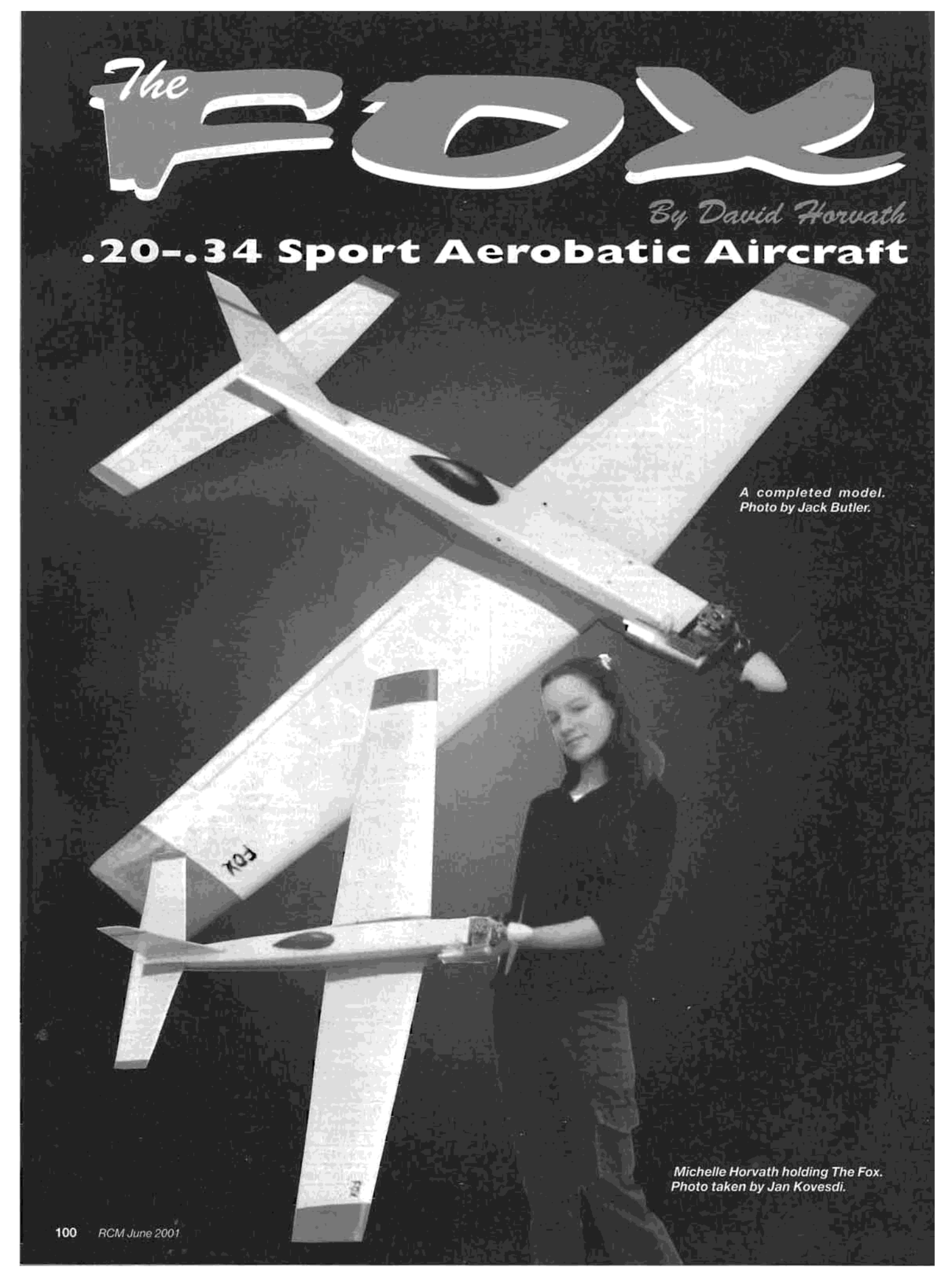
The FOX

By David Horvath

.20–.34 Sport Aerobatic Aircraft



A completed model. Photo by Jack Butler.

