by Al Clark

XB-70 Park Flyer

THE NORTH AMERICAN Aviation XB-70 Valkyrie is the coolest-looking bomber ever designed. In the mid-1970s, Competition Models, a little-known company in Long Beach, California, made a kit of the aircraft; amazingly it was manufactured for FF. The profile XB-70 was made entirely from sheet balsa and used a .020-.049 glow engine.

Bob Linn designed the model, and Curt Stevens drew the plans in January 1961. I don't know if Bob Linn is still with us, but I admire him for being brave enough to make the Valkyrie into an FF airplane. Although it intrigued me, I didn't see a way to convert it to RC; the 1970s equipment was far too large and heavy.

Fast-forward to 2007, when I received a phone call from longtime flying buddy and modeler extraordinaire, John Chapman. He was on a business trip and, as usual, was poking around in a hobby shop looking for anything interesting.

He found a stash of old kits, and among them was a Competition Models XB-70. John likes the Valkyrie at least as much as I do, so he bought it for less than $5.

While reviewing the plans, I realized that devising an RC version of the aircraft would be possible with the modern electric power systems and small equipment. I borrowed the plans and ran to the copy shop.

I learned that the Competition Models kit had been designed to duplicate an early concept for the XB-70 rather than the one that was built and flown. I also found that it featured several departures from scale to allow it to fly as an FF model, such as a much larger canard with dihedral.

The wing was undercambered with reflex and made from extremely thin 1/16 balsa. The large underbody of the full-scale XB-70, which contained the jet engines, was not reproduced.

I decided that I needed to start with a clean-sheet design based on the Competition Models iteration. My model is roughly the same size, because that allowed the fuselage to be built using 36-inch balsa stock.

I reshaped and resized the fuselage, wing, canard, and fins to match the scale three-view, and I made the wing flat from 1/8 balsa. The canard (with no dihedral) is 1/16 plywood, because I figured that it would take a beating on landing. I used 1/32 plywood fuselage doublers and added a complete scale-sized underbody to allow me to hide the RC gear, battery, and ESC.

The finished XB-70 weighs 12.6 ounces ready to fly, giving it a reasonable 8.1-ounce-per-square-foot wing loading. Using an AstroFlight brushless 010 motor and a 3S 700 mAh Li-Poly battery provides four to five minutes of airtime with decent performance.

Loops are often challenging for a delta-wing aircraft, because of the large increase in drag at high angles of attack, but, surprisingly, my Valkyrie will loop with a bit of a dive. Perhaps the canard helps with loops. Rolls, as expected, are blazing.

My design is unsuitable for novices, but you should be able to fly it with no problems if you can handle an aileron model well. Little material is required to build this aircraft and it's easy to construct, so let's get started.

CONSTRUCTION

Study the plans to make sure you understand how all the bits go together. All of the balsa is medium density. All gluing is done with thin CA unless otherwise stated.

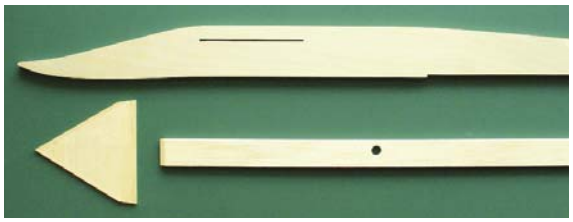
Cut the fins from 1/8 C-grain sheet balsa. Ensure that the grain is oriented vertically. Round the LEs and TEs.

This Valkyrie is mission status ready for three-channel electric fun

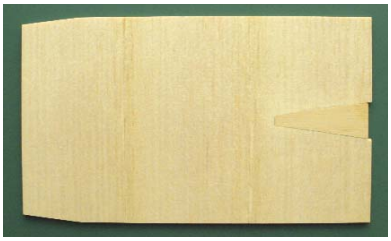
The XB-70 handles well—but orientation can be difficult in a banked turn when the thin wing is edge on, so don't fly too far out.

Static photos by the author Flight photos by Mark McCutcheon

Study the plans to make sure that you understand how all the bits go together. All balsa is medium density. Gluing is done with thin CA unless stated otherwise.

