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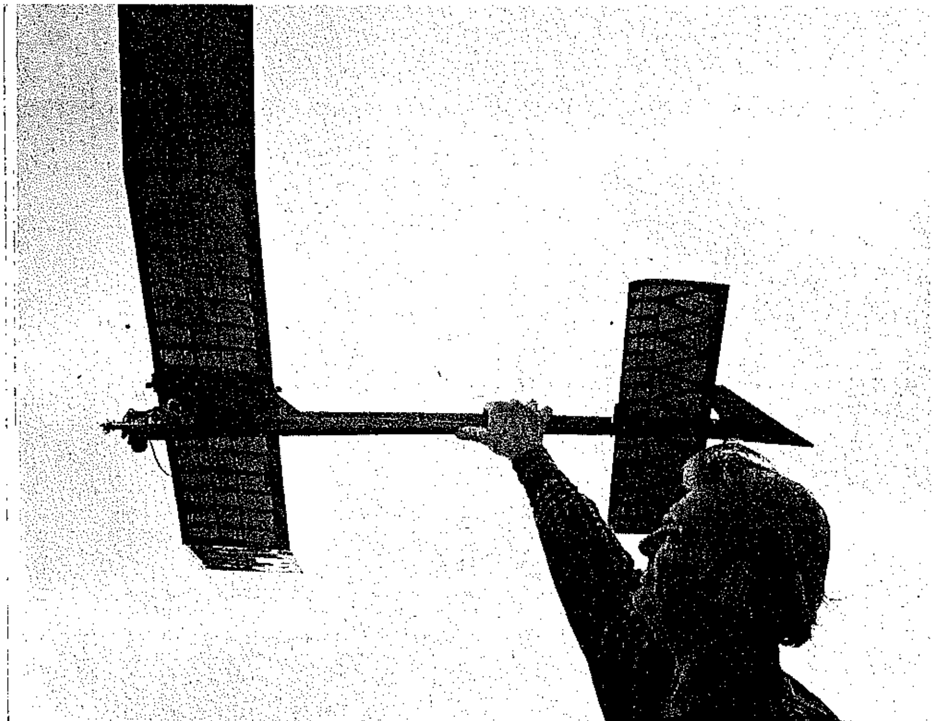
Slow-Worm 432

Want to learn to fly Free Flight Power? You won't find a simpler hot competition ship than this .09-.15-powered, 54-in.-span, 14-oz. pylon job. Or a more helpful mentor on trimming and flying than our author. ■Dave Platt



The author holds his Slow-Worm against the sky, backlighting the translucent MonoKote covering to give some idea of the appeal of Free Flight. Dave says he's built Slow-Worms in as little as one day. Before passing that water-cooled X-Acto knife, check the temperature!

The author and his Slow-Worm next to his van. He must have acted fast to have acquired that "modeler" license plate ahead of at least half the other modelers in Florida.

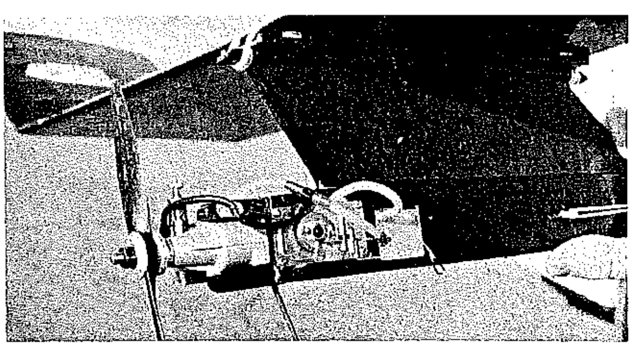
AS A LONGTIME modeler returning to Free Flight after a 35-year detour into most categories of CL and RC, I initially found Rubber models the most appealing. My first Power efforts began only after I became comfortable with Rubber. Later still came more Power models—more models, that is, not more success. I found, as others undoubtedly have, that along with the higher performance of today's engines come faster crashes and more complete demolition.

