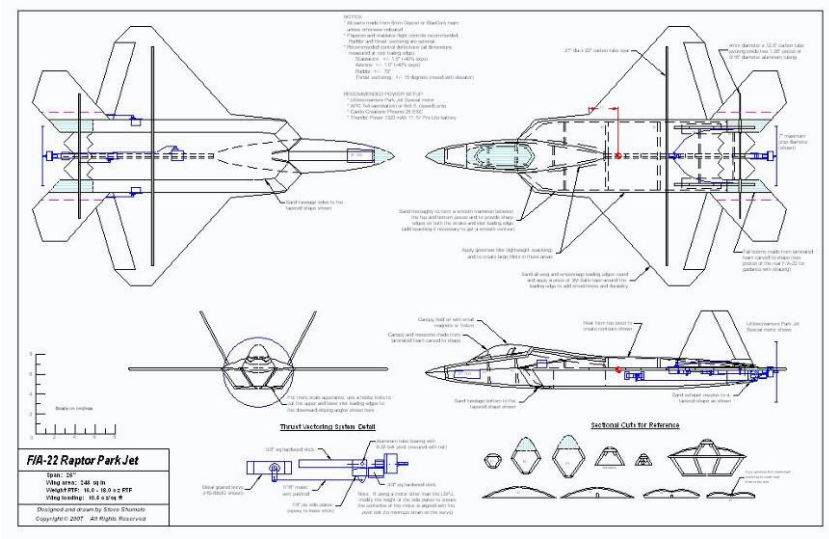
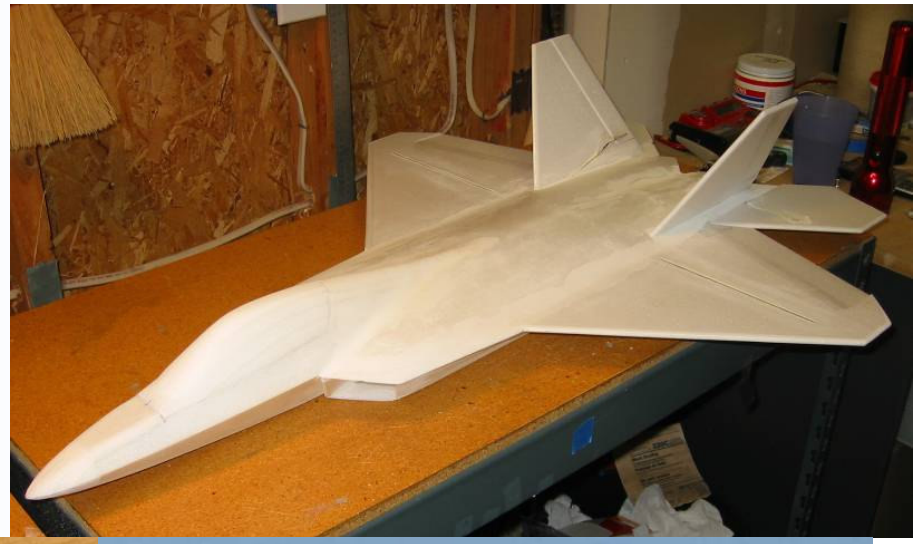
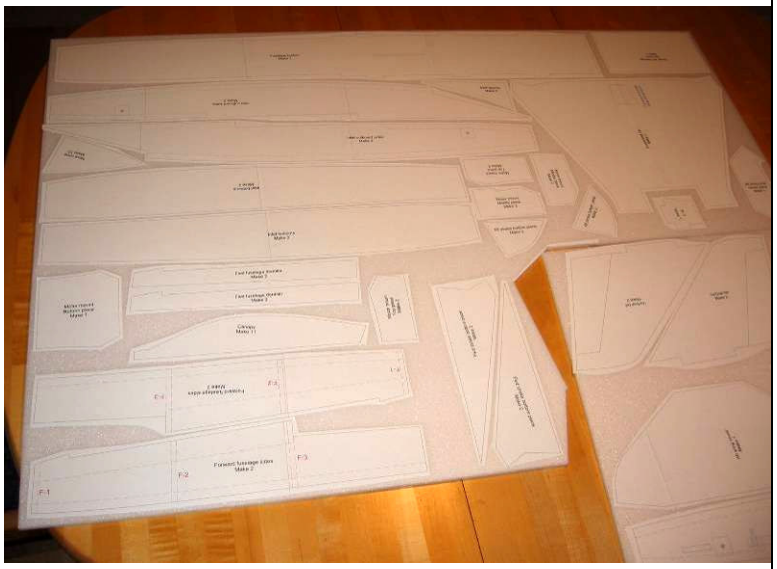
Construction Guide for the F/A-22 Raptor Park Jet

By Steve Shumate







Building Tips

This model can be built using the following types of adhesives:

- Epoxy (with or without microballons)
- Odorless cyanoacrylate (CA) with accelerator
- UHU Creativ for Styrofoam (or UHU POR)
- 3M 77 spray adhesive
- Hot glue gun
- ProBond (or Gorilla Glue)

To minimize weight, try to use as little epoxy as possible on this model, saving it for only critical joints such as wing spars and motor mounts. You can also mix microballons into the epoxy to reduce weight considerably and help it fill gaps better. The majority of construction should use a lightweight and quick-drying adhesive such as foam-safe CA, UHU Creativ, or 3M 77. I personally use 3M 77 and UHU Creativ (both pictured at left) for the majority of construction since they are strong and dry very quickly.

