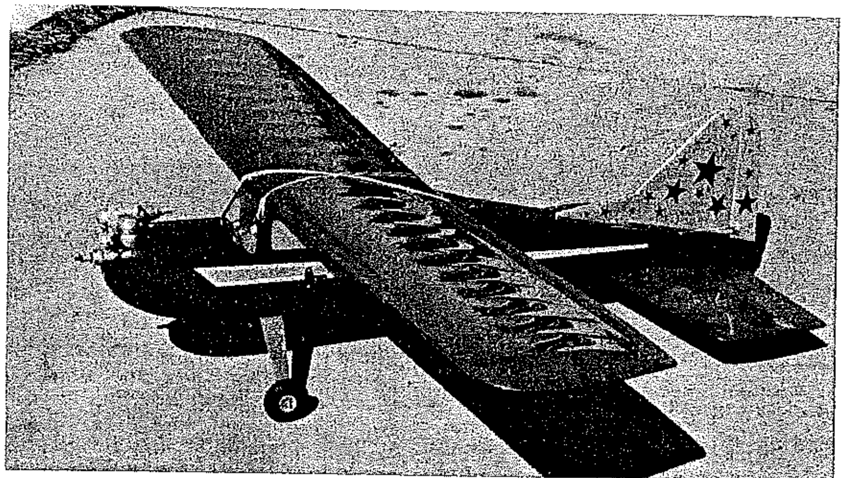
#672

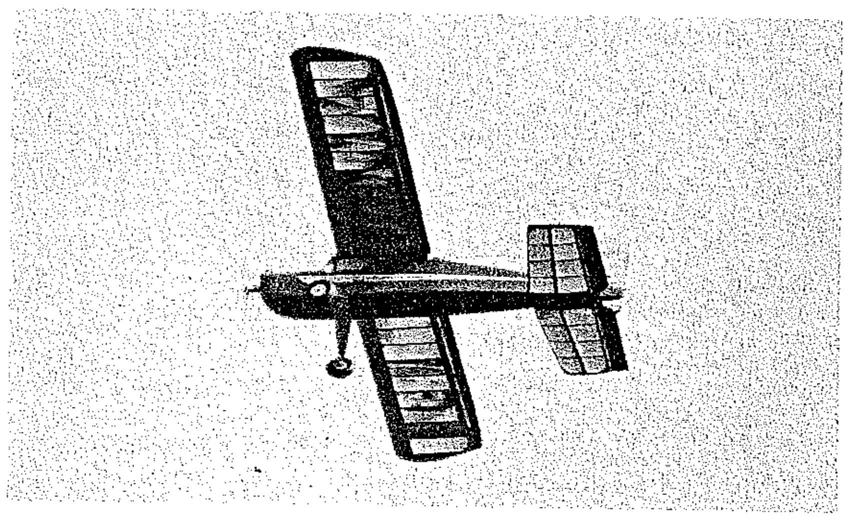
Krackerjac Mk. I and Mk. II

Our favorite odd-couple design team is back—this time with a two-for-one. If you like options when you build, this RC sport plane/trainer combo is for you. The Mark I soars delightfully, and its higher performance sibling gets excellent marks in hot-dogging.

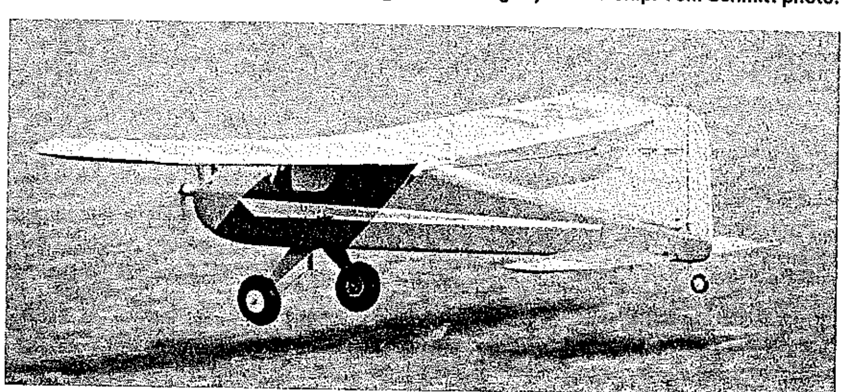
■Bill Winter with Bill Evans



Krackerjac Mark I, pictured here before its first flight, was flown by Bill Winter for a couple of years before being modified by installing spoilers. This 6-ft.-span .40-powered ship has wings and stabilizer of open-frame construction. The airfoil is thin, flat bottomed up to the main spar, and has a long Phillips entry. The model has over 6 sq. ft. of area and under 19-oz./sq.-ft. loading. It will soar easily even in weak thermals. The airplane takes off and climbs out at ⅓ throttle, will do consecutive outside loops at ½ throttle, and fly about inverted at ⅔ throttle. Bill added spoilers so landings could easily be made in short flying fields.



Mk I, Bill Winter's newest version of Krackerjac, is seen doing what Bill likes best—a slow flyby at low altitude and at low throttle. Model can be equipped with spoilers, much like those on Thermal Soarers to help control landings with this lightly loaded ship. Tom Schmitt photo.



With a little headwind, the model will fly on the ground cushion at extremely low throttle. Winter claims that at times he has been able to walk (quickly) beside the model while it was still airborne. Here the Mk I is floating in with its wheels just above the grass. Tom Schmitt photo.

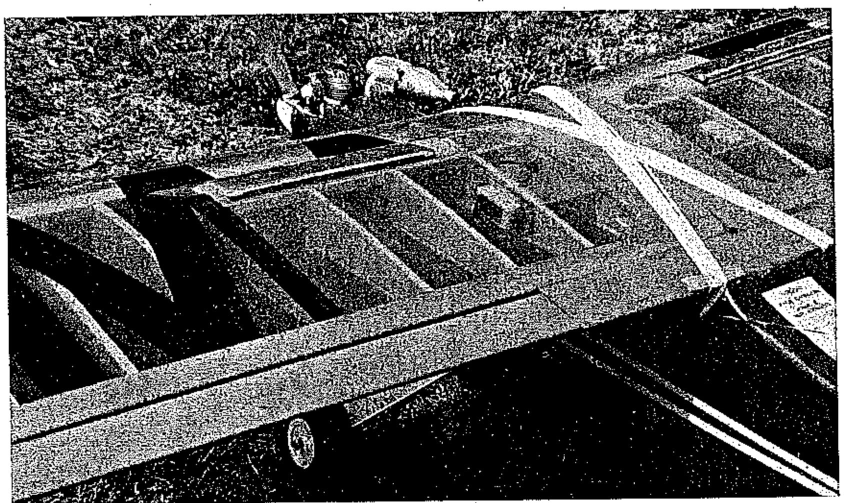
VOICE OFFSTAGE: Here we go again! From opposite schools of design, our coauthors have managed a second (and last, one presumes) unlikely collaboration. West Coaster Evans, who loves straight-up and 140°-plus flybys, is known for his philosophy that horizontal tails are tantamount to buggy-whip technology. East Coaster prehistoric old-timer Bill Winter is a go-slow airplane watcher who thinks that straight-up folks harbor hidden rocketry complexes.

