# MAX FAX

Journal of the D. C. Maxecuters

*... home of the dreaded POTOMAC PURSUIT SQUADRON of the Flying Aces*

**Editor: Stew Meyers** **2013-6 (NOV-DEC)**


## COMING ATTRACTIONS

We get together every Tuesday at 11:30am at Mylo's Grill for lunch.
6238 Old Dominion Dr, McLean, VA

Bauer Community center is available for indoor flying Mondays and Wednesdays from 12:45 to 2:15 PM during the school year.
The address is 14625 Bauer Drive, Rockville, MD

DCRC sponsors indoor R/C flying at the Montgomery County Soccerplex.
Indoor flying runs through 3/5/14 . Flying is every Wednesday from 11:45 AM until 3:45 PM. Not really suitable for free flight.

Next NBM flying sessions Sunday May 4, 2014.

The annual Kudzu Classic date set for May 17 --18, 2014. Raeford, NC
Details in next issue and Maxecuter web site.

2014 FAC NATS July 16 (WED) -19 (SAT), 2014 Geneseo, NY
see FAC website for details


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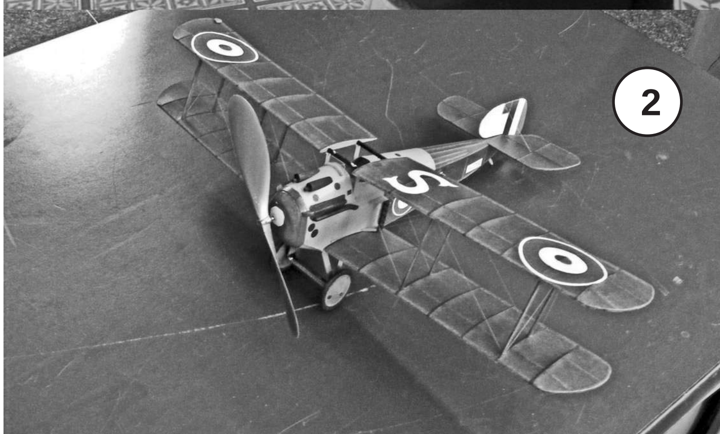
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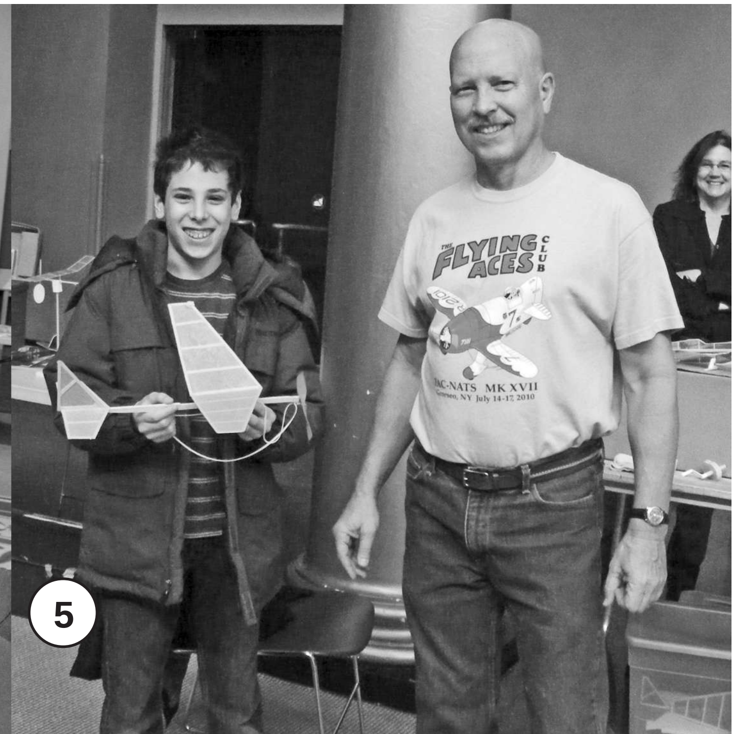
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FLYING ACES CLUB
FAC-NATS MK XVII


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# MaxFax 2013- 6

**(NOV-DEC 2013)**

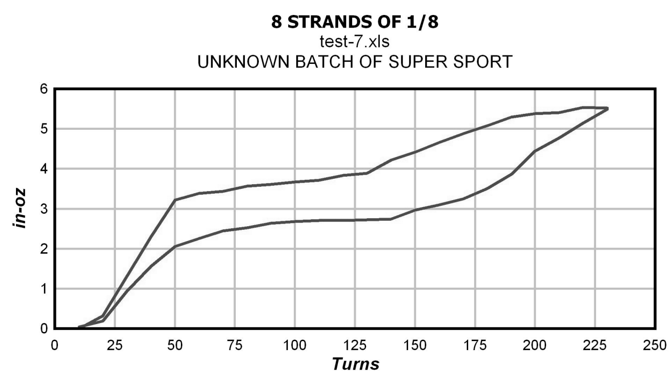
*Stew Meyers Editor*

## Helldiver Issue

We have the results of the January 26th National Building Museum meet. Dave Mitchell has provided some nifty no-cal Helldiver plans. He took first place in No-cal with it at the NMB last week. Dan Driscoll shows us his One-Blader. I am saddened to report we have lost a long time Maxecuter, Jerry Paisley. I found an article of interest, Making Lighter Rubber Scale Planes By Dan Garsonnin, but can't remember where I got it. Finally an introduction to the Recording Torque Meter.

Well I have fallen back into my evil ways, and this issue is late as ever. I'll confess when I wrote my January Flying Models Electric Flight on measuring Lipo Cell resistance, I became intrigued with making an automatic cell tester for small Lipos. This involved using an Arduino Microprocessor. Doug Griggs gave me one and I was off... down the rabbit hole of learning to program it in C++ and finding a reliable means of measuring the minute current involved. I took a side trip into writing a Visual Basic program to pipe the data to an Excel spreadsheet on my PC. The project was successful, everything works. I also used the basic system to characterize a capacitor powered electric motor system.

Fear not, these techniques have applications in the rubber free flight world. For the last 30 years I have played around with making a recording torque meter. My original effort resulted in a stain gauge torque meter that worked quite well displaying the torque on a LCD display. It was fine for measuring the torque of a small motor, but when I tried using it for rubber motors, my original intent, the shock of the bursting motor buggered up the stain gauged beam. Suffice it to say I have figured out how to use a non-contact rotary encoder to measure the angle of twist of a rugged wire torque meter. I have integrated the parts into an engineering unit and am developing the procedures to accurately measure rubber motors.




Here is my first effort at following the torque as we wind and unwind the four loop rubber motor. It's a 10 gram P30 motor I had kicking around in my misc. rubber box. It's probably wound to 50 % turns. One thing to note is the curve is not as smooth as the theoretical curves you find in the references. That tends to be the case when you make actual measurements. I remember being shocked upon seeing ultra high speed film of mechanical deployment systems. Things were a lot more violent than we had thought.

The nice thing about this system is the torque is recorded and you can see exactly what it was when the motor blows, if it does. The wire torque meter and its attached gear are free to snap back and forth violently. The absolute shaft encoder on the meshed gear can follow these movements with out damage as it's rated to 10,000 rpm and has double ball bearings.

MEMBERSHIP - Dues for membership in the DC MAXECUTERS are **$25** per year for residents of the USA, Canada, and Mexico, and **$35** for all other countries. You may now use PayPal at the website:
**www.dcmaxecuter.org**
Your mailing label indicates the year and month of the last issue of your current membership. A red "X" in the box below is a reminder that your dues are due. Send a check, payable to the"D.C. MAXECUTERS", to the treasurer, Stew Meyers.

PUBLISHING DATES - Six issues of MaxFax are sent each year as close to the nominal dates as possible, but since this is a volunteer publication nothing is guaranteed except that six issues will be sent to all members. (***Rising costs and dwindling membership will force us to go to four issues a year in 2014.***)

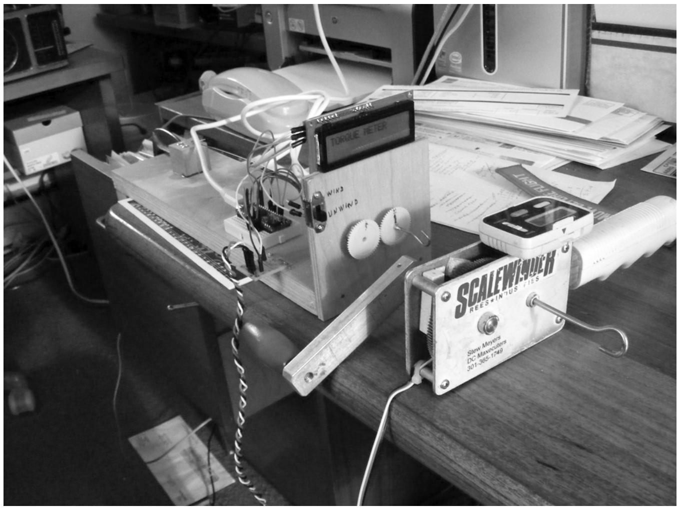
CONTACTS - Material for the newsletter and membership questions should be addressed to Stew Meyers phone 301-365-1749. Email gets immediate attention. stew.meyers@verizon.net

### Photos Page 2

1. FS Gilbert with his mythical Bostang, a Bostonian P-51.
2. FS also brought along this DPC Sopwith Dolphin. A nifty job still being trimmed out.
3. The kids from our morning building program getting instruction on their first launch."Don' t throw it up!"
4. The chaos of launch! Yes, over half have heaved them up into a stall.
5. Scott Richlen with his student Alex Friedman and his Z-15.
6. An old pro, Steve Fujikawa shows us how its done.
7. Dave Mitchell with his Helldiver featured in this issue.