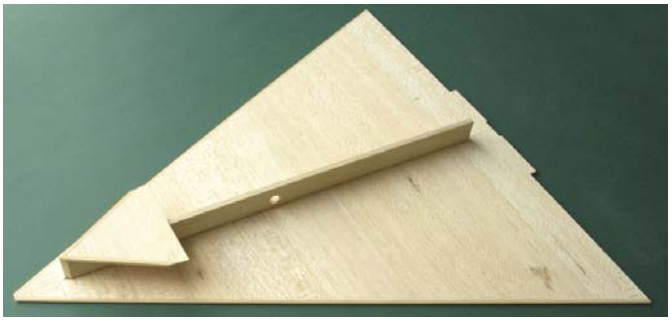


Cut the fuselage from a straight piece of 1/4 sheet balsa, with the grain running lengthwise. Cut the slot for the canard and check to make sure it fits.

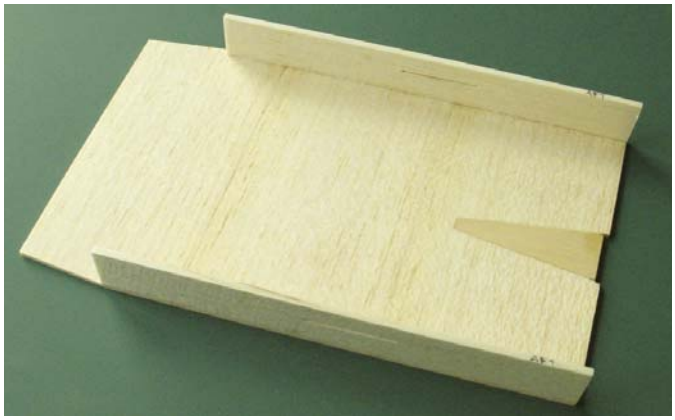


Again, ensure that the edges of all pieces are straight before adhering them. Don't forget the 1/8 square spruce edges on the front and the 1/8 light-plywood insert at the rear.

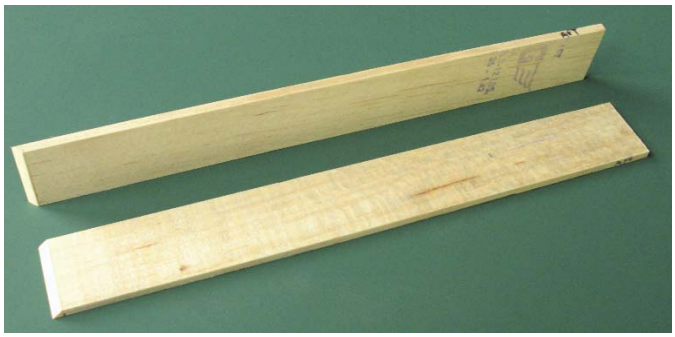
The wing is made from 3-inch-wide pieces of 1/8 C-grain balsa, with the grain running spanwise. Ensure that the edges of all pieces are straight before gluing them together.



Draw a centerline down the bottom of the wing. Carefully align and glue the 1/4 sheet lower fuselage on the centerline, making sure that the aft end is located as shown on the plans.



Glue the two rear underbody sides to the aft underbody bottom, making sure that the pushrod exit slots are in the correct locations.



Left: Cut the four underbody side pieces from 1/8 balsa, with the grain running lengthwise. Glue a 1/8 square spruce piece to the front edge of each forward underbody side. Bevel the spruce piece at a 45° angle toward the inside of the underbody.

Below: Try for a total gap of 1/64 inch on the hatch. When satisfied with the alignment, glue the assembly to the lower fuselage and wing bottom.

This is also a good time to make the two 1/8 triangular-balsa reinforcing pieces. This is easy to do by sanding the edge (along the grain) of a sheet of 1/8 balsa to a 45° bevel, and then cutting the beveled edge from the sheet.

Cut the canard from 1/16 plywood with the grain running spanwise. Round the LE and TE. Do not substitute balsa for the canard. The extra strength is needed for damage resistance, and the extra weight helps balance the model.

The wing is made from 3-inch-wide pieces of 1/8 C-grain balsa, with the grain running spanwise. Make sure that the edges of each piece are straight before you glue them together. I used CA, but you can also use Titebond if you don't mind the drying time and want to make the sanding slightly easier.

