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Construction Article

A-10 THUNDERBOLT
Plan #1144

By
Mike Pastro

Tired of the same old "look alike" airplanes? Then give this Sport Scale pusher a try, it's sure to turn some heads!

NOTICE OF CAUTION: Remember, at all times when working around a pusher type prop design, and especially when starting or making carburetor adjustments, to be very careful as the airflow to the propellor tends to pull things through the propellor.

ABOUT THE AUTHOR

Mike Pastro is 35, married, and has two sons. This is Mike's second article to be published in RCM. Mike's F-18 pusher design was featured in the April 1991 edition. Mike was very pleased with the positive reader response to the F-18 design and hopes that his rendition of the A-10 Warthog will bejust as popular. Mike's other designs to date include a twin engine DeHavilland Buffalo, a C-130 Hercules, an A-4 Skyhawk, and a Canadair Tutor Jet (the latter two are pushers of course). While not designing model aircraft, Mike is the Manager of Operations and Maintenance at the Abbotsford Airport in British Columbia, Canada Mike would like to give special thanks to his test pilot, Kerry McAllister, to Rip Kirby for the flight photos, to Bob Holman for his cooperation, and, of course, to his wife Kim for upping his allowance whenever he gets the urge to build another plane!

Introduction:

I have always been fascinated by the A-10 Thunderbolt (or Warthog as it is often referred to). Although it is somewhat blunt and prehistoric looking compared to the sleek, fast, front line fighter jets, it is definitely a functional aircraft. Designed to carry its 20' gatling gun in the nose, this tank killer played a very successful role in Desert Storm. It was news reports from Desert Storm featuring the A-10 that peaked my interest in this aircraft and inspired me to take on this project.

As you may recall, I built a pusher version of the F/A-18 that was featured in the April 1991 RCM. I am sold on the concept of pusher prop propulsion as a cheap and hassle-free alternative to ducted fans, but deplore the thought of powering any jet model by installing an engine on the nose. It is somewhat ironic, therefore, that this model started out on the drawing board having an engine up front! My original assumption was that there would be insufficient prop clearance in a pusher version of the A-10.

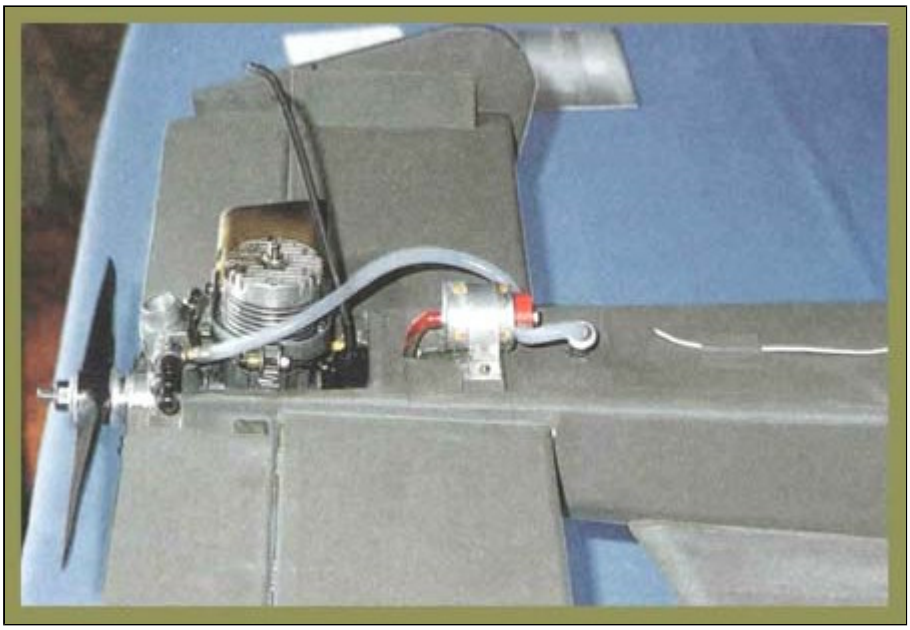
Fortunately, my dislike of “tractor jets” won out and I prepared a side view sketch of a pusher version before proceeding with my original design. It soon became apparent that pusher propulsion would probably work. There appeared to be adequate prop clearance after all and it seemed that the balance point could be achieved by putting the radio gear as far forward as possible. It was clear, however, that the fuel tank would need to be located at the Center of Gravity to minimize the amount of nose weight needed.

Nose wheel retracted.

I wanted the outline of the airplane to be very close to scale with a slightly enlarged wing and stab to enhance flyability. For ease of construction, I chose a thick, flat bottom airfoil instead of an undercambered one as on the real A-10. Of course the outer wing panels had to have some washout.

Prior to starting construction, I set out to find a suitable canopy and “things” that could be used for the fake engine pods. Unfortunately, I could not find a commercially available canopy that was close to scale nor could I find any good pods. I considered using plastic bottles or tubes but the items I could find were either too small, too large, too heavy, or too flexible, and none of them had the right shape. Remembering the excellent quality and exact scale shape of the canopy I had ordered from Bob Holman Plans for my F-18, I called Bob to see if he could produce scale, vacuum formed components for my A-10. He said he could and within three weeks I received a set of scale engine pods, wheel nacelles, and a canopy — all custom made for my A-10!

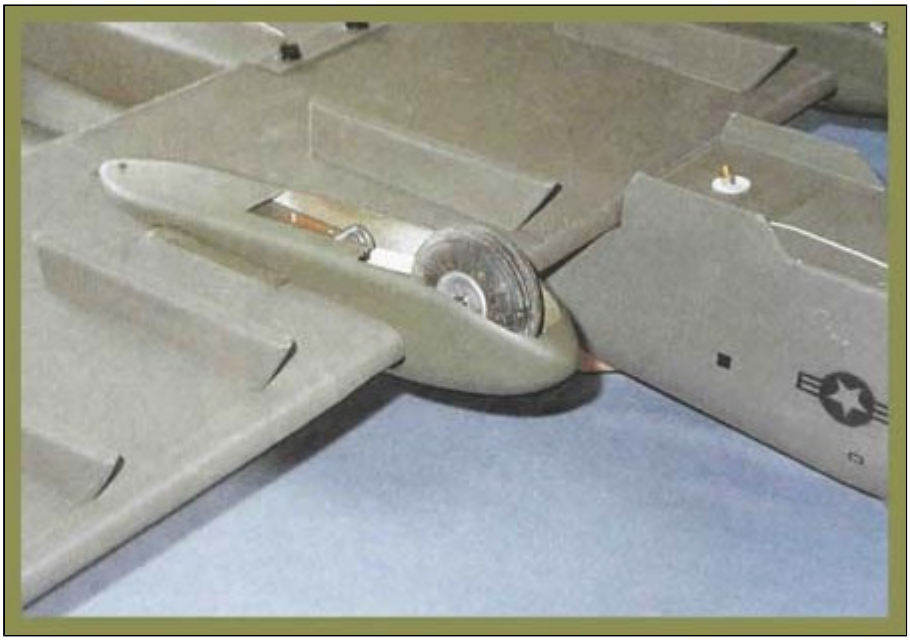
The plastic parts were even better than I had hoped. The canopy had the panel lines molded in and the pods had a scale looking rounded inlet. The pods and nacelles had to be assembled, but the parts fit perfectly and this was easily accomplished. (Using plastic cement, I glued a 3/8” wide strip of scrap plastic along the inside seams. When dry, I filled along the outside seams with glazing putty.)



Good detail of engine, pump, tail skid, Muff-L-Aire, ect.

Bob has agreed to make all of these components available at a very reasonable price. (Bob's address and phone number are included in the material list.) I highly recommend these parts as they will save you a lot of building time and are well worth the money.

After receiving the vacuum formed parts, the model was completed in approximately two weeks of rather steady building. It went together very easily and, when completed, looked even more realistic than I had envisioned. I opted not to install retracts but it was obvious that they could be incorporated into the aircraft with some modification (the plans show retract installation and I have installed them on my second A-10).