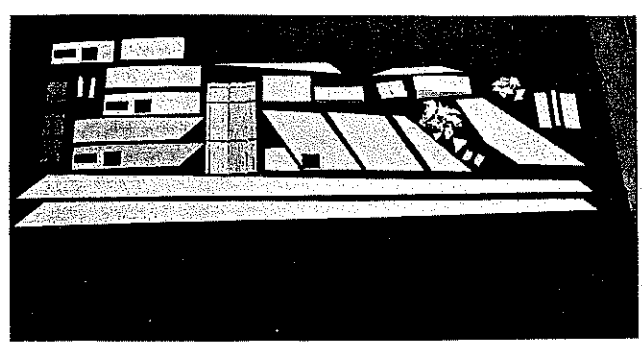
My response—call it obstinacy—was to dig in my heels and persist. After going through numerous models, built both from kits and through my own design efforts, a pattern began to take shape. My successes, when they came at all, were fitful and temporary. Even my good ships soon found ways to wipe out. My primary problem seemed to be consistency. Moreover, I'd needlessly concentrated on elegance, prolonging my building time and delaying the learning process.

Eventually realizing that what I needed was a model that could be built more quickly than it could be crashed, I came up with a prescription. The design would be simple, medium sized, functional (and, with care, maybe even attractive), with no auto surfaces and moderate power (if any engine today fits that description).

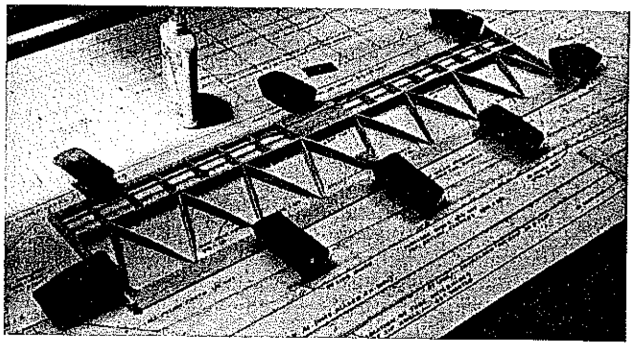
The first Slow-Worm was built to those requirements. The engine I selected was an O.S. Max .15 FP with a slightly bored intake, crankcase pressure to a hard tank, and burning 35% nitro. It turns a Cox 7 x 3½ prop at 19,000 rpm. As you can imagine, this is plenty of power for a 14-oz. all-up weight, beginner's ship or no. Properly trimmed, the model will do three minutes or so on a seven-second run. Or rather, that's what it does for me. For you, I expect it'll do more. I haven't stopped learning, of course. Who has?

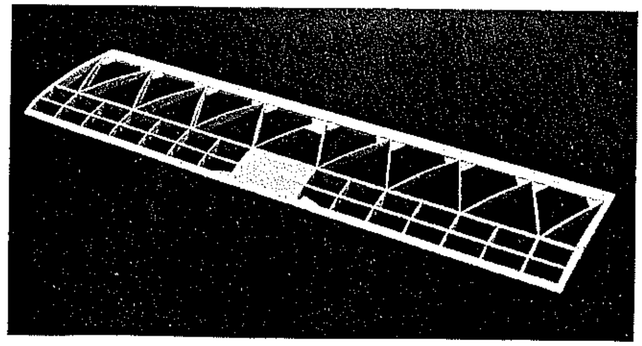
Slow-Worm got me over the "comprehen-





Left: The engine-timer-tank setup in the author's 432-sq.-in. version. The engine is an O.S. Max .15 FP swinging a 7 x 3½ GF Prop. Note the simple pylon. Right: The building process is always faster, easier, and more accurate when you first "kit" your project as shown here.





