finished covering job to seal and strengthen it. There are different kinds of dope available on the aeromodeling market. Many modelers are familiar with *butyrate* dope (cellulose acetate butyrate)…the kind that is advertised as being *fuel proof*, or resistant to being damaged by glow fuel. Butyrate is not the best choice for covering with silkspan, or any other material, for that matter, because it is so difficult to control the way it *shrinks*. Silkspan can *overshrink* when doped heavily. This can cause serious warps, bowed longerons and even broken structure beneath the covering. Butyrate dope can appear to be dry and yet continue to shrink and warp your airplane, especially in a place like the inside of your car on a hot day, for *months* after you apply it. That's not all…most other finishing materials you might want to use do not adhere well to butyrate.

*Nitrate dope* (cellulose nitrate) is not as common at local hobby shops because the slightest contact with glow engine fuel turns it into a sticky mess. However, you need to know about nitrate dope because it has several excellent qualities. Nitrate dries rapidly and as soon as it *appears* dry, it has finished shrinking. When your covering job is as

tight as you want it to be, you can *avoid* overshrinking by switching to *non-tautening* nitrate dope. Not only is nitrate dope easier to control, but it also works as a fine substrate, or base coat, under just about any type of model airplane finish you might ever want to use. Lacquer, acrylics, epoxy, even butyrate dope, are happy when applied *over* nitrate. If you are using glow engines, you can still get the benefits of a nitrate dope base and use a fuel resistant paint such as butyrate or epoxy for your top coats. Modelers who use electric power can forget about this problem.

The actual process of doing a silkspan covering job is easier to demonstrate than to describe, so let's move on to the photos and see how it's done.

The actual process of doing a silkspan covering job is easier to demonstrate than to describe, so let's move on to the photos and see how it's done.

PHOTO CAPTIONS

1. Bob's conversion of the Easy Built Models rubber powered free flight kit of the PT-19 was the subject of a recent Flying Models article. This time he details doing a covering job using tried-and-true *silkspan.*

2. Let's start with something simple…we'll put a piece of silkspan over fully sheeted (closed) structure. The first step is to cut a piece of material big enough to cover the entire workpiece *and* give you enough extra to hold on to.

3. Lay the working piece of silkspan flat on a clean, soft towel and spray it with enough water to leave it thoroughly wet. Don't worry…the towel will soak up any extra water. Now lay the silkspan in place and notice how it drapes itself over curves.

4 & 5 Stick the covering in place by brushing clear nitrate dope *through the covering* and *from the center out.* Pull and stretch gently as you go. Don't try to cover too big an area/too much curvature with one piece…if you start getting tough wrinkles at the outer edges, trim back to a smooth place and start a new piece. Over sheeted structure you should expect *no slack and no wrinkles* on a section of structure when you are done attaching the wet covering.

6. Sharper curves require a different technique. You can slit, or *fringe* the outer edge of the covering and work it around tighter curves as lots of separate little strips. Do this while the paper is still really wet and use plenty of clear dope.

7 & 8 Let's try the same job on open structure (where the covering will create the entire surface of the finished airplane). This is the PT-19's rudder. Cut an oversize piece of silkspan just as before. If there are struts, horns, or other projecting parts you can't remove, make slits or cutouts to allow the covering to lie flat around them.

9. With the covering *wet*, lay it in place and work out all the big wrinkles and slack spots.

10. Fold the edge back a few inches at a time, brush clear dope generously around the *outer edge of the structure*, and press the covering into place. Do this until you have the entire perimeter attached. *Don't* allow any wrinkles or creases to remain where the silkspan attaches to structure. If you have to, brush on more dope until the bad spot gets soft and loose again…now you can reposition and stretch that section of the job until you get it right. If it's *really bad*…pull off the entire section and do it over correctly!

11 & 12. With all the edges doped down smooth, the covering on an open area should be slack but smooth…as the water dries, it will pull up nice and tight. While it's still wet, you can fringe the edges where necessary and fold the covering around using plenty of dope to keep it there. If a stubborn spot doesn't want to *stay stuck*, give it a moment to allow the dope to become tacky and try again.