3M Satin tape is called out many times in these instructions since it works so well for hinges, leading edge protection, and general strengthening. Make sure to get 3M Satin tape (sometimes called 3M Gift tape), which is sold in the purple container. The common 3M Scotch tape sold in the green container doesn't work nearly as well, nor does common packing tape.

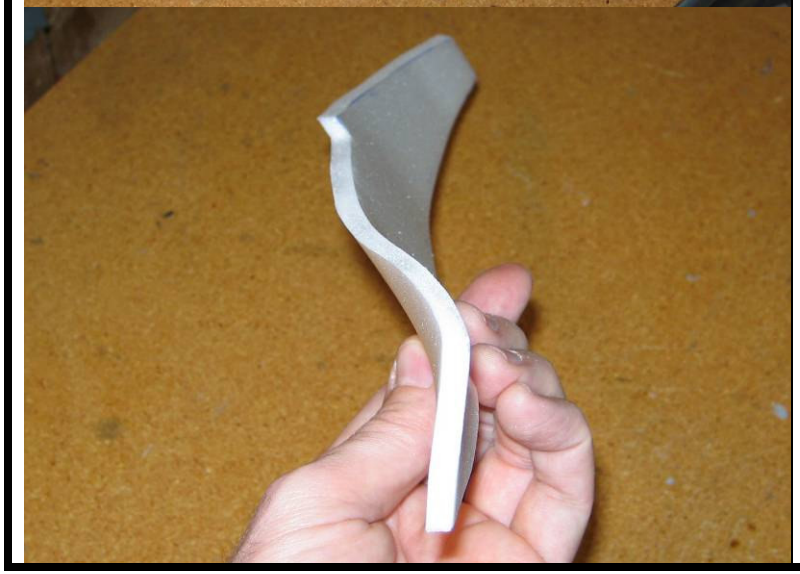
Begin construction by cutting out all of the paper parts templates with scissors, trimming them to within approximately 1/8" of the lines. Then test fit all of the templates onto the foam sheet, trying to minimize wasted foam as much as possible. Once you're satisfied with the arrangement, remove each template individually and spray the back of the template LIGHTLY with 3M 77 spray adhesive. Then replace the template onto the same spot on the foam sheet. Repeat for every template.

After all the templates are tacked onto the foam, cut out all the pieces by cutting on the lines with a SHARP hobby knife. To help keep track of the parts, keep the paper templates on each piece until you're ready to use it.

1. Begin assembly with the forward fuselage. Start by carefully cutting the beveled edges on all of the forward fuselage pieces as shown on the plans. Draw a reference line on each part that's inset from the edge the distance indicated on the plans (note you can trace the lines from an identical part onto the opposite part). Then cut the bevel with a sharp hobby knife. You can use a straightedge for the straight segments, but the curved segments will need to be cut by hand. It's best to practice with some scrap foam first to get the hang of it before cutting the actual parts.

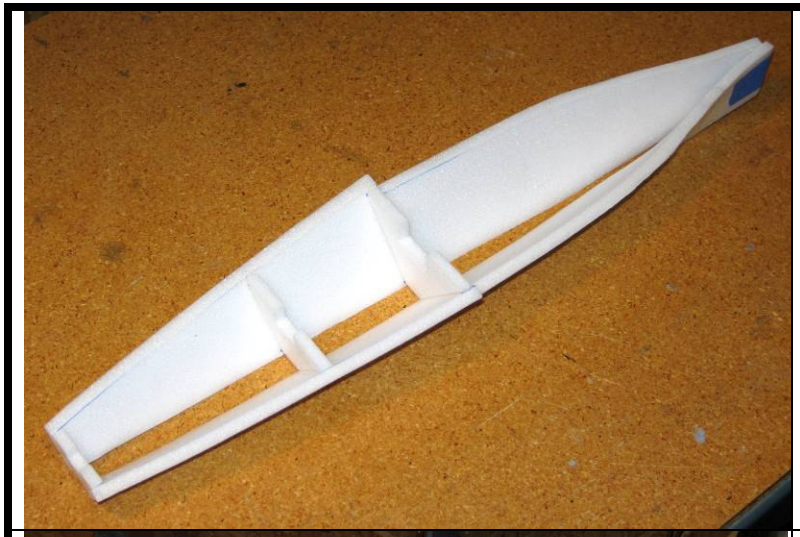
Be sure to make mirror-image left- and right-side pieces!

