



# The Flightline



**Volume 48, Issue 14 Newsletter of the Propstoppers RC Club AMA 1042  
February 2018**



## President's Message

We are all saddened by the recent news of the death of Janice Bevan, wife of Propstopper member and former VP Dave Bevan. During her decade long struggle with progressive dementia, Janice would frequently accompany Dave to the field and other club events. She will be missed by us all. Our hearts go out to Dave at this difficult time. For those who may not know Dave, there is an excellent biography of his impressive career in aviation design and research in the December 2005 Flightline at [http://www.propstoppers.org/pdf\\_files/dec05.pdf](http://www.propstoppers.org/pdf_files/dec05.pdf)

Between the weather and last month's cancellation by Brookhaven, we have had some bad luck with our monthly indoor sessions. There are only two sessions left on the schedule this spring. So, I hope everyone is able to take advantage. You would not know it from the temperatures we have seen this winter, but April, and the "theoretical" start of outdoor season is a short two months away.

In the meantime we still have some great regional events coming up to keep us interested. Now that AMA has picked up the old WRAM show at the Meadowlands Center the new AMA Expo East, February 23-25, promises to be bigger and better than ever. And, we have the Central Penn Aeromodelers Flea Market in Lebanon, PA coming up on March 10th.

**Dick Seiwel, President**

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**Agenda for February 13th Meeting At Gateway Church Meeting Room 7:00 pm till 8:30**

1. Call to Order and Roll Call
2. Approval of minutes
3. Treasurer's Report
4. By Laws Committee Report
5. Old Business  
Education/Presentation Committee
6. New Business
7. Show and Tell
8. Adjournment

## Minutes of the Propstoppers Model Airplane Club

January 9, 2018 at the Gateway Church meeting room

Call to order took place at 7:10 PM by Vice-President Chuck Kime in the absence of the president.

Minutes of the December meeting as published were approved.

Treasurer's report was presented by Pete Oetinger.

Roll call showed 12 members present.

### Old Business:

Mike Black reminded us that the club survey pointed to some issues that could improve our meetings. It was suggested that we have more informative talks about flying issues. We will try to build this in shortly.

### New Business:

The ByLaws Committee expects to report next month. Chuck Kime reminded everyone that club dues are due before you can fly at our fields.

### Show and Tell:

Dave Harding presented a demo on vibration problems that occur in aircraft and can disrupt electronics. He showed ways in which vibrations were damped. This applies to both full size and model aircraft. ([Click here to see a video of the presentation.](#))

Larry Woodward showed his home built rubber powered Easy B. It is in indoor lightweight stick and tissue model. He covered it with lightweight condenser paper. It has an all up weight near 4 g. He has even built several propellers from plastic and balsa. He has been test flying it at the Brookhaven gym on Tuesday morning's. He is hoping to get a 2 minute flight but he notes that he thinks the record might be closer to 5 minutes for this "easy build" beginner design. ([Click here to see a video of the presentation.](#))

Al Tamboro showed his home built free flight model. He salvaged the motors from dime store helicopter type aircraft. The model weighs approximately 5 ounces. He has been working on timers to set the flight time of this electric model.

Adjournment took place at 8:45 PM

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Propstoppers Web Site; [www.propstoppers.org](http://www.propstoppers.org)  
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**2017/18 Indoor Flying at the  
Brookhaven Gym**

**February 17, March 10:**  
**6:30-9:00 pm.**

**Flying after Tuesday Breakfast 10.00am**

All Tamboro's free flight models with components hacked from "dime store" toys.



# Membership Renewal For 2018

*Membership renewal for 2018 is now required. You can renew by mail or at the club meeting in December or January.  
Don't lose your club privileges!*

*Bring cash or check and your AMA card.  
Dues are \$60.*

To renew by mail, please send a check made out to the *Propstoppers* to:

Ray Wopatek  
1004 Green Lane  
Secane, PA. 9018

Please enclose a *copy* of your current  
A. M. A. Membership card,

*And Please, Please enclose a  
Stamped self- addressed envelope.*

**Ray Wopatek Membership Chairman**

## Calendar of Events

### Club Meetings

Monthly Meetings

Second Tuesday of the month.

Gateway Community Church at the Christian Academy. Doors open at 7:00

#### Gateway Church Meeting Room

Tuesday Breakfast Meeting

Tom Jones Restaurant on Edgemont Avenue in Brookhaven. 9 till 10 am. Just show up.

Flying after in the summer at CA or Elwyn Field 10 am. Weather permitting.

Indoors at the Brookhaven Gym in winter

10:00-11:00 (subject to availability of the gym).

### Regular Club Flying

**At Old Christian Academy Field;** Electric Only

Monday through Friday after school till dusk

Saturday 10 am till dusk

Sunday, after Church; 12 pm till dusk

At Elwyn Field; Gas or Electric

Monday through Saturday 8 am till dusk

Sunday 12 pm till dusk

INDOOR Flying, see attached dates.

### Special Club Flying

Saturday mornings 10 am

Wednesday Helicopter evening in summer

Thursday evenings in the summer

Tuesday mornings 10 am weather permitting after breakfast.

Check our Yahoo Group for announcements;

<http://groups.yahoo.com/group/propstoppers/>

### Beginners

Beginners using due caution and respecting club rules may fly Apprentice or similar models without instructors at Christian Academy Field.

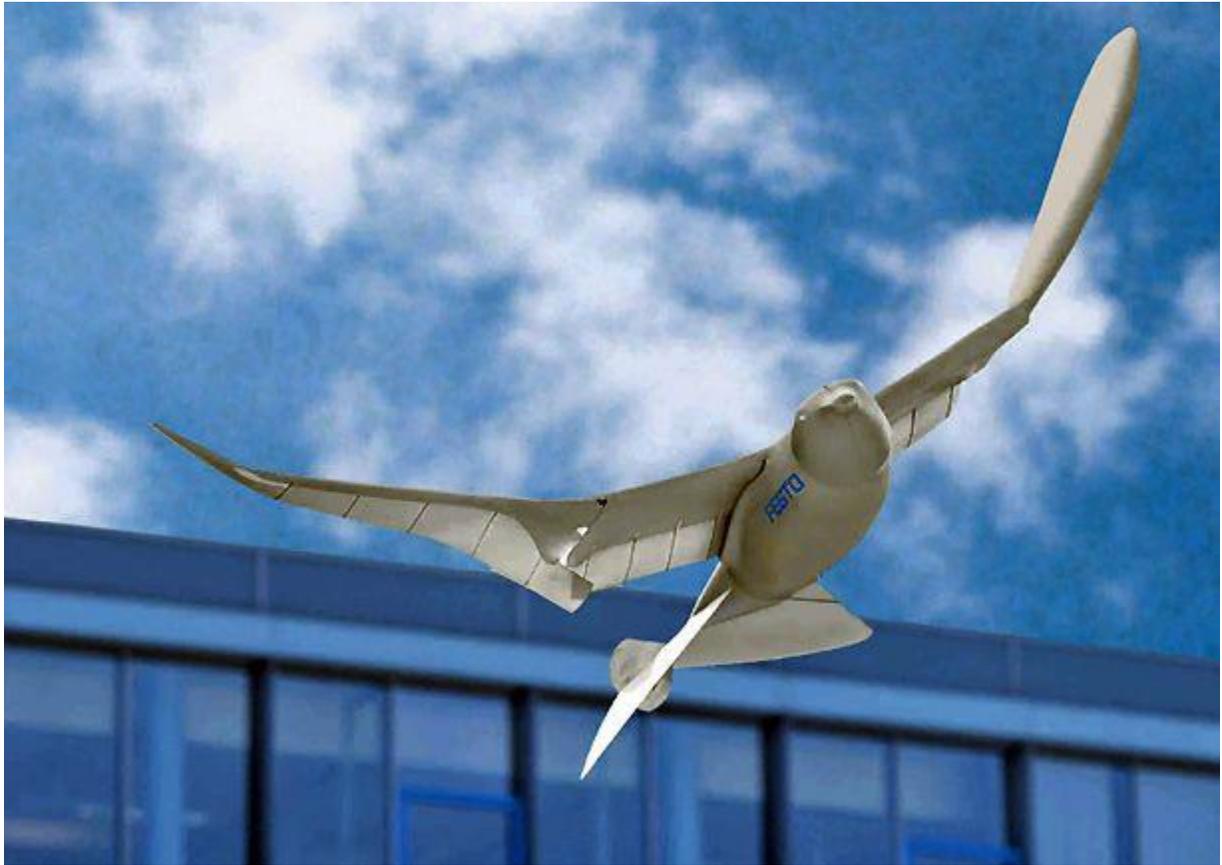
The club also provides the AMA Introductory Pilot Program for beginners without AMA insurance.

# **Festo SmartBird**

## **Bird Flight Deciphered, or just a 21st Century Ornithopter?**

By

Larry Woodward



From the very beginning man has been fascinated by, well let's be honest, he's been jealous of the birds ability to fly. And not to be outdone, he has put his superior intelligence to work on finding ways to, at least, approximate the flight of birds. So far we have done pretty well considering the scale and capabilities of modern aviation.

