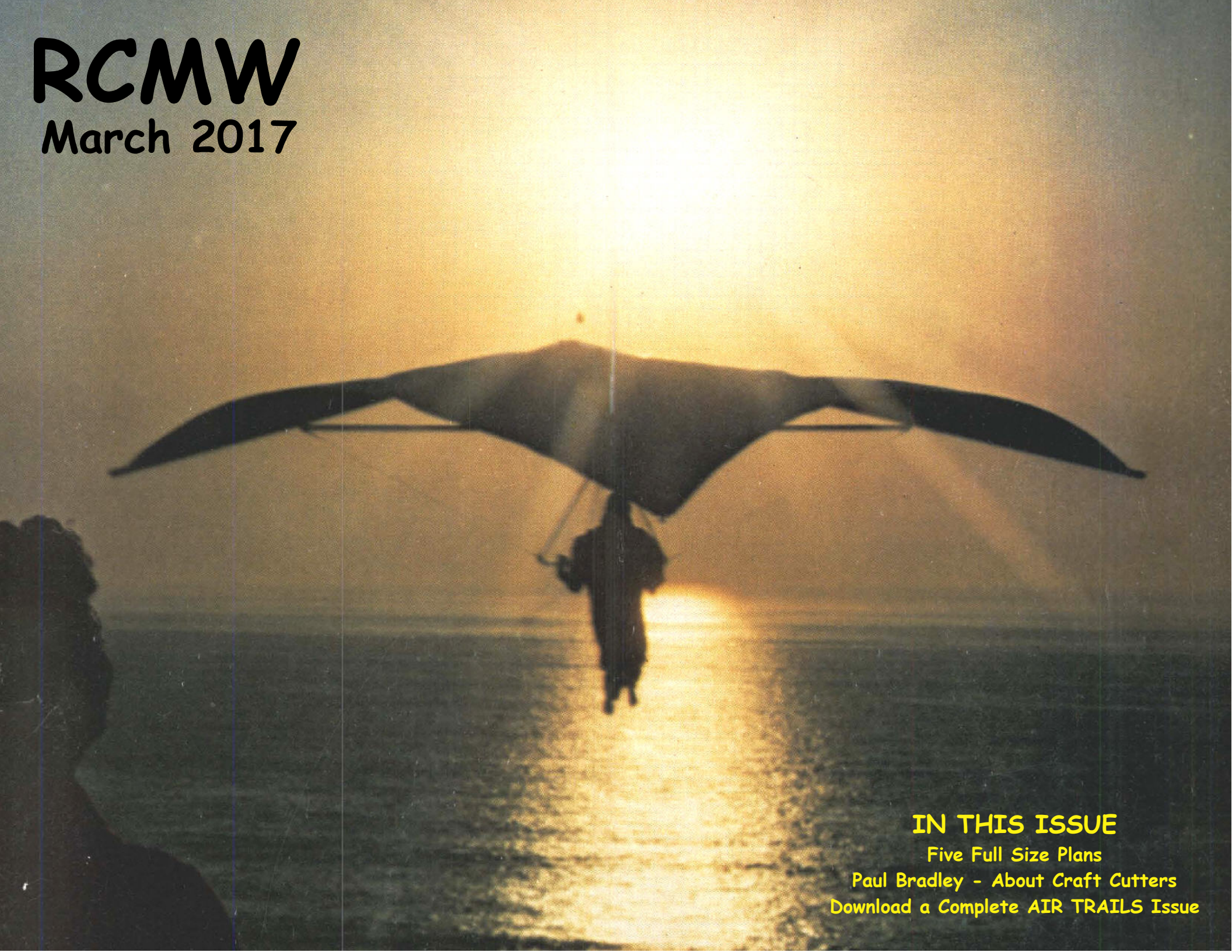
RCMW

March 2017



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ON THE COVER

The April 1974 cover of AIR TRAILS shows this scale model of A Rogallo Wing hang glider being flown in a California sunset

Photo by Jerry Trager

Model by Frank Kelly

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RCMW is the only model airplane magazine that provides all plans as full size PDF files in every issue. All pages of the monthly online magazine can be printed out, including the full size PDF files, using your own computer printer.

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Roland Friestad
1640 N Kellogg Street
Galesburg, IL 61401
USA

For the Model Bulder and Flyer - March 2017 Issue

Cloud 9
RC Micro World

Full Size Plans

It's been an "interesting" couple of weeks here at the bustling headquarters of RCMW. The main thing is that we were hit by a very bad virus that basically destroyed the main computer we used for creating each issue of RCMW and two other publications. Fortunately we have recovered and this is being written on a new "clean" computer. See page four of this issue for details.

Now for more interesting things related to model airplanes. This issue has an article by Paul Bradley about Craft Cutters. They are computer controlled cutting machines primarily used for cutting fabric and paper for folks (dare I say women without being accused of some sort of sexual misconduct ??) who are sewing, quilting or doing paper crafts. Paul has found that they can also cut balsa and tissue and window material for models. Take a look and see what he says.

Our first plan is for the KLEMM L-33, a scale FF model by Van Hereford for 1/2A Texaco Scale Duration competition. It was originally published in Flying Models but we don't know the date of the issue so couldn't provide the construction article. Nice model though. Let us know if you can find the issue date.

Now for a U-Control plan. The CRUSADER is a nifty twin-boom US stunter by Charles Mackey that appeared in the March 1960 issue of Flying Models magazine. Don't see a lot of stunt ships with that layout.

Next we have LA LIBELLULE, a French towline glider biplane that translates to DRAGONFLY. You'll see why the name when you see the plan and photos. Circa mid 1940's

Our monthly magazine download for this time is the December 1938 issue of Air Trails. WWII was coming but had not yet reached the USA.

The December 1941 issue of Model Airplane News contained Frank Ehlings PARAGON, a pretty standard appearing free flight model but with slotted wings. His comments on the effects of the slots are interesting.

Roy Clough was known for his unusual model designs that explored a wide range of aeronautical areas. In this model SPEED MADE EASY from the September 1946 issue of Model Airplane News he introduces us to rubber powered speed models. I'll be you younger readers have never see one of these being flown.

And finally, our regular ad for DIGITAL MAGAZINE COLLECTIONS appears as usual in the final pages of this issue. Take a look and see what you might like to have. Then you can get rid of those stacks of old magazines that could better be used for storing kits, glue, balsa and other essential supplies.

Keep 'em Flying,
Roland Friestad, Editor

DANGER !! - Very NASTY computer virus

Well, I wasn't planning on writing about this but it was sort of forced upon me so here goes. This is being written on March 12 and this March issue of RCMW is nearly 2 weeks late because my main computer was infected by an extremely nasty ransomware virus called "matrix"

The first indication was a text message that popped up stating "thematrixhasyou...." saying my files had been locked and to get them unlocked I had to send a payment to a certain email address. The payment to be in Bitcoins that are untraceable.

If you should get this message the very first thing to do is to IMMEDIATELY force a shutdown of your computer and call your service guys. On my HP this is done by pressing and holding the on button until it shuts down completely. If you don't do that the virus will spread through all your files and lock them up.

My computer service guy is pretty good but the only thing we could do is reformat the complete hard disk and reinstall the original software. Many newer computer don't even allow you to do this. I had to change to a new computer. I lost a lot of email and mailing addresses and names and still four days later am still reinstalling and trying to find lost stuff in backup files.

The Apple MAC users like to tell us that their computers are pretty much immune from these attacks but the word is that that is no longer true. It apparently comes in on an email message from someone you may know but with a strange sounding subject or none at all - DON'T OPEN IT !! - SHUT DOWN - CALL YOUR COMPUTER SERVICE EXPERT !!

Fortunately I had a lot of this issue backed up on another computer that wasn't infected and could reconstruct what was lost. The April issue of RCMW may be a bit late now also. This issue is being prepared on a "CLEAN" computer.

Making Model Airplane Parts With a Craft Cutter

by Paul Bradley

When the personal computer started becoming fairly common, the world of creating model airplane parts got quite interesting.

The domain of Computer Numerical Control or CNC became available to the individual. It was no longer the exclusive territory of commercial manufacturing. Personal computers opened the door to allowing people working at home the use of computer controlled machines to make things.

Some of the more well known types of tools that use CNC technology are laser cutters, CNC routers, 3D printers, and blade cutting machines like vinyl and craft cutters. Until recent years, CNC based tools driven by personal computers were generally at an expense level that is out of the reach of the average modeler.

Happily, the cost of CNC based tools suitable for the individual modeler has been dropping and many tools are now becoming affordable.

Of the tools mentioned in the preceding paragraph, the craft cutter is probably the most affordable. Craft cutters in the crafting world are also called electronic die cutters.

For us die cutting has a very different connotation so I will stick with the craft cutter nomenclature. Craft cutters can be bought for the price of a computer printer.

As it turns out, craft cutters at the low end of the price range work really well for making model airplane parts. Balsa up to 1/16" thick, 1/64" plywood, clear plastic, tissue, covering film, and thin foam sheet can be cut using a craft cutter.

When cutting wood the results are very comparable to what you get from a laser cutter and you don't have any edge charring.

Recently I purchased a craft cutter and began the journey of learning to use it to cut balsa. I sure am glad I did. It has given me a great new tool for cutting the balsa parts I use for the vast majority of my modeling projects.

In case you are not familiar with craft cutters and their use in our hobby, I thought I would share what I have learned.

Just what is a craft cutter? Craft cutters are about the width of a common computer printer. They are fairly narrow in depth and fit nicely on a desk next to the computer being used to control them. I have provided a photo of the craft cutter I am using.

My cutter is about in the middle to low end of the price range. That said, I have determined that it is very adequate and you really don't need to buy a more expensive model.

The basic configuration of a craft cutter varies by make and model, but generally follows the layout of the cutter I am using. My cutter has a lid that closes up the cutter when it is not in use. The lid also has storage compartments for keeping spare cutting blades in a handy place. The second photo of my cutter has the lid open. With the cutter opened up, you can see the core mechanism.

Craft cutters move the cutting blade back and forth across the width of the cutter while feed rollers move a cutting mat in and out of the cutter. The combined motion produces the necessary cutting paths to generate the geometry being cut.

The cutting blade is moved up and down to either cut or allow the blade to be move across the material where cutting is not desired.

There are several factors that influence the cost of a craft cutter. One is the amount of down force that can be placed on the cutting blade. Another is the size of cutting mats that can be used in the cutter.

Fortunately, the cutters at the low to middle end of the price range provide enough down force to cut our materials. The cutting mat size is a bit smaller, but still more than adequate for most modeling cutting needs.

In this photo of the machine with the cover opened you see the blade holder in the cutter. It is located on the far right end. The configuration of blade holders varies by make of cutter. Mine uses a fairly simple holder.

For all cutters the cutting blade is formed on the end of a round steel rod. The blade is held in the blade holder with a magnet. The blade is free to rotate as the blade holder is moved along the cutting path. That makes it easy tor the cutting edge to track the cut path as the blade holder changes direction.

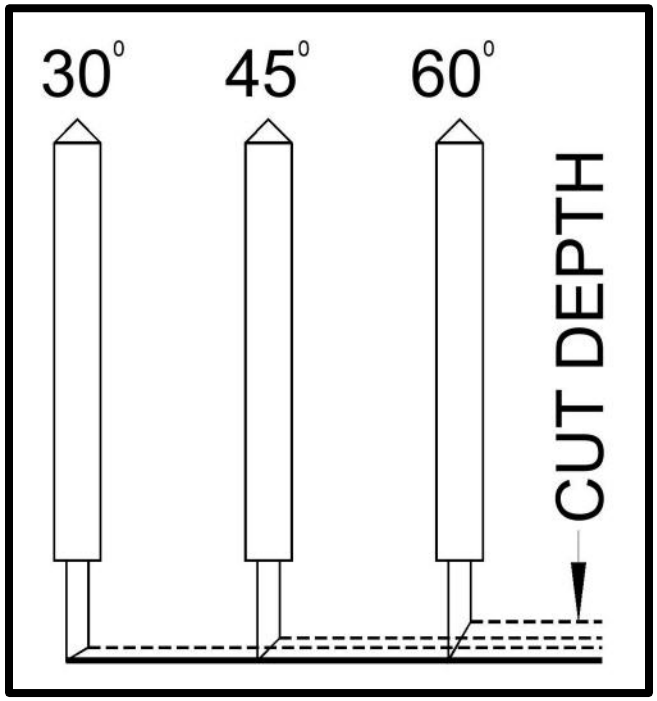
The photo above shows my cutter's blade holder and cutting blade. The depth of a cut is set by screwing in or out the threaded end of the holder. The brass lock ring allows the set depth to be fixed.

Some makes of craft cutters use a blade holder that has detent positions for setting the blade cut depth. That style of blade holder does make it easier to get consistent cutting depths.

Just visible at the top of the blade holder in the photo is a plunger. To remove a blade you just push down on the plunger and extract the blade from the holder. The blades hold their edge for quite a while and are relatively inexpensive to replace.

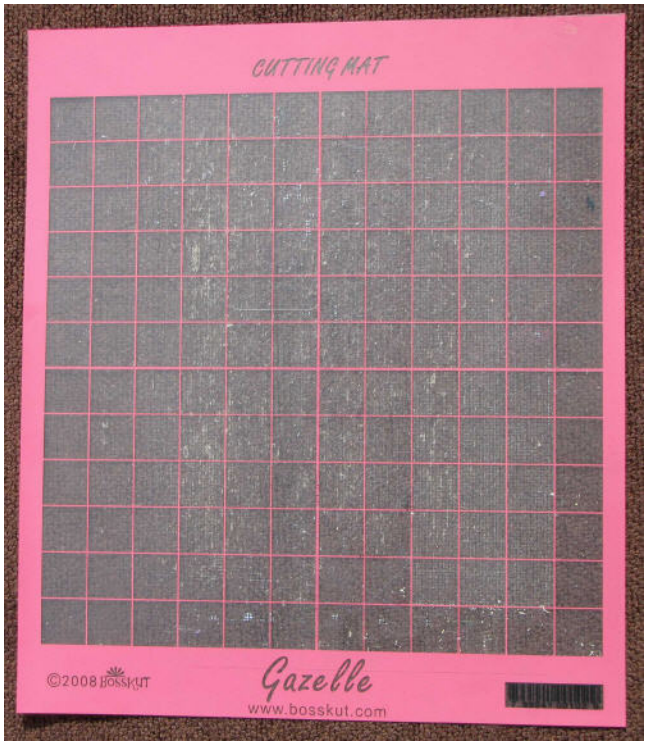
While on the subject of cutting blades, it is important to note that cutting blades come with different blade angles. The angles are 30°, 45°, and 60°. Why such a selection you may ask? To help answer that question we need to look at the drawing below of the three cutting blade configurations. Note that the 30° blade creates a more shallow cutting angle.

