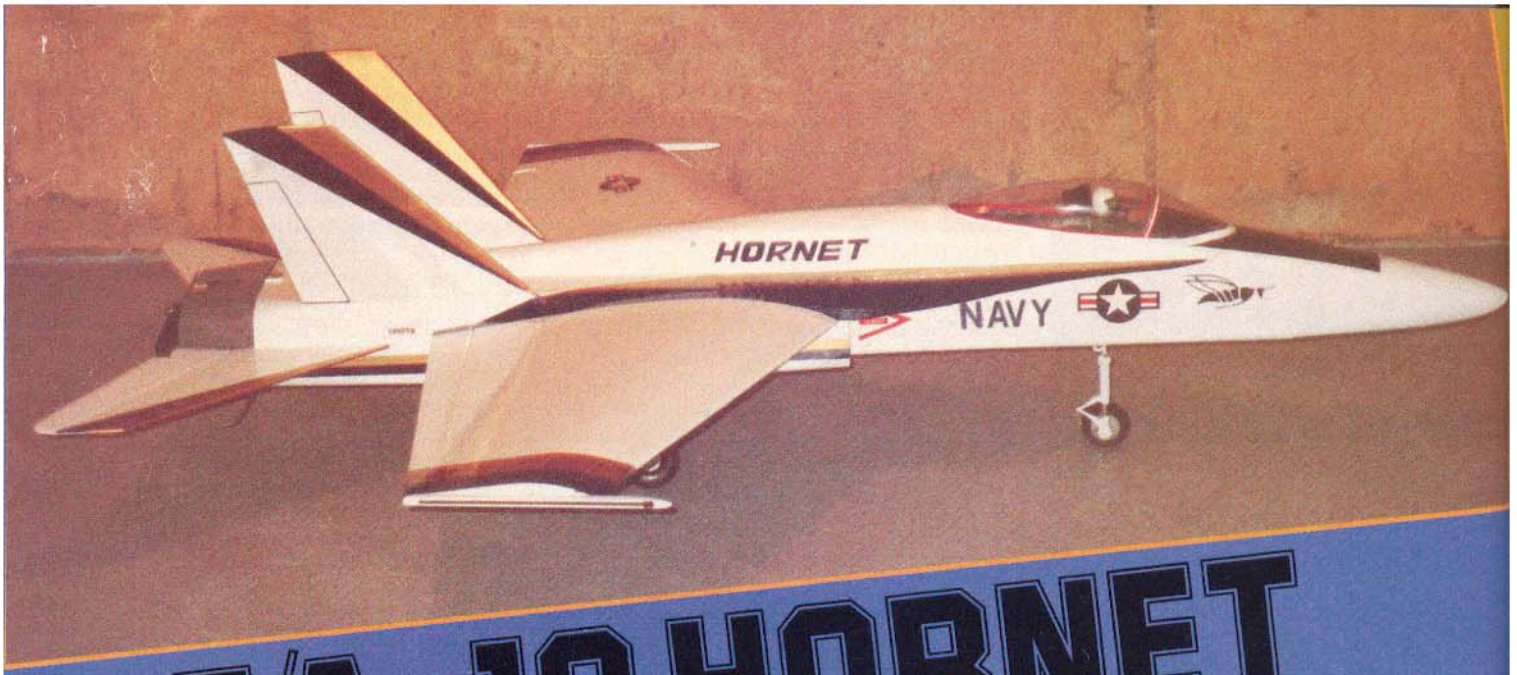


F/A-18 HORNET

Project Background

Over three years ago, I set out to build a model of the F/A-18 Hornet that would look close to scale yet exhibit gentle flight characteristics. In February 1987, plans for a .40 size pusher prop F/A-18 were completed and within a month the aircraft was ready to fly. I hate to say that it "flew off the drawing board" — but it did (only a few minor trim adjustments were required on the maiden flight). The prototype used an O.S. .40 FP engine for power but did not utilize a fuel pump. The fuel tank therefore had to be mounted in the rear and a fair bit of nose weight was required to balance it. It could fly fast and slow, was very stable yet maneuverable, and did not snap or spin. I later added an ASP .40 engine and the take-off roll was reduced from 90' to about 50'! The top end performance also improved. I flew the .40 prototype for close to three years before a loose battery connection resulted in an unplanned decomissioning!

It was a flight video and plans for this .40 size aircraft that originally got RCM interested in this project. RCM has made the .40 size plans available also.

Given the success of the .40 size model, I decided that a bigger one would be even better. I therefore proceeded to enlarge the .40 size plans (43" wingspan and 50" length) to the .60 size plans featured in this article. Some refinements were

Author's two F/A-18's with .40 powered in rear and .60 size in front.