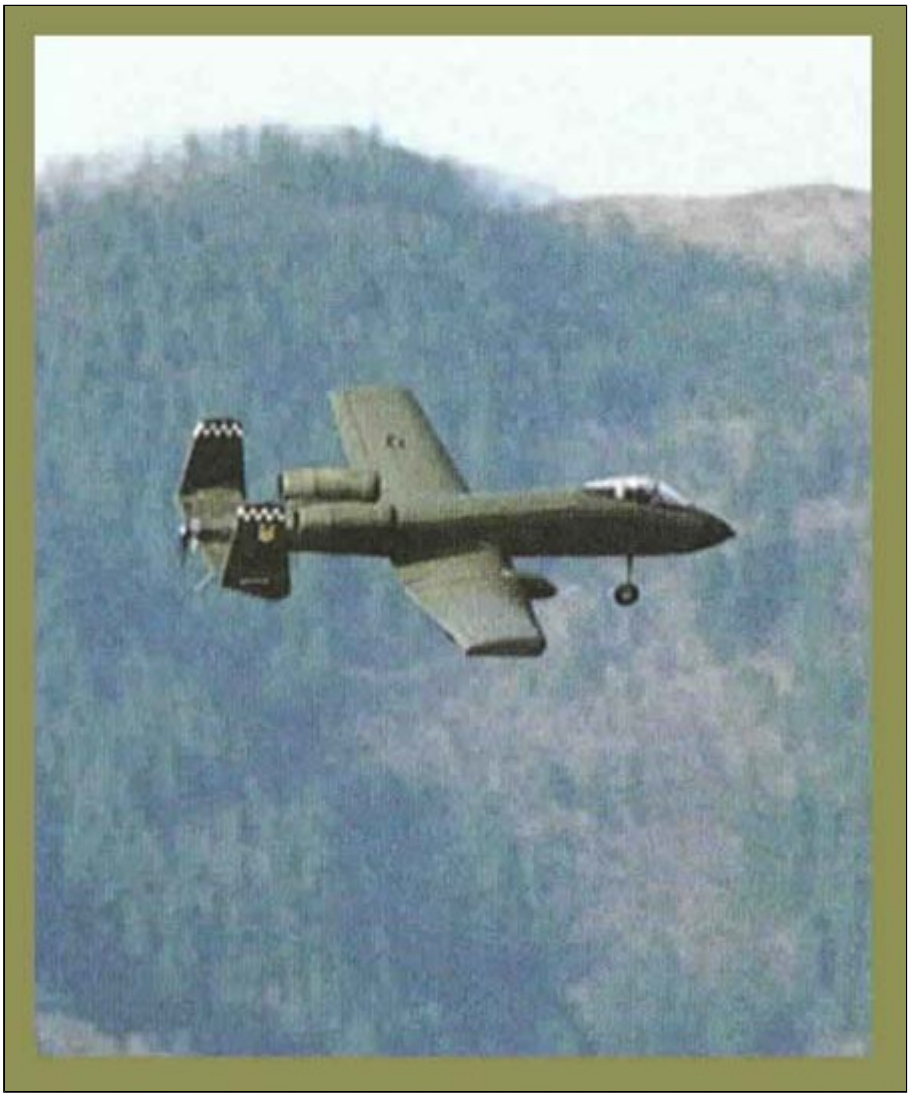


Underside of wing bolted to fuselage.

The first trip to the flying field wasn't quite as trouble-free as I had hoped. The grass on our upward sloping runway was about 3" high and wet and my ASP .46 engine was not quite broken in. After the first few taxi runs it was obvious that the plane was not going to reach take-off speed.

My friend and test pilot, Kerry McAllister, and I deliberated on the merits of cutting the grass versus installing larger wheels. Needless to say, the wheels won! (Kerry and I are notorious for seeking quick and simple solutions — we once taped a crescent wrench to the underside of an airplane to achieve the correct C.G.)

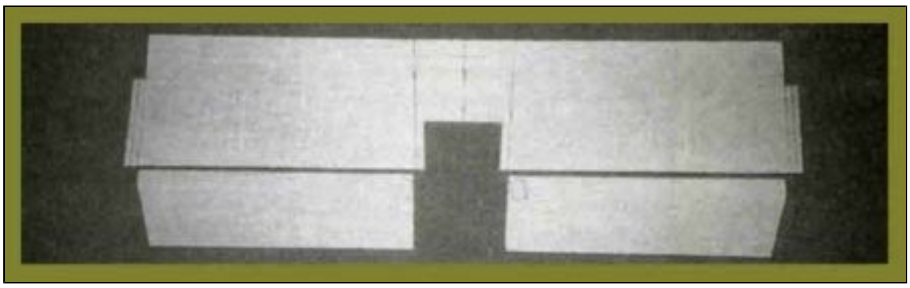
Increasing the main wheels from 2-3/4"-3-1/4'' helped, but the plane still zig-zagged and labored through the dense grass. Nonetheless, after about 100' the model broke ground and leaped into the air at about a 60º angle. I was videotaping the event and actually pointed the camera to the area on the ground where I thought the impending crash was going to occur, but to my surprise/relief, the plane continued to stay airborne. Not only that, it performed beautifully. With the exception of the tractor size tires hanging down, it looked very realistic and was able to perform very typical A-10 maneuvers. The plane slowed down to a walk on landing and stopped in about five feet, once the wheels hit the grass.



The second trip to the flying field happened one week later and was totally hassle-free.

The grass had been cut, the engine was running better, and the scale wheels were once again on the aircraft. This time the A-10 accelerated quickly, broke ground within 50', and climbed at a very positive 45º - 50º angle.

In Kerry's capable hands the aircraft was put through a series of very realistic A-l0 maneuvers. Rolls, Cuban 8's, Loops, Split S's, and even sustained Inverted Flight were easily achieved. I took the controls and was amazed at how stable the airplane was at all speeds. It flies quite fast at full throttle but, in my opinion, is most fun at about 1/3-1/2 throttle. At this setting the airplane achieves a very scale speed and can perform all maneuvers within the confines of a very small field. It turns on a dime!



Stabilizer and elevator can be made from light sheet balsa, or built-up as shown on plans if heavy balsa is used.

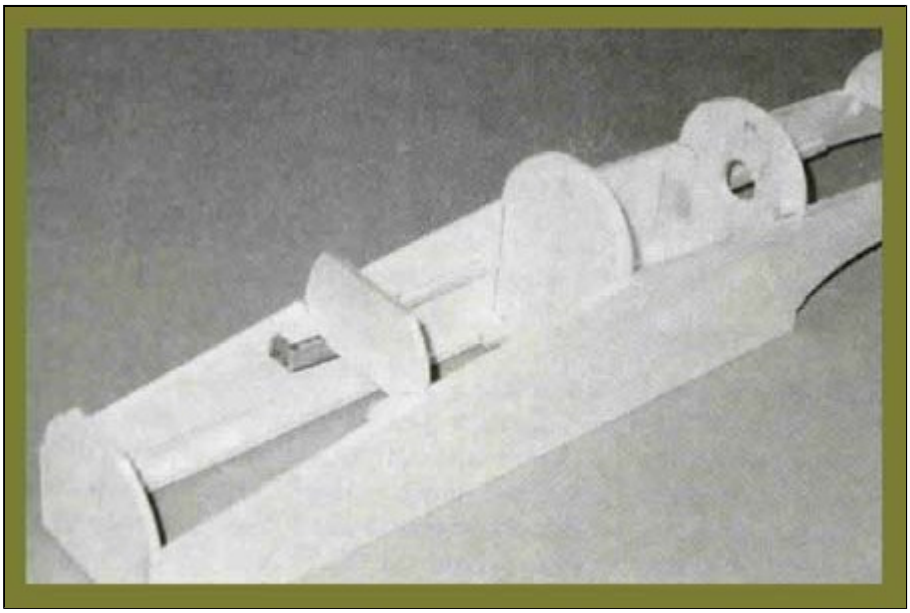
(Left) Vertical fins are built-up balsa. (Right) Fuselage formers F-1 through F-8.

(Left) Left and right fuselage sides with former locations and support blocks in place. (Right) Fuselage sides glued to bottom sheeting.

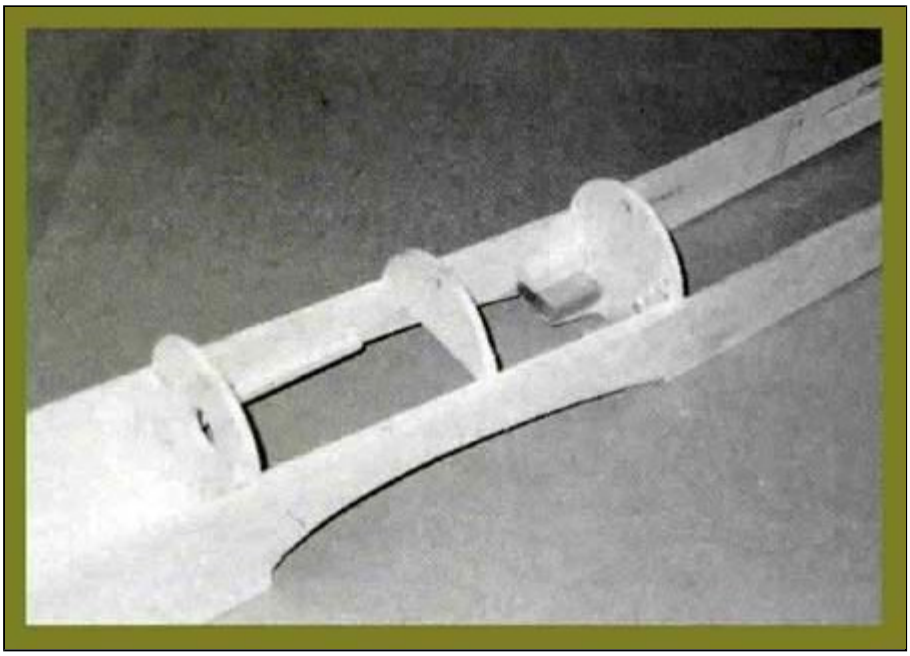
I can honestly say that the plane has no bad habits and is easy to fly. Anybody who has flown a low wing aileron trainer could handle it. Landings are as slow and predictable as on any trainer with a wing loading of, say, 24ozs./sq. ft. I attribute the success of this design to the thick, flat bottom airfoil; wingtip washout; and, the dihedral in the outer wing panels. The airplane handles its 7 lb. weight very well, as many of our club members who have seen it "dead stick" would attest. (The retract version flies just as well at 8 lbs.!)