The beveled parts should look like the photo at lower left when done (upper forward fuselage side shown).



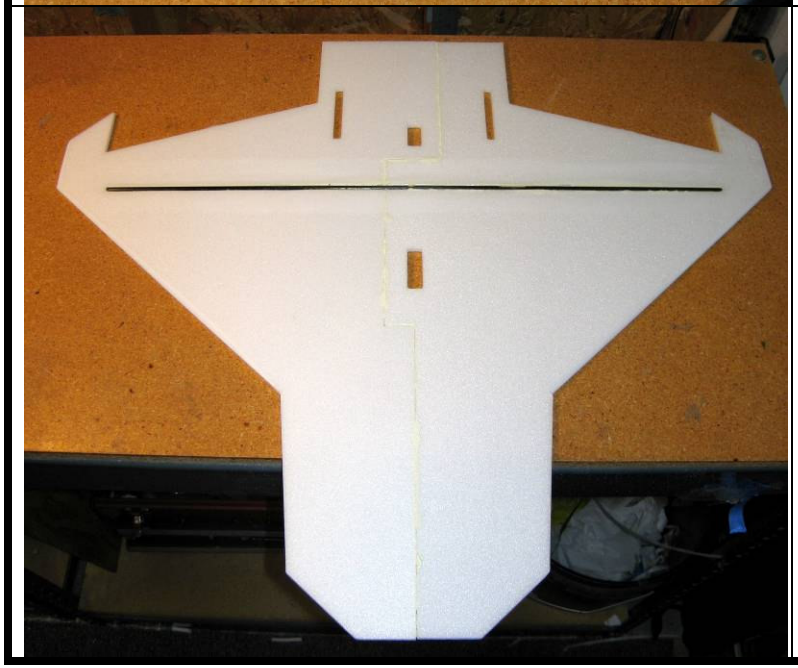
2. Next form the curvatures in the lower forward fuselage sides. Use a heat gun to gently heat and soften the foam and then bend them to the shapes shown. The curves required are a bit complex—there should be one gradual curve over the entire piece to form the taper of the fuselage (as seen from the top), and a quick twist at the aft end to match the angled fuselage sides to the vertical fuselage centerline support. Study these photos and the photos in the following pages to guide you. The curves don't have to be exact since the bulkheads will help form the fuselage as well once it's assembled.

Again be sure to make mirror-image left- and right-side pieces.



3. Glue the bottom half of the three fuselage bulkheads (the ones with the notch on top) to one of the lower forward fuselage sides at the locations shown on the plans, making sure they are perpendicular. Then set the fuselage sides upright and flat on the workbench, apply glue to the edges of the bulkheads, and then glue the two fuselage sides together.

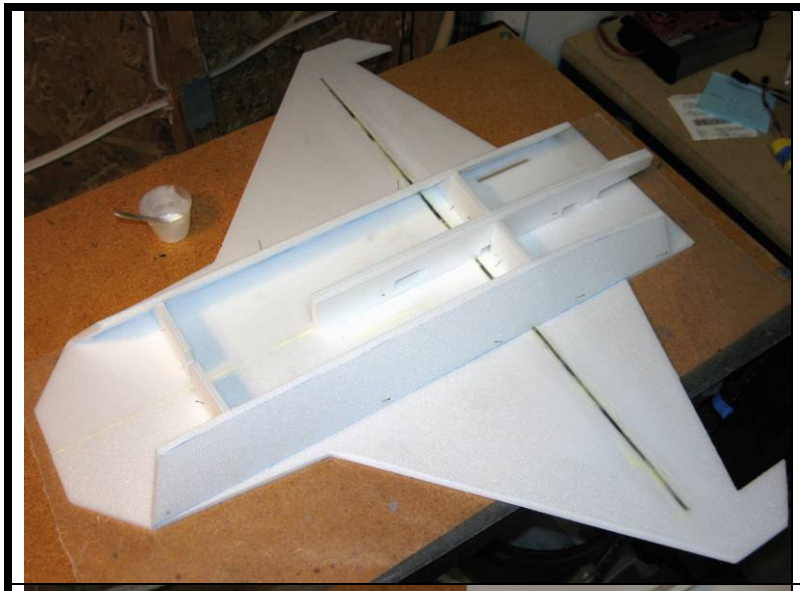
After the glue has dried, glue together the aft ends of the fuselage sides as shown, ensuring they are perfectly vertical. You may need to heat-form the foam a bit more to get things to align just right.



4. Next build the wing. Cut a slot to fit the carbon wing spar and use 30 minute epoxy to spar into place. Mixing some microballons into the epoxy is recommended to reduce weight and help the glue fill gaps better (you can also use ProBond). Place wax paper and some heavy books on top of the wing to hold it perfectly flat as the glue cures.

After the glue has cured, sand the leading edge of the wing to a well-rounded shape, as well as the wing tips. Apply a strip of 3M Satin tape around the leading edge for smoothness and improved durability.