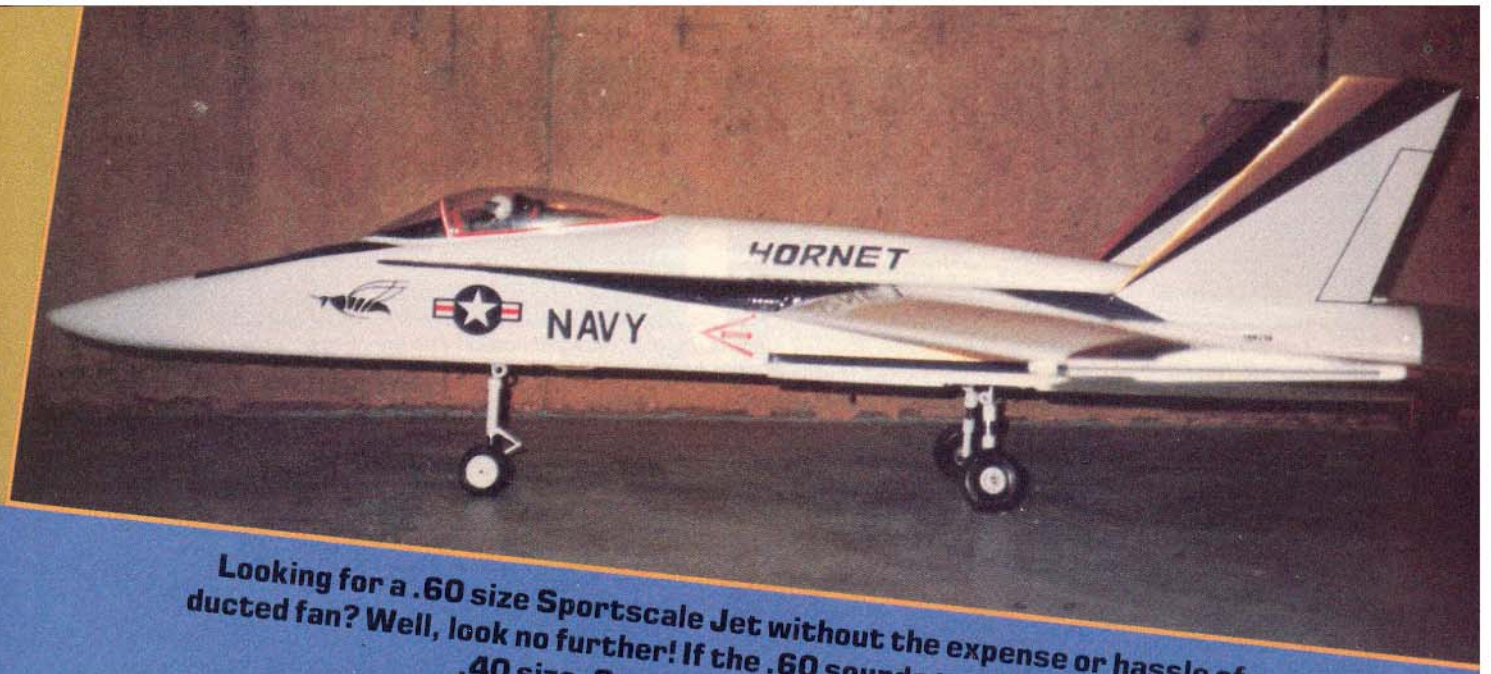
ABOUT THE AUTHOR

Mike Pastor, 32 of Abbotsford, British Columbia is married and has one son. He has a university degree in Business Administration and is Manager of Operations and Maintenance at the Abbotsford Airport — home of the world reknowned Abbotsford International Airshow held each August.

Mike has always been an airplane enthusiast and has flown R/C aircraft for 10 years. After an initial training period on traditional high and low wing trainers, Mike has concentrated his efforts on building and flying his own designs. He is partial to jets and prefers the economy and ease of operation associated with pusher prop propulsion as opposed to ducted fans.

The pusher prop F/A-18 aircraft, designed by Mike and featured in this article, is a simple, inexpensive, well-behaved, and good looking jet model that will enable the average sport flier to become a "jet-jockey."

Mike would like to give special thanks to Kerry McAllister for his proficient test flying. To Ron Smith for the flight photos, and to his wife Kim for her patience and assistance in preparing the plans and instructions.



Looking for a .60 size Sportscale Jet without the expense or hassle of a ducted fan? Well, look no further! If the .60 sounds too large, we also have a .40 size. See plan listing on page 240.

By Michael Pastro

Hornet is an easy to build and easy to fly aircraft that looks great on the ground and in the air. Using a rear mounted Schneurle .60 size engine and pusher prop, it provides realistic jet flight without the expense and hassle of a ducted fan.

The aircraft's light wing loading, flat bottom airfoil, wing tip washout, and overall design enable it to fly and land very slowly, yet it has impressive high speed performance and maneuverability.

The aircraft's specifications are as follows: wingspan, 54''; length, 67½''; wing area, approximately 900 sq. in.; wing loading, 22-24 oz./sq. ft.; weight, 8½-9 lbs.; channels, 4 (5 with retracts).

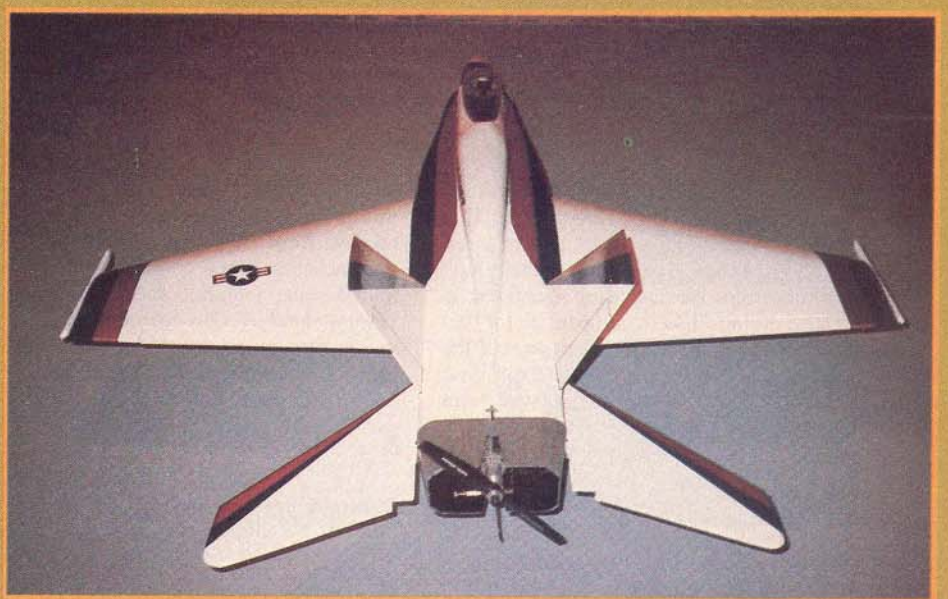
Use of a fuel pump is recommended; however, this aircraft could be flown

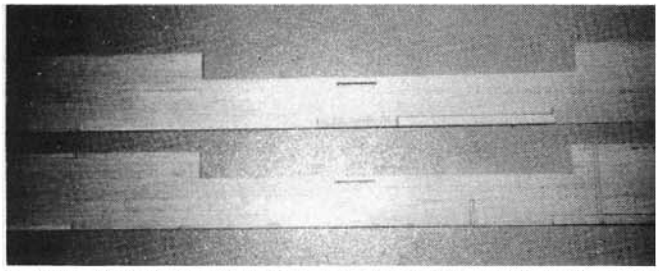
incorporated into the .60 size model such as retracts and a Perry Regulator Pump so that a mid-mounted fuel tank could be used.

