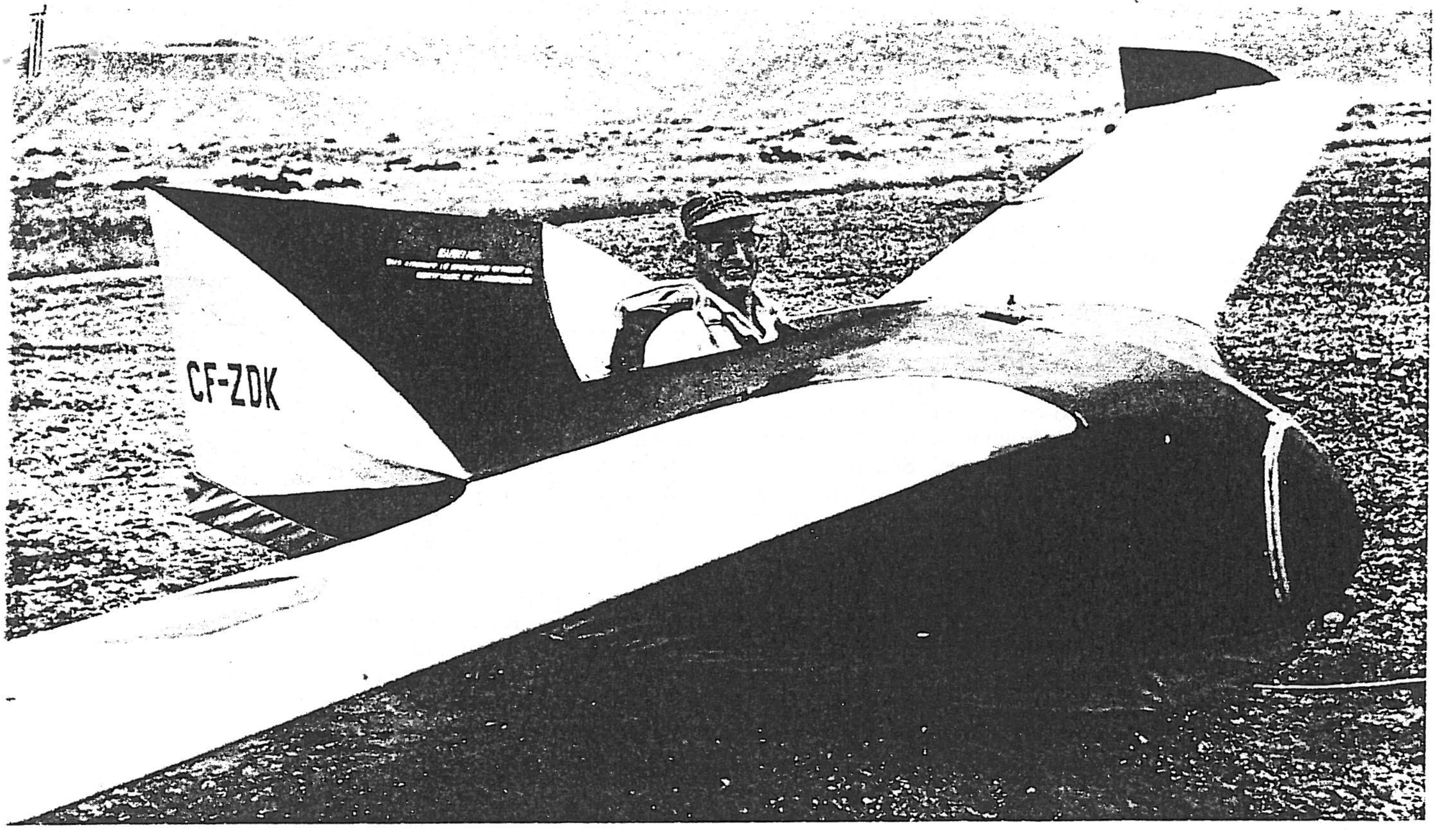
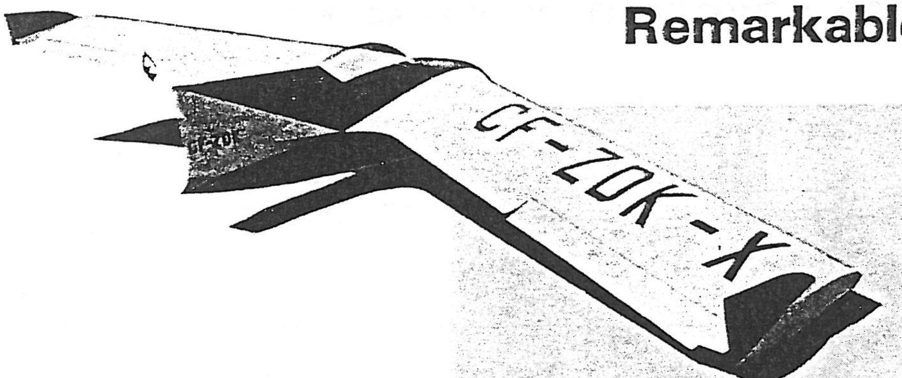
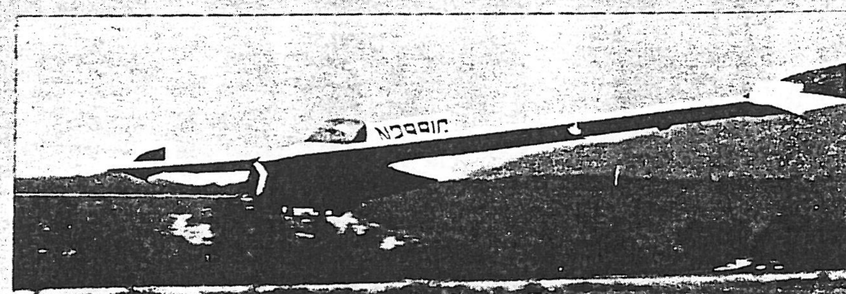