When cutting by hand I normally use a fairly shallow cutting angle when making cross grain cuts in balsa. Doing that reduces the likelihood of tearing. The same is true for a craft cutter blade. Shallower cutting angles mean less tearing in the material being cut.



As you look at the blade drawing, you can see that the 45° and 60° blades can make progressively deeper cuts. The 60° blades are normally referred to as deep cut blades.

It is the blade configuration that becomes the limiting factor in the thickness of material that can be cut. A 60° blade is good for 1/16", but not much more. Deeper cuts would engage the shank of the blade and would distort the cut. We will get into blade selection a bit later.



Before we move into actually using a craft cutter to cut model airplane parts, lets look at the last component of a craft cutter. That component is the cutting mat. My cutter came with a 12" by 12" cutting mat. It also supports a 12" by 24" mat.

I purchased the optional larger mat for those tasks that involved longer sheets of balsa. While I bought the larger mat, it is important to note that long sheets can be used with the smaller cutting mats. You just make several cut runs by moving the longer sheet on the mat between runs. A little fussy but very doable.

I mention this to make sure you understand that the lower cost cutters with smaller cutting areas are still very useful tools.

The cutting mats come with a nice printed grid. That is important for locating the material to be cut. It is possible to be quite precise in locating the cut image in the control software and then matching the location on your cutting mat.

The cutting mat also has a tacky surface. The tacky surface holds the material being cut in place during the cutting process. A variety of products are available to renew the tack of the mat when it looses its holding strength.

Using the cutter. Like any tool, getting good results from a craft cutter does require some learning by trial and error. Hopefully my comments here will help minimize the error phase of the learning process.

One aspect of craft cutters that I need to mention from the get-go is linear accuracy. This is an area that varies between different makes and models of cutters. It does not matter if the machine is at the bottom of the price range or the top.

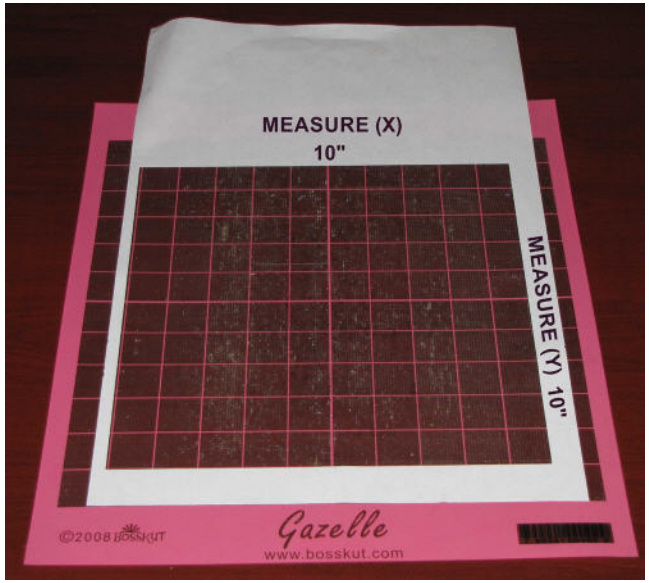
Most craft cutters use digital stepper motors to move the cutting blade and cutting mat. That means that the motors move in set steps rather than a continuous motion. The software tells each motor how many steps to move to produce a given amount of displacement.

Before doing any serious cutting, it is a good idea to evaluate the linear accuracy of your cutter. That is a fairly easy process. Draw a square that is just under the size of your cutting mat.

The cutter software will allow you to draw the square. For example, if you are using a 12"x12" mat, draw a 10"x10" square. Cut that square from paper. Measure the cut square and compare the measured dimensions to the drawing dimensions.

Any differences will tell you if your drawings need to have a scaling factor applied to the X (blade movement direction) or Y dimensions (mat feed direction).

My cutter is 3/32" short when cutting a 14" line in the Y direction. It is spot on in the X direction. When I am cutting model airplane parts I adjust my drawings by a scale factor of 1.06 for the length of the drawing that lies in the Y direction.



Not too surprisingly, wood density does play an important role in your results. Lower density wood tends to be soft and prone to tearing when making cross grain cuts.

Higher density wood takes a bit more force to make the cuts and can lead to the wood being moved on the cutting mat during a cut. Fortunately, there are ways to deal with both situations.

Let me first address the problem of material moving on the mat during a cut. I ran into this problem fairly early on when I tried to cut some really firm 1/16" balsa.

When the cutter started a cross grain cut, the drag was enough to cause the wood to move with the blade. Not good. The cutting mat was fresh and had nice tack. The tack was just not enough to hold the wood during cross grain cuts.

My solution was to apply strips of low tack tape to the edges of the wood being cut. In this case the low tack tape I used was transfer tape that is used for holding cut vinyl graphics when they are being placed on a surface. Blue painter's tape would also work.

I wanted a low tack tape since the cutting mat was also sticky. I did not want to have a problem removing the tape from the cutting mat. The addition of the low tack tape completely resolved the problem. No more wood shifting while being cut.

Cross grain cuts are the next issue. I don't know about you, but when I make cross grain cuts by hand I use a number of shallow cuts. That keeps the wood from tearing and produces nice clean cross grain cuts.

Guess what? The same thing works when using a mechanical cutter. You make multiple shallow cuts. It would be nice to be able to do every thing in one cut pass, but the reality is you need to make several shallow cuts to get the best results. I typically use four or five cut passes when cutting 1/16" balsa.

In addition to using shallow cuts, it is also helpful to set up the cuts that will be cross grain as a separate cut pass. Depending on the software being used to manage the cutting process, it is possible to group the cut lines by color.

You can then tell the software for a given cut pass to first cut the cross grain cut color and then the with grain cuts color. That process gets repeated for all the cut passes being used.

The reason for grouping cross grain cuts is related to the way the blade rotates in the holder to follow the cut lines. By grouping cross grain cuts the blade maintains the same basic orientation for each cut.

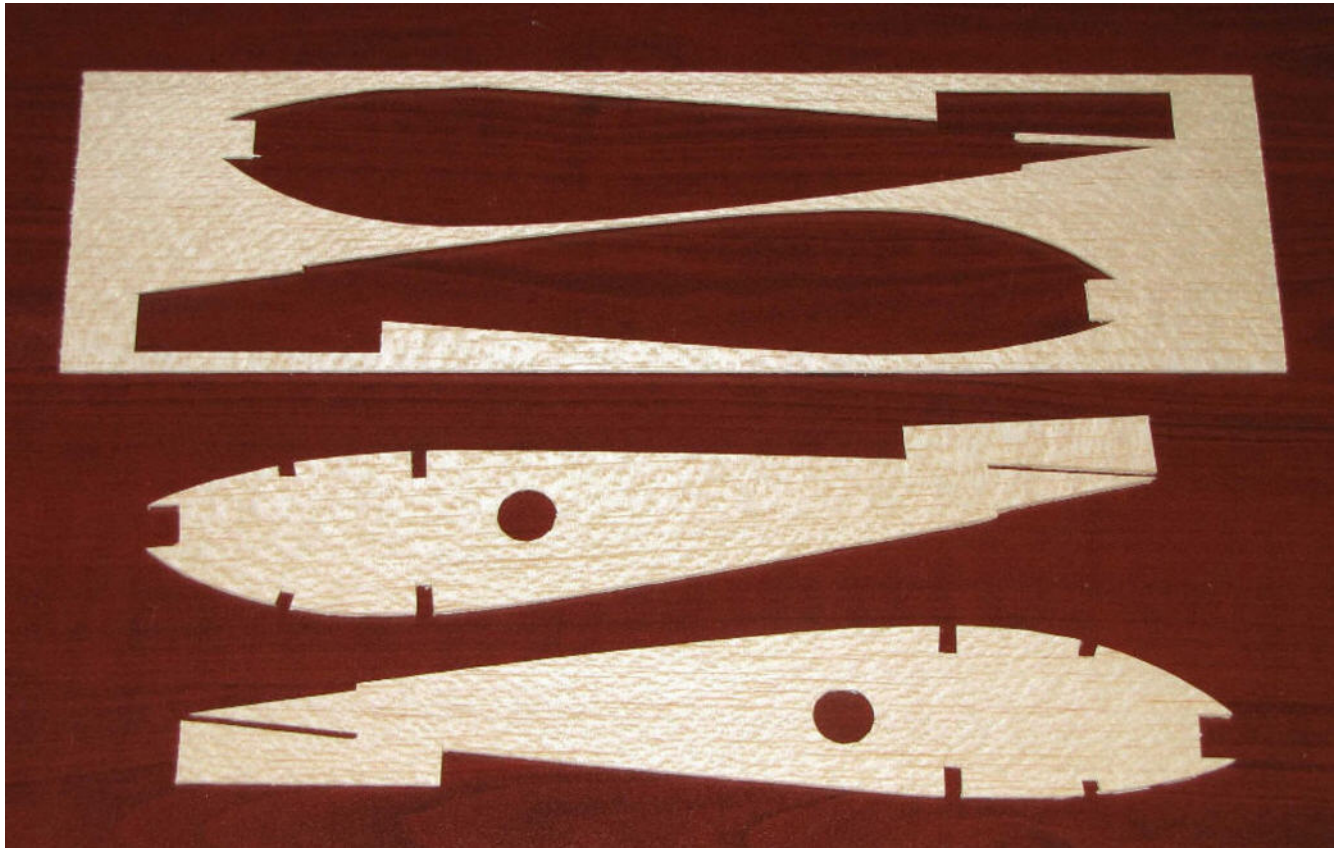
Not having the blade make turns to follow non cross grain cuts improves the start of each cross grain cut stroke. That in turn greatly reduces the occurrence of balsa tearing.

Another trick for getting clean cross grain cuts is to use the 30° blade for the first one or two cut passes. This is where having the three blade configurations pays off. The 30° blade has a shallow cut angle that is ideal when cutting cross grain.

Depending on the thickness of the material being cut, after one or two cut passes change the blade to either the 45° blade or the 60° blade. While a bit tedious, using a combination of shallow cut passes starting with a shallow angle blade will give you the best results.

On the next page I have included a photo of a cut job that used some firm 1/16" balsa. For this cut I did use some low tack tape on the edges of the balsa sheet. The balsa sheet was oriented so the long direction was in the direction of the cutting mat feed path (Y direction).

The drawing was given the 1.06 scale factor in the long direction. For this specific example it would work just as well with the balsa sheet oriented in the direction of the cutting blade movement. I had been cutting longer sheets and just got into the habit of feed path sheet orientation so the sheets would fit my longer cutting mat.



The results of the cut are shown in the photo. I used five cut passes to cut the ribs. In between each cut pass the cutting blade depth was increased very slightly.

That was done by feel using experience accumulated with the cutter. It is surprising how quickly you develop a feel for cutting depth adjustments.

Once the last cut pass was made, the balsa sheet was removed from the cutting mat. The two ribs required a very light pressure to remove them from the sheet. Not unlike days of old when removing cleanly cut die cut parts from their sheets.

The example shown here is fairly simple compared to what is possible with a craft cutter. You can cut really intricate shapes like those used for interlocking parts, just like current day parts designed for laser cutting.

Unlike laser cutting, there is no edge charring. Also, the cut edges are truly square. While not very noticeable on thinner material, a laser cut edge does have a slight slant. That is due to the shape of the focused beam of the laser.

My example used balsa but remember craft cutters work really well with other common modeling materials.

If you have ever built one of the old Comet models you know some have canopies made from sheet clear plastic. While not an especially big deal to cut out by hand, such a task is ideal for the craft cutter.

Craft cutters also work great for making cut tissue graphics, or graphics from covering film. Thin 1/64" plywood can also be cut nicely with a craft cutter as can the thin foam we use on micro RC models.

Getting good results with a craft cutter is simply a matter of technique. Let me summarize the things I have learned:

1. Test your cutter for linear accuracy. Make a test cut using paper and a square that is slightly smaller than your cutting mat. Measure the sides of the cut square and compare the values to the dimensions that were in the drawing used to create the cut. If the measured values and drawing dimensions are not the same, calculate a scaling factor to use on the drawings that will be used for making cuts.

2. Do not try to cut wood or foam with a single cut. Make multiple shallow cuts. As many as four or five cut passes when using 1/16" balsa is good.

3. When cutting balsa and foam, use the 30° blade for at least the first cut pass.

4. For thin materials like tissue and covering film, use the 30° shallow cut angle blade.

5. When cutting balsa, give the cross grain cut lines a different color than the other lines. Cut the cross grain lines together using cut to color software options if available.

6. For harder materials, supplement the holding power of the cutting mat by using low tack tape on the edges of the material being cut.

Are there any drawbacks to craft cutters? Unfortunately, yes. They are great for balsa and foam, but are not really good for harder materials like plywood thicker than 1/64". Clear plastic suitable for windshields does cut nicely.

Probably the biggest possible drawback is the digital format needed for defining the parts to be cut. Just like laser cutters or CNC routers, the craft cutter needs to have the item(s) being cut in a very specific digital format.

Generally you need to have your cut files in vector format. That is usually different from the format we often find for old model airplane plans that have been converted to a digital form. There are a huge number of model airplane plans available via the Internet.

Editor's Note -- And available at no charge to RCMW subscribers.

Most come in the Adobe PDF or Portable Document File format. Such plans are most often scanned from original paper plans or the plans included with magazine construction articles. Scanned images are just a series of dots known as a bit map that do not carry any information about the position of individual lines and curves.

A vector image is much like a list of map coordinates. Those coordinates tell the computer, for example, where a line starts and ends. The drawing software then fills in the space between the start and end points with a line.

When that information is passed to something like a craft cutter, rather than drawing a line, a set of instructions are created telling the cutter how to move the blade holder and cutting mat.

The result is a cut that follows the same shape as would be drawn on the computer screen by drawing software using the same coordinate information contained in the vector image file.

Creating a suitable vector image file is normally done using Computer Aided Design (CAD) software. That can be in the form of an original drawing or a drawing that is manually traced over the top of non-vector image.

Knowing how to use CAD software then becomes a hurdle in the process of going from a design idea or old model plan to cut parts.

Knowing that not everyone possess CAD skills, the software designers have another avenue to creating vector files. There are software tools available that will take a non-vector based image and convert it to a vector image. Sounds great, right?

As you might suspect there can be pot holes in the road from theory to reality. The conversion software, or image tracing software, is very dependent on the quality of the image being traced. If the image has thick lines the resulting traced parts may not fit well.

Things like stringer or spar notches would not properly fit the intended balsa stock. Software traced images may contain many more elements than a drawing created by manually tracing using CAD software.

The additional elements can really slow down the device being used to cut out the parts. In some cases the software traced image causes the cut job to simply fail due to an excessive number of generated drawing elements.

