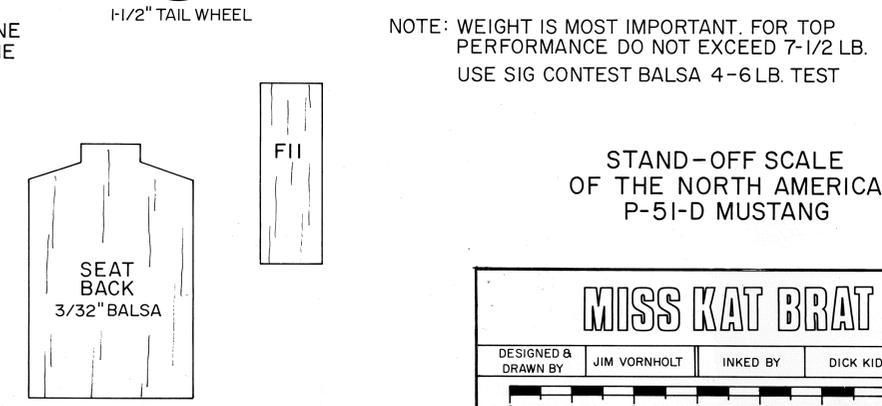
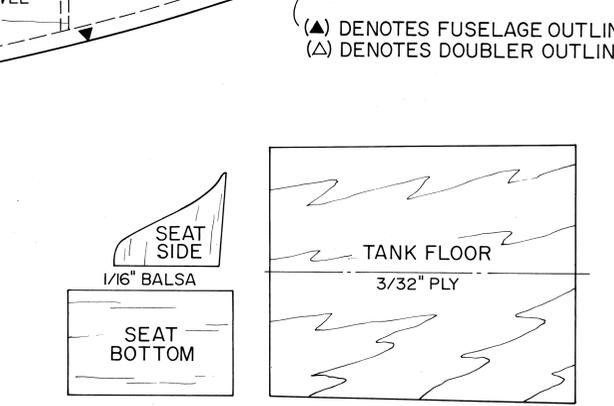
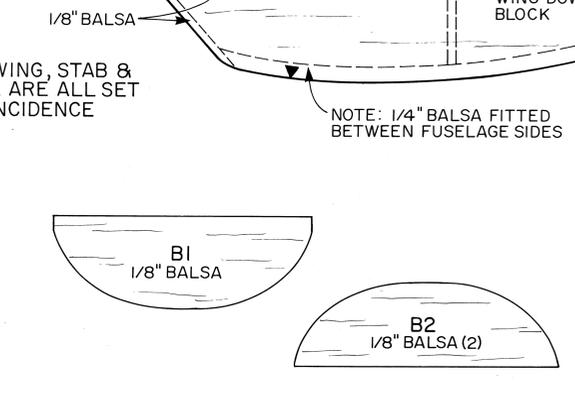
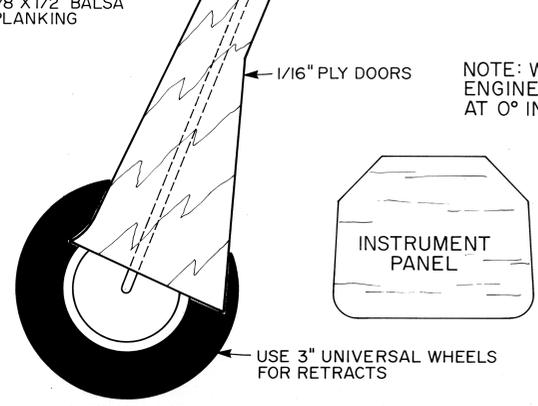
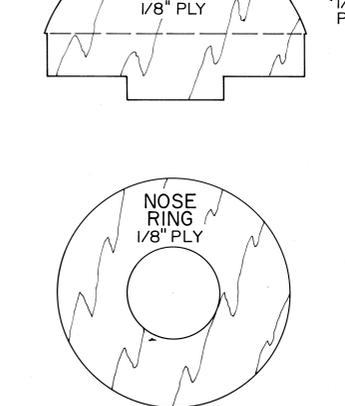
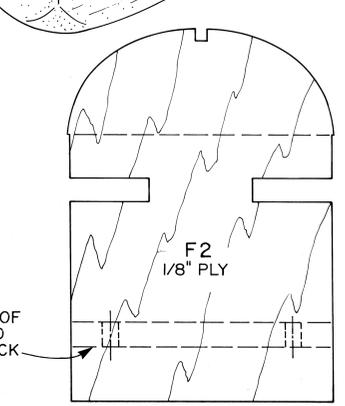
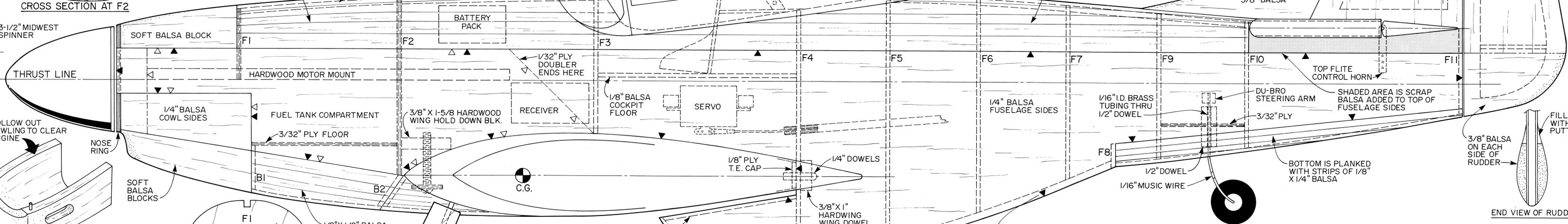
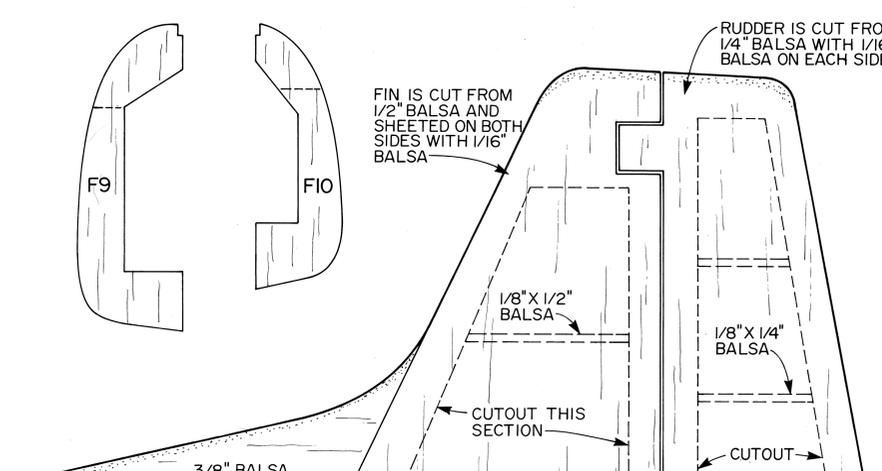