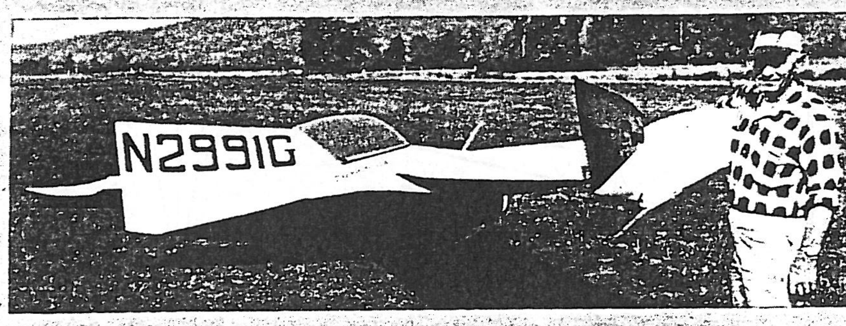
Remarkable L/D achieved by



Top: Al Wilson of Seattle ready to make first U.S. flight in the BKB-1. Craft is shown, left, in initial configuration and under Canadian registration. Witold Kasper is seen, below, taking off in modifield BKB-1. Note wheel now projects farther below fuselage and that the landing skid has been shortened. Mr. Kasper deflects a wing tip rudder.

Canada's loss is our gain as one of the truly unique sailplane designs crossed the border to find a home near Seattle. A good deal of the technical info that has been collected on Kasper's BKB-1 will be of interest to all amateur designers. AP's N.W. editor tells how it flys.