Michelle Horvath holding The Fox. Photo taken by Jan Kovesdi.

THE FOX

Designed by:
Dave Horvath

TYPE AIRCRAFT
Sport

WINGSPAN
51 Inches

WING CHORD
8 Inches (Avg.)

TOTAL WING AREA
405 Sq. In.

WING LOCATION
Low Wing

AIRFOIL
NACA 0012 Symmetrical

WING PLANFORM
Double Taper

DIHEDRAL, EACH TIP
1-5/16 Inches

OVERALL FUSELAGE LENGTH
34-3/4 Inches

RADIO COMPARTMENT SIZE
9-1/2" (L) x 2-1/4" (W) x 2-1/4" (H)

STABILIZER SPAN
20 Inches

STABILIZER CHORD (inc. elev.)
4-3/16 Inches (Avg.)

STABILIZER AREA
84 Sq. In.

STAB AIRFOIL SECTION
Flat

STABILIZER LOCATION
Mid-Fuselage

VERTICAL FIN HEIGHT
6-1/4 Inches

VERTICAL FIN WIDTH (inc. rud.)
5 Inches (Avg.)

REC. ENGINE SIZE
.20-.35 Cu. In. 2-Stroke

FUEL TANK SIZE
4-6 Oz.

LANDING GEAR
Optional

REC. NO. OF CHANNELS
3

CONTROL FUNCTIONS
Aileron, Elevator, Throttle

SIDETHRUST
0°

DOWNTHRUST/UPTHRUST
0°

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, Lite Ply & Ply
Wing	Balsa, Spruce & Ply
Empennage	Balsa
Wt. Ready To Fly	48 Oz. (3 Lbs.)
Wing Loading	17 Oz./Sq. Ft.

Michelle Horvath holding her Father's new model, photo taken at the Arboretum in Arcadia, California.

The Fox is a fast aerobatic sport plane designed for .20-.34 size 2-stroke engines. Construction is conventional, the basic building materials are balsa, plywood, and spruce. The 51" wingspan double tapered low wing model has a 405 sq. in. wing area, and employs an NACA-0012 symmetrical airfoil section set at 0° incidence. Dihedral is 6°, that is 3° per wing panel. Dry weight is 45 to 48 ounces, and the wing loading is a moderate 17 ounce/square foot.

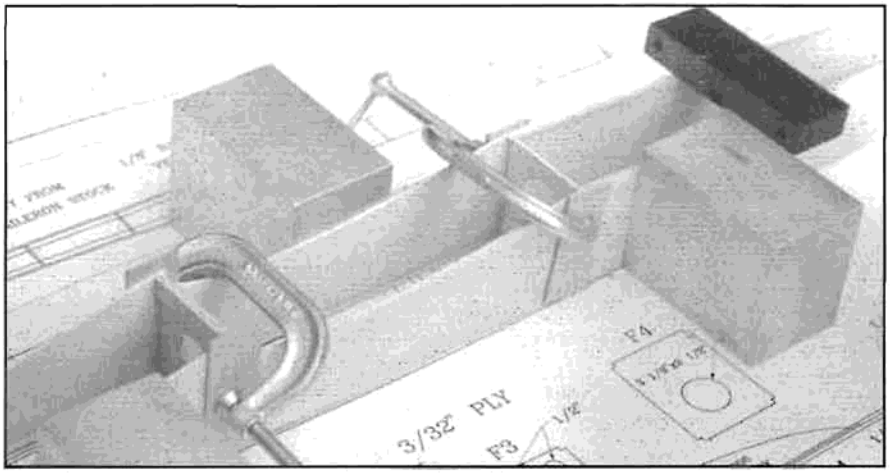
This model requires a three channel control for throttle, ailerons, and elevator. The battery pack, receiver, and servos are standard, no dual rate, mixing or exponential control is needed. To build this model from scratch takes 40 to 50 hours of construction time. Top speed is 100+ mph with a 10% nitro fuel.

