PILOT FLIGHT CHECK:

The Robertson Super Seneca I

by DON DOWNIE / AOPA 188441

When you've got spoilers, who needs ailerons?

■■ "With today's technology, there's no reason to design ailerons into almost any new small plane," said veteran engineer John Calhoun, vice president, engineering, for Robertson Aircraft Corp. "We incorporated spoilers and full-span flaps in the experimental NASA/University of Kansas advanced technology light twin (ATLIT), a Piper Seneca I. The basic concept seemed so good that we went ahead on our own to increase the performance of existing Seneca I's by using full-span flaps, spoilers, and our regular double-hinged rudder.

"After more than seven months of design, construction, modification and flight testing, we've received FAA approval on the no-aileron Seneca I."

There's really nothing new about the spoiler concept. Calhoun reminded us that Fred Weick had incorporated spoilers on a Fairchild 22 way back in 1936. Spoilers were standard equipment on the limited number of Northrop "Pioneer" (C-125) trimotor transports and are used successfully on Mitsubishi's current MU-2s.

But the modified Seneca I is the first certificated *light* general aviation aircraft that dispenses with ailerons and uses spoilers for roll control.

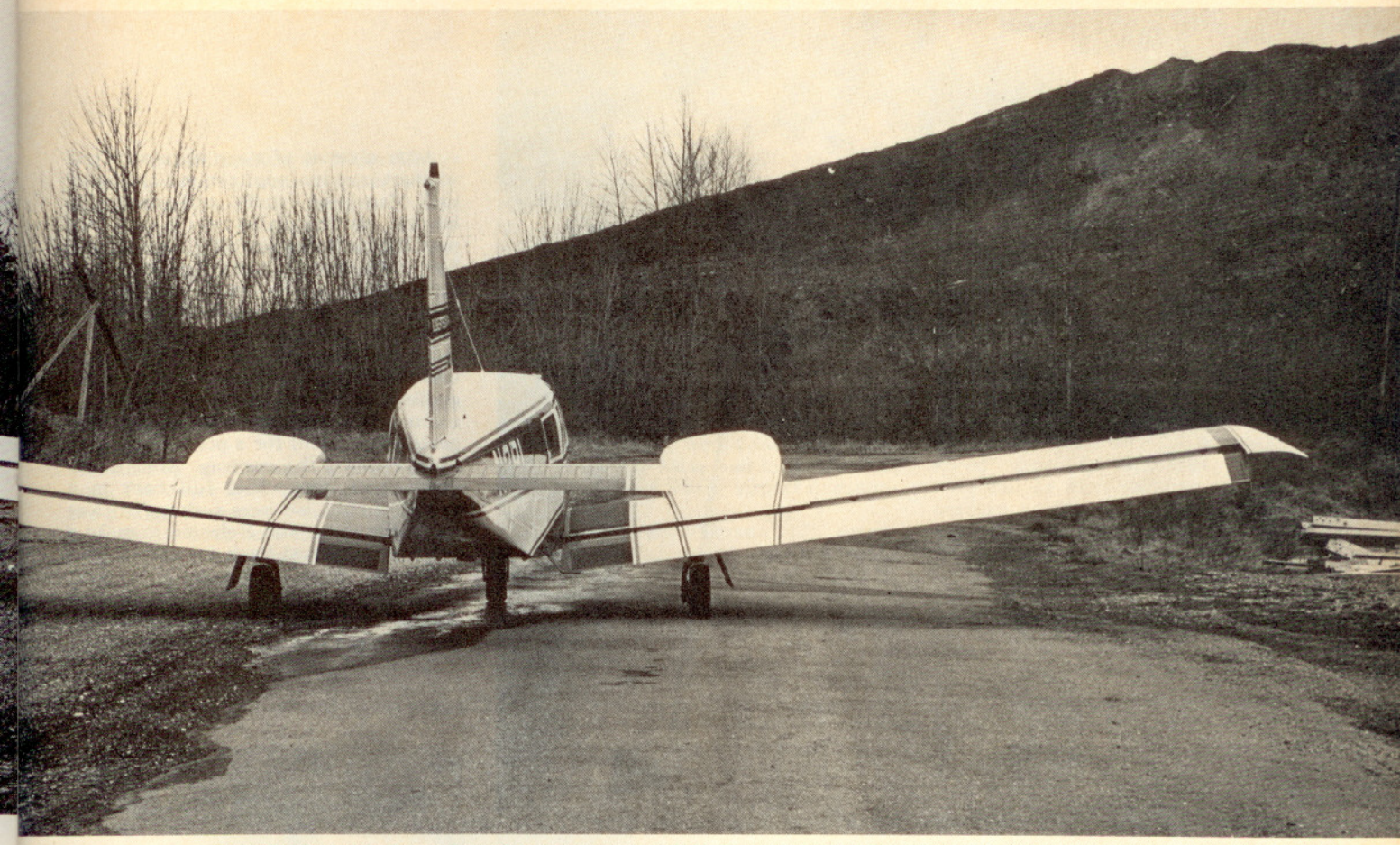
Robertson's engineering and sales executives feel that the "Super Seneca I" package represents a real breakthrough in light aircraft design and modification. And after flying the prototype, you can't help agreeing with them.