The model has generated a lot of interest within our flying club (the Abby Hawks) and a few of the guys are in the process of building from my plans.

The following is a description of the construction process.



Forward fuselage construction. Note hardwood blocks for mounting retractable nose gear.



Hardwood blocks used for wing mounting bolts.

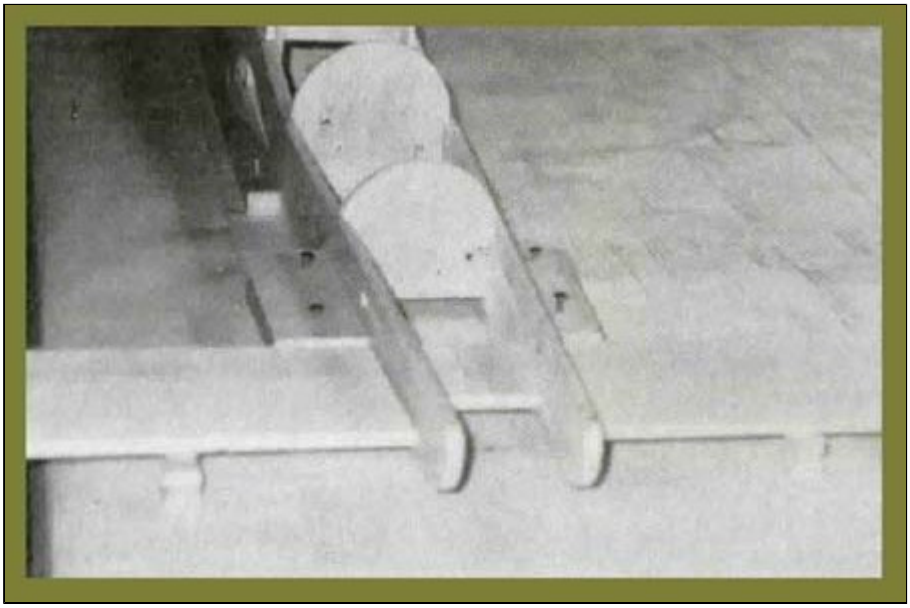
CONSTRUCTION

General:

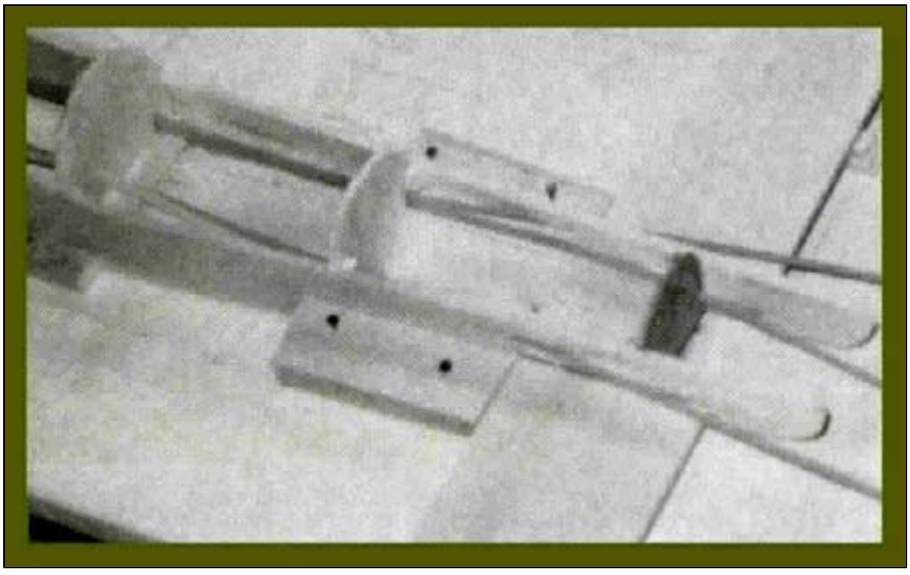
This model employs conventional materials and building techniques and construction is very straightforward. There are, however, a couple of areas where accuracy is important and where it will pay to be extra careful. These are as follows:

(1) The fuselage tapers aft of F6. It is important that each side tapers the same amount so that the fuselage remains straight. If this is not done properly, the engine and rudders will be offset from the centerline and this will affect the aircraft's performance. I highly recommend that a simple jig be used such as the one described in the construction sequence.

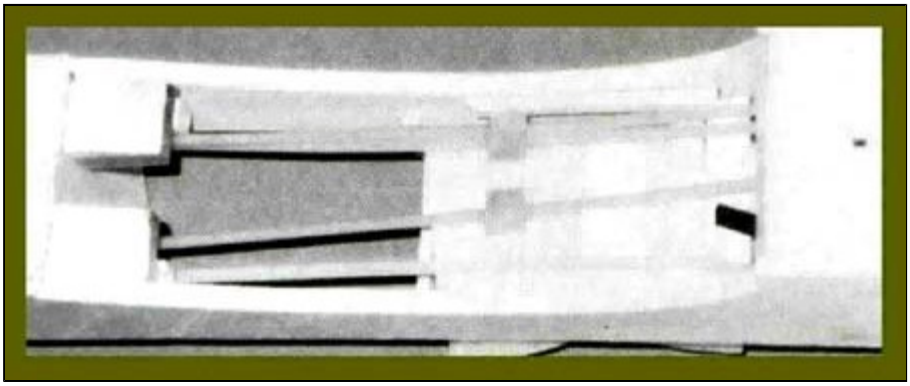
(2) The fake engine pods and pod supports must be mounted parallel with the centerline (top view) and the 0º thrustline (side view). If this is not done, the pods and supports may act like control surfaces and could affect the performance of the model.



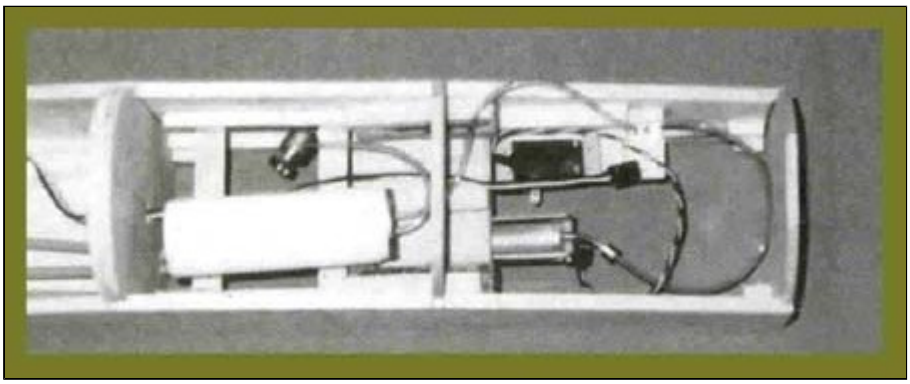
Simple jig is used to assemble the fuselage (see text).



Stabilizer is glued to fuselage while it is in jig, assuring proper alignment. Note that pushrods are installed at this time.



Balsa cleats are used in several locations to keep pushrods from flexing. Balsa fillets are glued to hardwood wing mount blocks.

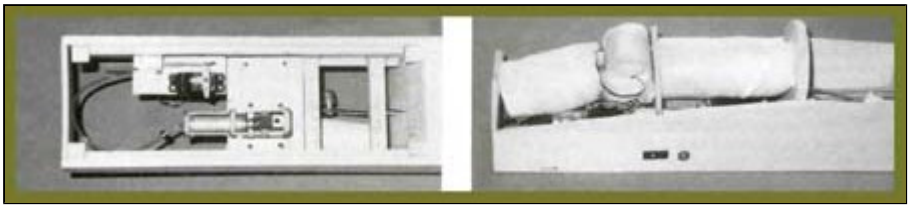


Top view of equipment location in fuselage.