13 & 14. Here's a fresh piece of silkspan ready to do the opposite side of the rudder. Use the same technique as on side one and try to get a slight overlap of the covering all the way around.

15. A piece of fine sandpaper (150 to 200 grit works well) makes an excellent tool for trimming surface edges. Sand around the perimeter *just hard enough* to tease the overhanging covering loose.

16. Let's do a bigger piece …*this time in color.* Here's one wing panel getting finish and color at the same time using dyed yellow silkspan. This is closed (sheeted) structure, so we'll start out just as we did with the cowl.

17. Dope from the center out, chasing *all* the wrinkles and loose spots by brushing in plenty of dope.

18. Wet silkspan will form readily around gentle curves.

19. A fine trick on edges and tight curves is to *press* the wet silkspan into fresh dope using the palm of your hand…push out and away from the center and press the covering down tight as you move along. (A little thinner will clean the dried dope off your hands when you're done…be sure to wash thoroughly afterwards.)

20 & 21. Here's the finished upper wing surface ready to trim. As soon as the wing is dry it'll be ready for cleaning up with sandpaper…that's the safest method to use whenever you can get a distinct edge to trim on.

22. Now we'll cover the top of the fuselage deck with a piece of blue dyed silkspan. This part of the structure is pretty much one long single curvature. *Stretch* the wet covering into place at either end then pull down tight along each edge and dope it in place.

23. Sometimes sanding the loose edges won't work. In places like this a fresh, *sharp* blade is your best friend. Always slide the blade along the cut…*slice*, don't press.

24. Here's the covered fuselage side. The top edge of the covering was cut to fit neatly against the upper deck so there'd be no need for trimming later, then doped in place and stretched smooth from the ends and lower edge.

25 & 26. Here's the bottom covering going on. It takes a delicate touch to get that final trim done right. Take your time…it's not a race.

27. A little extra dope will seal the seams and fix any loose spots that might show up after everything has had a good chance to dry.

28 & 29. The wing fairing is a concave compound curve…the toughest place of all to cover. You do it by using small pieces of wet silkspan stretched and pressed and smoothed into place using plenty of dope. This is a good place to try out some *non-tautening* clear dope…the kind that won't lift the covering to bridge across those concave areas.

30. A careful final sanding of all the edges and overlaps gets the covering ready for the first full coat of dope. Until now we have left all the areas of open structure undoped so the wet covering can shrink itself smooth across the full width of each of them. The dope will fill and seal the pores of the covering and bond the entire covering job tightly to the underlying structure. *Be careful*…as soon as the covering is as smooth and taut as you want it to be, switch to non-tautening dope to prevent overshrinking that can warp, bow and maybe even break balsa structure.

31,32,33. A wide, soft brush makes finish doping easier. All the color you see on this model is dyed silkspan attached and sealed with clear dope. This is the lightest way there is to get an attractive colored finish. Sand *everything* very gently between coats to remove that subtle *raspy* feel of the newly doped silkspan…be careful not to sand heavily where the covering meets structure, or you'll do a trim job you didn't intend ! Add more coats of thinned clear dope until the finish starts to show a subtle gloss. More dope beyond that point won't do much beside adding weight and increasing the chance of warps.

34. Color trim gets done with pieces of covering cut to size. Here the blue rudder trim strip is *just damp* and dopes into place easily.

35 & 36. Here's the trick Bob used to get "white" backgrounds on yellow covering for those old Army Air Corps markings. A circle cutter trims the covering and it lifts away easily after brushing in a little thinner to soften the dope. On an *open* wing structure he

could have covered that section with white silkspan and then *double covered* using yellow silkspan with the opening pre-cut.

37 & 38. The blue outer portion of the insignia is eased into place wet and doped down, then the little red circle finishes the job. A couple coats of thinned dope will seal the trim and blend it smoothly into the base covering