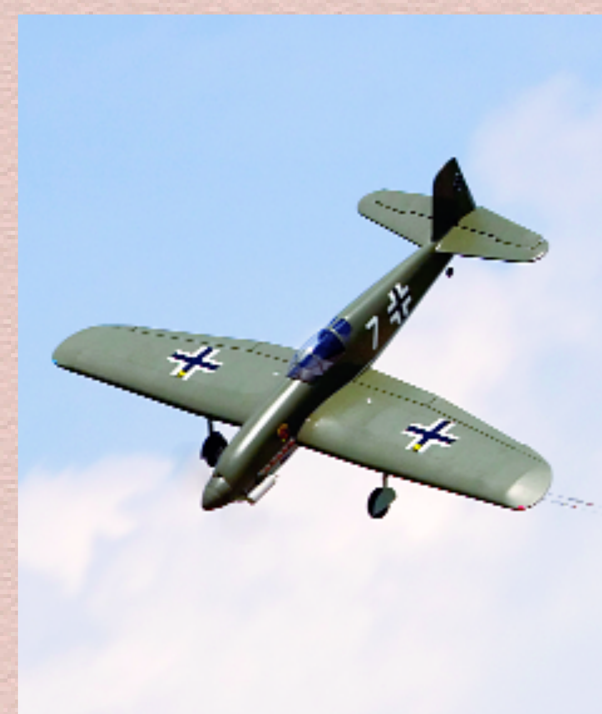
by Daniel Lee Grotzinger

Above: The author designed the He 100D Stunt for Precision Aerobatics, but he accurately replicated the outline of the full-scale Heinkel.

Left: The author/designer laps the Stunt circle with his He 100D. The engine's low thrustline enhances the model's neutral handling.

Below: The long tail moment eliminates the need for an oversized horizontal stabilizer. Elevator area is borrowed from the fixed stabilizer shape.



The inverted gull-shape wing is pronounced just enough to enhance the scale appearance. Flap sizes and deflection ratios were carefully considered.

The He 100D's finish is left matte, with recessed panel lines. Although designed for Stunt, the model's outline is accurate enough to warrant using authentic insignia.

Heinkel 100D Stunt

A Stunter with warbird appeal that is outside the typical lines

THE HEINKEL HE 100D is a little-known, seldom modeled aircraft that could have become the mainstay of the Luftwaffe during World War II. It was built as follow-up to the He 112: Heinkel's original design entry when the Reich Air Ministry issued specifications for a new fighter in 1935.

The He 100, sometimes designated "He 113," was in many ways superior to the Messerschmitt Me 109, which had initially won the Reich Air Ministry's competition over the He 112. But Heinkel was not awarded a production contract, mostly because of politics. As with the Bell P-39, there was little margin for weight-increasing modifications.

For a short time, clipped-wing preproduction model He 100V8 held an absolute world speed record at 463.92 mph. For more information, see Schiffer Military History volume 52 and Aero Publishers number 12.

You never forget your first love; that is certainly true of my experience in model aviation. I was an avid CL Precision Aerobatics (Stunt) builder and flier from 1960 until 1966. During those formative years, I devoured every article I could find about aerodynamics, especially pertaining to Stunt application.

During the next 30 years, I alternated between activity and inactivity in CL and RC because of military service, college, raising a family, and work. However, I followed the design articles—especially those by Al Rabe. I agreed with the direction he was taking Stunt design.

I learned about the He 100 while researching for an RC Scale Focke-Wulf Fw 190D. Later I acquired a 1/5-scale He 100D from Dennis Wann in Bryan, Ohio. I loved it and kept thinking that it deserved to be made an incarnation of a close-to-scale Stunter, although that would be a challenge.

I got fired up and started drawing after the 2002 Nats. Then the balsa chips started flying.

Large models fly better because of a somewhat more favorable Reynolds number. My bad shoulder did not want the pull of a .60 engine, so I compromised on a .51, which I already had. Rather than force a scale appearance on a set of Stunt design numbers, I worked backward. I altered scale three-views as little as possible to arrive at what my instincts told me would work.

In relation to the fuselage, I redrew and resized the wing many times. This resulted in approximately a 10% enlargement, with a slight chord widening and a modest decrease in the outer panels' taper. I retained the inverted gull wing and split flaps to preserve the aircraft's essential character, although it was obvious that it was going to present some challenges.