# Recording Torque Meter

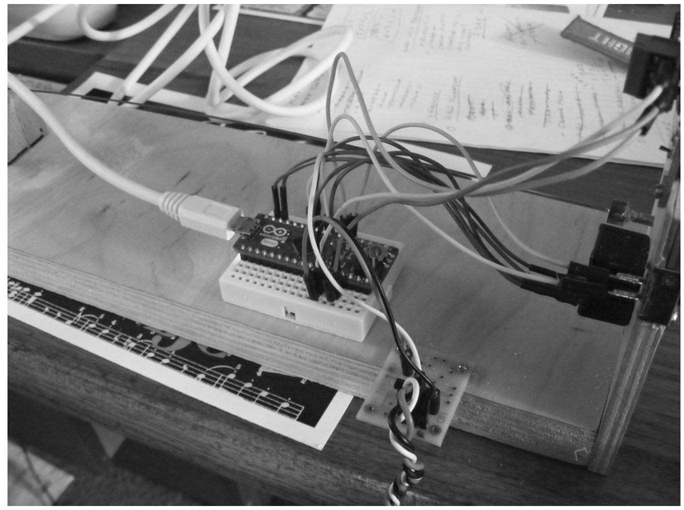
*Stew Meyers*




Here is the prototype clamped to my desk and plugged in to my computer. The Rees winder already had a magnet on the input gear to drive a reed switch connected to the pedometer counter. A hall-effect sensor was added to detect the magnet's passing when the gear rotates. This is in turn routed to a digital input pin on the Arduino micro computer via Futaba servo extension cables. This pulse registers a turn and reads the position of the shaft encoder which is translated into in-oz of torque. If the switch is in the wind position the turn is added to the total. If the switch is in the unwind position the turn is subtracted from the total.

Turns and Torque are displayed on the LCD display and sent to the computer over a USB port as CSV (Comma Separated Variable) data. A program on the PC stashes this data on an Excel spread sheet and a graph is displayed in real time of torque vs turns. If the motor blows you have the last value recorded.


The front of the unit shows the wire torque meter with its rubber hook and the gears coupling it to the absolute shaft encoder as well as the wind/unwind switch. The plastic gears have their 3mm hubs reamed out to fit the 1/8" shafts of the encoder and wire torque meter.

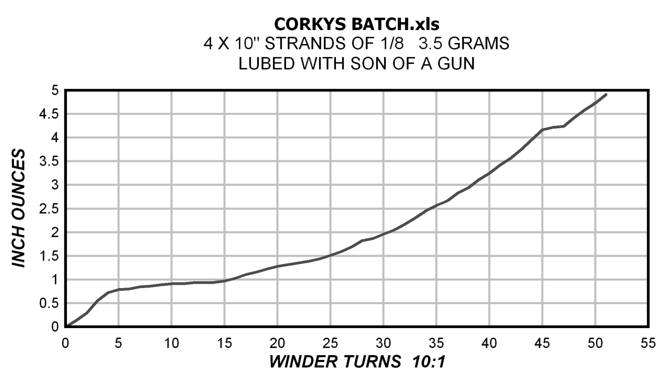


Here is the Ardino Micro and Bourns EMS22A Non-Contacting Absolute Shaft Encoder. Wires also go up to the LCD display and to a circuit board providing stain relief for the Futaba extension cable to the winder. Note the USB cable off the back of the Micro going to the PC. This also supplies power to run the system.

Where do we go from here? I am amazed at how well the thin gears have worked. I have now received some thicker gears with 1/8" hubs. Since the pitch diameter is different, I will have to build a new unit to accommodate them. For now I will work out the bugs with the existing unit. This mainly consist of taking data, recording, plotting, and saving it. Getting the discipline and routine down to do this and trying to automate as much as possible.

The prototype unit uses 9.5 inches of 0.032 music wire as the torque wire. This results in a deflection of 30 degrees per inch ounce with a 12 in-oz max torque. This is a bit heavy duty for characterizing batches of rubber with a couple of strands. However, the encoder has a resolution of 1024 bits per revolution. That's 12/1024 or 0.012 in-oz resolution, plenty enough. The unit is easily calibrated with a lead sinker on a beam.

Now I can accurately test the effects of various lubes, the effects of braiding , unequal sized loops, and of course characterize batches of rubber.




Wind to burst of an un-braided test motor.

## No-Cal SBC-3 Helldiver.

*Dave Mitchell*

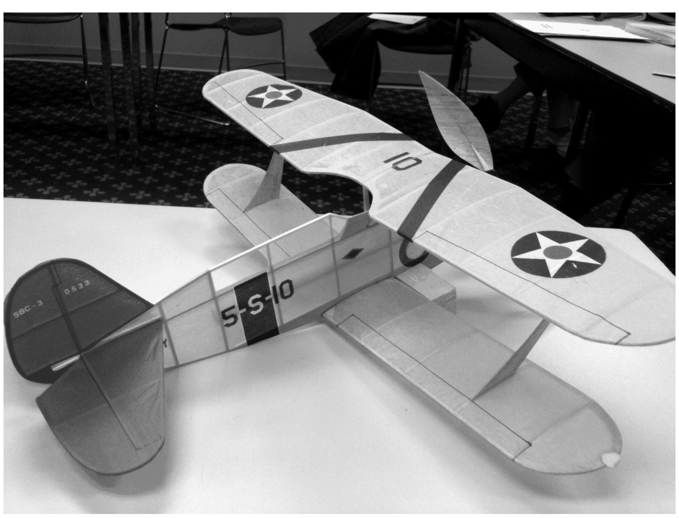
The Curtis SBC-3 Helldiver was the last bipe the US Navy procured in the years leading up to The Second Big Fuss. Its service life was short; it served mostly as a training platform for dive bombing techniques. As a model subject, however, it has outstanding moments and attractive color schemes. What more could you want?

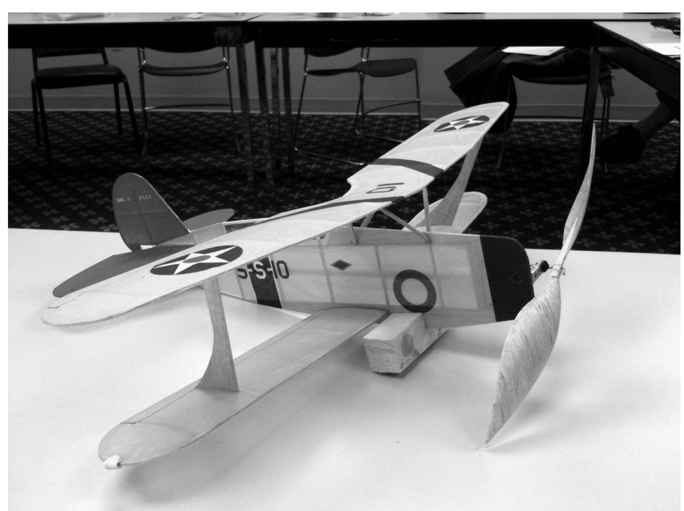
Having been inspired by a neat biplane No-Cal that Bruce Foster flies at the NBM from time to time, and after having several single-wing no-cals fold up in outdoor breezes, I reasoned that a clean SBC-3No-Cal might have a better chance of making it through more than one season of outdoor campaigning. So I designed the "Outdoor" version presented here. After a bit of fooling around with different props and CG locations, I finally hit the right combination this summer and the thing promptly specked out on one of those days we all dream about, chrome yellow and gray with a red tail against a bright blue sky....Thisoriginal outdoor version (about 11g ballasted) flew off on a 26" loop of 1/8" rubber and a 7-1/2" yogurt cup prop. The pitch? I have no idea--I think the blade was set in the hub at 45 degrees. Gene Smith sez this usually results in a prop with relatively low pitch, and that this is good for a draggy bipe. I used a Larabee-ish blade profile.

I had also previously flown this model at the Maxecuters' National Building Museum indoor event, where it could just manage a couple of minutes--not enough to knock on the big boys' door, but enough to make me think that if I could shave 3g off the weight and bring it in at the minimum 6g weight (sans rubber) that the Maxecuters require for the NBM, it might at least make things interesting---and look good in the process.

The first stab at this indoor version came in at 6.8g, but required an additional 2.8g of ballast for a dry weight of 9.6g. So much for a 6g target weight! Even so, at the January NBM event the model trimmed out pretty quickly and, despite some severe stalling early in the pattern on its first two officials, managed initial flights in the 135-150 second range, flying well on a 24" loop of .105 rubber and a 7" laminated-wood prop. I made each prop blade from a sandwich of two pieces of 1/64" balsa sheet with a core of Tyvek paper in-between, and formed each at a 17-degree angle on a 2-3/4" diameter pipe. Each blade was then set on a carbon-fiber spar to give a pitch of about 1.3. After a bit more nose weight was added, the bird was well on its way to an apparent 180-second best flight when it crashed into a column, sacking it for the day.