John Calhoun, a veteran of 30 years of designing with Beech, explained that the spoiler concept was not quite as simple as it appears from the cockpit.

"We had our share of troubles in refining the system," he explained frankly. "At first, the spoilers tended to overbank as they were applied. There are no springs or bungees in the spoiler system, and we found it challenging to put the proper control-wheel 'feel' into the system. By the time we felt we were ready for FAA certification, we had some 3,000 man-hours of engineering alone in the system, not counting the experience built up in the ATLIT program."

Normally, aileron response tends to decrease with airspeed. The reverse is true of the new Robertson spoiler system. With flaps fully extended (40°), the roll response of the spoilers is double that when the flaps are retracted. Thus, you wind up with more roll response at low speeds, when you need it most.

The advantages of the full-span flaps are obvious. When they're fully extended, the Robertson Seneca's wing area is increased by 2½% over that of



Robertson Super Seneca at "Black Diamond Wash," a 1,600-foot private airstrip south of Seattle. Spoilers (not visible here), full-span flaps, double-hinged rudder, and cambered wingtips are the major physical changes in the Robertson modification. Photos by the author.

the standard Seneca I with its flaps similarly extended. With the 20° flaps recommended for takeoff in the modified aircraft, ground roll is reduced to 640 feet, in contrast to 1,000 feet for the nonmodified Seneca I on normal takeoff with no flaps. Climbout speed drops from 85 mph on the original Seneca to 77 mph on the modified aircraft, while the best-angle-of-climb speed, essential to clearing obstacles, comes down from 110 mph on the Piper production model to 85 mph on the Robertson modification. Takeoff distance over a 50-foot obstacle is cut from 1,440 feet for the Seneca I to 1,050 feet for the Robertson Seneca, according to Robertson engineers.

We made two flights in the Robertson Super Seneca I prototype, N2BL, on successive rainy days at the factory at Renton, Wash., near Seattle. (N2BL is the property of radio and TV personality Bob Landers, of Palomar, Calif., and was to be returned to him after the Robertson installation had been inspected by Piper, Cessna, Beech, and NASA.)

Our first opportunity to fly the aircraft was with Earl Severns, Robertson's oldest employee in time of service. He was moonlighting for Jim Robertson, building the hardware that went into the original prototype STOL installations, even before the company was formed.

Severns gave us a quick walkaround in the rain and explained that the spoilers were rigged to be flush with the standard wing contour when the flaps are up and will travel about 3° up as the flaps are lowered. The leading edge of the modified Fowler flap travels aft 4 inches as the flaps extend. Flaps on the Robertson modification are electrically actuated, not operated with the "Johnson bar" used on the original Seneca.

Severns made the first demonstration takeoff on Runway 15, with an 8-knot wind from 140° and an outside air temperature of 34°F. With full fuel and the two of us aboard, we were passing through 1,300 feet as we crossed the south end of the 5,380-foot, sea-level runway, using 20° (half) flaps and full power on both engines.

Clearing the Sea-Tac TCA to the southeast, Severns demonstrated the modified Seneca's spirited rate of roll, from 30° left to 30° right in less than two seconds. Actual FAA numbers show 1.3 seconds with the spoilers "lock to lock" for a 60° bank.

