SPAD

Simple Plastic Airplane Design

SPAD Debonair

Thanks to everyone who posted their experiences at enlarging the Spads into big trainer planes! Sassy and I hit the shop Saturday, and by supper time we had one built...she flew today...and what a GREAT flyer!!! Sassy put us all to shame...as the winds were in access of 20 mph...and on her first flight of the day...a PERFECT greaser 3 point landing!!! I've NEVER seen a trainer this smooth, and rock solid...especially in this much wind!

60" span
40" fuselage
11" Chord (not including ailerons)
5" of dihedral
10" x 10" vertical
10" x 20" horizontal
O.S. FX 46

Spad Debonair

.40-.46 Sized Trainer

Materials Required:

1. 4 Mil Coroplast (Suggested way to cut 4' x 8' sheet)
2. 2 1/2" square PVC Gutterpipe
3. 4 yardsticks
4. #6 x 1/2" self tapping screws
5. smaller screws (for control horn attachment)
6. plywood for firewall
7. 1/4" dowel for wing hold downs and push rods
8. Meduim CA glue
9. Double sided foam mounting tape (For servo attachment)
10. Zip-ties (For servo attachment)
11. Your Radio, Engine, Mount, Tank, Pushrods, Hardware and Landing Gear
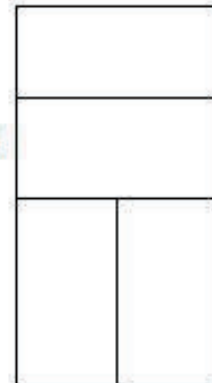
Helpful Tools:

1. Dremel tool with cutting wheel (for cutting out fuselage)
2. Butane or Propane torch (for flaming Coroplast)
3. Sheet metel sheers (for cutting small PVC parts)
4. Normal Shop tools and drill
5. Windex, acetone or other good cleaner

Important things to know before you begin!

1. Questions or comments? Go to the Spad message board at http://members.sitegadgets.com/spad/board.html

2. DO NOT install wing hold down dowels until your whole plane is finished to flight ready condition!!! Once your plane is done...strap or tape your wing to the plane and position the wing until your plane balances perfectly level AT THE FOREWARD SPAR. Mark the wing leading and trailing edge on the fuselage, and then remove wing. Measure 1/2" rear of TE line, and 1/2" foreward of LE line, and install hold down dowels in these positions as close to the top of the fuselage as possible without getting into the gutterpipe edge radius.

3. Clean and "flame" Coroplast at all wing areas to be glued!!! Flame with a torch fast enough not to melt the plastic, but slow enough to burn the manufacturing oils out of the plastic (slight vapor wave and maybe discoloration). Practice on some scrap Coroplast. DO NOT USE TOO MUCH GLUE!!! One drop of medium CA every 1/4" to 1/2" is all that's needed!!!

Fuselage
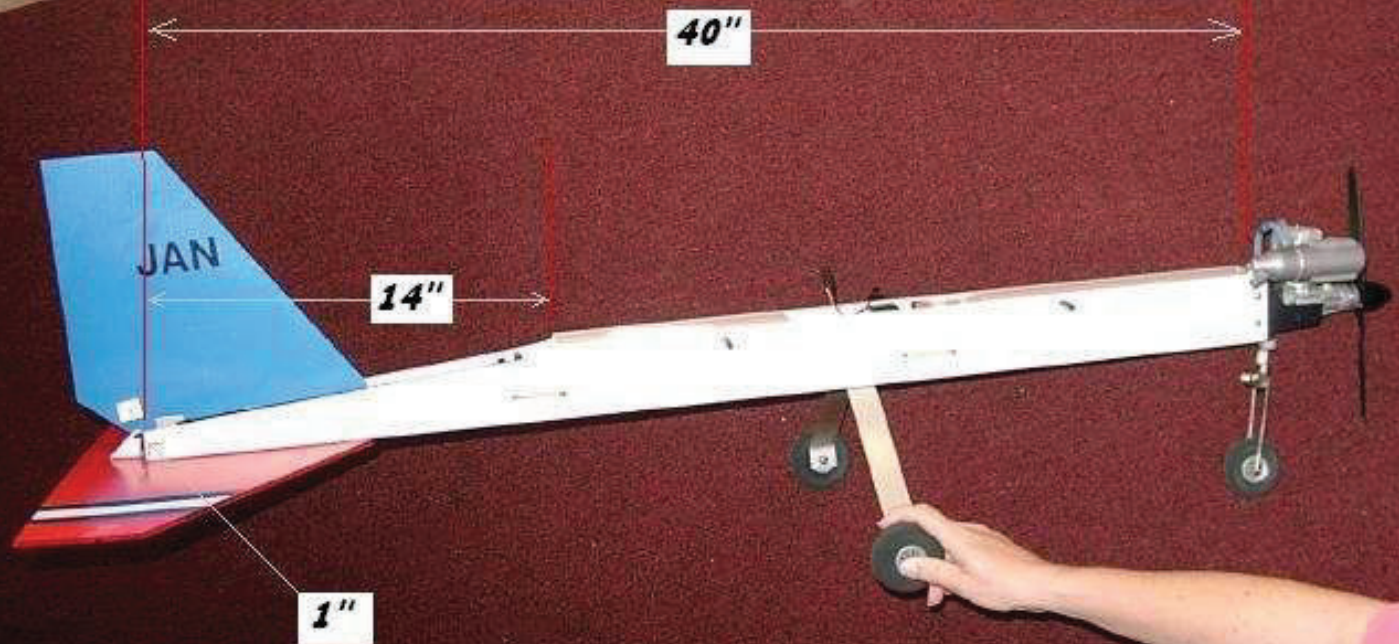
1. The fuselage made from a 40" piece of 2 1/2" square PVC gutterpipe.

2. The firewall is squared away...there is NO down or right thrust.

3. The rear fuselage cut-out is 14" long, angled down to 1" at the rear of the fuselage. DO NOT THROW THE SCRAP PIECE AWAY! Use this piece to make control horns, tail mount doublers, and the aileron servo zip-tie doubler.

4. A dremel with a cut off wheel works great for cutting the fuselage. A hack saw blade with a make shift masking tape handle makes a great "poor boy" method of cutting the PVC.

7"

11"

12"
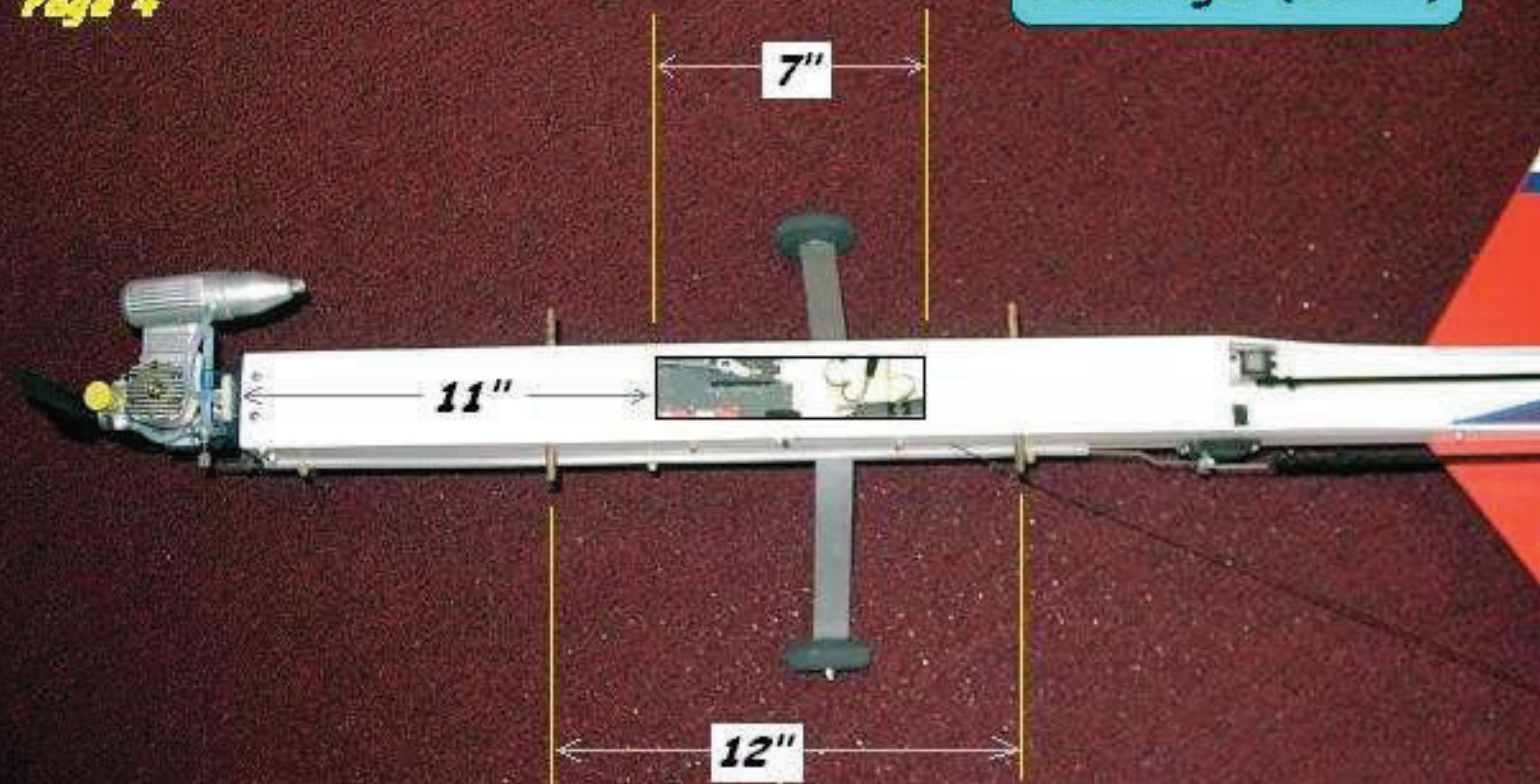
1. Radio access hole is 11" from the front of the fuselage, and is 7" long. Make the side lip at least 3/8" wide.