Left: The stabilizer under construction. Because the author uses a glass-topped worktable, he employs weights rather than pins to hold the structure flat against the plan. Note the plastic wrap between the frame and plans. Right: The structurally complete stabilizer. It's lightweight and strong, and the rear geodetic ribs with their gussets resist twisting, a great feature when using a heat-shrink covering material.

sion hump" in Free Flight Power and allowed me to move on. Together with a few friends, I've built the model in a gamut of sizes, from a great little 300-sq.-incher with a Tee Dee .09, on up to a 1,190-sq.-in. hummer with a Rossi .60 engine. All of them have proven easy to adjust and were quick-building—some in a single day. Want to make one? It's so simple, why not cut parts for two while you're at it?

Construction. The notes that follow are rather minimal, touching only upon important points. Slow-Worm's structure is simple, and the plan self-explanatory. After getting the building out of the way, we want to concentrate on trimming and flying the model.

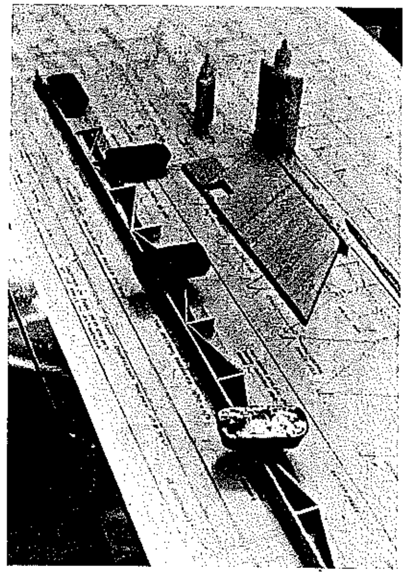
Wing. Make the main spar first. Cut four lengths of hard balsa stock and three shorter pieces of even harder stuff for the braces. Assemble the spar over the full-size front view. Sand the bottoms of the braces level with the underside of the spar.

Relieve three of the ¼-in.-thick ribs for the dihedral braces. One of these ribs is also relieved for the $\frac{1}{16}$ center section sheeting. Glue the center ¼-in. rib to the spar at an angle bisecting the dihedral angle in the frontal view, and perpendicular in the plan view. Do the same with the two ¼-in. ribs at the polyhedral breaks. Set this assembly over the plans, and build the rest of the wing one panel at a time.

You'll notice that cutting and joining of the leading and trailing edges and spars to the center of a thick rib is far easier than building separate panels and then trying to mate them accurately. Frankly, it's the method I always use, even when building someone else's design that doesn't call for it.

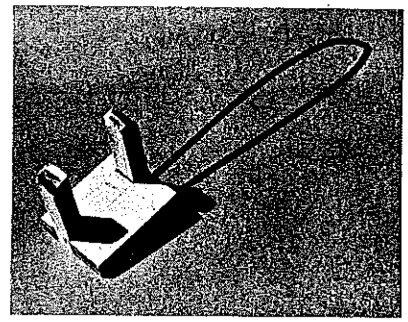
Fuselage. The engine mount may be of interest. I've used this style of mount for all engines up to .60, and it always works well. It's light, functions with any engine, and, unlike commercial mounts, is always available when I need it. This mount also holds the skid nicely.

Caution: Be certain you get the fuselage straight. If you don't, you'll have to correct it later, which is more work. The rest of the fuselage structure, like the tail, is simple enough to require no further description.



The fuselage being built over the plan. In this photo, it's about halfway finished. The black strip visible on the side panel is a strip of .007 x ¼-in. carbon fiber. It's not shown on the plans, but greatly strengthens the fuselage with little or no weight penalty.