Cut the flaperons free from the wing.



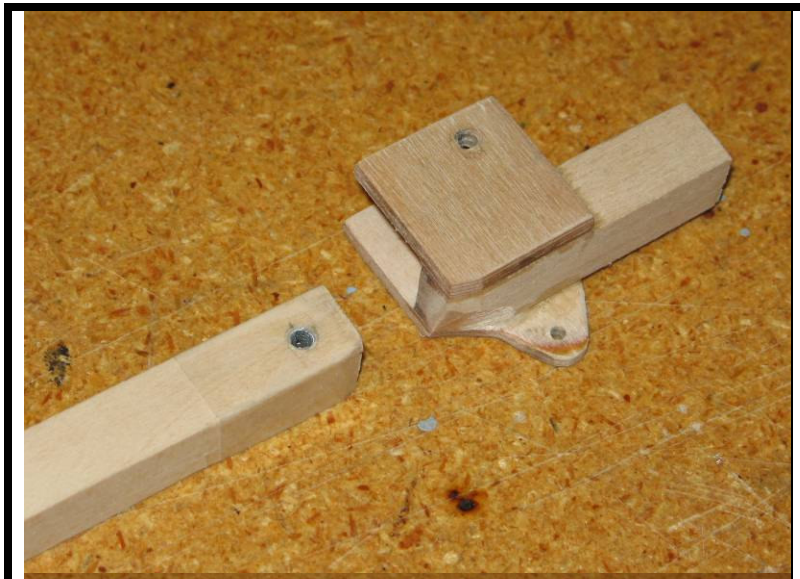
5. Laminate the two fuselage centerline support pieces together (3M 77 spray adhesive recommended). Then cut bevels on the edges of the aft fuselage sides as indicated on the plans.

Place the wing on a flat surface, and then glue the two aft fuselage sides and centerline piece onto the bottom of the wing as shown. Use the four temporary bulkheads provided to ensure the fuselage sides are glued on at the proper angle. Note pins can be used to hold everything together while the glues dries. I recommend using a gap-filling glue such as epoxy with microballons or ProBond for this step.

Remove the temporary bulkheads once the glue dries.

6. Glue the forward fuselage lower assembly in place on the front of the wing. Make sure the aft end of the forward fuselage mates with the forward edge of the centerline support piece. Also make sure the curvature is smooth as the angled forward fuselage sides twist to meet the vertical centerline support. Some trimming and additional heat-forming will likely be required to get a smooth curve here.

Also note that the top of the forward fuselage droops down a few degrees relative to the wing (see bottom photo at left). This is important for achieving a scale look. As long as the top of the forward fuselage assembly mates flat against the bottom of the wing, this droop will be set automatically. Trim the fuselage sides if necessary to achieve this.



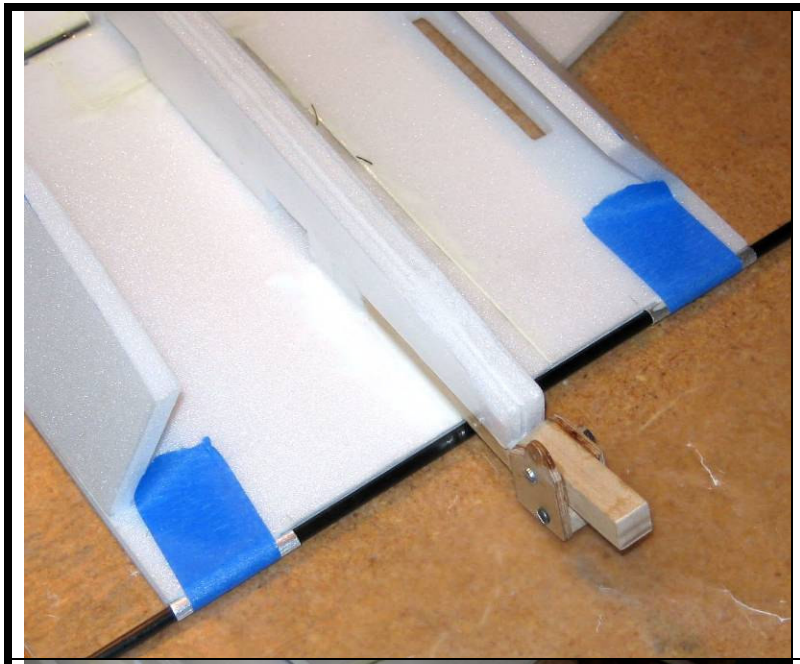
7. Next assemble the thrust vectoring motor mount. This step is optional—you may choose to install a straight motor stick if you don't want thrust vectoring.

Begin by drilling a hole in the main motor mount stick to fit the aluminum tube bearing. Then glue the bearing in place with thin CA. Cut a small chamfer in the lower edge as shown. Wrap the aft end of this stick with a layer of packing tape to ensure a smooth and low friction surface.