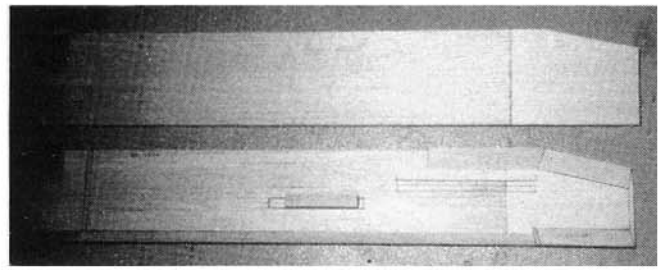
The .60 size version took two months of off-and-on building to complete. It would have gone quicker had I not had to take construction photos and do up instructions for this article! The .60 aircraft's maiden flight was on February 25, 1990, and it flew every bit as well as the .40 size model did on its first flight. In the capable hands of my friend and test pilot, Kerry McAllister, the aircraft looked incredibly realistic.

My R/C flying skills are only average, yet I feel very comfortable with this aircraft; in fact, it flatters my flying abilities. I am extremely proud of this aircraft and recommend it to anyone who wants a simple, inexpensive, well-behaved, good-looking jet. I hope you'll try it. You won't be sorry.

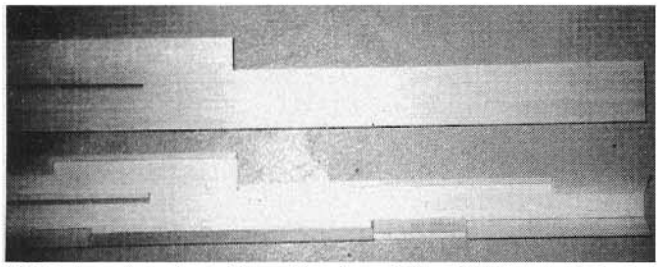
This sport scale version of the F/A-18

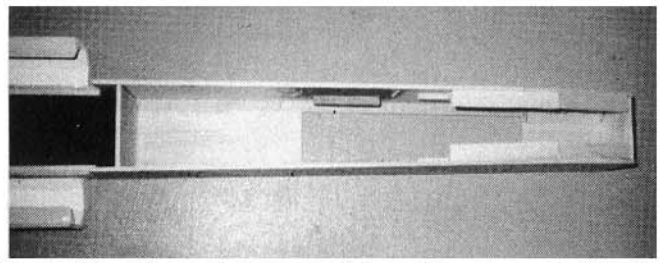




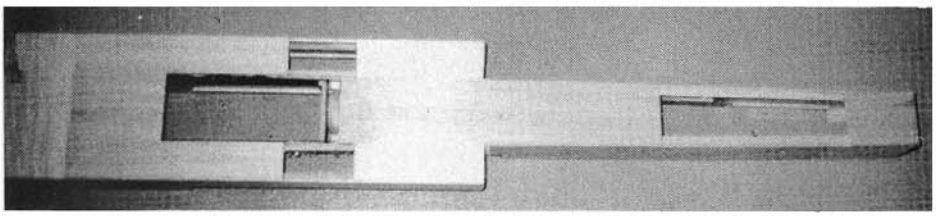


LEFT: Left and right center section sides. Note NyRod exit cutouts. RIGHT: Forward portion of center section sides. Use of triangular stock permits rounding of the nose. Note the nose retract anchor block and the servo mounting rails.





LEFT: Outer section sides with triangular and 1/4 x 1/4 stock glued into position. Note stab cutout and the main retract anchor block. RIGHT: Top view of forward fuselage. Center and outer section sides and bulkheads have been glued onto the bottom sheeting.



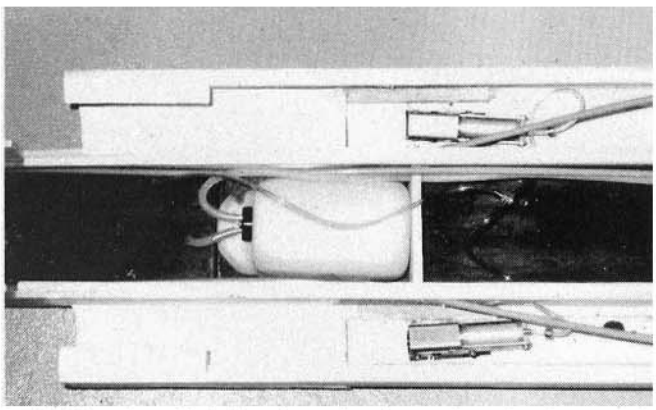
Bottom view of fuselage. Note the two center hatch openings and the openings for the main gear retracts.

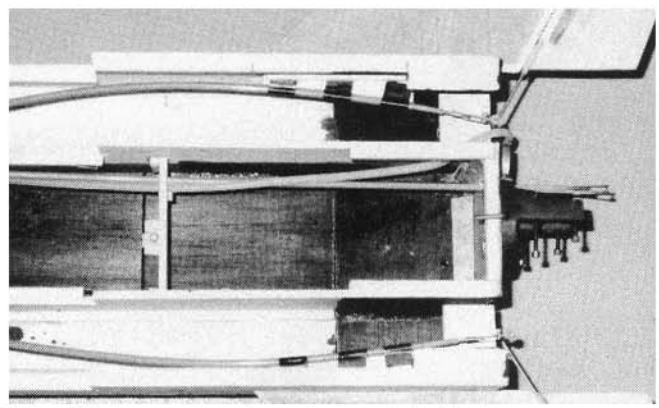
CONSTRUCTION

General:

Read all instructions and review both plan sheets carefully before starting construction.