Every airplane design is a compromise, and this one is no exception. The basic principle of physics tells us that drag is a square function of velocity, this simply means that every time speed is doubled, the drag is squared. For this reason the landing gear was replaced with a simple skid arrangement. To further reduce drag and weight, rudder control was omitted. The fuselage cross section is just large enough to enclose the standard radio gear.

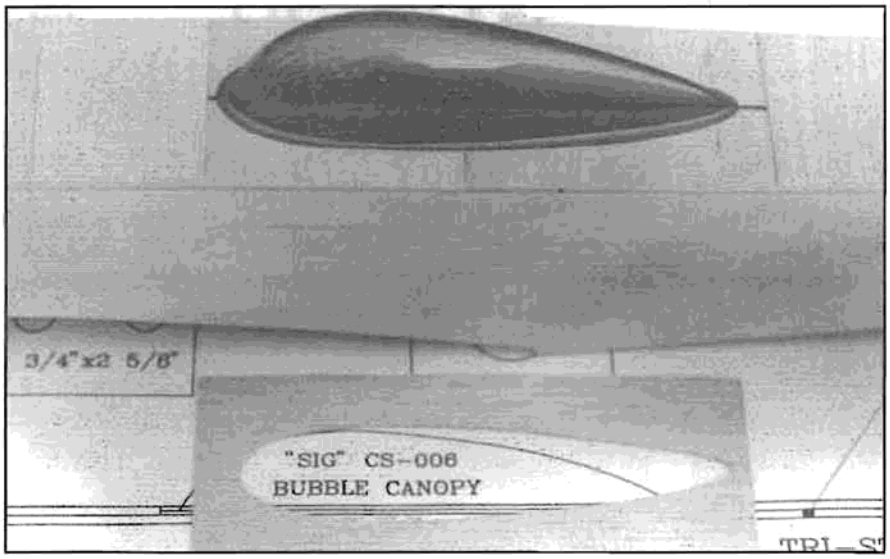
The usual chocolate bar wing planform was slightly stretched and tapered and all this definitely makes a difference in the model's speed and maneuverability. Further advantages are reduced drag, reduced weight, reduced building time, runway independence that eliminates cross wind disasters, no jumping act during landing, no busted landing gear, and fuel savings.

CONSTRUCTION

A careful balsa selection for this project is not needed. A medium or medium-hard balsa will do. Make sure all parts fit well and the glue joints are good. I use Elmer's Carpenters wood glue for general assembly and slow setting epoxy for high stress areas. I feel that a step-by-step construction sequence is not needed since this design is elementary. For those modelers flying from a paved runway, this model can be built with optional



Start the fuselage assembly with formers F2 and F4.



The canopy base is sandwiched between 1/16" fuselage top and the 1/16" balsa sheet.

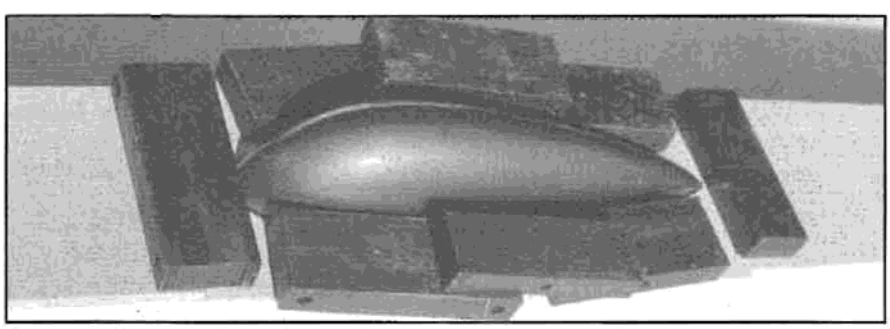
landing gear as shown on the plan. I recommend that only experienced pilots consider this project.