Sand the inside surface of the two 1/8" plywood side plates to make them as smooth as possible. Then glue both side plates to the movable portion of the motor mount stick using epoxy. After the glue is dry, drill the pivot hole through the top of both side plates at the same time, making sure it is exactly perpendicular to the plates (using a drill press is highly recommended).

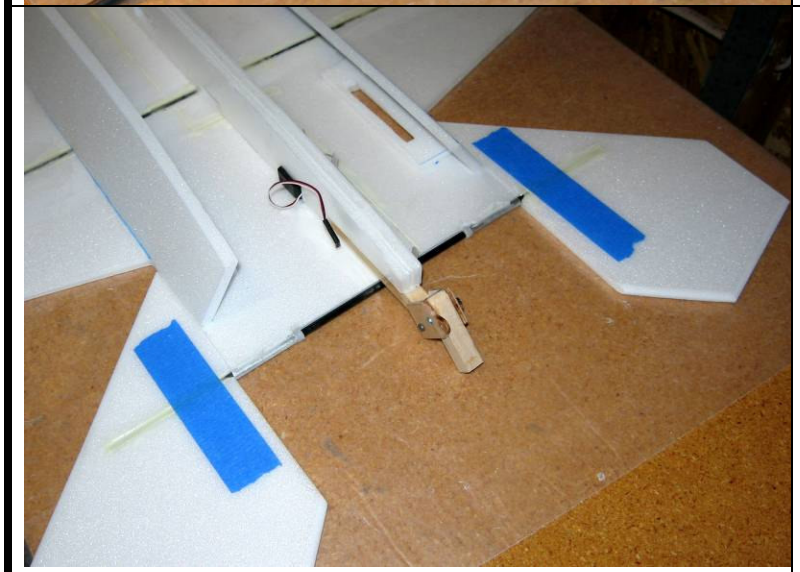
The assembled thrust vectoring system is shown in the lower left photo. The movable portion pivots around a small bolt, and the system is actuated via a pushrod and clevis on the bottom. Note that you may need to trim the lower edges of the motor mount to clear the pushrod and clevis. Make sure the system pivots smoothly, and sand or trim as required.

IMPORTANT NOTE: It is important that the thrust line of the motor runs directly through the pivot pin. This will minimize strain on the thrust vectoring servo and also prevent pitch trim changes with throttle setting. The parts provided were designed specifically for the Littlescreamers Park Jet Special motor with the stock 3/8" stick mount. If you use a different motor and mount, you may need to make new custom side plates out of 1/8" plywood that raise or lower the movable motor mount stick to realign the thrust line with the pivot pin. If so, this won't be difficult. The design of these plates is very simple (just trim or extend the square upper edge), so it will be easy to make new ones if required.



8. Glue the completed motor mount into the slot in the aft fuselage centerline support, aligning it to a zero-zero thrust line (no left/right or up/down thrust angle). Use 5 minute epoxy.

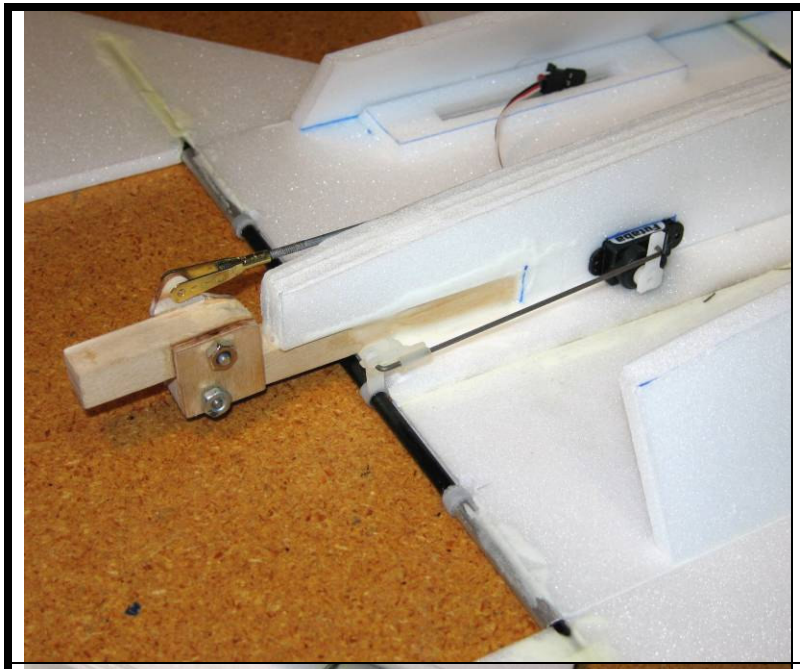
After the glue has dried, press a circular notch along the length of the aft edge of the wing assembly using the aluminum stabilator tube bearings. Then glue the stabilator bearings into place using 5 minute epoxy. Use small strips of tape to hold them in place and insert the carbon tube stabilator pivot into the bearings as the glue dries to make sure they are perfectly aligned.