Among the earliest attempts at mechanical flight were a variety of designs attempting to replicate the wing motion of birds. These Ornithopters (from Greek ornithos "bird" and pteron "wing") an aircraft that flies by flapping its wings) have appeared throughout recorded history.

Some early manned flight attempts may have been intended to achieve flapping-wing flight, though probably only a glide was actually achieved. These include the purported flights of the 11th-century monk Eilmer of Malmesbury (recorded in the 12th century) and the 9th-century poet Abbas Ibn Firnas (recorded in the 17th century). Roger Bacon, writing in 1260, was also among the first to consider a technological means of flight.

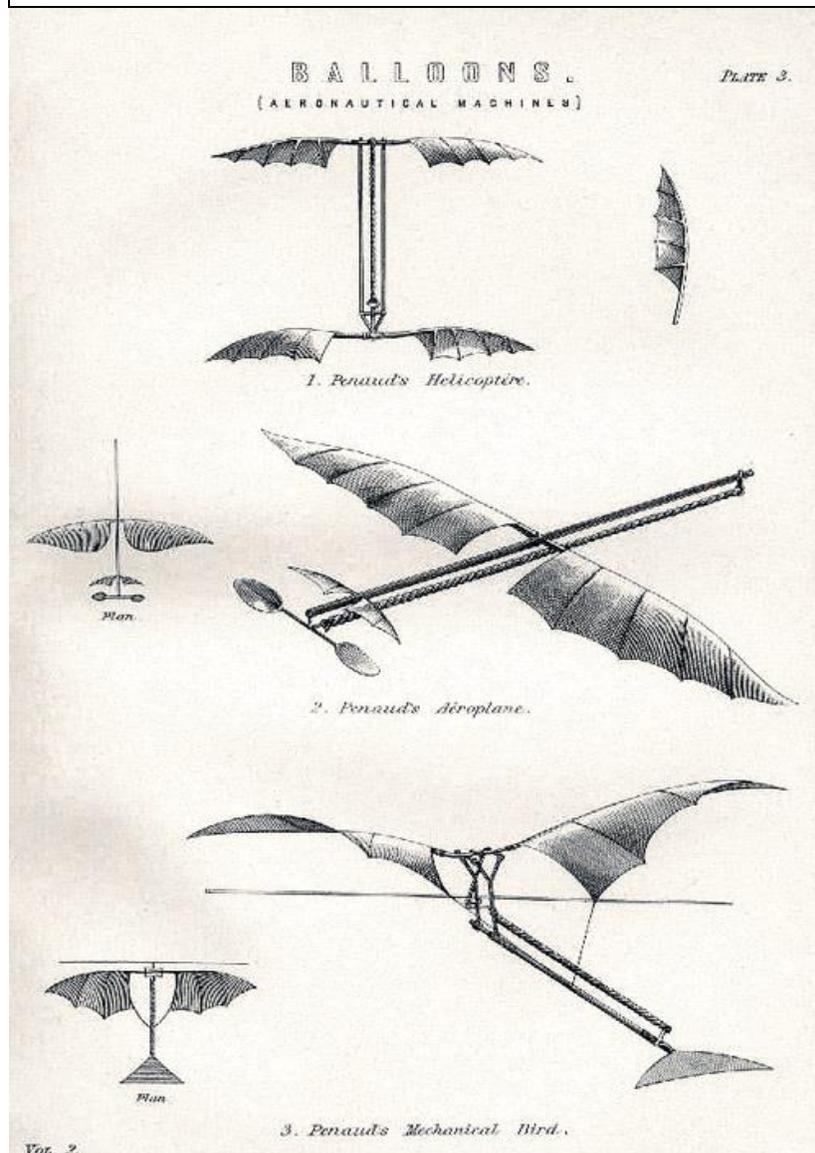
In 1485, Leonardo da Vinci began to study the flight of birds. He grasped that humans are too heavy, and not strong enough, to fly using wings simply attached to the arms. He therefore sketched a device in which the aviator lies down on a plank and works two large, membranous wings using hand levers, foot pedals, and a system of pulleys. He understood the possibilities of improving human performance through simple mechanics, but the realities of good old Newtonian Physics and power to weight ratio have kept the challenges of human powered flight alive and kicking to present day.



Source: *File:Leonardo da Vinci helicopter and lifting wing.jpg* - <https://en.wikipedia.org>

Alphonse Pénaud (31 May 1850 – 22 October 1880), was a 19th-century French pioneer of aviation design and engineering. He was the originator of the use of twisted rubber to power model aircraft, and his 1871 model airplane, which he called the Planophore, was the first truly successful automatically stable flying model. This work included a mechanical wing variant (Ornithopter) but it was not as successful as the Planophore. He went on to design a full sized aircraft with many advanced features, but was unable to get any support for the project, and eventually committed suicide in 1880, aged 30. (And I thought I was obsessed with rubber band flying.)

Click the image below for Dave Harding's 2014 article in "Free Flight Quarterly" about his reproduction of the Planophore.



Source: File:Pénaud's flying models.jpg - <https://en.wikipedia.org>

Although there have been several successful human powered flights in recent times, both fixed wing and multi-rotor, there appears to have been only one case involving an ornithopter.

On August 2, 2010, Todd Reichert of the University of Toronto Institute for Aerospace Studies piloted a human powered ornithopter named Snowbird. The 32-metre (105 ft 0 in) wingspan, 42-kilogram (93 lb) aircraft was constructed from carbon fibre, balsa, and foam. The pilot sat in a small cockpit suspended below the wings and pumped a bar with his feet to operate a system of wires that flapped the wings up and down. Towed by a car until airborne, it then sustained flight for almost 20 seconds. It flew 145 metres with an average speed of 25.6 km/h (7.1 m/s).[15] Similar tow-launched flights were made in the past, but improved data collection verified that the ornithopter was capable of self-powered flight once aloft.



Click the image above for flight video of the

Source: *File:Daedalus Project's Light Eagle.jpg* - <https://en.wikipedia.org>



It is in our romantic nature to recognize something about the flight of birds that goes beyond the “simple” problem of mechanical flight. We still envy the grace, beauty, and singular connection with the elements that birds in flight exhibit. And so, there are those who have taken up the challenge of applying our most advanced technologies to truly model the flight of birds in all its subtle and beautiful ways. There are those who will ask “why?” And there are those who say “why not?”



Click the image above for flight video of the Aero Velo

**Smartbird  
by The company Festo  
“At the forefront of automation  
technology”**



<https://www.festo.com/group/en/cms/10238.htm>

Festo, a family owned company with around 18,800 employees worldwide specializes in factory and process automation. As a way to showcase their design and technology potential the company has taken on the challenge of creating a truly realistic ornithopter called the SmartBird.

For the SmartBird, Festo was inspired by the herring gull. The ultralight rc flying model impresses with its outstanding aerodynamics and maximum agility and is able to take off, fly and land without an additional drive.

In doing so, its wings not only beat up and down, but twist in a specific manner. This is done using an active articulated torsion drive, which provides both lift and propulsion. Perhaps as interesting to me is the way it has incorporated an articulating head-neck assembly that moves as though the “bird” is looking around in the environment. It is not clear if this has any aerodynamic function or is purely aesthetic.

With these functional integrations, **Festo declares it has technically deciphered bird flight.**



Click the image above for flight video of the Festo SmartBird

# Boeing "Strikes" a Deal to Buy Revolutionary Heli-Plane Maker

From Dave Harding

It's been about a year and a half since we first learned of the Defense Advanced Research Projects Agency's "LightningStrike Project," the scary-sounding name attached to an entirely benign story of a new class of aircraft that DARPA wants to build. With LightningStrike, DARPA -- the "mad scientist" arm of the U.S. Department of Defense -- aims to create an electrically powered airplane that can launch vertically (i.e., no runway required) but fly horizontally at ordinary-plane-like velocities.

And now Boeing (NYSE: BA) will own that plane. Lightning Strike could become the future of Uber. Image source: Aurora Flight Sciences.



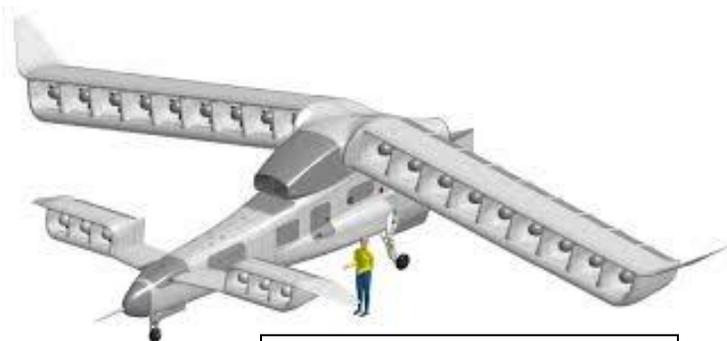
## What is LightningStrike?

Let's start off with a few details about the project itself. LightningStrike is the brainchild of privately held aerospace company Aurora Flight Sciences, a specialist in the field of unmanned aerial vehicles, and one with a special affinity for developing electrically powered aircraft (i.e., no jet fuel required). As DARPA's partner on the project, Aurora was hired last year to design and build an aircraft equipped with 24 hybrid-electric fans, powered by one Rolls-Royce AE 1107C turboshaft engine driving three Honeywell electric generators.