Still, they found middle ground and produced the Krackerjac MK I and II.

Asked why Evans would stoop to building a conservative cabin job with a conspicuous stabilizer, Winter would only say, "What's a nice guy like Bill Evans doing in a place like this?" The two had collaborated on the Simitar Slow Motion, published in the January 1987 issue of *Model Aviation*, a docile flying wing that was almost as easy to fly as an Eaglet. At that time it was Winter's responsiveness to the Simitar project that flabbergasted *Evans*. Winter, however, did impose certain conditions.

First, the model had to soar—so the speed range was set at 15 to 80 mph. Then, the plane had to be fully controllable on either rudder or ailerons—so it was equipped with elevons. Because of these specifications, the fuselage, behind the bobtail trailing edge termination, was extended some eight inches to the rudder post.

Since Winter also demanded extended periods of hands-off flying, modest dihedral was added. Indeed, his Slow Motion would do 720s hands-off with an initial tap of the aileron stick. To save weight, the ship had



This close-up shot shows some details of the Mk I built-up wing. The spoilers are shown partially deployed. Their control servos are visible under the transparent wing covering.

Steve Kaluf demonstrates short landing techniques using the spoilers. The plane will land at the observed attitude with reserve for more flare, and it can even abort with the spoilers deployed. Specs for the spoilers—size, opening, location, etc. shown on the plans are tailored for a safe flight envelope.

to be a tail-dragger. To "protect" the old man, Evans added a foot of span. Aerobatic capability was a must, with a K&B Veco .19 as maximum power. Even after adding a second foot of span, bringing the model to six feet, and using only an O.S. .15 for power, performance was essentially unchanged.

But why did Evans and Winter join together a second time? Why the Krackerjac?

Winter: In 1960, good systems for full-house control had been around for about five years, but most of us could afford only the single-channel escapement airplanes. Lacking elevator control, most designs were addicted to "ballooning" on turns into the wind, and fly-aways were commonplace. The original 54-in. model, called "K," for rudder-only control with "quick-blip" for high/low throttle (Max .15), ended that nonsense. The plane was published in *Air Trails*, then kitted by Jetco. (Incidentally, throttles at the time used an exhaust stack restrictor coupled with a butterfly in the venturi.) A thin airfoil with a long Phillips entry was the secret of the model's controllability. The original handled like a "multi"—excellent penetration and a facility for perfect touch-and-goes.

Of all my RCs over a 40-year period, three continue to be built: the Antique RC Special published in 1948; the early-60s Krackerjac; and the reed-systems low-wing Rookie, first published in *Model Airplane News* in the early Sixties and later somewhat modified for publication in *Model Builder*. Other modelers have frequently improved upon these designs and continue to do so.

Several years ago I obtained a 6-ft. version of Krackerjac for .40 power from a plans service. I built it. The model had only a dozen test flights when a magazine expressed a desire to publish it, and a major manufacturer asked about a kit. The mag wanted "perfect pictures," but unfortunately I'd already marred the covering to install spoilers. The wing was so efficient (6½ sq. ft. at 7¼ lb. gross weight) that, like a Glider, it was difficult to get it on the ground (a 300-ft. strip).

The Krackerjac soared with ease, as I discovered one day on turning into the crosswind leg (it was the sixth flight). When I noted no loss in altitude, I did a 360 and ended up in the clouds.

Equipped with a .40, the model demonstrated considerable prowess. It took off and climbed on one-third throttle, could fly inverted and respond to steering on half throttle, and performed consecutive outside loops at half throttle and one-third *down* elevator. Yet that magazine staff thought the plane should have a 1.20. Hard to believe!

I told the kit company that in my opinion the Krackerjac wasn't mainstream, and hence not in its best interests.

The aircraft was eventually given to Doug Pratt, who converted from my K&B .40 to an Enya four-stroke .46. Pratt has flown it for three seasons. I happened to mention this to Bill Evans, adding that if I could get clean photos I thought it should be published.

Evans: Curiosity killed the cat. Even though I find horizontal tails to be useless appendages, Winter's strange short-coupled cabin, with its big stab on the bottom, had an odd appeal. I could build one—my way, as you'll see—and fly it within a week.

Winter sent me a print. Finding on it an untried modification using a semisymmetrical airfoil and .60 power, I phoned him to ask, "Which one would you like me to build?" He said we might check out the never-built, more aerobatic version.

Winter uses lots of sticks; I'm always in a hurry. So I simplified his fuse and went to a foam, balsa-skinned wing and stab. It isn't neutrally stable as I prefer (Winter won't give up a measure of hands-off control), but otherwise it flies great. When Winter was able to join me in California, watching his pleased expressions as he flew this "performance" version was one of my treasured moments.

I'll never live down this project. It has a tail! Everybody I fly with or who visits my shop ribs me unmercifully. It was too much. I shipped the model to Winter a year later. Alas, he reports that UPS stress tested the wing and found it wanting.

Winter: So now I had *two* airplanes, each with a different performance envelope, and a working plan for my original with good new pictures of Evans'. Attempts to revise the original print for the tracer ran into a stone wall. The project sat for 15 months.

Evans: Don't ever get mixed up with these hair-splitting old-timers. They'll drive you up the wall! I kept asking Winter, "What's your problem?" If this were an Air Force project, overruns and delays would have provoked Congress. If he'd draw mine, we'd be done in a week. Finally I badgered him into drawing his but incorporating supplementary drawings of mine.

Then he decided to show cross-options. With all the stuff he crammed into the plans, one could come up with at least four different ships! Maybe he should have sold it to *National Geographic*. Surprise: The editor gave him the green light for two 40 x 52-in. sheets. I proposed that Winter designate his original the Mark I and call mine Mark II, and added, "Buddy, the East Coast now is on its own."

Winter: Which to build? Here is what to expect from each of the Marks.