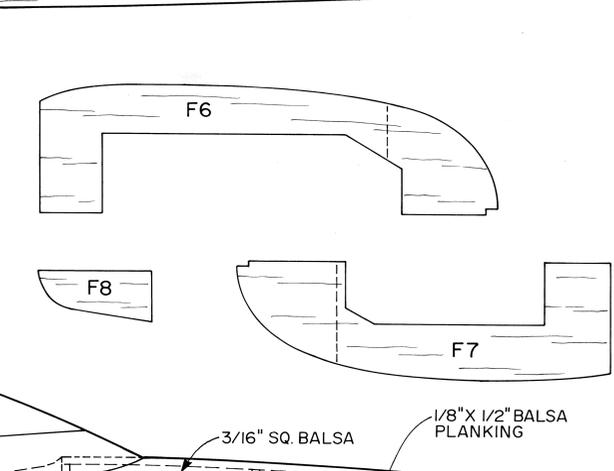
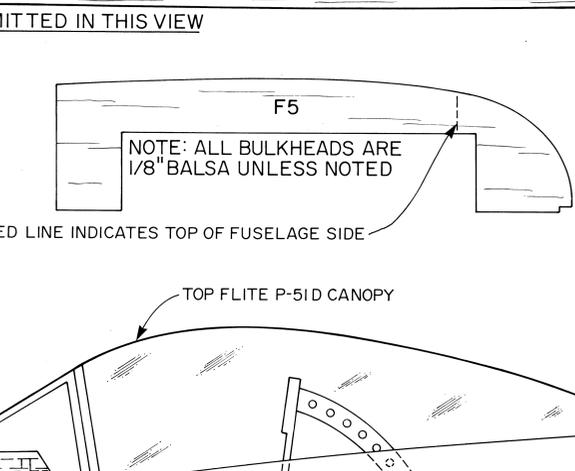
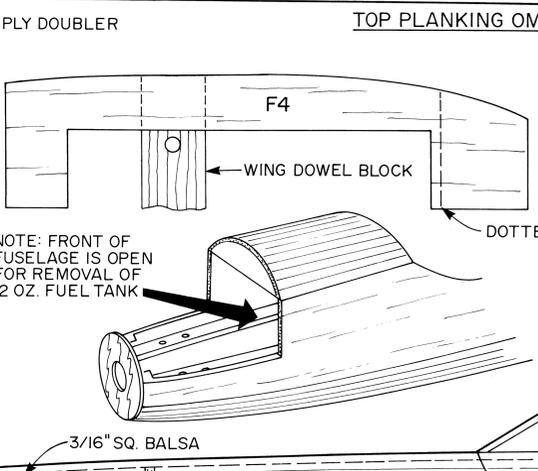
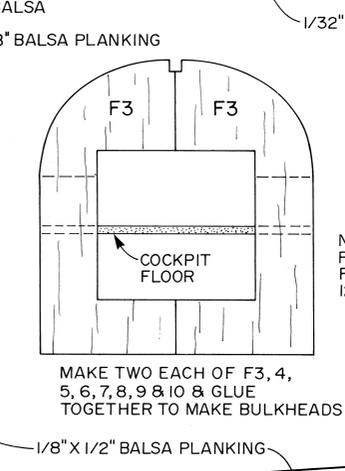
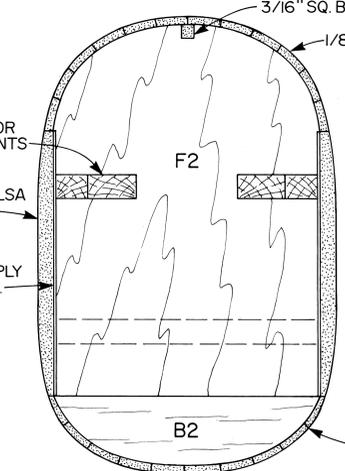
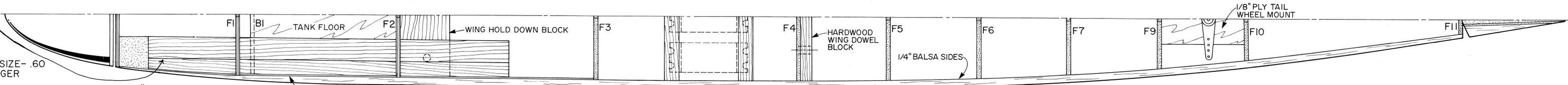
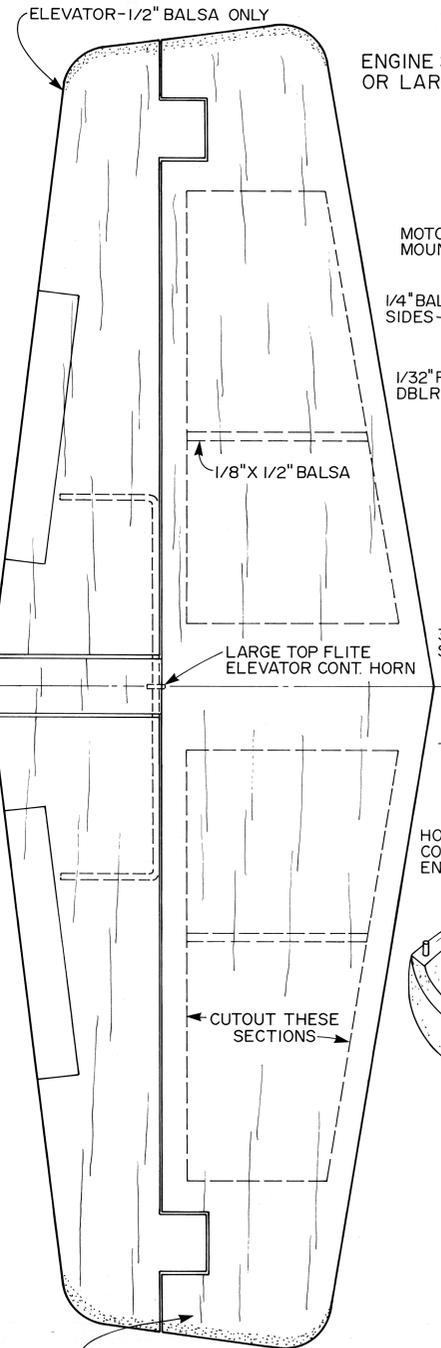