Despite this success, I was really bugged by all that clay in the nose. So I began trimming the length of the motor tube, to get to a point where the model would balance with little or no ballast using the CG I had established while flying at the NBM. The result is the "Indoor" version presented here, with the rubber conveniently divided pretty much 50/50 on the CG, and a dry weight (sans rubber) of 6.6g. This ought to slow the bugger to a crawl (it was pretty slow as it was) and I'm really looking forward to getting a chance to try her out. I'll probably drop the motor back to a 20" loop of .85 to start, and take it from there. Note that you could easily build the model lighter to actually hit that 6g mark-swapping out the 1/16" material for 1/20" would be a good place to start. A .6g weight overrun might seem like awfully small potatoes to worry about, until you consider that is equal to 10% of the total dry weight of the model. That small margin of error to me is the fascinating challenge inherent in building No-Cals, and is a large part of why I'm pretty hooked on them as a category!



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|---|---|---|---|---|
| | **14g. Bostonian ML (6 entrants)** | | | |
| 1 | John Murphy | Pup | | |
| 2 | Ray Rakow | - | | |
| 3 | Paul Spreiregen | Found | | |
| | **Phantom Flash ML (9 entrants)** | | | |
| 1 | Andrew Compton | - | | |
| 2 | Doug Griggs | - | | |
| 3 | Stefan Prosky | - | | |
| | **WW II No-Cal ML (9 entrants)** | | | |
| 1 | John Appling | FW-190 D9 | | |
| 2 | Wally Farell | P-39 | | |
| 3 | Mike Escalante | Dauntless | | |
| | **Parlor Fly ML (8 entrants)** | | | |
| 1 | Steve Fujikawa | - | | |
| 2 | John Murphy | - | | |
| 3 | John Appling | - | | |
| | **Dime Scale ML (6 entrants)** | | | |
| 1 | Steve Fujikawa | Farman Stratoplane | | |
| 2 | Mike Escalante | Monocoupe | | |
| 3 | Jim Coffin | Curtiss Falcon | | |
| | **FAC Peanut Scale (4 entrants)** | | | |
| 1 | Mike Escalante | Santos Dumont 14 bis | 24 sec | 80 scale + b |
| 2 | Wally Farrell | Piper J-3 | 41 sec | 62 scale +b |
| 3 | Bruce Clark | Andreason | 23 sec | 59 scale +b |
| 1 | John Murphy | 66 sec.. | | |
| 2 | Ray Rakow | 51 sec. | | |
| 3 | Paul Spreiregen | 48 sec. | | |
| | **Limited Pennyplane (4 entrants)** | | | |
| 1 | F. Thomas Schill | 6:31 | | |
| 2 | Tony Pavel | 2:08 | | |
| 3 | Charlie Coeyman | 1:58 | | |
| | **FAC NoCal (6 entrants ) -TOF** | | | |
| 1 | Dave Mitchell | Curtiss SBC-3 | 323 sec. | |
| 2 | Wally Farrell | P-39 | 185 sec. | |
| 3 | Scott Richlen | P-40 | 91 sec. | |
| | **A-6 (8 entrants)** | | | |
| 1 | Brett Sanborn | 4:33 | | |
| 2 | Tony Pavel | 4:01 | | |
| 3 | Paul Buck | 3:39 | | |
| | **ZAIC Z-15 (5 entrants)** | | | |
| 1 | John Murphy | 66 sec. | | |
| 2 | Ray Rakow | 51 sec. | | |
| 3 | Paul Spreiregen | 48 sec. | | |

# National Building Museum January 26, 2014

We had a record number of 32 flyers for Freeflight, and 16 for RC. There was a lot of visitor interest in the flying, Sally Otis, director of family programs for the National Building Museum, reported that more than one thousand people visited the museum during the day.

Grand Champ was Mike Escalante. His win in FAC Peanut and strong placings in Dime, WW-II NoCal, and Phantom Flash pushed him into the lead. We had some new fliers joining us. A High School Teacher from Richmond brought a student and a former student to give us a run for the money. Andrew Compton won the Phantom Flash and F. Thomas Schill won Limited Pennyplane. They also flew their rubber-powered TSA Competition model to revel in the high NBM ceiling. Scott Richlen brought one of his middle school model-building group, where Alex F. bettered him by one second in Ziac Z-15. FS Gilbert came down from Pennsylvania to compete in Bostonian with the fattest P-51 Mustang I have ever seen (named the Bostang).

There were thrills and spills. We even had a "Wrongway Corrigan" flight that after an obedient circle decided to fly straight down the length of the building, crossing the waters of the fountain along the way.

Stefan Prosky provided a gift of deluxe kit of a peanut Goodyear racer and it was awarded to the Grand Champion. Ron Stahl provided a Sky Bunny beginner's kit and it was given to Alex F. as a new builder.

Special thanks go to Allan Schanzle, Doug Griggs, John Appling and others who explained models to visitors. Thanks go out to those helping kids in the Delta Dart program.

At the RC Atrium, Paul Stamison ably ran the events. Ross Clements, a walk-in new flier, displayed good piloting to win the Mini Vapor slow racing as well as the tortoise race.

# An Experimental "One-Blade"

*Dan Driscoll*

I've built a number of Old Time models for both FAC and SAM competition, but I've always avoided designs with one-bladed props. I'd always heard that one-bladed props were difficult to properly balance, and that two-bladed props worked better. However, there are a lot of nifty Old Time model designs with one-bladed props, so I decided to try one. I selected "An Experimental 'One-Blade'" by William Kay in the November 1938 Aeromodeller. The design was presented in the original magazine as a 1/3 size full page plan with no accompanying article or photos. I like simple models, and with a constant chord wing, flat bottom airfoil, and box fuselage, this model seemed perfect. The 36" span model meets FAC rules and is approved for SAM competition.

I started the project by enlarging the plan by 300% to

bring it up to full size. This immediately showed some problems. The wingspan did not come out to the specified 36" and the wing center section was narrower than the top of the fuselage. Also, the fuselage length, and tail dimensions were a little off. I widened the wing center section to make the wing 36", and this worked out to make it equal to the fuselage top. I fudged around with the other components to make them agree with the dimensions on the plan. I also found that the wing leading and trailing edges weren't parallel and fixed that.

Actual construction went smoothly. I beefed up the area around the landing gear and the wing dihedral joints. The joint where the fin attached to the stab also needed to be strengthened, and the tail was easily modified for a pop up DT. A ¼" X 3/32" top wing spar was added 1 1/8" back from the leading edge. The SWG 18 wire specified for the landing gear equates to .048", and I used .047" wire. The gear proved to be pretty flimsy due to the long length, and requires a light touch for ROG's. The prop was counterbalanced with a 1/16" wire about 4" long with solder wrapped at the end. Completed weight with carved prop shown on plan was 80 grams. CG was set at 50% of wing chord.

Photos on this page are by Pat daily.