Wing:

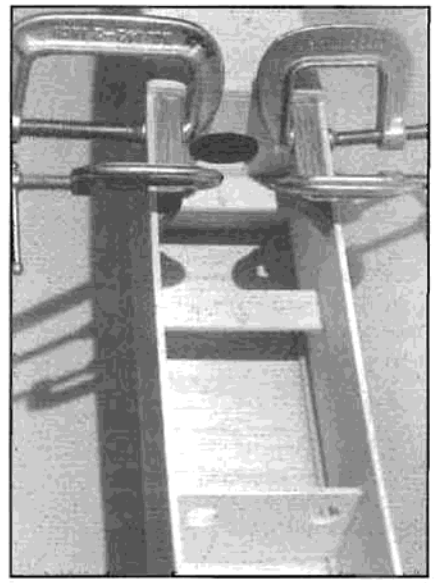
The wing has a "D" tube structure with capstrips and trailing edge sheeting. Cut templates from aluminum sheet. When using a sandwich method we usually end up with short ribs, for this reason cut the balsa strips 1/4" longer at each end, then trim the ribs during assembly.

Stack eleven pieces of 1/16" medium balsa strips between the templates, bolt the stack together and block sand to final shape. Carefully cut the spar notches with a razor saw before taking this assembly apart. Make a right and left set of ribs so the edges of ribs will taper outward. The wing panels are built right side up over the plan.

Lay the ribs over the bottom spar. Glue ribs #3 through #11 in place, adding shear webs, then the top spar. Make sure the shear webs fit well and that their grain is vertical. Join the wing panels with plywood dihedral braces using slow setting epoxy, then install the leading edges, the trailing edges, and the center ribs.



Canopy installation. Use a slow setting epoxy for this assembly.



The installation of wing bolt blocks. Use slow setting epoxy here.

Bill Of Materials

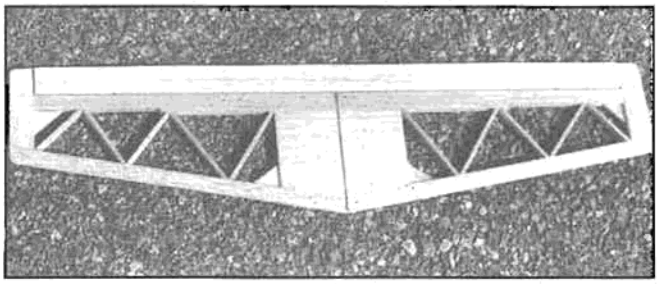
4 — 1/16" x 1/4" x 36" — Balsa Stick
3 — 1/8" Sq. x 36" — Balsa Stick
2 — 1/8" x 1/4" x 36" — Balsa Stick
1 — 1/4" Sq. x 36" — Balsa Stick
2 — 1/4" x 1/2" x 36" — Balsa Stick
1 — 1/4" x 3/4" x 36" — Balsa Stick
2 — 3/8" x 1/2" x 36" — Balsa Stick
3 — 1/4" x 1" x 36" — T.E. Stock
2 — 5/16" x 1-1/4" x 36" — T.E. Stock
6 — 1/16" x 4" x 36" — Balsa Sheet
2 — 1/8" x 4" x 36" — Balsa Sheet
1 — 1/4" x 3" x 36" — Balsa Sheet
1 — 1/4" x 1/4" x 36" — Tri-Stock
1 — 1/4" Dowel 3"
4 — 3/16" Sq. x 36" — Spruce
1 — 1/8" x 12" x 48" — Lite Ply
1 — 1/16" x 6" x 12" — Plywood
1 — 3/32" x 6" x 12" — Plywood
1 — 3/8" x 3/8" x 18" — Hard Maple