The 24 fans will be mounted on two sets of wings -- six fans up front on one pair of forward wings and 18 more aft on a set of larger wings.

These wings can pivot from full vertical to allow the fans to lift the aircraft at launch (and lower it for landing) to full horizontal when the aircraft is in flight, and will generate enough thrust to move the plane through the air at speeds from 345 mph to 460 mph.

Aurora has already completed Phase I of the LightningStrike project and entered into Phase II. A small-scale prototype of the plane conducted successful test flights earlier this year, and flight tests of a full-scale model (



Click on the image to see a concept video of the XV-



## Will lightning strike twice? Thrice?

This is not the only thing Aurora Flight Sciences is up to. Already this year, the company has announced a partnership with Uber to develop electrically powered vertical takeoff-and-landing (VTOL) aircraft like LightningStrike for use in a future "drone" air-taxi service. Aurora hopes to have a small fleet of 50 such aircraft ready by 2020 for Uber to test-drive. (It's not known for certain whether Rolls-Royce and Honeywell will be powering those planes, but it seems a safe guess.)

Additionally, Aurora announced in August that it has signed a \$499 million contract with the U.S. Air Force to support the latter's Aerospace Systems Air



Platform Technology Research project, conducting research into "autonomy, electric propulsion, advanced manufacturing, multi-vehicle coordination, and advanced multidimensional optimization" for use in military drones. (To be crystal clear, not all of this money is going to Aurora. As the Pentagon made clear at the time, Aurora and Northrop Grumman will be splitting this award.)

## Boeing swoops in:

Given the string of successes Aurora has been racking up, it was no great surprise when Boeing announced earlier this month that it had decided to buy Aurora Flight Sciences -- lock, stock, and barrel.

Calling Aurora a "world-class innovator, developer and manufacturer of advanced aerospace platforms" that has "designed, produced and flown more than 30 unmanned air vehicles since the company was founded in 1989," Boeing confirmed on Oct. 5 that it will acquire Aurora. Boeing did not disclose how much it is paying, and the fact it didn't feel compelled to do so suggests the purchase price was not high enough to be "material."



So how much will Boeing pay? According to data from S&P; Global Market Intelligence, Aurora Sciences has annual revenue of about \$72 million. Now, in defense circles, the rule-of-thumb valuation for acquiring a company has historically been about one times annual sales (though in recent years, valuations have gotten somewhat out of whack). Still, we're probably talking about a valuation of only \$100 million or \$200 million here.

Even if the purchase price ends up being toward the high end of that range, (a) it's still going to be peanuts for a company of Boeing's size; and (b) it's probably an investment well worth making for Boeing. In acquiring Aurora Flight Sciences, Boeing will:

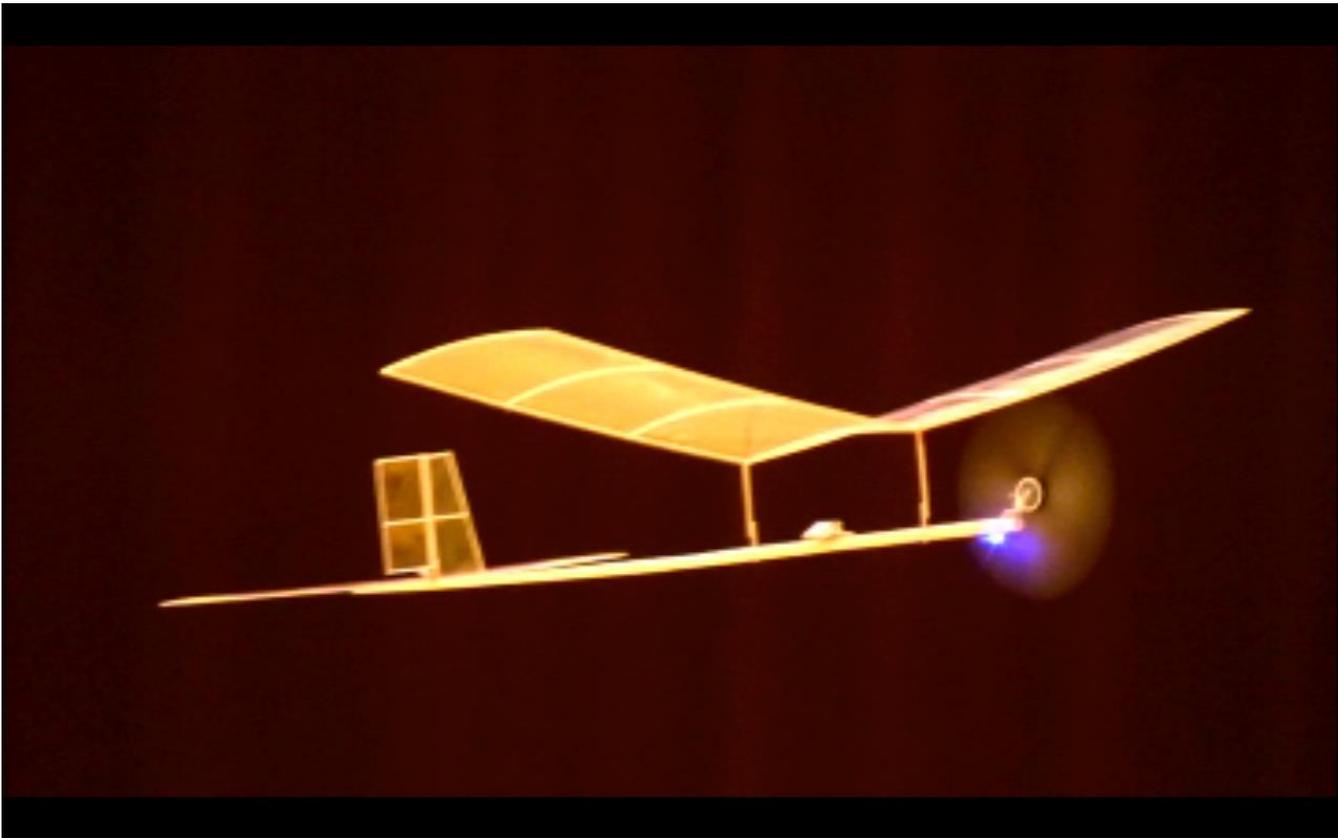
- Make a huge leap forward in drones technology and significantly strengthen the capabilities it acquired with its purchase of Insitu back in 2008.
- Nip in the bud a threat that (if Aurora and Uber succeed in their project) travel aboard big aircraft run by big airlines might become obsolete.
- And secure Boeing's future as a military VTOL provider, in the event that Aurora's technology proves superior to the VTOL tech that Boeing and Textron build into their popular V-22 Osprey military aircraft.

Snapping up half of a half-billion-dollar defense contract along the way is just icing on the cake.

# **Build the Easy Bee**

## **Rubber Powered Indoor FF model**

By Larry Woodward



My Show-N-Tell at the January meeting was the Easy Bee FF rubber powered model.

As I explained at the time, this is my indoor project for the winter to follow up on the sheet balsa FF model I worked with last winter. That project was a Guillows No 75 "Flying Machine" stock kit. My goal was to see how much I could increase the performance of a stock sheet balsa model, and in the process learn as much as I could about flight. I started a thread on rcgroups.com for the project and received loads of wonderful help from FF pilots all over the world. It was a fun winter and I am pleased to say that over the course of it I went from 12 second flights "out of the box" to a best flight of just over a minute.

My mentors on rsgroups.com, not to mention the guys here at home, encouraged me to move on to a simple built up model this year. I chose a very basic beginner design called the Easy Bee. It has an 18" wing, stick fuselage and can be flown in competition with either a stock plastic prop or fabricated balsa prop. I happened to have some condenser paper tissue, which I have never used before, or it can be covered with normal tissue, plastic films and other lightweight materials. My goal is to see if I can get a two minute flight with this model.

I am hoping that this article might encourage others to join in and give me a little competition.

## Materials:

This model will not break the bank. All you really need is a 24" sheet of 1/16" sheet balsa and a single length of 1/8x1/4" stick balsa, both easily available at any hobby shop or craft store. For a competition build we would be worrying about the weight and grain structure of the wood we use, but let's leave that for another time and someone with more knowledge than me..(Are you guys listening out there? That is an invitation to write an article.)

Covering can be any light tissue, or plastic film. I have used Xmas wrap, light packaging and plastic grocery bags among other things. I have found the light plastic bags used by the dry cleaner to be very good, and they come in really large sheets.

A simple plastic prop and bearing mount can be purchased or you can build your own props from balsa. For this purpose I will assume we are using a plastic prop. Maybe we can look at making balsa props another time (another hint to the troops).

I'll discuss other miscellaneous items as we go along.

## Balsa Stripping:

The basic frame is built from 1/16" square balsa. This could be considered overkill by a real competitor, but for a ham fisted beginner like me it is likely to give me a reasonable probability of success. The best way to get this is to strip it from the 1/16" sheet.