2. The wing hold down dowels are made from 1/4" dowels and are 4 1/2" long...BUT DONT PUT THEM IN UNTIL THE WHOLE AIRPLANE IS DONE! THAT WAY YOU CAN USE DOWEL POSITIONING TO GET YOUR PLANES CENTER OF GRAVITY PERFECT! (CG will be at the foreward spar). Position the dowels as close to the top of the fuselage possible without getting into the gutterpipe radius.

10"

1 1/2" 2"

8 1/2"

10"

Hinge Line →
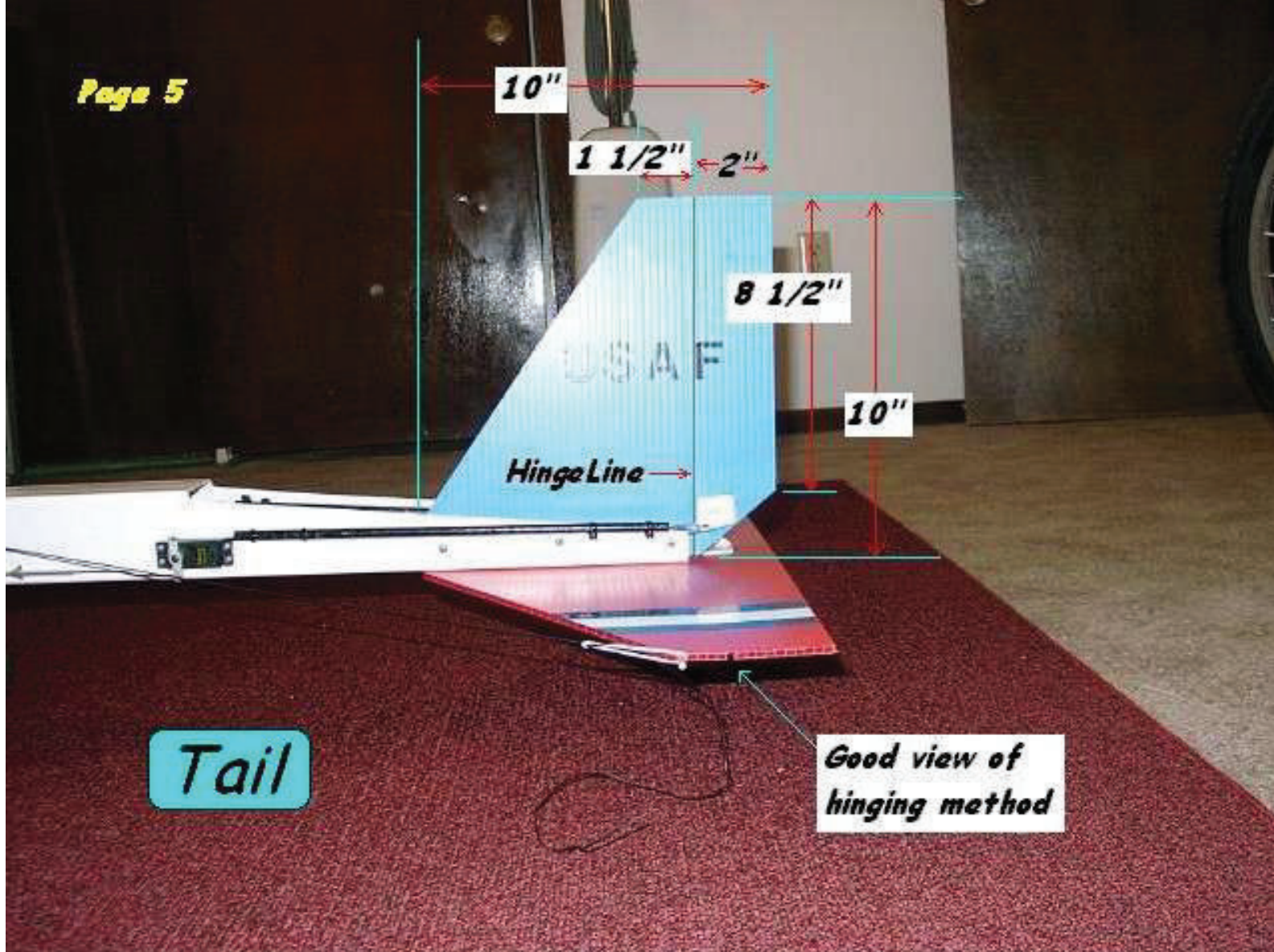
Tail

Good view of
hinging method

1. *Vertical Stab/Rudder is made from a 10" x 10" piece of 4 Mil Coroplast with the flutes running vertical.*

2. *Rudder is 2" wide. Hinge is created by cutting away one side of a Coroplast Flute.*

3. *Stab is mounted with 3 self tapping screws with PVC scrap doublers on the inside of fuselage.*

4. *Helpful hint: Drill head side of screw holes to diameter of screws your using...drill thread hole side with a very small "pilot" hole so the screws will self tap very tightly. Tighten screws only until Coroplast slightly smooshes a little.*

20"

2"

Hinge line

1 1/2"

10"
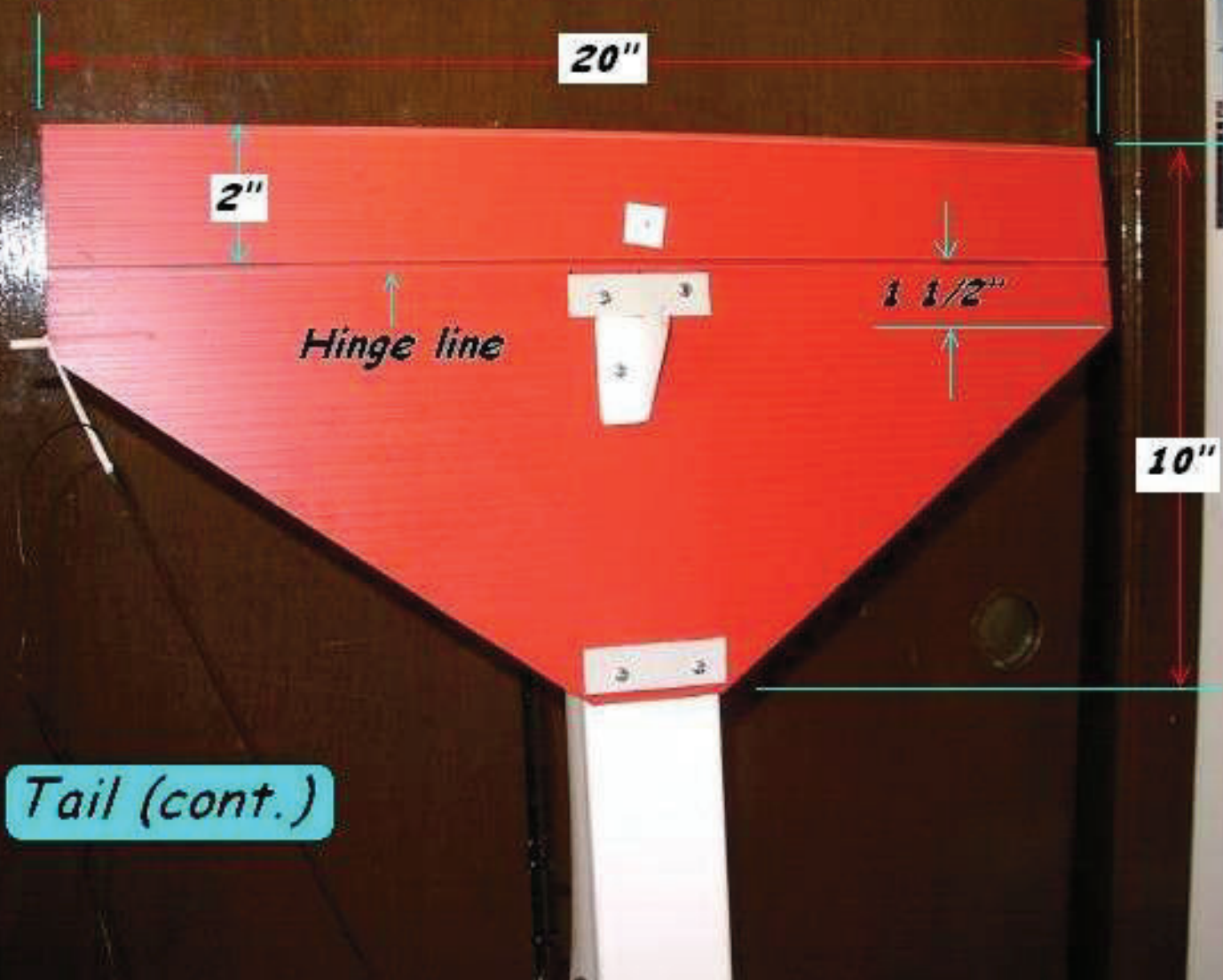
Tail (cont.)

