CONSTRUCTION

TEXT AND PHOTOS BY GIANCARLO & ALESSANDRO GENTA

THE EAGLE 7

This turbine-powered sport-jet is the result of many design experiments and also features **thrust vectoring** for maximum maneuverability!

MOST JET ENTHUSIASTS like scale models that capture the excitement and thrill of full-scale aircraft. There's an endless variety of kits available for almost any scale jet you might like to build, so why design and scratch-build a jet that's not scale? I designed the Eagle V sport jet three years ago (published in the December '04 and January '05 issues of *Radio Control Modeler* magazine) to prove that an all-wood entry-level jet could have the performance of one of those expensive fiberglass models. I built several Eagles from the plans, and from the feedback I received, all who've built the model were satisfied.

After the success of Eagle V, I started a research program on unconventional jet design and extended maneuverability and experimented with vectored thrust, forward-swept wings and tandem triplanes (canard, wing and stabilizer).

The results led to this plane—the Eagle 7. By building two front fuselages and two sets of wings (those of the Eagle V and 7), you can assemble any one of the four planes shown in Figure 1.

BUILDING NUMBER 7

Most of the structure is made of 1/8-inch lite-ply. Balsa is used in the tail section, and a few parts are made of aircraft plywood. The wing is covered with foam-core panels, while the tail and fuselage are covered with 1/16-inch balsa.

Construction starts with the tail. You must decide whether you will use one or two servos for elevator control. If you want two elevator halves, you'll need to install separate linkages, one in either boom. Another choice is whether you want to use functional rudders. The plane flies very well without them, so the choice is yours. If you do want them, you'll have to enlarge the fins' trailing edges and make the fin ribs correspondingly shorter. The rear parts of B1 can be made of balsa.

The fuselage is essentially a lite-ply box with thick balsa corner pieces. The position of former F12 is determined by the Baby Joe JJ 1400 turbine engine. If you use a different engine, such as the Wren MW 54, you'll have to move the former to suit the engine's longer length. Assemble the fuselage on the building board, and shim the rear bottom edge up 5/16 inch, 1 inch in front of former F14. If you omit the aero brake, the bottom can be made in one piece; otherwise, you must cut away a section of the bottom and install a doubler over the opening to close the aero-brake well. Trial-fit the booms and the stabilizer into place to check their alignment, but don't glue them in place yet.

SPECIFICATIONS

MODEL Eagle 7
TYPE Sport turbine jet
WINGSPAN 59.1 in.
LENGTH 73.9 in.
WING AREA 994 sq. in.
WEIGHT 16 lb. 8 oz.
WING LOADING 38.3 oz./sq. ft.
POWER SYSTEM Baby Joe JJ 1400, Wren MW54, or equivalent
RADIO REQ'D 5 to 8 channels (elevator, aileron, throttle, wheel steering and brakes, retracts, air brakes, vectored thrust and smoke system)

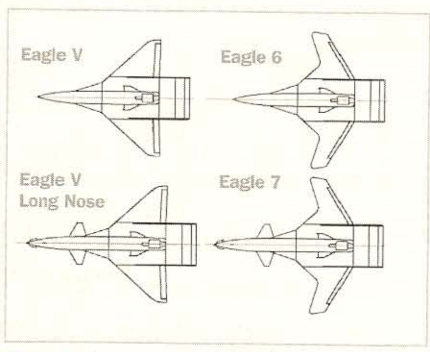


Figure 1. The various configurations derived from the Eagle V.

THE FUSELAGE IS ESSENTIALLY A LITE-PLY BOX WITH THICK BALSA CORNER PIECES

Looking very futuristic and featuring thrust-vectoring exhaust, the Eagle 7 is the result of much experimentation.