I employed a Southwick Skylark airfoil with the LE radius blunted to reduce pitch sensitivity. The TE was shortened to fit my planform, and that yielded a 22% airfoil less flaps. At that point I had a 57.5-inch wingspan with approximately 570 square inches of area. Yikes! The model had a long wing and a good airfoil, but not a lot of area.

More deviation from scale was unacceptable, so I was going to have to design my way around this problem. I kept thinking, high-aspect-ratio wings are more efficient, so why do Stunters have low aspect ratios? From that point on, weight reduction became Priority One.

No topic has generated more ink in Stunt discussions than wing imbalance vs. tip weight. Married to that is the issue of flap differential, either through area or movement. In a sharp corner, we want both wings pitching equally without introducing yaw and roll forces, which are difficult to trim out of all maneuvers.

I don't think the outboard wing generates as much additional lift from moving in a radius as some think. In a sharp turn, the need for a clean pitch change completely overrides the radius of the flight path. Most of the traditionally used wing imbalance is actually compensating for line weight and tug.

The Heinkel's right outboard panel is shortened by 5/8 inch, with 1 7/8 ounces of tip weight, and the flaps are equal. This proved to give clean squares and triangles in flight-testing.

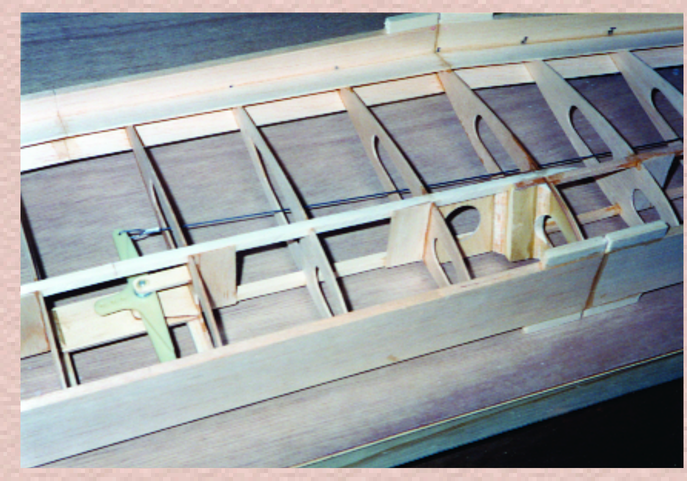
The fuselage profile is scale, except for 1/4 inch that was shaved off the bottom of the fuselage and 3/8 inch that has been removed from the top of the fin. The fuselage width was reduced 7/8 inch.

The stabilizer was enlarged but is not as large as on most of today's Stunters. I thought it was unnecessary, because a long tail movement requires less force for pitch stability and pitch change. The elevator was enlarged by borrowing area from the stabilizer. The balances were retained for scale effect.

I used 37° maximum flap deflection for 45° elevator deflection. I wanted to avoid stalling the wing and losing airspeed in tight turns but knew I needed to move that long tail in a hurry.

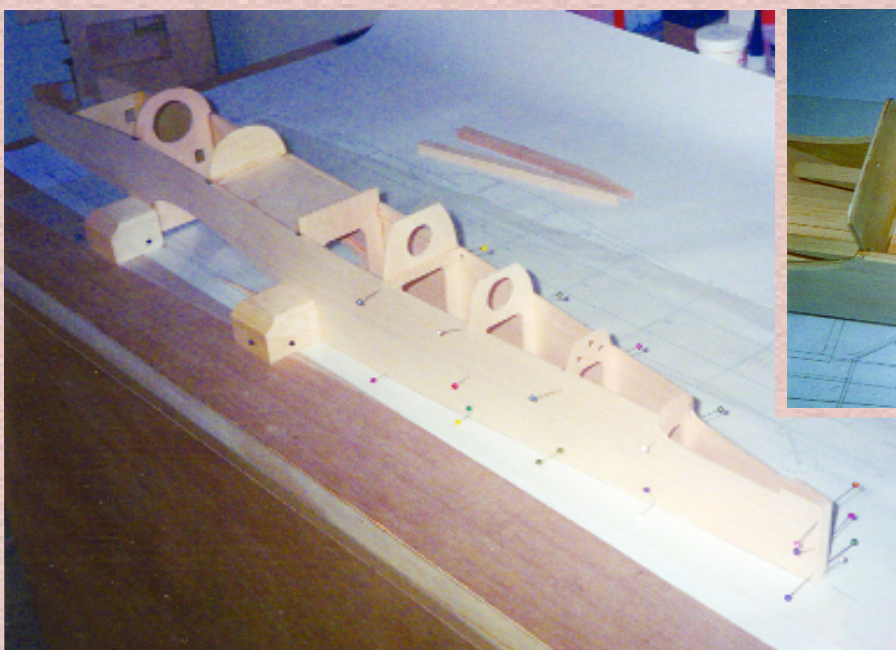
A plus for the Heinkel is that the low thrustline falls on the wing. Once I built a T-Bird II to look like a Goodyear racer, which lowered the thrustline to the wing. It flew better.