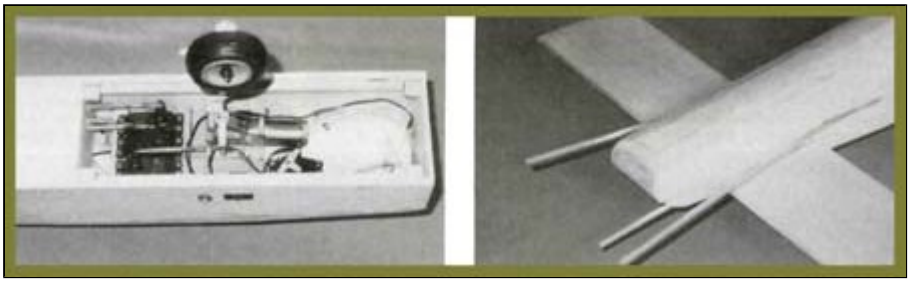
A Perry Regulator Pump is highly recommended so that the fuel tank can be located at the Center of Gravity. Without one, the tank would need to be placed as far rearward as possible and a lot of weight would be required in the nose to balance the model.

I used gap filling instant glue for the entire aircraft with the exception of the center wing dowel, wing bolt anchor blocks, dihedral joint, landing gear mounts, and where the F2/F2A, F4/F4A, and F8 formers are joined to the fuselage. Five minute epoxy was used at these locations.

I did not incorporate rudder control into this design and the plane flies great without it; however, functional rudders could be employed if you wish.



(Left) Bottom view of equipment location prior to installation of most gear. (Right) Battery, receiver, and air tank are all wrapped in foam prior to adding top sheeting.

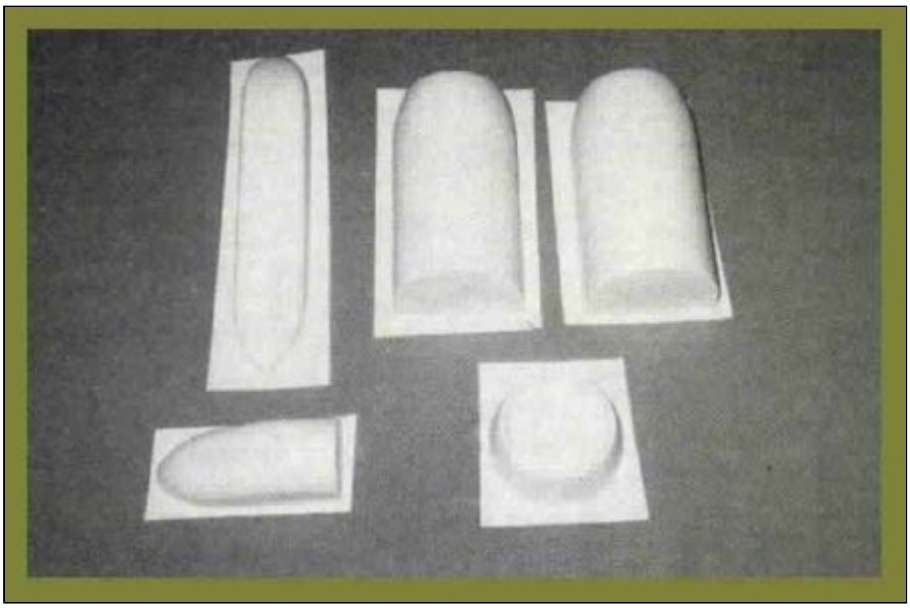


(Left) Radio gear fitted in place. (Right) Pushrod exit location in rear of fuselage.

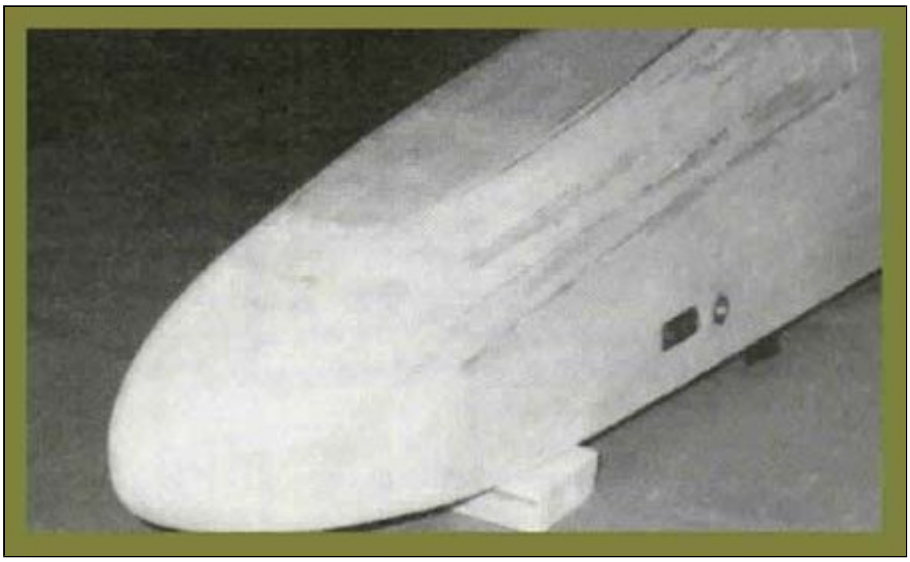
As with any building project, read the instructions and examine the plans thoroughly prior to starting construction. Determine your tank and servo locations and the NyRod routes prior to cutting holes in formers, etc. The plans show one possible set-up, but it is a good idea to confirm that it will work for your radio and engine.

The following instructions are primarily for the fixed gear version but reference is made to retract installation (retract installation is shown on the plans). The construction photos included in this article are a combination of my original fixed gear prototype and my second version which has retracts.

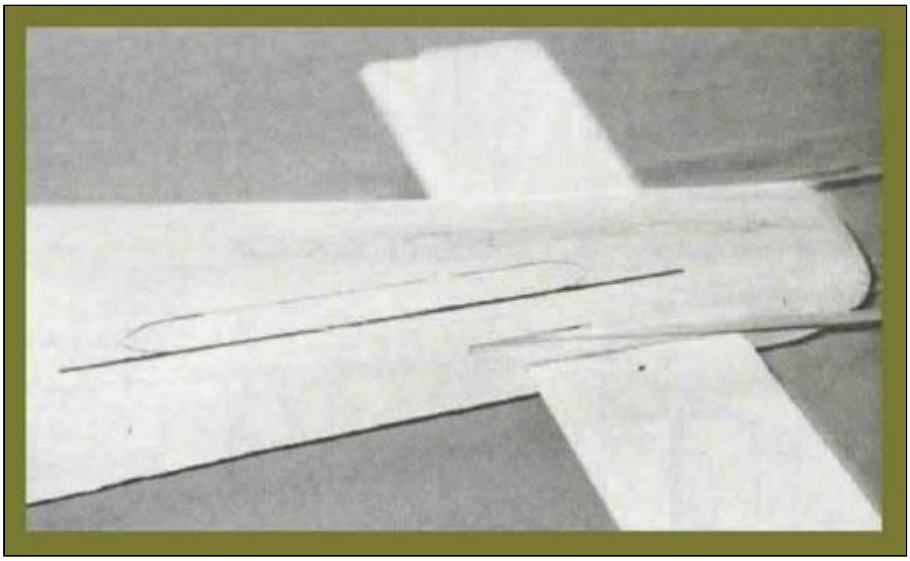
Now let's begin…



Engine pod and wheel nacelle prior to assembly.



Nose section after shaping. Note switch and retract filler valve location.



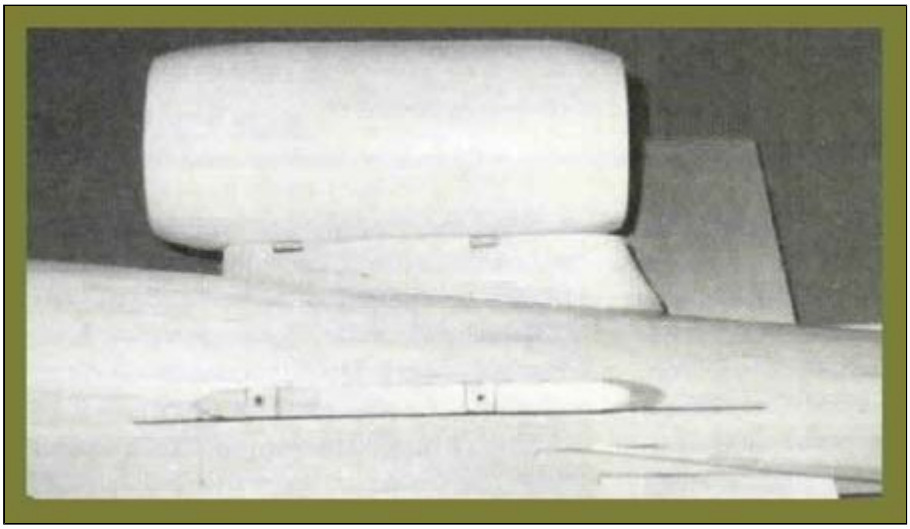
Make a reference line on fuselage parallel with building surface for engine supports.