Design objectives for the MK I were easy piloting (rather like a .40-powered Senior Falcon, Sig Kadet, or even the Goldberg Eagle), with the ability to groove well in all maneuvers; better than average aerobatics, with enough reaction time to prevent the airplane's getting ahead of the average pilot; slow landings; automatic takeoff (though it's a tail-dragger); and the ability to ride weak general lift and to thermal soar. (Flying techniques are discussed at the end of the article.) A low wing loading of 19 oz./sq. ft. and low drag result in a consistent machine that sustains open maneuvers at relatively low power. The hands-off stability makes for relaxed flying.

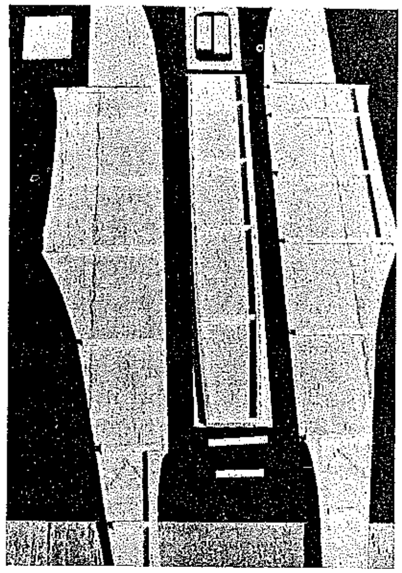
What about a bigger engine? Except for the improved vertical maneuvers it brings, added power is self-defeating in this case. A .60 two-stroke is the limit, and you'll find yourself doing aerobatics at half power. A potent four-stroke such as the Enya .60 is plenty. Watch the center-of-gravity with such a heavy engine. An Enya .46 four-stroke does all aerobatic maneuvers except the most advanced, such as knife-edge flight.

With careful building you can achieve a gross weight of seven pounds. Mine turned out to be 7¼ lb. with spoilers and two extra servos. Some may come in at 8 lb. or more—because some always do. Don't load up with paint.

Since the ship can soar with its lightly loaded, large wing (which, being the equivalent of an even lower loading on a smaller wing, has a significantly higher Reynolds number), long, low approaches are necessary—and even critical on a small field with obstacles beneath the approach path. You may overshoot a 300-ft. strip if the model is too high and/or too fast. You may wish to consider the spoiler option. Spoilers allow me to make higher approaches and then land within the first half of the strip. Used front-hinge as I did, they create another fun mode of flying (described later).

MK I's open-frame wing is thin, as well as large in area, and a heavy-handed pilot using an oversized engine might overstress the model (for example, in a dive followed by an abrupt pullout with an overapplication of *up*).

Evans on the MK II: Winter had specified the airfoil, incidence, and power (a .60 engine). This version is faster by far than the Mark I. It's also more spectacular and groovy. While it's closer to being neutrally stable than the MK I, the airplane is still safe to fly hands-off. (Winter said he wanted two degrees of dihedral for his own insurance.)



The fuselage sides and bottom are shaped, framed, and prepared for assembly. The ply gear plate is in place. The corner pieces (which will be rounded later) and the crosspieces are glued to the untrimmed bottom sheet with the grain running lengthwise. The side crosspieces are trimmed to exactly ¼ in. to fit. Note the fishtail butt joint in the side sheeting above the stabilizer saddle.

This is a docile aircraft, rather different from the fast, neutrally stable machines I'm used to. Still, I found it nice to fly. I wrung it out for Winter in California, then handed the controls over to him. It's a measure of the plane's easy handling and low-speed abilities that, cruising about at half throttle, Winter held light back-pressure steadily, executing a towering, perfectly round, beautiful loop—all without touching any controls, including throttle, on the downside. The model seemed to be on rails. Throughout the flight the O.S. .60 gave him more power than he wanted.

Very slight back trim for his slower "stooging around" resulted in a prolonged slight climb. Even with the ⅔-⅓ airfoil, this ship will climb on one-third throttle with the .60.

My foam wing with balsa skin weighs exactly the same as Winter's open-frame MK-I wing—for a total model weight of 7¼ lb.

The model is robust enough for any kind of flying. The wing is thicker, for one thing. Even with the increased performance, my MK II can be flown safely by anyone with aileron experience. Like the MK I, it will fly on rudder—nice to know, since on a very slow approach the rudder is the last control to fail on normal aircraft.

As shown, I used two exterior-mounted small Futaba servos for the ailerons. I've used this arrangement on many of my designs because it's simple and speeds up the building. Winter was shocked when he first saw it, but quickly agreed that this is a good way to go. He now has the same setup on his low-wing Desperado (a Simitar derivative with anhedral wing) and reports no trace of exhaust or dirt on the servos.

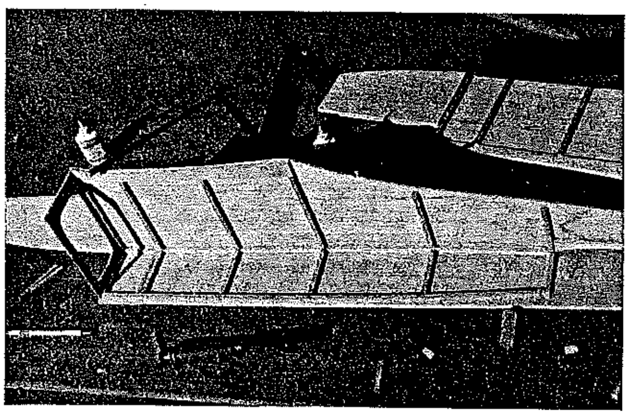
Winter on the plans: Many details and options are shown, so consider each before making a final decision.

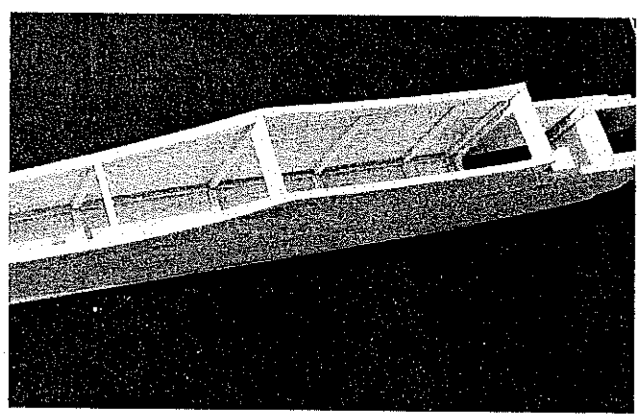
The MK I is presented basically complete, with optional spoilers shown. Though the spoilers do bring an interesting dimension to flying, they're not required.

