1929 VELIE

MONOCOUPE

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Ektachrome transparency by Ed Means

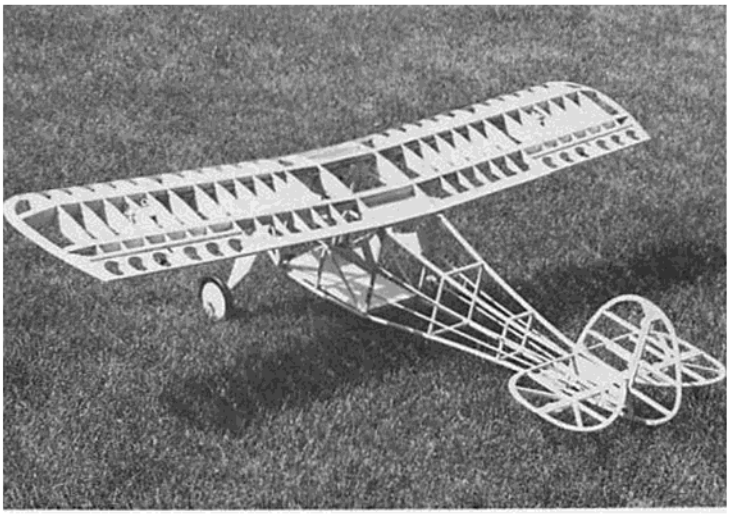
The Velie Monocoupe is a slice of aeronautical nostalgia. Designed by Clayton Folkerts, of later racing aircraft fame, the Velie was the second in a long line of Monocoupes – a definitive design. Powered by the 65 horsepower Velie air-cooled radial engine, the 1928/1929 version of this famous monoplane took home more than its share of trophies in the stock plane races that were popular in the late 20's and early 30's. With a span of 32 feet and an overall length of 19 feet, 9 inches, the Velie Monocoupe cruised at 85 mph. It seated two, in chummy side-by-side comfort. An excellent training aircraft, its stability also attracted the sportsman (and sportswoman) pilot of the era.

Factory drawings were used in scaling the model – twice! Basically, it is a 3X enlargement of Herb Clukey's outstanding rubber-powered model (a kit/plan for which is available from Flyline Models, 10643 Ashby Place, Fairfax, Virginia 22030). Herb used the factory drawings in producing his ¾" scale Monocoupe. He loaned the same drawings to me, to assist in the design of the R/C version. As far as can be determined, there is no deviation in scale for either model effort. Outlines and wing section (Clark Y) are as "Monocoupe" as one can get. The R/C plan includes more wing ribs than the prototype and the wing and landing gear struts attach differently – but these changes were dictated by the materials used in model construction. The model falls into the "standoff scale" category, due to these small changes as well as a lack of cockpit detail and the exposure of the engine cylinder as part of the 5-cylinder "scale" Velie engine. This latter, because I'm a firm believer in keeping R/C engines cool – particularly when they are as overworked as they are in the usual scale model.

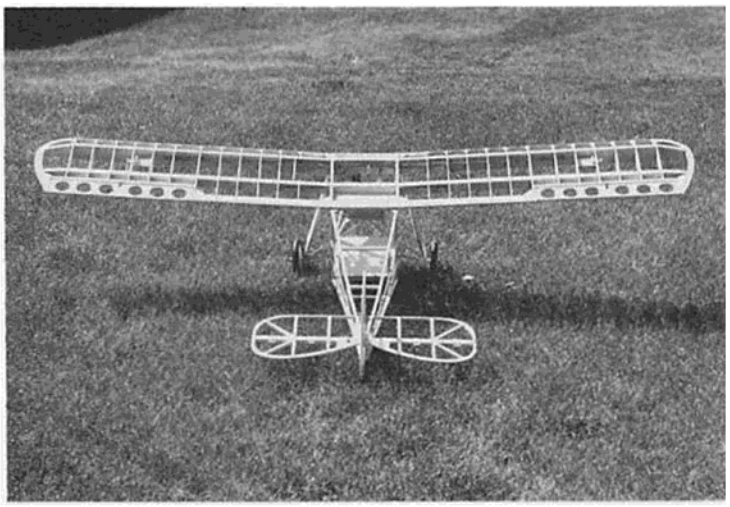
For the "super-scalebuilder," and the scale contestant, presentation data may be found in two books. The first, Joseph Juptner's "U.S. Civil Aircraft," Volume 2, has two excellent photographs, clearly showing markings on the prototype aircraft. The second book, "Of Monocoupes and Men," by John W. Underwood, includes a picture of the primitive instrument panel as well as an in-flight shot.