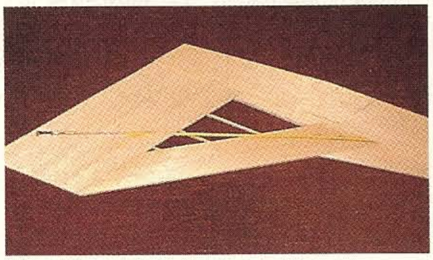
Complete the fuselage and the center section of the wing, and secure them with the wing joiners; then the hatch covers can be built on the fuselage and removed after everything has been shaped. Trial-fit the engine, tank and servos in place, and when you are sure everything is all right, glue the boom and fins into place using the assembly jigs to maintain proper alignment

Glue together the 3/8-inch balsa laminations for the vectoring thrust-tube cowl, and then cut and sand it to shape. Prepare the pivot supports and cut recesses in the cowl to accept them. Do not glue these parts or drill the mounting holes yet. Build the air intakes using the former F11 cross-section drawing shown on the plans for guidance. The rear hatch must be modified to fit inside and above the air intakes.

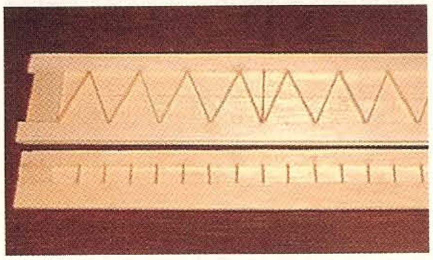
Since the airfoil is symmetrical and the wing has some washout, I built it on a jig made with eight rib supports connected together by two spars under the leading and the trailing edges. After you've assembled the jig, glue the ribs to the spars, and then put the bottom skin on the jig and assemble the spar/rib unit and place it on top of the skin. Install the upper skin, the leading and trailing edges and the tip block to complete the wing panel.

The front fuselage section is also built on the building board. The canopy/front hatch is removable for access to the radio. I used the canopy from a Spada Albatross kit, but many other canopies (such as the one from the Byron F16) can be easily adapted. Now join the forward and aft sections of the fuselage using plywood tabs and machine screws.

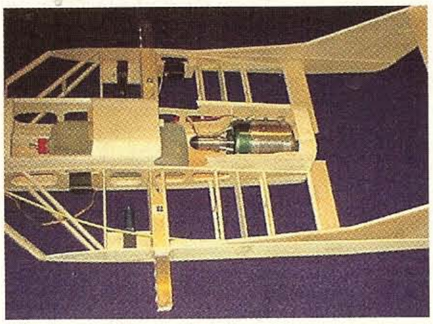
The canards have a lite-ply core with an 1/8-inch music-wire spar inlaid and covered by balsa. An aluminum joiner with an integral control horn connects the two spars to



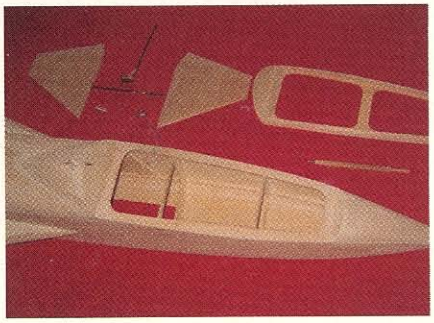
One of the boom fin sections showing the elevator control linkage installed. You can make a functional rudder, if you wish.



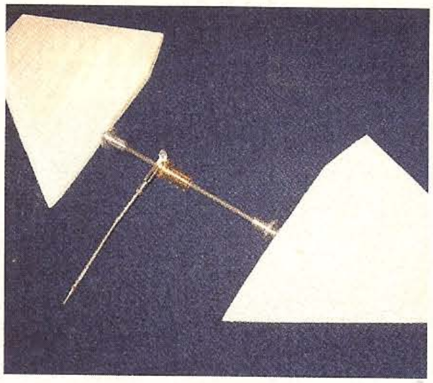
The horizontal stabilizer and elevator structures before the top sheeting was installed.



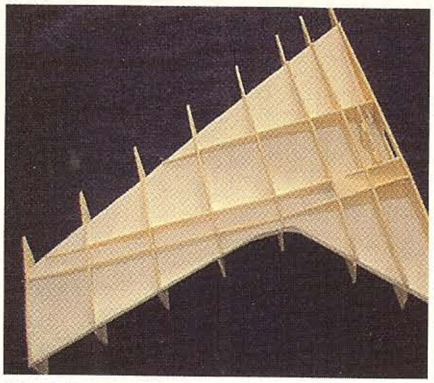
The completed rear fuselage structure with the tail booms attached. The elevator has not yet been glued in place.



The forward section of the fuselage showing the canopy/hatch as well as the canard control surfaces.