9. Sand the leading edge of the stabilators to a well-rounded shape, and the trailing to a tapered shape. Apply a strip of 3M Satin tape to the leading edge for smoothness and durability.

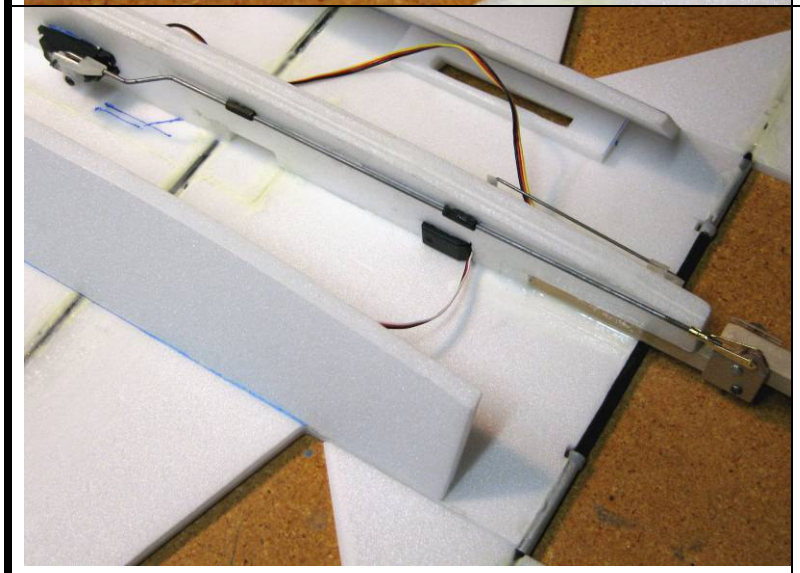
Note the hardware required for the stabilator pivots. The single carbon tube pivots inside two short pieces of aluminum tube. Two end stop bearings butt up against each aluminum tube to keep the pivot from sliding left/right. A control arm is also installed to allow a pushrod connection to the servo. Both the end stops and control arm can be made from spare nylon servo horns, just drilled out in the center to fit the carbon tube.

Lay the wing assembly down on a flat surface as shown. Slide the carbon pivot tube, end stops and control horn through the aluminum bearings. Once everything is in place and aligned, glue the end stops into place with thin CA (but don't glue the control horn yet). Then glue both stabilators to the carbon tube using epoxy (mixing with microballons is recommended).



10. Install the stabilator servo into the slot in the fuselage centerline support (thick CA can be used to hold the servo in place). Make and install a music wire pushrod to the stab control horn. Once everything is properly aligned, glue the stab control horn into place using thin CA.

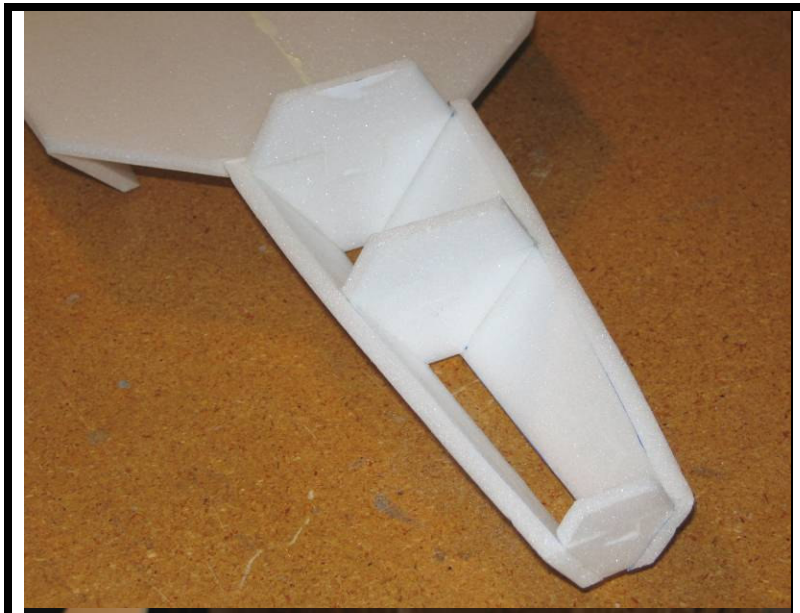
For extra strength, I recommend adding small strips of fiberglass chordwise to the roots of the stabilators, both top and bottom (see the plans for size and location). These aren't required for normal park flying, but if you intend to fly really fast or land in tall grass they add extra insurance against structural failure.