Plan your radio installation and fuel tank location prior to cutting out holes and slots for NyRod exits. The plan shows one servo/NyRod configuration that works well



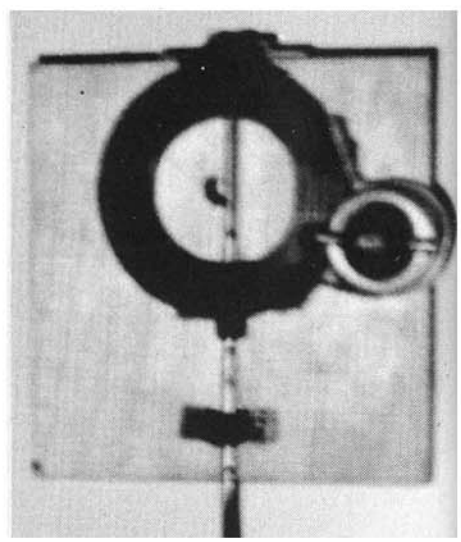


LEFT: Top view of mid-fuselage showing tank and main retract installation. Black areas have been fuelproofed with dope. RIGHT: Top view of aft fuselage. On the .60 version, torque rods are used to connect the elevators. On the .40 version, the NyRods are routed outside of the fuselage and connected directly to horns on the elevators. Note the throttle NyRod and fuel tubing.

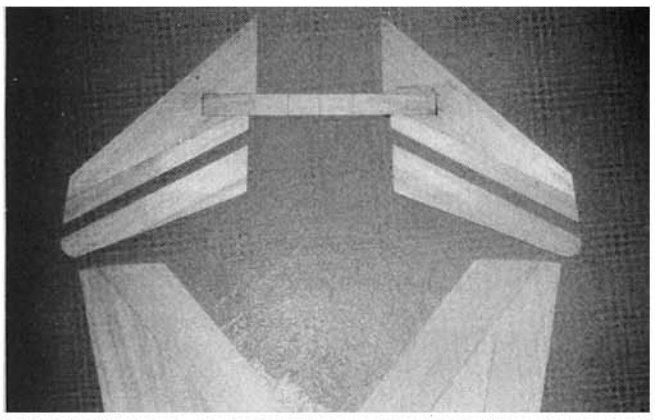
without a fuel pump by installing the fuel tank as rearward as possible in the center section (the .40 size prototype was flown like this and performed well). In this configuration, extra nose weight is required to balance the aircraft (balance with the tank full) and some elevator trim adjustment is needed during flight to compensate for fuel burn. If you have a fuel pump, install the tank at the Center of Gravity. Less nose weight will be required, fewer trim adjustments will be necessary and the engine fuel mixture will remain constant during the flight.

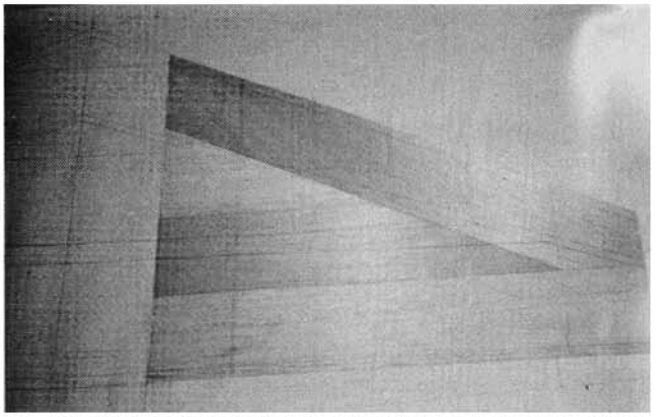
The prototype featured in this article uses a Webra .61 Speed engine and a Perry Regulator Pump. The carburetor housing of the Webra has been rotated 90° to the left so that the engine will run backwards. This allows a regular 11 x 7 tractor prop to be used (the prop is mounted backwards). With this propulsion package, the aircraft will take-off from grass in much less than 100' and the prop is not visible in the air! For added scale realism, use of retractable landing gear is also recommended. The mains retract rearward and the nose wheel retracts forward just as on the real aircraft.

Now let's get started . . .



Close up of F4 firewall showing the engine mount, 1/8" music wire tail skid, and Perry Pump clamped to engine mount.





LEFT: Tail feathers glued together and ready for fine sanding and hinging. RIGHT: Top view of wing sheeting with rib and spar locations drawn in. On the .60 version, the bottom sheeting goes to W-1 instead of the wing center.

with a mid-mounted tank and belly mount nose wheel retract.

Instant glues can be used but epoxy is recommended for joints where extra strength is required (especially bulkhead F3 and the hardwood retract mount rails).

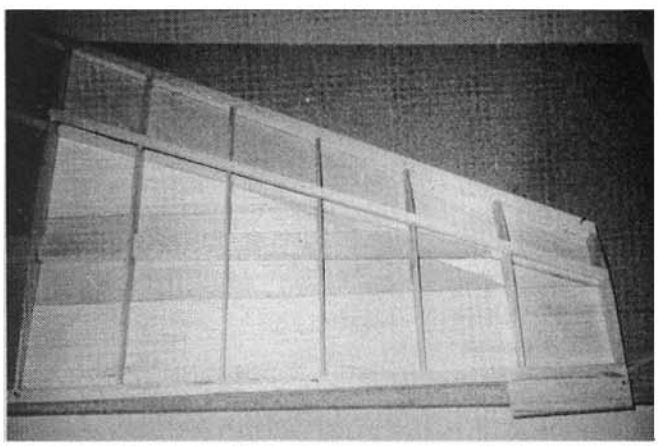
Fuselage:

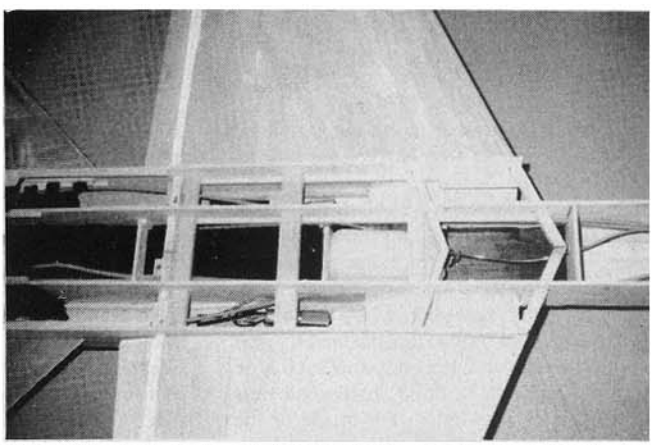
The fuselage is built directly over the top view plan on sheet No. 1. It is a good idea to protect the plan by covering it with wax paper or equivalent.