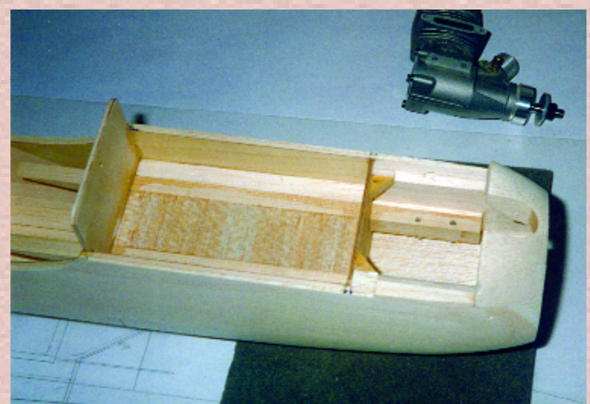
Photos by the author



Wing construction uses 1/4 x 2 balsa sheet on edge over the plans; it doubles as building fixture and LE and TE. Hal deBolt pioneered this wing-building method.

Adding 5/16-inch "feet" on the top and bottom of each end of the fixture pieces makes it possible to use less than straight wood without introducing stresses when attempting to straighten it.



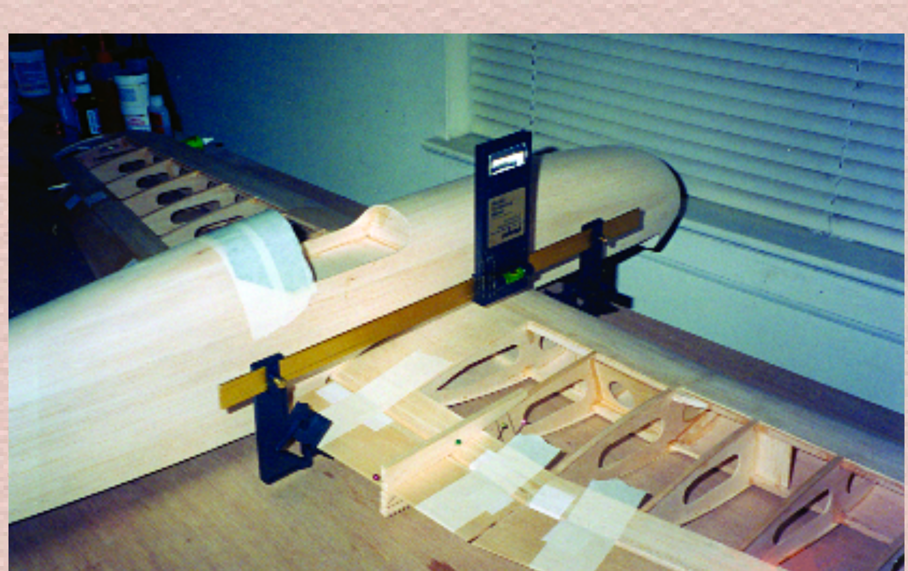


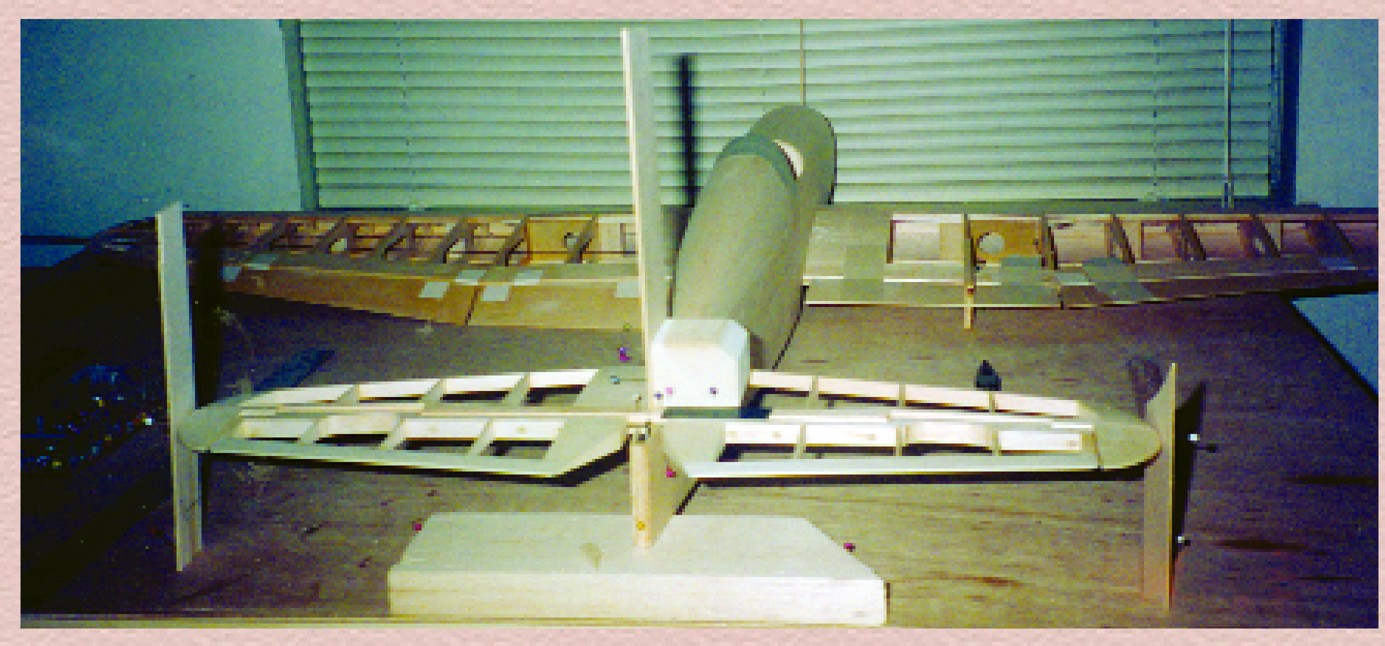
Above: The engine mounts are offset 1/16 inch to the inboard side. This allows side thrust and still puts the spinner at the centerline.

