



## AVENGER

A good looking Sunday sport airplane that is simple to build and fly, but will excite novice or expert by its exceptional capabilities as an aileron trainer or a novice pattern ship.

**T**o design and build an airplane that is both eye appealing and flies well has always been a dream of mine. Well, one day I decided to do something about it. Chuck Cunningham's articles in the May, June, and July, 1979, issues of RCM, plus my formal aeronautical training, was an invaluable aid when I started to put some sketches on paper. Basically, I wanted a military looking aircraft because I have always had a soft spot for postwar military but found fan jets in models too complicated and hard on the pocketbook.

By trying different construction methods, I finally settled on one that I think is simple enough in its construction for most builders to succeed with. The aircraft is an excellent flier which will excite novice or expert alike. It does nice crisp aerobatics without the high speed that a lot of pattern ships have, yet floats in just like a trainer with no tendency to tip stall in the low speed range. I feel this would make an excellent novice pattern ship or a good aileron trainer. Now, that I have your adrenalin flowing let's start construction.

### CONSTRUCTION

#### Fuselage:

Okay, start by taking two sheets of



#### ABOUT THE AUTHOR

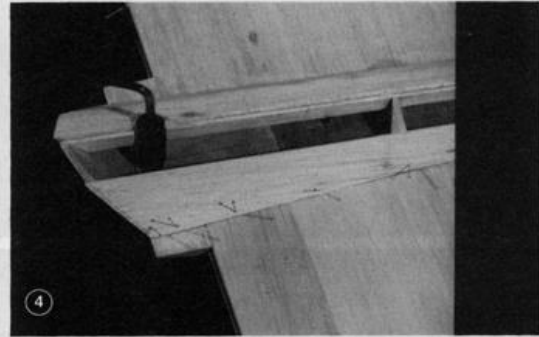
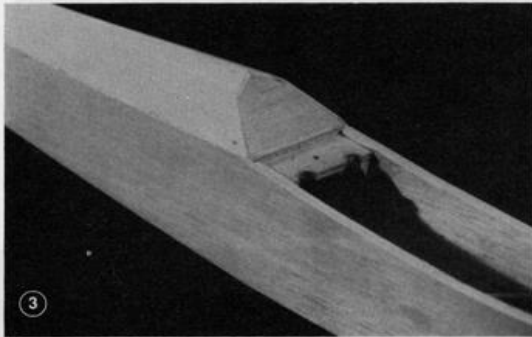
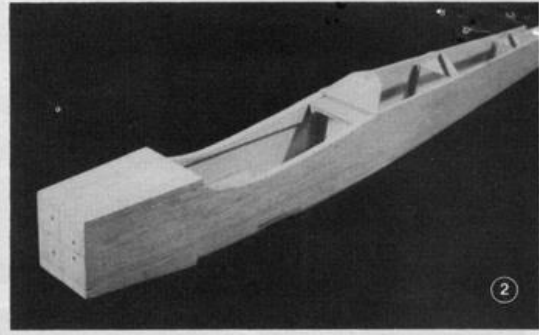
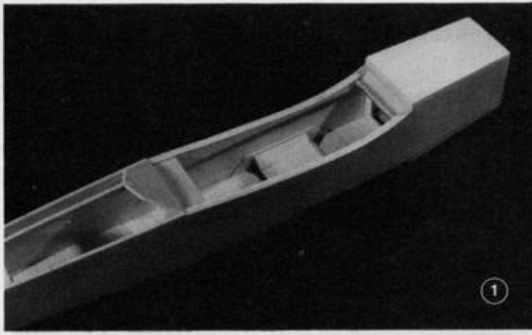
Born in Holland, April 13, 1950, Roy Looyenga immigrated to Canada in 1954. He has been active in aviation since 1957 when he got his first C/L trainer. In 1966 Roy graduated to full scale flying by obtaining his commercial pilots license and finding employment as a charter pilot and instructor. In 1977, his interest in models was rekindled when his wife gave him a M.R.C. R.T.F. Cardinal for Christmas (much to her regret now). Since then, Roy has become an active R/C'er with the Hub City Radio Control Club of Saskatoon.