Cut and glue bottom sheeting into position over the plan. All bottom sheeting is 3/16" balsa and runs lengthwise except for the aft 3" (that butts against the F3 firewall) which should be crossgrain. Hatch covers are added later and should be left out of the bottom sheeting at this stage. Similarly, be sure to leave openings for the retract plates which are also added later.

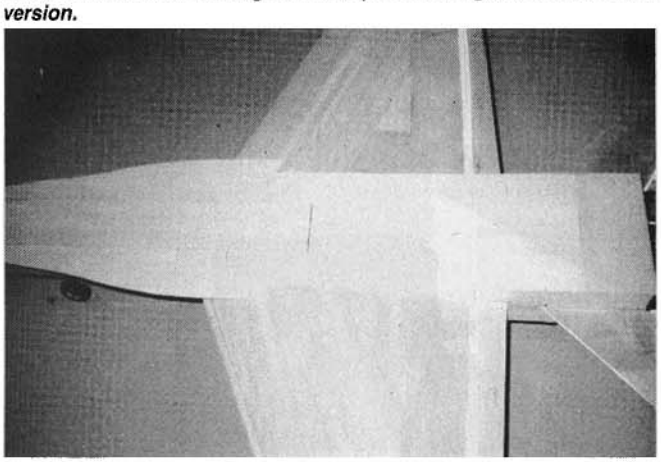
Stop — If fixed landing gear is to be used and the main gear is to be belly-mounted, a 3" wide x 3/16" thick piece of plywood should be substituted for the balsa bottom sheeting across the fuselage at the main landing gear location. Blind nuts should be installed (for bolting on the landing gear later on) before this piece is epoxied in as part of the bottom sheeting.

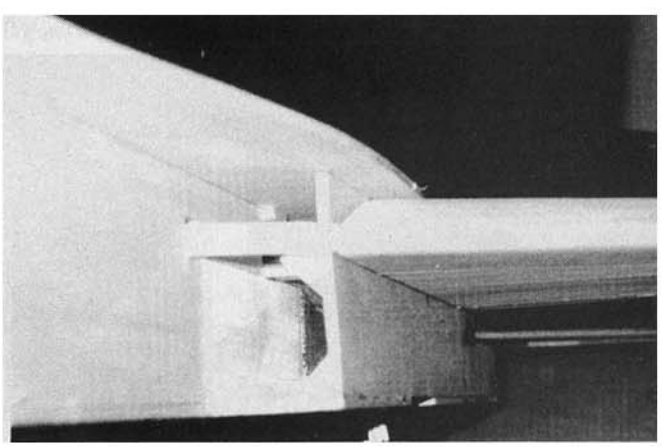
Carefully cut out two center section sides and two outer section sides from straight and firm 4" wide x 3/16" thick balsa. Refer to the templates on sheets No. 1 and 2, and use the dimensions for cutting. This will ensure accurate sides and proper wing/stabilizer alignment later on (wing is 0° and the stabilizer is at +1/2°). Because the center section sides are 53" long, it is necessary to butt-glue a 5" piece of 4" wide balsa to a normal 48" sheet. Add this piece to the forward end of the center section side. (This splice is later reinforced by gluing balsa triangle stock and servo rail supports across the joint. In addition, the entire nose section is later strengthened with fiberglass cloth



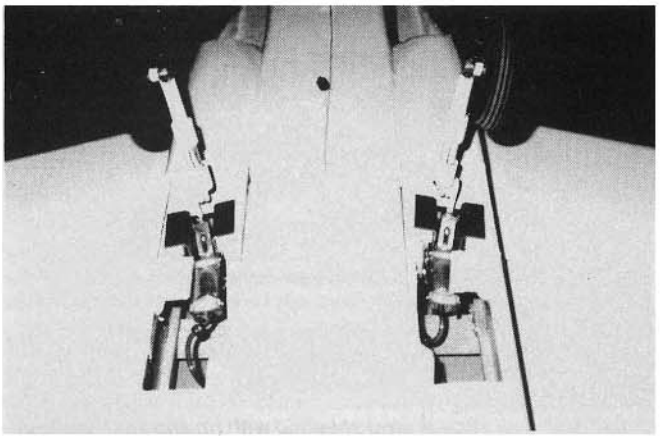


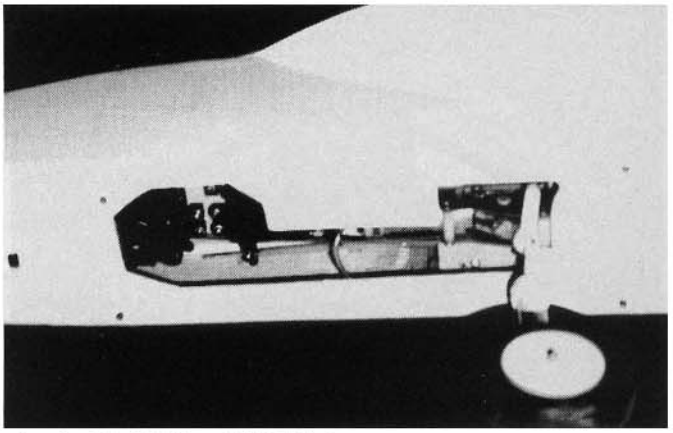
LEFT: Top view of wing with all ribs and spars in place. RIGHT: Wing and stabilizer have been epoxied into the fuselage. Center and outer section fillets have been glued into position. Again, note that there is no bottom wing sheeting between the two W-1 ribs on the .60 version.



