

4-F

Foam Fabricated Fun Flier

By Bob Wallace



It would be nice to be able to say that the "4-F" was the evolutionary result of a lengthy design phase, during which a prototype was built and flown, with several modified versions following that fine-tuned the design for optimum performance.

In truth, the design phase for the 4-F encompassed about twenty minutes of general sketching and drawing board dimensioning! The goal was to create a simple-to-fabricate and build, almost all foam airplane that would possess good sport flying characteristics.

While the term "4-F" was a designation used to classify one who was physically flawed for military service, this "4-F" is certainly not flawed or handicapped in terms of good flight performance. It could be classified as being "1-A" as it is an easy to fly, hand-

launch type aircraft, with no bad in-flight characteristics.

The 4-F is clearly not even a semi scale design, but it does have a bit of a WWII fighter appearance. The 4-F was powered with a Cox .09 R/C engine, and an Airtronics RD 6000 radio system was used.

While a glow engine was used in my 4-F, there is no reason why the 4-F could not be electric powered also.

Throughout the 4-F's design, fabrication, and construction phases, simplicity was of primary consideration.

The entire airplane consists of eight basic foam parts, with balsa being used only to cap the foam tail surfaces and aileron hinging surfaces. A piece of 1/8" lite ply is used for a firewall.

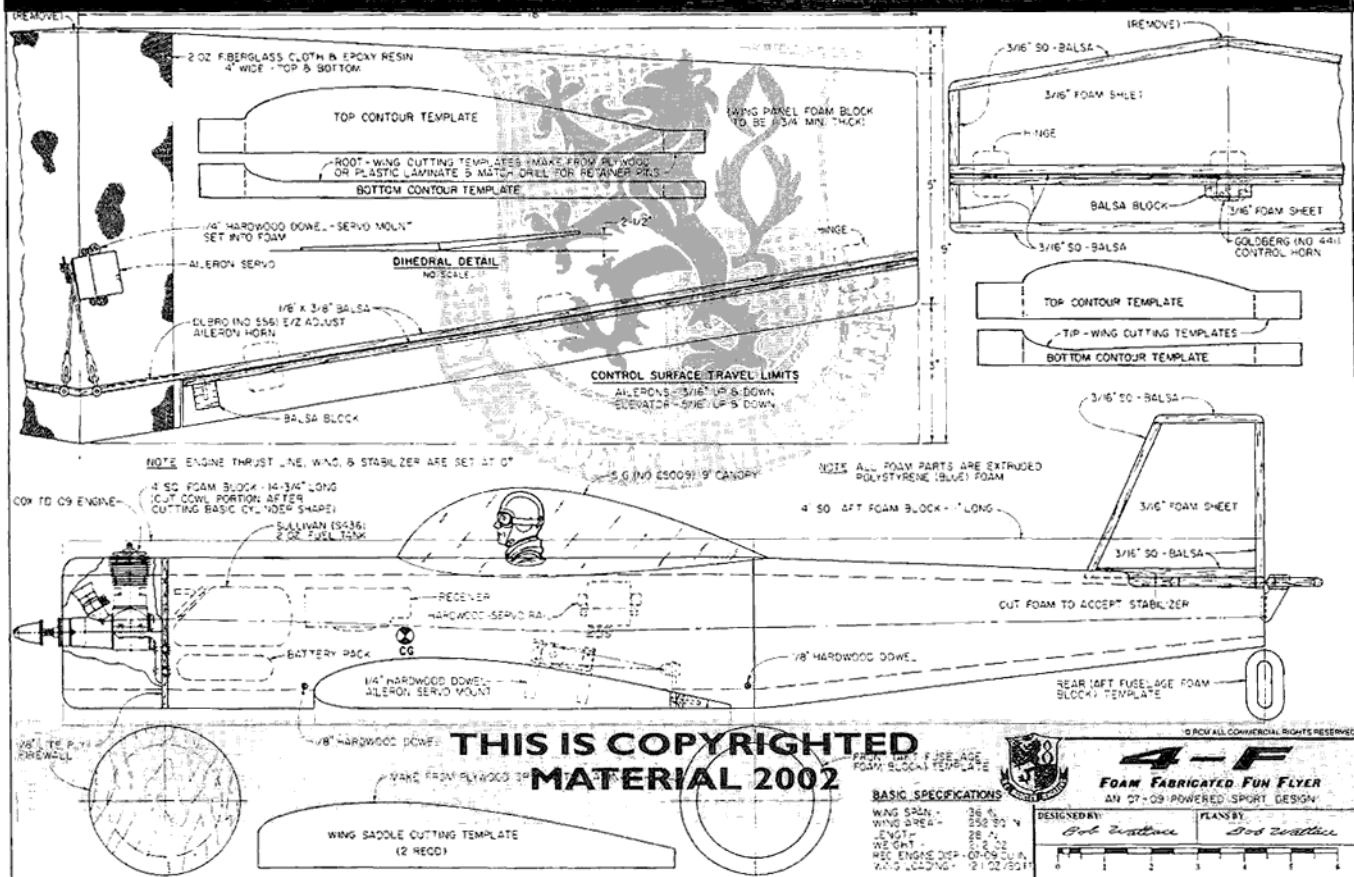
My 4-F was fabricated from scrap pieces of Dow extruded polystyrene