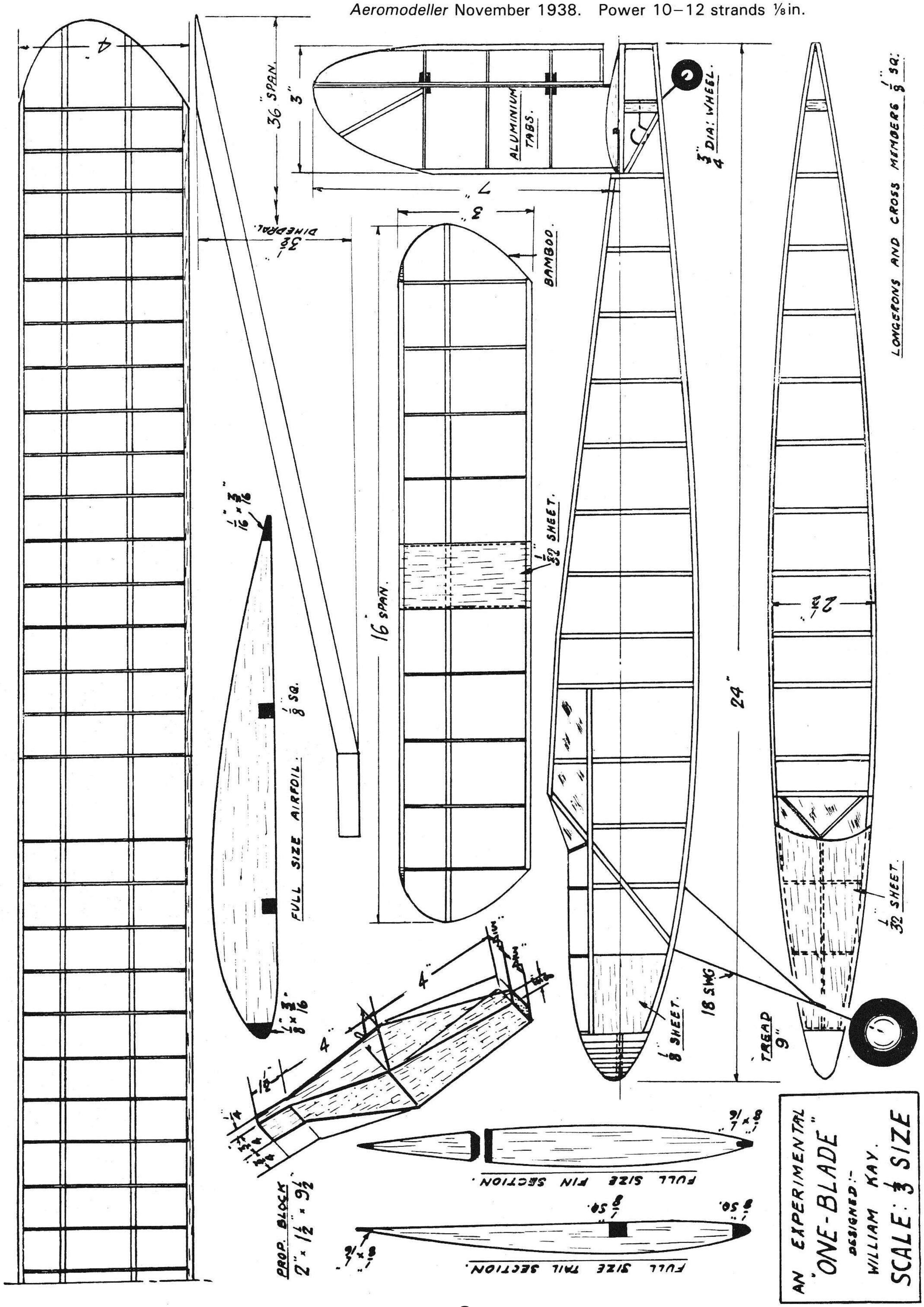
I started test flights with 300" of 3/16" rubber in eight strands braided. It flew right off the board, but not particularly well. The prop was too large, and by trial and error, was eventually cut down to 13" diameter and slightly reshaped. A formed blade of two layers of 1/16" balsa about the same diameter, but with a little more pitch, works better. At 1200 turns with the formed prop, the model struggles to get off a card table, but then flies quite well. On its first official flight at the 2013 Non-Nats, it maxed but went out of sight. A friendly farmer and Wally Farrell got it back to me a couple of weeks later. At the FAC Outdoor Champs, it maxed the first flight, but broke off about one inch of the prop tip on landing. I couldn't find the missing tip and completed the last two flights with the broken prop and finished out of the money.

I like this model, and I plan to build a one-bladed stick model next.

(As a side note, I put a 12" two bladed prop on the model, and it flew much better. SAM and the new FAC rules don't allow this for competition.)

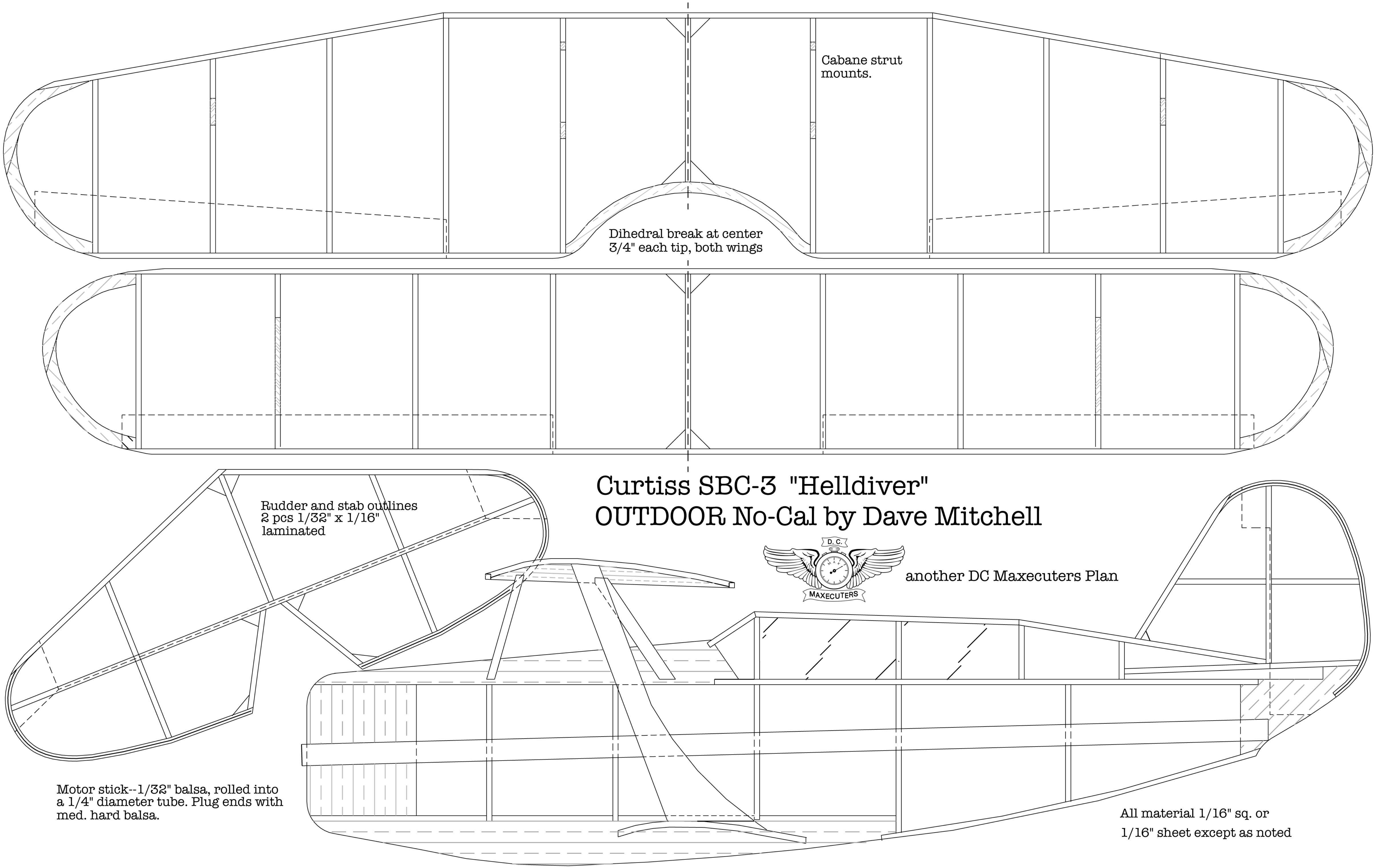
Editor's note: Dan didn't say so, but early on the model suffered from extreme vibration problems. You could see that wimpy undercarriage vibrate to almost a blur. This was blamed on the one blader prop and considerable time was spent trying to balance it to mitigate the problem. While holding for Dan I noticed the S-Hook looked a little askew. Sure enough it was off center and causing the rubber to bunch up on one side. When the S-Hook was replaced with a more symmetric one, things improved considerably.

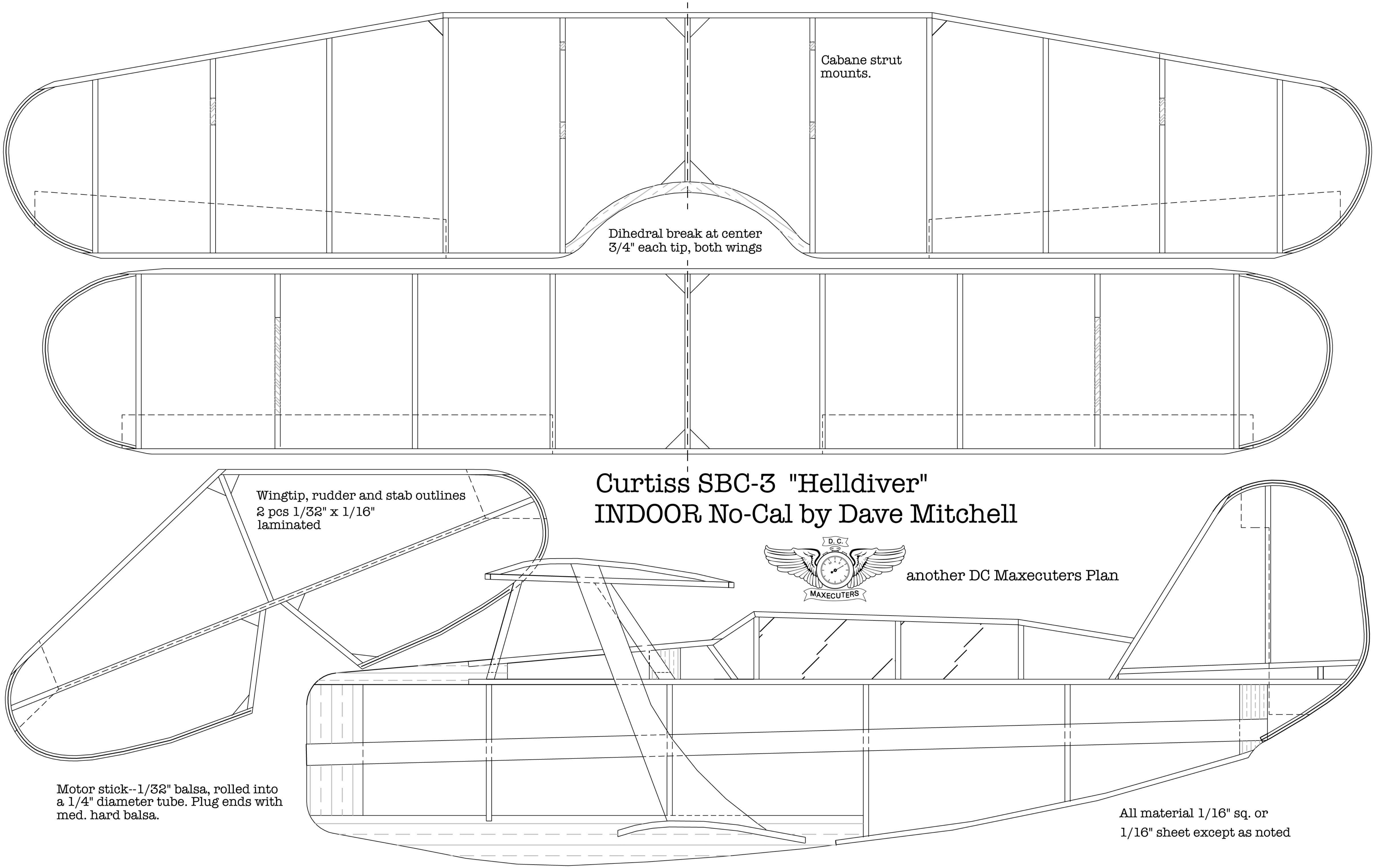
More notes: The fuselage is covered with Poly Span, the wings and tail with jap tissue. That long gear presents a very high angle of attack for a ROG launch, meaning the wing is just about stalled. If the tail is held up off the table at launch, it climbs out better with out a dropping down below table level to pick up speed.