MOTOR MOUNTS MADE FROM 3/8" X 3/4" & 3/8" X 1/2" HARDWOOD GLUED TOGETHER

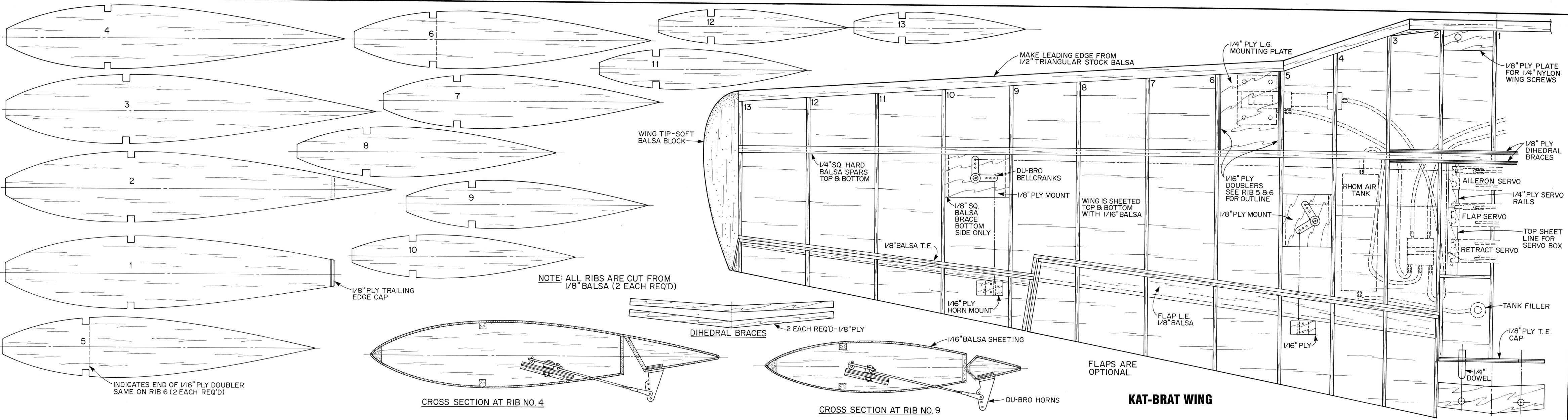


NOTE: WEIGHT IS MOST IMPORTANT. FOR TOP PERFORMANCE DO NOT EXCEED 7-1/2 LB. USE SIG CONTEST Balsa 4-6 LB. TEST

STAND-OFF SCALE OF THE NORTH AMERICAN P-51-D MUSTANG

MISS KAT BRAT

DESIGNED & DRAWN BY	JIM VORNHOLT	INKED BY	DICK KIDD
0 1 2 3 4 5 6			



INDICATES END OF 1/16" PLY DOUBLER  
SAME ON RIB 6 (2 EACH REQ'D)

CROSS SECTION AT RIB NO. 4

NOTE: ALL RIBS ARE CUT FROM  
1/8" Balsa (2 EACH REQ'D)

DIHEDRAL BRACES - 2 EACH REQ'D - 1/8" PLY

CROSS SECTION AT RIB NO. 9

FLAPS ARE  
OPTIONAL

**KAT-BRAT WING**

5° DIHEDRAL EACH TIP

4

6

12

13

3

7

11

MAKE LEADING EDGE FROM  
1/2" TRIANGULAR STOCK Balsa

1/4" PLY L.G.  
MOUNTING PLATE

1/8" PLY PLATE  
FOR 1/4" NYLON  
WING SCREWS

1/8" PLY  
DIHEDRAL  
BRACES

WING TIP-SOFT  
Balsa BLOCK

1/4" SQ. HARD  
Balsa SPARS  
TOP & BOTTOM

DU-BRO  
BELLCRANKS

AILERON SERVO

1/4" PLY SERVO  
RAILS

2

9

1/8" SQ.  
Balsa BRACE  
BOTTOM  
SIDE ONLY

1/8" PLY MOUNT

1/16" PLY  
DOUBLERS  
SEE RIB 5 & 6  
FOR OUTLINE

RHOM AIR  
TANK

FLAP SERVO

TOP SHEET  
LINE FOR  
SERVO BOX

1

10

1/8" PLY TRAILING  
EDGE CAP

WING IS SHEETED  
TOP & BOTTOM  
WITH 1/16" Balsa

1/8" PLY MOUNT

RETRACT SERVO

TANK FILLER

1/8" PLY T.E.  
CAP

1/8" Balsa T.E.