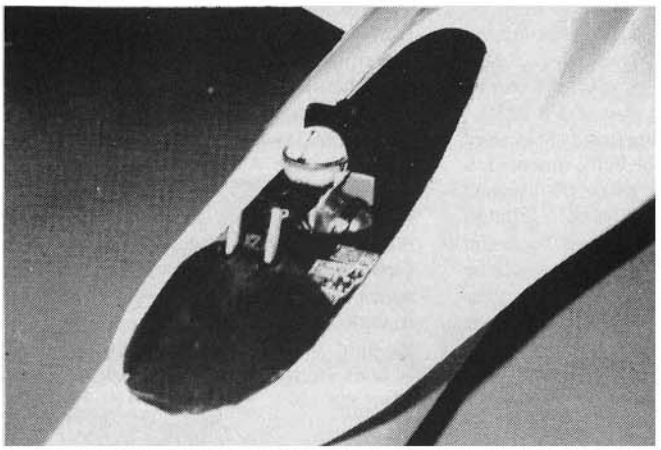


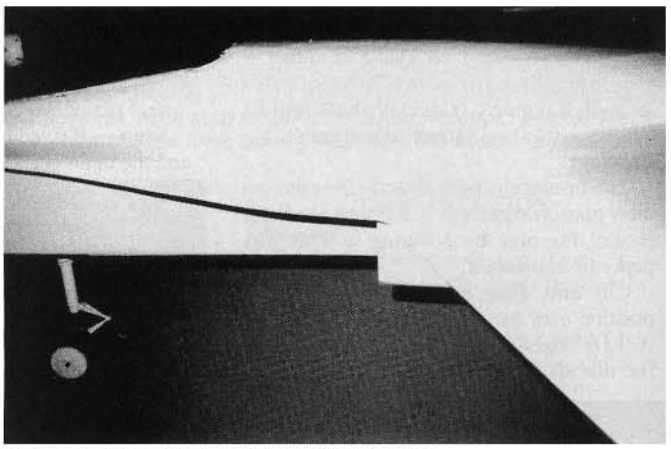
LEFT: Top view after top sheeting has been installed. RIGHT: Underside view of wing/fuselage joint and leading edge extension (LEX) prior to any carving or shaping.





LEFT: Close up of main gear retracts on .60 pusher. RIGHT: Nose retract cut out in forward hatch.





LEFT: Cockpit detail prior to canopy and trim. RIGHT: This shows how LEX is blended and curved into wing.

and resin.) Remember to cut out stabilizer and stabilizer brace slots and NyRod exits as required.

If retracts are to be installed, hardwood rails should be epoxied to the center and outer section sides so the retract plates can be screwed to them later on. For the main gear, the outer rails should be 1/4'' higher than the inboard rails so that the landing gear will angle outward. If a belly-mounted nose gear retract is to be used, hardwood rails must also be epoxied to the inside of the center section nose as shown on the plans. Depending on the type of retracts used and your wheel sizes, you may want to recess the hardwood rails deeper into the fuselage to ensure that all of the landing gear tucks up into the fuselage. If you do this, make sure that the nose gear will not interfere with the servos and that the main gear will not hit the wing spars when retracted (see the notes on retract installation on sheet No.1).

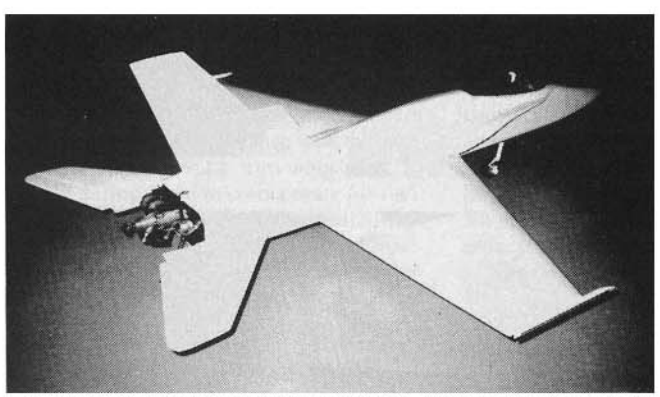
Glue 1/4'' x 1/4'' balsa, 1/2'' x 1/2'' balsa triangle stock, and 3/4'' x 3/4'' balsa triangle stock onto outer and center section sides as shown on sheet No. 1. Also, glue servo mount rail supports on center section sides (inside) after you confirm servo configuration and location. Remember to make left and right sides!

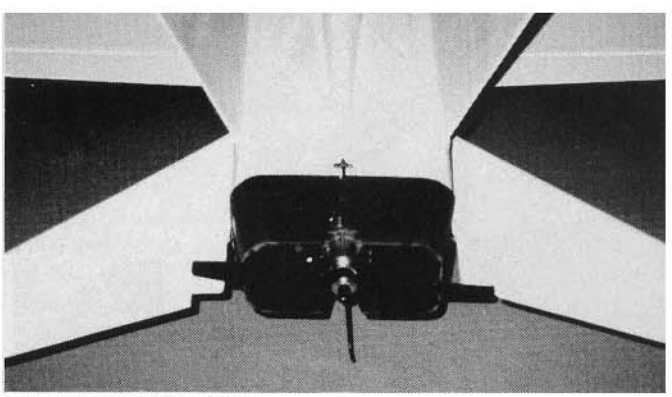
Cut out bulkheads F1 and F2 from 3/16'' balsa and drill NyRod holes in F2. Cut out firewall F3 from 3 /16'' plywood and install blind nuts for the engine mount and drill the NyRod and fuel tubing holes.

Glue center section and outer section sides and bulkheads F1 and F2 into position over the bottom sheeting. Ensure that the sides are 90° to the bottom sheeting.

Note that F3 is not glued into place at this time.

Stop — If fixed landing gear is to be used, cut out another bulkhead from 3/16'' ply that is the same dimension as F2. Install the nose wheel mount and drill NyRod holes in it and then epoxy it into position at the nose wheel location. Such a ply bulkhead is also required if a firewall-mounted nose





LEFT: .60 pusher less finishing touches. RIGHT: Close-up of tail section prior to trimming.

gear retract is to be used.

This is a good time to cover or paint the interior of the intake fronts and to fuelproof the fuel tank area.

