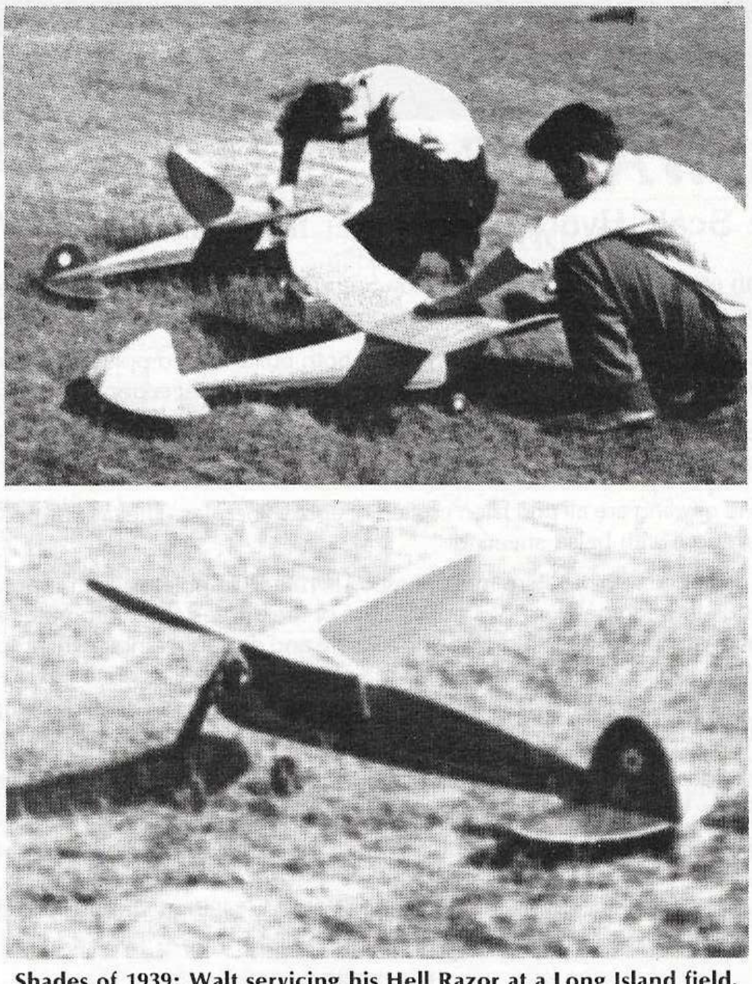
OT SPECIAL

HELL RAZOR

Another 1939 aircraft that used the Murray/Ritz wing. Great for R/C assist or free flight.

by WALT MUSCIANO

MURRAY/RITZ single-contour wings were discussed in Part I which appeared in last month's issue. Also presented was a construction drawing of Gordon "Scotty" Murray's The Answer model design of 1938 which used his single-contour wing. Models fitted with Murray/Ritz wings had such a slow gliding speed with a low rate of sink that it seemed they would never return to earth! Yet, because of the exceptional drag generated by the single-contour wing, the climb was not spectacular but satisfactory, and Scotty's designs won more than their share of contests. In an effort to increase the rate of climb, Murray and his flying buddies, including myself, constantly experimented with various adjustments. It was found that higher angles of attack of the Murray/Ritz wing improved the climb—probably because the undercamber turbulence, caused by the sharp downward pitch of the leading edge, was reduced when the leading edge was raised to lessen the downward angle and resulting turbulence. As one who worked with Gordon Murray, such as helping with the drafting of single-contour wing designs, I began experimenting in early 1939 with variations of Murray/Ritz wing-fitted designs in an effort to improve the climb.



Shades of 1939; Walt servicing his Hell Razor at a Long Island field. With Walt is Allen Labie cranking up a "pregnant guppy" original design; an example of very low CLA, a popular design trend at the time. Hell Razor bucked this trend and led to later pylon types.

Design considerations consisted of lowering the thrust line so the nose would tend to rise under power, using a lifting airfoil in the stabilizer not only to increase the effective lifting area but to provide a force to counteract and keep the effect of the lower thrust line under control, and increased incidence angle to reduce the undercamber turbulence. The lifting tail shifted the center of lift aft and resulted in relocating the wing forward, which increased the distance between the wing and the stabilizer. The basic Murray/Ritz single-contour wing was used as well as the basic planform of Scotty Murray's The Answer design tail surfaces. To match the simplicity of the wing, a crutch-type modified diamond-section fuselage was selected; possibly one of the first examples of crutch construction. To top it all off, we also took advantage of the flexible Murray/Ritz wing and incorporated elliptical dihedral into our model. The stabilizer was located below the thrust line to keep clear of the wing-created turbulence. The center of lateral area (CLA) in model designs of the late Thirties was located progressively lower and they began sporting deeper and deeper bellies, giving rise to the name "Pregnant Guppy." This was based upon the theory that during moderate climbing angles with relatively sharp turns, the model would skid toward the outside of the climbing circle and the low CLA would help keep the model on course.