The two canards with support bushings, joiner wire and the control horn attached.



The right wing under construction on the building jig.

hold the canards together. The canard spar goes through the fuselage sides and is supported with two aluminum bushings. I built one of my Eagle 7s with a one-piece fuselage, and I made one large hatch to make it easier to stuff in all the fittings into place. To enhance the plane's looks, I added an upper fairing made of 30mm foamboard covered with 1⁄16-inch balsa.

VECTOR THRUST & TURBINE INSTALLATION

My thrust-vectoring exhaust tube is made out of 0.020-inch-thick aluminum that's about 3⅛ inch in diameter and 3¼ inches long. Two 5⁄32-inch-diameter screws are used as the pivot points, and the tube is reinforced by two plywood rings. The tube pivots up and down with a control horn, and the whole mechanism is enclosed in a balsa cowl. The two 5⁄32-inch plywood pivot supports are glued to the fuselage.

You need not worry about hot gases flowing through the aluminum tube, since the exhaust draws cold air into the thrust-vector tube that cools the exhaust gases enough to prevent damage. What is important is to have abundant cooling air both on the inside and outside of the thrust-vector tube. The front of the tube is shaped by hammering it against a wooden dowel. This, again, helps the cooling airflow. The turbine engine's exhaust nozzle must be at least 20mm forward of the entry to the thrust-vector tube. If you use a Wren MW 54 that has a longer exhaust cone, you must move the engine, former F12 and the fuel tank forward. The engine wiring and plumbing diagram is also shown on the plans. Since turbine engines are fed with an electric fuel pump, the tank position is not critical, and you can locate it as close as possible to the CG.

Note: a smoke system with a standard 500cc fuel tank is enough for 4 minutes of very dense smoke. Plain diesel fuel produces a good dense smoke.