Cross sections and outlines are shown for the MK II wing and tail. Two versions of the wing are shown. Mine is slightly modified with a two-bolt-and-dowel attachment, while Evans' wing has four bolts. In one panel can be seen Evans' external, bottom-mounted servos and linkage, while the modified panel shows an optional standard single-servo arrangement. Two profiles show the mounting saddle for the semisymmetrical wing. The one near the side view shows how Evans reshaped the cabin top for his four-bolt attachment. The other shows his wing modified for a dowel and two bolts. Also shown is Evans' simpler open nose, which can be substituted for the more complicated, semi-enclosed nose of the MK I.

Construction

Fuselage. Two techniques are used to ease assembly. First, the bottom lies flat on the workbench. Evans used a length of ⅛-in. soft sheeting, with the grain running lengthwise, for the bottom, then glued on the ¼-in.-sq. bottom longerons and crosspieces. The sheeting isn't trimmed off until the





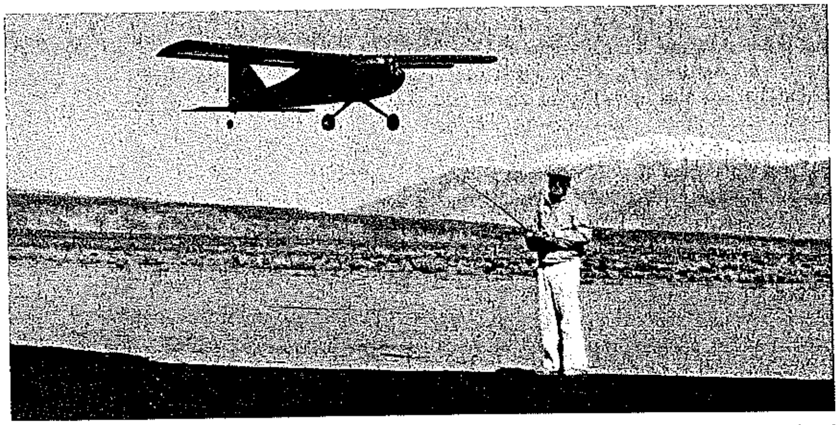
Left: Using the front cabin bulkhead as a jig, the builder glues the sides to the bottom sheeting and against the bottom side pieces. Right: The assembled fuselage minus the top sheeting. Note the sheet laminations in the nose. Excess bottom sheeting is trimmed off at this point. This construction technique ensures perfect centerline alignment of the tail. Both the Mk I and Mk II fuselages are built in the same manner.

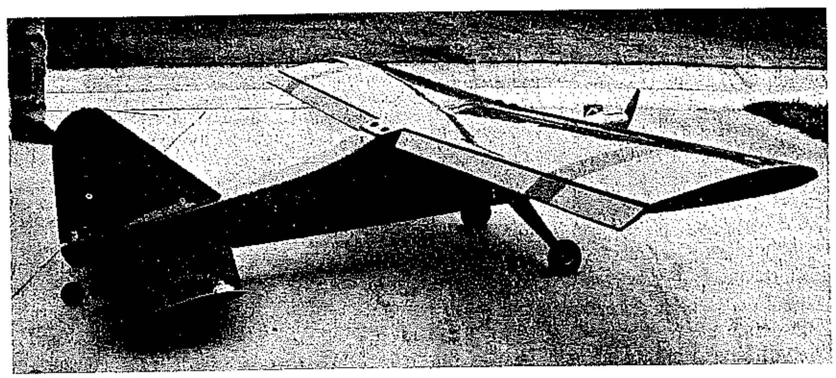
sides and top are in place.

Drawing a centerline on the bottom sheeting allows precise positioning of the "rudder post." After the top longerons and side crosspieces have been glued on, the finished sides are fitted on top of the bottom sheeting and against the bottom longerons. Erect the main cabin bulkheads before bending the sides inward, aft of the rear cabin station.

Second, lengths of sheet balsa (dimensions are given on the plan) are laminated to graduate inward to the nose ring, which avoids awkward bending of the sides in the area forward of the cabin. The nose is rough shaped with a sanding board, progressing from coarse to medium paper.

Note that the different airfoil options require different fuselage top rails for proper seating. For the semisymmetrical section, the matching saddle necessitates a deeper top rail to allow for the required cutout. Likewise, your choice of nose and wing options influences the selection of hold-down method and, consequently, the number and location of tapped hold-down blocks (dowels), etc.





Above: Bill Evans making a slow flyby with his Mk II Krackerjac in the crystal-clear air of Bishop, CA. This high-performance version is equipped with an O.S. .60 two-stroke and has ailerons rigged as flapperons. Look closely and you'll notice the "flaps" partially deployed. Below: A closer look at the Mk II. The flapperons are clearly visible. The model has a balsa-skinned foam core wing and stabilizer, no spoilers, and a Winter $\frac{2}{3}$-$\frac{1}{3}$ French-curve airfoil.

Tail surfaces. The selection of tail type determines the shape of the saddle for the bottom-mounted stabilizer.

The MK I built-up stab has a cross section which is basically like two triangles set base to base at the spar position. Dress the cross section to a precise contour with a sanding board, sloping the edges to match the shallow triangular shapes and beveling the edges of the flat spars. Hold the sanding board steadily against the edge (or spar) you're working on. Finish by moving the board about, gradually taking down material along the span, rather than anchoring it in one spot.

Bill Evans showing off one of his trademarks, small external aileron servos. Bill Winter was so impressed with their simplicity that he now has them on several of his models.

Bolt-on stab mounting is recommended for easy transportation in a compact car. If either tail option is epoxied in place, be certain to remove the covering at the wood-to-wood joints. This includes any covering that laps around the bottom of the saddle.

In assembling the vertical surfaces, the only caution is to trial fit the rudder tiller arm, allowing sufficient space for it to swing freely. To prevent metal-to-metal contacts, thin neoprene tubing is forced over the tiller, then passed through the rudder-mounted sheet metal bracket that accepts the tiller.

To align an independent fin—one that isn't integral with the stab—clamp a thin straightedge or hard, *straight*, flat piece of wood to the cabin top, aligned with center marks. Bend the straightedge or wood strip down to the centerline of the hole made for the tiller arm. Draw a guideline, and remove the strip.