3/16" x 4" x 48" balsa and cut out two fuselage sides. From the remaining scrap, cut out wing saddle doublers and glue the doublers to the sides. Remember to make a left and right side. While that is drying, cut bulkheads #2 and #3 from 1/8" plywood. Next, cut the firewall, wing hold-down blocks, and landing gear block. I usually construct these from two layers of 1/8" plywood, epoxied together with one running cross grain to the other for strength. However, you may use 1/4" ply if desired. Next glue 1/16" plywood doublers for the landing gear block to the fuselage, and add 1/8" x 1/4" balsa vertical strips to the inside of the fuselage for bulkheads F6 and F7.

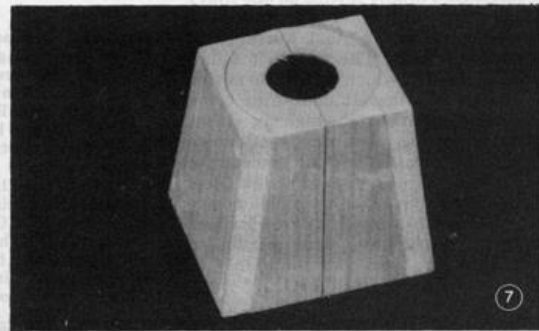
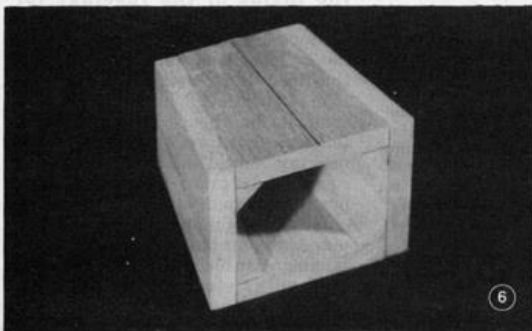
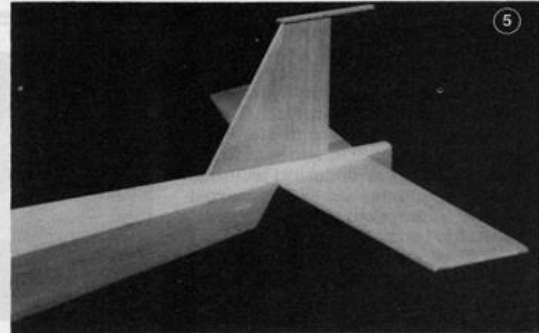
Assemble the fuselage inverted on a flat building board. Position and glue the firewall F2 and F3. Install the remaining 1/8" x 1/4" balsa to complete bulkheads F6 and F7 and tailblock (cut from scrap 3/16). After making sure that the fuselage is square and set up to your satisfaction, put it aside to dry.

When the fuselage is dry and still pinned to your building board, add the landing gear block complete with 1/2" triangular stock; balsa pieces of trailing edge stock to the rear of the firewall (F2); and pieces of 1/2"

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(1) Basic fuselage completed. Note the reinforcement for the landing gear mount. (2) Firewall has engine mounting holes drilled and blind nuts installed before assembly. (3) Close-up of rear wing hold-down plate. For one 1/4-20 nylon bolt. (4) Turtledeck being constructed on top of wing. Wing hold-down bolts have small cardboard access tube built in. (5) Fin and stab installed and turtledeck sheeting complete. (6) Cowl blocks ready to be tack glued in place and carved to shape. (7) Front of cowl blocks with 1/16" ply nose ring glued in place.