foam board (blue styrofoam).

White expanded polystyrene foam board (EPS) could also have been used. However, I preferred to use the blue foam board as it offers a bit more rigidity, sands easily, and is easier to finish.

Obviously, foam cutting equipment is required, and all of the foam parts used in constructing the 4-F were fabricated using the TEKOA Feather/Cut and related foam cutting accessories.

Designer with 4-F.



PLAN NO. 1312

FABRICATION & ASSEMBLY
Wing:

The wing features a simple flat bottomed type airfoil and a mild tapering planform. No wind tunnel tests or exotic airfoils were used! The "good ole TLAR" (That Looks About Right) method was employed in creating the 4-F's airfoil. The airfoil templates for my 4-F were cut out of .034" thick TEKOA Tri-T Template Laminate. After cutting the two foam wing panels, the foam strip-type ailerons were cut out by making two spanwise cuts, on each wing panel, removing a 1/4"

strip of foam. The hinging surface of the foam aileron and mating wing surface were then capped with 1/8" sheet balsa. The two wing panels were then bevel-cut to produce 2-1/2" (total) of dihedral and epoxied together. A small scrap balsa block was installed on each strip aileron to accept the torque rod arm and the ailerons were hinged and installed. The wing center section was reinforced (top and bottom) with a 4" wide strip of 2 ounce fiberglass cloth and thinned epoxy resin. Two strips of 1" wide fiberglass reinforced strapping tape, 24" long, were

applied to the bottom of the wing, extending spanwise, to reduce flexing. Carl Goldberg (211) Lite Jet hinges were used for hinging the ailerons.

Fuselage:

The fuselage consists of three formed foam parts. Actually two, as the cowl is cut off of the forward portion of the fuselage. Two 4" square foam blocks were used to cut the fuselage parts. The forward portion of the fuselage is a simple cylindrical shape that was cut and cored, using the TEKOA Multi/Cut,