1. Horizontal Stab/Elevator is made from a 20" x 10" piece of 4 Mil Coroplast with the flutes running the 20" direction.

2. Mount with self tapping screws into fuselage.

3. Mount doublers are 3/4" x 2 1/2"

4. Tail skid is 3/4" base x 2" long x 1 1/2" tall

5. Helpful hint: Small parts can be tacked in place with CA glue before drilling and installing screws.

6. Note small scrap PVC elevator horn back plate.

Tail (cont.)

Make sure elevator hinge clears edge of fuselage!
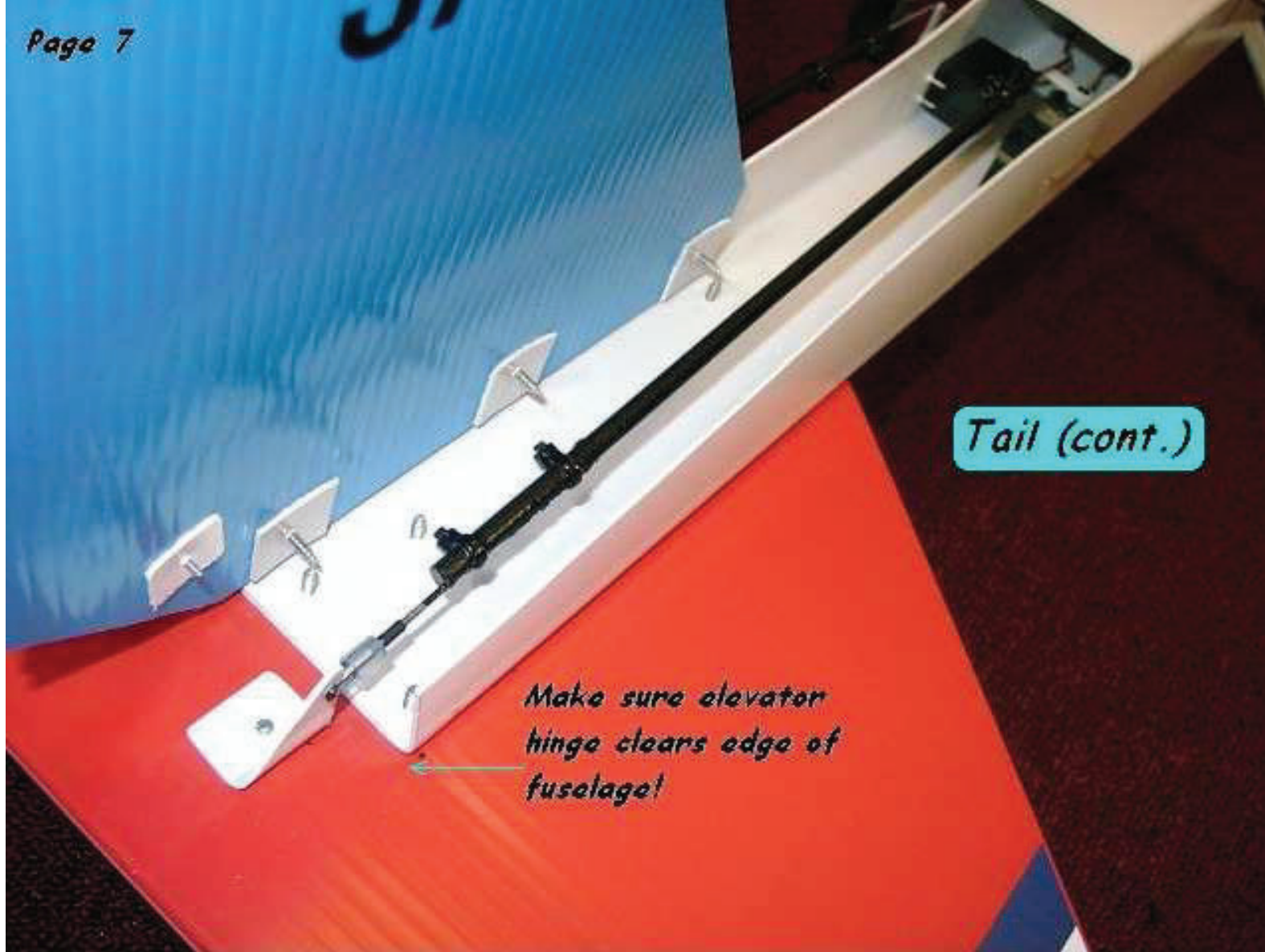
1. PVC Vertical mount doublers are 1" x 1"

2. PVC Control horn back plates are 3/4" x 3/4"

3. PVC control horns are 3/4" base x 1" long x 1" high.

4. Note push rods made from 1/4" dowels and zip-ties. They are fuel proofed with black model paint.

5. Note Rudder servo mounted with servo screws.

6. Note small screw securing control horns (also "flame" and use CA to glue them in place before adding screw and back plate)