Stripping can be done well with just a good metal straightedge and a VERY sharp blade. The key is to set up the width carefully and have very good hold on the guide throughout the cut.

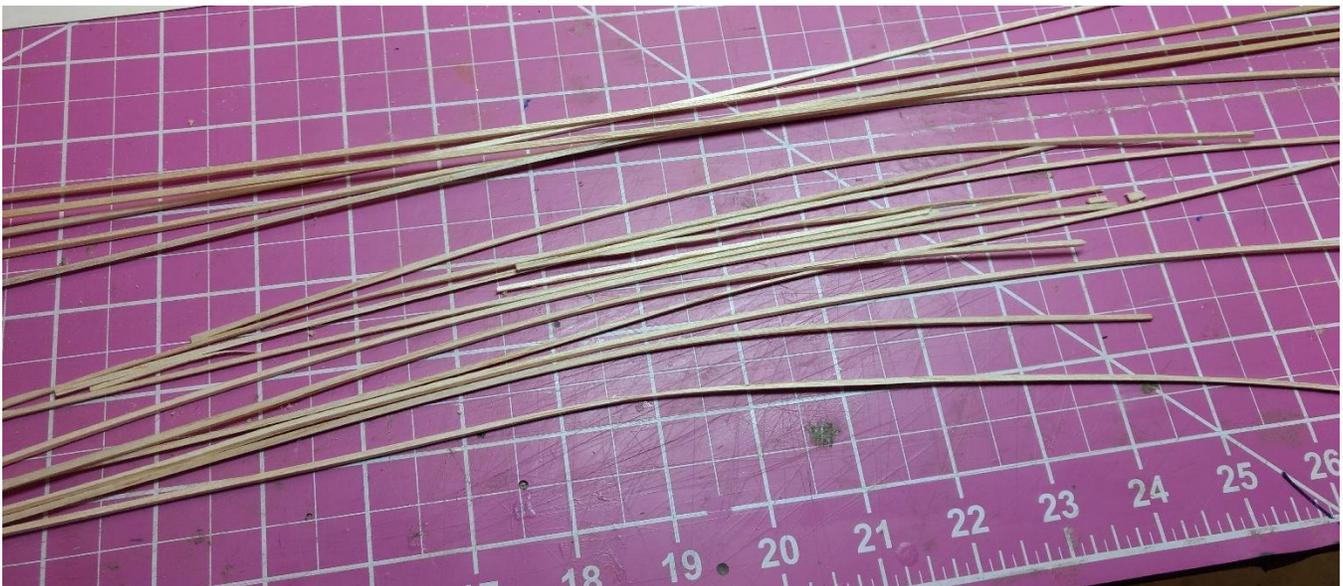
There are many designs, from simple to complex, for stripping devices. I have had good luck with a simple plastic device from HK that holds a #11 blade and is adjustable for width of cut. It is simply drawn along the edge of the sheet to make a clean even cut.



Dave Harding gave me this version, fabricated by fellow SAM members, that is as much an item of woodworking art as it is a tool.



One way or another, strip yourself up a nice supply of 1/16" square balsa. Some pieces will be straighter than others. Separate them out accordingly for different uses.



## Templates and the Building Board

Constructing the frames is first a matter of cutting to length and laying out strips to form the perimeter of the flying surfaces. Key to this is good clean and square cuts and a firm flat surface to hold everything flat and square. I build on a piece of ceiling tile. Use the back side, it will be smoother than the textured front surface. Cove the board with a sheet of plastic film that will release whatever glue you are using. I have found any polyethylene sheet to be very forgiving for almost every type of glue. I use dry cleaner bags.

Once you have a good board set up you will want to cut a template for the wing and other surfaces. This is made from any moderately thin cardboard like poster board and mat board. You want it to be thick enough to present a solid edge to the balsa, but not to be thicker than the 1/16" wood.



The Easy bee wing is 18" x 3" and is divided into 8 even spaces for the ribs. The stabilizer is 2.25" X 7" divided into four sections, and the fin is 2" high by 2" deep and 1.5" long at the top.

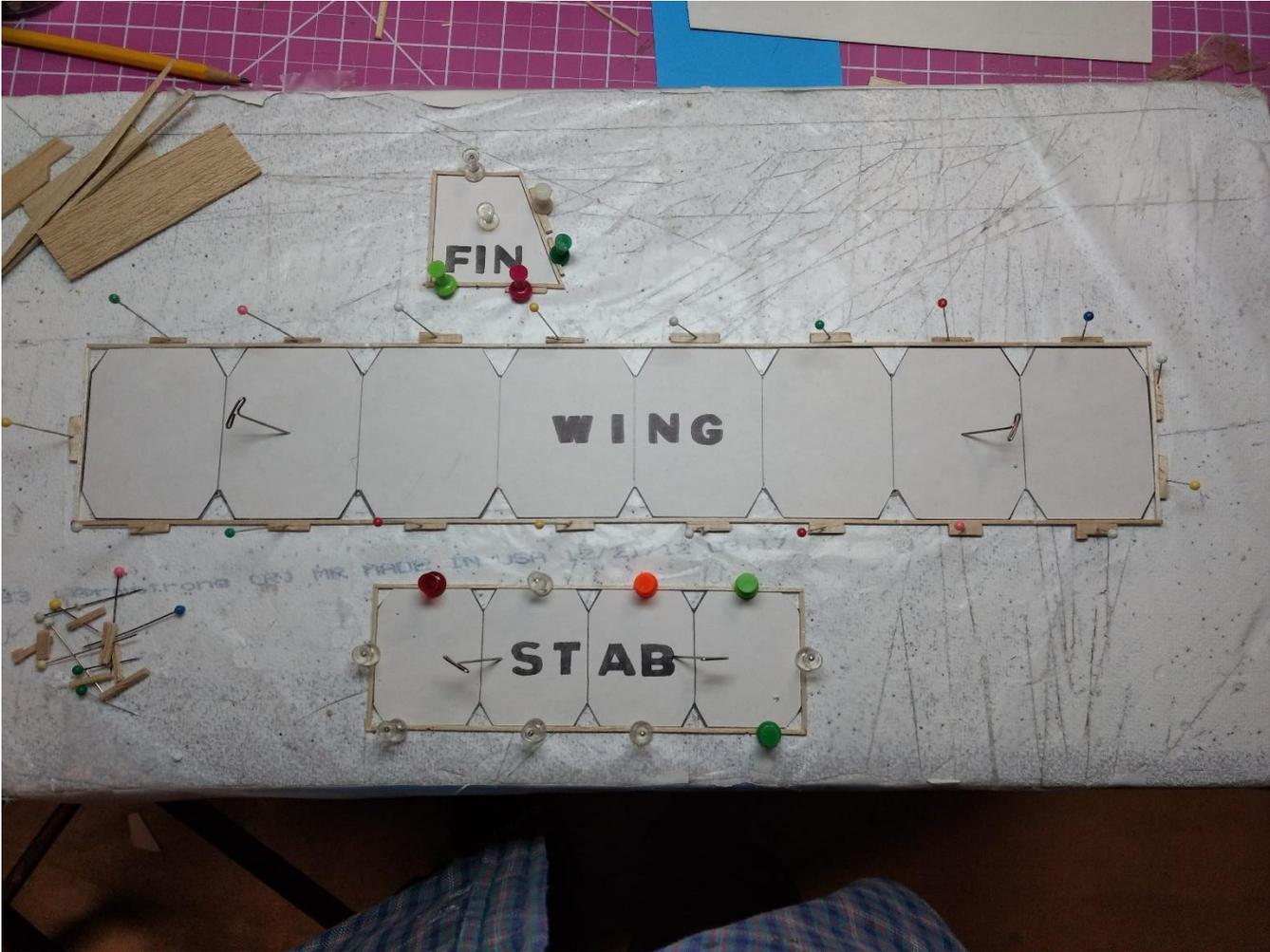
You will need some pins, most any type will do such as sewing pins, "T", pins, even thumb tacks will work. Again, a good sharp blade is essential.

For glue, I used a generic white wood glue thinned a little with water. I like this because it gives me a little working time to adjust things, it goes on a little thick to fill in gaps in my inaccurate fits, yet it shrinks up when it dries leaving a clean joint. The better your cuts and fits the less glue you need. With very good fits, CA gives beautifully clean results. But if you have to resort to thick CA to fill gaps, then it will be hard to sand later and add weight.