The Velie Monocoupe is relatively simple to build and prepare for flight. The usual admonition, "not for begin- . . . . . to page 70

Three-quarter left front view of the Velie Monocoupe uncovered framework.

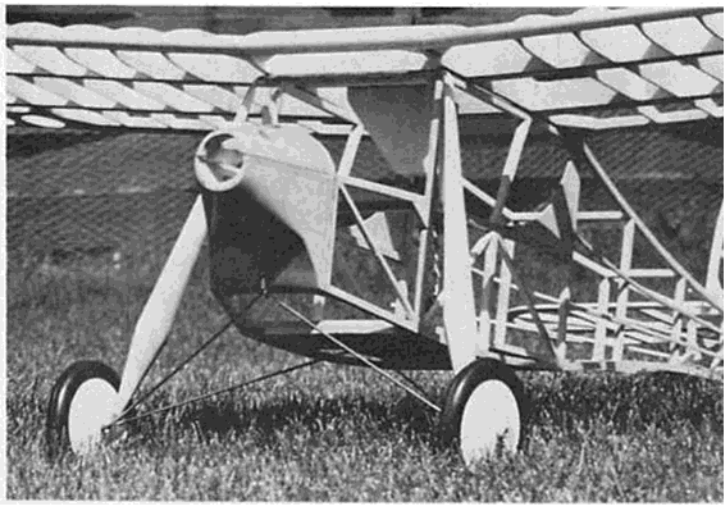


Three-quarter left rear view. Lightening holes used to reduce mass in ailerons. Note base plate in cockpit area.

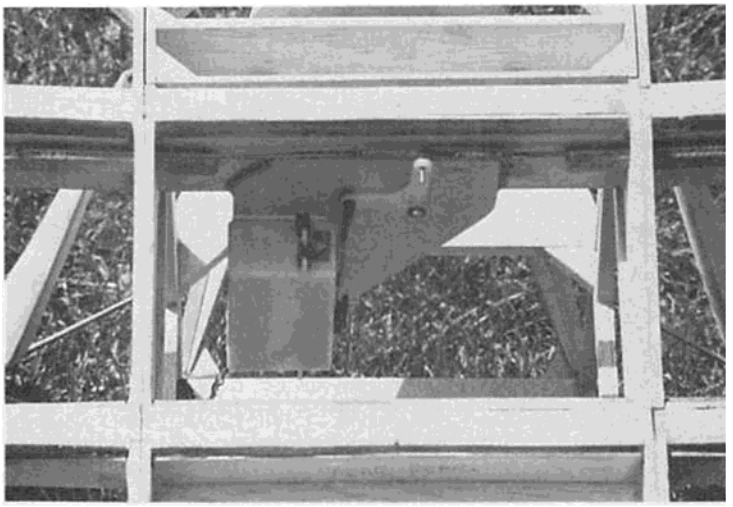


Rear view of the Velie Monocoupe. Generous wing, empennage areas provide slow, easy aircraft to handle.

Left elevation of Monocoupe. Uncomplicated, light structure for low wing loading.



Close-up view of cowling and landing gear detail.



Wing center section showing detail of aileron servo installation.

