SKYLANE IN THE FAST LANE

Step-by-step drag reduction improved this unique 182's cruise speed 20 knots without a powerplant change

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AOPA 447409

A genuine 182 mph Cessna 182? No kidding?

As amazing as that may sound that's just what is flying today.

This no-kidding 156-knot, 1969 Cessna 182 boasts neither an upgraded powerplant nor change to the basic Cessna airfoil.

Then how does a basically stock 138-knot Cessna 182M get into the 150-knot club?

Two words: drag reduction.

All types of drag—cooling, airframe and flat plate, to name a few—cut deeply into an aircraft's performance, yet there are only two ways to improve performance: additional horsepower or improved aerodynamics.

When fuel was a low-cost item the addition of extra horsepower was a sensible alternative.

For many years the addition of larger engines pushed aircraft faster, but the performance gain was at the expense of efficiency and economy.

Recently this trend in aircraft performance has shifted slightly away from the use of larger engines and toward the use of aerodynamic and powerplant improvements.

With the introduction of the models 201 and 231, Mooney Aircraft Corporation achieved major speed increases by improvements in overall aerodynamics changing cooling, intake and exhaust flow paths and the addition of high-efficiency turbocharging. Speed was increased sharply in the 201 without an increase in horsepower, and the 231 uses both improved aerodynamics and turbocharging to boost both performance and capability.

Gulfstream American's line of single-engine aircraft also benefited considerably from a drag reduction program engineered and implemented several years ago.

Bellanca Aircraft Corporation also made a number of improvements to its Super Viking line. The 1980 aircraft are 11 knots faster than the 1978 models with no change in powerplant.

As these and other manufacturers look to drag reduction for additional performance, other individuals are working to develop drag-reducing modifications that may be used to improve the performance of older aircraft.

One pair of pioneers in this field of design and retrofit work is Charles M. (AOPA 355532) and Julia K. Seibel of Arlington, Texas.

The Seibels started with a completely stock Cessna 182M, and, through approximately 300 hours of development and flight testing, turned the 182 into a performer capable of keeping up with a more expensive Cessna 182RG. Seibel's modified 1969 182 has a 156-knot maximum cruise speed, and the 1980 182RG has a reported maximum cruise speed of 158 knots.

The modified aircraft has a strictly stock powerplant. The performance gain is the result of aerodynamic improvements.

Where did the Seibels start? ". . . by looking at places on the aircraft where we felt we would have separated or stalled airflow," Charles Seibel said. Separated or stalled airflow causes very rapid drag rise around landing gear struts, wing struts and other areas where structural members disrupt the smooth flow of air.

The Seibels' ability to get quickly into the modification program was the result of an earlier experience with a Cessna 172. During so-called hobby work on the 172A, the aircraft, through various airframe modifications and installation of a 180-hp engine, was turned into a 172 capable of *cruising* near the structural red line.

Seibel, who heads the New Product Center at Bell Helicopter Textron, said work on the 182 was done in steps to permit measurement and documentation of performance gains achieved by each change along the way.

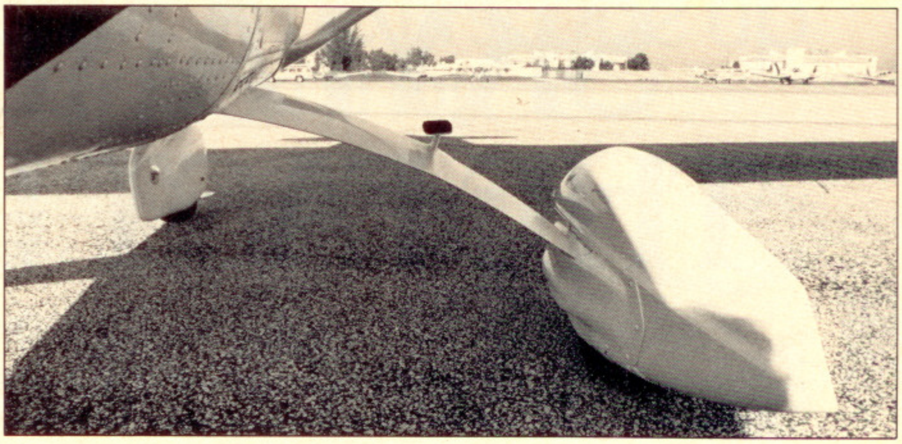
After installing a special, highly accurate flight-test airspeed system, Seibel conducted a series of tests to establish baseline performance figures for the unmodified aircraft.