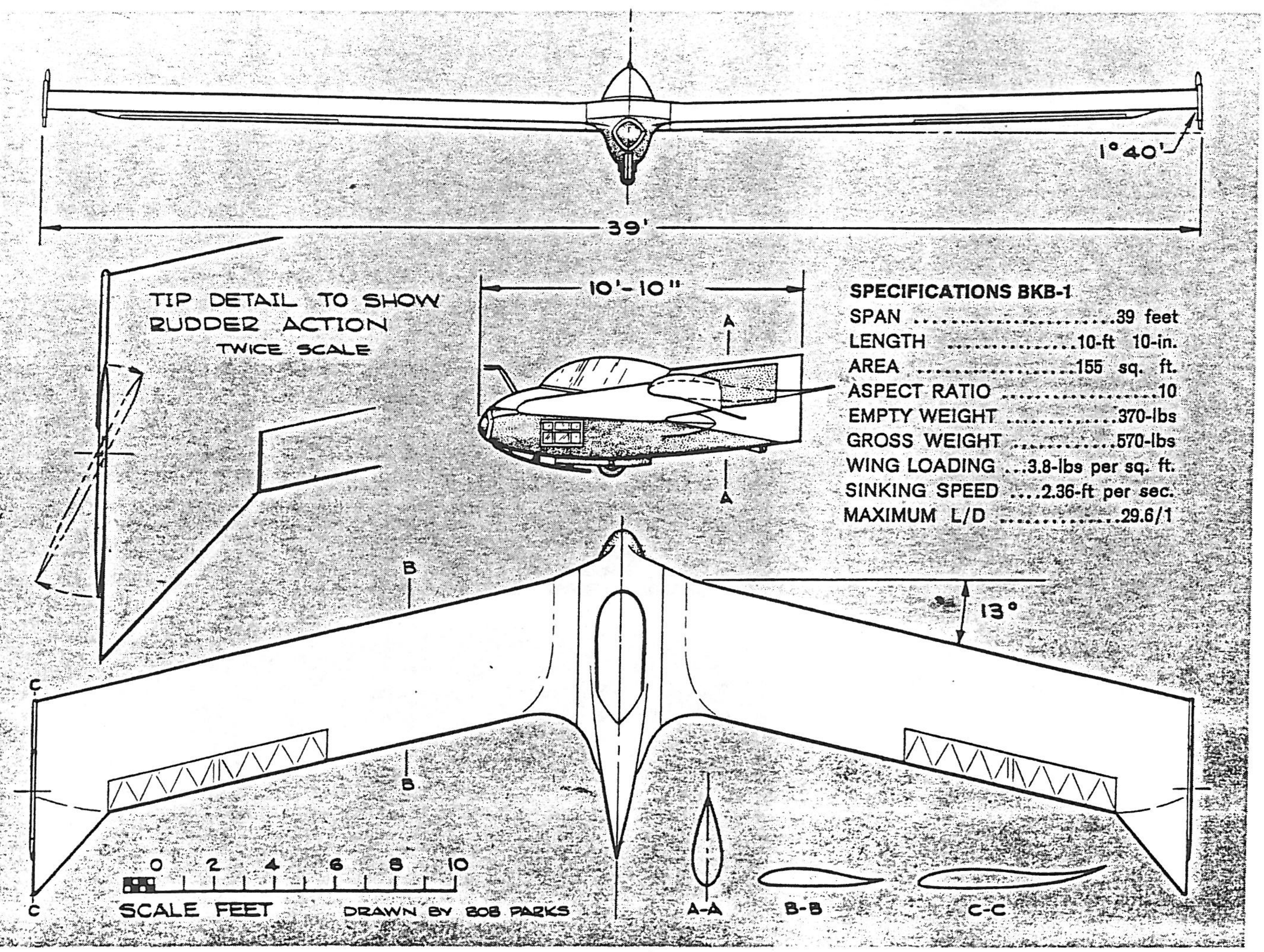
Short-span Tailless Sailplane BY PETER BOWERS

One of the most unusual homebuilt gliders in this country is the BKB-1, owned and flown by Witold A. Kasper of Bellevue, Washington, a suburb of Seattle. It was designed by two Polish aeronautical engineers, Stefan Brochocki and Witold A. Kasprzyk, while they were working at Canadair Ltd., in Montreal, in 1955. The designation results from the last initials of the designers and Fred Bodek, another engineer who helped build the ship.