Things to consider when buying a craft cutter. A very good resource for comparing different craft cutters is the Internet. Do a search for craft cutter comparisons. Sites that compare machine features and prices can be found that are quite helpful in making a decision.

Editor's Note -- Here is one internet review of 10 different machines

http://www.toptenreviews.com/home/crafts-sewing/best-die-cutting-machines/

One important item to consider when thinking about buying a craft cutter is the supplied software. Some manufacturers use software that can really limit the utility of the cutter.

For example, for some machines their software will not allow you to use your own drawings but rather only drawings/cut files they supply. Make sure the supplied software allows the user to import cut files from other sources. The typical nomenclature is an ability to import .dxf, jpg, tif, dwg and/or .svg files.

I discussed the value of being able to group cut lines by color to allow cross grain cuts to be handled in their own batch. The supplied cutter software should have the ability to cut by color or allow for some other means for grouping cut lines.

The software I am using is called Sure Cuts A Lot (SCAL). That software product supports many of the cutters currently on the market. It allows for cutting by color and also includes a trace function for converting bit maps to vector images.

Based on my experience in using SCAL and one other software product for craft cutters, I would recommend buying only machines that will run with SCAL. I also recommend using SCAL as the cutter control software.

The lowest cost craft cutter on the market today seems to be the Silhouette Portrait. It has a smaller cutting area than other machines on the market, but is very adequate for our needs. It comes with its own software but does work with SCAL.

The supplied software can certainly be used, you just don't have some of the features like cutting by color. An upgraded version of the supplied software is available for an additional expense that does provide the cut by color feature.

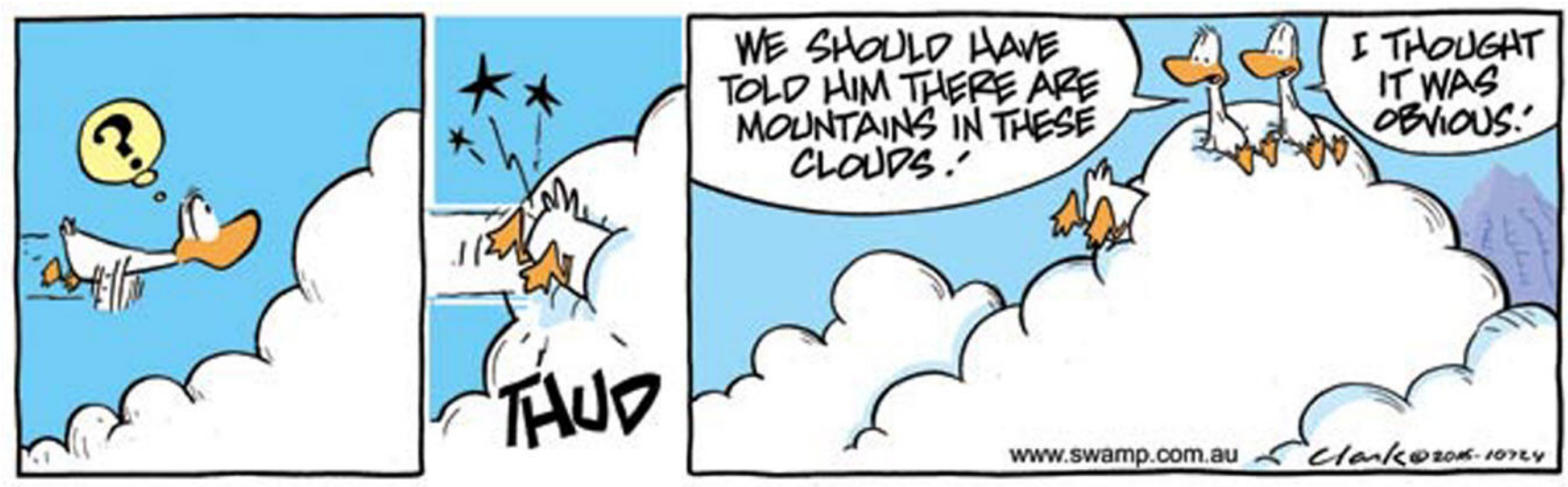
It would also be possible to purchase SCAL to use with the machine, but that would also be an added expense.

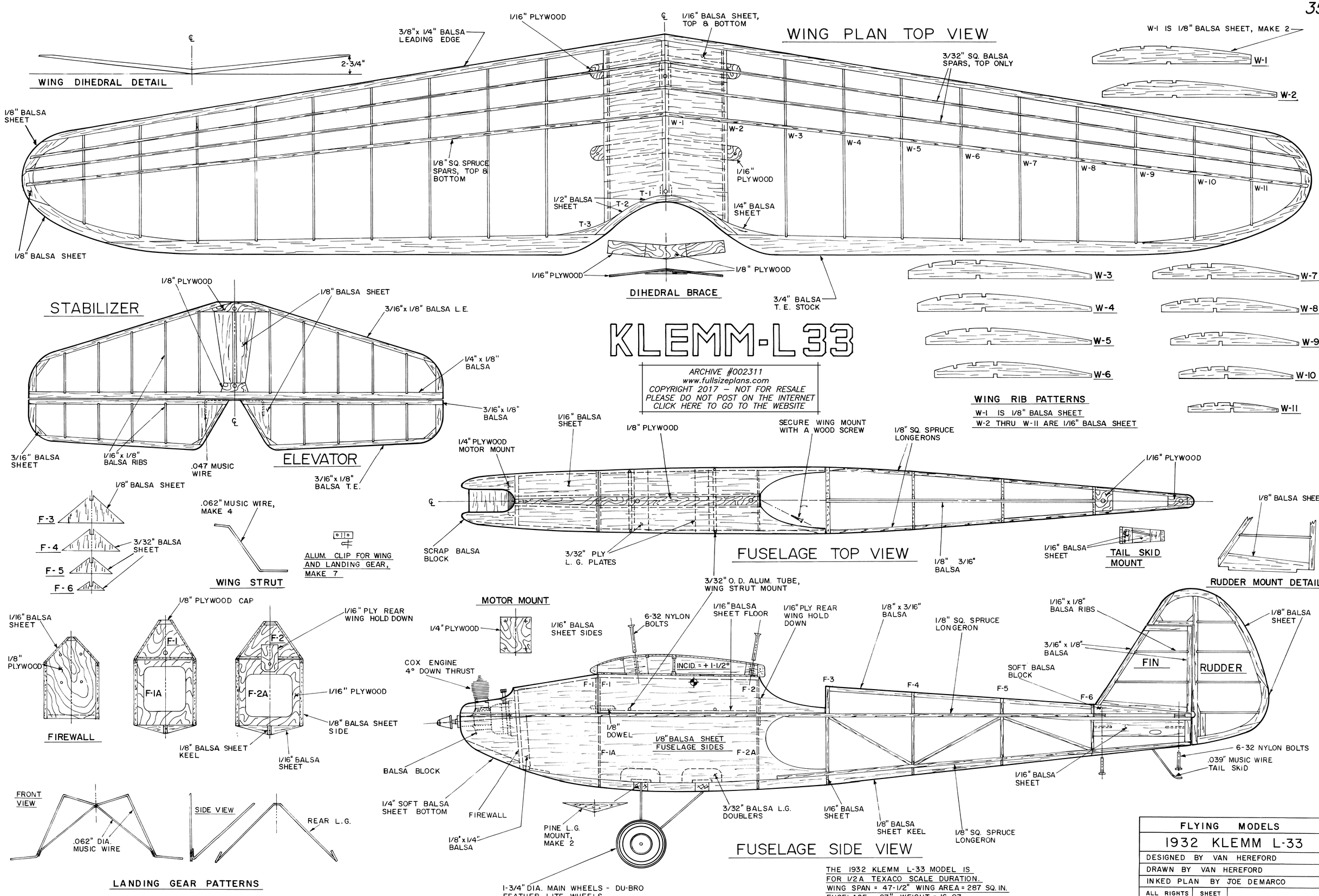
One cutter I would not recommend is the Cricut. It is a capable cutter but has software limitations that affect how we want to use the machine.

Bottom line. Craft cutters can be a great tool for cutting out model airplane parts. Like any tool they do have a learning curve.

They also require that the shape of items being cut be defined as a vector based drawing. That may be a hurdle, or just another learning opportunity.

I sure am enjoying my cutter and if you decide to take the plunge I hope your results are equally positive.





THE 1932 KLEMM L-33 MODEL IS FOR 1/2 A TEXACO SCALE DURATION.
WING SPAN = 47-1/2" WING AREA = 287 SQ. IN.
FUSELAGE = 27" WEIGHT = 16 OZ.

FLYING MODELS	
1932 KLEMM L-33	
DESIGNED BY VAN HEREFORD	
DRAWN BY VAN HEREFORD	
INKED PLAN BY JOE DEMARCO	
ALL RIGHTS RESERVED	SHEET 1 OF 1

CRUSADER

This nice looking twin-boom UC stunt ship by Charles Mackey originally appeared in the March 1960 issue of Flying Models magazine.

I hope Carl Sieverling won't mind sharing the same name he used for his stuntship in the October 1959 issue of Flying Models. At the time Carl's "Crusader" was published, five twin-boom designs using the same name had been completed and eight to ten were under construction, so it was too late to change the name. O.K. Carl?

The "Crusader" is designed for the competetive flier who wants everything in his stunt ship plus a little more. It's not the last word as there will always be better designs to come, but it should give you all you want for your competetive stunt ship and a little more.

The appearance of the twin-boom design is different, scale-like, and appealing, so most people seem to like the appearance including judges.

Judging stunt is very difficult. Try it sometime. You find that as you judge you learn what kind of a flight to expect just by looking at the airplane and if you find someone wth a pleasing design that is well built and finished and you think it's tops, you give him maximum points.

Then you sit back to take in the flight. You know his ship is different and well built and finished, but how does it fly? Now you have a special interest in this ship that you didn't have when you judged the rest.

Naturally, you will be fair and impartial, but you're just going to watch this guy extra close to see if he is as good as his ship looks. After seeing a few maneuvers, you soon find out.

The "Crusader" is stable enough to make a power on landing. It will start an average sized loop from a given position on the deck, fly the loop, and land on the same spot.

As far as maneuverability is concerned, the :"Crusader" has flown the five foot radii in the bottom of the hourglass and triangles successfully.

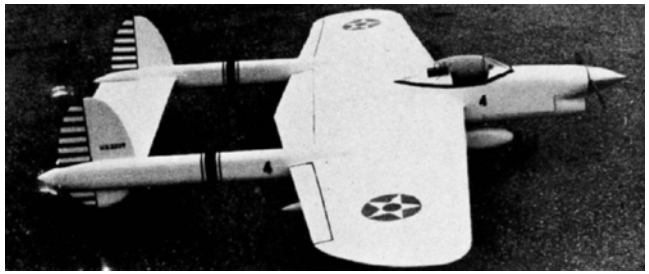
Perhaps one of the most outstanding features of the "Crusader" is it's ability to stay out well on the lines. Keep your controls solid enough the stand the high pressure imposed by the wind and you will find yourself hoping for windy days.

In calm weather you will do equally well on 65 foot lines with your motor four-cycling. On 70 foot lines in calm air, you should fly a little faster. Sixty five foot lines will be your best line length for all weather flying.

John and Wilbur Schmidt, a father and son team in our area, flew their "Crusader" under some unusual conditions at the Richmond, Indiana meet.

The ship weighted in at 50 ounces and the wind was blowing at a constant speed of 18 m.p.h. We later learned that john was flying on 73 foot lines.

I've always considered 50 ounces too heavy for a stunt ship with this wing area, but for some unknown reason, it turned well and still grooved. It's ability to stay out well in the wind cannot be explained by the weight because another "Crusader" flew equally well in the wind and it weighed 43 ounces. The original was built with one eye on the scales and weighed in at 40 ounces. Yours will probably come in at about 45 ounces due to an improvement on the landing gear and leadouts.



The bellcrankwas moved to the outside boom to eliminate tip weight. The less weight used to balance a stunt ship, the lighter and more efficient the ship will be. The 40 ounce "Crusader" requires no balance weight at all. The 40 to 46 ounce Ship will require about 1 ounce or more.

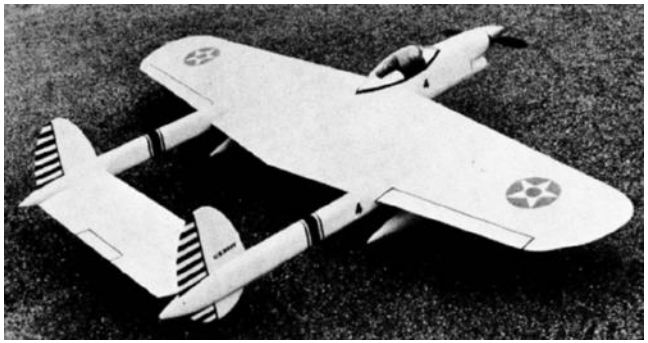
We have noticed that some builders always come out heavy and others light. If you are the latter, follow the plans. If you're about average, add 1" between formers F-1 and F-2. That will make the distance shown on the doublers 4" instead of the 3" indicated.

If you build on the heavy side, make the nose 1-3/4" longer. That would make the gap 4-3/4" instead of 3". This should completely eliminate the need for any ballast.

The original ship used cable leadouts that proved fatal when they twisted. The new versions use solid leadouts, staggered enough to allow clearance for the connectors or line clips.

If you can't obtain solid leadouts long enough, splice by bending a loop in one piece and put the other end through and twist a loop in it. Then bind with string and cement. This will eliminate the slack.

The landing gear is shown with 2" negative angle of attack on the wing. This was thought best for some time. One "Crusader" featured a positive angle of attack of about 13 degrees. This shop would stick to the asphalt for as many laps as you held down. Take off was accomplished as controls were neutralized.



This proved that you can use positive or negative and still woirk well. Both made beautiful landings unless the pilot goofed. The best setup seems to be straight ahead

You can still come in tail low and pop down like the jets, or grease in on all three and retain the ability to come off easy. After a lap or two on the deck when you are really rolling, this can be difficult with positive or a negative thrust setups.

Start construction with the wing. Mark off parts to be cut on 1/16" medium sheet balsa. Cut 2 of each except No. 13 where only one is required.

Cut the trailing edge to 1" width from 1/16" x 3" x 36". Mark the rib positions with a square. Cement 1/8" square to the trailing edge. Pin the ribs to bottom of 1/16" sheet trailing edge and mark the 3/16" square spars for rib position by pinning them to a table at the proper angle.

The true trailing edge position should be parallel to the edge of the table. Mark the rib angle every 2" with a square from the edge of the table. This should give you the proper angle.

Make the inside wing 2" longer by using rib No. 13. Slip spars onto the ribs and pin in place. Mark the leading edge and position. Block up wing, check for warps, then cement.