Hardware

1 — Du-Bro #2025 – Engine Mount
1 — Pkg. Du-Bro #178 — Bolt Set
1 — Pkg. Du-Bro #383 — Sheet Metal Screw
1 — Pkg. Du-Bro #181 — Ball Link
1 — Pkg. Du-Bro #608 — EZ Connector
1 — Pkg. Du-Bro #310 — Cap Screw
14 — Du-Bro #116 — Nylon Hinges
1 — Du-Bro #378 — Fully Threaded Rod
1 — Pkg. C.G. #402 — Aileron Horns
1 — Pkg. C.G. #351 — Threaded Rod
1 — Pkg. C.G. #441 — Short Control Horn
3 — Pkg. C.G. #310 — Reg. Snap Link
1 — Sig #CS-006 — Bubble Canopy
1 — S.T. #230 — Seating Tape
1 — Sullivan #437 — Fuel Tank
1 — Pkg. Sullivan #514 — Control Rod
2 — 10-24 x 1" — Nylon Bolt + Washers
1 — Aluminum Spinner Nut
2 — Small Flat Head Wood Screws

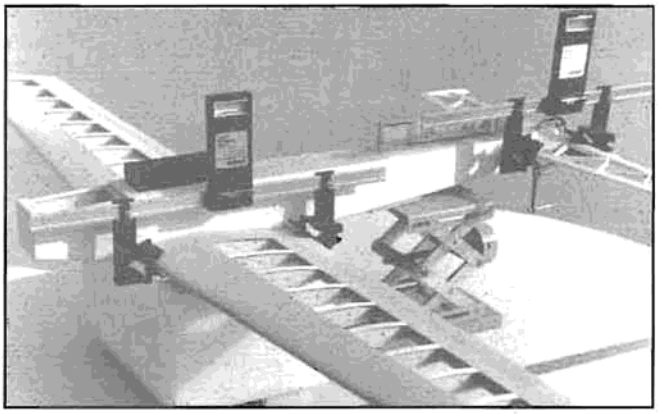
Optional

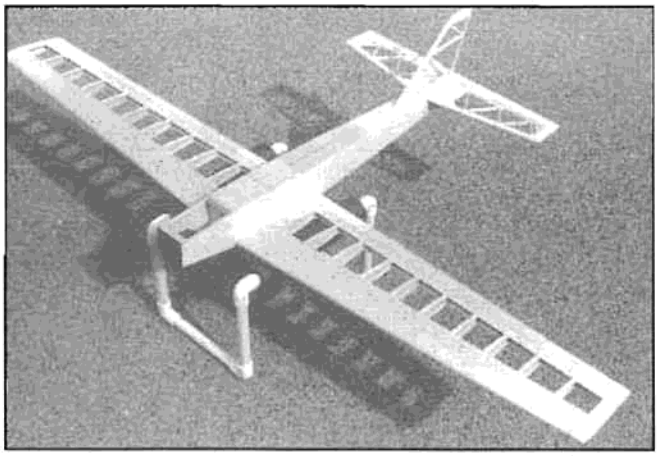
1 — Great Planes #L-1/2 Landing Gear
1 — pr. 1-3/4" wheels



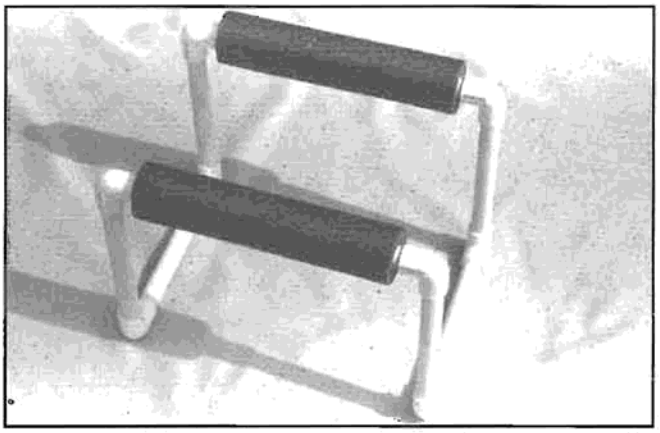
ABOVE: The horizontal stabilizer and elevator. Build from medium hard balsa.