Kasprzyk came to the United States and was employed by the Boeing Company in Seattle before the BKB-1 was finished and flown in 1959. It had flown only in Montreal prior to 1963 when Alden G. Wilson, a member of the Boeing Employees' Soaring Club, offered to drive to Canada and get it in return for a season's free use of it. Wilson made the first American flights. Kasprzyk, meanwhile, had become a U.S. citizen and had shortened his name to Kasper. U.S. citizenship invalidated his Canadian pilot's license. However, a valid Canadian license would have done him no good since the BKB-1 was now under U.S. registration. As an FAA Designee Flight Examiner, we took care of that problem by issuing a U.S. student permit—to a pilot who had been a national gliding champion in Poland before War War II!

While tailless gliders are nothing new, few have earned lasting names for themselves because most have had inherent disadvantages that outweighed the principal advantages claimed for the tailless: the performance increase that comes from the elimination of structural weight and parasitic drag. The BKB-1 has gone a long way toward eliminating some of the more serious disadvantages while retaining most of the advantages. It follows the traditional tailless characteristic of using sweepback to obtain a longer effective moment for the longitudinal controls than is available with a straight wing. Lateral control is by ailerons in the conventional location near the wingtips. However, in a design like the BKB-1, where a single surface performs the function of both aileron and elevator, it is called an "elevon."

The rudders on some other tailless types differ greatly. Some are on the wingtips (Burgess-Dunne and Lippisch "Storch") while others are on the fuselage aft of the wing (Messerschmitt 163). The BKB-1 combines the better points of each into a different operating principle. Relatively small rudders, operating in an outward direction only, are on the wingtips while the necessary vertical fin area is provided by finishing off the rear end of the fuselage (actually a pod) in a fishtail form. Since each rudder is connected to only a single rudder pedal instead of the two being hooked together through a closed-loop system, each can be operated independently. To turn left, for (*See pg.* 97)



Once clear of the airport, I climbed to 3000 feet over downtown Riverside and took a couple of photos. It's a cinch to fly the SA-11A with your knees since the side-by-side stick arrangement fits at just the right place. I was able to make steep banks easily and photograph the town below with both hands on the camera.

Under these conditions, you really begin to appreciate the wrap-around visibility of Playmate. The only restriction to visibility was the wide hinge-point at the top of the left-hand storm window. Stits is planning a fix on this detail and will probably hinge the window from the top edge of the canopy rather than 1/3rd of the way down.

After rolling around in the turbulent skies for perhaps 20 minutes, the shadows began to lengthen and so did the distance between the "F" mark and the bottom of the fuel gauges, so I headed back toward the airport. Traffic was still landing downwind and, as I circled the airport, a popular light twin used all the 2000 feet of oiled runway and half of the dirt area before getting stopped. Two other aircraft made long landings, but the steady flow of just-before-sunset pilots continued their merry pattern.

With a no-radio airport, you can't beat 'em so you just join 'em. I decided to follow the herd and make one single pass at the airport downwind. If this one didn't work out, I'd pull up and wait-out a break in traffic for an upwind landing.

It was moderately turbulent at pattern altitude and the large cross atop Mt. Rubidoux was quite close as I turned in on a wide base leg. I carried a full 85-mph turning final and added a bit of power to keep my speed up. The ground speed component must have been at least 100-mph as I skooted across the barbed-wire fence. Playmate and I were really moving.

O.K. Let's see if she'll "paste" on the ground. With a probable go-around, I don't want to float-out half the airport and wind up in a full stall with choppy air. I try to program my right hand to go from throttle to carburetor heat quickly if we go around.

Ease her down and try to plant the wheels on the 30 foot wide asphalt strip without a bounce. Controls are crossed to take care of the wind but Playmate handles smoothly.