36" SPAN
3"
ALUMINIUM TABS.
3/4" DIA: WHEEL.
LONGERONS AND CROSS MEMBERS 1/8" SQ.
7"
3½" DIHEDRAL.
BAMBOO.
1/32 SHEET.
16" SPAN
1/16" x 3/16"
1/8 SQ.
FULL SIZE AIRFOIL.
1/8 x 3/16
24"
1/32 SHEET.
1/8 SHEET.
18 SWG
TREAD 9"
PROP BLOCK 2" x 1½" x 9½"
FULL SIZE FIN SECTION.
FULL SIZE TAIL SECTION.
AN EXPERIMENTAL "ONE-BLADE"
DESIGNED:- WILLIAM KAY.
SCALE: 1/3 SIZE

# Curtiss SBC-3 "Helldiver"
## OUTDOOR No-Cal by Dave Mitchell

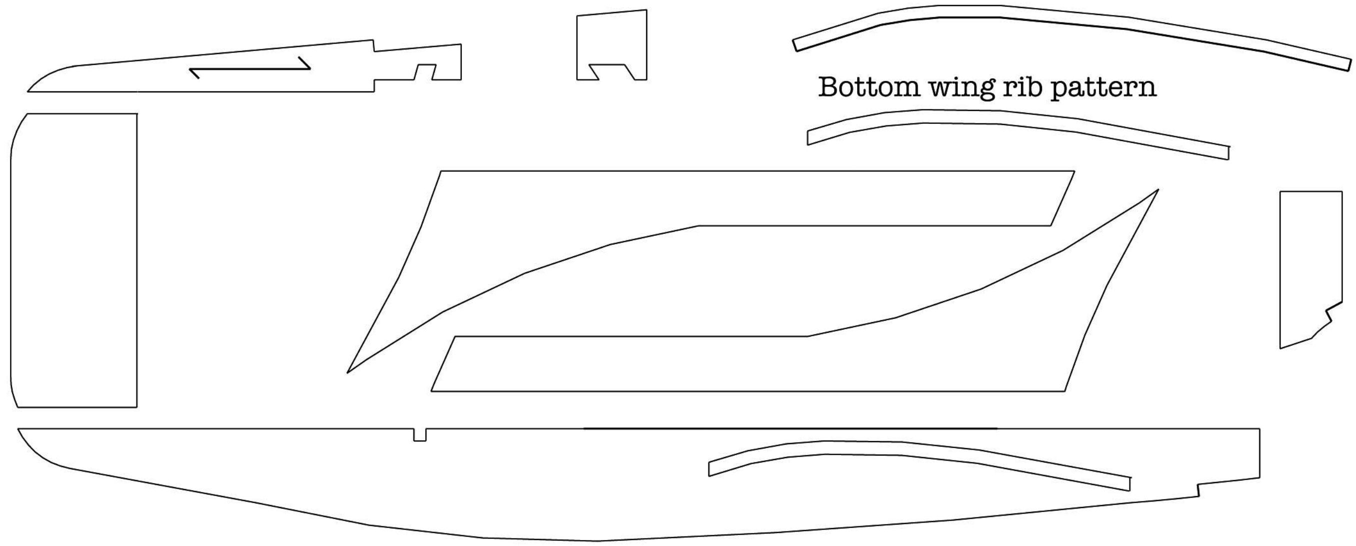
another DC Maxecuters Plan



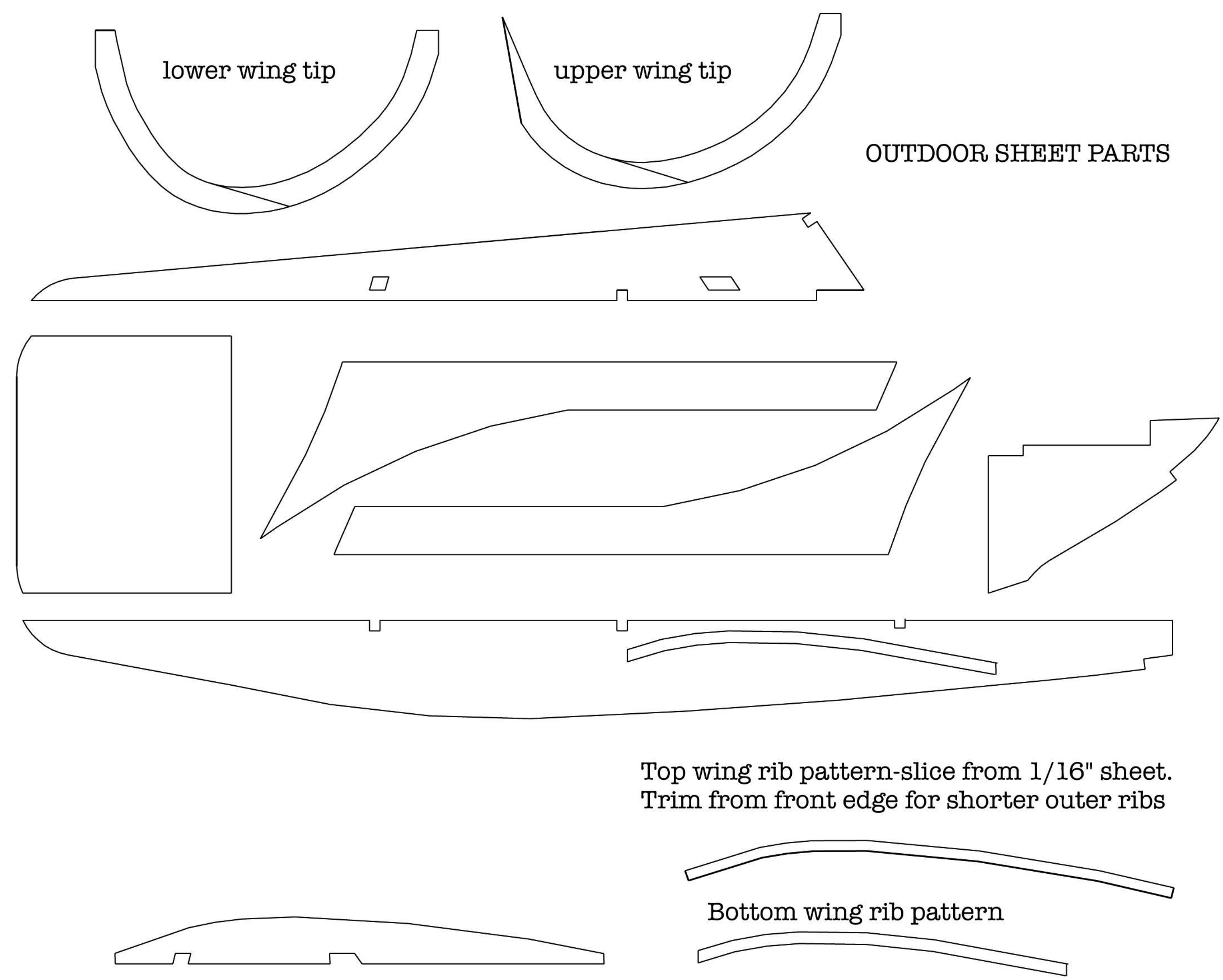

Cabane strut mounts.
Dihedral break at center
3/4" each tip, both wings
Curtiss SBC-3 "Helldiver"
INDOOR No-Cal by Dave Mitchell
D. C.
MAXECUTERS
another DC Maxecuters Plan
Wingtip, rudder and stab outlines
2 pcs 1/32" x 1/16"
laminated
Motor stick--1/32" balsa, rolled into
a 1/4" diameter tube. Plug ends with
med. hard balsa.
All material 1/16" sq. or
1/16" sheet except as noted

INDOOR SHEET PARTS

Top wing rib pattern-slice from 1/16" sheet.
Trim from front edge for shorter outer ribs




OUTDOOR SHEET PARTS



# Making Lighter Rubber Scale Planes.

*By Dan Garsonnin*

I would like to address the subject of rubber scale designing and building, the essence of which is maximum strength with minimum weight and good looks. That's a pretty broad subject, and I'm better at rambling than I am at organizing, so this won't be the easiest read – I'm sorry for that.