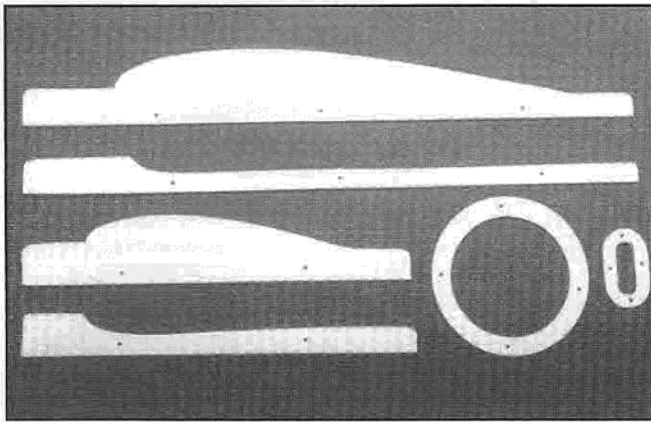
4-F

Designed by:
Bob Wallace
TYPE AIRCRAFT
Sport
WINGSPAN
36 Inches
WING CHORD
6-11/16 Inches (Avg.)
TOTAL WING AREA
240 Sq. In.
WING LOCATION
Bottom of Fuselage
AIRFOIL
Flat Bottom
WING PLANFORM
Double Taper
DIHEDRAL, EACH TIP
1-1/2 Inches

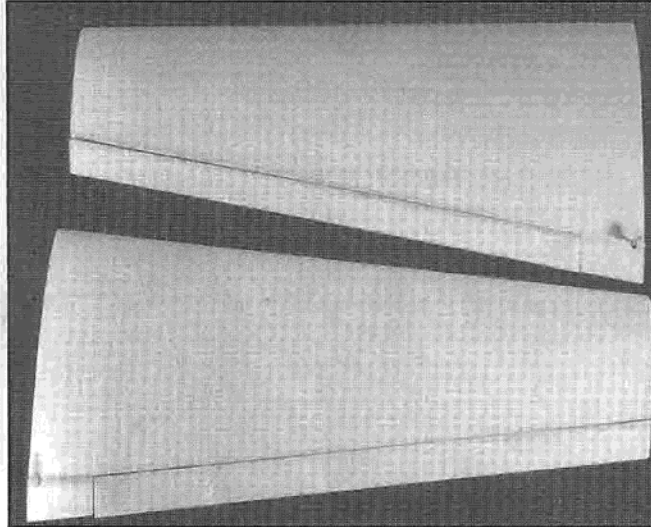
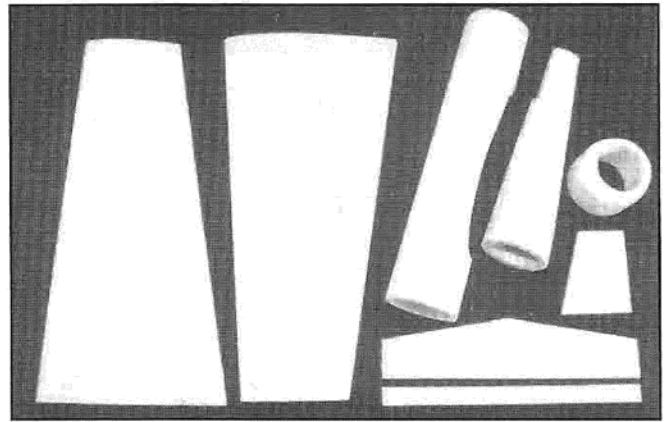
OVERALL FUSELAGE LENGTH
27 Inches
RADIO COMPARTMENT SIZE
2-1/4" rd. x 9" long
STABILIZER SPAN
12-1/4 Inches
STABILIZER CHORD (inc. elev.)
3-5/8 Inches (Avg.)
STABILIZER AREA
44 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
4-3/8 Inches
VERTICAL FIN WIDTH
3 Inches (Avg.)
REC. ENGINE SIZE
.074-.099
FUEL TANK SIZE
2 Oz.

LANDING GEAR
None
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Ailerons, Elevator & Throttle
C.G. (from L.E.)
2 Inches
ELEVATOR THROWS
5/16" Up — 5/16" Down
AILERON THROWS
3/16" Up — 3/16" Down
SIDETHRUST
0°
DOWNTHRUST/UPTHRUST
0°