1/16" PLY  
HORN MOUNT

FLAP L.E.  
1/8" Balsa

1/16" PLY

1/4" DOWEL

DIHEDRAL BRACES

2 EACH REQ'D - 1/8" PLY

1/16" Balsa SHEETING

DU-BRO HORNS

# MISS KAT BRAT

A COMPETITION PATTERN MUSTANG

BY JIM VORNHOLT





**A competition pattern aircraft does not have to look like a pregnant Guppy simply because the current trend may be going in that direction. Designed by a two time Nationals control line stunt champion, Miss Kat Brat is proof that a pattern RC aircraft can combine scale appearance with competitive performance.**

● A chance to fly in a real P-51 Mustang must be every modeler's dream. This dream became a reality for me at the 1975 E.A.A. Convention in Oshkosh, Wisconsin. That is where I met Jack Shaver of Atlantic City, New Jersey. Jack is the pilot of Miss Kat Brat, the P-51 Mustang that my model was painted after, and is a close friend of Tom Wood of Indianapolis. Tom also owns a P-51 Mustang. After a short discussion with Jack and Tom on the subject of R/C Mustangs, Jack asked me if I would like a ride in Miss Kat Brat. Well, I ask you - - - who could say no to a question like that? When we took off Tom went with us in his beautiful P-51 painted in 8th Air Force configuration. Tom Wood owns one of the largest Pontiac dealerships in Indiana and is a heck of a nice guy. Jack Shaver works for a large airline, the name of which slips my mind at this time.

Upon climbing into the cockpit, Jack strapped himself in and made a quick check. Then the huge four bladed prop began to turn. With a slight puff of smoke, the engine fired. Taxiing across the field with Tom in front of us, I could look out either side of the canopy and see Corsairs, Bearcats, Thunderbolts, and P-38 Lightnings. The steady roar of the Rolls Royce engine, and seeing the other war birds sitting in a row as though they could leap into action at a moments notice, was like a time machine sending me back thirty years. With a little imagination you could see pilots sitting around the Officer's Club discussing the days action over the faint sound of Glenn Miller on Armed Forces Radio, playing in the background. Jack and Tom are both top notch pilots and there is nothing that can compare to the feeling of flying upside down, and going through a series of rolls in a Mustang. We were in the air for about one hour, with Jack and Tom chasing each other through the skies as if they were in an actual dog fight. The most beautiful sight was flying what was called "Tail End Charlie" during W.W. II. That is when we were at 6 o'clock — to the rear — and about 50 ft., just below Tom. Looking up through the canopy, seeing the bottom of Tom's plane was a sight beyond description, and one few people will ever see. My thanks to Jack

Shaver and Tom Wood for making August 3, 1975 just about the most important day of my life, for, from the first turns of that big prop, I knew I had been born 20 years too late.

I have been a modeler for 20 years and have loved the Mustang ever since I was a small boy. The first 17 years of my modeling career were spent flying control line stunt (Pattern for the R/C boys) and I was lucky enough to win the Nationals twice, in 1960 and 1961, and placed fourth in 1962. I dropped out of modeling in 1963 to pursue a full time career of chasing girls. But, as the old saying goes, "Old modelers never die, they just get married and return to building model airplanes." So, about three years ago I took up the magic box and

found that ten years can take its toll on your nerves and reflexes.

Now, for a few words about the model. It is 98% scale and uses a symmetrical airfoil with the exception of ribs 1-5 which had to be cut thinner on the bottom to allow the wing to fit under the scoop. The alignment was changed to a zero-zero set up, removing the incidence and washout from the wing. Two ships were built at the same time, the second by Jerry Caldwell, President of the Indianapolis R/C Modelers Club (the oldest R/C club in Indianapolis, I might add). My main goal in this design was not for a Stand-Off Scale model, but a light weight, high-performance Pattern ship with scale appearance. I sometimes wonder why most modelers have a "Monkey see, Monkey do" attitude towards modeling. If a hot dog has a Pattern ship that looks like a pregnant Guppy, then other modelers believe they have to fly a pregnant Guppy if they want to win contests. I have believed for years that a semi-scale can compete equally in the Pattern Event if the ship is designed correctly. This was what I set out to prove, and I believe I have accomplished my goal.

There are three factors to keep in mind at all times with this type of model.

(1) Weight is very critical and should be kept under 7 lbs. This sounds impossible for this size model, but it can be done by using fuselage planking instead of blocks, white glue instead of epoxy, and Zap or Hot Stuff instead of glue. But most important, use only Sig 4-6 lb. balsa.

(2) Alignment: The best way is to center line every piece you make and build on a flat table. One bad habit the ship has is a tendency to roll to the left on take-off. This is true of any tail dragger, but more so with the Mustang. This tendency to roll left is due to the torque of the engine and P-factor from the prop. I have been experimenting with 4-bladed props which I think would help to eliminate the P-factor. It will work, but the engine has to run slower so it will not overheat. Also, you should use only a castor oil base fuel of at least 28% castor oil since this also cuts engine heat. Getting back to the left hand roll on take-off, this should be corrected by using the rudder. We all have a normal reaction of using right aileron when the left wing tip starts to drop, but this only adds to the roll instead of counteracting it.

Why, you ask? Well, with the wing at approximately a 10 degree attitude at lift off, the ship is just about at stall speed and drag is very critical at this point. This is especially true when flying off of grass runways as our club does. Now the wing starts to drop to the left and you add more and more right aileron. This puts the left aileron down farther into the air stream which only adds to the drag on the left wing. But, then, why doesn't the right aileron equalize the drag? If you

### P-51D "PATTERN MUSTANG"

Designed By: Jim Vornholt

#### TYPE AIRCRAFT

Pattern/Stand-Off Scale

#### WINGSPAN

60 Inches

#### WING CHORD

Root 15 1/8" — Tip 7 3/4"

#### TOTAL WING AREA

660 Square Inches

#### WING LOCATION

Low Wing

#### AIRFOIL

Symmetrical

#### WING PLANFORM

Double Taper

#### DIHEDRAL, EACH TIP

2-9/16" (5°)

#### O.A. FUSELAGE LENGTH

51-15/16"

#### RADIO COMPARTMENT AREA

(L) 13" X (W) 4 1/4" X (H) 2"

#### STABILIZER SPAN

21 1/4 Inches

#### STABILIZER CHORD (incl. elev.)

5 1/2" (Avg.)

#### STABILIZER AREA

115 1/2 Square Inches

#### STAB AIRFOIL SECTION

Flat

#### STABILIZER LOCATION

Top of Fuselage

#### VERTICAL FIN HEIGHT

7 3/8 Inches

#### VERTICAL FIN WIDTH (incl. rudder)

6 3/8" (Avg.)