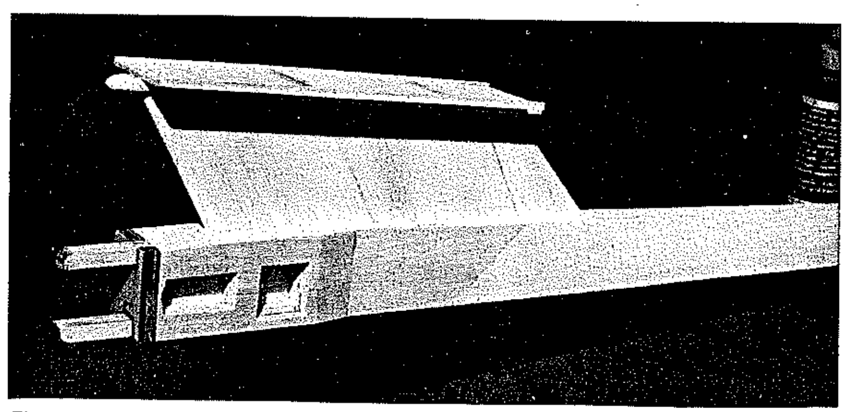
Covering. I'll confess to being a snob, modelwise. Instant hobby products offend me. I've always used traditional covering materials—silk, Japanese tissue, nitrate dope, etc.—and still do for most things. I have discovered, though, that MonoKote has great advantages when used for FF Power flying surfaces. Among these, the



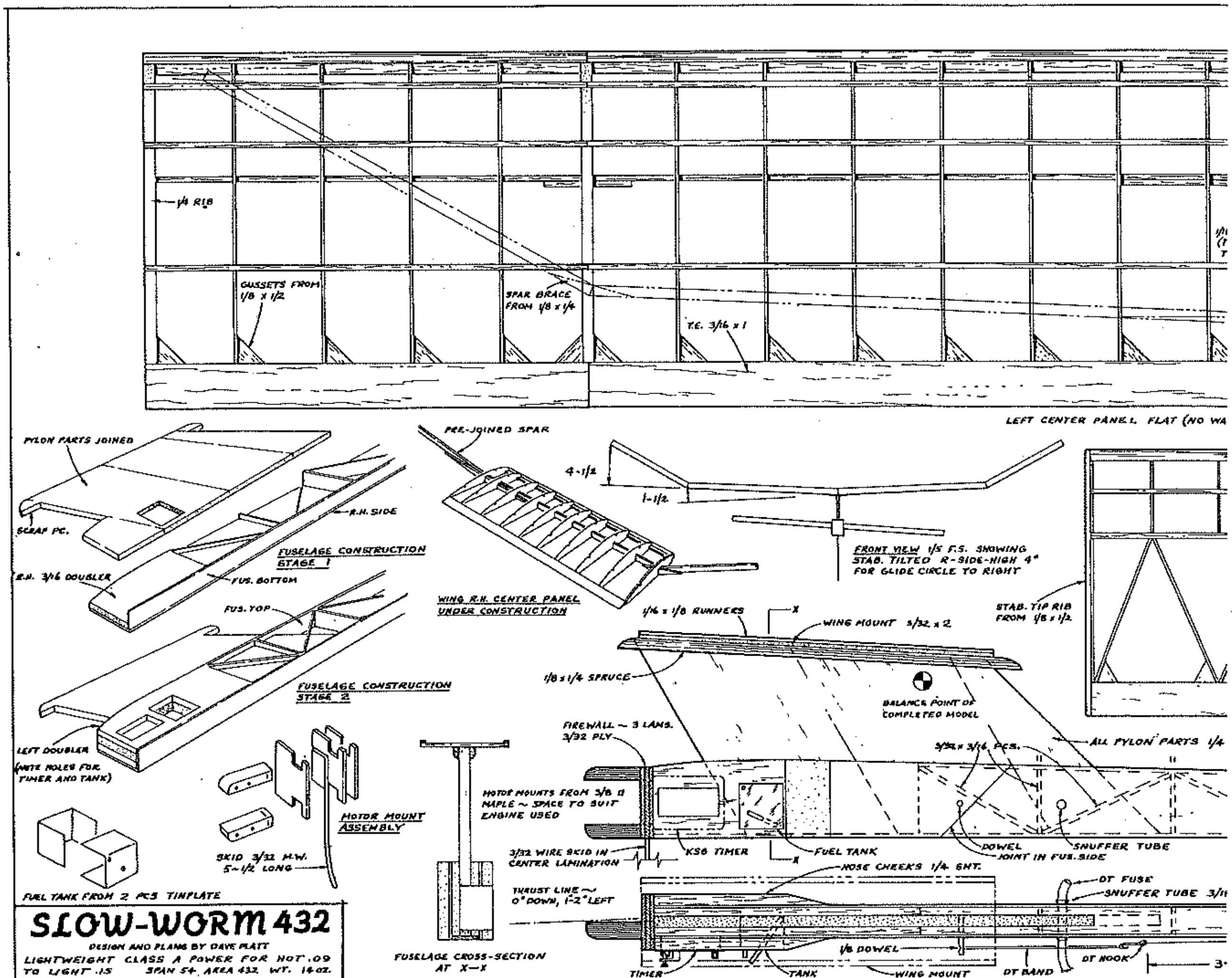
The simple, strong, and effective engine mount with the landing gear attached. It's easily and quickly made, and can be built to adapt to almost any engine configuration.