Template is used to help ensure proper alignment of mounts. Note: The engine mount location shown in these photos was 3" too far aft, and had to be relocated forward. Oops!

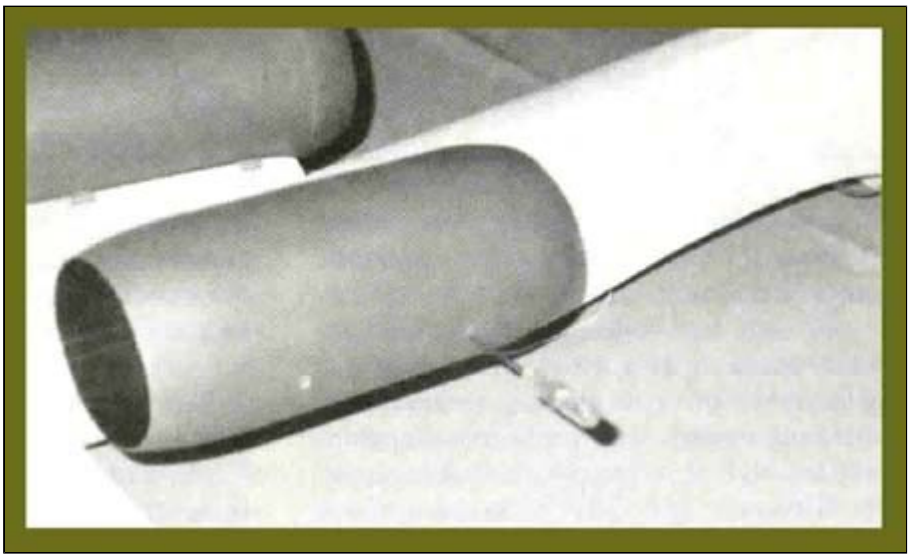
Tail Surfaces:

The rudders and stabilizer can be made from solid sheet if you are using a light grade of balsa. If your balsa is firm and heavy, build them up as shown on the plans. Using outlines on the plans, cut out the rudder pieces from 3/16” balsa and the stabilizer and elevator from 1/4” balsa (note the grain direction), and glue them together.

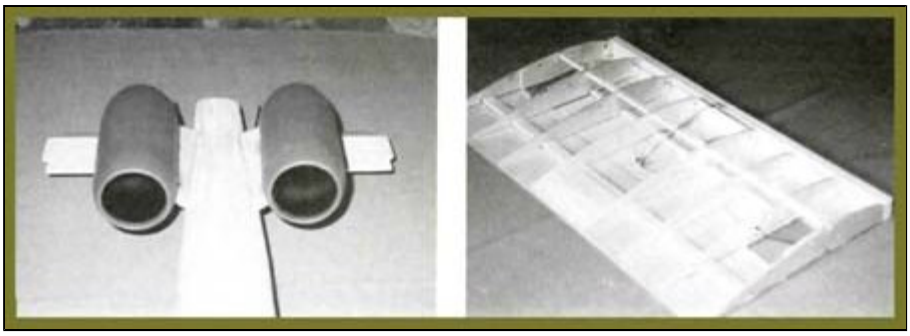
Sand the leading and trailing edges and the elevators to achieve the proper contours shown on the plan.



Fake engines are held in place with socket head screws and blind nuts in plywood inserts or mounts.



A ball driver is used to install fake engines.



(Left) Both engines painted and installed on mounts. (Right) Wing center section with retract air line installed.

If the rudders are built-up, strengthen the lower rudder joints as shown on the plans by gluing 1” nylon cloth in place.

Do not hinge and join the elevator at this time. Set aside.

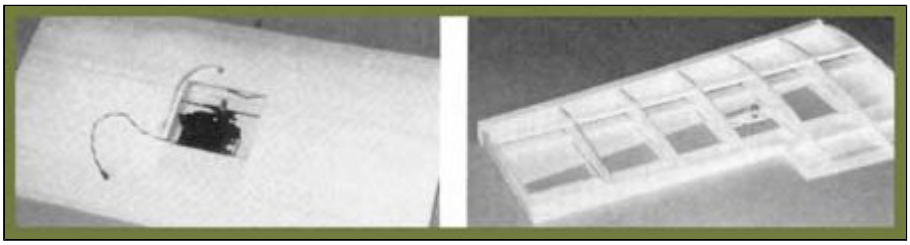
(Left) Hardwood landing gear blocks epoxied in place. Music wire is aileron pushrod. (Right) Retract mounting plate epoxied in position. Retract unit temporarily fit in place.

Fuselage:

Cut out formers Fl through F8 and drill holes for NyRods and fuel tubing. All formers are made of 3/16” balsa, except for F2A, F4A, and F8 which are birch 1/8” ply. Note that a modified F2 is required if a belly mount nose retract is used.

Drill engine mount holes in F8 (for inverted engine) and install blind nuts. If your standard muffler will interfere with the elevator, you can rotate the engine slightly so the muffler is angled slightly downward and away from the elevator. The muffler blows the exhaust towards the front of the plane. A Du-Bro Muff-L-Aire can also be used.

Drill nose wheel bracket holes in F2A, install blind nuts, and then install nose wheel bracket.



(Left) Center wing section with aileron servo installed on 3/16" or 1/4" plywood blocks. Note retract quick-disconnect. (Right) Outer wing panel with aileron bellcrank in place. Note scrap balsa used to fill in trailing edge at aileron location.

Glue F2A to F2, F3A to F3, and F4A to F4 (note that F4 and F4A are not flush at the bottom).

Drill 1/4” wing dowel hole into F4A and F4.

Use the outline on sheet #1 to cut two fuselage sides from straight and firm 48” x 3” pieces of 1/4” balsa sheet. A portion of the fuselage side forward of the fuel tank is taller than 3”, so scrap balsa must be glued to the 3” sheet to complete the shape. Mark all of the former locations on the fuselage sides (on the inside) for reference later on.

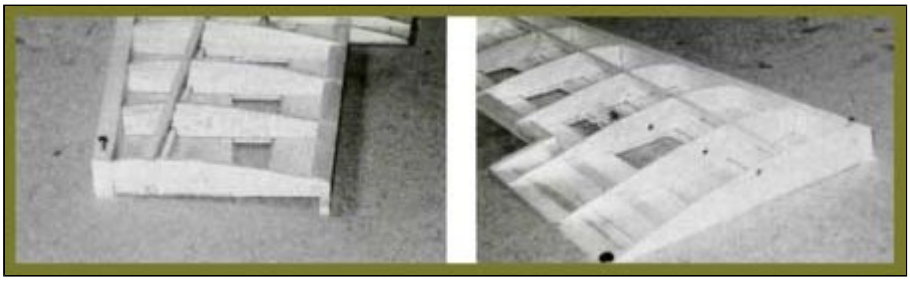
Carefully cut out the stabilizer slot and elevator NyRod exiting each side. The stabilizer should beat negative 1/2º to the 0º thrustline (i.e., it has a bit of “up” in it). Note that the location of the NyRod exit is not exactly the same on the right and left sides.

Cut two wing saddles from 1/8” ply and glue into position on fuselage sides (remember to make right and left sides).

Cut hardwood wing mount blocks and epoxy them into position as shown on the plan. Fillet the space between the bottom of the block and the wing cut out with balsa that is the same width as the block 1/2” x 1/2” balsa is glued above the wing mount blocks for added strength.

Install the 1/4” x 1/4’’ balsa servo rail supports and tank rail supports as shown on the plans. Also glue 1/4” x 1/4” balsa 3/16” up from the bottom of the fuselage sides between the Fl and F2A former locations (refer to plans).

Lay the fuselage top view plan onto a flat building surface and cover it with wax paper or equivalent to prevent it from getting damaged (you will be building over the top of it).



(Left) 1/4" washout is built in by shimming under T.E. prior to adding top sheeting. (Right) L.E. and T.E. are pinned to building board at the root, while 1/4" shim is placed under T.E. tip.

Cut the forward bottom sheeting by placing a 3-1/2” wide piece of 3/16” balsa on the plans ahead of F4A. Cut it to length (it goes up to Fl) and then cut it forward of F2 as this is where the hatch separation is. Set the forward hatch section aside. All that is left on the plan is the bottom sheeting between F2A and F4A. (Note that the hatch will be different if retracts are used.)

Glue the sides against the bottom sheeting, making sure that they are square to the building surface.