7. Elevator servo is installed to fuselage side with double sided foam mopunting tape and a zip-tie.

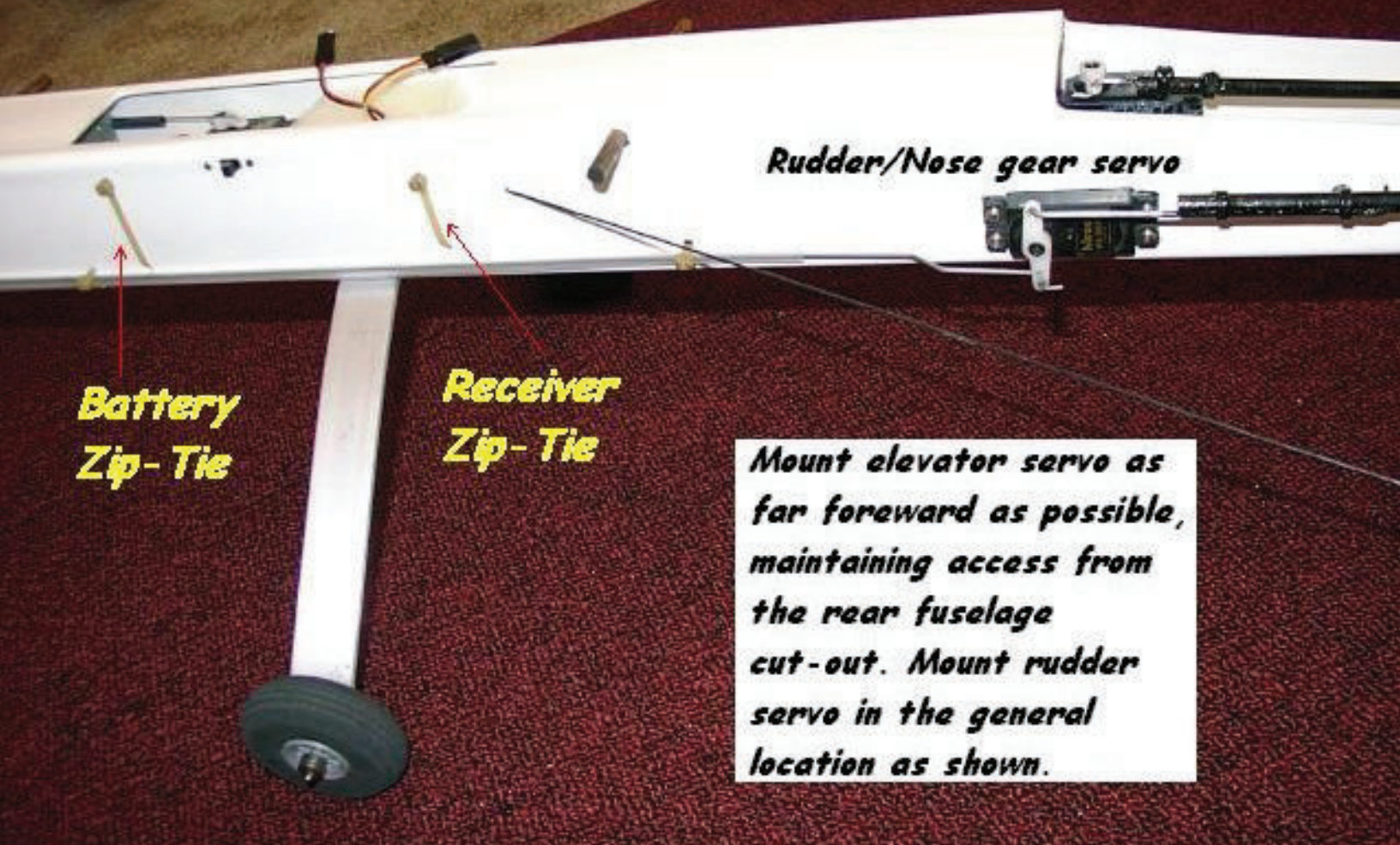*Tail (cont.)*

1. Note dowel used inside Coroplast flute for antenna anchor point.

2. Here is a good view of elevator servo mounted with double sided mounting tape and zip-tie.

3. Before mounting servos...MAKE SURE SERVO LEADS WILL REACH THE RECEIVER!!!

4. Antenna exits fuselage through small hole drilled directly behind reciever.

Landing Gear

15"
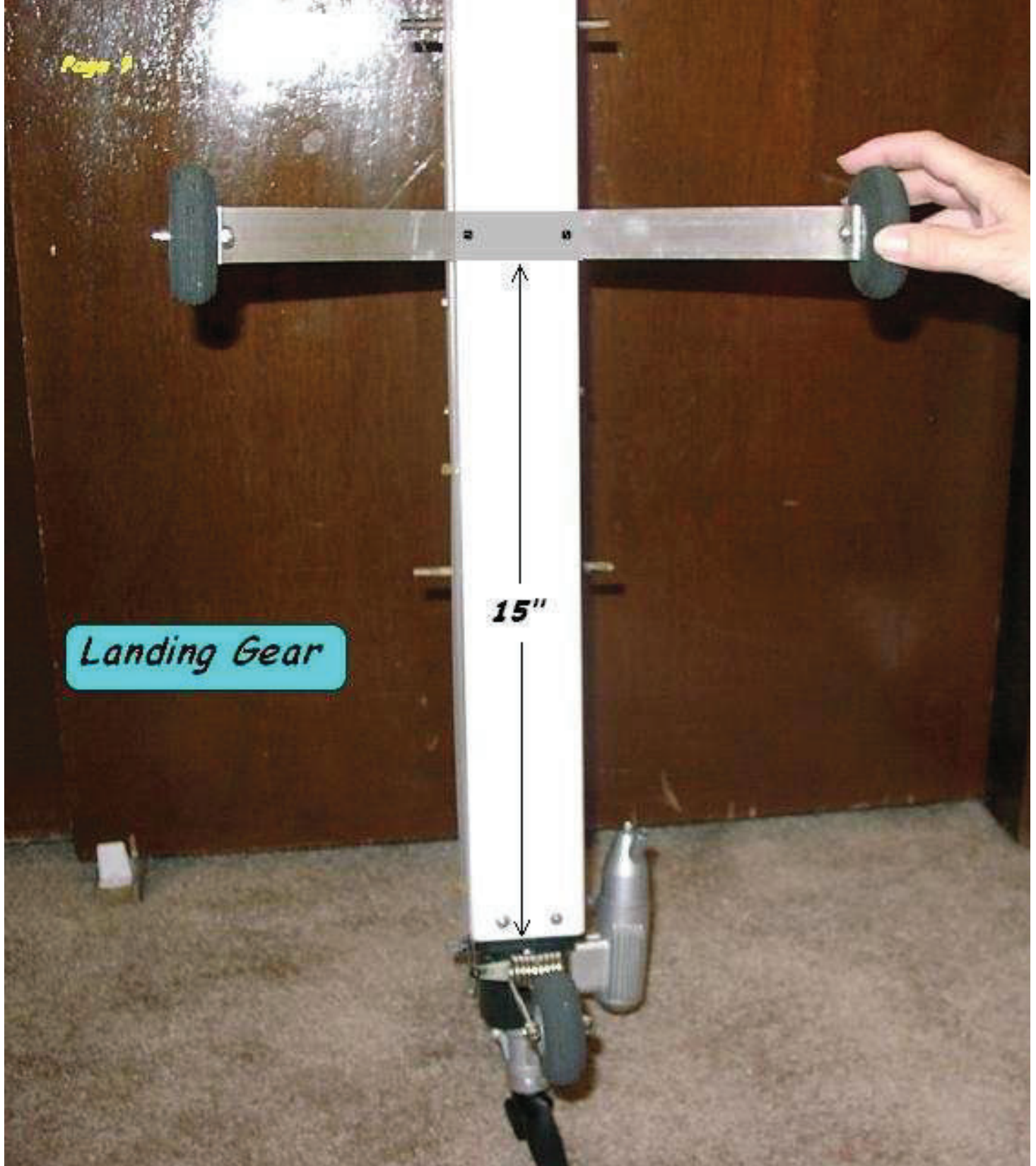
Mount the leading edge of landing gear 15" from front of fuselage. Duraplane landing gear was used on the prototype, and 3/16" plywood reinforcment was used inside the fuselage.

Rudder/Nose gear servo

Battery
Zip-Tie

Receiver
Zip-Tie

Mount elevator servo as far foreward as possible, maintaining access from the rear fuselage cut-out. Mount rudder servo in the general location as shown.

1. Cut hole in fuselage, and mount rudder /nose gear servo with servo screws. BEFORE COMMITING TO CUTTING THE HOLE, MAKE SURE SERVO LEAD WILL REACH RECIEVER.

Drill very small pilot holes for servo screws, so that they will self tap very tightly!

2. Note positioning of battery and receiver mounting zip-ties.

3. Nose gear stearing pushrod outer plastic tubing is simply zip-tied to the outside of the fuselage.

Throttle servo

Charge lead

Aileron servo lead
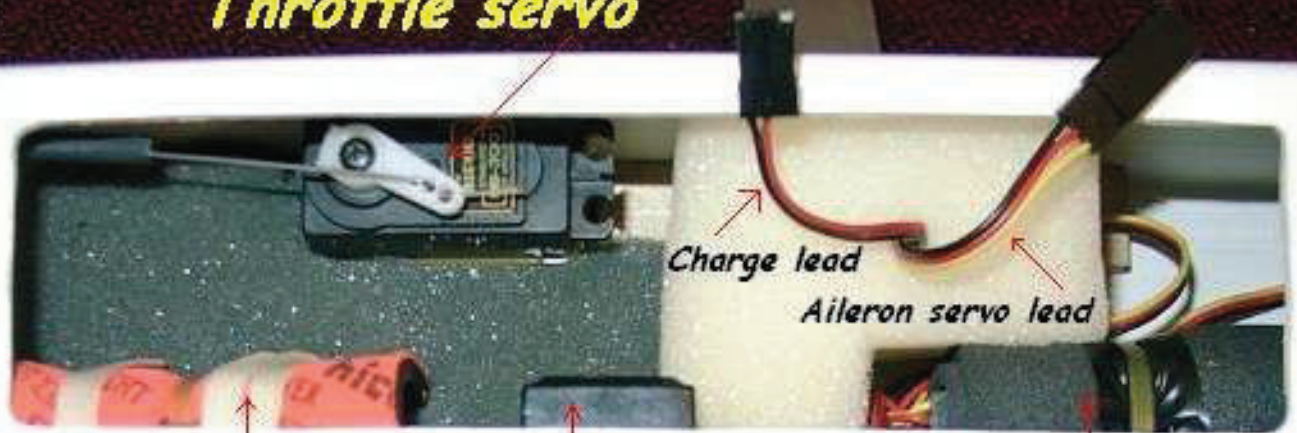
Battery

Switch

Receiver

Radio Installation (cont.)

1. Throttle servo is mounted to fuselage side with double sided foam mounting tape and a zip-tie.

2. Receiver and battery are wrapped in foam and mounted to fuselage side with a zip-tie.

3. Cut hole and mount switch conventionally.

4. Note foam scraps fill all voids for added crash protection of radio gear.

Firewall and Nose Gear

1. Nose gear push rod outer plastic tube is attached to outside of fuselage with zip-ties.

2. A pre-fabricated Dura-Plane firewall was used on the prototype, but a plywood firewall will work fine.

3. The prototype used a Great Planes 8 ounce fuel tank, wrapped in thin foam, and simply slid in place for a snug fit

4. When installing the firewall, use at least one self tapping screw per fuselage side (we used two per side on the prototype...which is more than enough!).