As engines increased in power and more interest focused on the climbing ability, models assumed a steeper climbing angle with very sharp banks. This revised the CLA thinking because now the models tended to slip into the center of the climbing circle and the CLA began to climb higher and higher. A high CLA was selected for our Hell Razor for stability during high angle of attack spiral climbing.

The performance of our model exhibited a more spectacular climb. Instead of smooth, flat climb, the model "corkscrewed" upward in a sharp bank and seemed to gain more altitude during the engine run. The longer distance between the centers of lift of the wing and stabilizer gave the model a smooth, and

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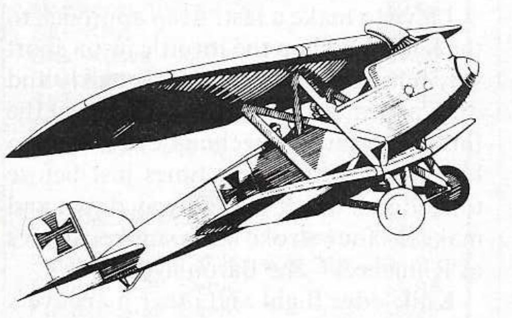
erratic, reaction to minor atmospheric disturbances, such as wind gusts, and yet the single-contour wing was still sensitive to thermals and the glide remained sensational. In the late summer of 1939 the prototype model was lost overhead in a gliding session which lasted over eight minutes. Like most modelers, I had a multitude of projects underway and never did get around to building a replacement. World War II slowed modeling activities to a virtual halt and the project was all but forgotten.

"Hell Razor" is a name that sort of evolved at the flying field. A new design always attracted attention, whether it be Schoenbrun's Rocketeer or Schulman's Skyrocket, and when my model made its debut on the field, someone remarked on its "lean and hungry" appearance and that it was like a "razor." The name stuck and we added "Hell" to make it a pun to sound like "hell raiser." Our model is the epitome of simplicity with light yet rugged construction.

CONSTRUCTION. The fuselage construction begins with the crutch which is the primary strength member, supporting and aligning the engine, wing, and tail. The hardwood engine mount bearers must be firmly cemented to the balsa crutch runners via a long scarf joint, as shown on the plans. In effect, the bearers become part of the crutch. Assemble the crutch over the fuselage top view and pin it to the workboard through the plans. Cement the cross pieces well to the crutch runners. Bend the landing gear to shape and sew it to the bulkhead with strong cotton thread. Smear the thread on both sides of the bulkhead with several coats of cement. Cement the plywood bulkhead and bulkhead "J" to the crutch runners.



Cut the necessary wood to shape to form section "E." Assemble it on the plan and cement it to the crutch, allowing space for the spine and bottom longeron. Then cement the two spine pieces together and, when dry, cut the spine to the shape shown on the profile view of the plans. Cement the spine into the slots "E" and "J" and to the crutch. Then cement the bottom longeron to the plywood bulkhead and to "E."

When the cement is dry, cut the wing platform to shape and cement it to the plywood bulkhead, section "E" crossbrace, and the spine. Very firmly cement the braces located between the bulkhead and "E" to the wing platform, crutch, and bottom longeron. When dry, continue cementing the remaining braces in place. Note that the bottom longeron must be bent upward as it progresses aft. Cement the $3/16$-inch sheet balsa gussets to the bulkhead and crutch. The $3/16 \times 1/2$-inch wing platform braces running from the bulkhead up to the wing platform not only reinforce the platform, but form a structure for the covering to create a rounded front on the fuselage. These should be very firmly cemented in place.

Now cement the $3/16$-inch balsa cheek cowl pieces to the engine mount bearer and bulkhead. When dry, trim the cowl and sand the entire fuselage frame, using a block. Re-cement all joints and then cement the stringers in place to the bulkheads and fuselage braces. Hold them in place with pins until the cement is dry. Sand smooth and cement the stabilizer platform to the underside of the fuselage. When the fuselage is being covered, carry the material over the wing platform and cement it to the top.

The tail surfaces are very conventional. The fin ribs have camber on the left side in order to induce the model into a right turn. The stabilizer tapers downward, giving it a slight anhedral effect. Cement the covered fin to the fuselage spine while cementing the ventral fin into the space between the

stabilizer ribs.

The wing construction was described for Gordon Murray's The Answer in Part I and that same wing design was used for our Hell Razor. The wing on the Answer had conventional dihedral with a center section and left and right panels. As Scotty Murray's flight buddies, including myself, began using Murray/Ritz wings, it was noticed that as the covering pulled tighter from the sun, re-doping, etc., the dihedral increased somewhat and the wing curved gently resembling an ellipse. This observation started a series of experiments to actually construct a single-contour wing with built-in elliptical dihedral. Elliptical dihedral is the most efficient form of dihedral, however it requires a very complex structure. The closest modelers have come to an ellipse with a conventional structure is polyhedral.