Evans cut the MK II stab from lightweight foam in two tapered halves, butt joined at the centerline after being skinned with $\frac{1}{16}$ sheet balsa. He used his own two-sided Core Film tape to attach the skinning. It's easy to apply, works well, and doesn't lift the balsa skin. Evans also used his own X-Hinges—long, sewn hinge strips cut to length and ironed on. They close the hinge gap and accept MonoKote well.

Note that the leading edge and spar are glued to the foam slabs. (Use yellow glue or a similar adhesive.) Sand these edges to a matching contour, first achieving a flat, sloped surface for the sheeting which will be glued on later and then rounding off the full leading edge.

Evans glued his stab in place. If you prefer to bolt yours on, be sure to reinforce the bolt holes between the top and bottom sheeting with an adequate quantity of balsa, installed so that the grain runs vertically. Bolts will crush unsupported foam. This must be done prior to skinning.

Adhesives: In view of the differences in materials between the two Krackerjac versions, a few notes are in order. While a wide variety of glues can be used on balsa-to-balsa joints, both authors used Hot Stuff (instant as well as slow-setting) because it shortens the building time. Winter finds 3M spray-can contact cement suitable for laminating nose block sheets. Epoxy was used on firewalls and wing joiners, though Winter used white glue on joiners in the open-frame wing.

Both Evans and Winter used two-sided Core Film for skinning. Contact cement may be substituted, but make sure it's compatible with foam. The 3M spray can variety helps this job go quickly.

White glue was used to attach the balsa edge pieces to the foam cores. Winter protects the inside surfaces of the nose cavity

Bill Winter didn't have to force a smile for this photo. He had just completed a towering, perfectly round loop at half throttle, while holding only gentle stick pressure, without corrections. And this was his first flight with Evans' high-performance Mk II.

with two coats of thinned epoxy.

Landing gear: Any standard metal gear is satisfactory. A Hallco gear in the appropriate size for a 7¼-lb. plane is a bit flimsy on anything but a good landing. The original had a Great Planes gear, which is wider and tougher. Both legs of this gear are bent at a slight toe-in angle.

Toe-in eliminates erratic takeoff runs, thereby reducing corrections. Planes with pronounced torque swings will behave better, if not perfectly, with toe-in. No more than two degrees of both toe-in and castor is recommended. A standard gear can be twisted to that angle in a large bench vise.

Attach the gear either with two ¼-in. nylon bolts fitted into blind nuts or with four self-tapping screws. The nylon bolts will shear in a semicrash landing; broken remnants can be removed by heating the tip of a screwdriver. (Klett plastic gear appeared after this design was produced. The medium size is recommended.)

MK I wing. This open-frame wing can be built with or without spoilers, as mentioned. Construction techniques will be familiar to any builder with the experience to undertake a project of this nature.

The long Phillips entry on the airfoil (the curve from the leading edge to near the spar position on the bottom) has characteristics close to those of a semisymmetrical section; the flat portion aft of the spars makes it easy to assemble on the bench. Though spacing blocks are eliminated, it's advisable to block up the leading edge to ensure alignment. Use a standard glue or epoxy to attach the joiners. If spoilers are used, note that spar webs in that area are on the front of the spars so that they clear the spoiler horn. The plans show the sizes and alignment of the bellcranks and linkage to the spoiler servo. If you have different servo arm travel from that indicated on the plan, compensate with appropriate holes; don't change the horn spacing at the spoiler.

Washout for the MK I wing is achieved by bottom-sanding with a board in the tip area as indicated on the plan.

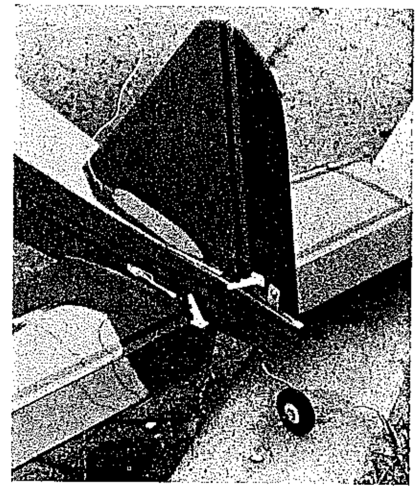
MK II wing. Evans built this wing of foam, skinned with $\frac{1}{16}$ balsa sheeting. The airfoil is an approximate ⅓-⅔ semisymmetrical section, set at less incidence than the MK I wing. This produces less angular difference between wing and stab, which improves aerobatics at higher speeds.

Again, Core Film tape and X-Hinges were used. Other hinges may be substituted. Those made by Robart, for example, are strong and easy to use—simply bore holes and insert the hinges with epoxy.

Since the ailerons are rather thick, fashion them of the lightest possible balsa.

Construction differs somewhat from that used in the foam stab. Each leading edge is built in two pieces. The inner pieces are glued to the flat edge of the foam, then sanded before skinning. The aileron spar receives the same treatment. The skinning extends over all edges. After skinning, the leading edge proper is glued to the front of the wing. Its depth is equal to the inner leading edge plus the thickness of the top and bottom skins.

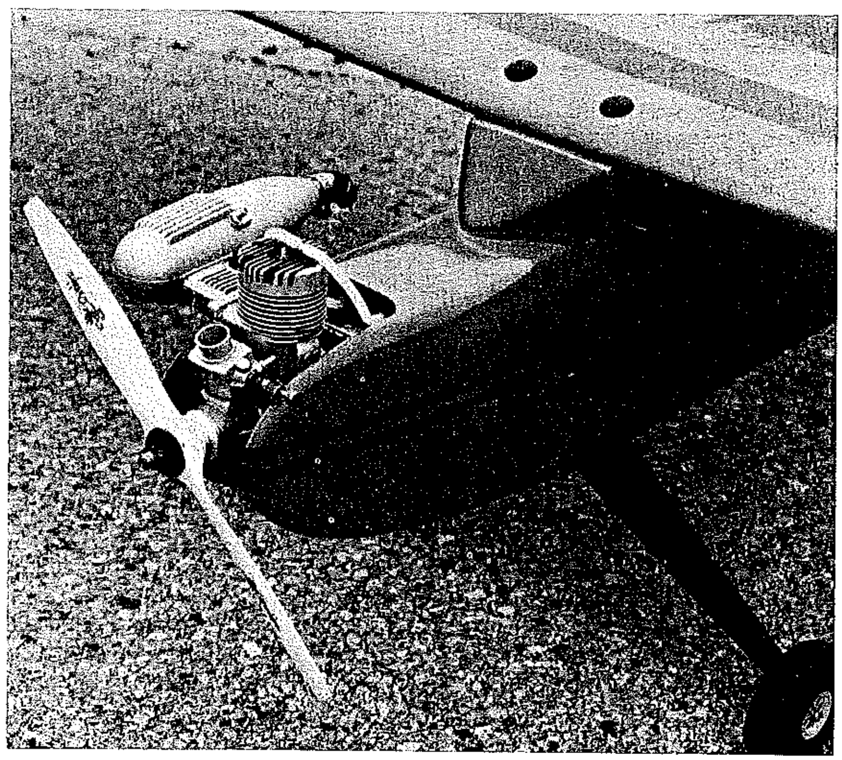
Evans' joiner, though built from ¼-in. ply, was shallower than the one shown. Since UPS performed the ultimate stress test, we changed to the full-depth joiner shown, cut to the depth of the foam wing from $\frac{3}{16}$ ply. The slot for a full-depth joiner is easier to cut with a saw. The tapered portion of the joiner will leave a gap in the slot,