RIGHT: A proper alignment is essential. Align the wing and horizontal stab to 9° incidence.

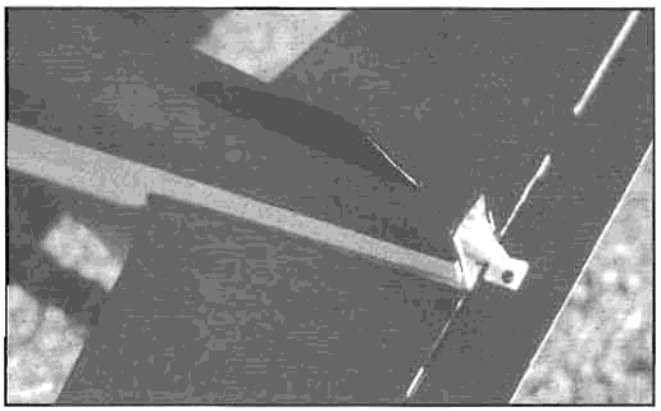




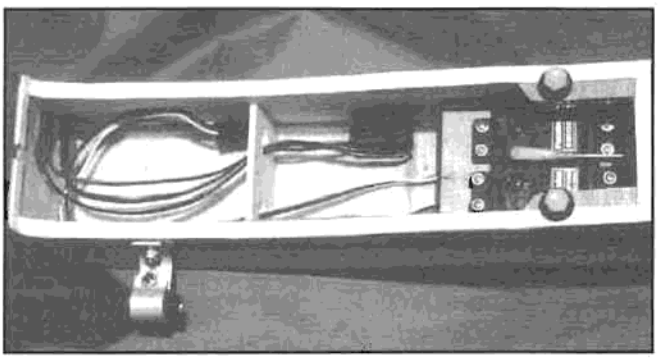
The framed up 56" wingspan prototype, ready for covering.



This simple PVC stand is very handy both in the shop and at the flying field.



Elevator pushrod and tail skid detail shown.



Close-up view of radio compartment. Elevator and throttle servos installed. Install receiver and battery pack in front of F3. Route servo and switch wires through access holes on F3.

Using a Dremel tool, cut 3/8" off from the threaded ends of the C.G. #402 aileron torque rods before installation, so they clear the elevator and the throttle servos. Cut the ailerons from medium-hard trailing edge stock. Make sure that the gap between the wing and the ailerons is minimal. The aileron hook-up is conventional.

Use a slow setting epoxy to install the plywood dihedral braces, the aileron torque rod tubes, the wing dowel, and the main skid. Make sure that the wing has no washout. The completed wing — hinged, covered with MonoKote less servo weighs 11 ounces.

Fuselage:

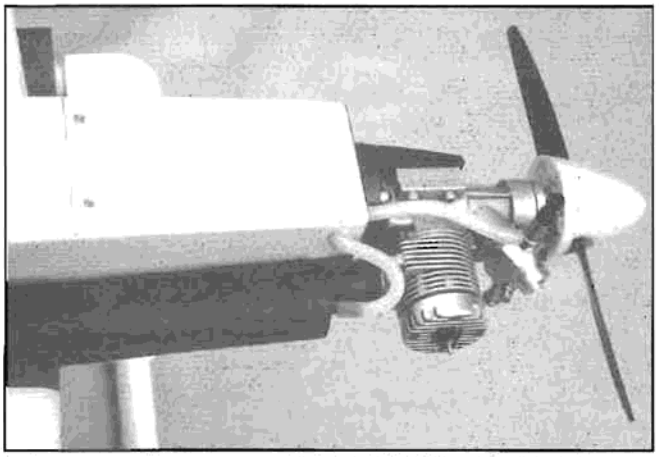
The Fox fuselage is a simple box structure. Tape two 1/8" lite plywood sheets together with double face tape, cut out the sides, sand and separate the two sides. Glue on the 1/8" square balsa longerons. Install a plastic antenna tube with epoxy along the left fuselage side. The fuselage is assembled upside-down over the plan. Start with formers F2 and F4 using "C" clamps. Use epoxy to install the plywood servo rails before the top sheeting is glued on. Make sure that there is a 1/16" clearance between servos and the top sheeting.