Install the fuel tank and route hoses and vent lines as required. Also route the NyRod tubes (use the blue ones) at this time. Anchor the NyRods to the fuselage sides in two or three locations to reduce "slop" in the controls. The final pushrod/linkage hookups will be done once the wing, stabilizer, and engine are installed.

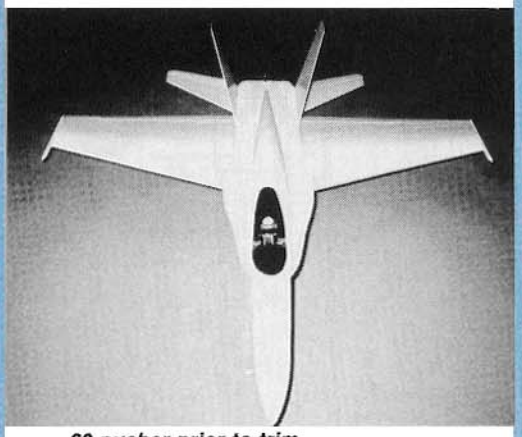
If air operated retracts are to be used, choose an appropriate location for the air tank at this time and ensure that you provide access for the fill valve. A suitable tank location is shown on the plans.

Set fuselage aside until final assembly.

F/A-18 HORNET
(.60 Size Pusher)

Designed By:
Mike Pastro
TYPE AIRCRAFT
Pusher Prop Sport Jet
WINGSPAN
54 Inches
WING CHORD
13⅜ Inches (Avg.)
TOTAL WING AREA
900 Sq. In.
WING LOCATION
Mid-Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Double Taper
DIHEDRAL EACH TIP
0
OVERALL FUSELAGE LENGTH
67½ Inches
RADIO COMPARTMENT SIZE
(L) 10" x (W) 3¼" x (H) 3½"
STABILIZER SPAN
30½ Inches
STABILIZER CHORD (incl. elev.)
7¼ Inches (Avg.)
STABILIZER AREA
156 Sq. In.
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
10¼ Inches
VERTICAL FIN WIDTH (incl. rud.)
8 Inches (Avg.)
REC. ENGINE SIZE
.61 2-stroke
FUEL TANK SIZE
10-12 Oz.
LANDING GEAR
Tricycle
REC. NO. OF CHANNELS
4 (5 w/Retracts)
CONTROL FUNCTIONS
Elev., Ail., Throt., Nose Gear
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, Ply & Foam
Wing	Balsa & Spruce
Empennage	Balsa
Wt. Ready To Fly	136-152 Oz. (8½-9½ Lbs.)
Wing Loading	21¾-24¼ Oz./Sq. Ft.



.60 pusher prior to trim.

Tail Section:

Cut out vertical fin pieces from 3/16" balsa as per outlines shown on sheet No. 1 and glue pieces together. Note grain directions.

Cut out stabilizer and elevator pieces from 1/4" balsa as per outline shown on sheet No. 2 and glue pieces together. Again, note grain directions.

Cut out the stabilizer brace from 1/4" hardwood and epoxy it into position between the two stabilizer halves.

Carve and sand leading and trailing edges to achieve desired profile (refer to cross sections shown on plans).

Install elevator torque rods and then hinge elevators.

Set tail surfaces aside until final assembly.

Wing:

There is no dihedral in this wing. Build the wing on a smooth, flat surface.

F/A-18 HORNET
(.40 Size Pusher)

Designed By:
Mike Pastro
TYPE AIRCRAFT
Pusher Prop Sport Jet
WINGSPAN
42¼ Inches
WING CHORD
10⅝ Inches (Avg.)
TOTAL WING AREA
500 Sq. In.
WING LOCATION
Mid-Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Double Taper
DIHEDRAL EACH TIP
0
OVERALL FUSELAGE LENGTH
53 Inches
RADIO COMPARTMENT SIZE
Ample
STABILIZER SPAN
23¾ Inches
STABILIZER CHORD (incl. elev.)
5¾ Inches (Avg.)
STABILIZER AREA
98 Sq. In.
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
8 Inches
VERTICAL FIN WIDTH (incl. rud.)
6¼ Inches (Avg.)
REC. ENGINE RANGE
.40 2-stroke
FUEL TANK SIZE
8 Oz.
LANDING GEAR
Tricycle
REC. NO. OF CHANNELS
4 (5 w/Retracts)
CONTROL FUNCTIONS
Elev., Ail., Throt., Nose Gear
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, Fly & Foam
Wing	Balsa & Spruce
Empennage	Balsa
Wt. Ready To Fly	80-88 Oz. (5-5½ Lbs.)
Wing Loading	23-25¼ Oz./Sq. Ft.

Cover wing plan with clear paper and build directly over plan.

Lay 1/16" bottom wing sheeting into place over plan and glue edges together. Note grain directions. Also note that there is no wing sheeting (top or bottom) between the two W-1 ribs.

Glue 1/2" x 1/2" balsa leading edge, 1/2" x 3/8" balsa trailing edge, 1" x 1/2"

balsa main spar (cut from 48" piece), and 3/8" x 1/4" bottom spruce spars into position.

Cut out ribs from 1/8" balsa and glue them into position.

Cut out the three 1/4" balsa fillets and glue them into position at the center of the wing as shown (these fillets strengthen the center wing joint and provide a larger gluing area when the wing is glued to the outer and center section sides). Be sure to place pieces of scrap 1/16" balsa under the fillets so that the bottoms of the fillets and spars will be flush.

Place a 1/4" shim under the 1/16" sheeting at the tip of the trailing edge as shown. Ensure that the leading edge and center of the wing (root) are pinned down. This will create approximately 2° of washout in the wing tip that will enhance slow speed flight.

Glue top 3/8" x 1/4" spruce spars into place.

Carve or sand the 1/2" x 3/8" trailing edge so that its slope matches the wing ribs.

Add top 1/16" sheeting up to rib W-1 and let the assembly dry.

When dry, remove the wing and round the leading edge to shape.

Cut the aileron from 2" x 3/8" aileron stock or cut and sand a piece of 3/8" balsa to shape. The outer portion of the trailing edge is cut and sanded from 3/8" balsa and glued into position at this time.