5. A 1/2" or 3/4" plywood firewall cut to the inside diameter of the fuselage and mounted flush will work fine. For a super strong firewall, laminate 1/2" plywood cut to the inside diameter of the pipe, to 1/8" ply cut to the outside diameter, to form a "stepped" firewall.

Just another reference photo

1. Note position of the throttle and Elevator servo zip-ties.

2. Helpfull hint: PVC gutterpipe likes to grab your drill bit when drilling holes! Be ready for this!

3. Helpfull hint: A Dremel stone works GREAT for cutting small holes such as the rudder servo and switch hole!

*Tattoo's old
Schwinn Bike*

Nose Gear Steering

1. Although a prefabricated Dura-Plane firewall/engine mount was used on the prototype, a plywood firewall and conventional engine mount and nose gear assembly will work fine. For help with this if you are unfamilure with these areas, please contact your local R/C club or hobby shop!

2. 2 1/2" wheels were used on the prototype

3. Note the "U-loop" used on the nose gear steering push rod at the steering arm... this absorbs impact shock, and helps prolong the life of your rudder servo!

4. Good view of holes drilled and nose gear steering pushrod outer casing installed with zip-ties.

Wing Spar

1. Build wing spar from two 30" pieces of yard stick. Use a 6" piece of yardstick to fabricate the dihedral brace and shape to fit.

2. You will need to make two spar assemblies.

3. The cheapy unfinished yardsticks will work fine! Try to get ones that are not too warped!
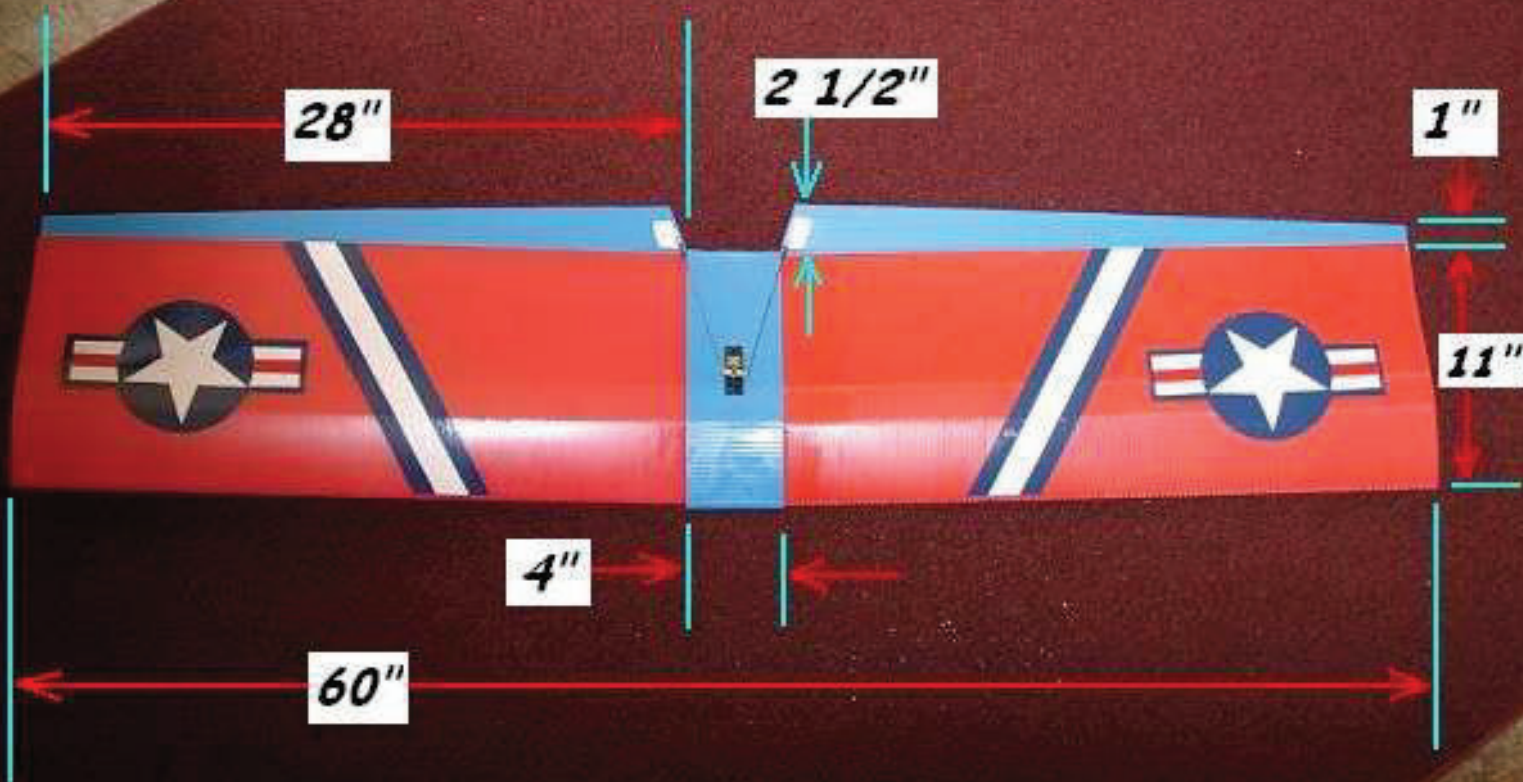
Setting Dihedral

A clean shop is a happy shop :)

5"

Shape dihedral brace and spar ends for 5" of dihedral

Setting Dihedral (cont.)

Glue dihedral brace in place
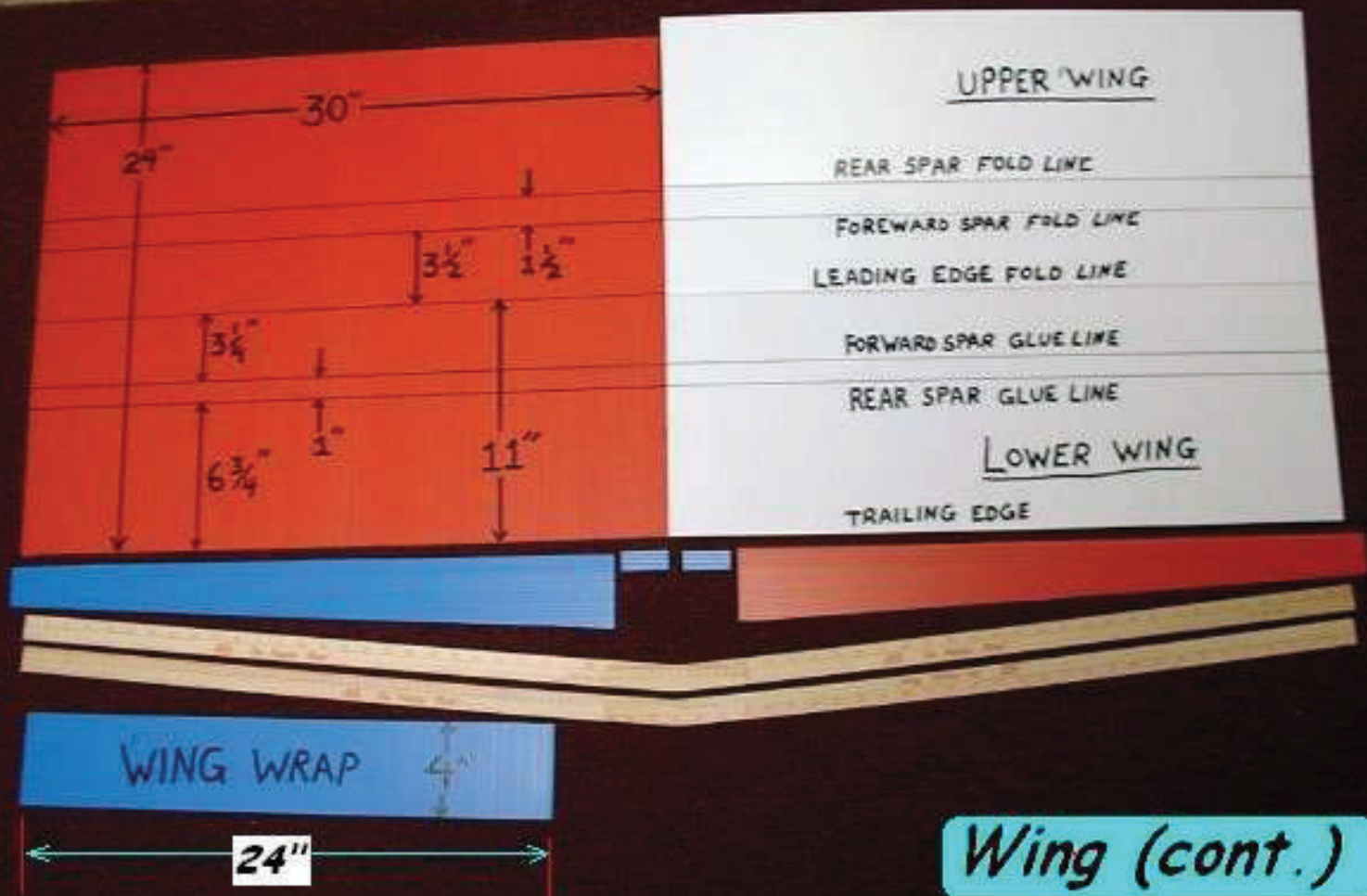using medium CA...don't forget
to make two spars!