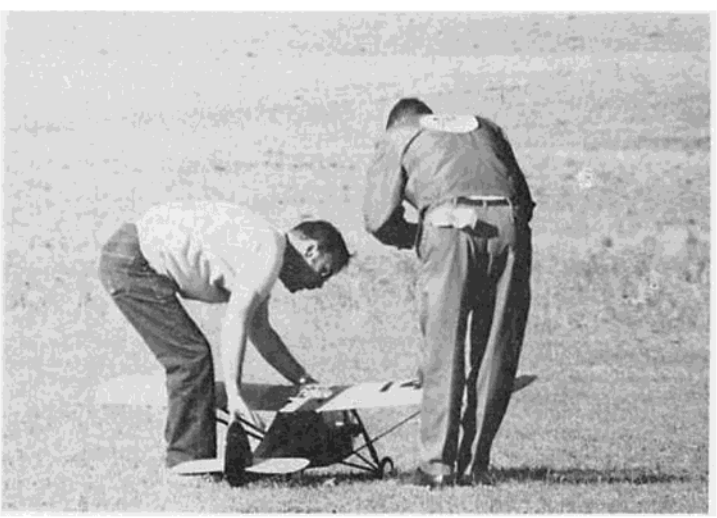
Close-up of uncovered Velie Monocoupe empennage. Light structure keeps weight down in the tail section.

Three-quarter right front view of completed Velie. Strut installation shown. More complex looking than it is to build.

Right side view of completed Monocoupe. Extremely easy flying aircraft for the sport flier.

All control surfaces are scale size. Note use of MonoKote strips to simulate divisions of the "window" in the wing over cockpit area.

Assembling the Velie. Author on right, Harald Krause on left. "Eaglerock Models" sweatshirt author wears advertises his yet-to-be-formed company.



Peaking the O.S. Max .30 - - - the author and Major Jack Aycock. Insignia on Major Aycock's jacket is that of the Alaska R/C Club of Anchorage.

The Velie Monocoupe taking off on first trim flight.

The Monocoupe climbs out. Note aileron deflection.

Final approach to first landing. O.S. .30 more than adequate even at 7,000 ft. plus altitude.

The author fetching the field box and starter for another "go" after successful first flight.

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ners" doesn't really apply although initial test flights should be made by a thoroughly competent pilot. The construction is about as basic as a Megow 10 cent model of yesteryear. A razor saw and a miter box are necessary additions to the tool box, in order to build this model – this because of the thick balsa and plywood sizes recommended. The Monocoupe goes together better with square-cut members. And, at 2¼" to the foot scale, some of the pieces get pretty hefty. Surprisingly, the original model weighs only 5½ pounds, ready to fly. No special effort was made to keep the weight down except in the wing and tail. The tail was kept reasonably light in view of the short nose moment.

Power for the original model is a .30. Larger displacement engines may be fitted if additional power is desired but the scale nose contours will have to be altered. The smaller engine has proven adequate at our club's flying field. The Pike's Peak R/C club field is at 7200 feet above sea level, so the "little" .30 has been severely tested. Remember, the prototype only had 55 horses available under cruising conditions, so, in order to achieve scale-like performance, stick with the "smaller" engines. Test flights reveal that one washer of downthrust and one washer of right thrust were necessary from 0-0 settings, using an O.S. .30 R/C.

Two final admonitions, before we get to the "how-to" part of this article. First, the wing struts on this model are functional and should be used. The wing center section of the prototype (and the model) projects well beyond the cabin structure. In order to duplicate this design feature, the fixed, forward part of the wing center section receives a minimum of support from the fuselage. The cabin structure, too, is a tad spindly. The wing struts, therefore, help hold things together, and should be used. Second, the fuselage longerons should be the hardest ¼" square balsa available to the builder. The structural integrity of the fuselage, aft of the wing, depends on these four members, which must retain a curved shape. Spruce longerons (¼" square) may also be used – but spruce may cause slight tail-

heaviness.