**LIST OF MATERIALS**

**Balsa:**

- (3) 1/16 x 4 x 36
- (10) 3/32 x 4 x 36
- (4) 1/8 x 4 x 36
- (2) 3/16 x 4 x 48
- (1) 1/4 x 4 x 36
- (1) 3/8 x 2 x 36
- (1) 3/8 x 4 x 36
- (1) 1/2 x 4 x 36
- (2) 3/16 x 3/16 x 36
- (4) 1/4 x 3/8 x 36
- (2) 1/4 x 5/8 x 36
- (2) 1/4 x 1/2 x 36
- (1) 1/4 x 1/4 x 36
- (1) 1/2" Triangle
- (2) 5/16 x 1/4 x 36 T.E. Stock

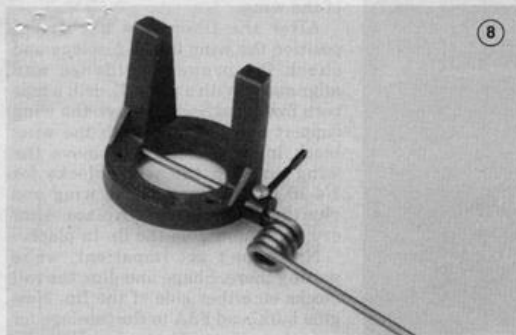
**Plywood:**

- 1/16 x 4 x 12
- 1/8 x 12 x 12

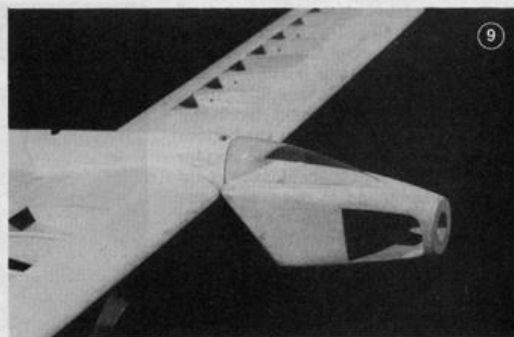
**Hardware:**

- 1-Kraft Motor Mount
- 1-5/32" Nose Gear Strut
- Dural Landing Gear
- Aileron Torque Rods
- 1-11" Sig Canopy
- 6-6-32 Blind Nuts
- 6-32 x 3/4 Bolts
- 2-DuBro Wing Bolts
- 1-Pair Axles
- 3-Wheels (3")
- 1-Fuel Tank (size according to engine)
- 2-Control Horns
- Wheel Collars
- Steering Arm
- Spinner

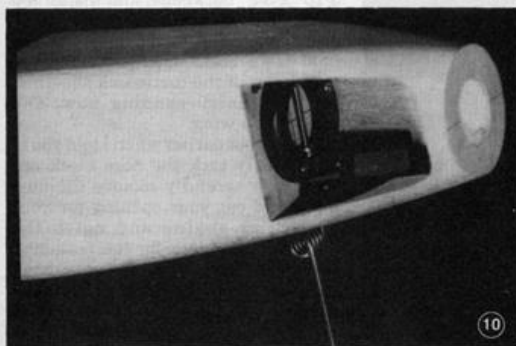
By Roy Looyenga



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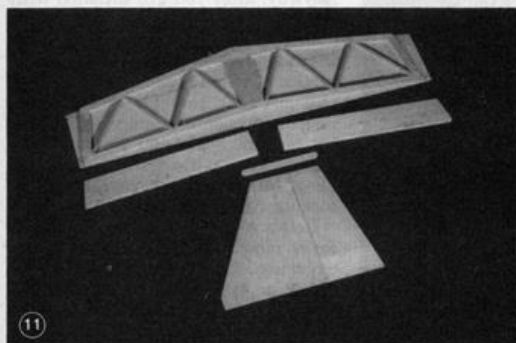


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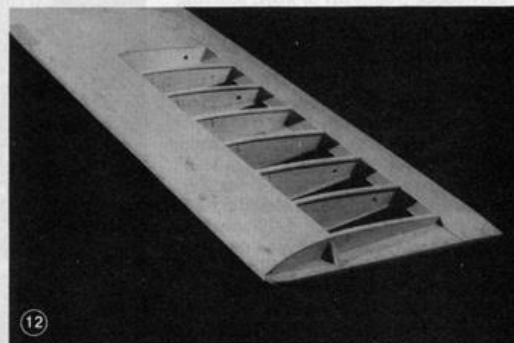