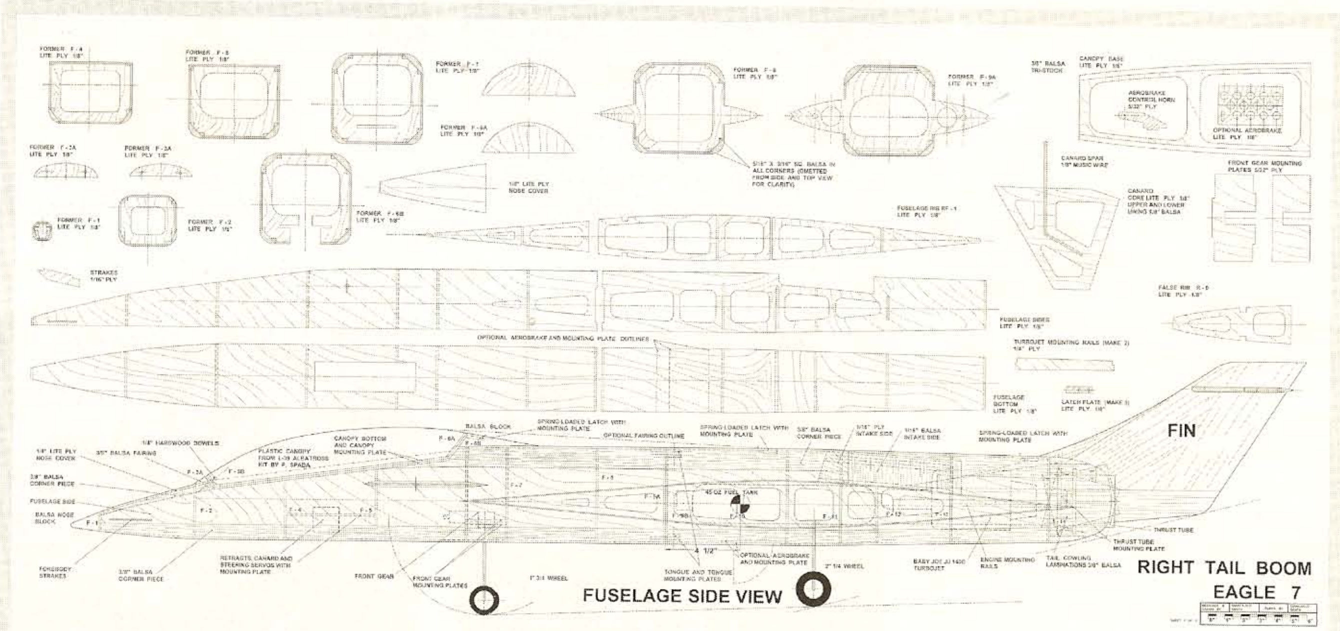
RADIO INSTALLATION

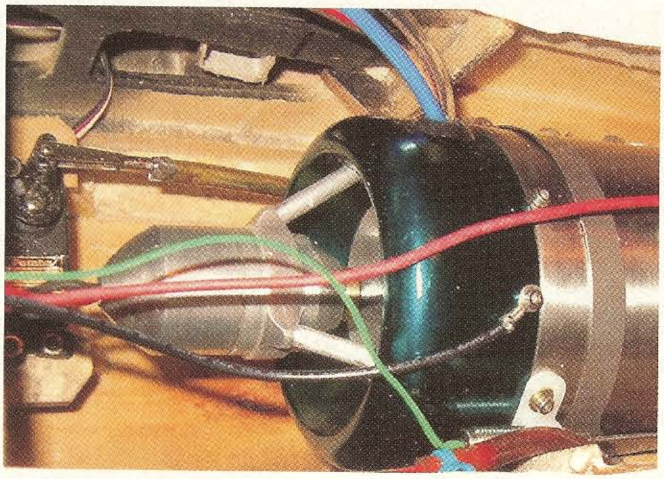
I used a 10-channel JR radio with 8 servos to control the elevator, throttle, ailerons, canards, thrust vectoring, aero brake, retracts and the smoke system. Thrust vectoring should be controlled by a separate channel, so you can mix it with elevator from the transmitter and activate it only when you like.

Wheel brakes are usually considered a must on heavy turbojet models, but the Eagle V could be slowed down enough for landing so that wheel brakes were not really needed. Also, the aero brake is not absolutely needed but is a definite help. The radio system uses two battery packs and has a monitor to switch from one battery to the other in case of a failure. You need two 5-cell packs instead of a single 4-cell pack.

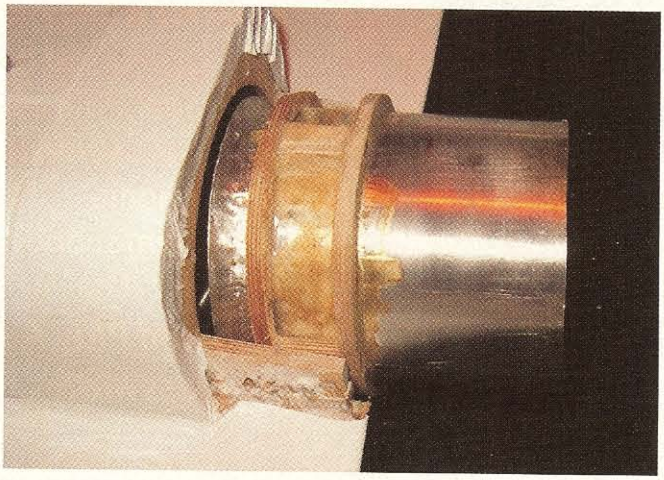
IN THE AIR

Initial flights were performed with vector thrust turned off with the transmitter mixer switch. Note: never fly with the thrust servo





The turbine engine installation is uncomplicated. Note the vector-thrust servo and pushrod just in front of the engine.



Here, the thrust-vector tube is shown without the cowl in place. The two plywood rings reinforce the aluminum tube and the pivot points.

unplugged, since the thrust position cannot be kept centered. After a few flights, the thrust control was activated at a safe altitude. With the maximum throws shown, the improvement in maneuverability is good.

The canards have much authority and seem to reduce drag at low speed, improving the glide and engine-out performance. They seem to increase drag at high speed and reduce top speed a little. The forward strakes effectively cure this problem, so don't overlook them.

The first flight was uneventful. The model accelerated smoothly and became airborne very quickly. Climb was gentle, and it flew straight off the drawing board (actually, the computer screen). It has good aerobatic characteristics, and if you decide to give the Eagle 7 a try, I hope you'll enjoy the project.

See the Source Guide for manufacturers' contact information.