FUSELAGE: After building two identical sides, the cockpit area of the fuselage is joined by two "base plates" of ¼" sheet balsa. The fuselage sides are pinned, inverted, over the plan. A large, rectangular pre-cut piece of sheet balsa is glued, inside them, across the bottom of the cockpit area. The advantage of this first "base plate" is that it can be cut truly square, and thus, aligns the fuselage sides exactly – a difficult task if only stick crosspieces are used. While things are still pinned down, two ¼" square balsa crosspieces, cut to precisely the same width as the "base plate" are glued to the forward and aft ends of the cockpit area. A perfectly rectangular "box" is thus formed, which establishes the fuselage alignment. Of course, the "squareness of things" requires that the fuselage remain pinned in position until the glue dries completely (at least overnight, even if you are using epoxy). After the "box" is dry, the longerons are partially sawed through (from the inside, outwards) and a small triangular section removed to allow the nose and tail of the fuselage sides to be drawn together. The rear posts are joined and pinned together, after glue has been applied to them. The second "base plate," this one in the form of a cut-off triangle, is now cut precisely from ¼" sheet balsa. Incidentally, the fuselage is 6" wide between longerons. It is less expensive to edge-glue two sections of 3" stock to provide material for the "base plates" than to buy 6" balsa. The second, triangular "base plate" is glued in place between the upper longerons, from the cockpit to the firewall. This establishes the "pointy" shape of the nose, after another ¼" square balsa crosspiece is added between the lower longerons. Again, after things dry, the forward fuselage cross section is sanded flat and the ¼" plywood firewall is epoxied in place. The remaining fuselage crosspieces may now be added, aft of the wing to the tail.

Other advantages of the "base plates," in addition to squaring the fuselage, is that they serve several structural purposes. The forward one is used as a fuel tank mounting plate as well as a support for a 1:1 bellcrank, used to transmit engine servo movement to the throttle arm. The larger, rectangular "base plate" provides a good surface to which the radio, battery and servos may be mounted as well as an anchor point for the wing

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strut fittings and the "J-bolt" which secures the rear landing gear strut. Hardwood or plywood blocks, with inset "blind nuts" may be glued in place to the "base plate" to fix the gear and the struts. One final caution in constructing the Velie Monocoupe fuselage. The forward cockpit uprights and crosspieces must be of **hard** ¼" square balsa, since they take the load of the main landing gear strut. Epoxy and extensive gusseting are indicated on the plan to assure the ruggedness of the main landing gear strut attachment.

WING: The only caution to be observed in constructing the wing is to build the center section concurrently with the outer wing panels. The fixed portion of the center section (the part that is glued to the fuselage) may be cut away later, when the wing is positioned above the cockpit. Spar joiners are plywood and run well into the outer wing panels. They provide a rugged mounting for the wing dowels (forward) and the wing hold-down screws (aft). The plans note the use of 1/16" sheet balsa webbing between the wing spars. The resulting structure is extremely strong and warp-free. The edge-set 3/8" square leading edge is shown "routed" out between the wing ribs – as a weight saving device. And, lightening holes are shown in the sheet balsa ailerons – to reduce their mass, rather than reduce the weight of the model.

The wing tips, cut from 3/8" sheet balsa, are designed to include an attaching gusset (as are most of the curved tail surface parts). The additional gluing surface thus provided helps prevent tip warpage when covering is applied to the wing. Note that the tip outlines are raised ¼" from the flat wing building surface to give a bit of upsweep to the lower tip surface. Blind nuts, for the attachment of the extremities of the wing struts, are tightened into plywood rectangles, which in turn are epoxied into the wing structure, flush with the lower surface, at the four points indicated on the plans.

The large "window" in the wing center section of the prototype poses a difficult design problem. Where to mount the aileron servo so that it didn't show? The plans show **one** solution to this problem – a "pendulum" mount that has the disadvantage of adding a third bellcrank in the aileron pushrod system. It works well, however. More courageous souls may choose to "bury" the aileron servo in the first rib bay outboard of the center section. Access to it would be difficult and a servo cable extension might be required. One final note concerning the Monocoupe's aileron system. Test flights have revealed that, using 90 degree aileron bell cranks (which give equal up and down movement) the ailerons are relatively ineffective. This is characteristic of high wing monoplanes equipped with generous aileron area. Thus, the Velie Monocoupe is a prime candidate for the use of differential aileron action. This may be achieved using 120 degree bellcranks, which give more "up" than "down" as the ailerons are operated. With the original bellcranks (90 degree), the Monocoupe is a "rudder airplane."

