

Randy Hebron's full span flapped, spoilerized, updraft cooled . . .

KR-1?



ARTICLE AND PHOTOS BY JACK COX

FOR LO THESE many years we've been pointing to the good ol' Pietenpol's somewhat ironic role as a latter day testbed for about every kind of engine you can think of — Model As, Corvairs, Continentals, Lycomings, Olds V-8s, Chevy Vegas, etc., etc. Well, now it's beginning to look like other homebuilt designs are vying for recognition as the "Adaptable Annie" of the homebuilt world — the KR series. More and more we are seeing both KR-1s and 2s with as many new looks as a crazed chameleon. With its relatively cheap, very simple basic wooden skeleton and its foam and glass outer skin so easy to mold and shape much as you please, it's easy to see why builders choose a KR-1 or -2 as the basis for their experiments. From Ken Rand's straightforward little designs we are seeing mutations that include tricycle gears, throw-over control columns, fixed gears, all-composite molded structure, GA(W)-1 and 2 airfoils, various engine and prop combinations, gull wing cabin doors, swept tails, etc., etc. At any fly-in these days you **must** spend

some time in the KR area, because you never know what's going to turn up.

At Sun 'N Fun this year we spotted still another KR chameleon — with full span flaps capable of being reflexed, spoilers, GA(PC)-1 airfoil, updraft cooling, a cruising range of nearly 1000 miles and a form-fitting, inflight adjustable seat to make it comfortable for one to sit in it long enough to fly that far.

All the modifications were developed by a young man — just 24 when he started the project — who got much of his information from articles that have appeared right here in *SPORT AVIATION*. For example, the GA(PC)-1 wing with its full span, reflexible flaps came, of course, from Molt Taylor's articles on his MiniIMP . . . and the updraft cooling was worked out using information from Peter Garrison's September 1976 article on the subject. The rest he figured out for himself.

The builder is Randy Hebron (EAA 149183) of 34464 Hively, Westland, Michigan 48185. Launching his KR from his home base airport in suburban Detroit, he climbed out to 9500 feet — in company with his father's Bonanza — throttled back to about 120 mph and 3 gallons per hour and cruised non-stop to Atlanta . . . on auto fuel, incidentally. After topping off with his first



load of 100LL, he climbed out to 5500 feet and zipped right on in to Lakeland . . . and Sun 'N Fun '80.

The first thing Randy did after landing in Florida was to dash to a "little white refrigerator" — for the usual reasons . . . and to peel off several layers of the long johns so necessary in Michigan in March and for flying at 9500 feet in an unheated cockpit. With the temperature in the high 80s, the KR cockpit became a sauna in short order as Randy taxied to his parking spot!

Refreshed after a good night's sleep, he returned to his airplane the next day to start fielding a weeklong barrage of questions . . . and guess who was at the head of the line! Well, at least our version of the Spanish Inquisition came at the **beginning** of the week, so he was relatively free for the rest of it.

After a quick walk-around inspection to get a handle on the major features, we invited Randy to give us a start-at-the-front-and-don't-leave-anything-out description of the airplane. It went something like this:

A Warnke ground adjustable propeller was used for the first 3 hours, but then a switch was made to a Hegy 52x44 fixed prop which propelled the tiny craft for the next 60 hours. At that point a Warnke was reinstalled and was on the airplane at Sun 'N Fun.

The engine is basically a stock 1600cc VW. Randy built up his own intake manifold so he could use a Bendix-Zenith updraft carb, and is using a single Slick 4016 mag. The latter is driven via a timing belt drive, as per the Rand plans. A Honda motorcycle generator provides power for the electronic goodies.

Because all the fuel is carried in the wings, an engine driven fuel pump is used. A Squareback VW oil cooler is fitted . . . "mounted backwards like they do on the Monnett stuff," according to Randy.

A fiberglass cowling was built up to encase all this, configured to provide updraft cooling. There are no cheek air inlets to the left and right banks of cylinders as we are accustomed to seeing — just two scoops. One is on top of the cowl and a larger one is on the bottom. The top one brings in air around the fuel pump, through the oil cooler, down through the cylinders and out the bottom of the cowl. The lower scoop brings air in, part of which is sucked through a motorcycle plastic foam filter and into the carb, while the rest flows up in front of the cylinders, back over the top of them, down between the cooling fins and out the bottom.