The Sig canopy base is sandwiched between two 1/16" balsa sheets. The bottom sheet is cross-grained to the top sheet. The opening for the canopy is parallel grained. Sand and spray-paint the inside of the canopy and epoxy this assembly in place. Use slow setting epoxy to install the firewall, the lite ply fuselage piece under the fuel tank, wing bolt blocks, servo rails, and the tail feathers. Don't forget to install the lite ply wing saddle doublers. Coat the fuel tank compartment with a thin layer of epoxy.

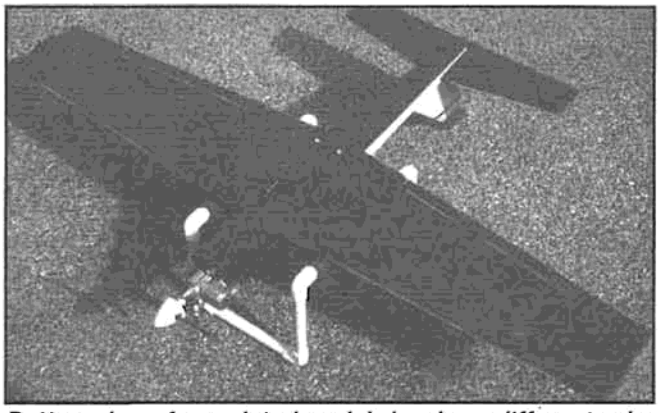
Paint the firewall before installing the engine mount. The removable hatch provides easy access to the fuel tank. The completed fuselage covered with MonoKote, less equipment, weighs nine ounces.

Tail Feathers:

The vertical fin and the stabilizer are built directly over the plan from medium hard balsa. Be sure to follow the grain direction shown on plan. Sand



Side mounted rear exhaust MVVS .28 GFR with a #3244 tuned silencer. Make the silencer bracket from stainless steel.



Bottom view of completed model showing a different color scheme. A simple skid arrangement, clean airframe, and moderate wing loading makes 100+ mph flights possible with small engines.

since a misaligned model will not fly properly; furthermore it may oscillate or flutter at higher speeds. Level the fuselage first, the reference line for alignment is the top of the fuselage behind the canopy where a bubble level is placed. With a Robart incidence meter, align the wing and the horizontal stabilizer to 0° incidence.

The engine's thrustline is 0°, both vertically and laterally. Make sure that the wing rests properly in its saddle, the stabilizer is in horizontal alignment with the wing, and the vertical fin is aligned with the center of the fuselage. After this is done carefully, drill and tap the wing bolt blocks. Install one wing bolt before starting on the other one. After the wing is covered, check the wingtips again for 0° incidence.

Engine And Fuel Tank:

There is an excellent selection of 2-stroke engines on the market for this design. The following engine-propeller combinations were extensively tested: MVVS .21 GFR with a #3244 tuned silencer turning an APC 8-1/2 x 5-1/2 Pylon prop cut down to 8 inch. MVVS .28 GFR with a #3244 tuned silencer turning a Master Airscrew 8 x 6 Scimitar prop, O.S. .25 SF turning a Master Airscrew 8 x 4 or 8 x 5 Scimitar prop, O.S. .32 F turning a Master Airscrew 8 x 6 Scimitar prop, Super Tigre G-34 turning a Master Airscrew 8 x 6 Scimitar prop. The propellers should be balanced since this helps reduce vibration.

The correct glow plug for the MVVS engines is the Nova Rossi plug which comes with the engine. Our O.S. and Super Tigre engines run with K&B #7300 HP Long Reach plugs. Tune the engine for a peak sustained rpm using a tachometer, then back off 1000 rpm, this will give us a slightly rich setting and a good engine run.