Left: The main fuselage sides should be medium-weight, firm-grain 3/32 balsa. Thicker wood is unnecessary.

Above: The He 100D is centered around the SuperTigre .51 engine's power capabilities. Choose the balsa filler blocks carefully to save weight.

Right: The control system requires split flap horns. The Tom Morris adjustable control system is set for 45° when the flap is at 37°. A 1/16-inch pin links the flaps at the anhedral joint.



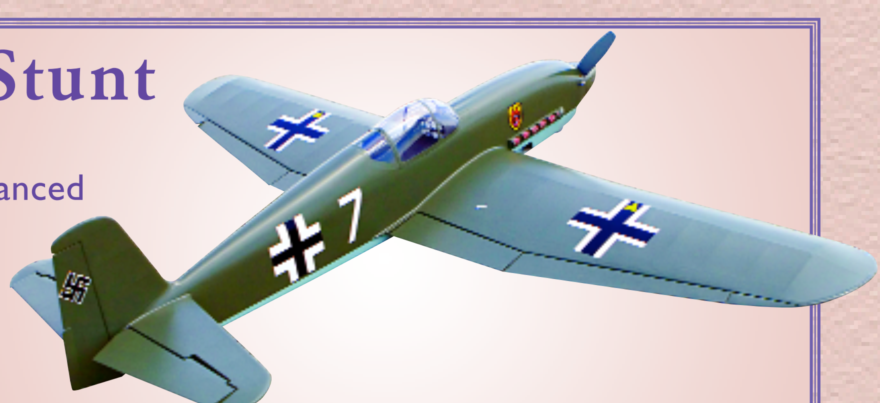


The He 100D's right outboard panel is shortened by 5/8 inch with 1 7/8 ounces of tip weight, and the flaps are equal. Flight-testing proved that this setup offers clean squares and triangles.