Install bellcrank and gear platform cut from a strong piece of 1/8" ply. Cut out tips from 1/8" sheet. Notch wing to take 1/8" sheet brace that fits behind 3/16" sq. spars at center section, top and botom and install.

Bend wing gears from hard 1/8" dia. wire and install with "J" bolts. Mark the ribs for leadout position. Burn out holes, or cut out with a knife. Install bellcrank and leadouts at this time.

Cut out wing flap from 1/4" sheet and hinge to the trailing edge of wing. To build the wing true, we suggest you acquire a few pieces of 2"x 6"x 6" lumber. With these you can block up the leading and trailing edge and allow clearance for your landing gear.

Make four boom sides from 1/8" sheet, remove center section and slide the boom sides over the trailing edge into proper position. Cut the sides or shim up if necessary to fit 3/16" sq. spars. Then cement on the center-section you cut out for installation. (Do not cement to trailing edge at this time.)

Cut out stab and elevator. Add special horn as shown and hinge full span. Be sure to keep hinges tight and free from play. Cut out boom formers. Cut holes in outside boom formers for pushrod, cement on 1/16" sheet plywood guides and slide over pushrod.

Cement formers to sides, then slip elevator into position and cement. Before anything has time to dry, block up the tail, booms, and wing along the leading and trailing edge. Cover top of wing with 1/16" sheet and capstrip. When dry, turn over and cover the bottom side.

You will find it necessary to cut false ribs for the sheeting along the booms. This is easily done by tracing the shape from the wing rib nearest the boom.

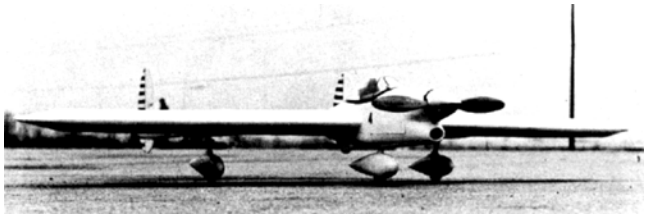
Double check the controls to see that they are tight, (without play) smooth and free, and have at least 35° movement in each direction. Flap and elevator should neutralize at the same time. While this is still drying, add the 3/8" balsa to booms and allow everything to dry in perfect alignment.

The nose section is made in the conventional manner. 1/8" balsa sides cemented to 1/16" ply doublers with 3/8" x 1/2" hardwood motor mounts and 1/8" ply formers.

The landing gear is bent and put on with "J" bolts, but not tightened. The nose section is cemented on with the wing section blocked up. The wing and tail section should be blocked up with the landing gear wire touching a flat surface of the table. Be sure the leading and trailing edges are on the same plane.

Attach the nose section, checking alignment from motor mounts to the table. Adjust gear to the proper height and tighten "J" bolts. Cement on nose section, pointing the nose out as plans show.

When thoroughly dry, add the remaining formers, pulling the sides of the nose section together as necessary. Plank top and bottom with 1/8" x 1/4" balsa.



Mount the motor and build the cowling around it, using the construction shown. Shape the outside to desired shape and hollow the inside. Be sure to make the air exhaust enough or you will have cooling trouble on hot days. Hold the cowling on with a bicycle spoke as shown.

Fuelproof tank compartment, cowling interior and motor mounts with fiberglas dope. The tank may be your own choice, most tanks on the market are fine. It's more a matter of installation and proper cleaning that makes the difference.

Finish construction and sand the entire ship down to the proper shape. Use plastic balsa if necessary. Spray on 2 coats of clear Butyrate dope, sand well and repeat procedure. Cover the entire model with Silkspan. Apply two more coats of clear Butyrate and wet sand with No. 360.

Next, spray on two more coats of clear and wet sand again. Spray on colored dope until it's well covered, then wet sand. Repeat until you no longer sand through the color. This usually will take 4-5 coats. Then rub out with Simonize Car Cleaner. Regular rubbing compound seems to take off too much dope.

To keep your model looking shipshape, we suggest you give it a good waxing. (Simonize is about the best to use after you have rubbed it out.) Wipe the oil from your ship after every flight and buff the wax with a soft cloth.

Wax is not fuelproof so you will find it necessary to re-wax it from time to time. To do this, it is necessary to clean your ship thoroughly. We recommend hot water and a good detergent, such as Tide or Cheer. If you don't clean the oil from the surface, the wax will roll up and smear. We have tried many good waxes with cleaners in them. They do a good job, but eventually they cut through the dope.

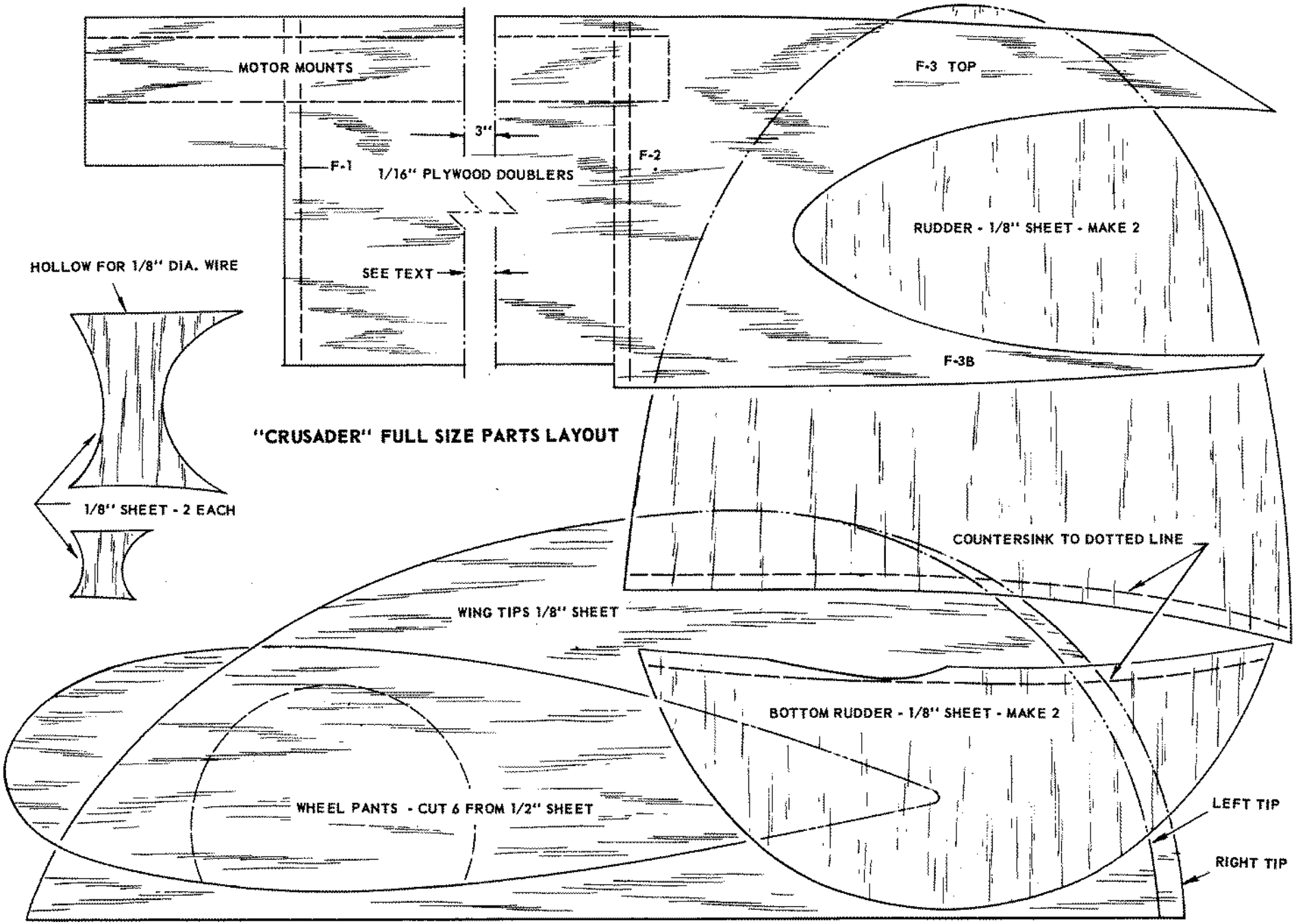
We suggest you balance your ship as plans show to start with, then you can make changes to suit your style of flying. Use a flying handle just large enough to give you enough control for the 5 foot radii. When you apply full control, about 30° on the elevator to 45° on the handle is a good start. From there it is up to the individual.

Practice is necessary, but don't wear out your ship. You will have to find out how much practice is necessary for yourself. Some fliers need 50 flights a week, others can get by on two.

If you find yourself in the group that needs many flights, we suggest you build a couple of "Crusaders" or a "Profile" from the September '59 issue of Flying Models. You can practice on one, saving the second for your last two practice flights and two officials.

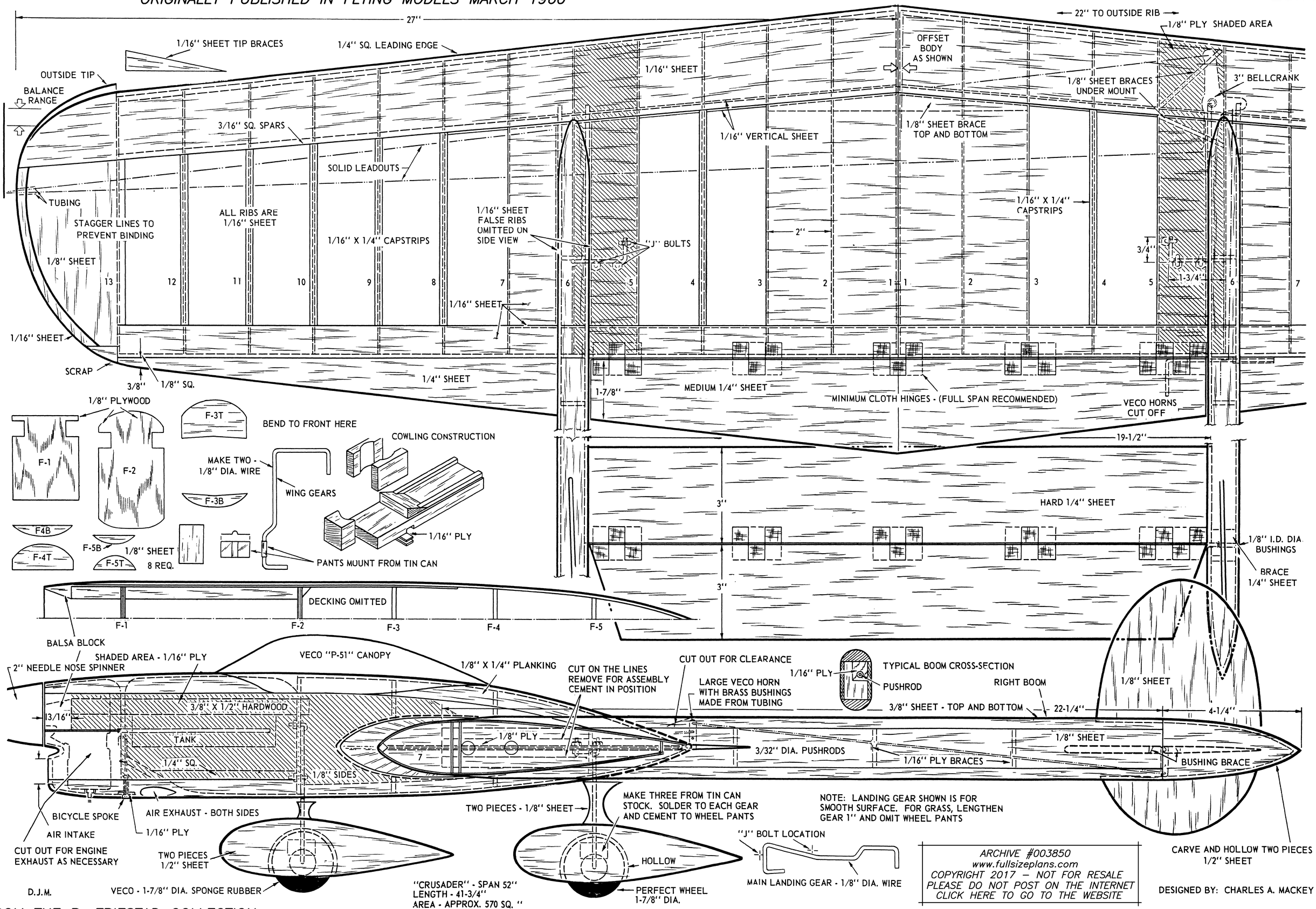
It will save your ship from wear as well as cut down on the chances of a crack-up. It is necessary that you have a ship with which to practice that flies similiar to your contest ship or you will have a little trouble making the change.

Decals are from Scalemaster's F-4 B-4. Rudder markings are painted. Happy landings!


MOTOR MOUNTS
3"
F-1
1/16" PLYWOOD DOUBLERS
F-2
F-3 TOP
RUDDER - 1/8" SHEET - MAKE 2
F-3B
HOLLOW FOR 1/8" DIA. WIRE
SEE TEXT
"CRUSADER" FULL SIZE PARTS LAYOUT
1/8" SHEET - 2 EACH
COUNTERSINK TO DOTTED LINE
WING TIPS 1/8" SHEET
BOTTOM RUDDER - 1/8" SHEET - MAKE 2
WHEEL PANTS - CUT 6 FROM 1/2" SHEET
LEFT TIP
RIGHT TIP

ORIGINALLY PUBLISHED IN FLYING MODELS MARCH 1960

29x42



FROM THE R. FRIESTAD COLLECTION

The DRAGONFLY

by Jacques Bluzat

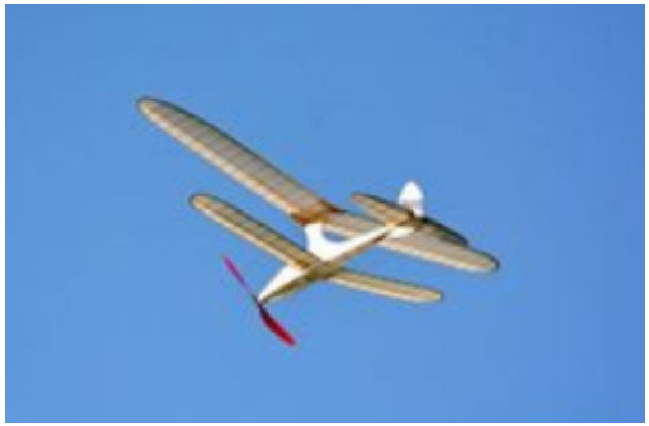
Ned Nevels, moderator of the SAMTalk Yahoo group, found a photo of this pretty model on Facebook. A bit of research turned it up on a French website and from there to Outerzone, a file sharing program based in England. The file was downloaded and extensively cleaned up.