The MVVS engines are mounted horizontally, the O.S. and Super Tigre engines are mounted at a 45° position. The silencer bracket for the MVVS set-up is made of stainless steel. In case the bottom needle valve assembly on the MVVS carburetor interferes with Mother Earth during landings, you can replace it with an O.S. #3H carburetor, no modification is needed.

The fuel tank is a 4-6 oz. Sullivan unit pressurized from muffler. It is essential that the fuel tank and fuel lines are installed properly. Make sure that the fuel tank is wrapped in foam rubber so it won't be in direct contact with the fuselage. Place a small block of foam rubber under the fuel tank to make it level. The engine runs from a 4 oz. tank are four to seven minutes, depending on the engine used.

Covering And Finishing:

Fill and block-sand all surfaces to final shape before covering. Our model is covered with MonoKote. Covering is simple since there are no compound curves. Bright contrasting colors are essential for a small model. Make the top color pattern different from the bottom, as this will help to maintain proper orientation. Make sure that all hinges are installed properly.

When done with the alignment, mark the fuselage outlines on both the top and bottom of the stab. This is a reference line for the covering. Make sure that the covering film does not interfere with the epoxy joint. Install the wing seating tape and, when done, coat it from the outside with a thin layer of epoxy. The wing dowel should fit tight in F2. Make sure the model is properly aligned, warp-free, and balanced. Chances are good that the model will balance without adding weight.

Radio Installation:

The radio compartment is large enough to accommodate standard radio gear. Mount the servos, receiver, and battery pack as shown on the plan. Do not use servo tape to install servos. Use standard servos since this will help balance the model. Make sure that the aileron pushrods clear the throttle and elevator servos. The throttle control employs a ball joint mounted on carburetor arm and a Du-Bro EZ connector on the servo arm. The aileron throw is 1/4" each way and the elevator throw is 3/8" each way.

Set the throttle control so you can kill the engine at any time. Make sure that the aileron and elevator connections have **no slop** since this can induce flutter. Use a hard balsa for the elevator pushrod. Wrap the receiver and battery pack in foam rubber. Run the receiver antenna through plastic lead-out tube. Route the servo and switch wires through access holes in F3.

Make sure that the aileron connector does not dangle in the fuselage since it will pull apart regardless of the radio brand we use. A simple solution is to pinch the aileron connector between the wing and the rubber foam which is over the radio gear. The best battery choice for a small model like this is the new Lithium-Metal Rechargeable battery. I have flown my Fox with this battery for over two years. More information on this battery was published in the June 1998 issue of *RCM* magazine.

Flying:

Now relax, it's only a toy. Check all control surfaces for proper motion. Range-check your radio while the engine is running. It is a good idea to have a helper for the first few flights. A moderate wing loading and abundance of power make hand launching easy. Do not run with the model. Throttle up, wait a few seconds until the engine revs up, then launch the model briskly into the wind. At this point minor corrections are needed. I hand-launch mine inverted, this way I can grab the fuselage at the C.G. This can be done after the model is trimmed and the pilot is comfortable with the aircraft.

To check alignment, make a half roll and, if aligned correctly, the model would need only a touch of forward elevator to maintain a straight inverted flight. This model is quick and agile. The maneuvers are wide, smooth, and fast. As mentioned earlier the maximum speed in level fight is 100+ mph, depending on the engine and fuel used.

I fly until the model runs out of fuel, then I land it "Pylon" style. After some practice you can land it next to your feet. The 3/32" music wire epoxied-in main skid, makes landings possible on paved runway. Make all landings directly into wind.

Conclusion:

Flying a hand launch model will greatly improve your flying skills. Since 1992, I have built eight of these models and logged over 700 flights with this design. I feel that the hand-launch concept is a practical reality, as is witnessed by the "Wonder" by Sig, and the "Shrike 20" and "Shrike 40" by Lanier. The popularity of AMA R/C Combat class and the Speed 400 Electric Pylon Racers proves this.

Remember: Simplicity is the ultimate sophistication.

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