I invite anyone to make comments of any kind, about any aspect of this article, technicalities, or indeed, even its presentation. At a later date, I hope to be able to supply photos to help substantiate and illustrate what I've written here. Perhaps a sketch or two wouldn't hurt, once I learn to use my new machines.

I hope to speak to those builders who are thinking of going beyond simple kit building, or building to a plan. A modicum of experience will be needed.

A very beginning step might be to replace kit material with your own lighter, stronger, or more suitable material. Further steps may include modifying portions of the model by discreet removal of bits of material, such as with hollowing, thinning, punching holes in ribs, scalloping between supports, etc., or even adding material for strength such as a gusset to prevent a tissue wrinkle, or other known structural, scale, or aesthetic weaknesses in the design.

A trap to avoid is over-lightening; i.e., a piece whose lightness/strength is out of step with the rest of the model, and may fail before the rest of the model. Admittedly, there will always be weak points, which we strive to correct, but beware of creating new ones by flagrant material removal. 1/16" balsa can often be reduced to 1/20" or even 1/32", but the remainder of the model must be also suitably light I can't remember when I last used wing ribs thicker than 1/32" on a Peanut, but then the rest of the structure is also very light. Lighter planes do land easier, bounce better, and are much kinder on strut supported top wings.

By this time, the builder is probably chafing at the inadequacies of the kits or magazine plans, and scratch building and designing enters the picture. Now, you can choose any design, to any scale, incorporate standard structures and features, plus your own innovations. And if you thought that model building was fun and satisfying, designing and scratch building your own is the ultimate.

When a concept of a scale model first occurs to me, it is often with an overall appearance, or style, in mind. On occasion, the style comes first and I seek a model to suit it. Sometimes the style is determined, almost dictated, by the requirements of a contest event. The style might be rigidly scale with as much realism as possible or it may lean a little more on the whimsical or sporty side with lots of clear-coated, brightly coloured, open tissue, paying homage to traditional charm. The intensely scale job will need focus on weight reduction but some fudging in technique can exist if it is to be covered by an opaque finish. The more traditional style will be easier to keep light, but the building quality and technique might be even more visible and critical to the satisfaction that the model offers.

My approach has been that somehow, the thought of a cutesy, brightly coloured, transparent, open-tissue thing, posing as a WW II warplane doesn't appeal. Anything since1940 will likely feature lots of opaque finish and perhaps sheeting to resemble the hard skin of metal aircraft, and any open tissue will likely be hidden or disguised as much as possible.

Lightening construction members: As soon as weight becomes a factor, the material in construction members is moved closer to the outside surfaces or extremities of that member. So, solid beams become I-beams, box-beams, tubes, etc., as can be seen on almost any bridge, tall building, and of course, airplane. People may be fooled into thinking that the vertical portion of an I beam offers much rigidity, when its real function is as a web to hold the top and bottom flange in their relative positions so that they can do the real work of resisting those bending forces.

By changing to a more sophisticated profile than just the square solid beam, individual spars and stingers can sometimes be lightened. Using a thinner, rectangular piece on the vertical can sometimes be accomplished if the reduced stiffness is fortified by gluing to the covering. So ribs and stringers, should they run the risk of buckling under tension, say tissue shrinkage, should be glued or doped to the tissue to help keep them straight.

Should, during shrinkage of the covering, you notice that the ribs are starting to buckle, get some thinner on the paper and rub some dope through the paper onto the ring ribs, to secure the paper and the rib before the thinners dry. You may be able to save the situation if you're quick, so do watch while the shrinkage, from water or dope, occurs. I did save a set of wings this way, once.

I use flanges. Many aircraft parts, in order to be easily manufactured out of metal, are often stamped out of, or extruded into, thin sheets and a flange is attached or moulded. A capped rib has flanges, top and bottom. If my bulkheads are too thin, I'll flange along the inside cutout, or relief. The efficiency of strategically placed flanges can result in huge weight savings while still maintaining adequate strength. Flanging often places the material right where you want it – at the outside surface of our construction member.

Weak bulkheads or formers will crush inward under excessive force (hand squeeze, cartwheel landing). Failure will begin as a crack or split starting at the inside relief or cutout. Gluing a flange around the inside edge of the relief can prevent that crack from ever beginning and will greatly raise the failure loads.

Sometimes, placing cyano-glue in strategically chosen spots or edges can strengthen pieces, which are too weak. Remember how difficult it is to work wood, which has cyano-glue on it, not to mention its weight; so do be judicious with its application

Simple structures or members: When examining a member for stiffness, there are a couple of figures, or proportions, to remember, although many people's instinct will tell them the same thing. For a construction member to retain its strength in compression, it must resist buckling. When the ratio of its length-to-its-thickness gets too large, the tendency to buckle increases – the member fails as a column -- it is too skinny. The same thing happens to sheet material if it's too thin. That doesn't mean that it loses all strength but that it loses much or most of it. So, when a stick or a sheet becomes longer than eight times its thickness, it begins the tendency to buckle, until around twenty times the thickness, it is as wobbly as it can get and cannot be counted on as a column or a rigid, compression member.

So width counts -- it adds stability – maybe something to consider if deciding to go with thicker, lighter material, or skinnier, harder material. The skinnier stuff may need additional support, the softer stuff may be prone to crushing – no free lunches – but you can seek advantages. And now consider the use of a flange, which can add to the thickness without adding that much to the bulk. Hooray for complex cross-sections. Consider the difference between the stiffness of a corrugated sheet of metal, and that same sheet flattened out. In some ways, the sheet has been made effectively thicker with the corrugations.

Of course, all that instability stuff doesn't apply to anything in tension. You won't find the bottom of my wings loaded up with spars – I rely mostly on the tissue, which is quite strong in tension. So, what's in tension and what's in compression? Simplified a little, if you apply a bending load to a simple beam, it will resist the bending forces by having half of its material in tension, and the other half in compression. The material furthest away from the centre (the neutral axis through the length of the beam) will carry almost all the load and only after its failure, does the inside material play an appreciable role. Since the inside material can resist even less than the outside material, failure of the skin, or outside surface, often means total failure. The integrity of the outside surface is important. And, those fibres down the middle at the neutral axis, are neither in tension nor compression, and add nothing substantial to the strength of the beam other than their own stiffness.

When the beam does bend, as do our components and even wings, the material in compression distorts by squishing a little, and the material in tension stretches a little, and the bend occurs. Without those little distortions, there would be no bending until the point of failure. If you picture this, you'll understand why the material furthest from the axis, at the outside surface, takes the highest load and distorts the most . . . and why if those outside fibres fail, those inside of them, closer to the axis, will have to take the entire load, and with less resistive leverage are likely to immediately fail. The crack is progressive and instantly becomes a break.

If you think that width is important for the stability of a compression member, say a fuselage upright, depth of beam is even more important. If you have a beam with a rectangular cross section, do place it on its edge to get that depth. The basic material resistance calculation is based on the square of the distance from the neutral axis. This means that the fibres, which are twice as far away from the neutral axis can resist four times the force before failure that fibres, only half as distant can. And now, the full implications of the value of an I-beam should be evident. And similarly, how the value of adding flanges, permitting very much thinner material to be used, should be recognizable.

Fortunately, the parts of a beam that are under tension follow the same rule: the forces and resistance depend upon that same square-of-the-distance from the neutral axis, only pulling instead of compressing. Wood tends to have the same resistance in tension as in compression, but concrete and stonework don't – hence the need for reinforcement (rebar) or engineered shapes as used in the arches in the Roman aqueducts from thousands of years ago. But, as mentioned earlier, paper is quite strong in tension. As long as the paper is taught and repaired, there is little need for bottom spars other than the L.E. and T.E.

And that square of in our formula – don't be afraid of that. We use the square often: if you double the measurements of your wing, you will quadruple its area, and if you double the airspeed, you will quadruple most aerodynamic effects like lift. Moments of inertia (the effects of a long or short nose on a glider) use the distance-squared. So don't get weirded-out. You don't have to calculate things out – the idea is to realize the importance of things.

I am not, in this treatise, suggesting that we calculate our stress analysis with numbers – only that we have a realistic idea of important parameters of force and resistance. As modelers, we do develop a feel for the materials we use and their strengths and weaknesses, and we can add that developed sensitivity to these physical considerations to help refine our structures in a logical way; in other words, and I think this is where that beautiful term comes in -- to guestimate.