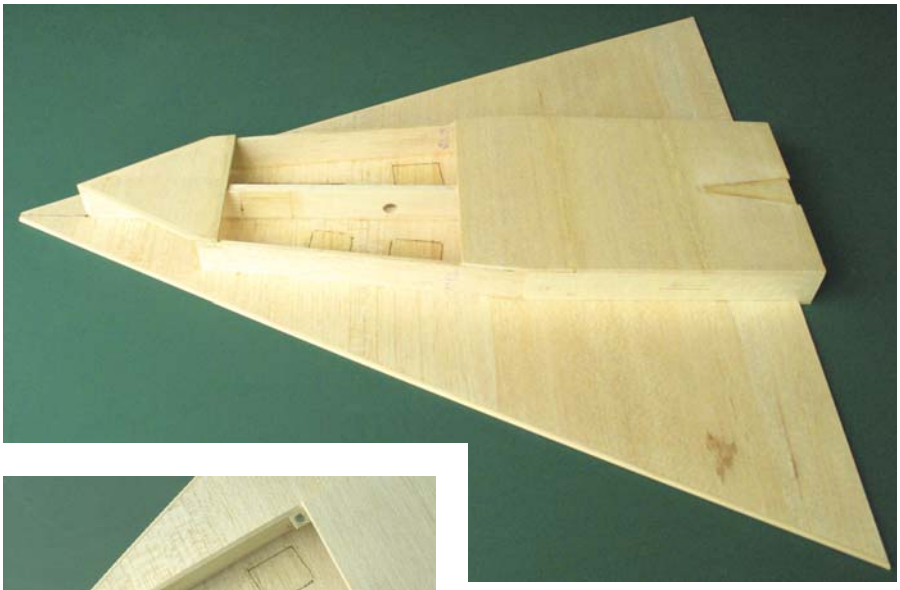
Add the 1/8 square spruce LE. It prevents dings from forming during landings.

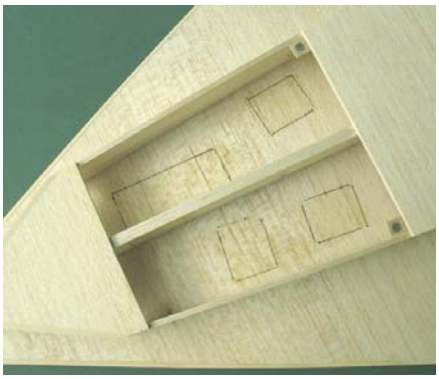
Round the LEs and TEs, and cut the elevons free. Bevel the front edge of each elevon per the plans. After covering, the elevons will be hinged with covering material.

Drill a hole in each elevon for the Du-Bro Micro Control Horn. Make sure to locate the hole per the plans.

Cut the fuselage from a straight piece of 1/4 sheet balsa, with the grain running lengthwise. Make a slot for the canard and check to ensure that it fits.

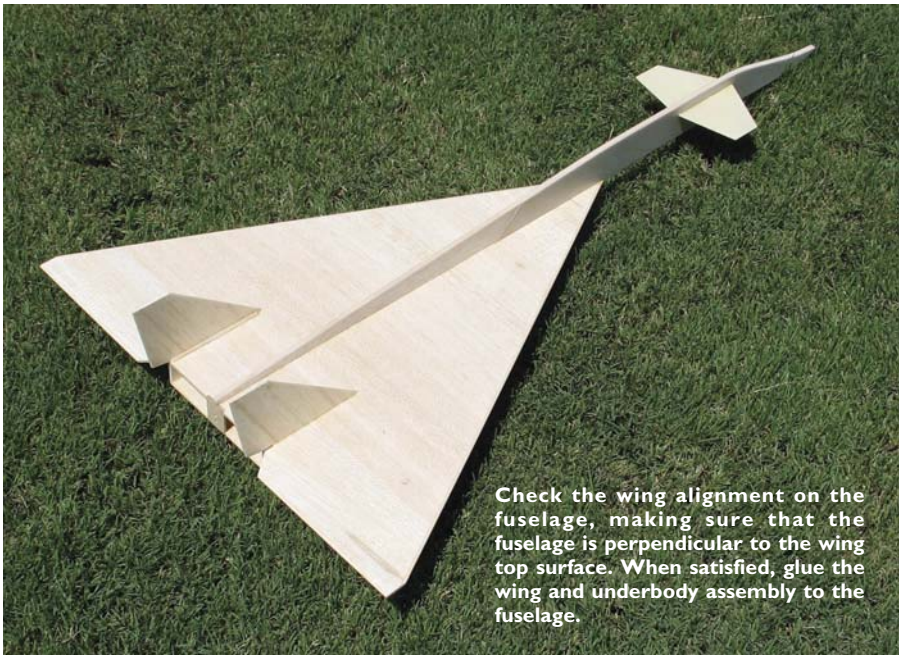
Fashion two doublers from 1/32 plywood, making them slightly oversize all around. Make the canard slots in the doublers,





Left: Mark the positions of the servos, ESC, battery, and receiver. Apply a very thin layer of 5-minute epoxy to the balsa at each position to make the servo tape and Velcro squares stick better.