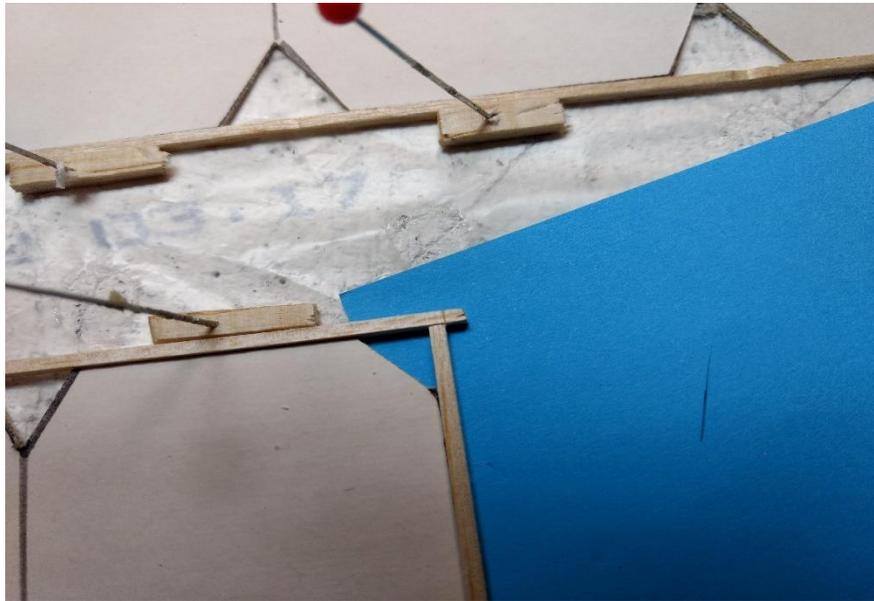
On the templates you want to cut out "V" shaped notches at corners and each point where a rib will intersect with the perimeter frame. This will allow the joint to be glued in place on the board without gluing itself to the template as well.

Pin the templates firmly to the building board and then select the straightest sticks for the perimeters.

## Pinning and Gluing the Frames



Cut and lay out sticks all along the perimeter of the templates. Hold the sticks firmly against the outside of the template to keep them straight and flat. Do NOT put pins through the balsa sticks. They are too thin and this will split them. Instead, hold them against the template with small pieces of scrap balsa pinned to the board. Or, I also found I could hold them in place well with thumb tack "push pins" place alongside the stick with the head of the pin pressing down on the balsa.



Clean square but joints are critical. Corner ends can be left long to trim later.

## Forming and Placing the Ribs:

Again, to make things a little easier, I am going to make my ribs from the 1/16" sheet balsa material. A more competitive Easy Bee would have lighter 1/32" ribs.

There are two ways to approach this, cut ribs and formed ribs. Cutting is probably easiest, but I think formed ribs, that have a consistent grain profile throughout their length, will be stronger.

The ribs are 3" long to match the wing chord and have a 6" radius curve to create the airfoil camber. To cut them you make a rib template of the correct length and radius. Place the template on a sheet of 1/16" balsa with the grain running perpendicular to the center radius and cut along the curve. This will give you the top surface of a rib. Now slide the template approximately 1/16" down from the curved edge and cut again. This will give you a 1/16" square rib with 6" curve. Repeat to form a good supply of ribs.

Try to cut at 90 degrees to the board to get a square rib profile. Note that the wood grain will be



parallel to chord in the center but will become increasingly angled toward the ends. This is the "weakness" that I am concerned about with this technique.

My second and preferred, technique is to form the ribs from 1/16" square stock by relaxing and then stiffening the ribs over a round form.

To relax the grain of the stock, I soak the sticks in a mixture of hot water and household ammonia, about 2 Tbs ammonia to 10 oz. water.



After about 10 minutes soaking, I form the sticks over a 12" diameter (6" radius) form. In this case a plastic bucket. The sticks are laid parallel to each other and carefully held in place with tape and an Ace Bandage to keep them all evenly pressed to the form with sides all parallel to each other. The bandage allows air to reach the wood as it dries overnight.



Next morning it all comes apart leaving a nice supply of uniformly curved sticks with the grain all running parallel to the rib.

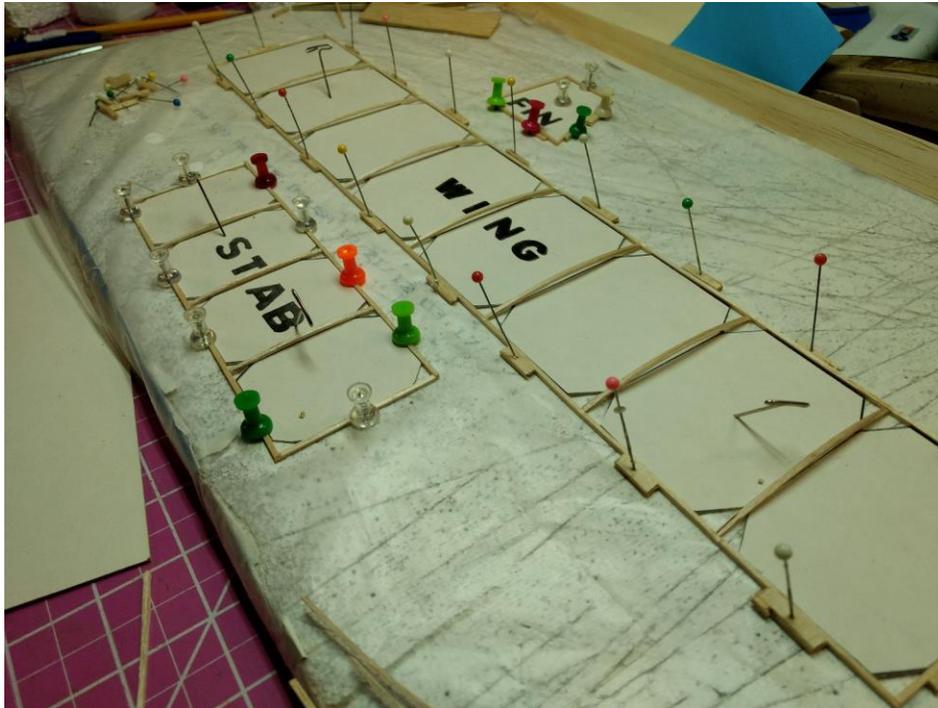


From here it is just a matter of carefully cutting individual rib sections to fit snugly between the perimeter edges at each of the cut outs. Again. Cut carefully to make a neat fit with a very little pressure, just enough to hold the rib in place but not enough to distort the shape of the rib or the frame.

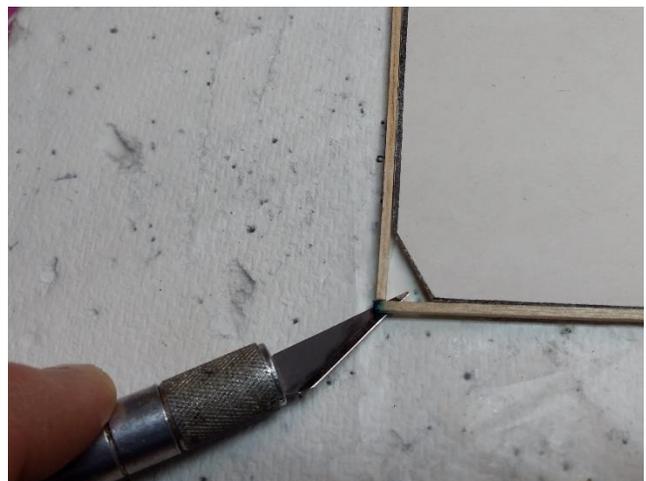
One way to get a good fit is to cut the piece a little long and then trim it back to size by trial and error with a fine sandpaper block or an emery board.

My fingers have trouble handling the small pieces so I make liberal use of my tweezers when placing items.

At this point all the frames can be left to dry. Go over each joint carefully and add a drop more glue wherever



things look a little short. But be cautious not to just add glue for no reason. Glue is weight!



When dry, be very careful removing the frame from the board. Hold the joint to the board with a finger or tool as you TWIST out the pins. Then carefully slip a thin blade under the joints to loosen them from the protective sheeting on your board.