The rear cockpit canopy is made from clear sheet material and is supported by a 1/16 balsa former.

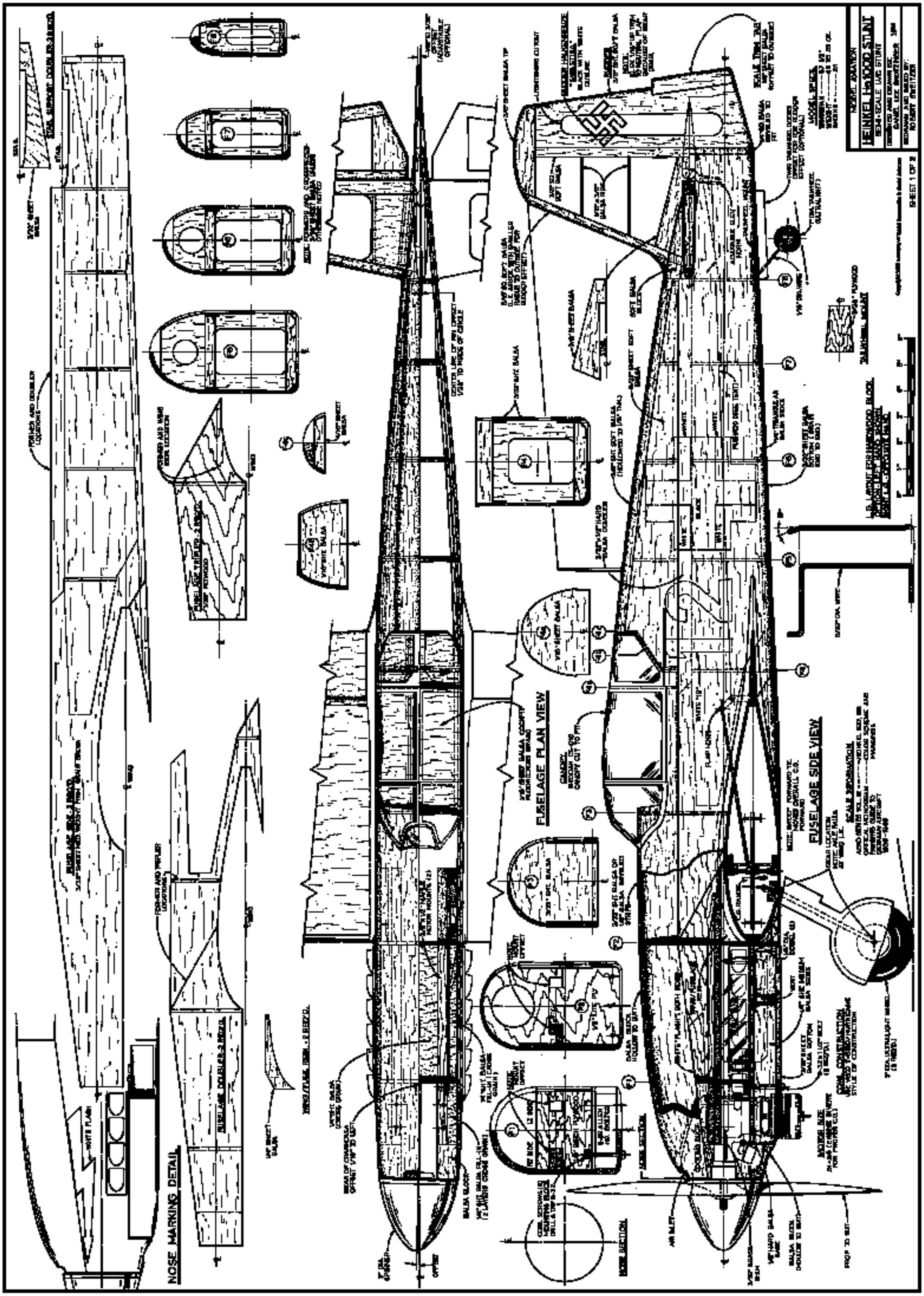
The fin is glued in place with the LE offset 1/32 inch inboard. The rudder is offset outboard 3/32 inch, and the trim tab is set as necessary.