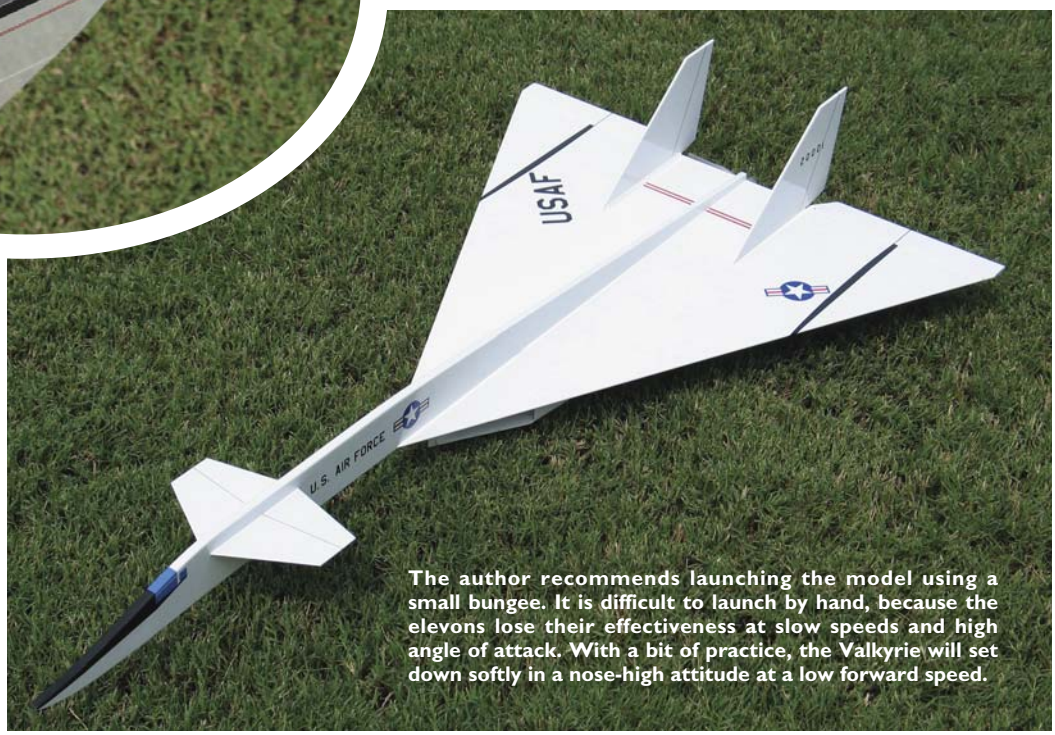
Install the 1/8 x 1/4 balsa stiffeners and the 1/32 plywood tabs to the inside of the hatch, taking care to leave sufficient room for the thickness of the underbody sides. Magnets secure the hatch.



Check the wing alignment on the fuselage, making sure that the fuselage is perpendicular to the wing top surface. When satisfied, glue the wing and underbody assembly to the fuselage.

Right: The author used UltraCote on his prototype and recommends it because it has no tendency to wrinkle over time on sheeted surfaces, as other covering brands might.

Below: The direction of motor rotation should be clockwise, viewed from the rear of the XB-70. Install the AstroFlight 010 using a bit of Loctite on the motor screws.



The author recommends launching the model using a small bungee. It is difficult to launch by hand, because the elevons lose their effectiveness at slow speeds and high angle of attack. With a bit of practice, the Valkyrie will set down softly in a nose-high attitude at a low forward speed.

making sure that the location matches the slot on the fuselage.

Adhere the doublers to the fuselage using thick CA. When it has cured, sand the edges of the doublers flush with the fuselage.

Cut the 1/4 sheet balsa for the lower fuselage, with the grain running lengthwise. Use thick CA to glue two pieces of 1/8 square spruce, side by side, to the front edge.