ability to retain any warp (or rewarp) without creeping is priceless for the consistent results it gives. MonoKote has greatly helped me achieve consistency of trim, so my models have been surviving much longer. And this is just one of the material's many virtues. I recommend MonoKote for the wings and stab, and regular covering (tissue, silk, or glass cloth) on the fuselage.

Trimming. In moving from RC to FF models, I came to learn the essential difference between the two. RC is a hobby of dexterity; FF is a hobby of reasoning. This being so, I found myself hungrily absorbing any decent article I could find on FF model adjustment. Every FF model appearing in the mags would find me quickly turning to the trimming section. Man, don't you just hate it when all the article says is, "Try hand



The structurally complete fuselage and pylon ready for covering. The engine mount is in place, the cutouts for the timer and fuel tank are complete. Note the strong landing gear wire.

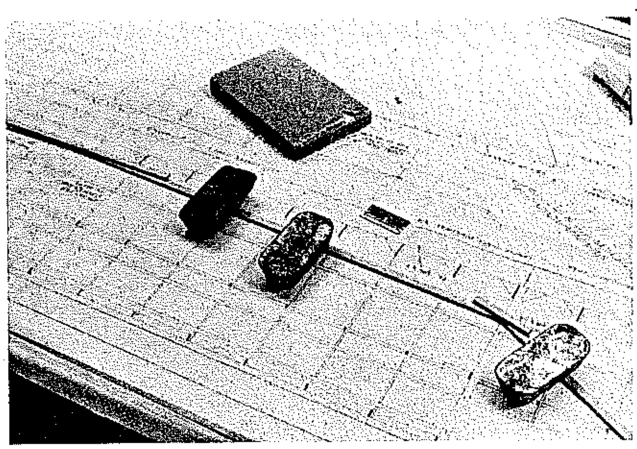


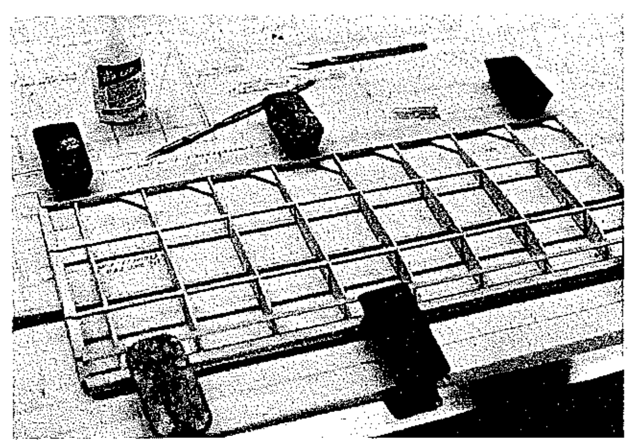
glides and then go to power flights.''?

Those who have mastered the intricacies of FF Power adjustment can skip this part, but I'm certain that there are other beginners out there who need this stuff. Heck, anyone can build the darned things—especially the Slow-Worm. Getting them to fly right is where the skill, the art, and the fun are to be found.