Glue formers Fl, F2/F2A, F3/F3A, F4/F4A, F5. and F6 into place (use epoxy on F2/F2A and F4/F4A). Note that the bottom of Fl should be flush with the bottom of the fuselage sides. F2. F3, and F4 sit on the 3/16” bottom sheeting. The bottom of F6 should be 3/16”up from the bottom of the fuselage side as it will also sit on the bottom sheeting.

1/2” x 1/2” balsa triangle stock should be glued into place at the former-to-fuselage side joints at F2A and F4 to strengthen these formers (see top view).

Important: The fuselage tapers aft of F6 and it is important that both sides taper the same amount so that the engine and rudders will be parallel with the 0º thrustline. The easiest way to ensure this is to nail straight pieces of wood onto the building surface (over the plans), around the fuselage outline. The fuselage is then carefully placed inside the“jig” where the proper taper will be held while the rear formers and stabilizer are installed.

With the fuselage inside the “jig,’’ slide the stabilizer through the slots in the sides. When you are sure that it is centered, square to the centerline, and parallel with the building surface (i.e., no droop), glue it into position.

With the forward fuselage sitting firmly on the building surface, epoxy the F8 fire wall into position, ensuring that it is square to the centerline and to the building surface (there is no down thrust or side thrust).

Glue 1/4” x 1/4” balsa into position at the fire wall-to-fuselage joint to increase the strength of the fire wall.

Glue former F7 into position.

Glue 3/16'' balsa sheeting onto the fuselage bottom between F6 and F8 as shown on the plans. This is most easily done by removing the fuselage from the and tracing the inside outline of the rear fuselage sides onto a 3/16" piece of balsa.

Install the elevator and throttle NyRods through the predrilled holes in the formers and brace/secure them as necessary to reduce flex. The elevator NyRods are routed through rear slots in the fuselage sides. Note that a "Y" connection must be made to connect the two elevator NyRods to one pushrod. Do this prior to sheeting the upper fuselage.

Cut two 3-1/2" x 1/2" fuel tank rails from 1/8" lite ply and glue them into position on the 1/4" x 1/4" balsa tank rail supports that were previously glued to the fuselage sides.

(Left) Wingtips are blocked up to 2-1/2" for dihedral. (Right) Completed outer wing panel with aileron and tip in place.

Wrap the fuel tank in foam and place it over the tank rails.

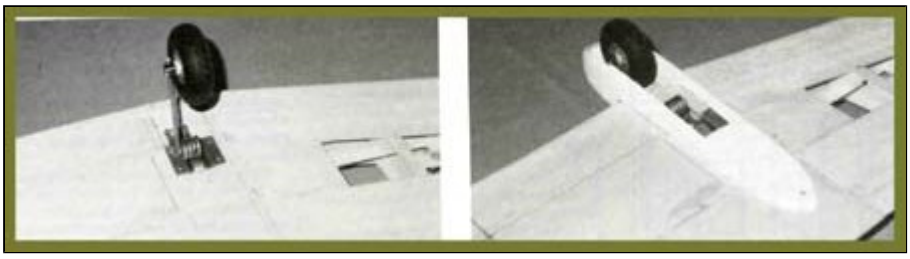
Route the fuel tank tubes as shown on the plans. The vent tube goes through the bottom sheeting forward of F4 while the tube from the pick-up goes rearward through formers F4 to F7 and then through the bottom sheeting forward of F8. Drill a hole through the bottom sheeting and stabilizer for the crankcase pressure tube which connects the pump to the engine. Fuelproof the bottom sheeting where the tubes go through it.

Route the aileron servo extension (and air lines if pneumatic retracts are used) from the radio compartment through to the wing opening aft of F4.

Cut the canopy floor out of 1/8" balsa and glue it in place over Fl, F2, and F3.

Glue the top 1/8" balsa sheeting in place. Use a relatively light grade of balsa to permit bending and to save weight. If your balsa does not bend easily, help it along by making a series of shallow, lengthwise slices in it using an X-Acto knife. Do the sheeting in two sections — Fl to F3, and F3A to the end. You may find it helpful to make paper templates of the required sheeting and use them to cut out the balsa sheeting.

Glue a 1/8" balsa "cap" at the rear of the airplane as shown on the side view plan to finish off the rear sheeting.



(Right) Main gear fit into position. (Left) Landing gear nacelle fit in place on wing, held in place with screws.

Rough cut the nose cone from 4” x 4” balsa block (or laminate balsa sheet to form a block) and glue it in position. On my first prototype, I actually used pine 2” x 4” for the center portion of the nose cone and added balsa to the sides to permit rounding. (I did this because I knew that I would need nose weight anyhow.)

Carve and sand the fuselage to achieve a scale-like appearance.

Fuelproof the F8 fire wall and the fuselage sides in the engine area and tank area.

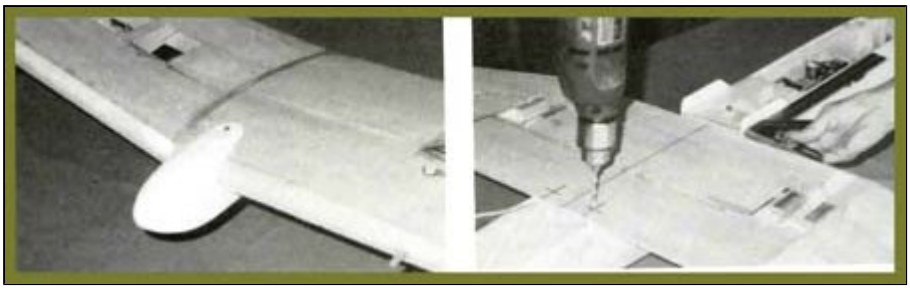
Fake Engine Pod Installation:

Important: The fake engine pods and supports must be connected to the fuselage so that they are as close to parallel as possible with the centerline (top view) and the 0º thrustline (side view). If they are installed on an angle, they may act as a rudder or elevator and affect control.

If you construct your own engine pods from wood, fiberglass, or plastic, be sure that they are light, yet rigid.

Use the template on sheet #1 to cut out two engine pod supports from 1/2” balsa. Shape the leading and trailing edges as per the plans and cut out notches for the 3/16” ply anchor blocks.

To ensure that the pod supports are installed at 0º incidence, draw a reference line on the fuselage where the bottom of the pod supports should line up. Make sure that the forward fuselage is resting firmly on the building board and that the reference line is parallel to the building board.



(Right) Screws anchor into plywood blocks in wing. (Left) Square wing with fuselage, then drill holes for 1/4" nylon wing bolts.

Temporarily place the pod supports into position using a template to ensure that they have the proper upward angle as per the front view.

Extend a straightedge from the forward fuselage side past the pod support location and visually line up the outer edge of the support with the straightedge. Trim the outer edge of the support as necessary to ensure that it is parallel with the forward fuselage sides.

When you are sure that the pod supports are parallel as per the top and side views, glue them into position. You may wish to contour the edge of the pod support to match the curve in the fuselage side prior to gluing it onto the fuselage.

Cut out the ply engine pod anchor blocks from 3/16" ply. Drill them and install blind nuts and then glue them into the notches in the engine pod supports.

Final Fuselage Assembly:

Hinge and install the elevators to the stabilizer.

Install the forward bottom hatch by hinging it at the front as shown on the plans. Install a small 3/16" ply anchor block at the center of the bottom sheeting near F2 and screw in a hatch latch. This will enable the hatch to be opened quickly for adjusting servos, etc. (On the retract version, I used four screws to hold the forward hatch in place as it is considerably longer than on the fixed gear version.)

Final sand the fuselage and cover it with your favorite iron-on covering. Do not cover the section of the stabilizer where the rudders are glued on. I used olive drab Solartex over the balsa and sprayed olive drab Formula U polyurethane on the plastic parts.

Cover the rudders and then glue them into position on the stabilizer, ensuring that they are square to the stabilizer. Glue 1/2" balsa triangle stock at the rudder-to-stabilizer joint on the underside to increase the strength of this joint. (You could install the rudders before covering them, but I found it easier to do the covering prior to installation.)

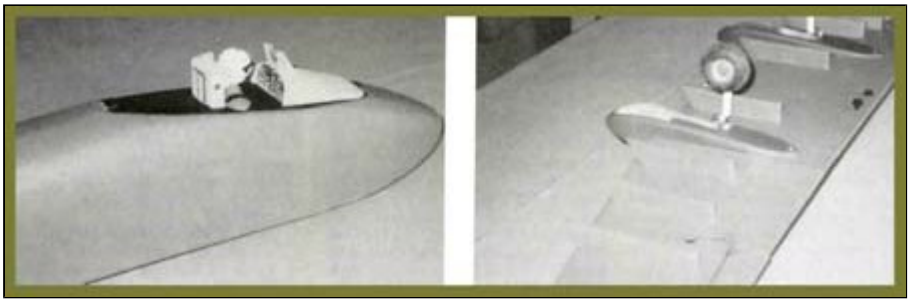
Screw or glue canopy into position after you have added cockpit detail and pilot.