The tuned exhaust system consists of 4 individual pipes cut to a length that provides maximum scavenging at about 2900 rpm.



As we've indicated, the usual KR fuselage fuel tank has been eliminated in favor of wing tanks. This leaves a lot of room for the pilot's knees and for radio and instruments to project behind the instrument panel. Each wing has a 12 gallon fiberglass tank built in, each fitted with finger strainers and underwing quick drains. Fuel lines run into the fuselage and aim forward toward the firewall. Here, on the sidewalls of the cockpit, each line has a single on/off valve fitted. From there, the lines run to a T on the backside of the firewall . . . and thence to the carb via a single line. The pilot has the option of selecting left or right tank or feeding from both of them simultaneously.

A stock Rand landing gear is used — with just minor modification. The gear leg castings were cleaned up by grinding off the rough edges, casting marks, etc., and the transverse spring leaf was tapered about 3/8 of an inch from the hinge point outward — just enough to remove the part that overhangs the castings. The Rand wheels and brakes were used but heel pedals are fitted to actuate the brakes rather than the pull-on-a-cable method suggested in the plans. A cable is used, however, to allow release of both gear locks with one yank.

Randy's main gear leg castings are the early type . . . not designed to break away under severe loading as are the later versions. The idea was that the castings would fail before structure would start ripping out or the plane began to turn turtle. Since a flipover would be a possibility with his "hard" gear, Randy felt it only prudent to build in a substantial turn-over structure behind the seat.

A great deal of effort was expended towards making the seat comfortable . . . in anticipation of a lot of 5 and 6 hour flights. The seat and separate seat back were carved out of foam to fit the contours of the builders' backside and glassed. The back is adjustable — in flight — through a range that extends from almost straight up and down to a "laid back" 60 degrees. A layer of padded upholstery covers the form-fitting foam and glass, resulting in a seat that remains comfortable for extended periods of time.



To add to the physical comfort of long distance touring, both rudder and elevator trim are provided — in both instances by means of a simple spring tensioner attached to the appropriate control cable. The rudder trim spring is, of course, attached to the left cable due to the "backwards" turning VW. The spring tension is tailored for the cruise condition only.

The instrument panel contains the usual (and FAA required) basic gages plus rate of climb, turn and bank, cylinder head temperature and fuel pressure. A single electrical fuel gage can be switched to show fuel levels in either the left or right tank. A KX-145 navcom is installed in the panel and the antennae are located in the tailcone — foil strips bonded down in the proper planes to the non-conducting wooden fuselage.

The aircraft's wing is where Randy really went off on his own. His objectives were to significantly lower approach and landing speeds . . . with full roll control right down to and through the stall. As previously noted, he was influenced by Molt Taylor's use of the GA(PC)-1 airfoil and full span, reflexible flaps. Molt, of course, uses his surfaces as flaperons, but Randy wanted maximum benefit from his flaps, so he opted for spoilers for roll control. He obtained additional information from NASA and ultimately decided on a configuration similar to that on a NASA modified Piper Seneca (and on aircraft like the Robertson STOL conversions) — full span flaps with spoilers located just ahead of them (see pictures). For landing the flaps can be lowered to about 35° and in cruise they can be reflexed up to 15° . . . which produces an 8 mph increase in indicated airspeed.

With what pretty closely approximates a variable camber wing, there are, of course, some significant pitch changes attendant with the changes in flap position. The present elevator trim system is adequate to handle the situation, but Randy says an adjustable stabilizer would be best for making maximum use of the wing's potential.

The spoilers started off with a chord of 3/4 inches, but, after a couple of hours of test flying, were widened to 4 inches. The extra width provided just the amount of crispness in roll that Randy was looking for. The spoilers are spring loaded in the closed position and are popped out by cables connected to the stick just like conventional aileron cables. Each spoiler cable has a spring attached to keep it taut when the opposite one is being pulled.

On the leading edge of the left wing Randy installed a threaded receptacle into which he screws the pitot tube. At fly-ins he can remove it so spectators won't be bumping and bending it. (Right after installing the pitot, guess who was the first person to walk into it?)