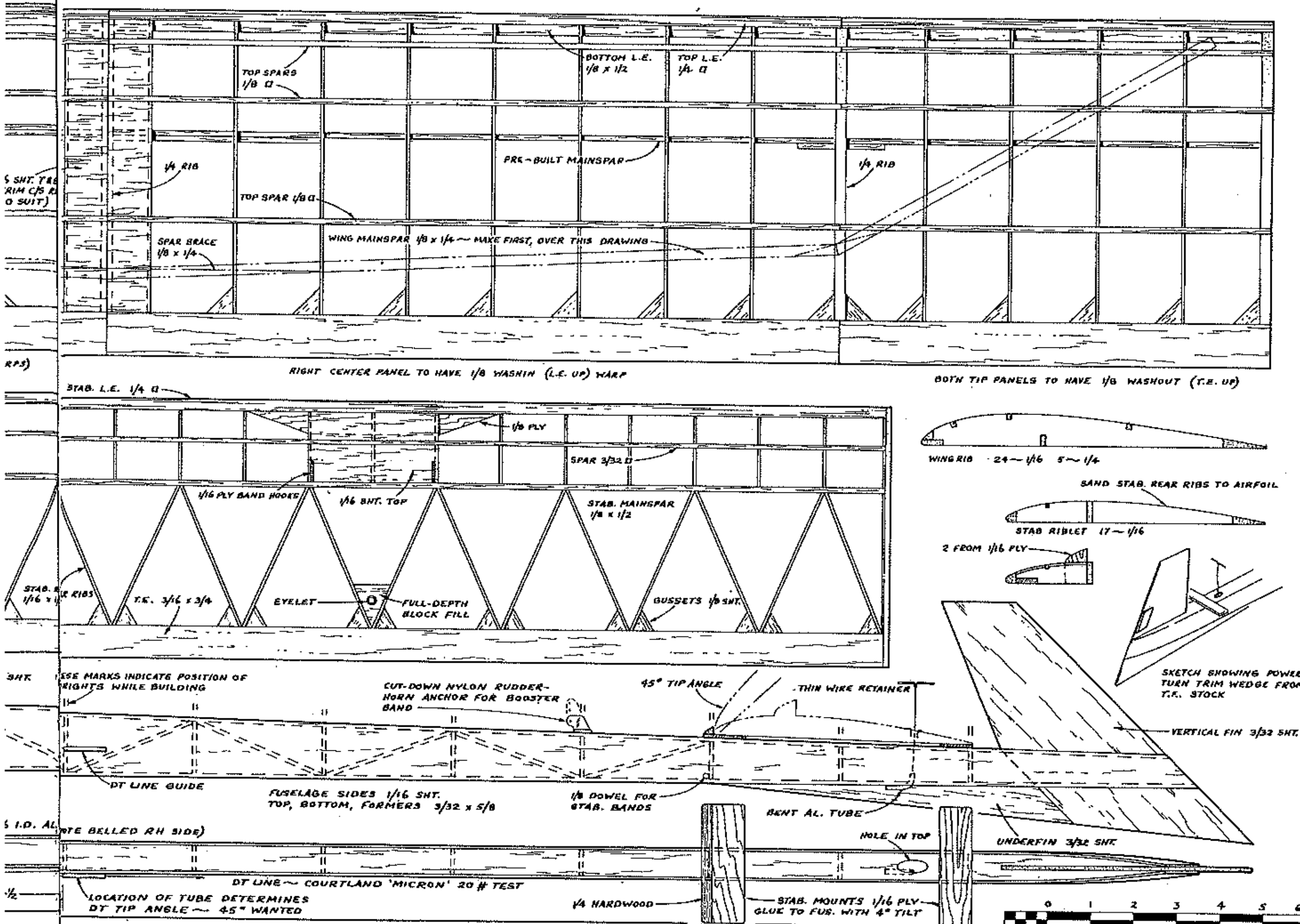
I'm going to make two specific recommendations to help you out. The first is one you've doubtless seen many times already. Pay careful attention to the preflight checks, and really *do* them all. The second is a bit unusual: Take this text with you when you go flying! Reading that ''If the model does so and so, you adjust thus and such'' isn't going to help unless you have it there when you need it. You're not going to remember small details of effects, etc., unless you have the words right at your elbow. Take the magazine with you.