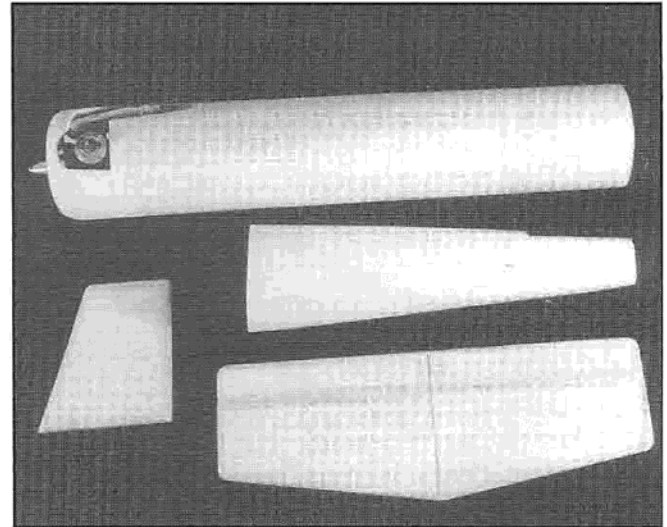
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage Foam & Lite Ply
Wing Foam & Balsa
Empennage Foam & Balsa
Wt. Ready To Fly ... 21.2 Oz. (1 Lb. 5.2 Oz.)
Wing Loading 12.1 Oz./Sq. Ft.



LEFT: The only foam cutting templates necessary (fabricated from TEKOA .034" Tri-T Template Laminate material). **RIGHT:** All the basic foam parts.



LEFT: The wing panels ready for joining. **RIGHT:** Fuselage and tail surface parts.



equipped with the Circl/Cut attachment. No templates are required for fabricating this part.

The wing saddle cut is made after the cylindrical shape has been cut by placing the cylindrical shape back into the rectangular scrap foam that it was originally cut from. Templates are used for cutting the saddle opening. The cowl portion is simply cut off of the front of this fuselage portion, and the nose of the cowl is cut and sanded to a nice concentric radius.

A round 1/8" lite ply firewall is epoxied to the front fuselage portion. It is easier to install the engine mount and drill the holes for the fuel lines and throttle control rod before gluing the foam cowl portion in place. The lite ply firewall is sandwiched between the foam cowl and front fuselage portion.

After sanding, any imperfections can be easily be filled with lightweight spackling material.

The aft portion of the fuselage was cut using the TEKOA Roto/Cut attachment, and templates that were cut from Tri-T Template Laminate. The front face of this fuselage portion is circular, and matches the aft face of the cylindrical front fuselage piece. The rear face of this fuselage portion is a small oval shape. I found cutting this foam part to be the most challenging. It's not difficult, but it does require a bit of practice in order to produce an unflawed part. Cutting the inner core out of this part is easy, as the templates prevent the part from being damaged or flawed, and the inner foam piece is discarded.

Cutting a good outer surface is more of a challenge, so being prepared to sacrifice a few foam blocks during the learning process is advised. It is just another one of those hands-on "learn by doing" skills that cannot be mastered just by reading about it.

After cutting the flat recess on the aft end of this fuselage portion to accept

the horizontal stabilizer, it is glued to the front fuselage portion.

A Sig (CS009) 9" clear plastic canopy was installed, along with a small pilot bust, in an effort to enhance the 4-F's WWII appearance. The canopy was installed by cutting a slight recess into the fuselage foam to match the canopy edge and it was glued in place using Wilhold RC-56 adhesive.

A small amount of lightweight spackling material was used to blend the canopy into the fuselage.