Heinkel 100D Stunt

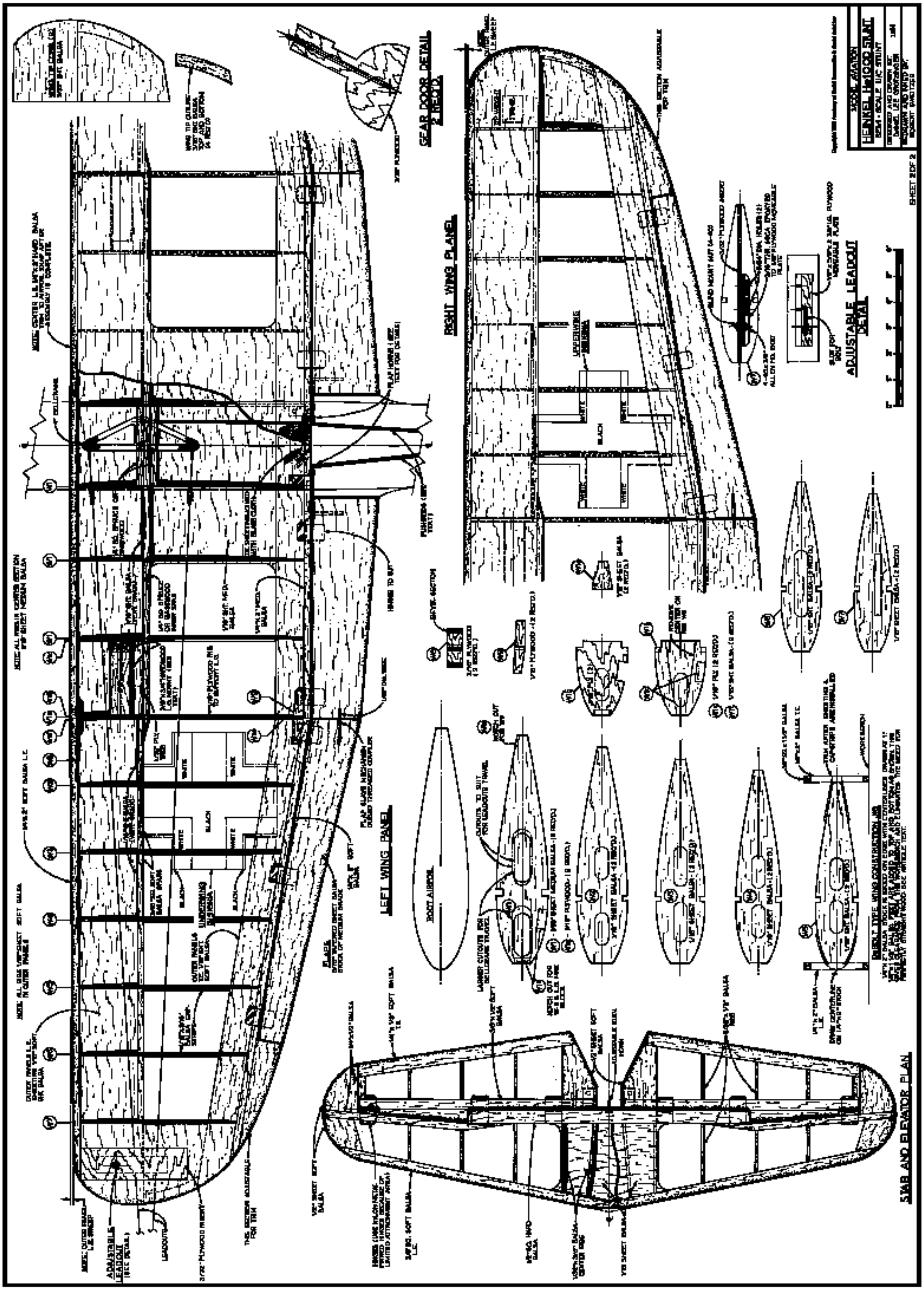


Type: CL Stunt
Skill level: Intermediate to advanced
Wingspan: 57.5 inches
Weight: 48-52 ounces
Wing area: 570 square inches (approximately)
Length: 45.25 inches
Engine: .51 two-stroke
Construction: Balsa and plywood, wire landing gear, clear plastic canopy
Finish: Fiberglass and paint
Other: 3-inch spinner, 10 x 5 propeller, 6-ounce fuel tank, 3-inch main wheels, 1-inch tail wheel, Tom Morris hardware

Full-Size Plans Available—see page 199



Full-Size Plans Available—see page 199



I had a Sterling Spitfire that flew poorly. I made a similar change, with remarkable improvement. The engine, tank, and spinner fall near the wing, giving a favorable vertical CG in spite of the tall fuselage profile.