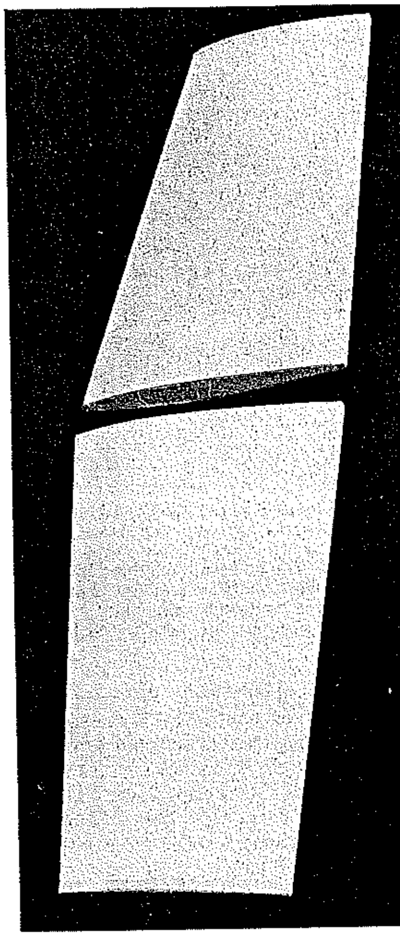
This close-up shot of the Mk II's tail feathers shows the short external clevis rod runs. The clevises are in the middle holes of the large horns. The bolt visible behind the rudder horn retains the tail wheel tiller arm. The plans show a bolt-on arrangement for the stabilizer. It's epoxied in place on this plane.

which can be filled with epoxied scrap foam or with microballoons mixed with epoxy.

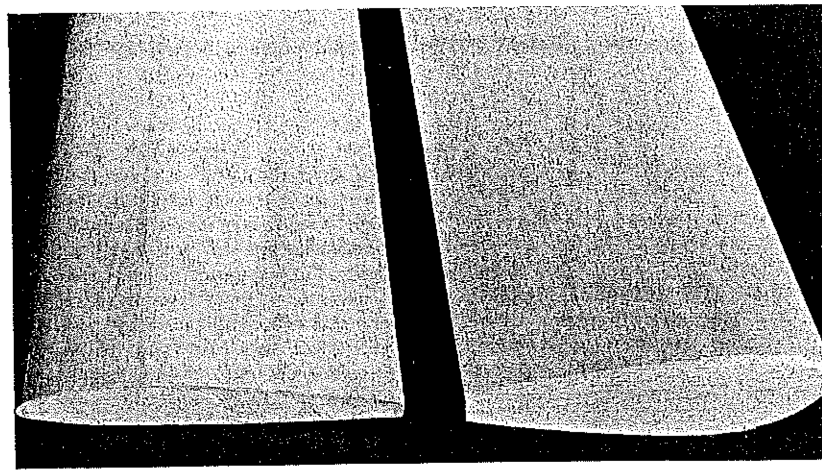
For installing the two outboard servos on the wing bottom, Evans threaded the servo leads through a short paper tube which is buried in the foam wing before skinning. An optional standard single-servo installation is shown. It requires a servo cavity and wood mounting pieces (built after skinning and panel joining are completed).



The business end of Evans' Mk II. It's an O.S. .60, swinging an 11 x 7 Zinger prop. The simple open-nose configuration is shown as an option on the plans. The profile is less deep than Winter's Mk I version. The windshield is carved from a block of balsa. Vertical-grain blocks under the two wing hold-down bolts prevent their crushing the foam and wing skin. Note the exhaust diverter made from a copper plumbing elbow and retained by a common hose clamp.



The foam-core stabilizer halves for Evans' Mk II have been skinned with balsa sheeting and are ready to be joined at the center with epoxy. The tips are made from sheet balsa.



Bill Evans' balsa-skinned foam-core Mk II wings. The root (left) has not yet been slotted for the joiner. The plans show a full-depth joiner requiring preslotting of the foam only. Evans inserts a deep joiner through a bottom slot, including a bottom skin cutout. The wing tip (right) is made from soft sheet balsa cut oversize, then sanded flush with the top and bottom sheeting.

Block up each panel in turn at the proper dihedral, aligning the wing root with the edge of the workbench so that a sanding board can be used for smooth, matching root sections. Some foam is removed to accommodate the smaller front and rear joiners. Trial fit the panels and all joiners until the fit is perfect.

Before permanently inserting the joiners, work epoxy evenly into the slots and smooth it evenly over the joiners. Cover the center joints with ¾-oz. glass cloth. Attach the cloth with epoxy, rubbing out the excess to the outer edges and wiping off *all* residue.

The wing tips are sloped with a sanding board. Make a plywood jig piece for checking the proper angle. The tips, made of soft sheeting, overlap the top and bottom skin (leave excess). Block sand them to match the wing top and bottom.

Covering. Though iron-on coverings are easy to use, we recommend a textured material for the MK I. Many companies sell different varieties, which often can be painted. The MK I used silk/rayon applied with butyrate on the fuselage, finished with two coats of K&B epoxy paint. The wings and tail, however, were covered with Super MonoKote. Though an excellent, popular product, this turned out to be unsuitable for a large-area open-frame wing in a ship of this size and weight. On one landing made with considerable vertical impact during spoiler experiments with the MK I, the dead weight of the wings flexed them down without structural damage but split the covering chordwise edge to edge.