Cover the remaining areas, apply trim, and install the engine pods. The plastic parts are painted to match the iron-on covering. When bolting the pods into position, I found it helpful to use hex head bolts and a ball driver (the ball driver fits through two small holes drilled into the outside edge of the pod).

Install the engine mount on F8 and then install the engine onto the mount. If a Perry Regulator Pump is used (and I highly recommend that one is), route the crankcase pressure tube through F8 and through the hole previously drilled through the stabilizer and bottom sheeting. (It may be easiest to fish a fine wire through first and then slide the tube through over the wire.) Install the muffler or a Du-Bro Muff-L-Aire.

Install the Perry Regulator Pump onto the bottom of the rear fuselage as shown on the plans (clamp the pump into position by screwing the clamp into 3/16" ply anchor blocks that are embedded into the bottom sheeting). Complete the plumbing for the pump and engine.

Install the receiver, servos, switch, antenna, elevator horns, nose gear, and complete the linkage assemblies.



(Left) Pilot and cockpit detail prior to installing canopy. (Right) Underside of completed wing.

Wing:

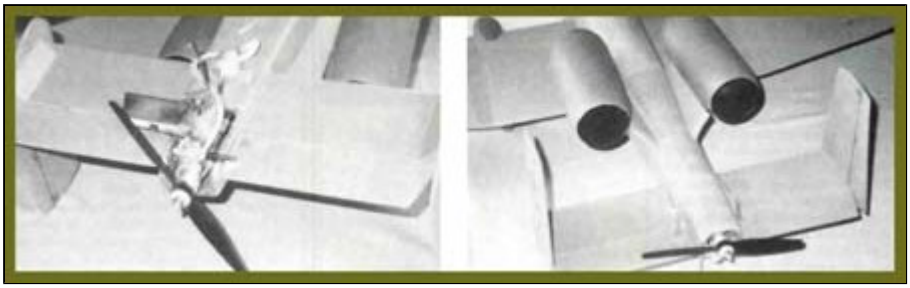
The wing is built in three sections (center plus two outer panels). Build directly over the plans on a flat building surface.

Important: If retracts are to be installed, plan their installation prior to proceeding. Retract mount plates will need to be installed as will tubing (for air retracts) or linkages (for mechanical). The plans show a typical retract installation.

Use the templates on sheet #2 to cut out the wing ribs from 1/8” balsa. There are ten Wl ribs and two each of W2 through W7.

Cut six Wl rib doublers from light 1/8” ply and glue these to six of the W1 ribs (note that the use of doublers is different if retracts are used).

Ensure that the aileron pushrod hole is drilled through all ribs W1 through W3.



(Left) Engine and fuel pump mounted, tail skid is in place, and 1/2" balsa tri-stock has been added to strengthen vertical fin/stabilizer joint. (Right) Completed aft section...very clean.

Center Panel:

Place bottom 1/16” balsa sheeting in place as shown on the plans and glue the edges together so that it forms one piece. Mark the rib and spar locations on the sheeting. Cut a 3/4” x 6” relief in the bottom sheeting to accept the landing gear block.

Glue the 1” x 1/2” balsa leadingedge up against the bottom sheeting (the leading edge does not sit on top of the sheeting).

Glue the 1/2” x 1/4” balsa rear spar, the 1/4” x 1/4” spruce bottom spar, and the hardwood landing gear blocks (for fixed gear version) to the bottom sheeting. (Obviously, if retracts are used, ply mount plates must be installed instead of the blocks.)

Glue W1 ribs in position. Note that the six inner ribs which go over the landing gear blocks have the ply doublers.

Glue a 1/4’’ balsa fillet between the two center W1 ribs aft of the main spar and sand it to match the contour of the W1 ribs.

Glue a scrap piece of 1’’ x 1/2’’ balsa to the inside of the leading edge between the two center W1 ribs and sand it to match the contour of the W1 ribs (this is to strengthen the center dowel).

Glue the top 1/4” sq. spruce spar into position.

Add the top 1/16” balsa sheeting. There is no sheeting between the two center WI ribs at the servo location. If retracts are used, route the air lines or linkages prior to installing the top sheeting.

Install the aileron servo so that the servo arm will line up with a 1/16” wire pushrod installed later through the holes in the ribs.

The front end looks "all business!" All-up weight with retracts is just over 8 lbs.; grass field take-offs are still very good with a .45-.46 engine.

Outer Panels:

Place bottom 1/16” wing sheeting and capstrips in place over the plan. Mark the rib and

spar locations.

Glue the 1” x 1/2” balsa leadingedge up against the bottom sheeting.

Glue the 1/2” x 1/4” balsa rear spar and the 1/4” sq. spruce bottom spar over the bottom sheeting.

Glue ribs W1 to W7 in position. Use the dihedral gauge on sheet #2 to set the angle of the W1 rib on the outer panel. Sand the end of the leading edge at W1 to match the angle of the rib.

Glue 1/2’’ x 1/4’’ balsa over the 1/2” x 1/4” rear spar between ribs W3 to W7 and sand it to match the contour of the ribs.

Cut out the aileron bellcrank mounts from 1/8’’ ply, install the bellcranks onto the mounts and then glue these assemblies in position between the W3 and W4 ribs. Glue 1/4’’ x 1/4’’ balsa at the bellcrank mount-to-rib joint to increase its strength.

The following procedure will ensure that the two outer wing panels have the proper amount of washout to enhance the model’s slow flight performance. Start by ensuring that the outer panel is firmly pinned to the building surface along its leading edge and along the W1 rib (i.e., the root). Place a 1/4” shim under the bottom 1/16” sheeting at the trailing edge tip as shown on the plans (ensure that the leading edge and root remain pressed against the building surface). Glue the top 1/4” x 1/4” spruce spar in position and then glue the top 1/16” sheeting and capstrips in place. When dry, remove the panel from the building surface and note the intentional warp that has been built into the wing i.e., washout.

Add a 3/16’’ thick balsa fillet (W8) between the top and bottom 1/16” wing sheeting at the aileron cut out.

Slide the 1/16” music wire pushrod through the center section and then slide the two outer wing panels in position. Block the ends of the outer panels up 2-1/2” to achieve the proper dihedral. With the three wing sections temporarily fitted together, mark the aileron pushrod at the bellcrank locations and at the servo arm location. Slide the outer panels out of position and remove the pushrod. Install your choice of aileron servo coupling on the pushrod at the servo location, and “z’’ bends at the bellcrank locations, and then slide the pushrod back through the center section.

Final Wing Assembly:

Carve and sand the leading edges of all three wing sections to shape.

Slide the outer panels onto the aileron pushrod and connect the pushrod to the bellcranks.

Block the tips of the wing panels up 2-1/2” and, when you are sure that the wing sections are lined up properly, epoxy the outer panels to the center section. Let this dry thoroughly before moving.

Strengthen the dihedral joints by wrapping them with 3’’ of two ounce fiberglass cloth and resin. At the same time, it is a good idea to fiberglass the leading edge and trailing edge of

the center section (2” – 3” wide cloth).

Cut ailerons from 1/2” balsa and sand them to match the contour of ribs W4-W7 (i.e., the aileron is the trailing edge of these ribs).

Hinge and install the ailerons and then install the aileron horns and the bellcrank-to-horn pushrods. (The shape of this pushrod is shown on sheet #2.) The aileron servo must be connected to the aileron pushrod when completing these linkages.

Using the 3-views on sheet #2, cut out the wingtips from 1/2” balsa. Glue them to the W7 ribs and then final sand them to achieve a scale shape.

Trial fit the wing in the fuselage wing saddle. Sand the saddle or wing as necessary to achieve a good fit.