A last comment on the pesky "wing window" - - - it is covered with heavy (.030) clear plastic as are the rest of the transparent areas of the cockpit. The "window" splits along the front of the front spar – the fore-aft dividers are strips of MonoKote **carefully** ironed in place (too much heat, and the "window" warps). Common pins and a thin film of epoxy hold the plastic to the structure.

LANDING GEAR: Although the Monocoupe landing gear appears to be complex, it is easy to bend and attach. The main (wheel-holding) strut is bent from one piece of 36" 1/8th diameter music wire. The flat center of this strut is wire-bound to the front upper crosspiece of the cockpit and then liberally coated with epoxy. The two lower struts for the landing gear are bent from 3/32" music wire and attached at the center to the fuselage with a single "J-bolt" each. The ends of all three struts (on each side) are drawn together, lashed with copper wire and soldered – the whole assembly is self-jigging. The distinctive fairing on the main landing gear strut is fashioned as a sheet balsa "sandwich." The inner core of 1/8" sheet is made in two pieces to channel the gear wire.

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It is faced on both sides with ¼" sheet, the wire channel being filled with silicone "Tub Seal" before the final covering is glued in place. The "Tub Seal" is used to hold the wire and balsa together while ordinary Titebond or white glue holds balsa to balsa. When the "sandwich" has dried, it should be faired to cross section. The fairings for the auxiliary struts are cut from 3/32" sheet balsa. As indicated on the plans, they may be attached to the wire using silk or glue or, alternately, with MonoKote. The easier technique entails ironing a piece of MonoKote to one side of the fairing strip, the fairing positioned on the wire, and the other side drawn taut. It then is ironed firmly to the second side of the fairing and around the "back" to completely cover it. Since the auxiliary strut fairings needn't be streamlined, they are thus attached and covered all in one operation. "Vintage" wheels (4-3/8" diameter) are held in place with 1/8" wheel collars.

TAIL SURFACES: Tail surfaces are of conventional construction. The outlines are cut from ¼" sheet balsa; the leading edge, spars and crosspieces are ¼" square balsa. My model used pinned nylon hinges for all movable surfaces – the plans show the hinges at their scale positions. The sub-elevator strut, bracing the horizontal surface, is cut and fitted at this point in the construction sequence. It is covered, using the MonoKote wrapping technique, and epoxied in place after the entire model is covered and assembled. The covering of the fuselage and stabilizer must be cut away at the attachment points. A bracing wire (not included on the author's model, but indicated on the plans) may be attached between horizontal and vertical tail surfaces – in line with their respective spars. A ¼" length of inner NyRod may be epoxied into holes drilled through the fin and stabilizer spars to guide a length of monofilament fishing line if it is desired to simulate this bracing wire. The nylon insert prevents the line from "sawing" through the spars.

The tail skid, bent from 3/32" diameter music wire is bound to a triangular plywood plate which, in turn, is epoxied to the top of the lower longerons. The spring construction of the prototype tail skid may be simulated by gluing ¼" wide strips of 1/32" plywood, curved to match the wire skid, together. This plywood lamination may then be "Tub Sealed" to the wire skid, and bound to it with thread.

COWLING AND ENGINE MOUNTING: The engine is easily located to the ¼" plywood firewall, using commercial mounts. I used one of the cast aluminum type, fixed to the firewall with three 6-32 bolts/blind nuts. With the mount in place, but the engine removed, pre-cut cowling blocks are glued in place and carved to shape. The lower cowling block may be grooved on its rear surface to accept a piece of brass tubing as an oil drain before being epoxied in place. The upper (removable) cowling block should be faced with thin (1/32" or 1/16") plywood where it contacts the lower cowling. A thin sheet of paper glued between upper and lower cowling blocks will simplify cutting the upper cowling free after it has been formed. Simulated engine cylinders may be fabricated from balsa cylinders and blocks, the cooling fins simulated by wrapping the cylinders with very heavy thread. The upper two "fake" cylinders are shown displaced from their scale position by 10 degrees, for ease of attachment. Very conscientious scale builders may "drop" them to the exact location, which partially bridges the cowling parting line. Valve rocker pushrods, the exhaust manifold (bent from brass tubing) and the projecting scale carburetor may be added at the builder's option. A commercial metal spinner was used on the author's model for flying purposes although a scale spinner may be carved from hardwood. The scale spinner includes the propeller hub as part of its streamlined shape and is rather difficult to form.