The name of the model, LA LIBELLULE, translates to THE DRAGONFLY which seems appropriate due to the appearance of the two wings

Designed by Jacques Bluzat, the model was originally published in the November 1946 issue of the French model magazine Le Modele Reduit D'Avion.

The photos show a model built in 1997 by Yves Drhouin and a more recent model built by Robert Pacheco who converted it from a towline glider to what appears to an electric powered RC model with a folding blade prop.

The cleaned up and full size PDF file of the plan is on the next page.



LA LIBELLULE

PLANEUR BIPLAN

de Mr J.L. BLOZAT. Aé. C. Cannes

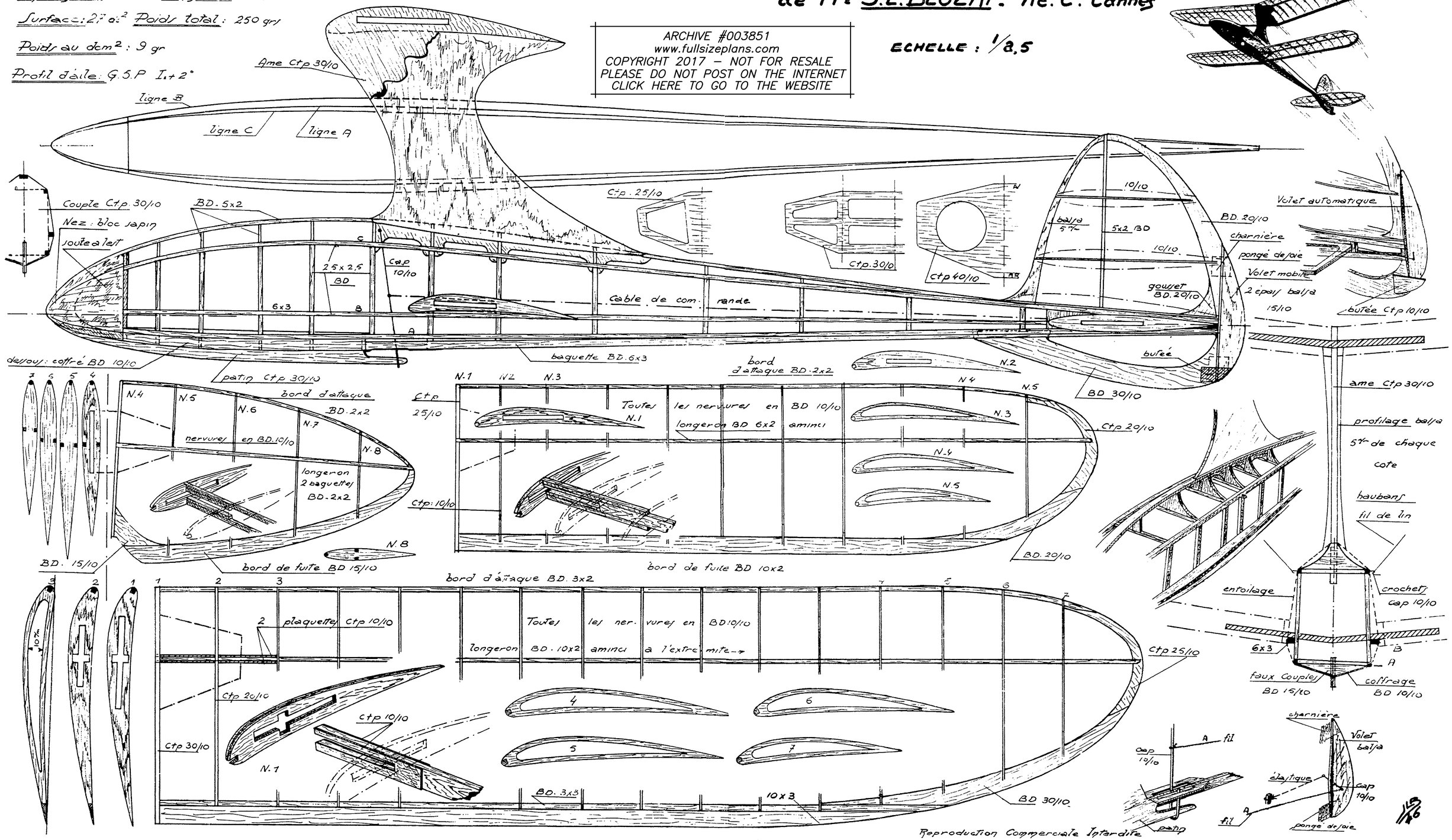
Envergure : 130 cm Longueur : 98,5

Surface : 27 dm² Poids total : 250 grs

Poids au dcm² : 9 gr

Profil d'aile : G.S.P I.+2°

ECHELLE : 1/8,5



ORIGINALLY PUBLISHED IN NOVEMBER 1946 ISSUE OF LE MODELE REDUIT D'AVION

Back Issue
MAGAZINE ARCHIVES
from the Digitek Books Collection

Here's the next in our series of monthly back issues of model airplane magazines available for download to subscribers. This month's selection is the AIR TRAILS December 1938 issue.

For a long time AIR TRAILS had the largest circulation of any of the model magazines and also contained the most pages. This issue came out before the buildup to WWII had really heated up, so everything seemed pretty normal as far as content of aviation magazines. Only a few years later the contents would become heavily devoted to the war.

This issue contains quite a few general aviation articles, two adventure stories, several model plans and a guest editorial by Bill Effinger, the owner and moving force behind Berkeley Models.

To get your copy, just go to the following link and click on the download button that after a short time will appear in the upper right corner of your browser screen. The issue will be downloaded as a PDF file and you can read or print out any or all of the pages as you choose.

-- CLICK ON THIS LINK PLEASE --

This download link will be expire on June 1, 2017, so if you'd like this issue for your own collection, better do it now.

If you would like more complete digital collections of RC Modeler and other model magazines, take a look at the back pages of this issue.

The PARAGON takes Wing

This model by Frank Ehling appeared in the December 1941 issue of Model Airplane News and is unusual because of it's use of slots in the wing. Read Ehling's interesting comments on the effect of using slots and of blocking them off. Might be worth a try.

HERE, for the first time, is a gas job that employs the use of wing slots to obtain the highest degree of wing efficiency and to increase stability.

Why use wing slots? That can be best answered by giving some advantages of wing slots ; those used on this model were designed by your editor, Mr. C. H. Grant. This is the ideal wing section for the beginner, for while we do not claim this wing section to out-climb any others, it will certainly out-glide the rest.

This is accounted for as the wing slot, when used correctly, will increase the efficiency of the wing section greatly and produce the extra lift desired by the builder who wants topnotch performance.

The stability gained by using slots is not to be overlooked as this ship was flown many times and then a change was made to shift the weights backward. To our surprise the ship's performance was almost doubled.

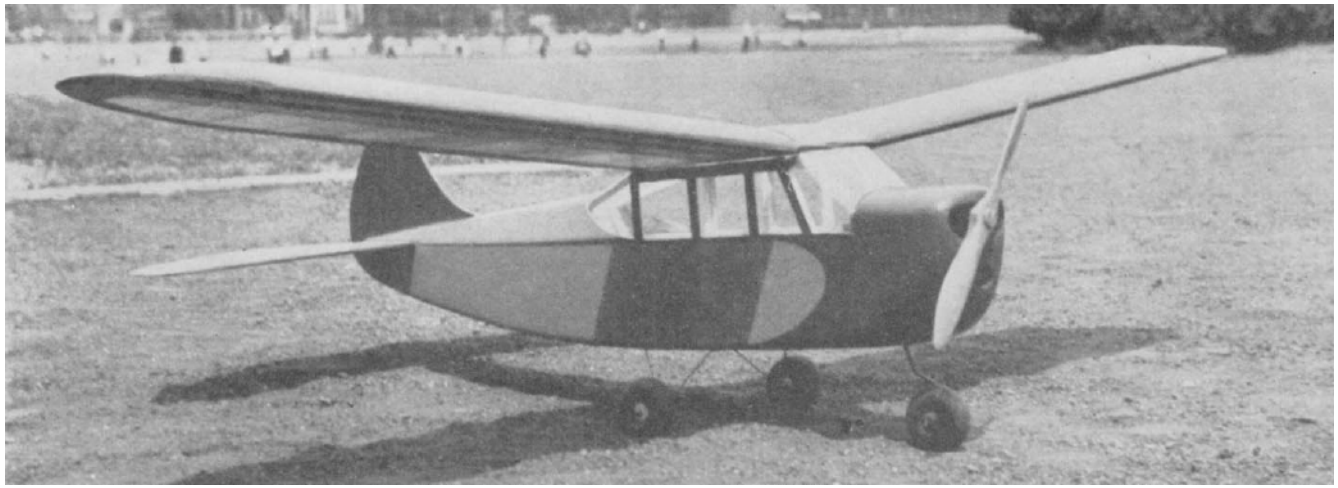
To check this, the slot was closed with the use of Scotch tape and again flown; then the ship that was as stable as an ocean-going liner was turned into a tricky little hard-to-fly ship.

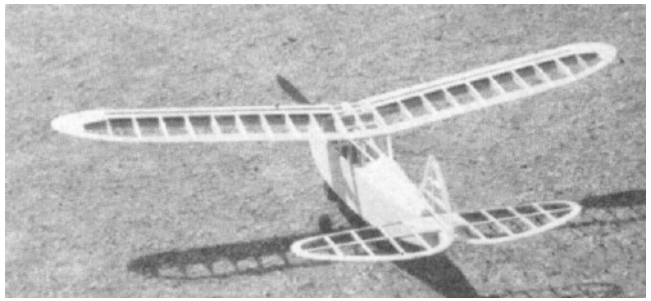
This was the final proof of our experiments. The wing slots also offer the designer the use of a shorter tail moment arm: this will be appreciated by the flier who wants his ship to recover as soon as the motor cuts. Also the ship soars more easily than one with a long tail moment arm.

When this model was designed, no thought of contest work was in mind; however, since completion it has proved to be a potential contest ship. This along with the appearance of a real plane has won the hearts of all who have seen it.

It has had over fifty flights, though taken to the field on only three different occasions. The Paragon has lived up to its name in more ways than one. It is as stable as a giant clipper, with the zest of a pursuit ship, and a glide that can he compared with an underweight model, proving the effect slots have on model airplanes.

Powered with the new Bantam it makes an excellent class A job and it can also be flown with any class B engine as long as the total weight does not exceed twenty-two ounces to obtain the highest efficiency. (+ 3° incidence for Bantam) (4 to 3%0 incidence for Ohlsson 23 or 19).





Wing

Start the wing by enlarging the wing plan four times the size shown. **(Editor's Note -- The plan in this issue has already been enlarged.)**

The wing slots are built first. This is done in the following manner: cut the ribs that are needed, the spar, leading and trailing edges and assemble these as you would build a regular wing.

Cover this panel with 1/32" sheet and sand smooth. Then cover with tissue and dope. The rest of the wing proper is now built in the usual way.

Sheet the leading edge where the slot is with 1/32" sheet, then cover with tissue and dope. Tips are carved from solid blocks. Now cover the whole wing with Silkspan and dope.

When this is finished the two wing parts can be cemented in place to form the slot, making sure the opening is as shown on the plan. The two panels are joined together with the 1/8" sheet gussets and a dihedral as shown on the plan.

Stabilizer and Rudder

This construction is as simple as can be; all that is required is to draw the plan full size, then cut the parts from 3/16" sheet and cement in place.

This structure, when dry, is sanded to a streamline shape. The rudder is built in the same manner. When finished both are covered with Silkspan. The fillets between the rudder and the stabilizer are then carved to conform with the fuselage and cemented in place.

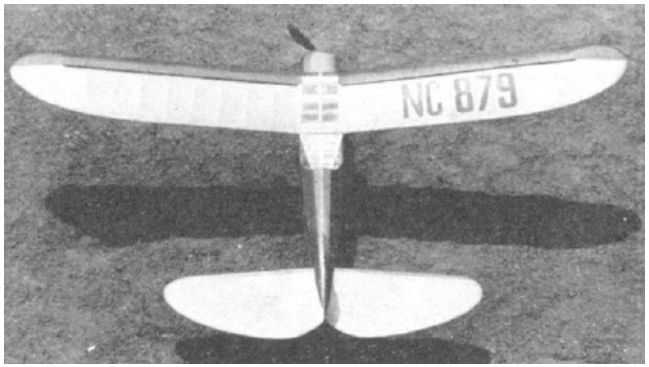
Fuselage

The fuselage is of simple box construction with a few formers on top at the rear of the cabin. A plywood bulkhead serves as an excellent place to bolt on the for ward landing gear, which is bent to shape as shown on the plan from 3/32" diameter music wire.

The rear gear is bent to shape from 1/16" diameter wire. Solder the clamps in their proper place on the rear gear. The whole assembly is then bolted to the correct place on the plywood strips, which are cemented to the inside of the fuselage bottom.

The whole structure is covered with 1/16" soft balsa sheet. After this has been sanded smooth the whole body is then covered with tissue.

The ignition track is made in the following manner: Cut two formers from 1/8" birch plywood to the size shown. Cut the motor mounts from aluminum. Drill the required holes and bend to shape. They can now be bolted to the former.

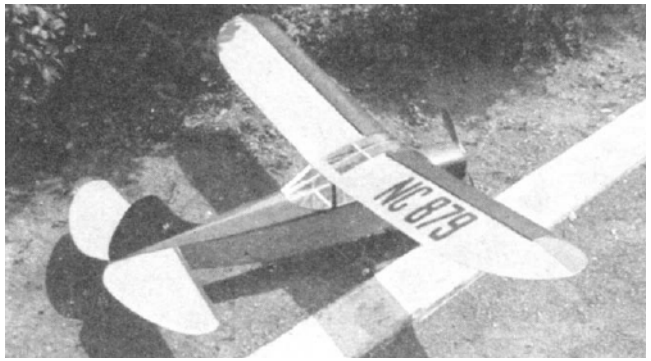


To the rear of the former the brass angle can be bolted and to this the tongue can be bolted, which is cut from pine. The box to hold the battery, coil and timer is made of hard balsa and this is held to the tongue with rubber bands till the ship has been thoroughly tested, then it can be cemented in place.

The cowl is carved to shape, hollowed out to 1/4" thickness and covered with silk and dope. Silk can be used for the hinge.

Cut out for the exhaust opening ; this will be determined by the individual engine that the builder uses.

The windows are now covered with a good grade of celluloid or something that will not wrinkle when it gets a little damp. The center part of the wing should also be covered with celluloid, as this is very helpful when you want to see inside the body without removing the wing.