Wing

1. When buying Coroplast, **KEEP IN MIND THAT THE AILERONS ARE 28" LONG WITH THE FLUTES RUNNING LENGTHWISE!!!**

2. The exposed dimensions of the ailerons are shown in this picture, there is one flute for the hinge **AND THREE FLUTES SANDWICHED INSIDE THE WING!!!**

3. Slightly taper the roots of each aileron as shown in the picture so they look cooler.

4. You will also need to make two PVC control horns as you did for the rudder and elevator.

1 1/2"

3 1/2"

6 3/4"

1"

3 1/4"

11"
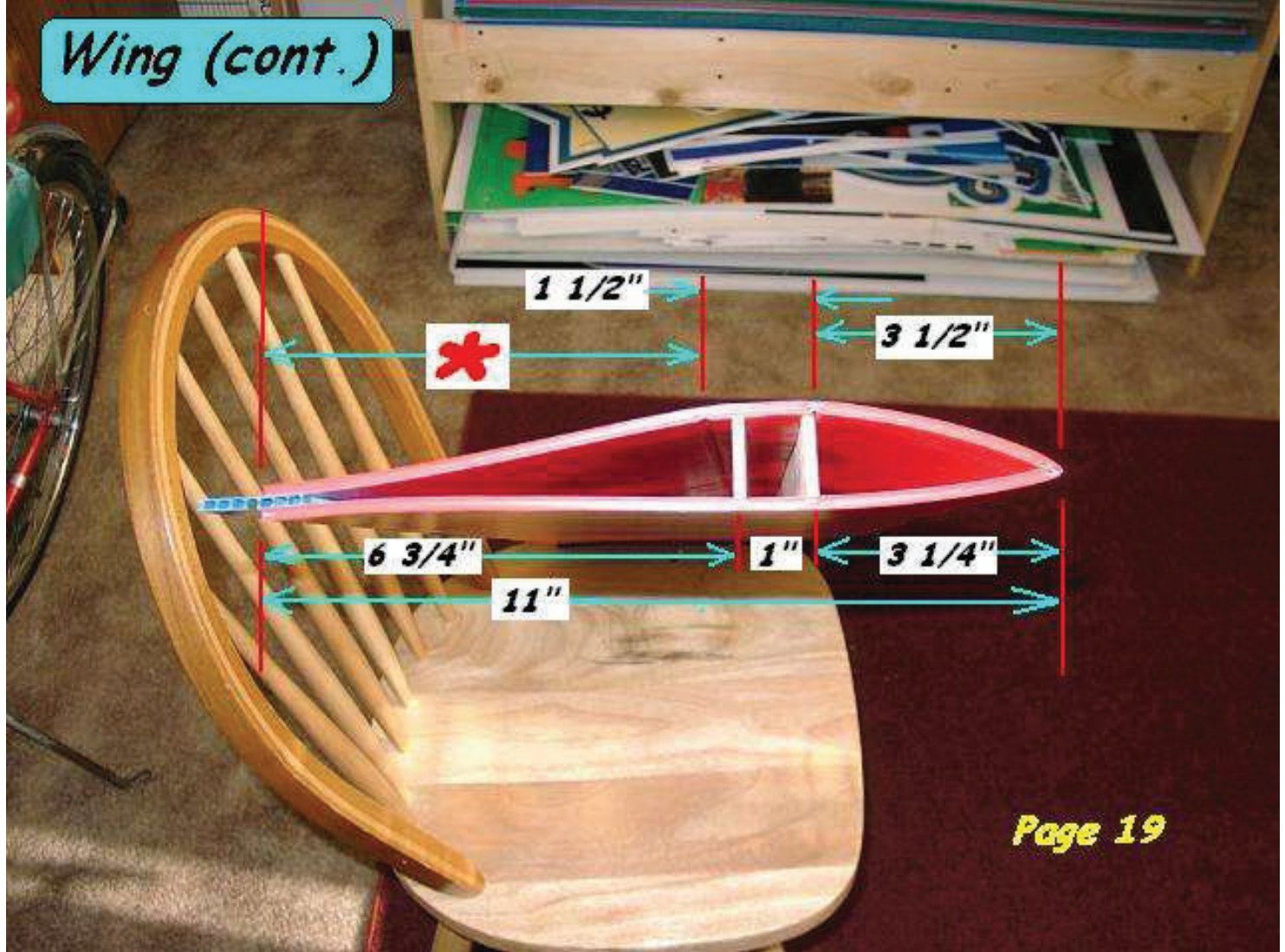
1. This picture will familurize you with how the wing will be folded. Note that the nature of the Coroplast will cause the leading edge to raise slightly when bending, giving you a slightly simi-symetrical wing...this is perfectly acceptible!

2. The ailerons are hinged just like you did the elevator and rudder...by cutting out one side of a Coroplast flute. WHEN GLUING THE AILERONS TO THE LOWER WING PANEL DURING ASSEMBLY, MAKE SURE THE HINGE HANGS CLEAR OF THE WING TRAILING EDGE!!!

* This dimension will be determined during test folding and trimming during the wing assembly procedure.

UPPER WING

REAR SPAR FOLD LINE

FOREWARD SPAR FOLD LINE

LEADING EDGE FOLD LINE

FORWARD SPAR GLUE LINE

REAR SPAR GLUE LINE

LOWER WING

TRAILING EDGE

WING WRAP

24"

Wing (cont.)

1. We are now ready to cut out all the wing parts and assemble your wing! Follow the steps on the following pages IN ORDER!!!

2. Note that the coroplast flutes run in the CHORDWISE direction on the wing panels, long ways on the ailerons, and SPANWISE on the wing wrap.

3. Note the small 2" long x 3 flutes wide Coroplast pieces used as filler between the ailerons.

4. Different colored wing panels were used for these photos for clarity between the wing halves.
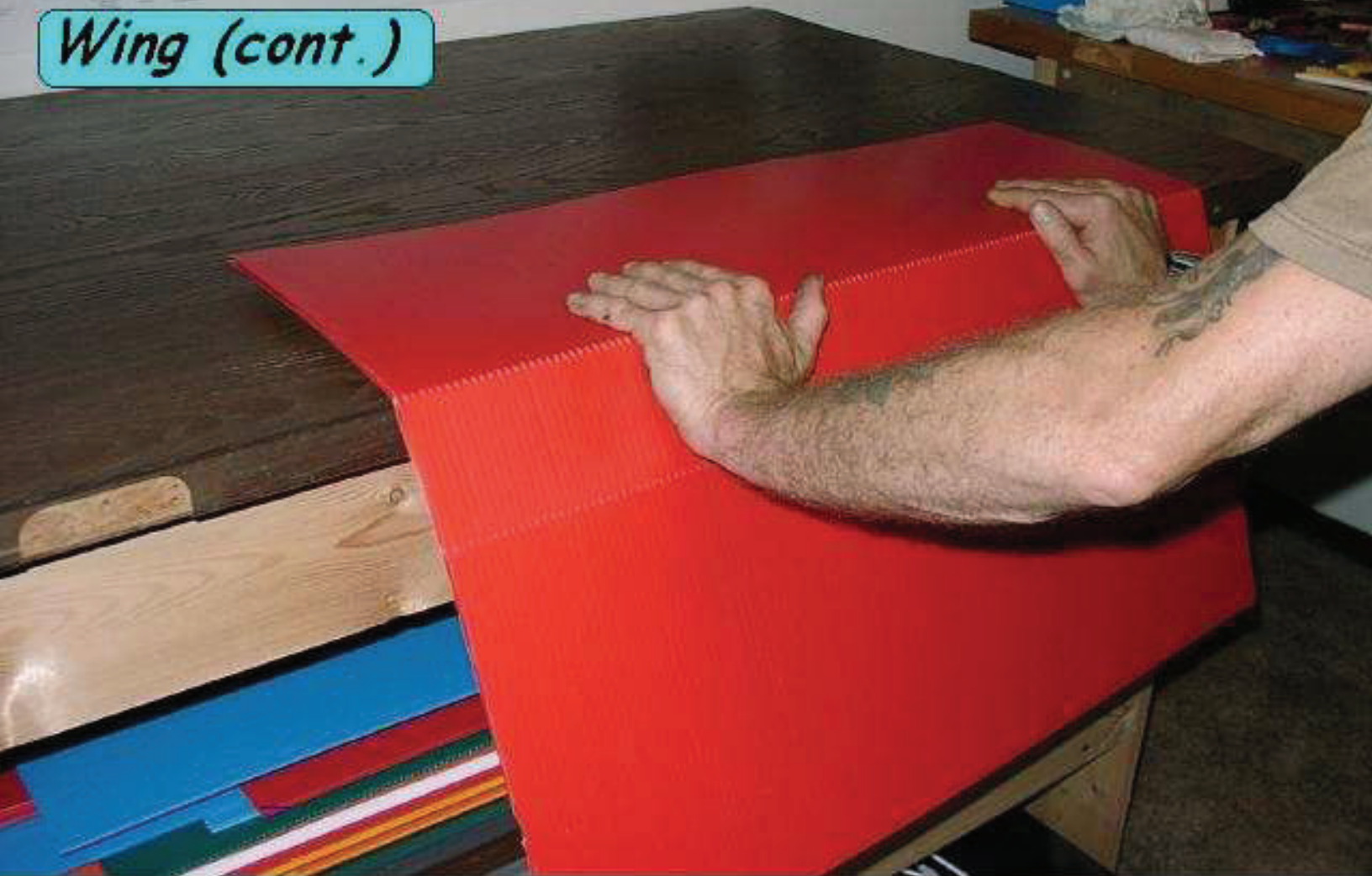
30"