First, a streamlined nose gear kit was installed on the 182. The kit uses a redesigned nose wheel pant, strut fairing and torque links that fold into the fairing assembly accommodating normal strut movement.

In addition to improving both airflow and appearance of the nose gear area, the kit actually provides "a little thrust when installed," Seibel said.

"The corkscrew effect of the prop wash pouring under the nose of the aircraft has the airflow very disturbed. The design of the streamlined assembly straightens the airflow path improving propeller efficiency through airflow control," Seibel said.

The complete nose gear kit adds 3½ lbs. to the aircraft's empty weight and 6 knots to the cruise speed.



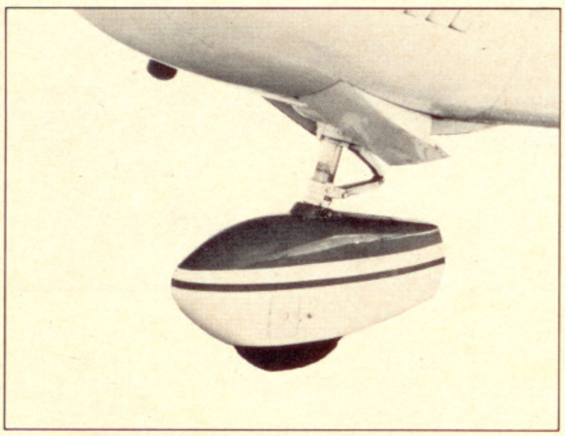
The standard main gear-strut and wheel pants had a very high drag factor, but the streamlined fairing and modified wheel pants cut that loss almost 75%.

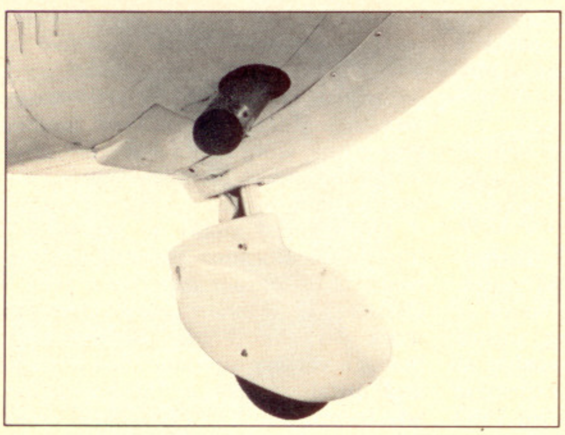
(The streamlined nose gear kit is the only portion of Seibel's modification work that is commercially available. The unit is list priced at $1285, and can be obtained from Avcon Industries, 1006 West 53 Street, Wichita, Kan., 67204. The kit is approved by the FAA under STC No. SA2748SW.)

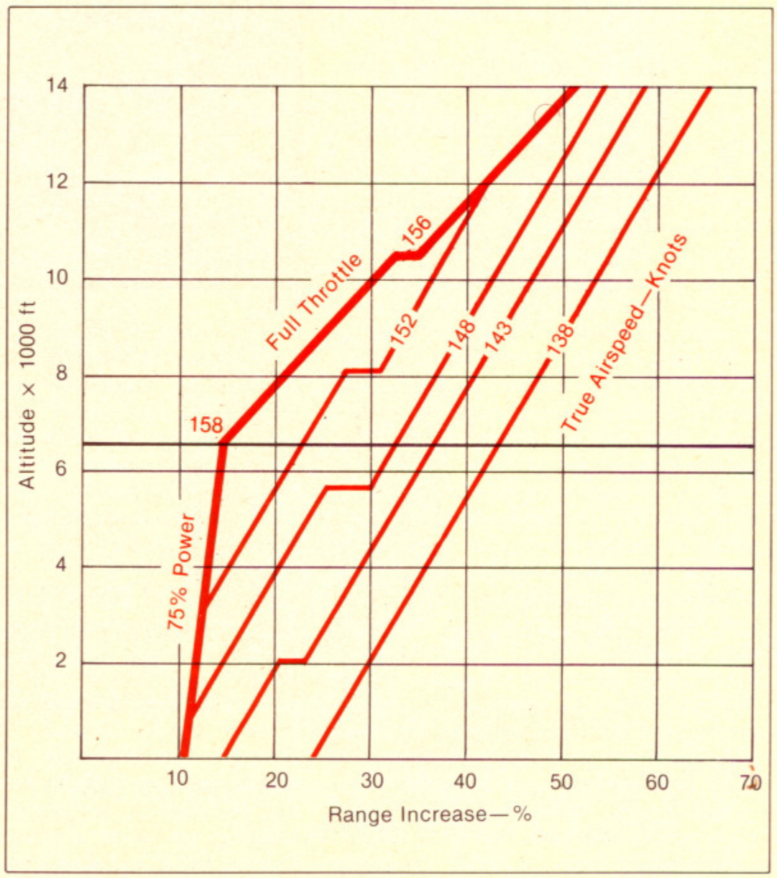
After completing work and flight evaluation of the nose gear assembly, Seibel made a general cleanup of the aircraft, including reattachment of cooling baffles and reexamination of door and window fit, which added another 2.2 knots to cruise speed.