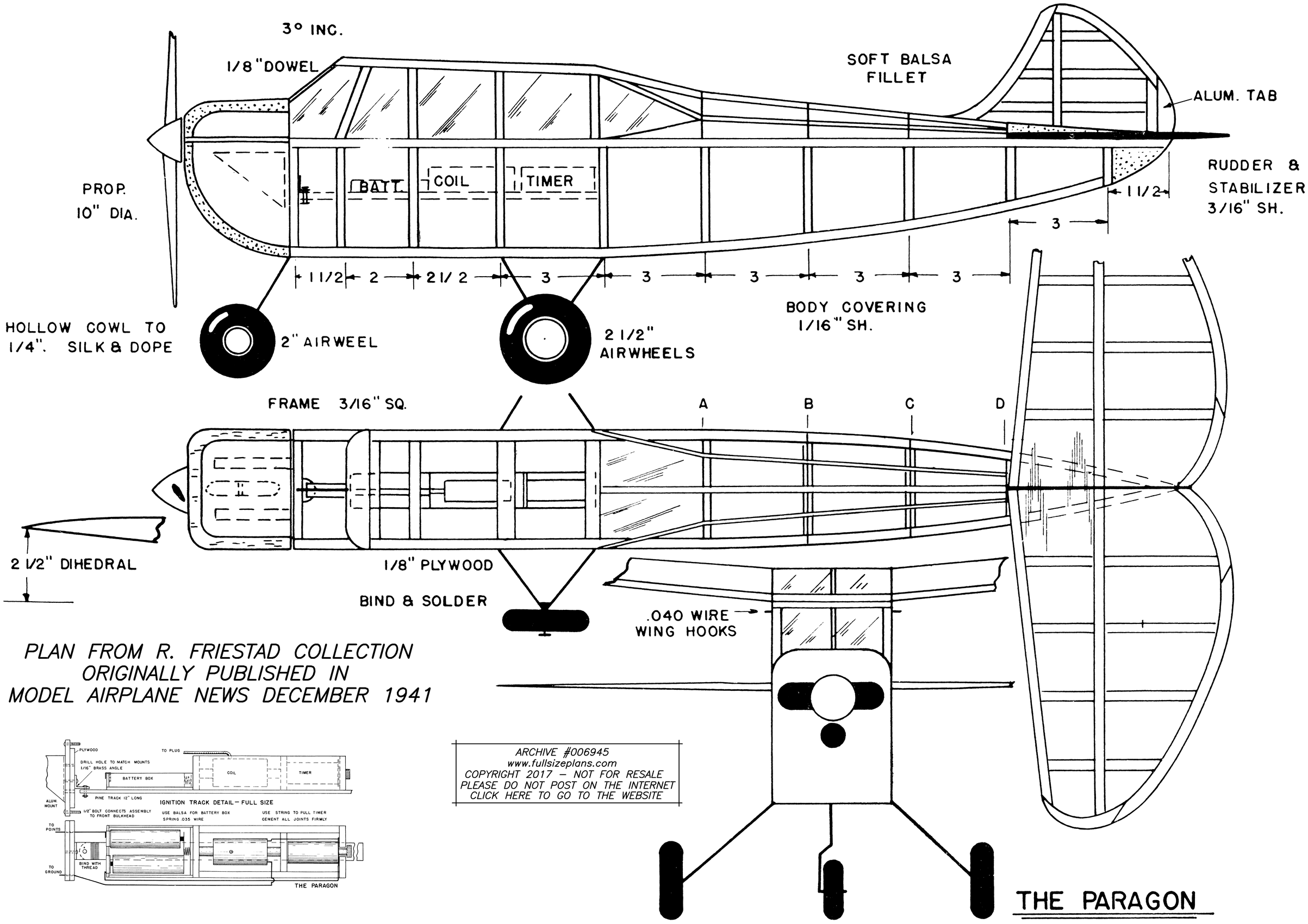
Flying

Glide the ship till the glide is as flat and prolonged as possible. This will take a little time as this ship can be tail-heavy and still give a fair account of itself which can be credited to the use of slots.

After a satisfactory glide is obtained the ship may be flown. Give it a ten-second run and watch how it acts.

It may be said that it will not be necessary to fly the ship in tight circles as it has not looped yet. We hope you get as much fun from this ship as we did.

30x41


3° INC.
1/8" DOWEL
SOFT BALSA FILLET
ALUM. TAB
RUDDER & STABILIZER 3/16" SH.
PROP. 10" DIA.
BATT.
COIL
TIMER
1 1/2
3
1 1/2
2
2 1/2
3
3
3
3
3
BODY COVERING 1/16" SH.
HOLLOW COWL TO 1/4". SILK & DOPE
2" AIRWEEL
2 1/2" AIRWHEELS
FRAME 3/16" SQ.
A
B
C
D
2 1/2" DIHEDRAL
1/8" PLYWOOD
BIND & SOLDER
.040 WIRE WING HOOKS
PLAN FROM R. FRIESTAD COLLECTION
ORIGINALLY PUBLISHED IN
MODEL AIRPLANE NEWS DECEMBER 1941
PLYWOOD
TO PLUG
DRILL HOLE TO MATCH MOUNTS
1/16" BRASS ANGLE
BATTERY BOX
COIL
TIMER
PINE TRACK 12" LONG
ALUM. MOUNT
IGNITION TRACK DETAIL — FULL SIZE
1/2" BOLT CONNECTS ASSEMBLY TO FRONT BULKHEAD
USE BALSA FOR BATTERY BOX
SPRING .035 WIRE
USE STRING TO PULL TIMER
CEMENT ALL JOINTS FIRMLY
TO POINTS
BIND WITH THREAD
TO GROUND
THE PARAGON
ARCHIVE #006945
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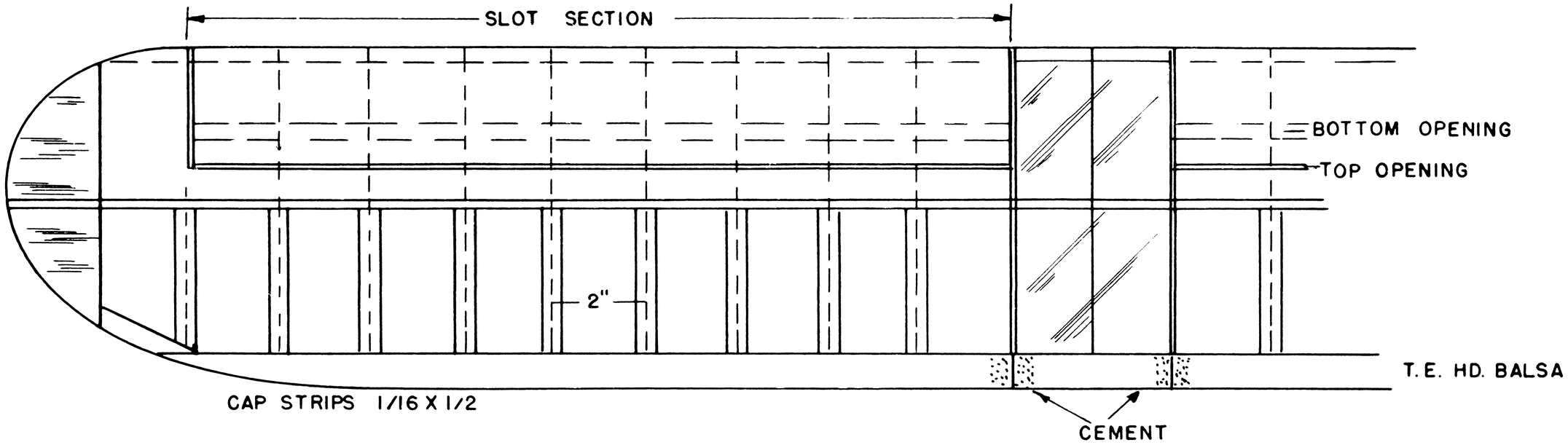
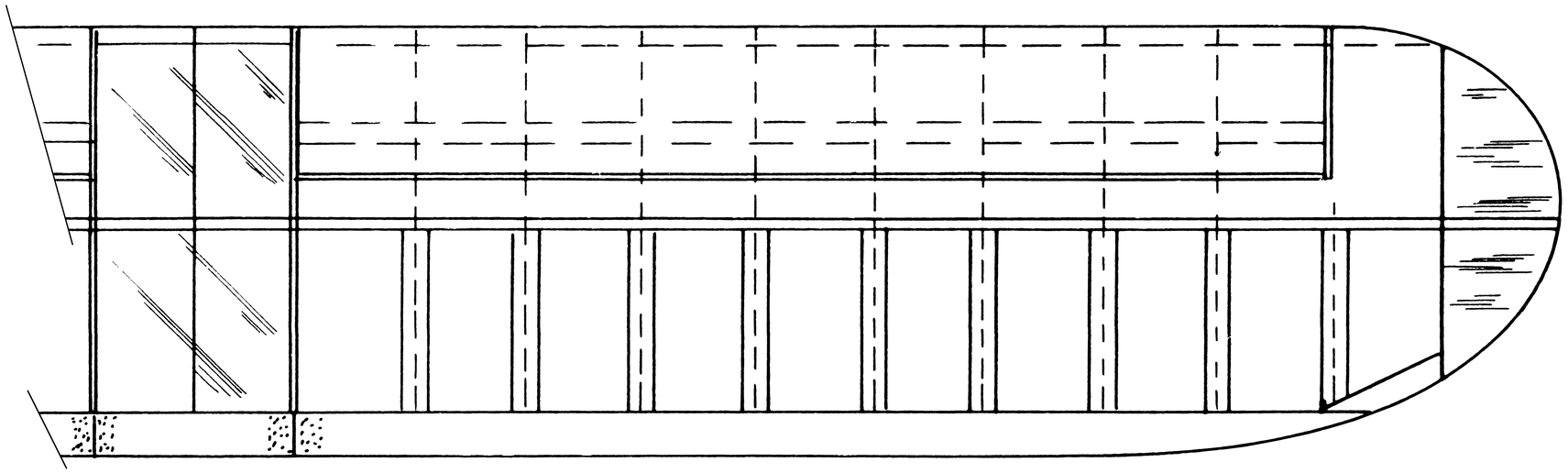
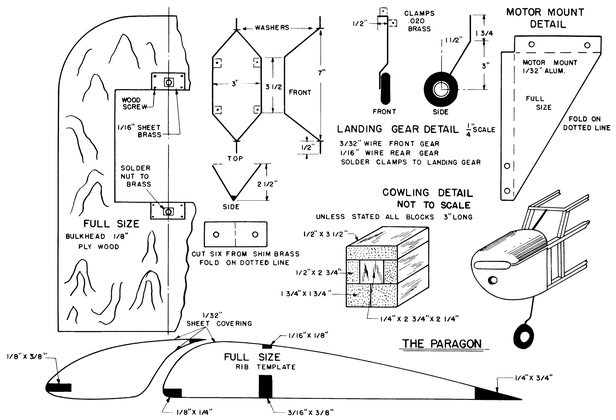
CLICK HERE TO GO TO THE WEBSITE
THE PARAGON

30x41

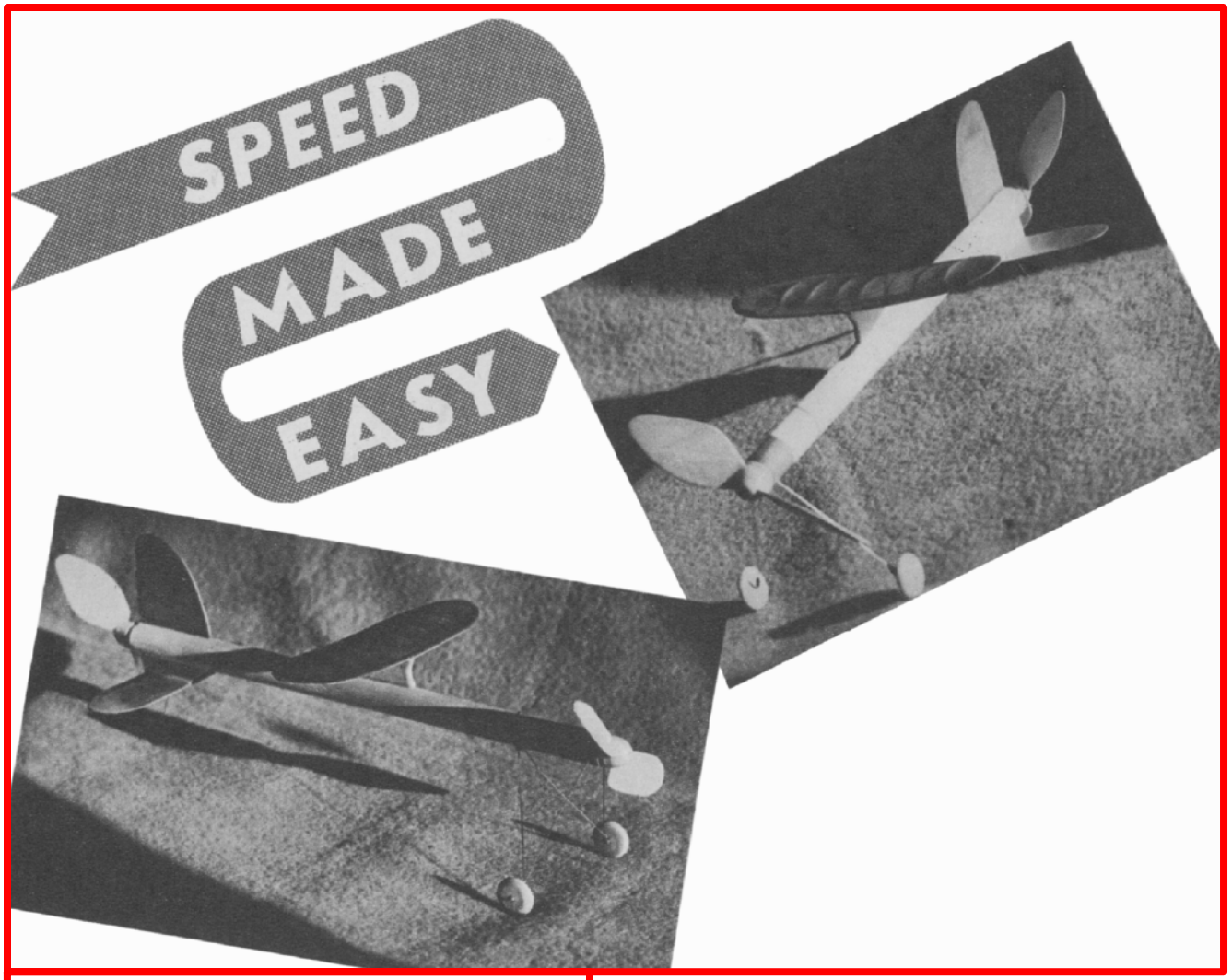




PLAN FROM R. FRIESTAD COLLECTION
ORIGINALLY PUBLISHED IN MODEL AIRPLANE NEWS DECEMBER 1941



THE PARAGON



Once upon a time, largely back in the 1920's and 1930's, rubber powered speed models were very popular. Interest had pretty much died out by the 1940's but here is a more recent version by Roy Clough that appeared in the September 1946 issue of Model Airplane News. Neat idea, looks like fun.