Bevel the spruce pieces as shown on the plans top view. Punch the 3/8-inch-diameter hole for the battery lead, as the plans show.

Cut the four underbody side pieces from 1/8 balsa, with the grain running lengthwise. Use thick CA to adhere a 1/8 square spruce piece to the front edge of each forward underbody side.

Bevel that square spruce section at a 45° angle toward the inside of the underbody. Refer to the plans top view to see the correct angle.

Slice the pushrod exit slot into each of the rear underbody sides, locating them exactly as shown on the plans. These slots should be slightly wider than 1/32 inch to provide good pushrod support.

The bottom of the underbody is built up in the same manner as the wing, using 3-inch-wide pieces of 1/8 C-grain balsa with the grain running spanwise. Make sure that the edges of each piece are straight before gluing them together. Don't forget the 1/8 square spruce edges on the front and the 1/8 light-plywood insert at the rear.

After trimming and sanding the bottom to the outline shown on the plans, cut the hatch portion loose. You now have three pieces that make the bottom of the underbody.

Draw a centerline down the bottom of the wing. Carefully align and glue the 1/4 sheet lower fuselage on the centerline, ensuring that the aft end is located as the plans show. Glue the forward piece of the underbody bottom to the 1/4 sheet lower fuselage, positioned even with the front.

Adhere the two rear underbody sides to the aft underbody bottom, making sure that the pushrod exit slots are located correctly. Turn this assembly over and carefully center it on the 1/4 sheet lower fuselage, using the hatch as a guide for fore and aft position.

Try for a total gap of 1/64 inch on the hatch. When you are satisfied with the alignment, glue the assembly to the lower fuselage and the wing bottom.

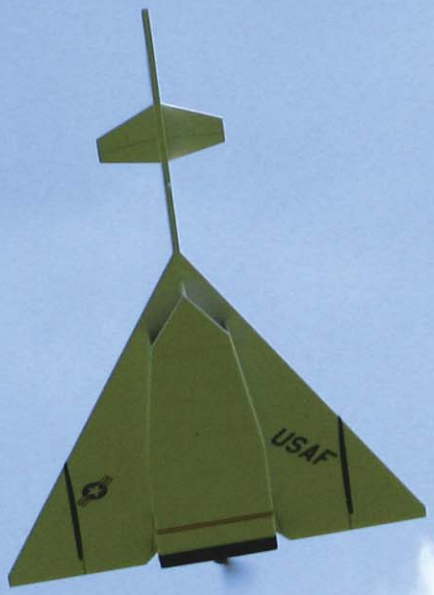
Now is a good time to mark the positions of the servos, ESC, battery, and receiver; apply a very thin layer of 5-minute epoxy to the balsa at each position. That will make the servo tape and Velcro squares stick much better when you install them later. Position the two forward underbody sides and glue them in place.

Install the 1/8 x 1/4 balsa stiffeners and the 1/32 plywood tabs to the inside of the hatch, taking care to leave sufficient room for the thickness of the underbody sides. Drill a 1/16-inch-diameter hole at the rear of the hatch, slightly off center, as shown on the plans. This will be used later, to remove the hatch with a paper clip.

Cut two 3/32 plywood hatch magnet holders, and drill a 3/16-inch-diameter hole into each for the RadioShack rare earth magnets. Glue one magnet into each hole, flush with the surface.

Adhere the two magnet holders to the underbody bottom, locating them per the plans. Mark a center point on the inside of the hatch at each magnet location.

Use a sharpened 3/16-inch-diameter brass tube to drill a hole partway into the hatch at each location. You need only make the hatch holes deep enough to mount the magnets flush. If you end up drilling all the way through, it's no problem; you can plug the holes after you install the magnets.



XB-70 Park Flyer
Specifications

Type: RC electric profile scale

Skill level: Beginner builder; intermediate pilot

Wingspan: 20.5 inches

Wing area: 224 square inches

Wing loading: 8.1 ounces/square foot

Length: 56.5 inches

Weight: 12.6 ounces

Power: AstroFlight 010 brushless motor; 9-amp ESC; 11.1-volt, 700 mAh Li-Poly battery

Construction: Balsa sheet, bass, plywood

Finish: UltraCote

Radio: Two Hitec HS-55 servos, microreceiver

Once you have flown this aircraft for a while and feel comfortable, it will fly around fine at reduced throttle. But pay attention not to get too slow and behind the power curve in the turns.