As viewed by a newcomer to the concept of roll control by spoilers, the rate of roll is excellent with flaps up and superb with flaps extended. With feet

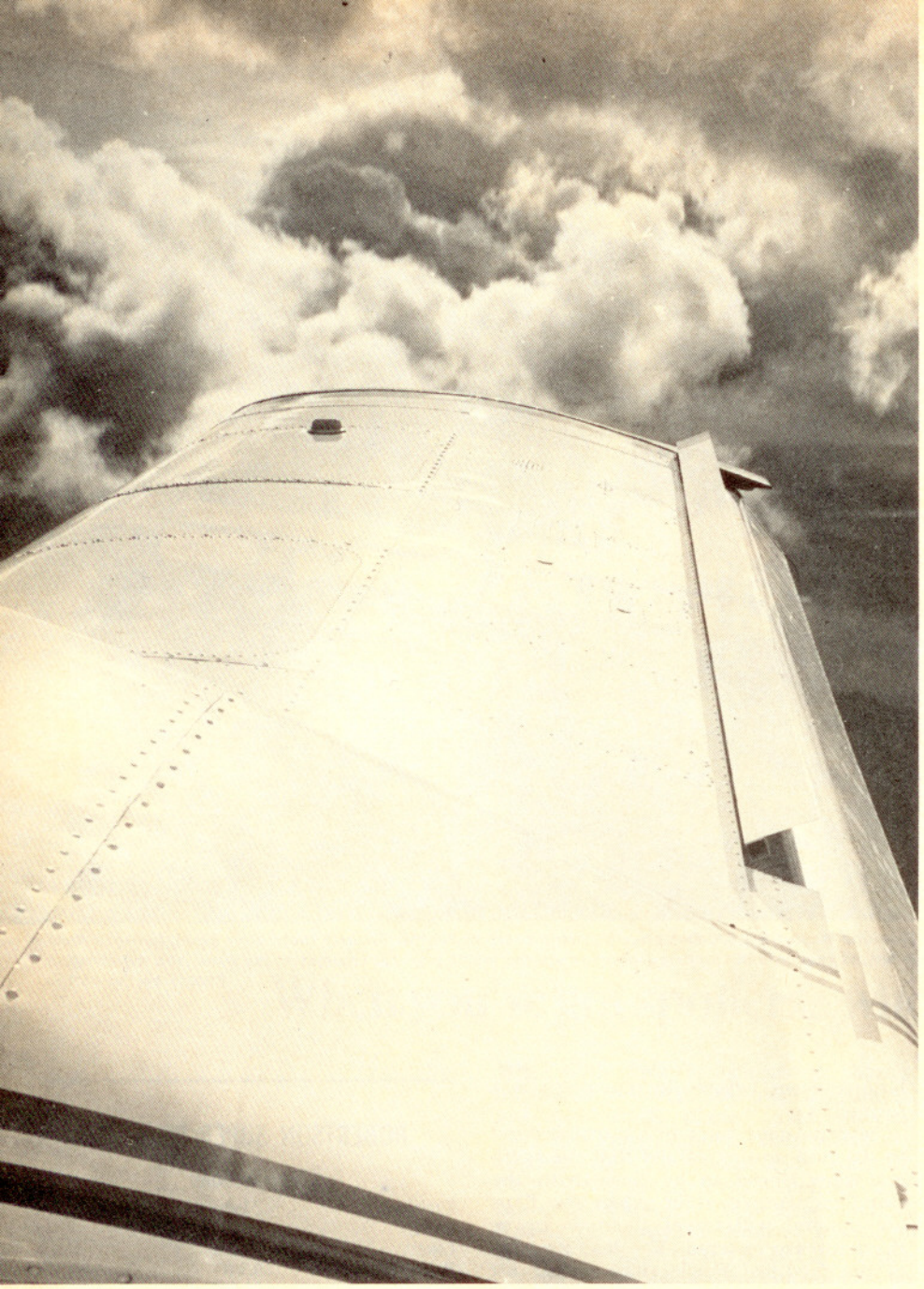
ROBERTSON SUPER SENECA I

Specifications

Engines	2 Lycoming IO-360, 200 hp
Seats	6–7
Length	28.5 ft
Height	9.9 ft
Wingspan	38.9 ft
Wing area	206.5 sq ft
Gross wgt	4,200 lb
Empty wgt	2,599 lb
Fuel capacity	100 gal
Conversion price	$8,500

Performance

Range	1,140 sm
Top speed	195 mph
Cruise, 75% power	190 mph
65% power	180 mph
Min. control speed, single engine	67 mph
Stall, gear/ flaps down	66 mph
Takeoff roll	640 ft
over 50 ft	1,050 ft
Landing roll	705 ft
over 50 ft	1,335 ft
Service ceiling:	
single engine	4,350 ft
twin engine	19,400 ft
Rate of climb:	
single engine	200 fpm
twin engine	1,460 fpm



Lowered flap and extended spoiler work together to provide excellent roll control, without adverse yaw, at low speeds.