IT IS undoubtedly true that many model builders who would like to enter speed contests are deterred because they have heard from the experts or discovered by experience that high speed rubber jobs are usually tricky and hard to handle to obtain consistent results.

While it is no trick to build a very fast rubber job, it is often another matter to design one that will exhibit sufficient directional stability to make clocking it a comparatively easy matter. It is of paramount importance that the speed model fly straight and true across the measured course. To have the hottest model on the field means nothing if its flight is so erratic the judges cannot clock it.

The typical speed model is nothing more or less than a "pared down" fuselage job, with wing area cut to a minimum and propeller pitch and power upped to maximum. Since this results in tremendous torque effect such devices as offset thrust, left aileron, right rudder and sometimes acute dihedral are resorted to.

By means of these power-absorbing devices it has been standard practice to adjust the model for stright flight during the peak of its power output, which generally means the length of the measured speed course, after which the model goes "haywire" and performs anything from a snap roll to a dizzy spiral climb to the right. This might be fine in an aerobatics contest, but it leaves too small a margin of error to be productive of longevity in heavily loaded speed jobs.

That is why the records have been set by experts familiar with every whim of the breed. However, there is no reason for leaving the speed jobs to the experts just because they have proved tricky in the past.

It is possible to design stable high speed models and to make them simple enough in construction for any beginner to build.

First of all, what makes for speed? Boiled down to essentials and sifted of trivia, speed may be said to be achieved by piling on thrust and cutting down weight and resistance.

It is more important to cut resistance than weight, but elimination of excess weight should not be ignored.

It seems to be the opinion of some builders that a speed model must be heavy to fly fast. This is not so, although it is easy to see how the idea got started since fast models have small wing areas to support their weight.

However, there is considerable difference between heaviness and high wing loading, and power absorbing weight should be eliminated wherever possible without weakening the structure of the model.

A high wing loading permits a plane to fly faster since the lift at high speed just about balances the weight of the plane with a minimum of drag, whereas excess wing area, or low wing loading, at high speed results in greatly increased drag and gives the model a tendency to climb.

Power used in climbing does not contribute to-forward speed, therefore wing area must be held down below the climbing point.

A heavy model must fly faster than a light one of the same aerodynamical shape to stay in the air, but the light model can equal the speed of the heavy one on less rubber and pull away from the heavy job hands down with an equal amount of rubber.

Since there is a limit on the amount of power that can be packed into any given fuselage, the lighter model will always be ahead of the ship which is burdened with extra weight.

Resistance is the thing to develop a healthy regard for if you covet speed trophies. Resistance begins at the spinner and takes its toll at every exposed surface between that point and the rear edge of the rudder. It absorbs more power than weight of the plane in most cases.

The writer has no intention of becoming involved in a controversy on streamlining in models, but he would state from experience that delicately engineered "airflow" surfaces are a waste of time below a certain size.

This certain size covers most rubber models. The important thing to consider is "flat plate" resistance. Of a secondary nature, but . still important, is "wetted surface" or area resistance.

Flat plate resistance consists of entering surfaces, or simply the profile of the model as viewed from the front. The smaller the area covered by a frontal view of the model, the less resistance.

This small frontal area, so important to speed jobs, is achieved by using a small crossection fuselage, thin control surfaces and very narrow airfoils.

Wetted surface resistance is that set up by air flowing over the wings, fuselage and control surfaces. Its effect is determined first by the amount of surface it covers and second, by the smoothness of those surfaces.

The amount of skin friction which results in wetted surface resistance is considerable at high speeds, but it can be minimized by doping and polishing all external surfaces.

Now let's build a speed model. Since torque is such a troublesome problem the best thing is to eliminate it. A glance at the photos and plans of the model accompanying this article will show how this can be done.

Aside from the fact that counter-rotating propellers eliminate torque effect they also have the advantage of permitting all the power (minus slippage and bearing friction) to be converted into thrust without diverting any through offset surfaces, to hold the model in level flight.

Begin construction with the fuselage which is easily made from an 18" sheet of 3" x 1/16" medium balsa. Soak the wood a few minutes in hot water and bend around a dowel or broom handle. Wrap with soft twine or gauze and allow plenty of time for the blank to dry in shape before removing and cementing the edges together. When dry, cement in discs of 3/32" stock at each end.

Wing, stabilizer and rudder are of profile construction which makes for easy and speedy building with practically no warpage trouble. Cut the outlines from medium 1/16" sheet and fill in ribs as shown. Cover all surfaces on both sides, water shrink and dope.

Rudder and stabilizer are pinned flat in order that they may dry with no offset of any kind, but the wing should be allowed to curve gently upward to provide a slight dihedral angle.

Sand the leading edge of the wing to knife-edge sharpness before covering. This wing section, by the way, is a rubber model approximation of the airfoil used on the P-51 Mustang in which the center of pressure is located well toward the trailing edge.

Therefore in balancing the model it will be found that the center of weight will come approximately in the center of the chord rather than one-third back from the leading edge. This makes for considerably more speed and irons out the zooming tendency usually compensated for by downthrust.

The wing pylon is built up of three pieces of 1/16" stock, cross-grained for strength. Use plenty of cement, in mounting it to the fuselage.

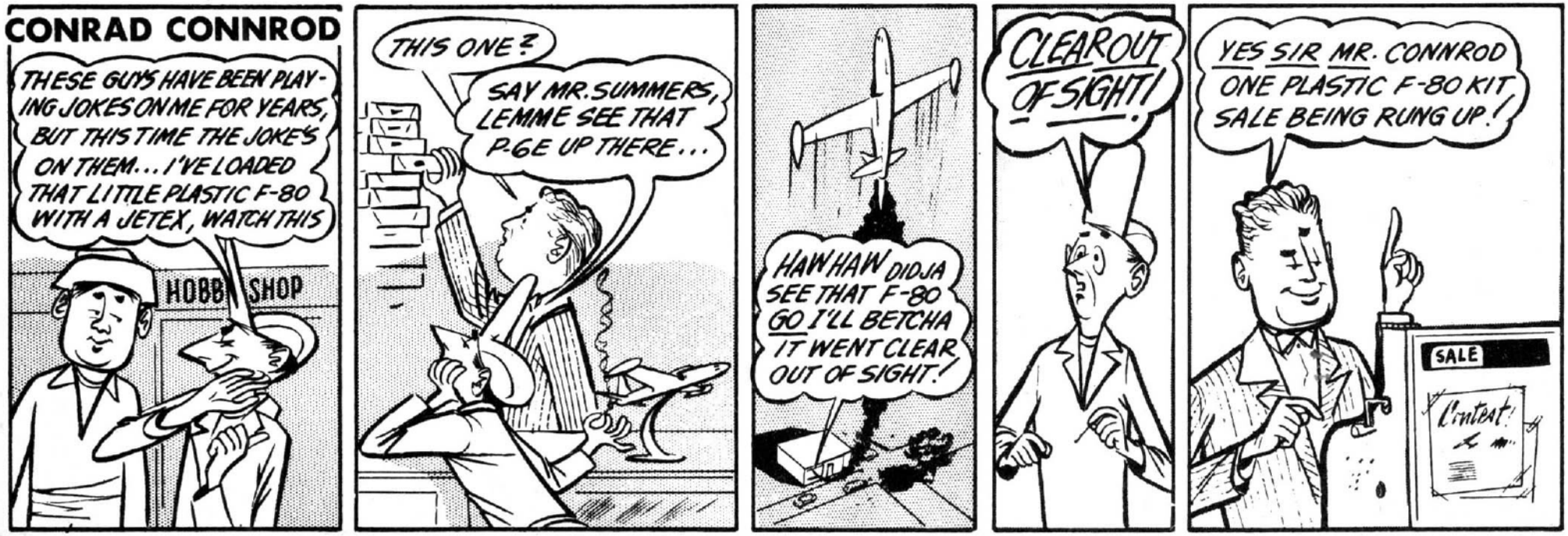
Mount the rudder dead center on the upper side of the fuselage directly over the stabilizer mount.

Propellers are built up. Cut blades from hard 1/16" stock and mount in spinners at 45° angle to the thrust line. Be sure to make one left and one right hand prop. Good bearings and alignment are important so don't rush over this phase of construction.

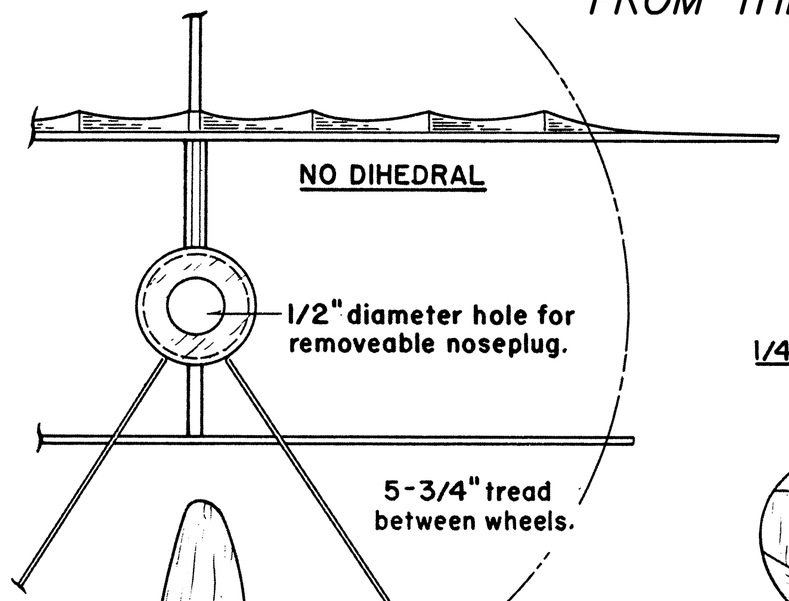
Landing gear is light wire bent to shape and attached as shown on plans. Use plenty of cement here. Wheels should track evenly and rotate smoothly for R.O.G. takeoffs.

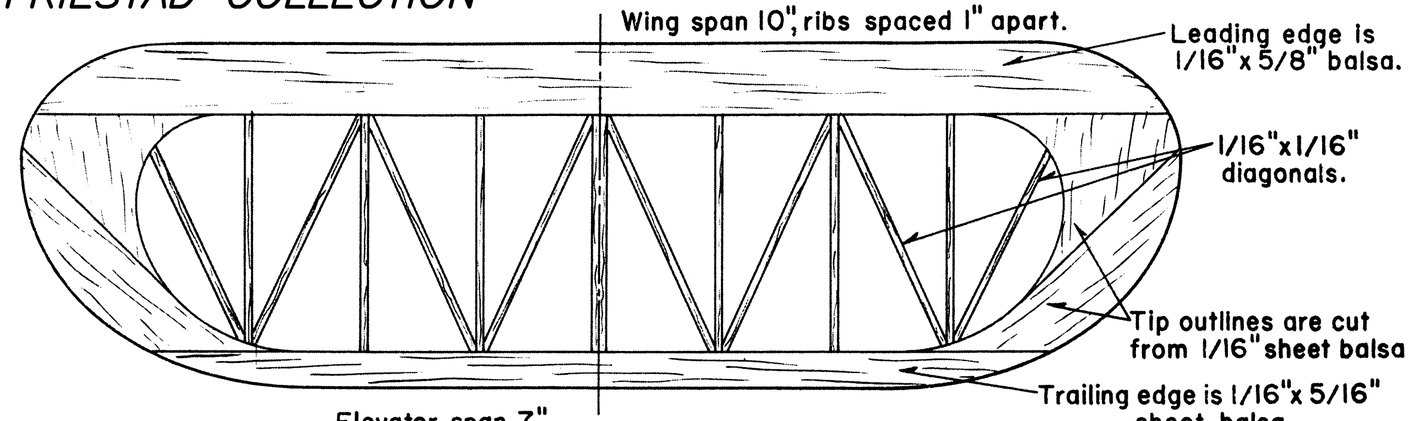
Test the model over tall grass with six strands of 1/8" flat brown rubber. Launching is done from an "underslung" position by holding both propellers, swinging the model forward and releasing. If properly built the plane will fly straight as an arrow with no tendency to deviate either right or left. After preliminary testing, power can be upped to twleve strands of rubber or more.

In competition it is a good idea to start the model quite a few feet behind the starting line in order that the props have a chance to bite into the air and overcome the initial inertia before hitting the measured course.