Before gluing in the magnets, check their orientation to ensure that they will be attracted to the other magnets rather than repelled. When you confirm this, glue one magnet into each hatch hole, making sure that they are flush.

Put the hatch in place and round the outer edges of the underbody, referring to cross-section view A-A on the plans.

Assembly: Trial-fit the canard into the fuselage, adjusting the slot if necessary to get it to fit. Align the canard and apply glue.

Check the wing alignment on the fuselage, making sure that the fuselage is perpendicular to the wing top surface. When you're satisfied, glue the wing and underbody assembly to the fuselage.

Drill the firewall holes per the plans and check the fit of the motor. (I used an AstroFlight 010.) Check the fit of the firewall to the wing, lower fuselage, and underbody bottom, ensuring that it contacts all three surfaces. You don't want down, up, left, or right thrust built in. Use thick CA to adhere the firewall in place.

Mark the positions of the two fins on top of the wing and glue them in place, making sure that they are perpendicular to the wing top surface and have no left or right offset. Add the two 1/8 triangular-balsa reinforcing pieces.

This completes assembly. Fill any dings with spackle and sand smooth. Slightly round the edges of the fuselage, as shown on cross-section view A-A on the plans,

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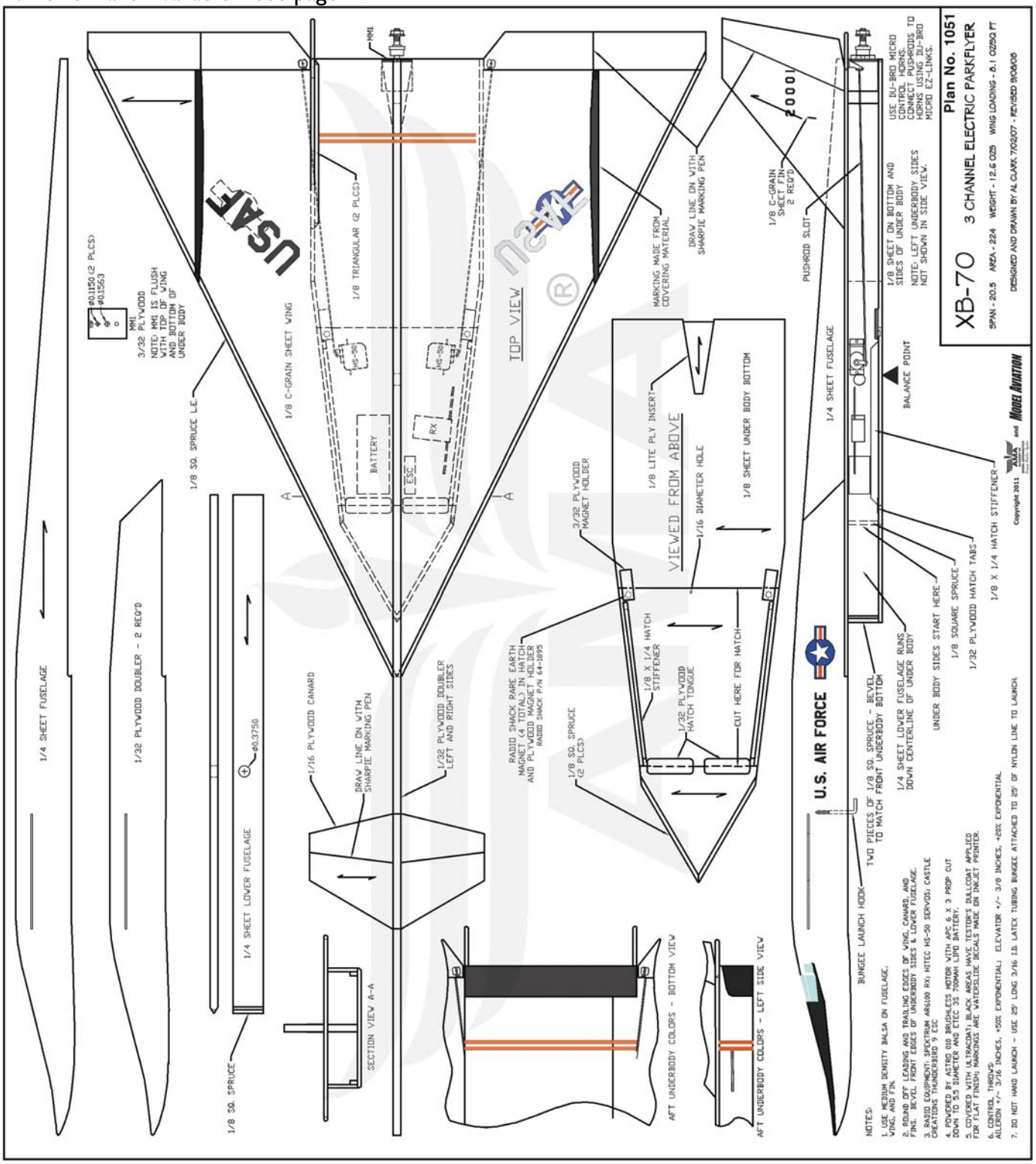
Full-Size Plans Available—see page 171