After a series of steep turns with and without rudder application, and gear- and flap-down stalls and turns, we headed for the Bellevue (Wash.) Airport, where Robertson STOLs originated. The strip here is 2,325 feet long, with obstructions to the south. At Severns' suggestion, my first landing was a touch-and-go, and the super-efficient full-span flaps would have had me undershooting without a considerable application of power.

On my second attempt, Severns suggested that I aim for a point just a little farther down the runway. After touchdown, with the wheel full back in a complete stall, we were perhaps halfway down the strip, and I elected to make a full stop and taxi back for takeoff.

Takeoff from a standstill is good, with Vmc at 67 mph. Our rate of climb was better than 1,300 fpm, with 20° flaps, as soon as the gear came up.

SUPER SENECA I continued

on the floor and no rudder used, the "skid ball" deflected no more than an eighth of an inch in yaw when full spoiler was applied with flaps up, and perhaps a sixteenth of an inch in yaw with flaps down. This lack of adverse yaw is a result of the fact that the opening spoiler increases the frontal drag on the lowering wing, causing the Seneca to turn into that wing in a normal, coordinated turn.

With conventional ailerons, many aircraft, particularly those with long wing spans, have a problem with adverse yaw—an effect particularly noticeable in sailplanes. The drag of the lowering conventional aileron tends to swing the nose to the high side of the turn. Some manufacturers overcome this tendency by interconnecting rudder and aileron or by designing the upgoing aileron to create a comparable amount of parasite drag.

Another problem is that at high angles of attack, the down-moving aileron may tend to stall the wing rather than make it rise. This effect, sometimes erroneously called "aileron reversal," has led to some interesting spin problems in older aircraft.

In any event, none of these uncomfortable situations seem to occur with Robertson's spoilers.

If you're not familiar with the Seneca I (and I wasn't), it does sound somewhat like an out-of-tune bagpiper when it's gear-up in a stall. One steady-sounding horn is supposed to tell you that the ship is in a stall, while another warbling tone warns you the gear is still up. It takes 13 to 15 inches of manifold pressure to silence the gear-up horn, while a slight release of back pressure on the wheel will quiet the stall horn. With both horns blowing, however, it is reminiscent of two cats in springtime.

Returning to Renton, I tried something I've never done before except in a two-control Ercoupe. I made a landing in gusty air with both feet on the floor, a maneuver not really recommended by Severns. Actually, I had to cross my ankles to keep from nudging the rudders by instinct. Swirls in the water on final approach made it evident that there was turbulence, yet the "Super Seneca" kept going straight ahead without rudder application, and I made a relatively presentable touchdown and rollout without use of either rudder or differential throttle.

The following day, Robertson's chief pilot and vice president, Henry McKay, gave a brief demonstration of the no-aileron Seneca with a landing at "Black Diamond Wash," a painfully narrow private strip owned by a Robertson Cessna 210 owner. McKay said the strip was 40 feet wide and 1,600 feet long; however, recent rains had made the first 300 feet of the hillside airport questionable.

With Robertson Cessna 421 owner Bill Schmidt with us, we were approaching the Seneca's gross weight of 4,200 pounds, but McKay's demonstration was a clincher for Robertson's high-lift system.

If you happen to be the owner of one of the more than 900 Seneca I's that have been produced, you might well want to take a hard look at this new $8,500 modification.

For pressurized twins like the Cessna 421, some members of the Robertson team are already looking into a quick-descent system permitting both spoilers to be opened simultaneously, producing sink rates of 8,000 to 10,000 fpm in case of failure of the pressurization system. This relatively conventional use of spoilers has long been the primary "sink speed" control for sailplanes.

It will be interesting to see the subsequent engineering efforts on spoilers after the initial success of the no-aileron Robertson Seneca modification.

Who knows—within 10 years we may not find an aileron anywhere on new production general aviation aircraft. □

At rainy Renton Airport, Earl Severns demonstrates full (40°) flap and full (60°) spoiler extension on the Robertson Super Seneca. In cruise, spoiler and single-slotted, full-span flap fair smoothly with the wing.