24"
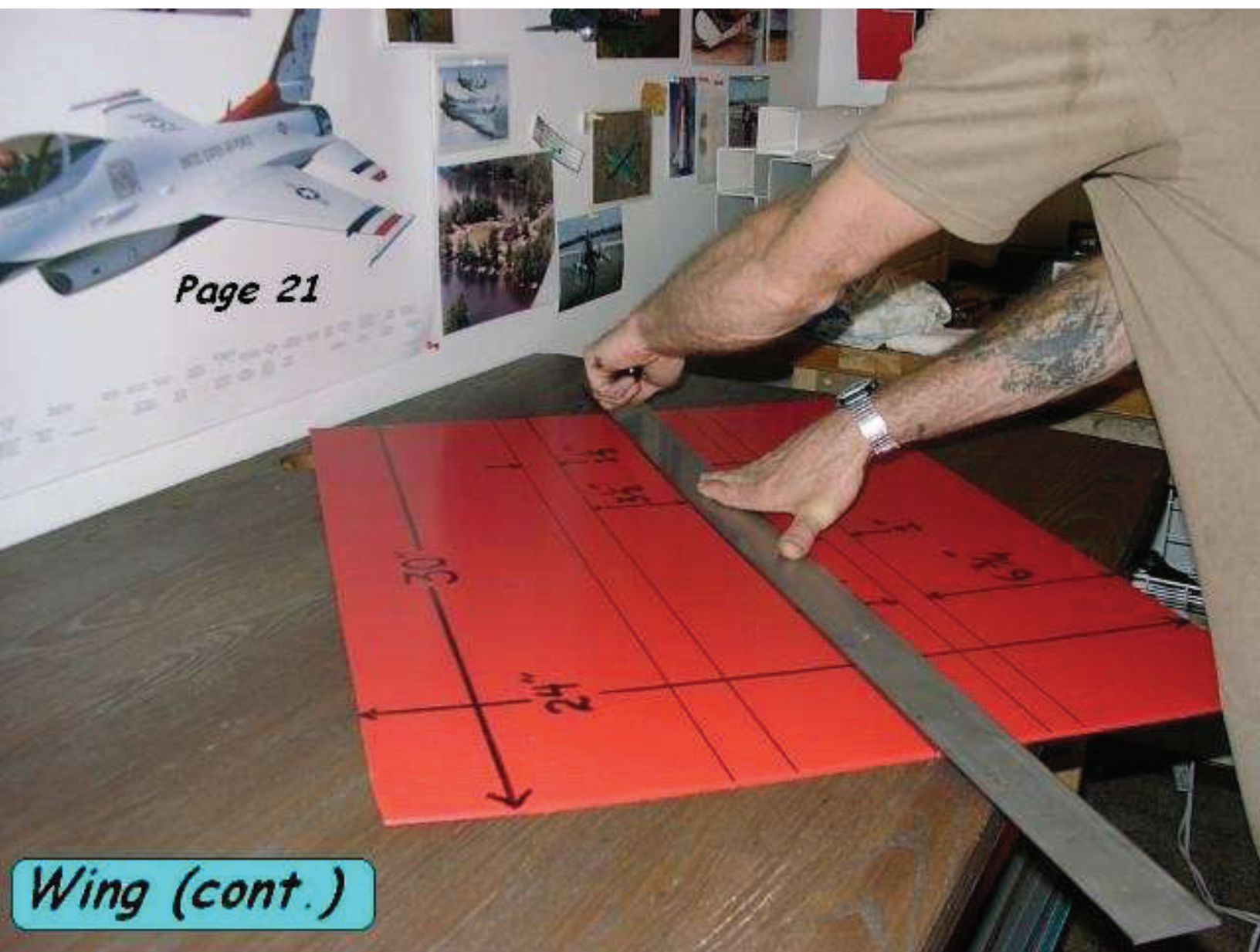
Wing (cont.)

Step 1. Using a straight edge and small blunt tipped object such as a #1 phillips head screwdriver, score the leading edge fold line, and both upper wing panel fold lines several times to weaken the inside layer of the coroplast flutes.

Wing (cont.)

Step 2. Flip the wing panels over, and using palm pressure, bend all fold lines along the edge of a table. Once the initial bends are done, pre-fold the wing panel in half along the leading edge fold line, to assure it will fold easily as you assemble the wing.

UPPER WING

FOLD LINE

FOREWARD SPAR FOLD LINE

LEADING EDGE FOLD LINE

FORWARD SPAR GLUE LINE

REAR SPAR GLUE LINE

LOWER WING

TRAILING EDGE

Wing (cont.)

Remember to clean the coroplast well, and flash all glue areas!!! There is very little indication of the manufacturing oils burning out of the plastic, but if the Coroplast starts to buckle slightly...it's a micro second away from melting!!! You may see a slight vapor shock wave, and slight discoloration and warping...the Coroplast will return to normal in seconds.

Step 3. Clean and Flash one wing panel for spar glueing.

Step 4. Glue both Spars to this wing panel on spar glue lines (a good bead of CA glue will work here)
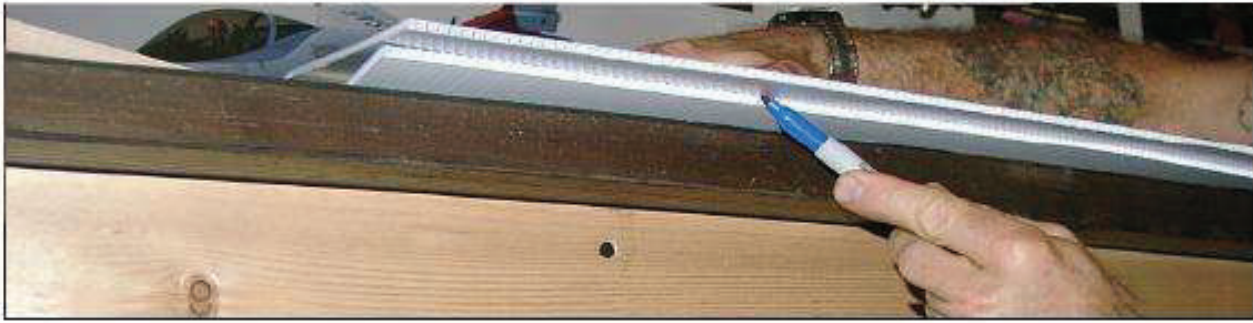
Step 5. Trial fold the top wing panel over spars and you will see that the top panel trailing edge hangs over the bottom trailing edge...mark the over hang, unfold and trim away the extra so that the trailing edges will be flush with each other.

Step 6. Clean and flash the aileron that goes with the wing panel you are building...don't forget the small filler piece too! Glue the aileron and filler piece to the lower trailing edge using medium CA. DO NOT USE TO MUCH GLUE... THIS IS THE BIGGEST MISTAKE MADE WHEN GLUING COROPLAST TO COROPLAST!!! TWO ROWS OF ONE DROP OF GLUE EVERY 1/4" TO 1/2" IS ALL THAT IS NEEDED!!! Your wing should now look like the photo below.