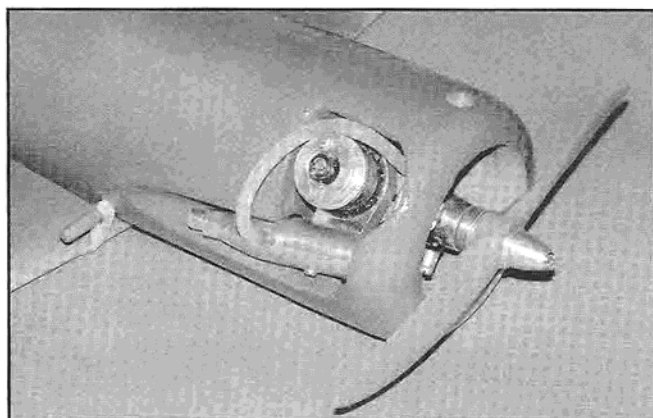
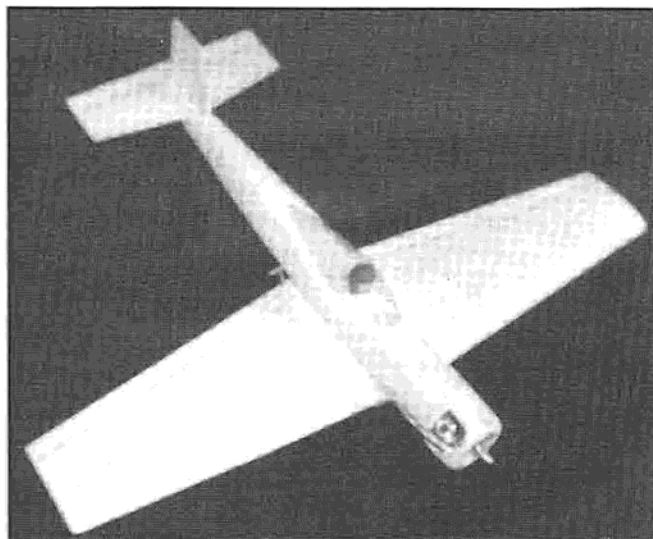
The installation of the two 1/8" wing retention dowels completed the basic fuselage assembly.

Tail Surfaces:

All of the tail surfaces were made from foam that was cut to a 3/16" sheet thickness using TEKOA's Multi/Cut, equipped with the Straight/Cut attachment. The various parts were then cut to shape, according to the plan sheet, and then capped with 3/16" square balsa.

A small piece of 3/16" balsa sheet was inlaid in the elevator for mounting the control horn. Carl Goldberg (211) Lite Jet





ABOVE: Close-up of cowl area with Cox TD .09 throttle and muffler equipped engine.

LEFT: Ready for painting.

hinges were used for hinging the elevator. All perimeter edges were rounded and the tail surfaces were glued in place.

Radio & Equipment Installation:

An Airtronics RD 6000 transmitter, #92777 dual conversion micro receiver, three #94501 microlite servos, and a #95002 270 mAh battery pack were used in my 4-F along with a 2 ounce slant style Sullivan fuel tank.

As the Cox .09 TD (throttle and muffler equipped) engine that was used in my 4-F is a relatively lightweight engine, all radio components were installed as far forward within the fuselage as possible.

Finishing:

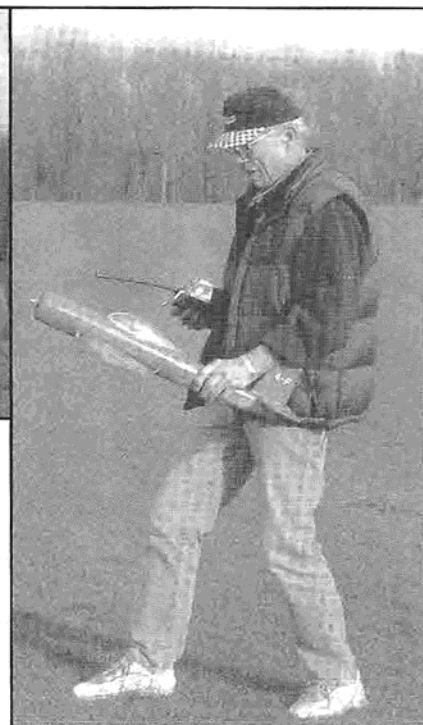
As the 4-F was intended to be a quick-to-build, inexpensive, fun type sport aircraft, the finishing process was also kept simple and quick.

The wing and fuselage/tail assembly were inspected and any dents, dinks, or surface imperfections were filled with lightweight spackling material, sanded smooth with 500 grit sandpaper, and vacuumed.

The finish on my 4-F consisted of one coat of latex house paint and a protective coat of satin finish polyurethane, aka a "Home Depot Special"!