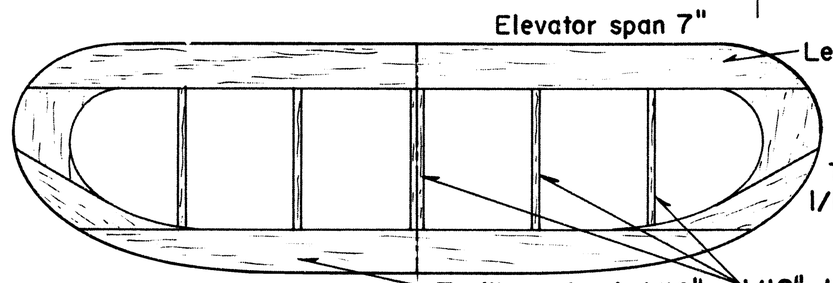


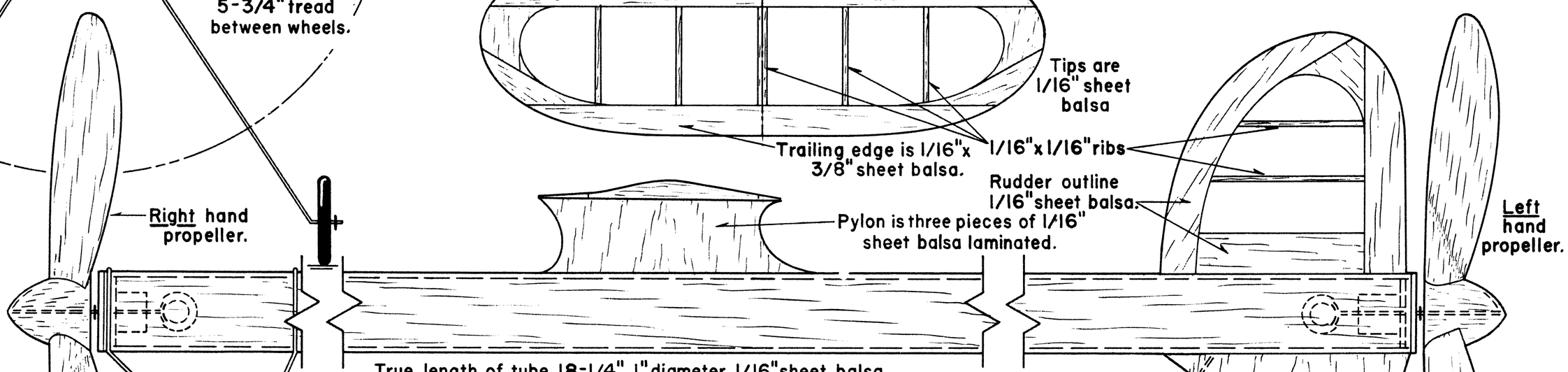
CARTOON FROM MODEL AIRPLANE NEWS JULY 1954

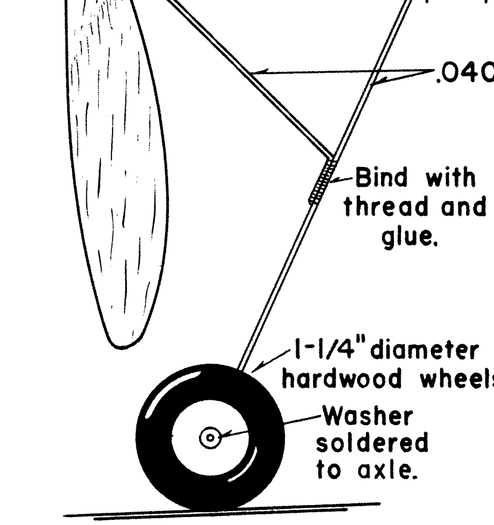


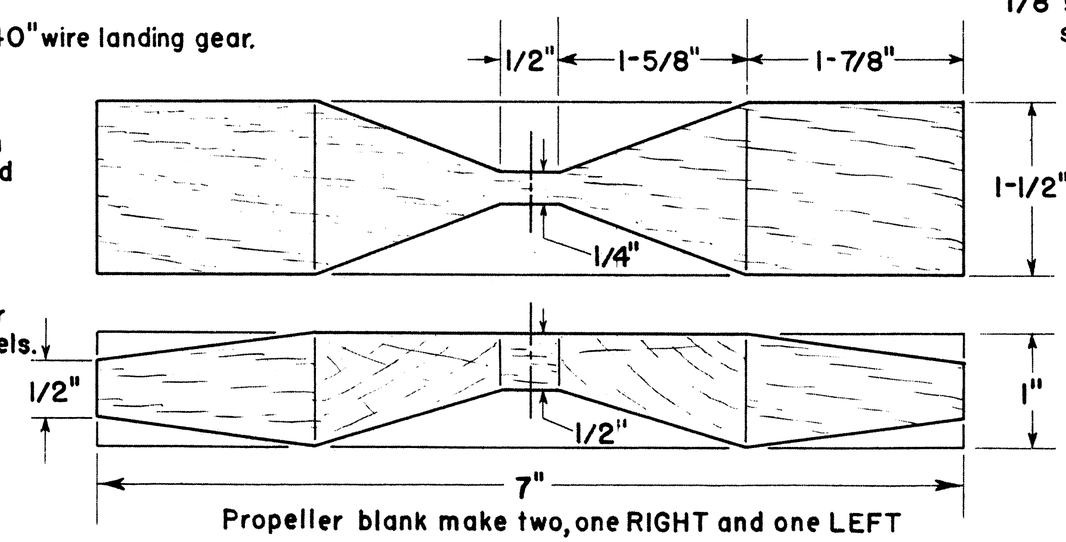


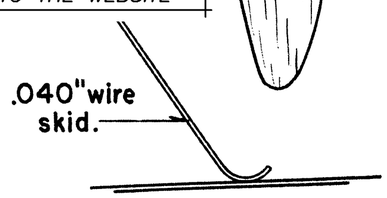
1/4" squares











DRAWN by JAY T. HOLMES.

ORIGINALLY PUBLISHED IN MODEL AIRPLANE NEWS SEPTEMBER 1946 – DESIGN BY ROY CLOUGH

Back Issues of Model Airplane Magazines

If you're like me, you enjoy paging through model airplane magazines and plans, sometimes to find a project to build, to research a particular aircraft, or to just spend some pleasant time away from the daily grind.

If you like to build models, the magazines of today don't offer much since they are primarily expensive catalogs of ready- to-fly models. There's nothing wrong with RTF or ARF models but they don't offer much to interest model BUILDERS.

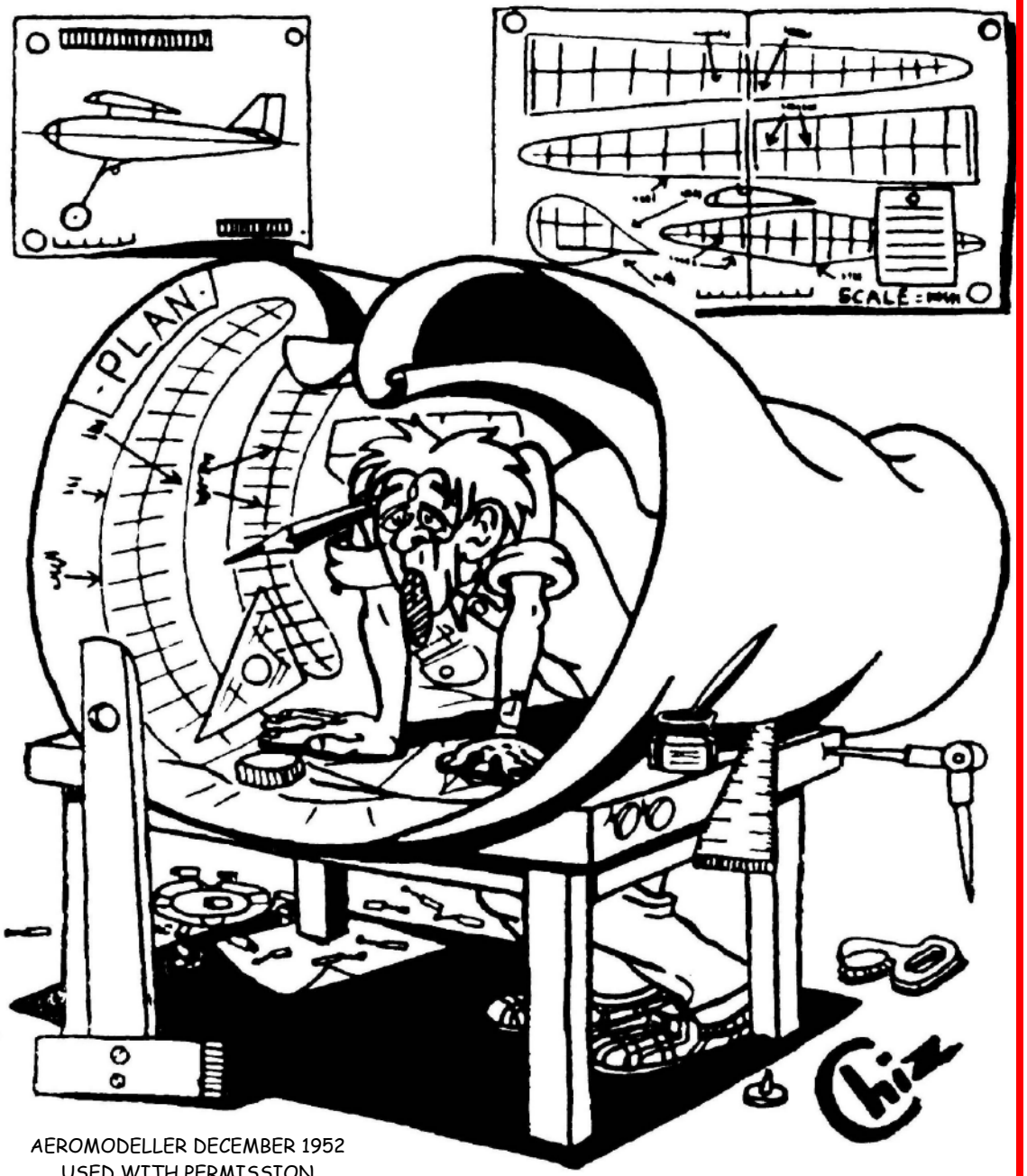
That's NOT the way it was in the past, when you had to build a model before you could fly it. If you're an old-timer, as I am, you have fond memories of Air Trails, Flying Models, Model Airplane News, Aeromodeller and many of the several other magazines available "way back when".

If you're a relative newcomer to modeling and want to learn how to build them, those old magazines can provide a wealth of useful information, plans and how-to-do-it articles.

There are several problems with those old magazines. They are sometimes hard to find, often in bad condition, and in many cases they are so fragile that they can fall apart just by turning the pages. This is because they were often printed on pulp paper, also known as newsprint. Newsprint is inexpensive, but has residual chemicals that cause it to deteriorate when exposed to the air and particularly to sunlight. Your wife or "significant other" might also ask "When are you going to get rid of all those smelly old magazines?"

I admit to being a bit of a "nut case" but have been collecting these magazine for over 50 years and now I am trying to digitize them to preserve them for other modelers. They are now available as digital PDF files. See the details on the next page.

Keep 'em Flying - Roland Friestad



AEROMODELLER DECEMBER 1952
USED WITH PERMISSION

Great Gifts for Modelers Digital Magazines on USB Flash Drive Cards

AEROMODELLER, the premier British model airplane magazine is being digitized. **Ready now are all 240 issues from 1950 and 1960** including the full size plans that were sometimes included in each issue. On the left is a reproduction of the November 1935 cover of Vol 1, No 1. All of the earlier issues will also be available later in 2016

Catalog # D001033 - $75 - Postage Paid

AIR TRAILS - This magazine went under several names. The final issue was published in March of 1975. There are 435 monthly issues included in the complete set and priced as follows ---

D001010 - January 1937 through December 1943 - 84 issues - $50

D001011 - January 1944 through December 1950 - 84 issues - $50

D001012 - January 1951 through December 1961 - 132 issues - $50

D001013 - January 1962 through December 1971 - 96 issues - $50

D001014 - January 1972 through March 1975 - 39 issues - $25

AIR TRAILS ANNUALS -

D001009 - 1938 through 1969 - All 25 issues - $30

D001015 - SPECIAL - Complete set including the annuals - $200

MODEL AIRPLANE NEWS - The first issue of this magazine was published in July of 1929 and it is still being published. We have the following collections currently available ---

D001002 - July 1929 through December 1942 - 161 issues - $50

D001004 - January 1943 through December 1952 - 120 issues - $50

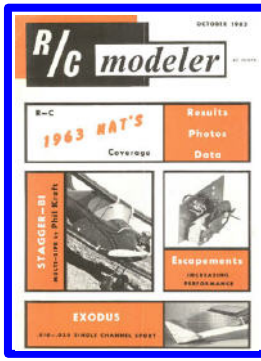
MODEL BUILDER - This magazine ran from the first issue of September~October 1971 through the final issue dated October, 1996 -

D001001 - The complete run - 295 issues - $75

FLYING MODELS - The first issue of this magazine to use the name was published in June of 1947 and it is no longer published. We have the following collection currently available ---

D000013 - June 1947 through December 1963 - 123 issues - $50

RC MICRO FLIGHT & RC MICRO WORLD - The complete run of RC Micro Flight, 1999 through 2004 and all issues of RC Micro World, 2005 through 2012 are available - D001016 - $30



RC MODELER - Now available is the digital collection of the early issues of this magazine. The collection includes all issues from Vol 1, No 1 (October 1963) through December 1972. 109 issues all on a single USB Flash Drive.

D001017 - $50 - Postage paid

All prices include postage paid worldwide

Send payment using Paypal to
cardinal.eng@grics.net

Or check or money order to
Roland Friestad
1640 N Kellogg Street
Galesburg, Illinois 61401
USA

Makes a Great Gift for Modelers
Circle your interests and give this sheet to someone who has a hard time finding you a gift

Prices Effective April 1, 2016 - Subject to change without notice

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The early issues of
AEROMODELLER
Computerized in High Resolution
On Custom USB Flash Drives

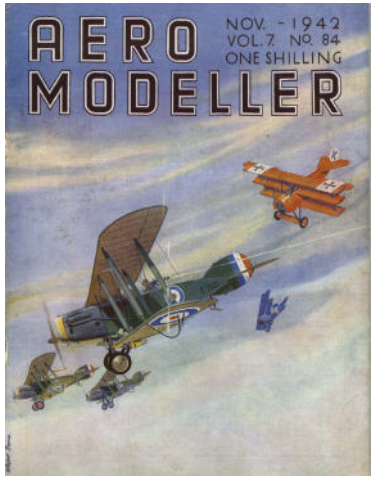
Our crack staff hard at work digitizing plans, magazines and books

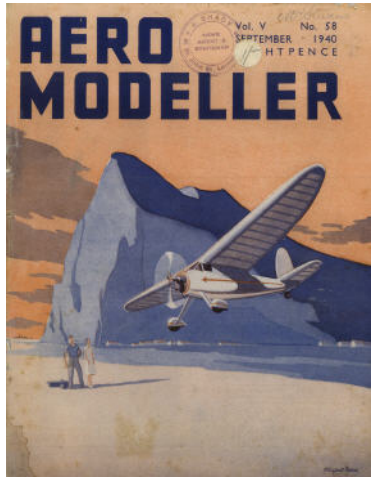
Now, after several months and hundreds of hours of work, we have available high-resolution digital copies of the British Aeromodeller magazine starting with the very first issue dated November 1935, shown above, and through the December 1942 issue. These issues are extremely rare and hard to find. These early issues are from the late Ivor F collection in Australia, with thanks to his son Tahn Stowe.

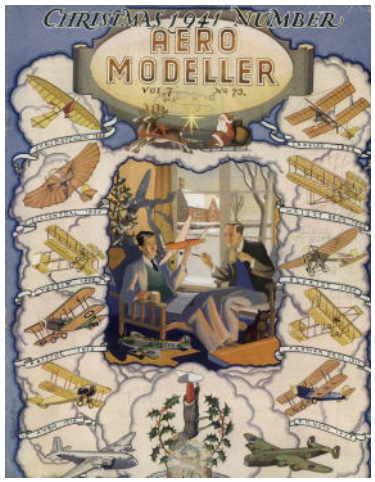
Furnished on our custom made USB Flash Drives this collection is priced at only $60 US, postpaid world-wide. PayPal, Money Order or check drawn on a USA bank. Catalog number - D001047 - 85 issues -

Roland Friestad
1640 N Kellogg Street
Galesburg, Illinois, 61401
USA
cardinal.eng@grics.net

P.S. - Don't forget to include your name and address - Sometimes people forget !!







Price subject to change without notice - Effective September 2016