FINISHING: The author is addicted to MonoKote, and thus, it was used to cover his model. Prior to ironing on the "miracle" covering, all bare balsa surfaces (cowling, simulated engine, wing struts, and main landing gear fairings) were filled and doped to a high gloss black. The fuselage and rudder are black, the wings and horizontal stabilizer are orange. One and one-third rolls of orange MonoKote were used, while the fuselage and rudder required one roll of black. The resulting job duplicates the hand-rubbed Berryloid dope finish sported by the prototype. The license number, 147N, is fictitious – to differentiate it from 147K shown in one of Mr. Juptner's pictures. MonoKote trim strips were used to apply the number to the wing. The discs of the wheels may be spray painted orange, if desired. Very thin coats (almost dry) of butyrate dope will do the job. Windshield and window installation are accomplished just before the covering is applied – to permit the covering overlap shown on the plans.

EQUIPMENT INSTALLATION: Although a two-ounce fuel tank was originally fitted to my Monocoupe, it provided only a three minute engine run. It was easily concealed in the instrument panel area, as shown on the plans. Later, a four ounce cylindrical tank was installed which projects into the "pilot's" face in a most unscalelike manner. In any event, the tank is sealed from the rest of the structures in an epoxy-coated box-like compartment that keeps the juice out of the electronics.

Pushrod openings should be provided for rudder and elevator in the rear of the fuselage. The battery (forward), the servos, and the receiver (aft) are fixed to the floor ("base plate") of the cockpit. There is more than enough room for the largest of servo installations, but position them as far forward as possible on the "base plate" for balance purposes. Using Kraft KPS-9 servos thus positioned, my model required only one ounce of weight in the nose to meet the CG indicated on the plans. The throttle servo may cause some minor installation problems. As noted earlier, a simple 1:1 phenolic bellcrank, pivoted below the forward "base plate" may be used to transmit the engine servo "push" in a straight line to the throttle. Remember, that such a bellcrank reverses the direction of servo movement, so choose the proper output to give "go" when you move the "go" stick of your transmitter.

I have a fetish about equipment accessibility in my R/C models. Servo trays and rubber bands hold everything in place and all screws and nuts are easy to get at. I've found that, even with the super-reliable radio equipment of today, there are times when being able to disassemble the bird comes in very handy.

FLYING: The Velie Monocoupe has very generous control surfaces. Very little movement is necessary to produce more than adequate control. The third hole out on large control horns is plenty around the tail sur-

faces. As noted earlier, aileron control is relatively insensitive using 90 degree bellcranks, so if you use them, come as close to the aileron as you can with the actuating rods. Using the proper differential bellcranks, aileron movement should be minimized until their effect is determined.

Ground roll for take-off of the Monocoupe is about 50 feet in a slight breeze. The left wing tends to drop just before it breaks ground, requiring just a touch of rudder to bring it level. Airborne, the model is S-L-O-W and majestic in flight. A prototype speed is easy to attain with all those struts hanging out in the airstream. Aerobatics require a soft touch – there's a lot of control available. Loops require a slight dive, as an excess of power is not available – as there was not in the prototype. With all of its wing area, the Velie Monocoupe is a "floater." Landings may be "played" as long as runway remains. With the tail skid digging in, the landing roll is pleasantly short. All in all, with a slight nose heavy bias, the Velie Monocoupe is great for boring great circular holes in the sky. Hope you like yours!

In conclusion, the author would like to thank two people. First, Dick Zasadney, of Warren, Ohio, who translated my wrapping paper pencil drawings into the beautiful plans that accompany this article. And, second, Major Jack Aycock, USAF (Retired), owner of Custom Hobbies, Colorado Springs, Colorado, who acted as the intrepid test pilot, bringing the Velie Monocoupe through scratchless on many a Sunday morning. □