#### REC. ENGINE SIZE

.60 or Larger

#### FUEL TANK SIZE

12 Ounce

#### LANDING GEAR

Conventional

#### REC. NO. OF CHANNELS

4-6

#### CONTROL FUNCTIONS

Rudder, Elevator, Ailerons, Throttle (Flaps & Retracts)

#### BASIC MATERIALS USED IN CONSTRUCTION

Fuselage ..... Balsa, Ply & Hardwood  
 Wing ..... Balsa & Ply  
 Empennage ..... Balsa  
 Weight Ready-To-Fly ..... 104 Oz. (120 max.)  
 Wing Loading ..... 22.7 Oz./Sq. Ft. (26.2 max.)

look at your model from the rear and tilt it to about a 10 degree attitude, you will see that the right aileron is not flying. By this I mean it is almost 90% out of the airstream and is not helping you at this particular time. The only time ailerons work equally is when the ship is at a horizontal attitude with Mother Earth. So build it straight, keep it light, and stay off those ailerons during take-off.

(3) Power: This was a determining factor in the crash of one of the Mustangs. Jerry's Mustang was lost due to an engine which had to be sent back to the factory twice before it would run through a complete tank of fuel. Jerry was a great help in working out a lot of the construction bugs such as flap hook-up and setting up the Rom-Air retracts.

Trimming and Flying: Since I'm far from the world's greatest pilot, I thought it would be wise to let someone else make the first flight with my Mustang. This unrewarding task fell upon my old friend, Herman Cholewinski. Herman is Vice President of our club and one of the most competitive pattern flyers in the Indianapolis area (also, his wife, Angie, is the beautiful young lady holding Miss Kat Brat). The only trim necessary was the addition of 3 ounces of lead to the nose. The ship seemed to track straight through loops and rolls. This is why I stress the alignment factor.

### CONSTRUCTION

Start by choosing only the lightest wood available. I used Sig 4-6 lb. contest grade balsa and used glue sparingly. I recommend Wilhold Aliphatic Resin instead of epoxy whenever possible. For the fuselage, begin by cutting two 1/4" x 4" x 48" sheets for the fuselage sides. The motor mounts are made from hardwood spars which can be purchased at any cabinet shop, or glue one 3/8" x 1/2" and one 3/8" x 3/4" hardwood spars together, making the correct size mount. Zero-zero alignment is very important. Use the top of the fuselage side for a reference point from which all center lines are drawn. Motor mounts are laid 11/16" below the top of the fuselage sides and the plywood formers can be put in place at this time. Locate the position of the wing on the fuselage. The center line of the trailing edge and leading edge are the same distance from the top of the fuselage side. Draw the shape of the wing airfoil and cut out this section. A quick check for alignment can be made by placing the fuselage upside down on a flat table. If you are correct, all center lines will be an equal distance from the table. Now cut the rest of your fuselage formers from 1/8" balsa, cutting out the centers to allow for the pushrods. At this point I should say that the fuselage sides can be made from either 1/8" or 1/4" balsa. I used 1/4" but 1/8" could be wrapped around the formers easier. If you use 1/4" fuselage sides, be sure to wet them

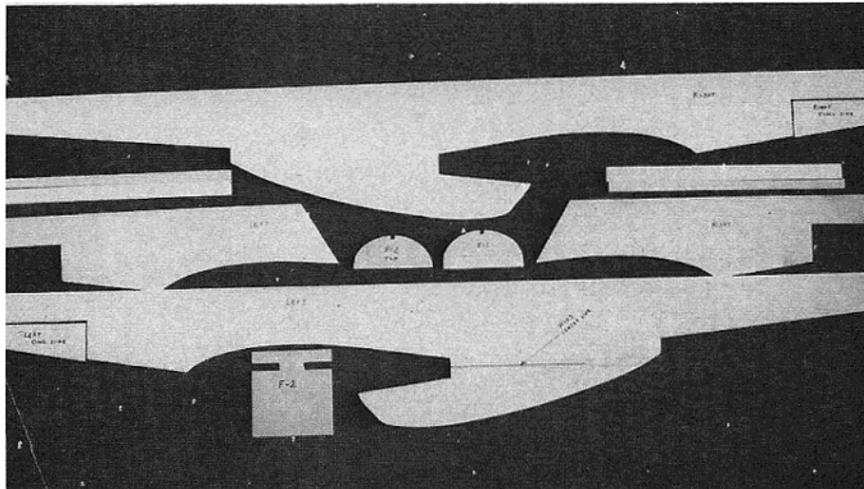
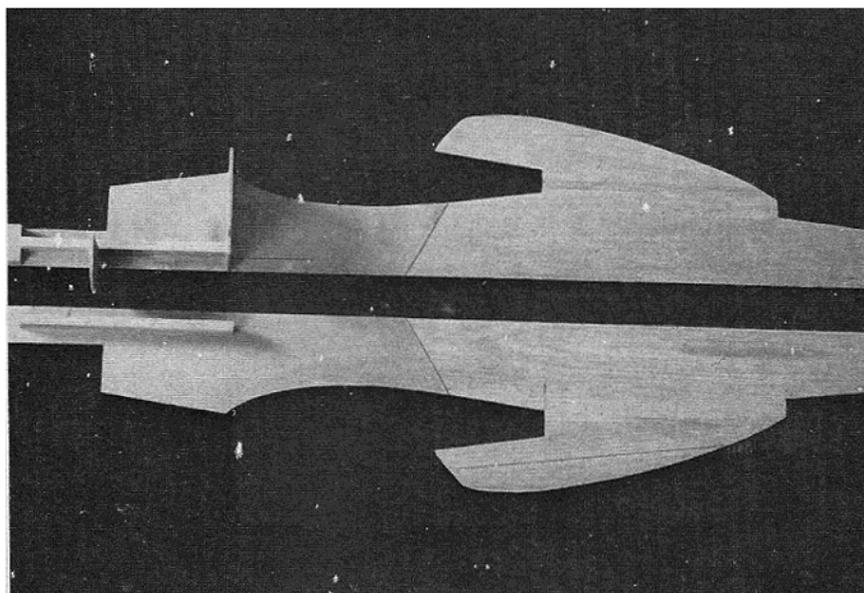
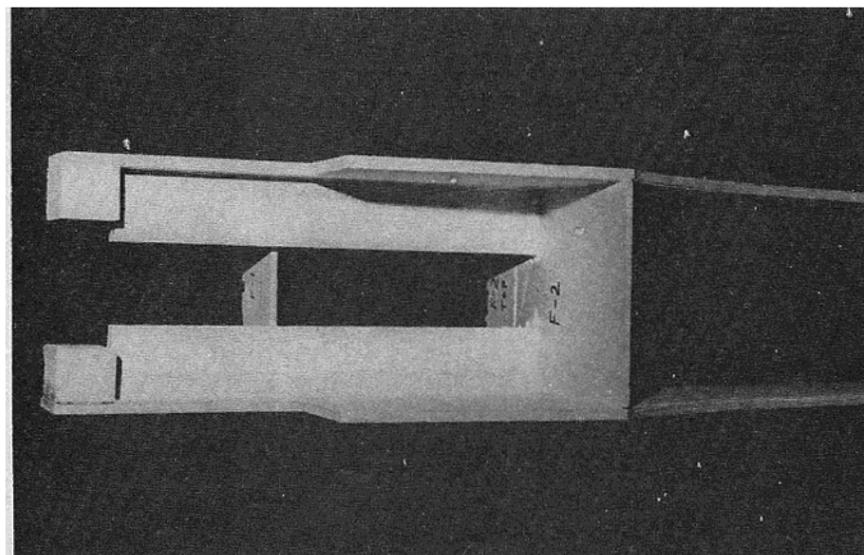