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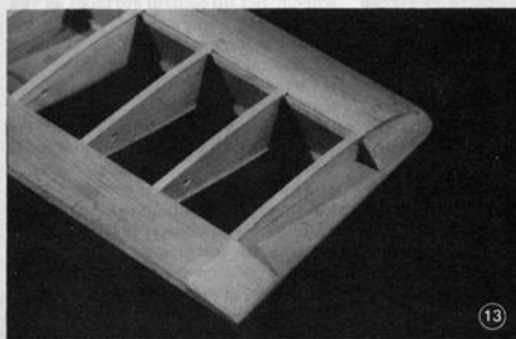
(8) Kraft engine mount drilled for nose gear wire. Engine mounted horizontal. (9) Avenger nearly completed with rear portion of Sig 11" canopy fitted. (10) Close-up showing Kraft mount installed. (11) View of tail surfaces. Built-up stab with sheet top and bottom make light and strong stab. (12) Completed wing using "D" tube construction. (13) Close-up of wing tip. (14) Leading edge of wing showing 1/8" plywood wing hold-down plate.



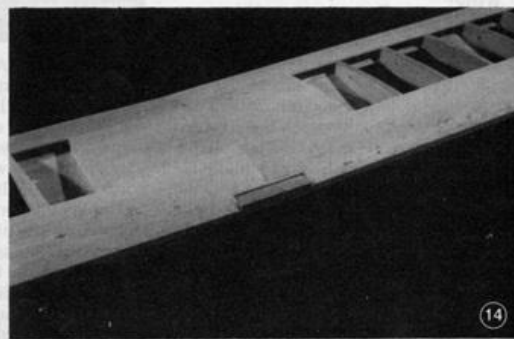
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triangular stock to the front of bulkhead F3. Glue 1/2" x 3/8" pieces of balsa block between the firewall and F3 bulkhead on the bottom of the fuselage (these are for shaping later). Now add 1/2" x 4" sheet from the firewall to bulkhead F3 on the bottom of the fuselage. Complete the bottom by gluing 1/8" balsa sheet cross grain from F3 bulkhead to the rear of the fuselage. The fuselage may now be removed from the building board and the Du-Bro (or similar) landing gear may be positioned and drilled through the landing gear and block. Then install the blind nuts.

Next drill holes from the motor mount fuel lines, and the nosewheel steering cable, and install blind nuts where needed. Glue 3/8" x 4" top block in place from the firewall F2 to F3 bulkhead. The nose block is constructed separately with four pieces of 1/4" x 4" balsa with 1/16" ply nose ring F1 and 1/2" triangular stock in the corners for shaping later. Do not attempt to shape or cut any access holes in the nose block at this time. After the nose block is completed, temporarily attach it to the fuselage with a couple of drops of Hot Stuff or the equivalent. Glue the 1/4" wing hold-down blocks and the 1/4" triangular support. Now, glue the turtledeck bulkheads F3B, F4 and F5A in place along with the 3/16" x 3/8" backbone. Sheet the turtledeck from F3B to F5A, starting with the bottom sheeting and adding the top sheeting later. Set the fuselage aside while we build the empennage.

#### Empennage:

Construct the horizontal stab directly over the plan using 1/4" x 1/2" and 1/4" square balsa. After the frame is dry, sheet both sides with 1/16" balsa. Cut the elevators from 3/8" sheet and shape. (Note: elevators are not joined.) Glue the 1/4" sheet to make the fin and rudder as one unit with grain as shown. When dry, separate the rudder and sand to shape. The rudder top plate is cut from 1/8" plywood. Rough sand fin, stab, and fuselage to shape and put aside while we build the wing.

#### Wing:

The wing utilizes standard construction with the following specifications and construction notes: All ribs are identical except for half ribs in the center section with 1/16" vertical webbing between the ribs. All spars are 1/4" x 3/8" balsa. Ribs, capstrips and sheeting are all 3/32" balsa.

Install the strip ailerons and the linkage in the usual manner. The only different part about this wing is the half ribs in the center section to support the front wing hold-down block; check plan for particulars.