The He 100D employs a wide-blade, large-diameter, low-pitch propeller (Graupner 12 x 5). This allows the airplane to fly at a modest speed, but the wide center-section of the wing and tail would get a large volume of faster airflow and help compensate for a small wing and long tail.

Slightly more than 1° of engine side thrust was used to hold the Heinkel on the lines at a lower speed in overhead maneuvers. Very little rudder offset is used. I'm letting the engine do the work for me, and I don't consider side thrust to be a loss of efficiency; it doesn't create the problems that flap differential and rudder offset do.

Please realize that any airplane is an aerodynamic package. Making any one of these changes on an existing design may or may not improve it. Together they have worked well for the Heinkel He 100D Stunt.

CONSTRUCTION

This section will focus on important points that differ from the usual. Because of closer adherence to scale dimensions, weight and alignment become especially important.

Wing: The wing's construction uses 1/4 x 2 balsa sheet on edge over the plans, which doubles as building fixture and LE and TE. Hal deBolt pioneered this method. I refined it by putting 5/16-inch "feet" on the top and bottom of each end of the fixture pieces.

That makes it possible to use less than straight wood without introducing stresses when attempting to straighten it. Lines drawn on the center of the width of the fixture pieces from end to end used for rib placement determine straightness.

Set a small adjustable square—to be used as a gauge—to 2 5/8 inches, and sand all the fixture ends to the same height. If this was a typically flat Stunt wing, all lines would be in the center at 1 5/16 inches from the top and bottom edges. Those lines would be drawn by connecting marks placed at both ends and each fixture piece. These end marks can be placed with better accuracy using the adjustable square as a gauge.

To accommodate the anhedral and dihedral, the mark at the anhedral break (top-view aircraft centerline) should be 1/8 inch above the true fixture centerline (1 7/16 inches above the plans surface). The center-section leading the TEs have no wing sweep or taper, so there does not need to be a joint in the fixture at the anhedral break.

Place the anhedral mark accordingly. Then the marks at the dihedral breaks (which do have a joint) are 5/16 inch lower than the anhedral mark (1 1/8 inches above the plans surface).

Mark the tips 3/8 inch higher than the dihedral joint marks (1 1/2 inches above the plans surface). By connecting these marks, you have your centerline for rib placement with anhedral and dihedral built in.

Centerlines are carefully placed on each rib, and they can be glued in place on the LE and TE by matching lines. Ribs can be positioned accurately over the plans by extending a line up from the plans onto the LE and TE with a square.

Now the wing can be built in one piece. You can remove it from the building surface to facilitate control installation, etc. Just make sure it is pinned flat while you are gluing *all* sheeting and capstrips.

The wing should lay flat up or down with all feet touching the work surface without being forced. If it lays flat one way but not the other, the work surface may be untrue or your fixture ends are unequal in height.

If the wing warps when off the work surface, there will be a consistent imbalance in the up and down position. After thoroughly checking, pin it down and finish sheeting it. Whichever the case, determine the problem and correct it.

This system will show you any errors. If you use it properly, you cannot build an untrue wing. When completely sheeted and capped, remove the excess fixture material and shape the LE and TE. You may need to read the section about wing construction several times while referring to the plans and photos to make complete sense of it.

Control System: The control system requires split flap horns. I used a Tom Morris flap horn for the right flap with the left side cut off. Only this horn is connected to the bellcrank. It is also connected through the 1-inch hole to the elevator horn, which is a Morris adjustable set for 45°, when the flap is at 37°.

A Tom Morris 1-inch elevator horn is used for the left flap with the right side cut off. A pushrod connects it as a soldered Y joint to the elevator pushrod roughly 10 inches back. There is no play, rotational inaccuracy, or differential using this setup.