I made all of the markings using Testors ink-jet decal paper and my ink-jet printer. I drew the decals using a combination of AutoCAD and PowerPoint.

After printing the images onto the decal paper, I sprayed them with three coats of Krylon Crystal Clear. Then I cut them out and applied them the way I would normal water-slide decals.

I have duplicated all of the markings on the plans, so you should be able to scan them and make your own decals.

Equipment Installation: Trim the pegs on the Du-Bro Micro Control Horns so that they protrude slightly from the tops of the elevons, and glue them to the elevons. Make sure that they are angled to align with the pushrods.

Fabricate the two pushrods from 1/32-inch-diameter music wire. Make a Z-bend at one end and an L-bend at the other.

Try to make the length between the bends as close as possible to what the plans show. If you don't like using pliers to fashion your Z-bends, Radical RC sells a nifty set of Z-bend pliers for 1/32-inch-diameter music wire.

Plug the servos into the receiver and center the arms. Make sure that the arms are oriented on the correct side of each servo.

Clean the servo cases with alcohol and apply 1/16-inch-thick servo mounting tape to each. Attach a pushrod to a servo and control horn, position the servo so that the elevon is neutral, and stick the servo to its mounting area.

Repeat this for the other pushrod and servo. Each pushrod is secured to the control horns using a Du-Bro Micro EZ Link.

Check the length of the ESC wires (I used a Castle Creations Thunderbird-9) to see if they will reach the motor when

installed. You will likely have to add length to the ESC wires.

Solder the wires to the motor, plug the ESC into the receiver, and check the direction of rotation of the motor. It should turn clockwise when viewed from the rear of the XB-70.

Install the motor using a bit of Loctite on the motor screws. Install the ESC using Velcro self-adhesive squares. Plug the servos into the receiver and mount the receiver using Velcro self-adhesive squares.

Trim an APC 6 x 3 propeller to 5.5 inches in diameter, balance it, and install it on the motor. Make sure that the front of the blades are facing forward—not aft!

Use thick CA to adhere two pieces of Velcro (part hook and part loop) to the bottom of the wing where the battery is positioned. These Velcro pieces will hold the battery in place.

Glue a piece of 1/4 square balsa at the front and rear of the battery pack, to keep it from shifting fore and aft. Run the battery lead through the hole in the lower fuselage so it can be connected to the ESC.

Drill a small hole in the bottom of the forward fuselage, and screw the "L" hook (from a home-improvement store) in the position shown on the plans. Remove the "L" hook, apply 5-minute epoxy, and reinstall. Install the hatch cover.

Check the balance point. My prototype balanced spot on, but you might need to add a small amount of weight to the nose or the tail.

If nose weight is required, use a Dremel tool or drill to make a small pocket in the forward fuselage (from the bottom) and glue the weight into the pocket. Then cover with a small piece of covering material. If tail weight is required, glue it to the inside of the underbody at the rear.

Set the elevon throws per plans note #6. The elevons have no reflex at neutral; they are set to 0°. Set the exponential for elevator and aileron near 20%.

These are good starting points; you can adjust the settings later to suit your taste. Make sure that the elevons move in the proper directions for both elevator and aileron commands.

Flying: I wish I could tell you that my Valkyrie flew directly off of the board, but it didn't; initial flights were thrilling. When I commanded a turn, the model initially rolled in the opposite direction and then came back for an erratic turn. At high angles of attack it went out of control in yaw and could not be recovered.