Complex structures: Structures made up of more than one member. The reason we use shear webs and spacers is that if all the pieces can be adequately stabilized in position, the entire structure can act in concert, as a whole unit. If the pieces are allowed to shift, slide, or buckle in relationship to one another, compromising the integrity of the unit, its failure loads will be much lower – it will break or deform earlier. For example, hold a phone book in front of you as if to read the cover, in your left hand by the spine, and bend the pages back and forth with your right hand, and they slide, one page against another (in shear) and the book bends easily. Now, still holding the spine with your left hand, grip the open edge of the book firmly in your right hand so that the pages cannot slide, and the book no longer bends – it has become a unit, structurally. As a unit, all the pieces are subject to that same calculation with the square of the distance from the neutral axis of the unit (beam).

In the case of wings, if all properly stabilized, the whole wing can be treated as a beam, using the same parameters of comparing the square of the distances from the neutral axis to get an idea of where to place what material to be most effective. I am not a fan of sunken spars – unless something specific is trying to be achieved. Spars at the surface, at max camber, will offer the greatest strength.

Of course, the spars must remain resolutely in position relative to one another. To prevent local buckling of the spar, rib pitching has to be close enough. Webs can help in preventing buckling as well as sliding (shear), and they don't have to be very strong --they are only there to stabilize, not to share the load. The stabilizing muscles along an aging spine are not strong, but they must be constantly employed.

And, to reiterate, if the parts are sufficiently stabilized so that the whole wing acts as a beam, the individual members are to be treated as members and not beams in themselves. The entire member will either be in tension or compression. Spars with rectangular cross section will be most valuable if placed flat, rather than on edge as a beam, and as close to the wing's surface as possible, keeping it as distant as possible from the wing's neutral axis. Remember that the formula is -- cross sectional area x distance x distance, commonly called "the moment of inertia", should you hear the term in a discussion on structures. Moment of inertia will typically be heard in discussions about how long to make a glider's nose, or how light does that stab or those wing tips really have to be.

For a few years, I worked on a line of A-2s, which had fully sheeted wings, and I wanted to reinforce the top sheeting (1/16 6lb stock). I didn't wish to sink a spar below the sheeting because the notch would weaken the already thin-wing ribs, and I wanted to keep all the material as distant as possible from the neutral axis from maximum strength. I ended up letting in a 1/16 20 lb stock wedge (wide at the root, narrow at the tip) to the top sheeting. The ribs weren't any thinner, didn't need notching, and I pitched (spaced) the ribs a little closer to make doubly sure the sheeting wouldn't buckle. The sheeting became the spar, and the most efficient one possible. In fact, the wing had become a total monocoque structure, which has the most efficient distribution of material.

One difficulty that is prone to glider wings (under-cambered) is to prevent reflexing of the wing so it flattens and loses its camber and its effective depth as a beam. I placed several glider wings between two chairs and sat on them until they broke. In every case the camber flattened and the wing broke right away – but not until the camber flattened. It is similar to bending a steel measuring tape. It doesn't bend until it flattens, and then it bends pretty easily. And, the forces causing the flattening are severe and difficult to resist. Capping thin, curved ribs might be very desirable.

The way to think of this is to look down the end of a wing – at the profile, the airfoil with all the spars. The neutral axis will run along the profile, in the direction of the least bending resistance of the wing, somewhere between the top and the bottom, and roughly parallel to the base line.

Establishing the neutral axis of a wing panel is probably the most "iffy" part of the whole process. I haven't actually done one mathematically. I think that if I dredged up all my high school algebra, I could. But up till now, I've estimated it. If a wing has three balsa spars – L.E. and top spar and T.E. – of similar cross section, the axis will lie closer to the two bottom spars because they offer more resistance. But it won't lie very much closer because any change in the distance between neutral axis and a construction member is to be measured as the "square of", to establish its moment. Small change in distance equals big change in resistance. So, even with piling material on, it is difficult to build a strong, thin wing. A slightly fatter one could be just as strong and be very much lighter.

When a spar breaks, or the bottom tissue rips chord-wise, that neutral axis will immediately take a new position, closer to the greatest mass of the remaining parts, everything will now be stressed more, especially those parts closest to the fault which have become more distant from the axis and more alone in assuming the loads, and more subject to deformation.

Should dissimilar materials be used as spars, it gets more complicated. The materials must be compared to the main material (balsa of a given density) for resistance and elasticity (the ability to deform temporarily without permanent change – steel is very elastic, lead is not -- and converted to "equivalents" in balsa area. In the drawings and calculations, a balsa spar of larger cross sectional area would represent a spruce spar. It does get quite a bit more complicated, but for rubber scale, I am usually looking for the lightest stuff – the heaviest would be a medium balsa spar.

Fuselages: I became a little distressed while laying down stringer after stringer, all in effort to nearly reproduce that round fuselage cross section, common to WW II aircraft, and thinking of the weight of all this material. Couldn't some material be removed or done without? Duration ships get along with a square or diamond shaped fuselage that has four longerons . . . four longerons! And they use bigger rubber. And now, this F-4U was going to require twenty-four longerons in the nose – just to make the shape – it certainly wasn't for needed strength. These scale ships are hugely overbuilt. Surely . . . something could be removed without compromising the needed strength.

Oddly enough, the primary limitation to reducing fuselage stringers and longerons seems to be the pull of the covering – shrunken tissue. I want taught tissue but I don't want the starved-horse syndrome. The stringers will sag between formers if: the formers are too widely spaced or the stringers are too thin and/or too few – both are expressions of a too-strong tissue. The solutions can involve using a weaker-pulling tissue, tightening the spacing of the formers, or using more stringers or stronger stringers. Whichever combinations of those procedures you choose might depend on if you have different tissue or dope, or if your formers are already determined and you don't wish to draw new ones, or if you have stiffer, stringer material. My last Peanut had some 1/16 x 1/32 stringers, placed on edge and firmly attached to the tissue to resist any buckling.

Many fuselages are constructed using keels. These keels are often heavier than needed. The F4U from that W.W.II book had huge keels, which I pared down, once I had the framework in my hand and realized that something had to go. Later models used keels of stringer-size (or marginally larger) but I started with a temporary structure tying the keels together, with diagonals and verticals (1/4 x 1/16), which were fairly easy to cut away once the frame had its own stability. I guess it's like interior scaffolding but only two-dimensional.

Often, much material is invested in the bulkheads and formers. I am convinced that with the use of laminations, so that the grain is always in the right direction, the scale, curved, characteristic shapes can still be retained but made lighter. Because I don't want to laminate more than two layers (the shape becomes inconsistent or deformed), a thickness of only 1/16" will be developed, which is insufficiently strong for a full former on anything larger than Peanut Scale. The laminations would have to serve as a flange to a normal style of former, cut from sheet

Note that laminating a 1/16" sq former outline, braced inside with a triangle if 1/16" sq, is adequate for a Peanut sized model, and is very light and sophisticated. There are no notches – all the stringers are floated on the outside. Important bulkheads would have to be bigger and stronger, or somehow fortified. . (I have tried pure laminations as formers on a larger ship, but I'll leave that for a later posting.)

If only a flange is to be made with laminations, and not the entire former, perhaps the outline of the former is not the best place for a flange. Flanging the cutout in the center of the former would permit a narrower former, made with thinner wood. As a bulkhead is crushed, the break begins at the inside cutout edge, as the piece collapses inward. A laminated flange there would prevent (within reason) that break from starting.

My latest project is a double-sized version of the F-4U out of that Fighters of WW II book. This is a big plane with a wingspan of 42", a root chord of 9" (largest I've ever dealt with) and a nose width of 4 ..". Since I only use soft balsa in my scale ships, it will never weigh very much – which is the point. All my bulkheads and formers have been reduced to .." wide, flanged on the inside with .." x 1/16", which was easy to do. But, whereas I did use 1/8" thick bulkheads in the nose, all of the formers from the mid-wing point aft are only 1/16" thick, yet are sufficiently strong with the inside flange. The rubber also has nice contact spots on the smooth flanges.

All the longerons are 1/8" sq soft. Only four notches were cut into the formers – I used four keels. Otherwise, all the bulkheads and formers are notch-less and smooth on the outline – easy to make. The stringers were floated between the keels, packed or relieved when needed for that perfect, flowing outline, and were lined up by eye during the gluing. This is a fairly easy process and the results are most rewarding.

My tendency has been to use sheeting on these metal ships where ever the weight can be afforded. With rubber ships, that usually means only the cowling. The F-4U was easy – no compound curves, although merely wrapping a cylindrical shape in sheet can produce an ugly, starved-horse shape if you are not careful. It is possible to pull the sheet too tightly between the formers, and do avoid shrinking glues which can pull the sheeting in toward the former – no cellulose glues (Ambroid).

I have never liked the task, and I'm not that fussy about the results either, of planking. So, all my cowlings are sheet balsa -- even the ones with fancy shapes – if I have to mould them.

With balsa sheet wrapping, the sheet, forming a monocoque structure, can take all the loads with no interior structure, in principle. Sometimes I have to use a keel, or some rudimentary stick structure, just to locate and fix the nose. My F-4U has no structure just forward of the wing. The cylindrical cowl is all that's needed. Now, just in order to make the cowl with my hands, and to properly position it, I may find that I do need some sort of keel, or maybe keys, or something more to help accomplish this task of dexterity – lots of careful finger-tip work.

Almost any cowl, such as a Cessna or Spitfire, can be made with three pieces of moulded balsa sheet (one for the top and two for the more curved bottom), with a standard style of nosepiece, plug and bearing.