Back on the fuselage, the skirt of the Rand supplied bubble canopy was cut down a little so its lines would flow gently into those of the top of the fuselage — for looks as much as for aerodynamics.

From the wing aft, the KR-1 is pretty much off the Rand-Robinson plans. Brass bushings were installed in the aluminum rudder and elevator hinges, and a snowmobile bogie wheel was substituted for the stock tail-wheel . . . but that was about it for tail modifications.

The finish of the entire airplane is straight out of Burt Rutan's Composite Aircraft Finishing Manual — and with Imron for color. Randy had already decided to use 6 oz. bidirectional glass cloth instead of Dynel, so he was able to use the VariEze system right down the line, and with beautiful results.

With test flying imminent, Randy had to go through more than the usual amount of inspections and last minute adjustments before taking to the runway. This was so due to the great number of unknowns he had built into the airplane — particularly the engine cooling and the flap/spoiler system. Eventually, however, everything

appeared ready and high speed taxi tests were commenced. He worked up to tail high runs at 50 mph without incident, so it was obviously time to fly.

On the first take-off Randy found that those 50 mph taxi runs were actually well above lift-off speed. By introducing an angle of attack at around 40 or so, the little bird was off in a flash. Some 40 minutes were spent flying round and round the pattern, feeling out the controls, monitoring engine temperatures and pressures, etc., so, finding nothing unusual, a routine landing was made. The thrill of flying one's own homebuilt was certainly a part of the experience, but Randy recalls that things went well enough to make the flight somewhat anticlimatic after 4 years of building time. Considering possible alternatives, however, he had no complaints whatever.

In the subsequent 82 hours of flying time (as of Sun 'N Fun in March), Randy has determined that his KR-1 is capable of an indicated top speed of 170 mph. Normal cruise varies with the amount of fuel he wants to run through the VW. He can indicate 95 mph at 2200 rpm or push it up to 3400 rpm and do nearly 160 indicated. A favored combination is 2900 rpm and 120 mph indicated — burning 3 gallons per hour. With a fuel capacity of 24 gallons (and assuming most of it to be useable), the aircraft has a bladder busting duration of 8 hours to dry tanks.

And speaking of fuel, Randy has burned auto gas, 80 octane and 100LL and has not been able to detect any difference between them . . . except for what he considers to be the objectionable smell of auto gas!

The big question, I suppose, is how successful the modifications have been. Randy is very pleased with his KR-1 low end performance. He is able to land at 45 mph . . . but has found that the landing speed is dictated largely by the length of the main gear legs. The airplane will fly a lot slower than it can be landed because of the flat angle at which a KR-1 sits when on the ground. He could ease in under full control at 40 or so, but the nose would be up enough that the tail wheel would hit first and slam the plane down too hard on the mains. Throughout, the spoilers provide solid roll control. They are also very effective in crosswind landings, Randy says.

So, in summary, Randy **does** feel he met his objectives with the airplane. He does not think his modifications added anything to the top end of the performance scale, but added quite a bit to the other end. He does not recommend that others attempt such radical changes to the basic KR-1 design because a lot of engineering is required and a **whole** lot of extra work is involved. He estimates a full year was consumed determining whether to go with flaperons, drooping ailerons and flaps, or full span flaps and spoilers — and then where the spoilers would be positioned on the wing.

The KR-1 was intended as a fun project, with some heavy emphasis on education in the process, and when it was completed, a useful life as an efficient single place cruiser. Randy has access to a Bonanza when he needs extra seats, so he had no incentive to go even to a two seat homebuilt. He knew exactly what he needed and wanted . . . and he went out and built it.

Randy started flying lessons when he was 17 and with some time out for college, got his private when he was 21. He started the KR-1 at 24 and is now 28. Along the way he and his wife, Elizabeth, have had 3 daughters . . . so, obviously, the fellow has been busy! He is in charge of manufacturing at a machine shop operation that makes electrical components for large construction equipment and military ordinance.

And the future? Randy is already thinking about an amphibian . . . or a self-launching sailplane.

With a few mods, we suspect.