Wing (cont.)
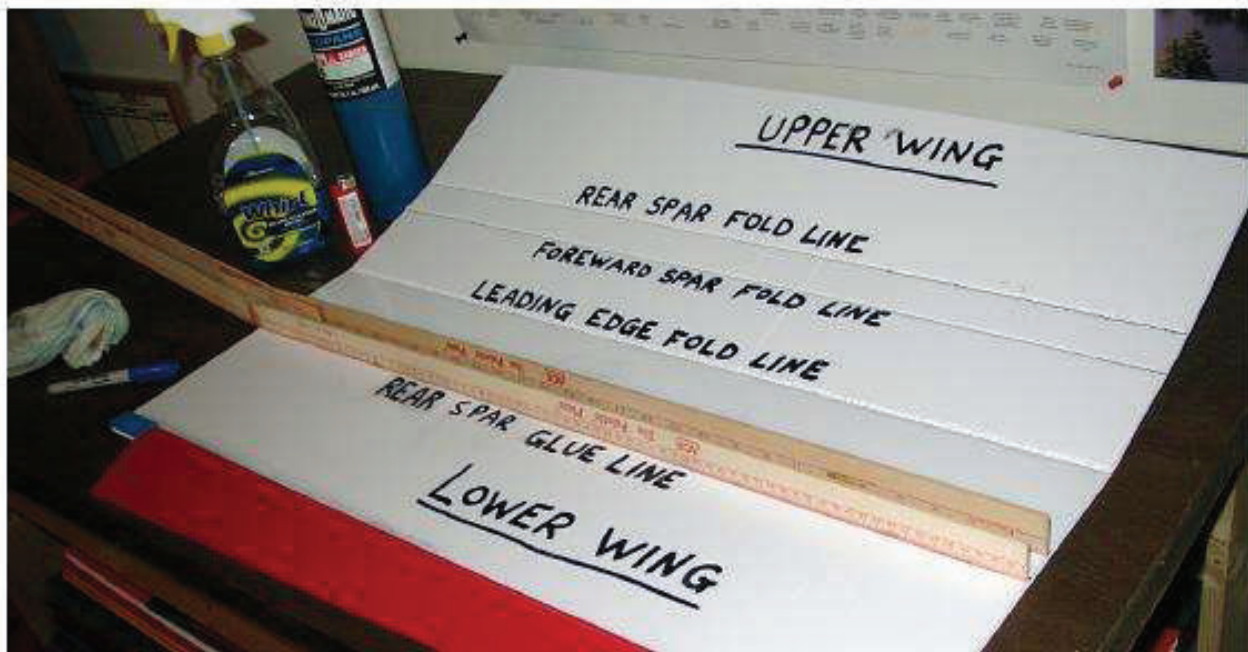
Step 7. Clean and flame the top side of the aileron (and filler), the upper wing panel trailing edge, and the area between the upper spar folds. Apply a bead of medium CA glue to the top of each spar, and two rows of glue dots to the top glue surface of the aileron (and filler). Fold the wing over and glue in place...try not to let the leading edge raise too much, but a little is ok. Notice that we used a 40 pound section of angle iron to weigh down the trailing edge. IT ALSO HELPS A LOT IF YOU CAN GET SOMEONE TO HELP YOU...4 HANDS ARE BETTER THAN TWO!!!

Wing (cont.)

Trim along this edge for proper dihedral fit.

30"

24"

3½" 1¼"

1"
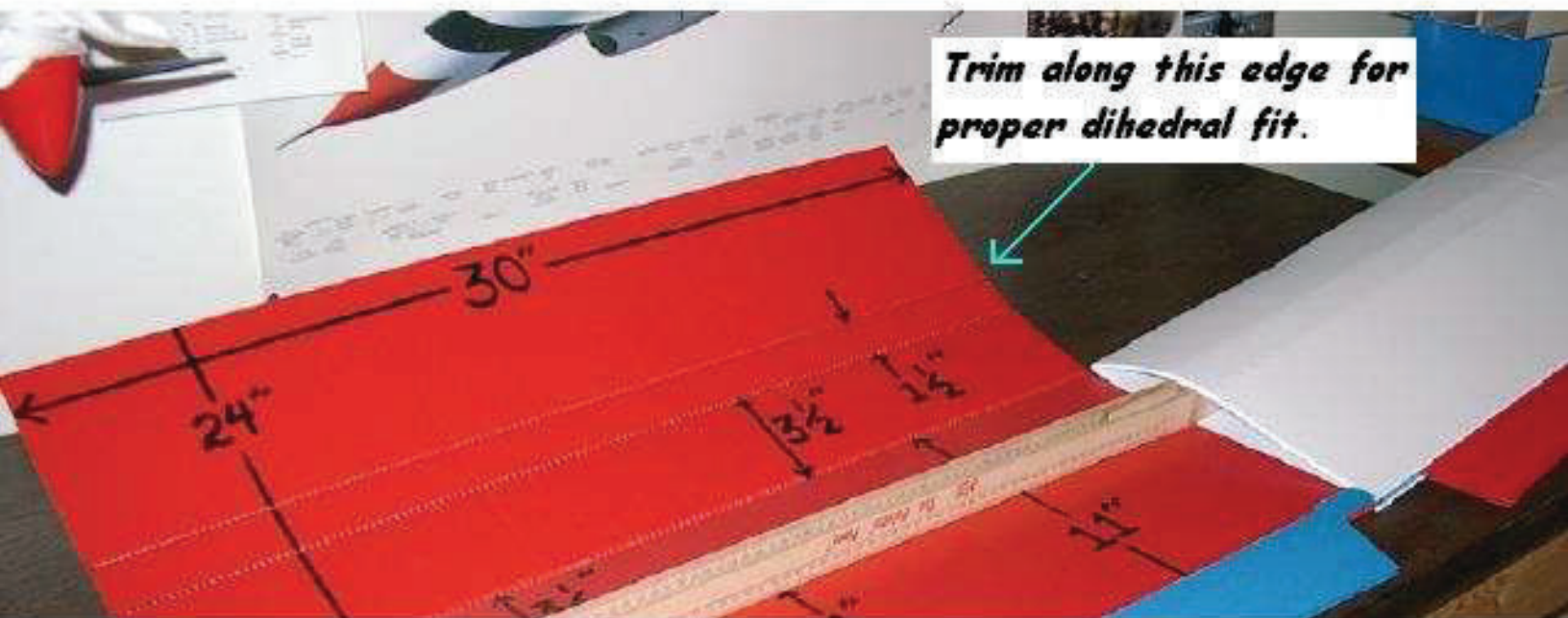
Step 8. With one wing half now done, clean, flame, and glue the spars down to the other wing panel. Test fold the wing, and you will find out that you will have to trim some material from the upper wing panel root to compensate for the dihedral...don't worry about making it look pretty, as it will be covered by the wing wrap! DON'T FORGET TO TRIM THE TOP PANEL TRAILING EDGE TO BE FLUSH WITH THE LOWER PANEL TRAILING EDGE BEFORE GLUING THE AILERON ON! Repeat all the steps to complete the second wing half.

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Step 9. Clean and flash the wing wrap and wing center area. Trial fit the wing wrap, and score and crease 3 flutes of the wing wrap for the leading edge fold. Trim the wing wrap to the correct length (to be flush with the trailing edge). Glue the wing wrap in place using a bunch of medium CA dots...it REALLY helps to have 4 hands here! Start on the bottom at the trailing edge, and make sure you get a good bond...especially on the lower wing, as this piece is what is holding your wing together during high G maneuvers! It is kind of tough to get this piece to form around the dihedral. Wrap it around the leading edge and glue to the top of the wing. Once the glue has set, install 5/32" dowels, or wood strips (made from scrap yardstick) in the wing wrap flute at the leading and trailing edges for rubber band crush protection.

Aileron Servo Installation

1. Make two PVC control horns, and install using PVC back plates and small screws like you did on the elevator and rudder. Notice how they are angled towards the aileron servo. Don't forget to flash and glue them in place too!

2. Using the servo, mark for the servo hole just aft of the rear spar. Cut this hole out for a snug fit, with the servo mounting tabs resting on the wing wrap. Cut a small hole in the bottom of the wing aft of the servo, for the servo lead to pass through.

3. Install the servo using a zip-tie and zip-tie doubler on the bottom of the wing. (See page 29)

Wing Bottom

1. Install the aileron servo using a Zip-tie doubler on the bottom of the wing made from scrap PVC. Drill the zip-tie holes to the width of the servo you are using.

2. You did it!!! Your Debonair is almost done! You can now tape, strap or rubber band your wing to the fuselage somehow, and move it fore and aft until your plane balances perfectly level when picked up by a finger tip under the FORWARD spar at each wing tip. Once happy with the balance, mark the leading and Trailing edge of the wing on the top of the fuselage. Measure 1/2" FORWARD of the LE mark, and 1/2" REARWARD of the TE mark, and this is where to install the 1/4" x 4 1/2" long wing hold down dowels.

Flying Your Debonair!

Sassy is all smiles after her first flight with the Debonair prototype!

1. Set all control throws for 3/4" travel each way (1 1/2" total)...make sure the rudder and nose wheel go the correct directions!

2. Install the wing with a minimum of 16 (8 per side) #64 rubber bands.

3. MAKE SURE THE AILERONS ARE RIGGED PARALLEL TO THE FUSELAGE AT NEAUTRAL WITH THE WING INSTALLED!!! THIS IS VERY IMPORTANT!!!

4. Follow all AMA safety regulations!

5. If you need more instructions than this on flying your plane, YOU ARE NOT READY TO TRY THIS BY YOUR SELF! Enlist the help of your local club and get a qualified instructor to check over your plane and teach you to fly it!

6. Have fun! That's what this is all about!!!