When assembling the wing panels,



### AVENGER

Designed By: Roy Looyenga

#### TYPE AIRCRAFT

Sport

#### WINGSPAN

58 Inches

#### WING CHORD

11 1/4 Inches

#### TOTAL WING AREA

667 Sq. In.

#### WING LOCATION

Shoulder Wing

#### AIRFOIL

Symmetrical

#### WING PLANFORM

Constant Chord

#### DIHEDRAL EACH TIP

1/2 Inch

#### O.A. FUSELAGE LENGTH

49 1/4 Inches

#### RADIO COMPARTMENT AREA

(L)12" x (W)3" x (H)2 1/4"

#### STABILIZER SPAN

24 Inches

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

6 1/4 Inches (Avg.)

#### STABILIZER AREA

150 Square Inches

#### STAB AIRFOIL SECTION

Flat

#### STABILIZER LOCATION

Mid Fuselage

#### VERTICAL FIN HEIGHT

7 1/4 Inches

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

6 1/4 Inches (Avg.)

#### REC. ENGINE SIZE

.45 — .60 Cu. In.

#### FUEL TANK SIZE

10 — 16 Oz.

#### LANDING GEAR

Tricycle

#### REC. NO. OF CHANNELS

4

#### CONTROL FUNCTIONS

Rud., Elev., Throt. & Ail.

#### BASIC MATERIALS USED IN CONSTRUCTION

Fuselage .....	Balsa & Ply
Wing .....	Balsa & Ply
Empennage .....	Balsa
Wt. Ready To Fly .....	88 Oz.
Wing Loading .....	19 Oz./Sq. Ft.

put 1/2" dihedral under each tip.

After the wing is joined, should you plan on installing rockets on your ship, pick out some hard 3/32" balsa and glue between the ribs on the bottom as shown on the plans, then install 4/40 blind nuts. Install 1/8" plywood blocks both front and rear as shown on the plans. Wing tips are cut from 3/16" balsa and glued on; support the tips with a balsa gusset as shown. Fill in the trailing edge of the tip with scrap balsa and sand to shape. Don't forget to fiberglass the center section

of the wing.

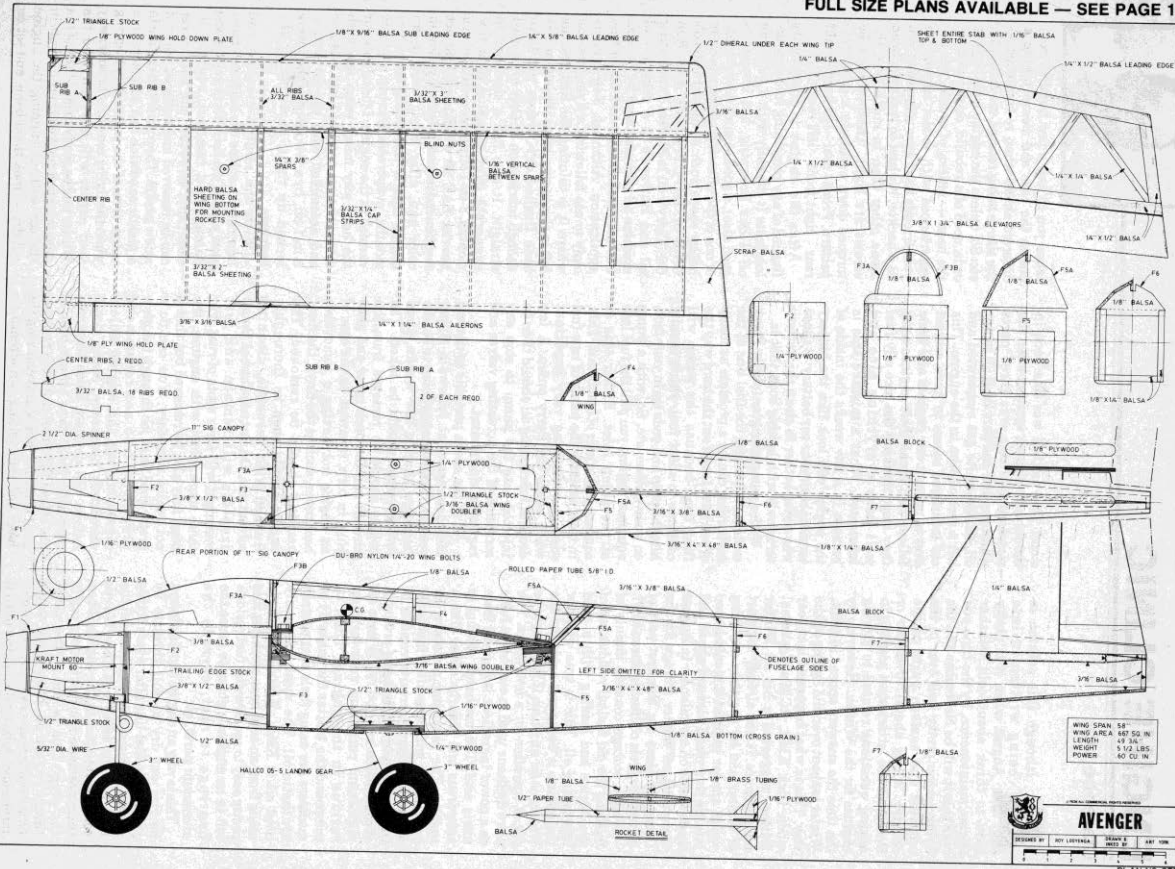
After the fiberglass has dried, position the wing in the fuselage and check for proper incidence and alignment. With a #9 drill, drill a hole both front and back through the wing support and down through the wing block in the fuselage. Remove the wing and tap the wing blocks for 1/4-20 bolts. Remount the wing and glue the horizontal stab in place. After dry, align and glue the fin in place.