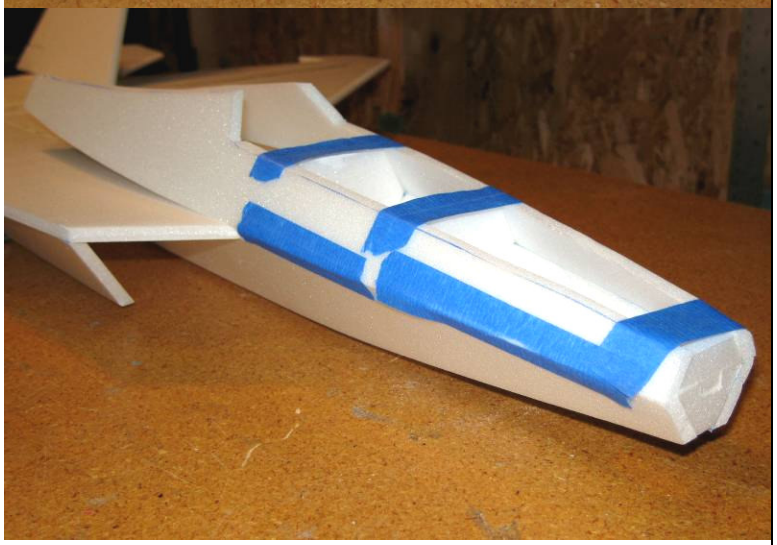


11. Next install the thrust vectoring servo and pushrod. A strong (40+ oz/in torque) metal-geared servo is required since a plastic-geared servo could get stripped if the prop hits the ground during landings. The prototype used a Hitec HS-85MG servo, which worked very well. Install the servo in the slot in the fuselage centerline support, securing it with CA.

Make the pushrod from 1/16" threaded music wire, with a large Z-bend at the front end to rise up to the servo arm. Install pushrod guides as shown to eliminate flex in the pushrod (I used scrap carbon fiber tubes from the stabilator pivot rod). Make sure the pushrods guides are very securely attached, or a rough landing could break them free. I used small strips of fiberglass cloth with epoxy over the pushrod guides to provide a very strong attachment.

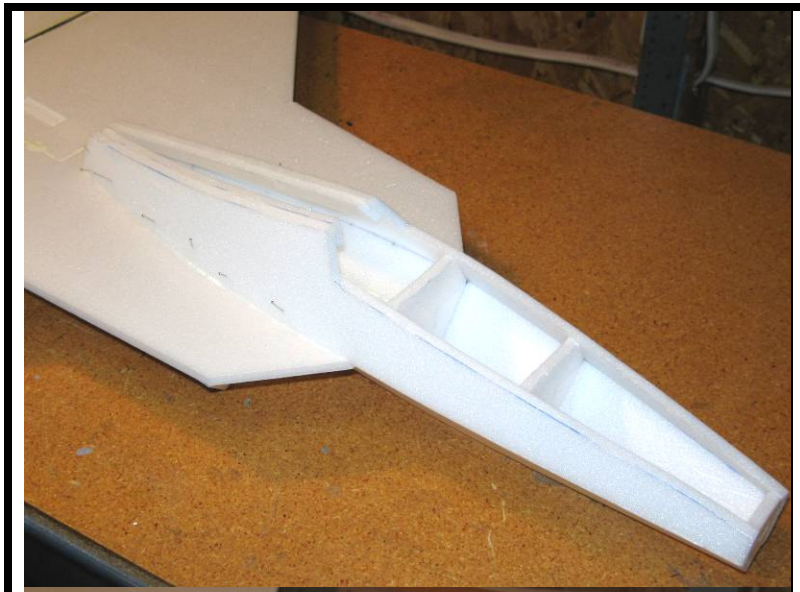
Use a steel threaded clevis to connect the pushrod to the motor mount. Verify that the system moves freely and with minimal slop, and adjust as required.

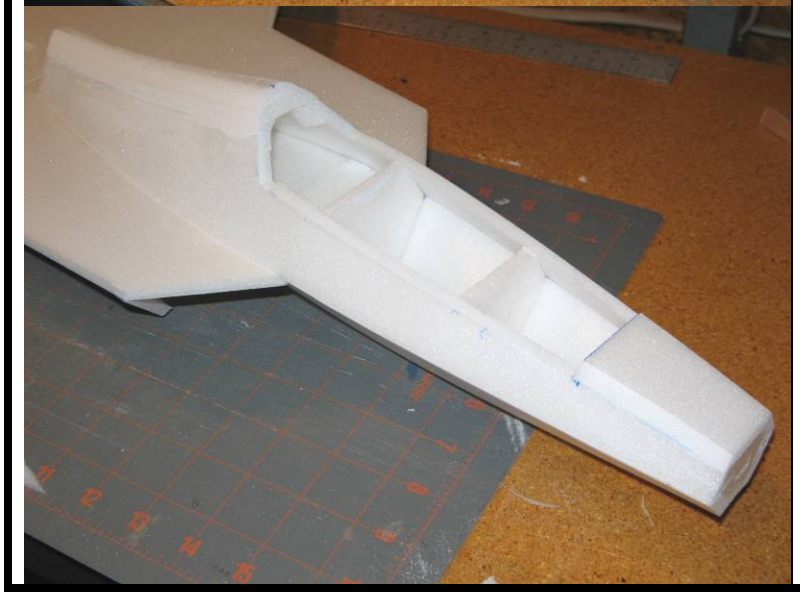




12. Use a sanding block to lightly sand the top of the lower forward fuselage until it is flat and even. Then glue on the upper half of each of the three forward fuselage bulkheads.