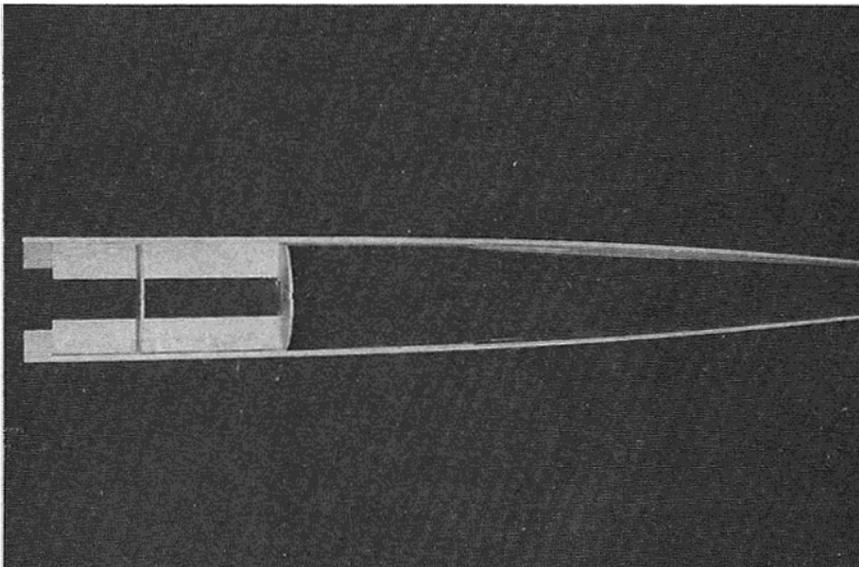
Photo of parts necessary to frame up fuselage. Doublers are 1/16" plywood. Motor mounts made from 3/8" x 3/4" and 3/8" x 1/2" glued together. Scoop is attached to fuselage sides which is cut from 4" or 6" wide stock.



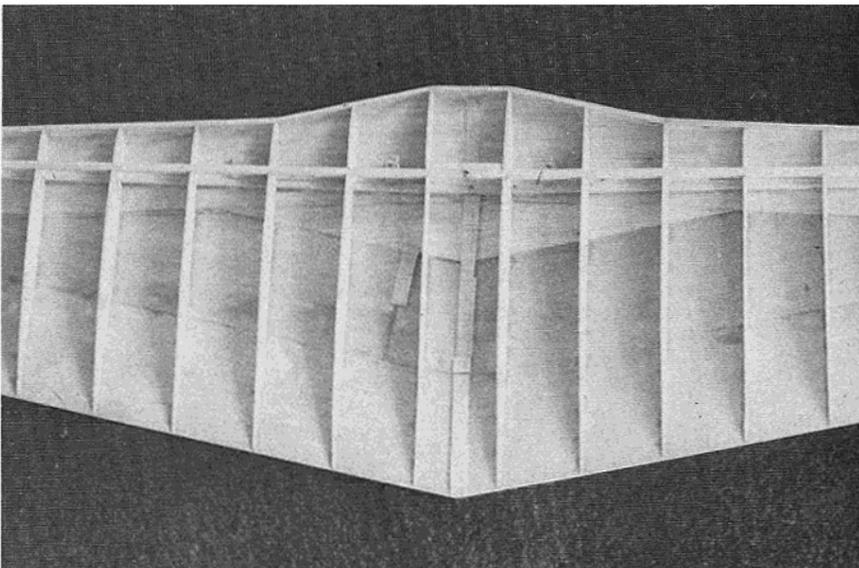
Fuselage sides with mounts, F-1, F-2, 1/16" ply doublers, and balsa nose block in place.



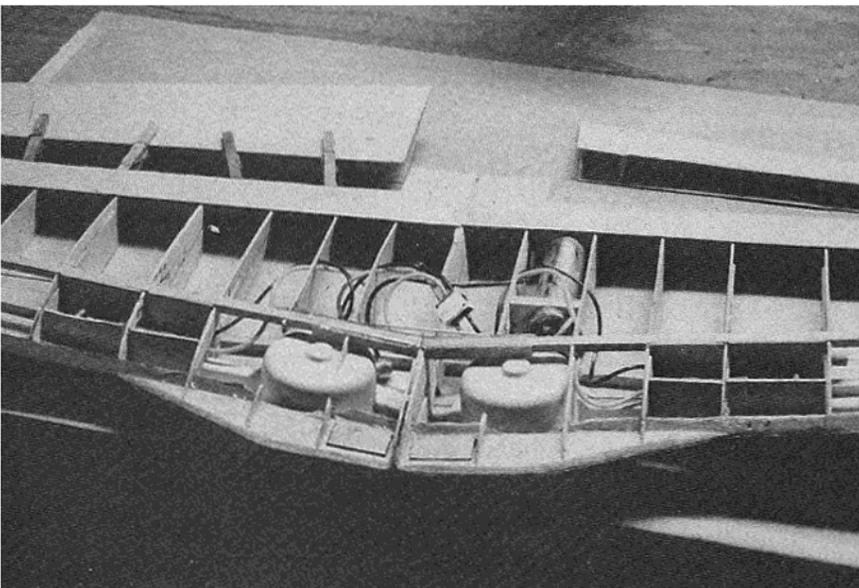
In this view of Miss Kat Brat, the second fuselage side has been added.