Seibel then started working to improve airflow around the main gear structure. Restressing his point about separated airflow and drag rise, Seibel said testing showed a high amount of airflow disruption in the main gear strut and wheel areas.

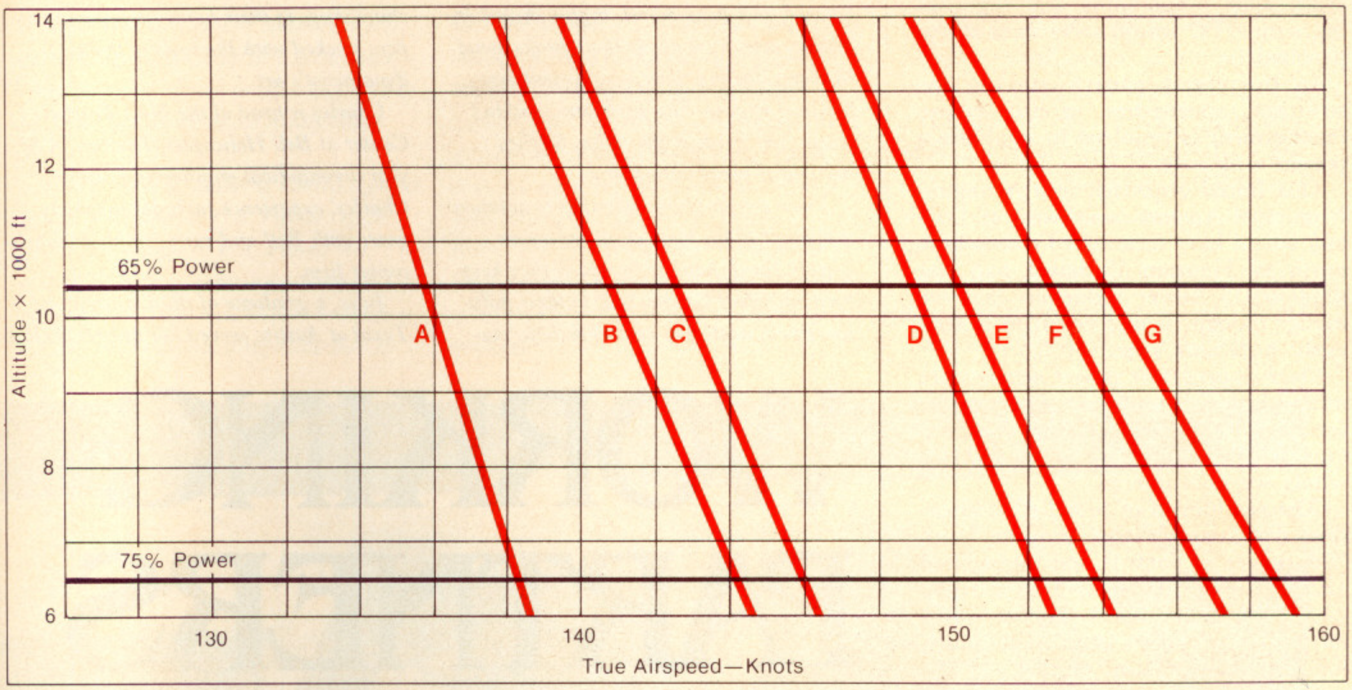
"Once we got involved in the main gear, wheel pant and strut design, it was obvious that we could achieve a







Poor airflow characteristics around the Cessna's cowling and nose gear structure (upper left) generated a good deal of drag. A streamlined nose gear-strut and fairing (lower left) improved airflow and propeller efficiency. The complete modification package improved the aircraft's range by as much as 53%. The chart (right) shows the range increased as a function of speed and altitude.