Install the aileron torque rods and then hinge the ailerons in place.

Sand the entire wing and set it aside for final assembly.

Final Assembly:

Position wing into fuselage and when you are sure that it is centered, epoxy it into place (where the bottom wing spars and balsa fillets meet the center and outer section sides).

Glue the center section and outer section fillets into place over the spars and fillets.

Connect the aileron pushrods to the aileron torque rods (keep in mind that 3/8" up and 3/8" down aileron throw is required at the aileron root).

Epoxy stabilizer assembly into place and connect elevator pushrods to torque rods (1/2" up and 1/2" down is required).

Route all necessary air hoses for your retract systems (if used).

Sheet the aft 3" of the top fuselage (that butts up against the F3 firewall) with 3/16" balsa running cross grain.

Epoxy the firewall (F3) into position up against the center section, sides and bottom, and top 3/16" sheeting.

Route throttle pushrods and fuel tubing (including pump plumbing if used) through the firewall as required.

Fuelproof the firewall and other areas where wood may be exposed to fuel and residue.

Finish sheeting the fuselage top with 3/16" balsa running lengthwise. Note that this sheeting extends beyond the front intakes and becomes part of the leading edge extensions.

Add more 3/16" balsa to complete the leading edge extension top view as shown on sheet No. 1. Balsa should be added to the underside of the outer edge of the leading edge extension to help fillet the body to wing joint at the leading edge (see outline on sheet No.1). The outer edge of the leading edge extension should then be rounded to achieve a scale contour.

Cut out a template of a 111° angle and use this to instant glue the vertical fins into position at the desired angle along the outer edge of the top fuselage sheeting. This joint will later be seamed with fiberglass cloth and resin for strength.

The upper fuselage can be carved and sanded from blue construction foam, or made of carved or built-up balsa. Side and top view templates of the upper fuselage are shown on sheet No. 2. Numbered cross-sections of the upper fuselage are shown on sheet No. 1. The simplest construction method is to use the templates to jigsaw or hot wire a rough square shape from construction foam. This can then be sanded to a scale contour using the cross-sections as a reference. The canopy must "blend" into the upper fuselage so it is a good idea to trial fit the canopy into place occasionally during the shaping of the upper fuselage. You may wish to cover the upper fuselage with 6 oz. fiberglass and epoxy to prevent it from getting dented.

Glue upper fuselage into place.

Cut and carve nose cone to shape from solid balsa block and epoxy it into position.

Carve and sand all edges (especially where the triangle stock has been used) to achieve scale-like contours.

Install servos, receiver, battery, etc., and final connect all linkages.

Install bottom hatch covers (this can be done by screwing them into plywood anchor plates or by simply hinging one end and using a latch at the other end to hold it in place).

Install the engine mount and engine and complete fuel line, pump (if used) and throttle connections. The engine is mounted sideways and the exhaust is blown straight down. Use of a Du-Bro Muff-l-aire is ideal. As mentioned in the introduction, some engines that have bolt-on front housings can be made to run backwards (so that a normal tractor prop can be used) by simply rotating the carburetor housing 90° to the left.

Use the outlines shown to construct a tail cone from 1/8" or 3/16" balsa with triangle stock at the corners to permit rounding. Anchor blocks to which the tail cone can be screwed must be added at the aft end of the fuselage. Carve holes in the side of the tail cone for access to the glow plug and needle valve.

Rough-sand airframe.

Seam critical joints with 1½" to 2" of fiberglass cloth and resin. This includes the joint where the top wing sheeting meets the top fuselage sheeting (the fiberglass also helps to contour this joint), the area where the wing bottom sheeting and outer section sides meet, and the rudder/top sheeting joint. It is also a good idea to cover the first 14" of the nose to strengthen the nose section and to prevent hangar rash.

Final sand the airframe and cover it with iron-on covering or paint. EkonoKote was used on the prototype with decals fabricated from MonoKote Trim Sheet.

Trim commercially available canopy to fit and glue or screw it into place. The canopy used on the prototype was an F-18 Canopy ordered from Bob Holman Plans. It is good quality and is just the right shape and size.

Cut and install sidewinder rails.

Bolt retract units to retract mounting plates cut from 3/16" ply (see sheet No.1 for template) and screw these plates to the hardwood mounting rails. Install the retract air tank and complete the necessary plumbing for the retract system. Cut openings in the bottom sheeting to allow landing gear to retract up into the fuselage cavity. If fixed gear is used, bolt the main gear to the plywood cross piece that was incorporated into the bottom fuselage sheeting and install the nose gear into the ply former previously installed at the nose gear location.

Important — Adjust the length of the nose gear so that the fuselage bottom is 3/4" higher off the ground at the nose wheel location than at the main gear location. This ensures that the wing has a positive angle of attack for take-offs.

Balance aircraft from side to side and at the Center of Gravity. If the fuel tank is rearward of the Center of Gravity, balance the aircraft with the tank full. Add weight as necessary to the nose or to a wing tip to ensure that the aircraft balances properly. With a mid-mounted fuel tank, the prototype required only 2 ounces of weight in the nose and 1 ounce in the right wing tip (to counter balance the side-mounted engine).

Make tail skid from 1/8" music wire and install it through the engine mount and brace it against the firewall top as shown on sheet No.1.

A wheel collar below the engine mount is also a good idea.

Set up the control surface throws as follows: ailerons 3/8" up at the aileron root; elevator 1/2" up and 1/2" down at the elevator mid-point.

Flying:

The flat bottom airfoil, low wing loading, wing tip washout and overall design of the F/A-18 make this model very stable. It can fly quite slow without stalling, yet has great high speed performance and maneuverability.

When taking off and when flying slowly, remember that this is a pusher-prop aircraft and, like a jet, there is no prop wash over control surfaces to make them respond at low speed. Do not "horse" the aircraft into the air on take-offs. Let the airspeed build up and gradually apply "up" elevator. The rest of the flight is very similiar to a conventional sport aircraft.

Good luck and happy flying! □

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