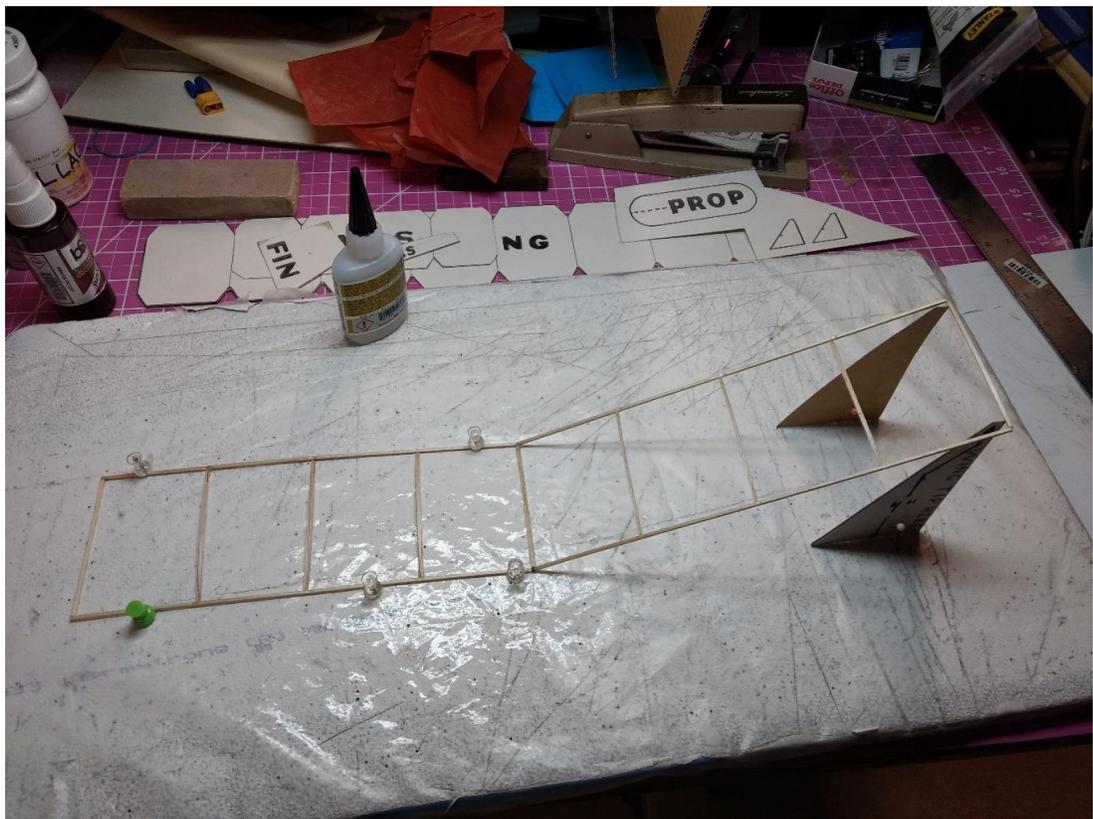
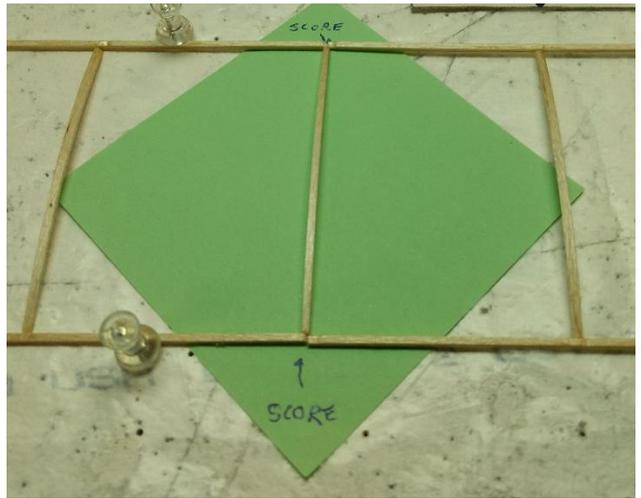
## Forming the Dihedral

The Easy Bee has 2" of dihedral at each wing tip. To create this, first we make a weak spot in the outer edges at the ends of the center rib by cutting partially through the top of the leading and trailing edge strips. Then, CAREFULLY snap the joint to release it at the partial cut without damaging the leading and trailing edges or dislodging any rib joints. Don't worry if you do, you can just glue them back together later.

Now pin one half of the wing solidly to the board and carefully lift the other end off the board until the outer edge is 4" off the board. Support it here with something straight and square to hold the wing frame at the dihedral angle but square to the board.

Place a generous drop of glue at the center dihedral joints where the leading and trailing edges were cut.

I like to add a little triangular piece of balsa to the outer edge of these joints for extra strength, and to give me something to attach the wing supports to later. But this would be considered sinful added weight by a true competitor.



## Covering the Wing and Stabilizers

I am covering my wing with condenser paper which is extremely light but very thin and, as I discovered, problematic to work with. Ordinary packaging tissue or Xmas wrap will work. Japanese tissue, purchasable from hobby supply retailers, is much lighter and has superior strength when wet.

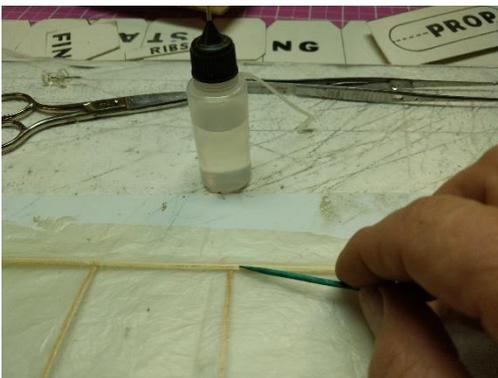
Plastic wrap type materials are a very good alternative but require special procedures due to the fact that almost nothing will stick to them. So I will leave that topic for another day.

When you ask people about what adhesive to use for tissues, you will get a host of different opinions. Mostly it has to do with which type will be easiest to work with for particular covering materials. For tissue I am interested in some forgiveness when laying down the tissue. If you work with a water based adhesive it will weaken the tissue while it is being applied. The water may also warp your frame. With “sticky” adhesives you don’t get a chance to work out wrinkles and errors. Actually, for tissues, a cheap stationary glue stick works well, but dries quickly if you don’t move fast.

A traditional technique involves “dope”, a noxious laquer-like fluid that has the ability to be softened with heat and can be loosened with thinners, but it requires very good ventilation and is a specialty item to locate. I found a slightly heavier, but similar, technique can be achieved with ordinary alcohol based shellac.

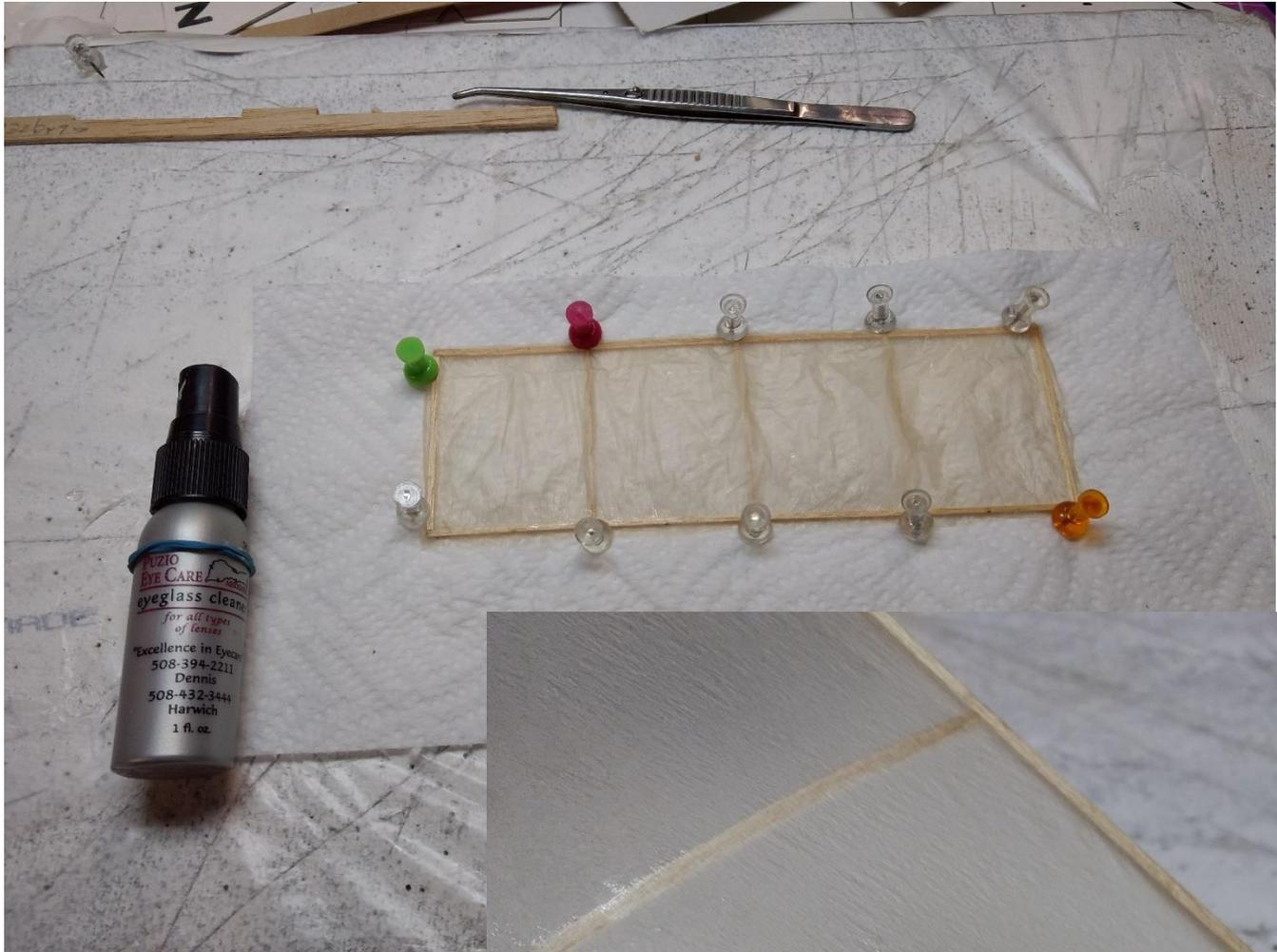
Start by cutting out sheets of tissue about a couple inches larger all round than your frame. Plan to cover the wing one half at a time due to the dihedral. Apply a thin coat or two of shellac just to the top surface of the frame at the perimeter only. Do not apply adhesive to the ribs except those at the ends of the frames. Let the shellac dry.