The tires screech and we're on. There's no bounce and that's a reassuring development. Now on with the brakes and ease back on the stick—just a little—to keep from digging in. At light weight, it's surprising how quickly she comes to a stop. Turn-off is at mid-field on the oiled strip; that's about 1000 feet. Zero wind landing roll is 340 feet.

Thirty seconds after the prop stopped, both wings were folded and we opened the hangar doors—but only a little way—to push Playmate in out of the weather.

I'm tempted to build one myself.

TAILLESS

(*Continued from page* 63)

example, the pilot merely presses the left rudder pedal and moves the stick to the left to initiate the left-turn aileron function without having to come back on the right rudder pedal. Pressing both pedals simultaneously forces both rudders outboard. When the rudders are operated simultaneously this way, they serve as air brakes in place of the standard spoilers used on conventional gliders and sailplanes.

This peculiar rudder control feature presents a problem to the pilot of more standard machines who is accustomed to letting his feet rest heavily on conventional rudder pedals, where it is the differential in pressure, rather than the pressure itself, that moves the rudder. The author, a "heavy-foot" pilot, wondered why he wasn't doing very well in the BKB-1 on his first flight in it and found that he was flying along with full air brake applied. It really takes will power to stay off of those pedals until you get used to the ship.

Longitudinal stability is achieved in most tailless designs by combining sweepback with heavy wash-out at the wingtips. Since building the wash-out into the wing complicates the construction problem, the BKB-1 used an untwisted wing and merely trailed the elevons a bit high to achieve the same effect. Unfortunately, because of the span of the elevons, this caused a lot of unnecessary drag that kept the ship from achieving its calculated maximum L/D (Lift-over-Drag) ratio. The initial performance turned out to be close to 20/1. Kasper corrected this after flying the BKB-1 himself by shortening the outboard ends of the elevons and building a new extended trailing edge onto the wingtip which incorporated the necessary wash-out. This took care of the elevon drag problem and raised the L/D to well above 25/1.

Everyone who sees a tailless, or flying wing aircraft, seems to have one major concern about it—they wonder if it will "tumble", or spin about its lateral (pitch) axis if it is put into a steep stall. All normal stall tests made on the BKB-1 showed stall entry and recovery characteristics comparable to standard types. The tumbling capability of the design was discovered accidentally and literally by backing into it. Kasper was doing aerobatics at an air show and zoomed the BKB-1 straight up to emulate the tailslide and subsequent whipstall maneuver done by a previous performer. The tailless didn't slide backward out of the vertical stall as expected—it flipped about its axis and resumed level flight. *That* performance proved to be enough for one day.

Later, Kasper did some experimenting at a safe altitude and found that he could tumble the ship forward or aft after a vertical stall. After building up his experience with single flips, he got to the point where he could go through several cycles. Most important, he has determined that the tumbling can be stopped at any desired point. The record so far is three consecutive flips, at a rate of one per second. No other tailless in the world is known to have this capability and it must be seen to be believed.

The structure of the BKB-1 is all wood. The wings are covered with 1/16 inch birch plywood to give them torsional stiffness; only the elevons are fabric covered. All control surfaces are operated by push rods and hook up automatically when the wing spar stubs are mated on the fuselage centerline and locked in place with a single taper pin. The landing gear is conventional, with a single wheel built into the belly just aft of a standard rubber-sprung nose skid. Spring-leaf skids under each rudder protect the wingtips. The pilot sits under a re-

KASPER TAILLESS, Cont.

moveable "razorback" canopy built up from two sheets of flat Plexiglas. Since he is located in the middle of the wing instead of being ahead of it as in a standard design, his normal downward visibility is limited. Windows installed in the lower wing root fillets improve the situation.

Kasper's calculations indicate that the short-span BKB-1 is capable of a maximum L/D of 29/1, which is truly remarkable for a sailplane with an aspect ratio of only 10. Whether or not the prototype actually achieves this is of little importance. Kasper and his associates have proved their point—that the inherent drawbacks of the tailless design can be overcome. Kasper is now well along on a refined version with a span of 15 meters (49 feet). He's shooting for an L/D of 50/1. Don't make any bets that he won't do it!