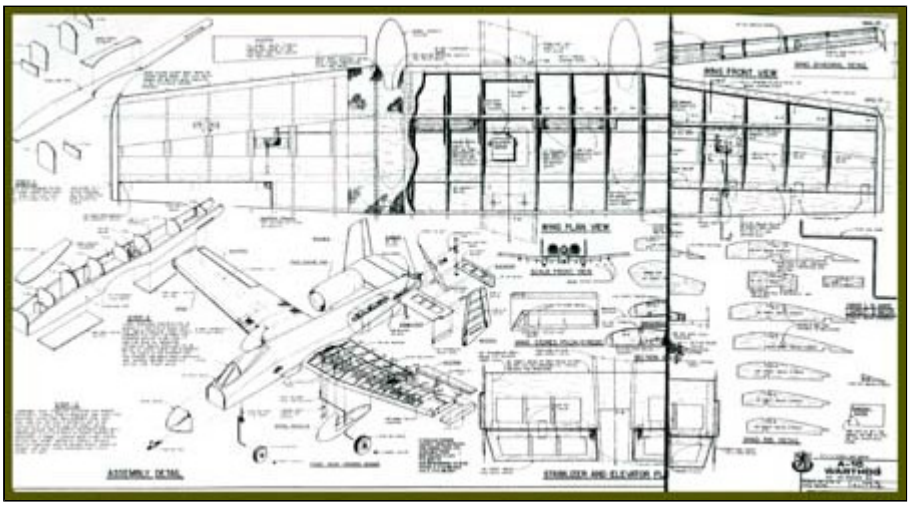
Place a mark on the leading edge at the exact center of the wing and 7/16” from the bottom of the leading edge. Drill a 1/4” diameter hole in the leading edge at this location (make sure the drill bit goes in straight). Epoxy a 1-3/4” piece of 1/4” diameter dowel in the hole so that 5/8” of the dowel is exposed. Let the epoxy dry thoroughly.

Fit the wing in the fuselage wing saddle by inserting the dowel in the hole in the F4/F4A former. When you are sure that the wing is square to the fuselage, drill two wing bolt holes through the wing and through the hardwood wing mount blocks. The location of the holes is shown on sheet #2. Use a 3/16” diameter drill bit and then tap the wing mount blocks so that 1/4” nylon wing bolts can be installed.

The landing gear nacelles can be built from balsa or fiberglass using the side and top view outlines on the plans. If retracts are used, the nacelles must be hollow. Glue or screw nacelles in position.

Final sand the wing and cover using the same method used on the fuselage.

Bend 5/32” music wire to the landing gear shape as shown on sheet #2. Drill a hole through the hardwood landing gear block and install the landing gear in position. Landing gear strut covers should be added to improve scale appearance. (If retracts are used, install main gear onto ply mount plates and complete plumbing. A quick disconnect must be used to permit removal of the wing.)



Plan #1144 A-10 THUNDERBOLT.

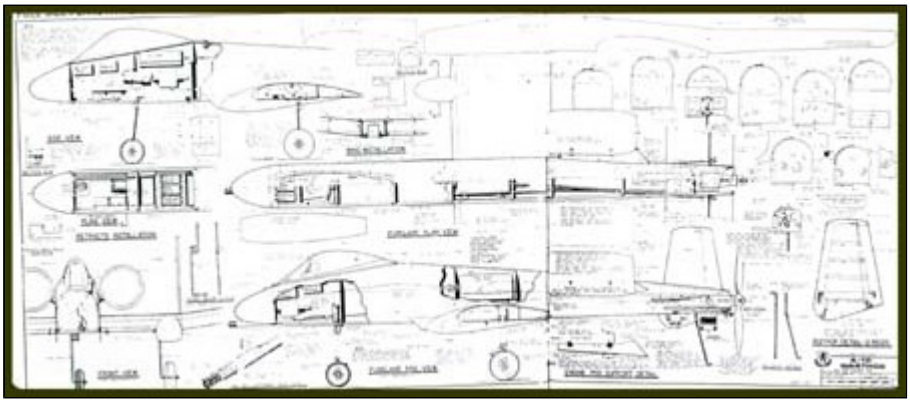
Pre-Fligbt:

Add nose weight as necessary to balance the aircraft at the Center of Gravity shown on the plans. **Note:** If a fuel pump is not used and the tank is rearward of the Center of Gravity, balance the model with the tank full.

Also balance the model from side to side and add weight to the light wingtip to achieve balance.

Adjust elevator throw so it is 1/2” up and 1/2” down.

Adjust aileron throw so it is 3/8” up and 3/8” down.



Flying:

As mentioned, the fixed gear prototype model weighed 7 lbs. and had an ASP .46 engine. With a Master Airscrew 10 x 6 pusher propeller, take-offs from grass are approximately 50’. Any good .40- .46 engine should fly the model well.

The flat bottom airfoil, wingtip washout, and dihedral make this model of the A-10 very stable. It can land and fly very slowly, yet has good high speed performance and maneuverability. It can loop, roll, and sustain inverted flight without difficulty. The model looks incredibly realistic performing a series of tight turns and Cuban 8's.

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 similar to a conventional sport aircraft.

Good luck with your building project and have fun hunting tanks!

A-10 THUNDERBOLT (WARTHOG)

Designed by: Mike Pastro
Type Aircraft: Pusher Prop Sport Jet
Wingspan: 57 Inches
Wing Chord: 9 Inches (Ave)
Total Wing Area: 550 Sq. In.
Wing Location: Low Wing
Airfoil: Flat Bottom
Wing Planform: Double Tapered Outer Panels
Dihedral, Outer Panels: 2-1/2 Inches each tip
Overall Fuselage Length: 49 Inches
Radio Compartment Size: (L) 5-3/4" x (W) 3-1/2" x (H) 3-1/2"
Stabilizer Span: 19 Inches
Stabilizer Chord (incl. elv.): 6-/14 Inches
Stabilizer Area: 119 Sq. In.
Stabilizer Airfoil Section: Flat
Stabilizer Location: Fuselage Bottom
Vertical Fin Height: 9-1/4 Inches
Vertical Fin Width (incl. rud.): 5 Inches (Ave)
Rec. Engine Range: .40 - .46 2-Stroke
Fuel Tank Size: 10 Ozs.
Landing Gear: Tricycle
Rec. No. Of Channels: 4 (5 w/retracts)
Control Functions: Elev, Throt, Ail, Nosegear

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage - Balsa & Ply
Wing - Balsa & Spruce
Empennage - Balsa

Weight Ready To Fly: 96-112 Ozs. (6-7 lbs.)
Wing Loading: 25-29 Oz./Sq. Ft.

A-10 Thunderbolt (Warthog) .40-.45 Pusher R/C Comprehensive Material List

Balsa Sheet:

1/4" x 3" x 48" - 2 (for fuselage sides)
1/4" x 4" x 36" - 1 (for stabilizer)
3/16" x 4" x 36" - 2 (for fuselage bottom, bulkheads, rudders)
1/8" x 4" x 36" - 4 (wing ribs, fuselage top sheeting)
1/16" x 3" x 48" - 7 (wing sheeting)
1/2" x 4" x 36" - 1 (for wingtips, ailerons, fake engine supports)

Balsa Stick/block:
1/4" x 1/4" x 36" - 2 sticks
1/2" x 1/2" x 36" - 1 triangle stock
4" x 4" x 4" - 1 (nose - or you can laminate sheet balsa)
1/2" x 1/4" x 36" - 3 (wing spars)
1" x 1/2" x 36" - 3 (wing leading edge)

Spruce/Hardwood:
1/4" x 1/4" x 36" - 6 (spruce: wing spars)
1-3/8" x 1" x 1/2" - 2 (hardwood: wing mount blocks)
1-1/2" x 1/4" - 1 (Dia. dowel: wing dowel)

Plywood:
1/8" x 4" x 7" - 1 (firm ply: F2A, F4A, F8)
1/8" x 4" x 20" - 1 (lite ply: fuel tank rails, rib doublers, wing saddle doublers, aileron bellcrank mounts)
All of the above wood is avialble in a custom cut package for $25.00 plus S&H from Balsa USA, PO Box 164, Marinette, WI 54143, (800) BALSA US, as for part #406.

Miscellaneous:
1 - Perry Regulator Pump
1 - .40-.46 size engine mount
1 - 10oz. fuel tank
1 - 40" fuel tubing
1 - Set of 36" blue NyRod (elevator pushrods)
1 - 48" throttle pushrod
1 - 36" x 1/16" music wire (tail skid)
4 - Control horns (ailerons and elevators)
1 - Nose wheel strut and mount
2 - 13" x 5/32" music wire (fixed main landing gear)
4 - Plastic landing gear straps (fixed gear version)
2 - 6" x 3/4" x 3/8" hardwood landing gear blocks (for fixed gear)
2 - 1/4" Dia. nylon wing bolts
1 - 2-1/4" Dia. nose wheel
2 - 2-3/4" Dia. main wheels
1 - Set Robart landing gear covers (optional)
3 - 5/32" wheel collars
1 - Package of 15 medium size hinges
2 - 6' rolls of covering
- Spray paint to match covering (for plastic parts)
- 2 ozs. instant glue
- 2 ozs. fiberglass cloth and resin (dihedral joint, wing center, nose section)
- 5 minute epoxy
- Miscellaneous blind nuts, bolts, and screws for engine mount, engine, servos, hatches,

landing gear straps, ect.
A complete set of vacuum formed components (canopy, engine pods, and wheel nacelles) is
available for $45.00 + $5.00 S&H, from Bob Holman Plans, P.O. Box 741, San Bernardino
CA 92402, (909) 885-3959, bhplans@aol.com

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