Lay the tissue pieces over the frame and “tac” it down in a few places with the tip of a hot covering iron. A small low temperature soldering iron might do as well, although I have not tried it. The idea is to slightly soften the shellac coating in a few places to hold the tissue in position as you work your way around the perimeter pulling the wrinkles out and stretching the tissue taut. Don’t worry if it is not perfect and don’t pull so tight as to stress the frame.



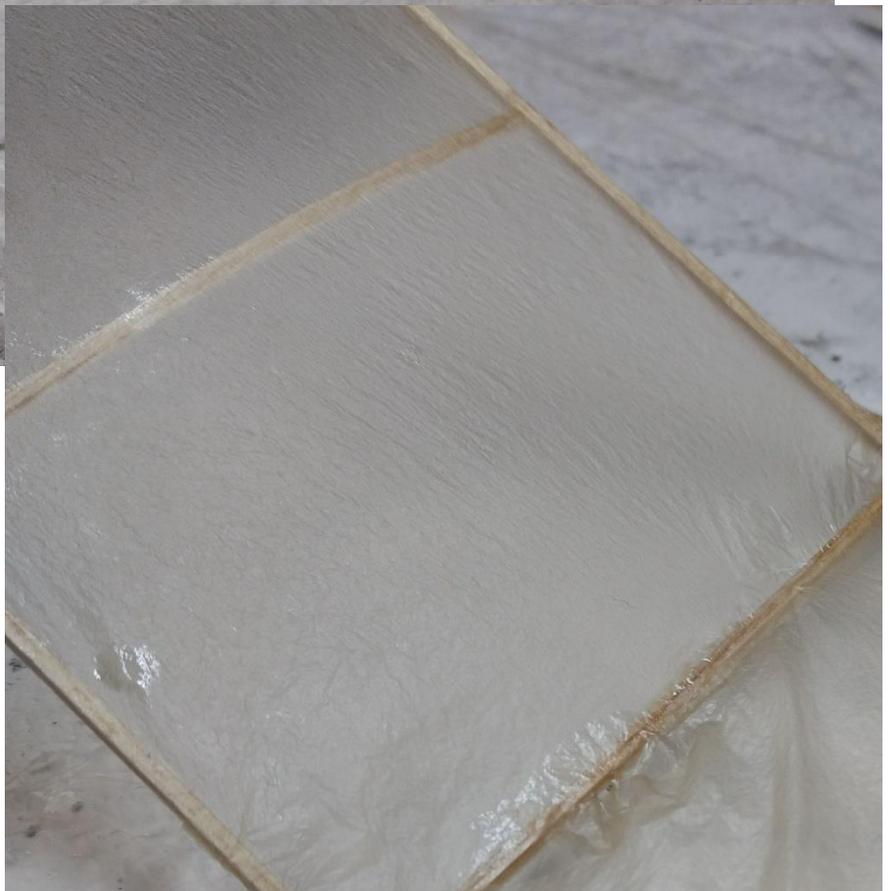
When everything is nicely tacked down, go over the seams with a little bit of alcohol, just enough to dissolve the underlying shellac and seal it to the tissue. Let it dry well and touch up any loose spots with more shellac. Then trim the tissue carefully around the perimeter with a very sharp blade or fine scissors.

Finally, after everything is nice and dry, you can try shrinking the tissue a little to take out any remaining wrinkles. But be careful not to go overboard or the shrunken tissue will stress the frame and warp the wings. I like to pin the wing back to the board to keep it flat. I spray the tissue very lightly with a fine mist from an atomizer bottle (came with eyeglass cleaner). I keep a sheet of absorbent paper towel under the wing to help soak up excess water. Let it dry completely and remove carefully from the board. If there are any warps, try very slightly dampening the tissue again and letting it dry flat again.



Small wrinkles and imperfections are not important enough to worry too much about. You will end up doing more harm than good trying to fix everything.

But you will really appreciate what it means when you see some of the remarkable work your fellow Propstoppers can do.



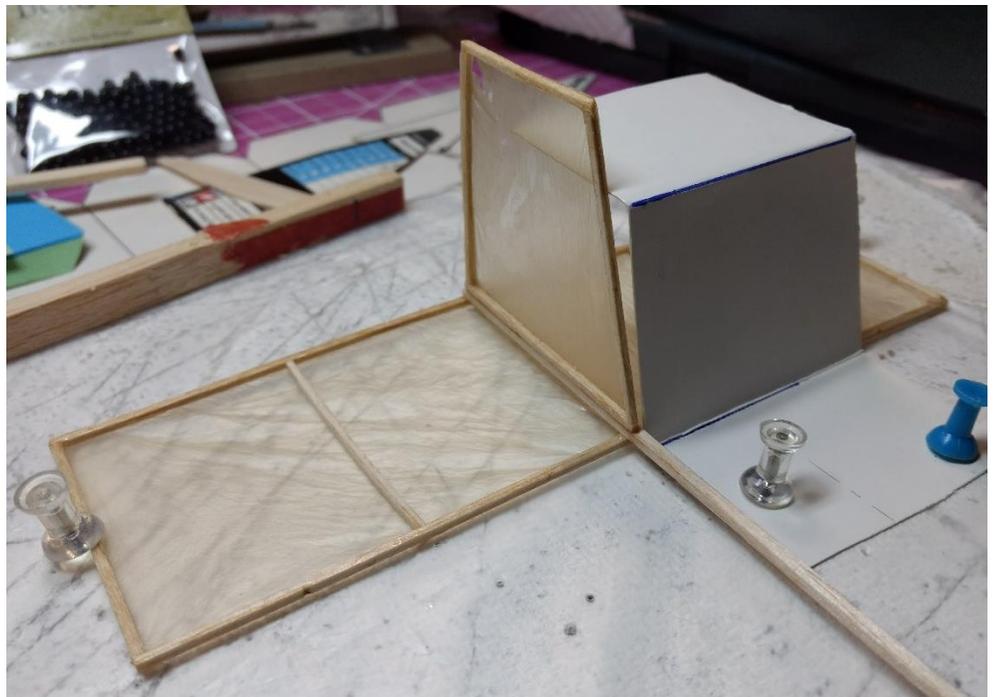
## The Tail Assembly:

The tail assembly consists of the horizontal and vertical stabilizers, which you have covered when you did the wing, and the tail boom stick.

The tail boom is a 7" long strip of 1/16" square stock. Try to select a piece that is very straight and even with as much strength as possible. Glue one end of it to the bottom of the center rib on the stab. Use some sort of guide to make sure it is lined up perpendicular to the edge of the stab.



Now glue the vertical fin to the horizontal stab. Since the stab is covered on the top you will turn it over and glue the fin base directly to the bottom of the boom stick. Typically, the Easy Bee is flown with the fin facing down. Notice the cardboard "Z" jig to keep the fin perfectly perpendicular to the stab.

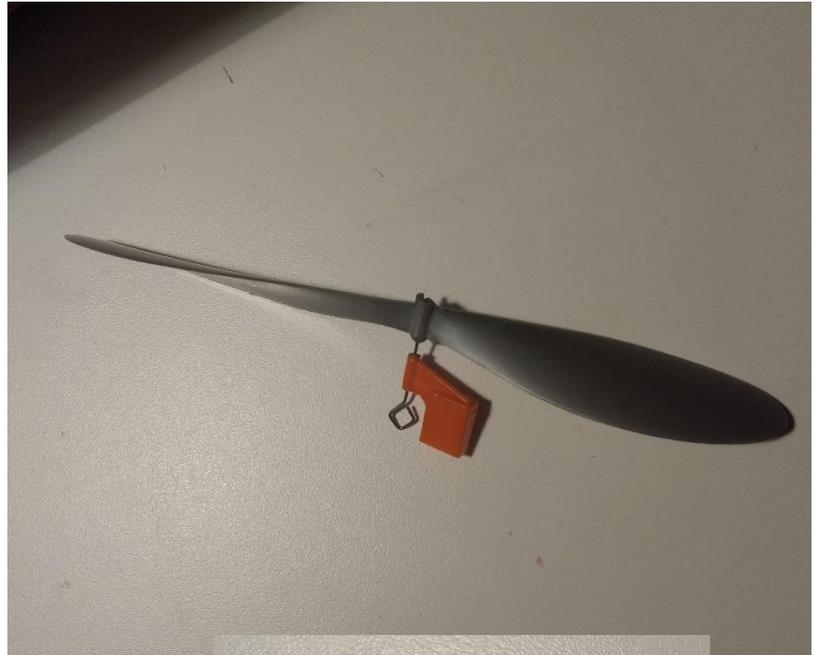


## The Motor Stick:

The motor stick is a 9" length of 1/8 X 1/4" balsa. One end of it will hold the prop and bearing assembly. For competition you would want to make your own, but for this model we will use a simple plastic prop and bearing from any small dime store balsa glider or purchased from a hobby retailer. We will look at making balsa props and custom bearings at another time. About a seven inch prop is fine. Shape one end of the stick to fit the bearing mount.

At the other end of the stick you will make a small hook from thin wire, a paper clip will do, and lash it to the stick, with the hook facing down and back, using some light sewing thread. Then soak the lashing with a little thinned glue. This will be the end hook for the rubber motor.