All of this ended in a crash into a pond near the edge of the park at which I fly. After waiting a half-hour for the XB-70 to drift to shore, I took it back to the shop and dried it out. The ESC was shot, but the rest of the gear survived. Amazingly, it dried out and looked as good as new.

After pondering the ill handling for quite awhile, I surmised that the profile fuselage was the culprit. The thin forward fuselage was acting as fin area ahead of the balance point. This was too much for the scale-sized fins to handle. The model was essentially underfinned, causing the erratic behavior during the first test flights.

I scaled up the fin areas by 50%, keeping the same proportions. It is almost unnoticeable unless you compare with the factory three-view. Larger fins cured the problem, and the aircraft now handles normally. Although the construction photos show smaller fins, the flight photos and plans depict the bigger ones.

I recommend launching the XB-70 using a small bungee. It is difficult to hand launch, because the elevons lose their effectiveness at slow speeds and high angles of attack, causing loss of control. This airplane makes an excellent lawn dart with its pointy nose, and I know from experience.

I made my bungee from part of an old mini hi-start that I had, but anything that will give 5-6 pounds of pull will work. I used yellow surgical tubing that measures 7/32 inch OD, 1/8 inch ID, and 25 feet long. Attached to that is 25 feet of braided nylon line, 30- or 40-pound test, with a small ring on the end. Stretch the bungee to get 5-6 pounds of pull.

Launching the model from some type of small, flat surface works well; use a card table, cardboard box, or similar. Make sure that the launching surface is angled up approximately 20° or the Valkyrie won't clear the grass before gaining flying speed. I use a 24-inch-high cardboard box with a smaller box stuffed under the front edge to get the 20° angle.

Launch the model with power off. As soon as you release it, go to full throttle and hold close to one-third up-elevator. Be ready for a quick pitch up when the speed increases and the elevons become effective, after which you can go to neutral elevator.

Don't try to make the aircraft climb too steeply; a shallow climb works best. The little AstroFlight 010 has good power, but this is no 3-D model. If you allow the nose to get too high, the drag will increase significantly, causing the XB-70 to lose speed and "get behind the power curve."

When that happens, the elevons become ineffective and the model will roll to the right, causing it to fall off into a spiral. You can recover from that by letting the airplane dive to gain speed, but it does require some altitude so you don't want to let that happen right after launch.

Attain a comfortable altitude following launch, and set the trims for level flight. The XB-70 handles well, but orientation can be difficult in a banked turn when the thin wing is edge on, so don't fly too far out on the first flights. Have someone let you know when 4 minutes has passed, so you can set up the landing approach while there is still battery power.

The aircraft will fly dead-stick, but it comes down fast and doesn't have much flare out without power, so it is better to avoid running out of power. Fly a normal landing pattern and throttle back some once you are on the final approach leg. Adjust power to establish a smooth descent.

When the XB-70 is close to the ground, throttle back and add up-elevator for a nose-high flare. With a bit of practice it will set down softly in a nose-high attitude with a low forward speed.

Remember to cut power immediately before touchdown so you don't break the propeller. I have made many flights so far and am still on the original propeller.

Once you have flown the model for a while and feel comfortable with it, you will be able to fly it around at reduced throttle. But pay attention in the turns; do not let the airplane get too slow and get behind the power curve. Try some aerobatics too.

Rolls are easy. Merely apply full aileron and add a touch of down-elevator as the aircraft rotates through the inverted part of the roll.

A bit of dive is required for a loop. Achieve some altitude and establish level flight at full throttle; set up a shallow dive and pull full up-elevator to get a loop.

Thanks to Mark McCutcheon, a longtime flying buddy and an extraordinary modeler, for taking the flight photos. He has that magic touch and gets the necessary angles and lighting for the perfect shot.

The XB-70 is a nice change of pace from the usual park flyer. It looks great in the air and is a good conversation piece at the flying field. Read up on your Valkyrie history; you will get many questions when people see you flying yours. Enjoy! MA

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Sources:

AstroFlight
(949) 855-9903
www.astroflight.com

Du-Bro
(800) 848-9411
www.dubro.com

RadioShack
(800) 843-7422
www.radioshack.com

UltraCote
(800) 338-4639
www.hangar-9.com

Radical RC
(937) 256-7727
www.radicalrc.com

Castle Creations
(913) 390-6939
www.castlecreations.com

APC
(530) 661-0399
www.apcprop.com

Testors
(800) 837-8677
www.testors.com