The outer flaps are slaved by a 1/16-inch-diameter music-wire pin that enters the female receptacle (Du-Bro threaded brass connector). The female end is installed first, approximately two-thirds of the way back from the hinge line.

Carefully start a pilot hole with a straight pin, and then use progressively larger drill bits, turning them with your fingertips. This allows you to make precise adjustments.

The connector will require a stepped hole to fit properly and tight. Before pressing it in place, make pinholes in the flap surface to wick in cyanoacrylate glue. Adhere this *after* it is in place. Temporarily mount the flaps with strong-tack masking tape, to simulate cloth hinges. Carefully mark the male pin's position, and then inset it in the same manner as you did the female, but *do not* glue.

The gap between the flaps is a strong 1/16 inch, but it must bevel to approximately 5/32 inch at the rear to accommodate up movement. In neutral, the pin must enter the brass receptacle by roughly 5/32 inch. Neutral fit should be perfect. Sand the flap LEs slightly, if needed for adjustments.

Test for up and down with your tape hinges tightly in place. They will bind because of the geometry involved. Use a drill bit to slightly oval the mouth of the brass coupler to the front and rear. Remove the male pin, and slightly bevel and round the bottom and rear of its end. Reinstall and test.

Close observation will show you where to make small changes until it is right. If you mess up, make a new pin. Be patient; this is work, but not as much as a 32-coat paint job.

When you are sure it is right, glue the flap in with cyanoacrylate. As a precaution, dig a trench in the bottom of the flap and expose part of the pin, and fill the trench with epoxy flush to the surface. This will ensure that the pin will not loosen with time. (Something I did not do and now need to.)

Permanently mount the flaps with Tom Morris Dacron hinges, which will allow more freedom of movement. It also allows for slight inaccuracy in the male and female parts.

Fuselage: The main fuselage sides should be medium-weight, firm-grain 3/32 balsa. Thicker wood is unnecessary. Smaller airplanes use 1/2-inch-thick material, because they are not as tall in profile. There is a lot of wood here as long as it is kept rigid; think in terms of trusses and I-Beams.

The engine mounts are offset 1/16 inch to the inboard side. This allows side thrust and still puts the spinner at the centerline. The 1/2-inch square stabilizer center TE edge is *hard* balsa. All the rest is light contest balsa.

The radius of the fin LE is offset slightly, to direct more air on the inboard side. The fin is glued in place with the LE offset 1/32 inch inboard. The rudder is offset to the outboard 3/32 inch and the scale trim tab is offset a "bunch."

The landing-gear legs and their composite trunion mount (taken from a set of B&D retracts) were inset into a plywood pocket mounted in the wing. A piece of 1/16 plywood angled from the back of the top spar to the front of the bottom spar forms the back wall of this pocket and doubles as shear webbing for the wing.

The wing center spars should be spruce or bass. The axles fall just below the LE, and the gear extends 4 1/4 inches from wing to axle. A traditional torsion gear and block may be used. I like this better.

Finish: Light, light, light! The entire bare Heinkel was painted with one coat of AeroGloss clear. I painted 1/2-ounce glass cloth on the fuselage, with finishing resin thinned 50% with denatured alcohol. When cured, I applied a second coat to fill the pores. Then I sanded until the cloth's surface was cut.

I covered all open surfaces with Polyspan filled with three coats of AeroGloss clear. Chart tape simulates the scale panel lines. I applied one generous coat of Perfect Primer and then removed the chart tape to give the panel lines depth. Then I applied two coats of scale-accurate Perfect military flat. Except for markings, that's it. The He 100D is extremely light *and* scale.

If I haven't upset anyone yet, I may now. The rule book stipulates that the airplane be judged for perfection of appearance; nowhere does it mention a high-gloss mirror finish. As much as I loved those mirror finishes, an accurate military finish on a warbird should score as well as a nonrealistic high gloss. In this case, weight *and* scale appearance enter the equation.

I thank the following: John Florio (deceased), for being my mentor in the early years; Dave Gatewood (deceased), for getting me back into Stunt and his support during this project's design and building phases; Jack Sheeks, for his support in test-flying and encouragement to publish the design; and Bob Hunt for being open-minded and enthusiastic after test-flying the prototype.

Good luck with your Heinkel. Please call or write if you have questions or comments; I don't have a computer, so I rarely check E-mail. **MA**

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Sources:

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