The tail boom assembly is normally glued directly to the end of the motor stick. But, I like to be able to remove it for transportation and to be able to adjust it for trimming CG and turning. So I have come up with a simple variation on the traditional paper tube mounting method. I glue a short length of shrink tube that fits the size of the tail stick to the end of the motor stick. Again, it is probably a little more weight than a paper tube but much less trouble to make and maintain. I can slide the tail boom in and out of this as needed.



## The Wing Mount:



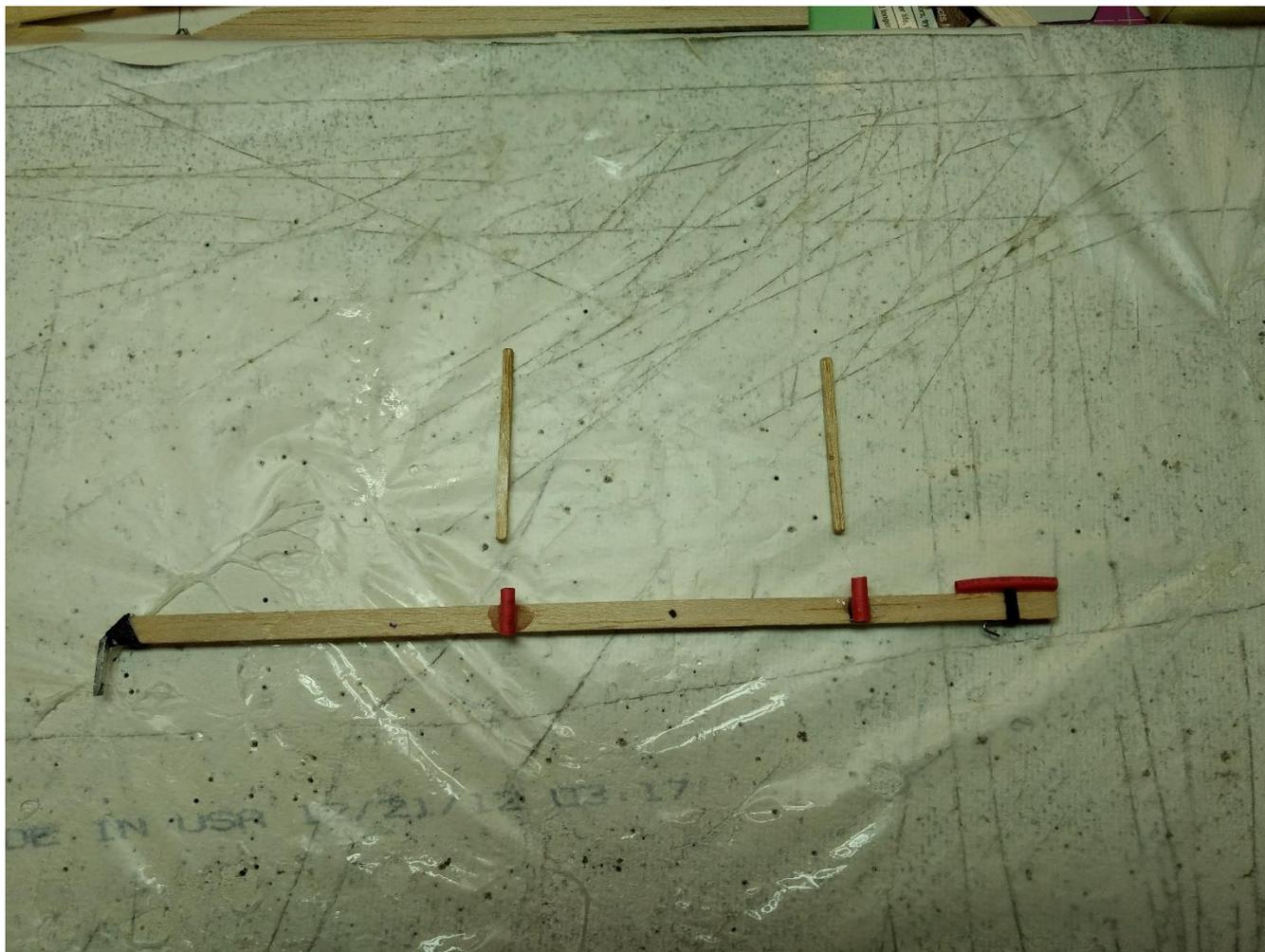
The wing is mounted to the motor stick with two posts of 1/16" square balsa, each about 2.5" long. Typically, the posts are glued directly to the wing at the dihedral point on the leading and trailing edges.

Here again I have a personal variation that adds a little weight, but makes life a lot easier. The wing is very fragile and the mounting post joint at the dihedral is under a lot of stress during a less than perfect flight and when handling/transporting the model. So I like to be able to remove the post at this joint. Again, I use a small length of shrink tube glued to the dihedral joint to allow this to happen. It gives the added advantage of being able to adjust the wing angle of incidence.

The bottom end of the posts can be glued directly to the motor stick, although I use shrink tube mounts here too. Care must be taken to space them exactly the same distance apart as the wing

mount tubes. Also they should be perfectly squared up to the wing. If any twisting or other stress is applied to the wing when the mounting posts are set into the tubes, it will distort the wing and affect flight characteristics negatively.

The posts should be located such that the wing center is right above the CG. To find this, mount the prop and tail section on the motor stick along with a short rubber motor. Use a thin blade or stick to support the center of the motor stick and move it around until you find the center balancing point. Mark this on the motor stick as your theoretical CG. Now position the motor stick mounts symmetrically about this point.

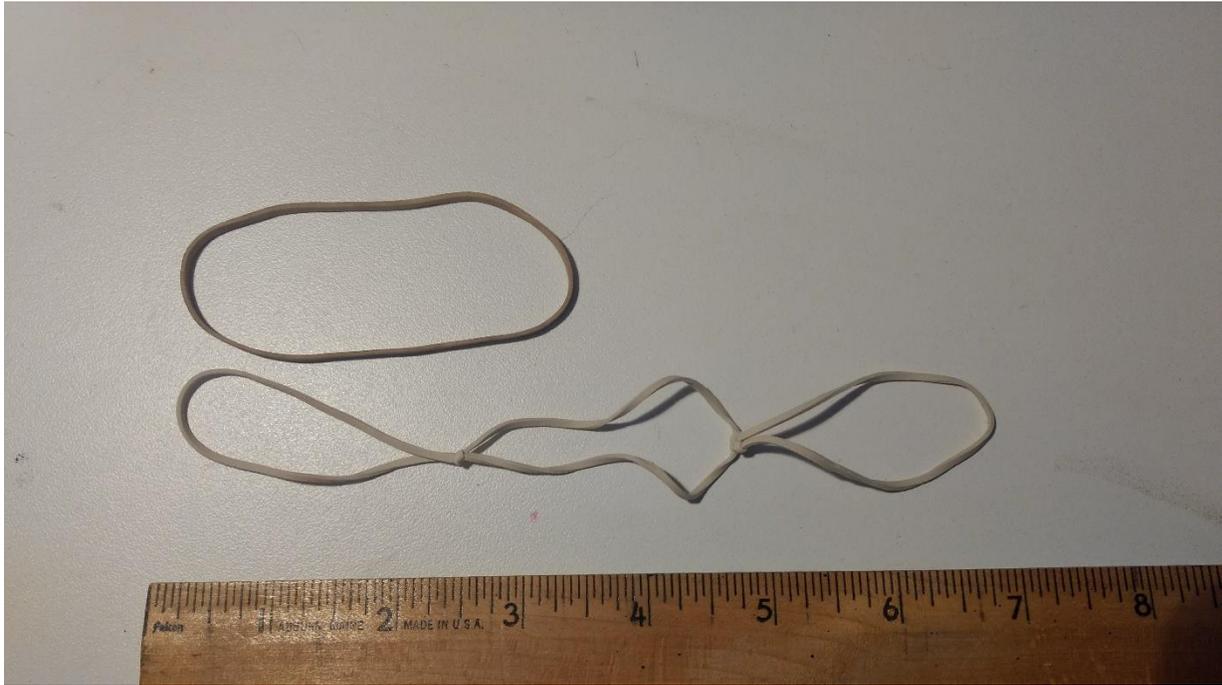


### **The Rubber Motor:**

The subject of rubber motors, actually just the strip of elastic band, is as complex and controversial as any discussion of fuel or electric motor selection. Chemical compounds, power distribution curves, competitive sources and suppliers and even “vintages” will come into play. Again, this is a topic for another day. For our first flights we will dispense with the search for competition quality material and make initial flights with whatever is locally available.

A suitable rubber strip will be a loop made from material no wider than 1/16” and as much as 12” long. The ubiquitous #64 rubber bands we use for our wing hold downs on rc planes are too thick.

But similar sized and larger loops are available from office supply stores in thinner material. For initial flight testing even a single 4" loop will give enough turns to work out proper trim and launch techniques. For longer flights you need a longer motor for more winds. A "daisy chain" of smaller loops will work reasonably well as a way to get a longer motor.



### **The Easy Bee:**

Now pack it all carefully in a box for safe transport!

I look forward to seeing you and your Easy Bee at our next indoor session.