Now, don't get impatient, we're getting there. Shape and glue the tail blocks on either side of the fin. Now glue bulkhead F3A to the fuselage for canopy support. Then glue F3B, F4 and F5A to the wing, install 3/16" x 3/8" backbone, and install top sheeting to the turtledeck. Drill holes and install the guide tube for the hold-down bolt. When dry, add the remainder of the turtledeck sheeting. Do your finish sanding now, and remove the wing.

Remember earlier when I told you to temporarily tack the nose block on? Well, now carefully remove the nose block and cut your opening for your particular engine and notch the bottom of the block for the nose gear clearance. Now is the time to install the nose gear and linkage to make sure everything works.

After the nose block is reinstalled, you find the engine compartment very cramped for fixing up sloppy linkages. Anyway, after you are satisfied with the fit of the engine, hoses and linkages, you can permanently glue the nose block in place. Take the rear portion of a Sig 11" canopy and cut it to the correct length. I built an instrument console and ejection seat out of 1/16" balsa and painted them flat black. This, along with a Williams Bros. Military pilot, completed my cockpit; finish yours as desired.

Being a naturally lazy person, I cover most of my models with film covering. The Avenger, being no exception, was done all white with Air Force decals. The rockets were given two coats of K & B white epoxy with model rocket decals. Install the radio, pushrods, fuel tank, landing gear, and wheels. Set up control surfaces as you would for any sport model. Test flights should be no problem as the model is not critical to fly. Just be sure the C.G. is correct and that you have a reliable power plant. With my Webra Blackhead .60, it has lots of power for vertical maneuvers and aerobatics. It is meant to be a sport flier so go out and have fun with it. If properly cared for your Avenger should give you many hours of enjoyable flying. Don't be afraid to send pictures or write me if you have any questions. Roy A. Looyenga, 2401A Melrose Avenue, Saskatoon, Saskatchewan Canada, S7J 0V4. □



WING SPAN 58"  
 WING AREA 687.52 IN.  
 LENGTH 49 IN.  
 WEIGHT 5 1/2 LBS.  
 POWER 60 CU IN.

**AVENGER**

DESIGNED BY: JOE LUTHEMANN    DRAWN BY:    SCALE:    1/8" = 1"

PLAN NO. 853