Preflight. This check consists of trying to ''blueprint'' the airplane, just as you would blueprint an engine for optimal performance. Check the CG (center-of-gravity), of course. That's fundamental. Make sure it's exactly where marked, adding lead to the nose or tail if you must to get it right. Check





Left: The wing begins to take shape with the main spar being assembled and positioned first. Right: The left center wing panel nears completion. Note the ¼-in.-thick ribs being employed at the dihedral break, and the heavy-duty gussets on only one side of the rib trailing edges.



that all wing warps agree with the plan callouts. Glue keys to the underside of the wings next to the wing mount to ensure consistently accurate wing alignment. As you do this, measure from each wing tip to the fin, making sure the wing is square to the fuselage. Do the same with the stabilizer.

Thrust line okay? Fin straight? Lay a straightedge along the pylon back to the fin to check alignment. Most people also tell you to check the incidences of the wing and tail, but I'm not going to—they'll be adjusted during flight testing later anyway. Run the engine and see that the timer is working right. Try out the DT (dethermalizer) two or three times; check the tip-up angle, too. Lastly, look at the tail tilt. It must come close to the four degrees indicated on the plan. Alright, let's go fly.

Flying. Now that we're at the field, there's something I want to share with you. I call it my "alarm bell" theory. It works this way: If I make an adjustment and the model doesn't respond as it should, alarm bells start ringing. They were always there, of course; it's just that I used to ignore them. Result: crashed airplanes. Now I listen. When something abnormal or unexpected

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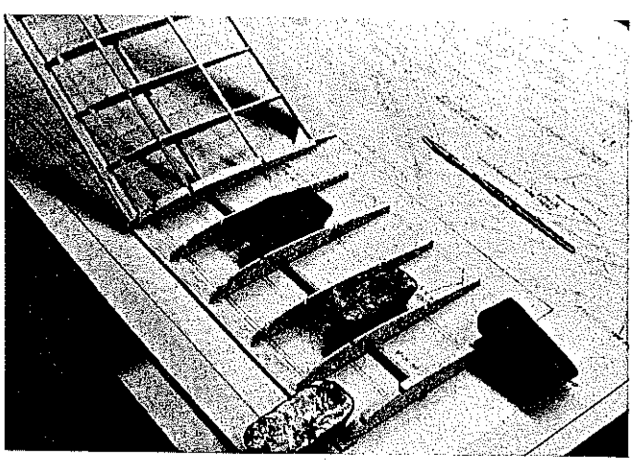

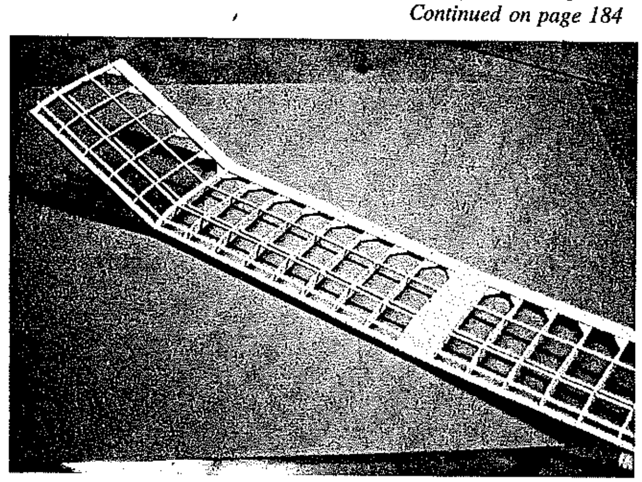

Left: The center panel is supported at the correct dihedral angle as the tip panel is built over the plan and attached directly to the center panel. Right: The completed wing, ready for final sanding and covering. With a little practice, the wing can be built to this point in about two hours.

2) CG (center-of-gravity)—fore/aft balance point of model complete with rubber motor.