Covering the sheeted fuselage with ½-oz. glass cloth, attached with K&B satin brushing epoxy, provides strength, a good finish, and imperviousness to raw fuel. The glass cloth brushes out flat without pulling and follows all curves and corners. After allowing it to stand overnight, it can be sanded beautifully with a fine-grade paper, then given a second coat. The K&B epoxy colored paint won't leave a trace of a brush mark. Even a single coat works well, and two are sufficient. (Other material is required on the open stab and wing.)

Super MonoKote worked well on the MK II, its wing being solid rather than of open-frame construction. Evans loves the effect of orange accented with dark blue striping.

The MK I has a red fuselage, orange wings and stab, and a silver vertical. The red-orange combination was happenstance—Winter had a 25-ft. roll of orange on hand. Yellow would make a less fiery contrast with the red background.

Flying. Anyone building one of these models already knows how to fly—or should. The notes that follow are intended to familiarize you with the handling characteristics of Winter's and Evans' models—a preflight handoff, so to speak. Our primary focus is on the MK I.

Since MK I is intended to fly on the wing more than on power, spectacular vertical maneuvers or high-rate rolls are not to be expected. This craft wasn't designed to perform in the knife-edge category—responses are more realistic. But with stick pressures from the pilot, the MK I delivers some nice performance indeed. Pilots of full-size airplanes will sense a familiar feedback; in fact, flying the model is rather like being in the cockpit. And this aircraft does even more than one would expect. Because it flies on the wing, the Mark I will surprise you in certain modes.

Of course, vertical performance would improve with a .60 engine, but that much power would be a disadvantage in other respects. A bigger engine would have to be throttled back considerably most of the time, using high power only for climb maneuvers. At full power, heavy *down* trim would be required due to the lift available, and one would then need to either fly backstick or remove considerable *down* trim during approaches and landings. With the K&B .40, MK I lifts off at one-third power without the pilot's touching elevator, so there's no need for more than two-thirds throttle at that point. Incidentally, while a 10 x 6 propeller is the usual choice, an 11 x 5 wood prop is better matched to the model's aerobatics.

The proper center-of-gravity (CG) location for a flat-bottomed airfoil section is 25% of chord. Though many pilots are accustomed to trimming at 33%, this requires more *down* trim for cruising and heavier control deflections for inverted and outside loops. The forward position gives a more solid feeling, better penetration, and less bouncing around in wind (light wing loadings do ride bumpily in wind). Approaches are more positive, more in the groove.

A good test for the appropriateness of the CG location in aerobatics is to perform an outside loop at constant elevator and power. If the ship "buttonhooks"—that is, tightens up during the last quarter of the maneuver, then straightens back to level flight at lower than its original altitude—this means it's too nose-heavy.

Because the model is both short-coupled and a tail-dragger, full *up* elevator is recommended while slow taxiing on grass—especially if the grass is long or ragged. To begin takeoff, advance the throttle slowly and smoothly—never abruptly—while continuing to hold *up* elevator for a *short* distance (typically 10 ft.). Actually, if lower power

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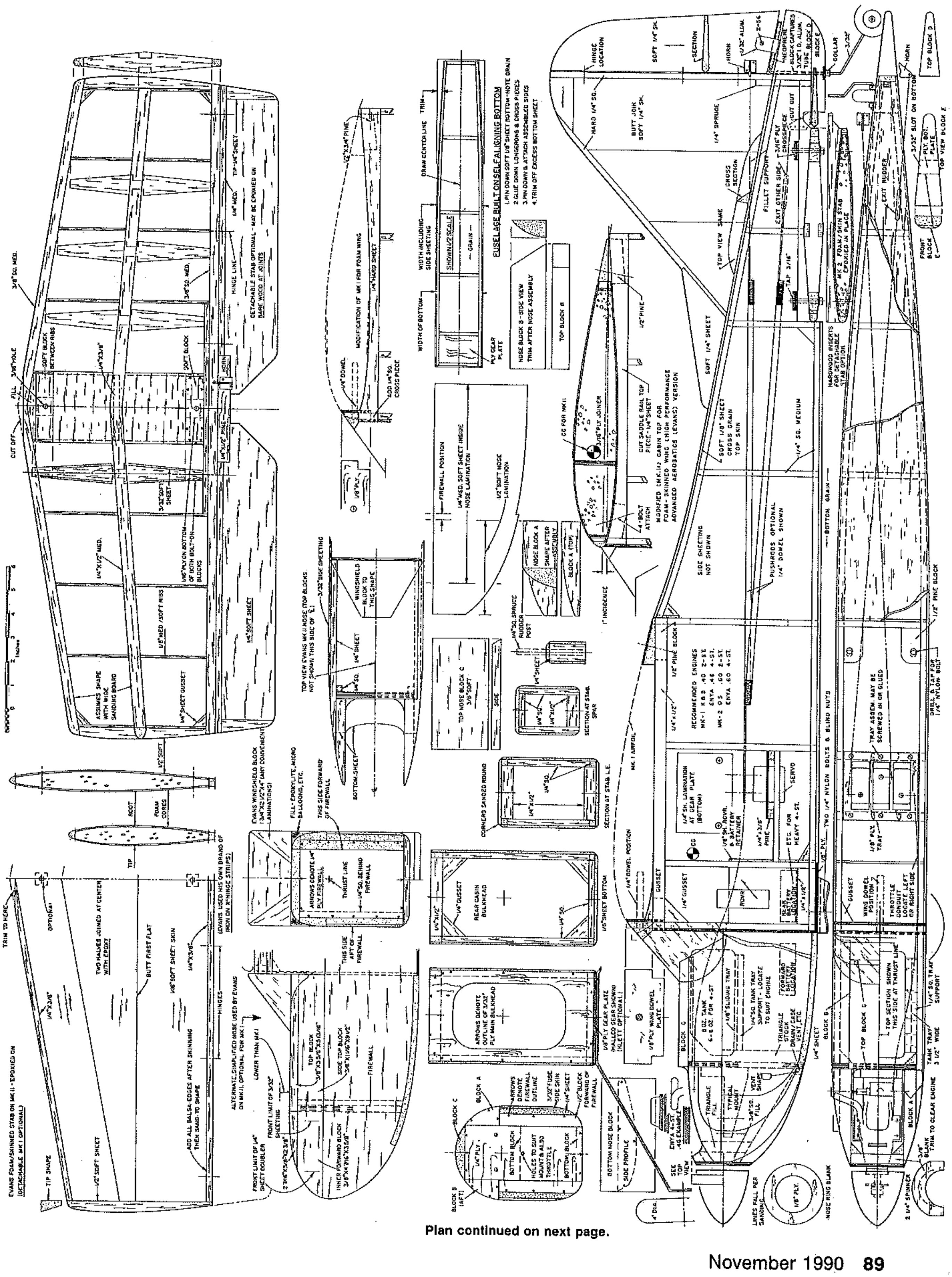
Full-Size Plans Available . . . See Page 212



Plan continued on next page.

turn.