Another view of basic fuselage assembly.



A view of wing before gear and bellcranks installed.



Rom-Air retract installation. Flaps cut off, ready for capping and hinging.

when you are ready to install your rear formers numbers F-3 through F-11. Now, at this point, put the fuselage aside and start on the wing.

I recommend, and use, an RCM Wing Jig for wing construction. Cut each rib individually to assure the proper airfoil from the root to the tip chord. With all ribs in place on the jig, add the leading edge and the 1/4" x 1/4" spars. Plank the top of the wing and remove from the jig. There is no trailing edge spar since the top and bottom planking come together

#### Fuselage & Wing Wood

- 1 — 3/2" Midwest P-51 spinner.
- 1 — 1/32" x 12" x 24" ply — double sides.
- 2 — 3/8" x 1/2" x 12" hardwood motor mounts.
- 2 — 3/8" x 3/4" x 12" hardwood motor mounts.
- 1 — 3/8" x 3/4" x 12" hardwood wing holddown — front & back.
- 1 — 3/8" x 1/2" x 12" hardwood — servo mounts.
- 1 — 1/8" x 12" x 24" plywood — formers F-1, F-2, nose ring, bellcrank floors, wing hold-down plates, front & back.
- 1 — 1/16" x 6" x 12" ply — L.G. doors, wing rib doubles.
- 1 — 1/4" x 6" x 12" ply — landing gear floors.
- 2 — 1/4" x 6" x 48" sheet balsa — fuse. sides.
- 1 — 4" x 48" x 1/8" sheet balsa — formers F-3 thru F-11.
- 2 — 1/2" x 36" triangle leading edge stock.
- 6 — 1/8" x 4" x 48" sheet — wing ribs.
- 1 — 1/2" x 3" x 48" sheet — stab & rudder.
- 2 — 1/6" x 4" x 36" sheet — stab & rudder planking.
- 13 — 1/16" x 1/2" x 36" fuse. cap strips.
- 2 — 1/8" x 1/4" x 36" fuse. cap strips — bottom rear.
- 12 — 1/16" x 4" x 36" sheet — wing planking.
- 1 — 1/8" x 3" x 36" caps. for flaps & ailerons.
- 4 — 1/4" x 1/4" x 36" wing spars.
- 1 — 3/16" x 3/16" x 36" fuse. stringer.
- 2 — 1 1/2" x 1 1/2" x 7" balsa block wing tips
- 1 — 1 1/2" x 4"W x 4"L soft balsa nose blocks.
- 1 — 1 1/2" x 4"W x 4"L soft balsa — cowli blocks.
- 1 — 1/4" x 36" dowel rod — pushrods.

#### HARDWARE

- 2 — nylon wing bolts.
- 5 — nylon horn — rudder, ailerons, flaps.
- 1 — large Top Flite elevator control horn.
- 1 — Top Flite P-51 canopy.
- 1 — pair 3 1/2" Robart wheels.
- 1 — 12 ounce fuel tank.
- 23 — large nylon Du-Bro hinges.
- 1 — 5/32" x 36" music wire or Rom-Air landing gear.
- 1 — Du-Bro tail wheel steering arm.
- 1 — small tail wheel collar.
- 1 — 1 1/2" tail wheel.
- 2 — 5/32" wheel collars.
- 4 — 6-32 blind mounting nuts.
- 4 — 6-32 engine bolts.
- 4 — nylon bellcranks.
- 4 — solder links — wing bellcrank.
- 12 — Kwik-Links.
- 1 — small bottle Withold Aliphatic Resin.
- 2 — bottles Zap or Hot Stuff.

to form the trailing edge. Place the 1/16" plywood bellcrank mounts in position for the flaps and ailerons. Place the 1/16" plywood half doublers on the ribs for extra strength to support the landing gear floor. Install the Rom-Air landing gear if you intend to use them. This is quite a job and will take a couple of nights work to get the wheels to fit into the wing and still be straight when they are down. There is no miracle answer to this problem other than time and patience. Now install the Rom-Air tank and

hoses.

Next, measure on the plans the size of the ailerons and flaps. I might add that there was a third Mustang built which used strip ailerons which are very effective and a little easier to install. If you use strip ailerons, just cut off 1 1/4" from the trailing edge, cap the cut-off section, and add your ailerons. With strip ailerons, torque rods were used which eliminated the bellcranks in the wing. If you want the scale ailerons, this is the time to draw them on to the top planking. Now cut out and cap the wing ends and ailerons. Hook up the bellcranks and add the rod to the servo. Now, with the ailerons hinged, plank the bottom of the wing. Don't forget to install the wing hold-down blocks.

Now, we go back to the fuselage. Bolt the wing on the fuselage, making sure the wing centerline is exactly square with the center line of the fuselage. With the wing bolted in place, add the stabilizer. Before gluing, measure from the hinge line of the stabilizer to the outside corner of the wing tip on each side. If each side is of equal length, then the stab is in alignment and can be glued at this time. Install the elevator pushrod and capstrip the fuselage with 1/8" x 1/2" strips. I used Hot Stuff for this job and it seemed to go very quickly. Just remember to start at the center of the fuselage former and work down on both sides. If you work from one side over the top to the other side you can very easily warp the fuselage. Jerry Caldwell can testify to this because he did it, and had to build a completely new fuselage!