Modelers who have not tried latex house paint as a finishing material will be pleasantly surprised with the results. While it is not impervious to glow engine type fuels, a light final coat of ordinary polyurethane solves that problem. Latex house paint is inexpensive and the color selection is unlimited. The best way to buy it for model aircraft finishing purposes is to purchase a quart of untinted base color and ask for small amounts of the primary tinting colors, in separate containers.

Just go to your local Home Depot,



Launching 4-F (a simple underhand toss is all that is required).

Lowes, local hardware or paint store, armed with several small containers with screw lids (baby food jars are ideal), for the tinting colors. Even if you are charged a bit extra for the additional tinting colors, it is well worth it, as a quart of latex paint will cover a lot of airplanes.

My 4-F, was finished by spraying the latex, after thinning it with water. (I have also seen R/C aircraft that have been finished with roller applied latex house paint, and the results were surprisingly good.)

As I intended to use WWII Japanese insignias on my 4-F (what insignia is easier to fabricate than a circle), the bottom surfaces were done in a light bluish gray and the top surfaces a deep green color.

After the latex had dried and the insignias that were cut out of pressure sensitive MonoKote Trim Film were applied, a light coat of satin finish polyurethane was sprayed on. The polyurethane was sprayed, unthinned, right out of the can.

While certainly not a flawless, showcase finish, the end result is surprisingly good, fuelproof, and much better in appearance than many would expect.

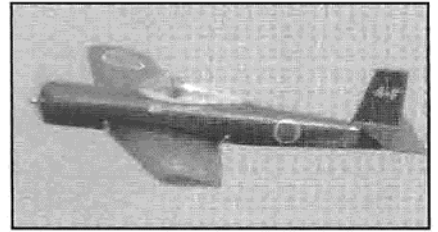
The 4-F ready to fly (less fuel) weighed in at a very modest 1 pound 5.2 ounces (21.2 oz.), that produced a low wing loading of 12.1 oz./sq. ft.

Flying:

The initial 4-F test flights were made on a mild December day that featured mild 40° temperatures and also no wind. A radio range check was made and the Cox .09 TD engine was started and adjusted to produce a slightly rich full throttle setting and a reliable idle. After topping off the fuel tank, we were ready.

With an easy, underhand forward toss the 4-F was climbing out at a nice gentle angle.

It was evident that some right aileron correction was needed, and this was



added via the RD 6000's electronic trim lever. After gaining sufficient altitude and adding a little down elevator trim, the 4-F was flying straight and level, thumbs off. A bit of general maneuvering revealed that pitch control was a little on the sensitive side, while the roll rate was a little sluggish. Several minutes were then spent performing various maneuvers in order to become better acquainted with the 4-F's in-flight characteristics. A soft, uneventful belly landing was then made by simply chopping the throttle to idle on final approach and gliding in.

The elevator and aileron control surface travel rates were then adjusted, and the fuel tank was refilled for a second flight that produced pitch and roll response that were much more to my liking.

Slow flight and stalls with the engine at idle did not result in any tendency to drop a wingtip and enter into a spin. When the 4-F stalls, the nose just drops until sufficient air speed has been regained for normal flight. The 4-F is aerobatic, and inverted flight is quite good in spite of the wing being a flat bottomed type. As there was virtually no wind and the 4-F flew in a smooth predictable manner, it was fun to perform low level maneuvers without any undue concerns. The Cox TD .09 engine proved to be an ideal power choice. It was equipped with an APC 7 x 3 propeller that provided such good performance, that I never felt a need to try other size or type props.

Hand launching is super simple, even for old Mode 1 fliers like myself! Be assured that a "run and heave" javelin type throw is not required. Just stand stationary, take a short step forward and make an easy underhand outward toss like pitching a horseshoe, and the 4-F will be climbing out nicely.

The 4-F's flight performance certainly measured up to all of my expectations.

I consider the 4-F to be an inexpensive, easy to fly, fun type sport aircraft, that is a suitable first time project for any R/C modeler interested in becoming involved in foam cutting.