Baseline performance figures were established for the standard 182 (Line A) by early 1978. The streamlined nose gear was added and flight tested (Line B) during April and May 1978. Performance gains from a cleanup of window fit and cooling baffle attachment were documented in November 1978 (Line C). The streamlined main gear-struts and revised wheel pants were flight tested in July 1979 (Line D), and the flap and aileron gap seals were tested for performance in August (Line E). Modified wing-strut attachment fairings, exhaust stack and spinner seals were flight tested in October 1979 (Line F). Final modifications (Line G) included movement of radio antennas, avionics cooling scoop removal and prop blade gap seals. These were installed and flight tested in December 1979.

good deal of drag reduction if we could improve the flow around the strut and over the wheel pant area.

"After working through two designs on strut and wheel fairings, we settled on the set currently on the aircraft," Seibel said. The 182 now has a complete Fibreglas fairing over the leaf gear strut, a new step, a set of Cessna wheel pants modified to fit tighter around the wheel and a cap that covers the brake assembly.

These changes and a set of modified wing strut attachment cuffs raised the 75% power cruising speed of the modified aircraft to just over 145 knots at 6500 ft.

Seibel's gear strut fairings would not fit newer 182's with tubular main gear struts. The wing strut attachment cuffs, however, do fit current production aircraft.

Reducing the main gear drag played a major role in the Seibels' performance gain. The stock leaf spring landing gear, according to Seibel, contributes 33% of the fixed gear 182's total airframe drag of 106 lbs. of the total 326 lbs. The modifications reduce landing gear drag to only 29 lbs.

Other aerodynamic improvements include a set of B&M Aviation, Inc., flap and aileron gap seals, repositioning of nav/com antennas, closure of the gap between exhaust stack and cowling and installation of a set of brush seals to control air leakage around the prop and spinner.

What have these improvements done to the flying qualities of the popular Cessna? Very little. The modified 182 flies very much like any 182.

The changes are obvious in examination of the gear, wheel pant and wing strut areas. Little changes made by removal of avionics cooling vents, antenna repositioning and capping the fuel filler necks are also noticeable.

There are two problem areas as a result of these changes. The tightly enclosed gear raises the first question: what happens in mud, snow or slush?

Seibel does not have an answer. "We just don't have any experience in either mud or snow with an equipped aircraft. However, we do have a mud wiper built into the wheel pant that should go a long way toward taking care of any potential problems," Seibel said.

The cover over the brake assembly is the second potential problem. It would have to be removed to get a good look at the caliper assemblies.

Engine start, runup and taxi and takeoff are conventional 182 as is the somewhat heavy nose gear steering.

On departure the modified aircraft's acceleration and initial climb are brisk. In our flight the aircraft indicated a 700 foot per minute climb with two persons onboard and a near-gross-weight departure.

Installation of the flap and aileron gap seals make the modified aircraft comfortable in slow flight and stall regimes. The aircraft maneuvers easily in slow flight, and warning from elevator and aileron buffet provides ample advance notice before the aircraft shows any tendency to stall. The stalls we did were straightforward with no tendency to fall off to either side.

While moving back into the airport traffic area, one of the modified 182's potentially annoying habits cropped up. It was difficult to get the aircraft to descend quickly without allowing airspeed to build well into the yellow arc unless power reductions that might shock cool the engine were made.

The modified 182 glides better than either the fixed or retractable 182 in similar configurations. In fact, Seibel says an additional 10° of flap is needed to make the modified aircraft descend like an unmodified aircraft using similar power settings. This corresponds with my experiences in the 182RG and the modified aircraft.

Being caught in a "Keep 'em high" position high and close to the airport or approach fix could create unnecessary cockpit workload. On the other hand, familiarity with the aircraft, some preplanning and negotiating with ATC would solve most of the problem.

In the visual pattern and on instrument approaches careful power management is required to establish a proper sink rate.