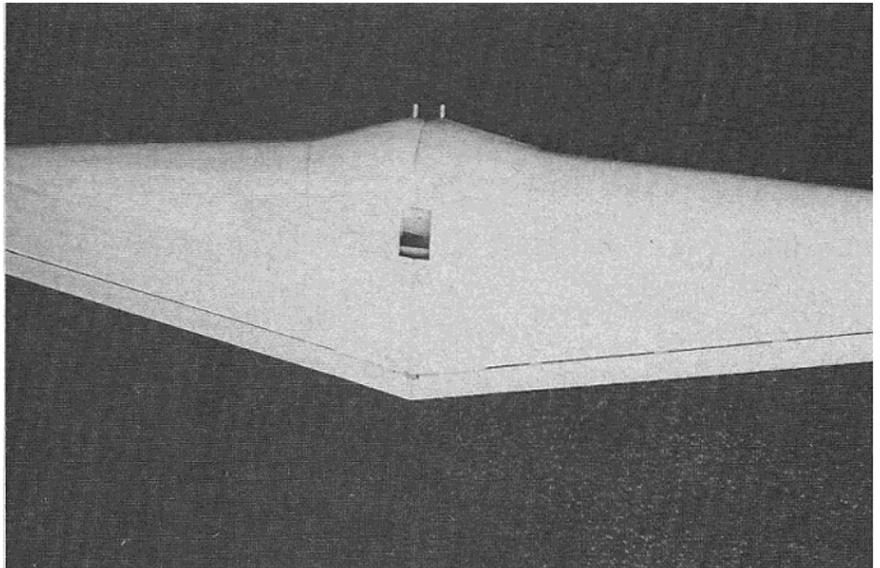
At this point, add the nose block and 1/8" plywood nose ring and, finally, shape the fuselage. The scoop is made from either 1/8" or 1/4", depending on what you used for the fuselage sides. It's a one piece scoop and is attached to the fuselage. The wing slides under the scoop and the 1/4" dowel pins hold the rear of the wing in place.

I forgot to mention that if you use flaps, hinge them at the top and cut the angle as shown on the plans. I used the bellcrank system, but torque rods could be substituted. Now, add the fin and rudder, making sure they are straight. Mount the engine and build the cowl from 1/8" or 1/4" balsa side pieces and a soft balsa block. Sand to shape and cut all holes for the air intake, exhaust, and needle valves. By now you should have something that resembles a Mustang, if not, refer to the plans and start over!

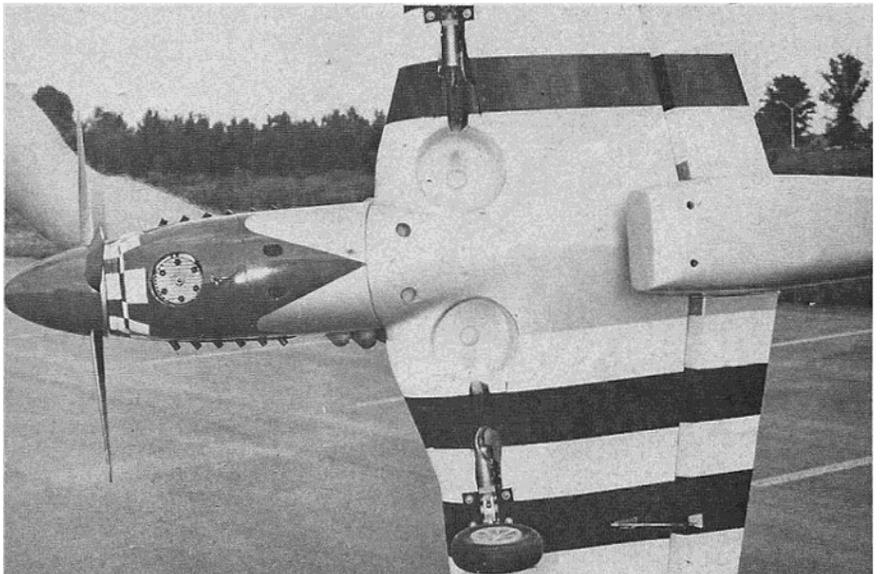
Finally, sand the entire model and fill all cracks with some type of putty. I used Dap, which you can get at any hardware store. At this point, my Mustang model weighed 55 ounces including the Super Coverite, Rom-Air tank and gear. Now you see why I recommend Sig 4-6 pound contest balsa!

**Finish:** First install your cockpit detail and then glue the canopy in place.

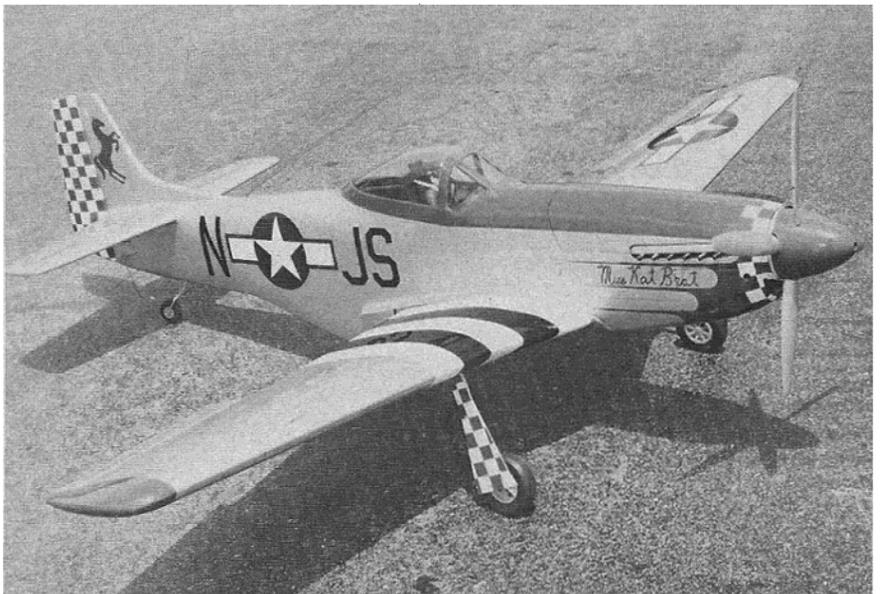
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Wing of Mustang #3 which used strip ailerons.



Bottom view of Mustang with Rom-Airs extended.



This is one pattern ship that doesn't look like a pregnant Guppy!