FOREIGN PLANES

(*Continued from page* 55)

V. W. Aircraft, 14529 Stone Rd., Newburg, Ohio; and Falconar Aircraft.

Huggins has numerous conversions for the standard 30 to 40-hp VW engine and for the newly obtainable 1500-cc Volkswagen engine. He also sells modification prints for the conventional steel tube type engine mount or for the bolted-to-the-firewall installation for the VW engine. Falconar stocks VW engines as well as their newly modified Little Demon engine which uses Volkswagen VW 1500 parts. The 1500 VW engine produces 50- to 60-hp when used as an aircraft power plant.

Falconar offers "mods" that include the carburetors mounted under the engine and/or dual carbs over each cylinder, plans showing a single magneto mounted through the distributor hole (this part removed when converting) and dual mags mounted at the rear of the engine.

Huggins shows a conversion permitting the use of Chevrolet Corvair cylinders on a standard 40-hp Volkswagen engine. This conversion boosts the hp from 40 to approximately 50. Detailed descriptions, mounting data, power and fuel consumption curves, parts and price lists are available from the suppliers listed. Conversion plan costs for the 30- to 40-hp VW engine are $5 and up, while plans for the 50- to 60-hp VW engine are $10.

When fuel consumption gets down to 1½ (30- to 40-hp) to 2½ (50- to 60-hp) gallons per hour (aviation gas sells for $1 or more per gallon in France), parts are readily available, installation simple and reliability is great, you have the answer to why Europeans use VW engines in their home-built aircraft. This is even more surprising when you know that the French Government reimburses a homebuilder 50% of the cost of a new aircraft engine provided the engine was manufactured in France and the aircraft design was government approved.

Falconar also specializes in selling complete materials kits for all the aircraft in his stable. These kits do not violate FAA rules because all materials are aircraft quality and wood pieces are finished to cross sectional size and approximate length only. Sheet metal parts are cut to rectangular size of the part and are not finished in any way.

These kits can be purchased in subkits, which in reality, break up the total package into fuselage, wing, tail or undercarriage. Sub-kit "A" contains all the wood materials necessary. Subkit "M" contains all the necessary hardwear, fittings and metal materials necessary. The combined kits (A & M) include all the materials necessary to build the entire airplane, except for the propeller and the engine. A separate kit for covering and finishing the airplane is available when the builder is ready to finish his aircraft. In this way the amateur can build his airplane piece-meal without straining his budget. Complete material kits vary in price from $750 for a Mignet H.M. 290 Flying Flea to $2,150 for the Deluxe Piel Emeraude C.P.301A. Falconar says that "building an airplane from one of these prepared materials and hardware kits will normally save a builder approximately 20% in the man hours necessary to build an aircraft and also will save the expense of power machinery such as a table saw." A great deal of time and effort can be and is expended by the amateur in collecting the necessary materials and parts and getting access to power equipment. Also to be considered is the fact that chances in making errors in equipment, material specifications and sizes is reduced considerably.

In writing to any of these designers overseas, we suggest you use air mail because ordinary mail delivery takes 3 weeks to a month by ship and air mail takes approximately 3 to 4 days. If you are writing to any of the French designers, write your letters in French for a more prompt answer.

TESTING

(*Continued from page* 86)

PERFORMANCE IMPROVEMENT

This comes after the plane is well checked out and you start looking for all the little ways to add a few mph. Too often, a pilot-builder will make a number of different changes all at once; and then won't know which ones are the most beneficial. While there are advantages of making a lot of changes during one trip back to the shop, little is learned from the subsequent test results. When various little cleanups are made, fairings added, new cowling or cockpit canopy, try to do them one at a time followed by a careful test flight so that you can find out just how much good each particular change made. Some fancy fillets and fairings that look great can actually reduce performance instead of improving it.