3) Stability margin—the distance between CG and AC, expressed in percent of the wing chord.

4) Tail moment arm—the distance measured between the 25% chord points of wing and stab.

CG location: The CG must always be *ahead* of the AC, as shown, if the model is to be stable. It works like this: The model's weight acts downward through the CG, and aerodynamic forces act upward through the AC. On a model in equilibrium flight, these forces exactly balance. If the model noses up, the aero force increases enough to bring it back to level flight. For a nose-down condition, the aero force reduces, allowing the tail to drop.

The distance between CG and AC (margin) is the leverage the aero forces have to restore level flight. When the margin drops to zero, the model will have neutral stability. That is, it will go in whatever direction it is pointed until some outside force diverts it. If the CG is behind the AC, the model is unconditionally unstable; if the nose comes up, it will continue to rise.

What about too much margin? If a model has a very high positive stability margin, two undesirable things happen:

1) The stability is so high that little can stop it. After contact between the outboard wing tip and a curved ceiling or beam, the model chugs along, turning into the obstruction. It invariably hangs up or slides down the curve. With optimum margin, even an overwound model tends to stall, turn into torque (away from the obstacle), and continue flying.

2) The angular difference between wing and stab is greater, giving higher drag. More power is required for both climb and cruise, and the flight speed is higher. The only time a high margin can help is in highly turbulent air; the higher speed helps the model penetrate better.

On Outdoor models, the correct stability margin is fixed by adding weight to the nose or tail and adjusting the trim to fix the glide.

If the wing of an Indoor model can be properly located with respect to the CG, it is possible to set the cruise trim of a new model almost perfectly in as few as two test flights. Once the margin and trim are set, always fly the model with the same weight of rubber as was used to find its CG, *or* ballast the plane to keep the same CG location.

World's lightest timer! Two of the photos show the works of Stan Chilton's gear-retraction mechanism on his record-holding ROG Stick model.

One shot shows a top view of the retracted gear with the hinge mechanism. The other is a side view of the stop and timer. Well, you can see the stop, but the timer is too tiny to see. It is a tiny piece of double-sticky transparent tape. The hinge mechanism is both a pivot and a torsion bar which retracts the gear.

Stan cocks the timer using a pair of tweezers, and the tape holds for a couple of minutes. Although there is a CG shift when the gear retracts, the model is very stable and shows no apparent effect from the retraction.

How long? The last photo shows one of Jim Clem's interesting experiments. It was inspired by a rash of loooong Federation ROGs *(Federation ROG is not an officially recognized AMA class—Ed.)*. This prototype version was 39 in. long overall and proved to be slightly unwieldy. Jim won the individual honors in Federation ROG at the USIC by flying a 34-in. version to 7:51. In flight, the long ones seem to fly just about like the shorter ones, except that they may have higher potential duration.

Slow Worm/Platt

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happens, find out why immediately.

Let's toss the plane once. We want a nice, flat glide, not too close to the stall (models tend toward a more stally glide when they get up and out of ground effect). There should be a tendency to turn to the right. Not too pronounced, though—just a tendency. If the model was too slow (stally), add a shim under the stab leading edge. If the glide was too fast (divey), add the shim under the stab trailing edge. Precut some 1/64 ply shims the same size as the forward stab mount, and put these in your field kit. When you use them, glue them in place. You don't want a crashed ship over a shim that compressed or fell out.

Repeat the tosses until the glide looks good. How about the turn? If it doesn't match the above description—"alarm bells!" Find out why! If the fuselage or fin is bent or misaligned, it will affect the glide circle. It must be corrected or you'll never get the ship flying properly at the high speed that power flights bring.

Let's say the glide circle was okay, or close enough that a minor adjustment to the stab tilt angle fixed it. This means we can proceed to the next stage: the first power flights.

Set the DT! You want only about 20 or 30 seconds at this point. Set the engine timer for about three seconds. Start the engine, adjusting it for slightly richer than the leanest setting. Hold the model around the fuselage behind the pylon, aim *dead into the wind* and about 80° up; trip the

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