After several attempts we discovered that if the wing was made in one panel with no dihedral breaks, all ribs in place, covered, and with wing formers in place, elliptical dihedral could be induced during the covering shrinking process. After the wing was silk or Silkspan covered, it received a thorough sprinkling of hot water on both sides. The wet wing was then quickly placed between two level chairs or tables, supported by the edges of the tables at a point on the wing near the tips as noted on the front view of the plans. A fairly heavy weight, such as an old-fashioned pressing iron (about 3 to 4 pounds), was gently placed on the center of the wing and the wing began to sag at once. It is advisable to begin with lighter weights and increase with progressively heavier weights to be sure that the structure and glue joints you have made will hold up under the weight. It is important that the edges of the tables are parallel to each other in all planes and that the weight is so located that it does not twist the wing, i.e., the leading and trailing edges at the center should be the same distance from the floor at all times.

Check the dihedral continuously by placing a straightedge atop the wing, tip to tip, and measuring the distance from the straightedge down to the wing at the center line. Keep adding hot water to the wing, especially the wood portions, until the curvature is acceptable. When thoroughly dry, leave the weight in place and brush one full-strength coat of clear dope on the upper surface of the wing and let it dry overnight. Then remove the weight and continue doping the wing, top and bottom, as on a conventional wing.

The engine mounts are of a break-off design developed and used successfully by the Brooklyn Skyscrapers club members. This was described in Part I. Of course, you can install a conventional fixed engine mount but in addition to its safety breakaway feature, this mount design facilitates the installation of various makes of engines without drilling and re-drilling holes in a fixed mount. Merely use a new set of mounts for each engine installed. In fact, in the late Thirties I shared an engine with flying buddies on the flying field and transferred mounts and engine from plane to plane during the entire day. Yes, we were that poor, but we had fun with only the basics for model building and flying.

Proper balance is achieved by moving the batteries forward or aft after the coil has been secured in place. The coil location is limited by the length of the high tension wire to the spark plug. You can install the two intermediate or "C" size batteries in a sheet balsa box or in an Acme or similar battery holder.

Make free flight adjustments with wing incidence and thrust line. About two degrees down and right thrust were neces-

sary on the prototype, which climbed in tight right circles and soared in large right circles.

RADIO CONTROL VERSION. Radio control installation in the Hell Razor is very basic and quite easy because of the spacious fuselage. An R/C Hell Razor can be a real fun-ship with rudder control only, however, we suggest both rudder and engine control for optimum enjoyment and safety. Engine control on R/C free flight designs is added insurance because many tend to climb steeply even with smaller engines.

R/C operation can be conventional with full control of engine and rudder, and elevator as well, if desired, from takeoff to landing. You'll find that the Hell Razor's light wing loading will make the model eligible for "Schoolyard" flying.

Another fun-filled method of operation is to take advantage of the low rate of sink and slow flying speed characteristics of the Murray/Ritz wing. Power the model up to several hundred feet altitude and stop the engine. Now, enjoy the silent, lazy circles of your Hell Razor as it transforms into a glider. A slight movement of the rudder now and then to direct the model into or out of a thermal and to keep it overhead is all the effort you need to enjoy a pleasure-packed afternoon.

The caption on the plans has been prepared to indicate clearly those items which are necessary only for radio control with "RC" in a square, items which are necessary only for free flight are shown by "FF" in a hexagon, and items which were installed on the prototype model in 1939 are shown by "P" in a triangle.

The powerplant shown on the plans is the electric ignition engine used for the prototype free flight in 1939. The engine for an R/C version of the Hell Razor can be any modern glowplug powerplant from .09 to .15 cubic inch displacement. Naturally, the purist can install an ignition engine in the R/C version, but it should not be as powerful as the free-flight powerplant. In fact, why not install one of the new electric motor flight systems in your R/C version?

The modifications required to convert from free flight to R/C are very minor.

Cement the stabilizer very firmly to the fuselage instead of using rubber bands. Cover the upper surface of the stabilizer over ribs No. 1 only to have a wood-to-wood joint with the fuselage. Omit the stabilizer saddle, as well as the stabilizer hold-on dowels.

Install a rudder post (this is a must) in the fin and hinge a solid, soft balsa rudder to the post. Firmly attach a nylon control horn to either side of the rudder.

The Hell Razor fuselage is big enough to accommodate any fuel tank suitable for the engine. We show a four-ounce tank which should provide long flights with a .15 engine. Install the tank of your choice and run the fill, feed, and vent connecting tubing as required.

Install the R/C equipment and the control rods which can be made from a strip of balsa and wire for the rudder and flexible cable for the engine control. Be sure that the rudder has at least 30 degrees travel each to the left and right so the Hell Razor can be spiraled out of a thermal when necessary.

Happy Flying! ■