I use a small medical syringe to meter the fuel into the engine. The Cardinal will fly out of sight on a full tank, so measuring your fuel is important. Limit your first test flights to short engine runs of one to five seconds, stretching them to as long as is practical (i.e., as long as you care to run after your model) once things look safe.

Normally I start by priming the engine and hooking up the battery. Once the prime and any fuel left in the tank run out, I feed in a measured amount, check the wind direction, and start the engine. The needle valve is preset to produce a slow, even run; so once it's running, it's time to launch!

If it's a gusty day, the Cardinal is probably ready for it. With its trim and dihedral this model will handle a fair amount of wind. Make sure she's launched directly into the wind, or just slightly off to the right.

Sport flying should *always* be this much fun!

Krackerjac/Winter-Evans

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is used to begin the roll, followed by a smooth and steady advancing of the throttle, the pilot won't need to hold *up* for takeoff at all. By allowing roll to develop a bit before going to higher power, you increase airspeed to the point that the rudder has good bite for steering. With a tail-dragger, steering control at low speeds derives from the tail wheel much more than from the rudder. If a quick surge of power is allowed to lift the tail instantly, the airplane will lose steering power due to loss of tail wheel traction.

In a 5-mph headwind, MK I will climb quickly to landing pattern height at even one-third power. On more power, expect the airplane to climb rapidly and fly on the wing.

The two degrees of dihedral permits free flight hands-off stability, yielding continuous turns on either aileron or rudder without compromising wingovers, etc. When "stooging around," wide turns can be tightened as much as desired by a touch of *up* elevator. The nose won't drop, and when you return to neutral and roll out the plane will be nose-up.

To invert MK I, raise the nose slightly (say, 10°), and then do a half roll. This allows you time to feel for matching *down* elevator before the nose drops. Powered by the .40 engine, the model will sustain inverted maneuvers—including steering, figure eights, etc.—at two-thirds power, one-half going down (or no more than two-thirds going down in any circumstances).

Three or more consecutive, concentric outside loops can be done, flying off the top at half power and one-third to one-half going down. More power and speed opens up the outside, increasing loadings on the upside and possibly causing twisting out. This ship has area that's intended to be used.

Landing approaches are long, and the airplane shows a surprising ability to keep coming. This makes a really good idle essential. A bigger, lower pitched prop provides a bit of braking. Because of this clean approach, use stick pressure, rather than movements, for *up* elevator as you begin the flare—otherwise, you'll go out the other side. Slowly build up sink for touchdown by gradually increasing *up* pressure.

As mentioned, the ship soars easily. It has been soared out of the turn into crosswind without adding power, simply by trimming with rudder for flat, wide circles. Normally, soaring with MK I is done by climbing to moderate glide altitude, then going to a notch above idle and trimming with rudder for continuous flat circles. In lift, the circle tightens and speed increases; go to idle or shut off, and the model becomes a Glider. Dress circle diameters with rudder trim; when locked in, the model will bank more steeply and go "automatic."

It's easy to see why spoilers were added to MK I, though they're optional. These small, front-hinged spoilers, which are typical of blade types designed to put a Sailplane on the ground, will kill some lift with a minimum of buildup in drag in the MK I. If the spoilers are set in the full-open position at 60% vertical, their effect requires steady compensation with *up* elevator. A go-around from an aborted landing is possible with the spoilers at less than full power. Use a proportional channel radio so that spoilers can be opened to any degree desired.

The spoiler system is designed to produce a dethermalized descent in the Free Flight style, but one that's variable from slight to a limited "full." Compensating *up* elevator varies with the amount of spoiler applied. The model can hold an increasing nose-up attitude to augment sink as desired, to the point of a STOL descent if one chooses. It's possible to fully open the spoilers with landing pattern power on the downwind, arriving at even 50 ft. high and just 100 ft. short of the runway, then go to idle and STOL down to the head of the runway—or exit thermals, or approach on a 60° flight path from high altitude anywhere and easily hit a spot. The spoiler action is limited enough to allow a final flare in safety. These techniques are fully described in Winter's article "Spoilers (with Power!?)" in the February 1986 *Model Aviation.*

The flying habits of the MK II don't require special description. If you can build it, you'll know what to do with it. The MK II excels at close-in maneuvers, allowing the nervous pilot enough reaction time to prevent the ship's getting ahead of him. (Due to the airfoil type and the angular rigging, spoilers are not appropriate.)

In the gentlest headwind, either model will fly on the ground cushion at extremely low power while the pilot holds *up* elevator. Winter claims that he has walked (quickly) beside the MK I. If the pilot slows up too much on the final close to the ground, both ships can stagger around like drunken sailors until aileron response is lost (a common condition), but they can be landed by rudder. It is reassuring to know that rudder will hold the heading if you goof a go-round.

If you're the sort of modeler who must have fireworks, build a standard Stik with a piped .60. If it's realistic enjoyment that you want, either of these Krackerjacs is pleasant to own and fly.

Epilogue. When Evans shipped the MK II to Winter, the stab was detached, and to it was taped a note: "Leave this off; it flies better without it." Winter's comment: "If Evans isn't spoofing, he would have used ailerons as elevons and reflexed them upward by 3/16 in. for neutral control, with the CG at 20%." Enough already!

Miracle Landing/Jolly

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libbed as he walked away. "The epoxy's not holding up. Once you lower your standards to Krylon, the model will last forever."

My paradox proved true. This was the day our 737 was made to see. The most difficult shots we'd been asked to do, like flying over the edge of the runway three feet above the ground, came off without a hitch. Imagine all that foam, glass, and Krylon scooting along at 80-mph-plus over the same ground track time after time. Then there were the landings. The model had to touch down within a foot of a white dot on the runway, with the camera zooming in tight for realism.

Mile Square wasn't closed, by the way, since we were flying off an adjacent runway under tightly controlled conditions. Sport flying continued on the active runway, and there was no lack of interested helpers. Each of the 12 flights on that last day was picture perfect. Kent would light the fires, and the plane would accelerate, lift off, and fly. Steve Korney tracked the 737 at over 80 mph gear-down and over 90 mph gear-up. We literally stopped traffic on nearby streets as drivers spotted what appeared to be a stricken airliner landing at Mile Square.

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