Moulding balsa sheet may be easier than you think – but it is still a task, not onerous, thankfully, and the results can be entirely pleasing. Only A grain balsa is suitable for any wrapping. A wooden (or could be foam) plug, or male mould, is carved to the exact shape needed, minus the thickness of the wrapping, which is always 1/32" – strong enough for any sized rubber scale ship – the shape will provide the strength. Any localized reinforcement can be provided with moulded doublers, although there is usually no need.

Choose the most flexible piece of soft wood you can find and it has to be softened with water. Even a soaking in boiling water is usually not quite enough softening, so household ammonia can be added. Ammonia dissolves the lignin (if I'm not mistaken) that holds the wood fibres together. Add a small amount, say 5% to the water and immerse the balsa. Watch for some of the loosened fibres to be collecting on the bottom, and occasionally check the wood for flexibility. The more ammonia, the quicker all this happens. I have never over-soaked a piece, but I imagine it can be done, judging from what collects beneath. I would like to supply a formula with what percent of ammonia to add for how much time, but I don't have these figures.

The softened balsa can then be wrapped, pulling and pushing here and there to help, without splitting the balsa, with a roll of cloth material, maybe an inch or inch-and-a-half wide. Just do one piece and mould and wrap as much of the shape as you can. I have a feeling that heating really does help, rather than air-drying; so stick it in the oven (300 degrees for 15 min. will probably do). When perfectly dry, unwrap it and see mow much of the shape you've managed to successfully mould. Use another piece of balsa and mould those parts of the shape which are not yet moulded – as I said, I have managed with three pieces. When all the pieces are moulded and dry, slip them all on the mould, overlapping, and decide where the best place for the seams should be so that only properly moulded portions will be cut and used to fit together. Make the cuts with a dimensionless cutter (I can never find one, so try a #11 blade with a new, long point) and cut both adjoining pieces at once, on the mould, so that they do fit one another.

If you know you will use a support structure (keels or something) under the moulded sheeting you will probably want to try to mould and cut and join your pieces with the seams directly over the structure. The cowlings I have produced in this manner are the most beautiful parts of my planes. Once, for a shadow Peanut scale (outlines only with single surface wings) I made a Found Brothers cabin plane, which included fat, hollowed, balsa wheels and a moulded cowling, which weighed only 2 grams and flew for two minutes on .020 x .020 rubber. The plane was so light and reliable, and thus, virtually unbreakable, that I flew it through countless events and presentations for the next twenty-five years – the most reliable and long-lived plane I ever had.

One extensively moulded plane, still on the board, is a Douglas B-26 (really long nacelles) also with a wingspan of 42". The entire fuselage, from the main trailing edge forward, including the inboard wing panels and both nacelles are fully, moulded sheet balsa. Open structures are on the outboard wing panels, aft fuselage, and tail feathers. The weight of all the finished components, all assembled except the tail parts and minus the propellers and thrust bearings, sits at 120 grams – 4-.. oz. The plane will never fly much because to save weight, the aft fuselage and tail are made super-light with condenser tissue. It won't take too many landings, no matter how gentle, to mangle those tail parts. That's a very impressive weight, for the appearance of the plane, but still . . . I am used to things with less than half that wing loading, so I have my doubts. Maybe I shouldn't because a test glide (tail taped on) was relatively slow and flat. Maybe I'm apprehensive at the scale of the project and the edges I'm pushing. Still . . . it has to be a challenge or it isn't much fun.

## PHOTOS PAGE 19

1. Jin Choe's Horton flying wing- AR6400 radio. It uses the take off dolly to the right as its very hard to hand launch a flying wing.
2 Ken Morrow's masterful rendering of Jin's Avro 504 kit won the craftsmanship award.
3. Ross Clements in front of some the guys he beat in the races.
4. Jin won the unique award with his Horton flying wing. Hopefully it will become a kit.

Meanwhile at the Rubber end --

5. Ray Rakow 's and Bruce Clark's models share the table.
6. Alan Schanzel's exquisite 20" Comet Dime Scale Vultee.
7. & 8. Close ups of the front end of the Helldiver featured in this issue.

# Gerald James Paisley

(we know him a Jerry Paisley)
April 30, 1925-Jan 6, 2014

Jerry passed away on January 6, 2014 at age 88 and after a wonderful lifetime, leaving his wife Helen, whom he married in 1948, four children (Diane, Deborah, Michael and Scott), 11 grandchildren and several great grandchildren. Jerry and Helen were from Great Bend, Kansas. He served in the US Navy in World War II in the Western Pacific where his ship saw action several times. After returning from the WWII, Jerry graduated from College with an engineering degree and worked for Colonial Pipeline for most of his career. He and Helen retired to Smithfield, VA around 1995.

Jerry was a member of the DC Maxecuters (1976), the Brainbusters Model Airplane Club of the tidewater area (the same club that Earl Stahl belonged to), the Flying Aces Club (a Blue Max holder) and the Kudzu Squadron of the FAC. Jerry and Scott and Helen were very active in attending model plane contests from Geneseo to North Carolina.

I first met Jerry and Scott at Comsat about 1976 along with their buddies Mike Escalante and his dad and Allan and Chris Schanzle. They came to watch Maxecuters fly rubber-powered planes at Comsat. Scott and Jerry became active builders, designers, and flyers. Jerry published several of his designs in Max Fax. The ones I remember were his de Havilland Chipmunk, Brewster Buffalo, and Beechcraft Staggerwing. I also remember his Albatros DIII and Fokker DVII.

You couldn't meet a nicer guy than Jerry. He never spoke unkindly of anyone and always had a great sense of humor and told wonderful stories of his experiences in the Navy. Jerry and I made several trips from the Richmond/Norfolk area to fly in Maxecuter events at Comsat and indoor sessions. Riding with him for several hours and talking of airplanes, kids, the Navy and life in general were great times.

He also would come up to Richmond to fly with me, Wally Farrell, Dave Franks, Dave Rees and Bob McClellan and also attended events at Petersburg. He and Bob were best buddies and they attended almost all of the Kudzu events and the water fly sessions that Dave and Marie Rees put on in North Carolina. We had great fun at those events. Jerry and Helen and Bob and Jane were regulars and great friends.

I am going to miss Jerry a lot. I spoke with him back in early December while he was hospitalized and he sounded just like always. Allan Schanzle and Verna and Sandie and I attended his funeral services and listened to wonderful remembrances of Jerry by Scott. What a great guy and wonderful friend Jerry was.

Thermals Jerry! Pat Daily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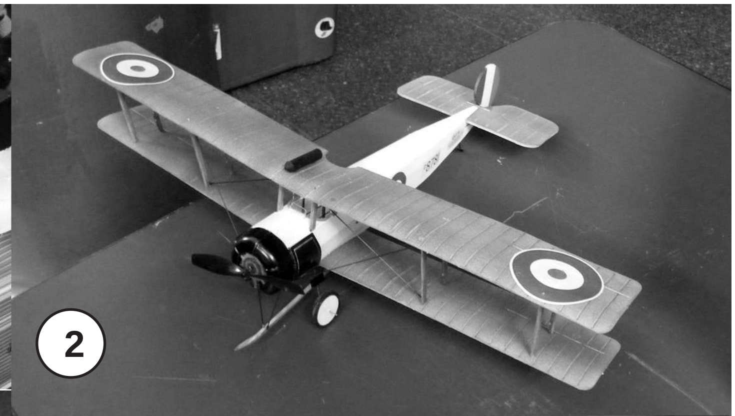
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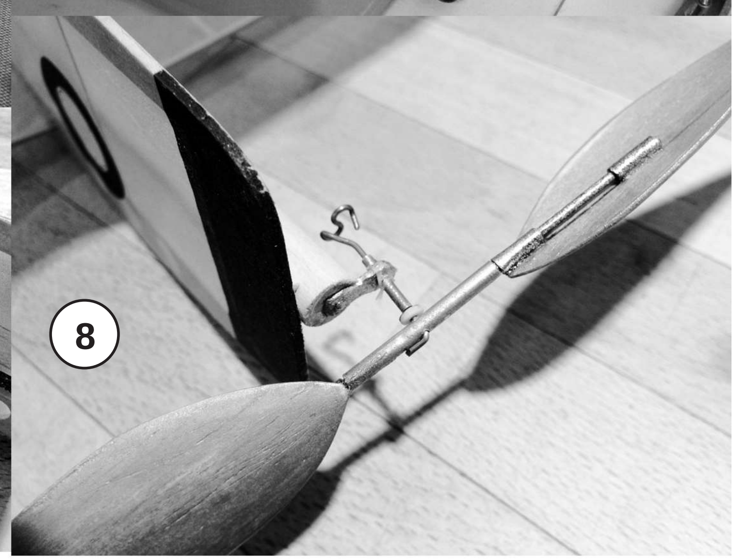
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**Jerry at Comsat with his D-7**

Here is a list of Jerry's plans that appeared in MAX-FAX.

| | |
|---|---|
| Beechcraft E-17 | 07,08/1991 |
| Bogus Interstate Cadet (Bostonian) | 07,08/1990 |
| Brewster Buffalo | 03,04/1993 |
| Cessna 145 | 11,12/1988 |
| Fokker D-7 | 05,06/1998 |

These will be available the Maxecuter website.