Our initial approach into Arlington Municipal Airport (southwest of Dallas) would have terminated somewhere north of Houston if Seibel had not suggested a power reduction that we earlier thought would result in a seriously high sink rate.

Once appropriate power settings are established, 75 to 80 knots over the fence provided comfortable landings even in the 18 to 25 knot quartering winds we encountered.

The real payoff of Seibel's modifications demonstrates itself en route. With 75% power at 6500 ft. the unmodified 182 cruised at 136 knots TAS burning 14.3 gallons per hour. The modified aircraft trued at 156 knots while burning the same amount of fuel.

Covering the same distance more quickly while burning the same amount of fuel gives the modified aircraft a 14% range advantage.

The conventional 182 flies 9.51 nautical miles per gallon (nmpg); the modified aircraft gives 10.9 nmpg.

The dramatic difference in range and fuel consumption comes when the modified aircraft's aerodynamic capability is used to establish a 136-knot cruise at higher altitudes.

While the unmodified 182 cruises at 136 knots using 75% power at 6500 feet, the modified aircraft cruises at 136 knots at 10,200 feet using 49% power. The modified aircraft burns 9.33 gph, while the unmodified burns at 14.3 gph.

The modified aircraft has a 17.04 nmpg rate of fuel consumption at the higher altitude, a 53% improvement over the unmodified aircraft's 9.51 nmpg rate.

What about cost? Seibel says he could add his performance-boosting modifications to older 182's for approximately $150 retail for each nmph gained. If he should decide to build and market a complete package, it would cost about $3000; however, that decision has not been made.

The one-of-a-kind aircraft offers the Texas engineer a choice of the best of both performance worlds. He can storm along at over 150 knots and still realize a 14% improvement in fuel economy and a 20 knot speed advantage over conventional 182's, old or new; or he can climb higher, throttle back, cruise at the same speed that conventional aircraft work to carry at lower altitudes and enjoy a 53% increase in range. □

Charles and Julia Seibel, highly skilled engineers who have spent their professional lifetimes dealing with complicated aeronautical engineering problems, couldn't leave their work at the office. So they brought it home with them.

Their personal commitment to aviation is evident to the most casual observer —from the T-hangar in which they keep their modified Cessna 182, to their fully equipped, neat-as-a-pin workshop/machine shop, to their home engineering offices stocked with the tools of the aerodynamicist's art.

Charles is head of the New Product Center at Bell Helicopter Textron. A 37 year aeronautical engineering veteran, Charles' experience includes his many years with Bell and running his own helicopter firm.

Julia, a graduate of the University of Texas at Austin, served her apprenticeship

WORKING PARTNERS

Julia and Charles Seibel, a pair of incurable tinkerers, developed the modification package as a joint effort.

Extensive testing established drag characteristics of the aircraft. Julia applies tufts of yarn prior to a test of the main gear and wheel pants.

at Trans World Airlines, Southwest Research Corporation and Bell Helicopter before being promoted to chief engineer of the Seibel family airplane modification shops.

In fact, Julia K. Seibel is named right at the top of an official U.S. Patent Office form as the holder of U.S. Patent No. 4,027,836, a drag-reducing fairing for landing gear. Julia's invention occupies a key spot in the Seibel drag-reduction efforts that turned a very dovish Cessna 172 into a 140-knot performer and a 1969 Model 182 into a 156-knot racehorse.

Now, why does a man who spends most of his working hours monitoring, prodding, pleading and pressing the work of some 300 engineers and craftsmen at Bell's New Product Center come home to labor over and swear at an additional stack of aeronautical riddles and aerodynamic problems?

"I like the work," Seibel confesses. "When I moved upstairs at Bell and couldn't keep my hand in the development of individual projects, I struck out looking for something to keep creatively busy; and with my aeronautical background, what better way to keep busy than to fool with airplanes?"

Fool indeed! The Seibels' approach to their work is anything but fooling, and the results certainly are no joke.—PVO

Both Julia and Charles Seibel are private pilots, and they use their modified Cessna 182 for business and vacation travel.

Draping Fibreglas on the tooling, Charles Seibel starts work on the lower half of a main gear-strut fairing and step.

Julia Seibel holds a patent on the streamlined nose-gear pant and fairing assembly utilized on the modified aircraft.