Test fit the upper forward fuselage sides, trimming and sanding as required to get a perfect fit. Note the upper and lower pieces should meet to form a sharp edge to give it that scale Raptor look. Once satisfied with the fit, glue the upper forward fuselage sides onto the bulkheads and lower fuselage sides only (don't glue the aft part to the top of the wing yet). Use tape to hold the sides in place as the glue dries.

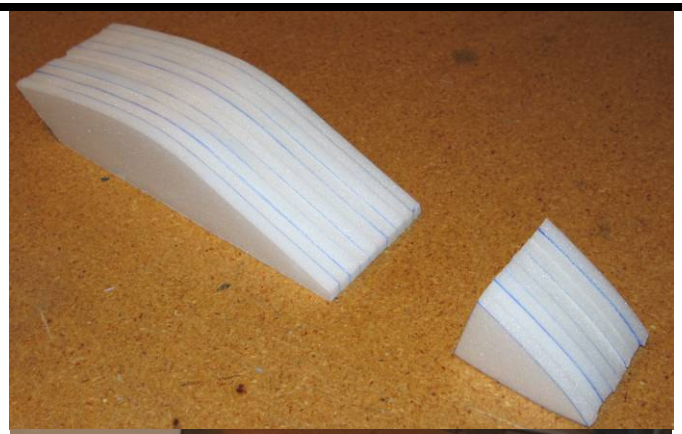


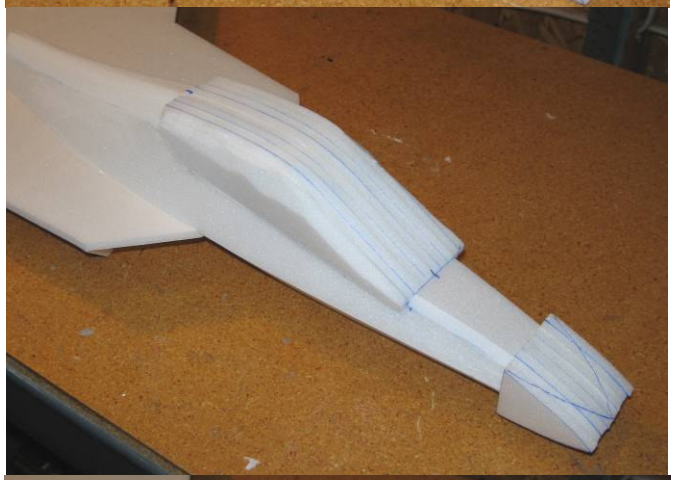


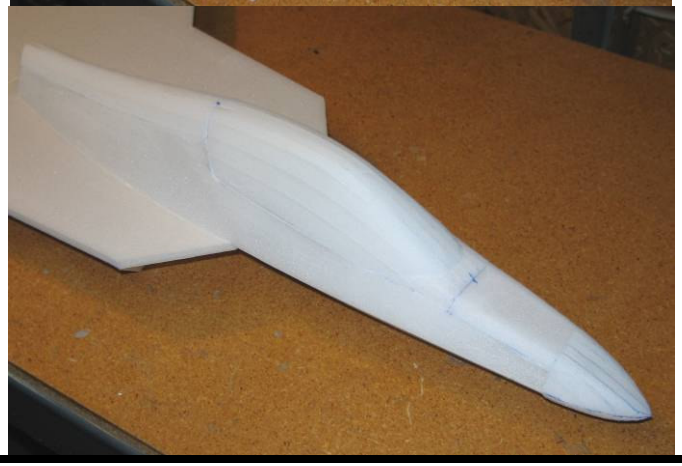
13. Glue bulkheads F4 and F5 to the top of the wing in the locations shown on the plans. Then glue the aft part of the upper forward fuselage sides to the top of the wing and the bulkheads. Note how the fuselage sides curve inward as they run aft—you can heat form the foam slightly to attain this curvature. Pins can be used to hold the foam in place as the glue cures.

Cut the bevel in the two turtledeck support pieces and then glue them in place on the top inside edges of the fuselage sides. Then glue the two turtledeck top pieces in place, one at a time so they can be formed to the proper curvature. Once the glue is dry, carve and sand the turtledeck roughly to shape.

Install the forward fuselage top (bottom photo).







14. Laminate all of the nosecone and canopy pieces together using 3M 77 adhesive. Then glue the nosecone block to the front of the fuselage.

Once the glue has dried, sand the nosecone to shape. Start by tracing the top outline of the nosecone onto the foam (using the provided template) and cut it to shape with a long knife or saw. Begin with coarse sandpaper (100 grit) to rough out the basic shape, then move to a finer sandpaper (220 grit) to do the final shaping. End with 320 grit sandpaper to do the final polish sanding and provide a very smooth surface.

Carve the canopy to shape using a similar procedure.