PIPER MALIBU

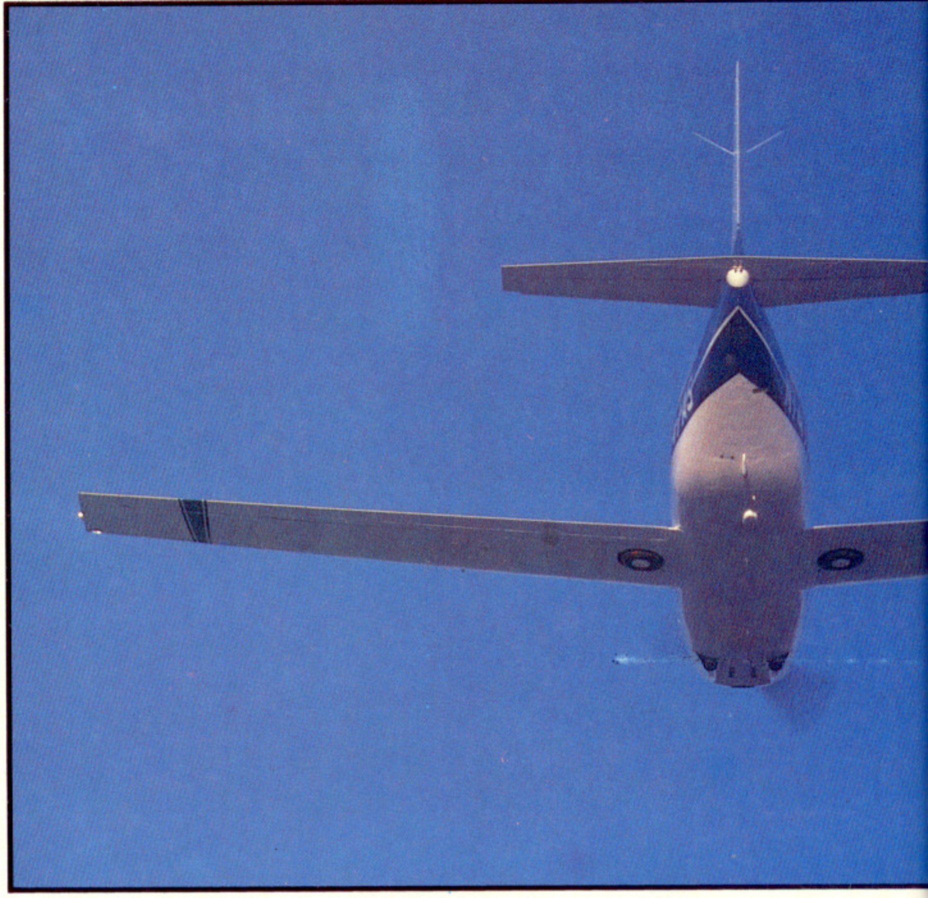
Vero's hero, one year old

BY THOMAS A. HORNE

The Piper Malibu, the most significant new single-engine airplane design to hit the market, continues its sales success. Since the airplane's introduction in the fall of 1983, Malibus have been leaving Piper's Vero Beach, Florida, factory at a fairly steady rate of 10 per month. It appears that the market for pressurized single-engine airplanes is alive and well.

A large part of the Malibu's success can be attributed to its advanced design methodology and its new engine technology (see "The Malibu Makes It," February 1984 *Pilot*, p. 24).

Piper's use of computer-assisted design/computer-assisted manufacture (CAD/CAM) has been beneficial also. Computers nearly have done away with the old-fashioned drawing-board-and-T-square approach to industrial design and, with it, the costly expenditure of many man-hours. Parts fit better, tolerances are narrowed, and reliability is enhanced through the use of computer modeling.



The Malibu's extensive use of metal bonding provides high strength with less weight and helps the airplane's appearance, too. There are few rivets and the airplane's lines are smoother.

The Malibu's engine—a Teledyne Continental TSIO-520-BE—has been specifically designed for low fuel consumption during high-power, high-altitude operations.

Its intercoolers act as radiators, cooling the hot, compressed air that the turbochargers send through the intake manifold. When air leaves the turbochargers' compressors, its temperature can reach 375°F. The intercoolers lower that temperature to approximately 175°F. This results in better cooling and a reduction of the heat-related wear and tear on the engine's internal components.

The Malibu in cruise must operate at a mixture setting 50 degrees lean of peak turbine inlet temperature (TIT—a measurement of the exhaust temperature as it enters the turbochargers' turbine housings). This is a limitation. Run the engine as most would be tempted—at 50 degrees rich of peak—and you will subject the engine to damaging high temperatures and internal pressures.

The lean-of-peak procedure is designed for maximum power and fuel efficiency with minimal exhaust temperatures. At cruise settings of 75-percent power or less, enriching the mixture above the recommended value will result not just in higher fuel flows, but in a detrimental boost in power. For example, at the Malibu's normal, 75-percent power setting, a too-rich condition can boost the engine to 80-percent power and beyond.

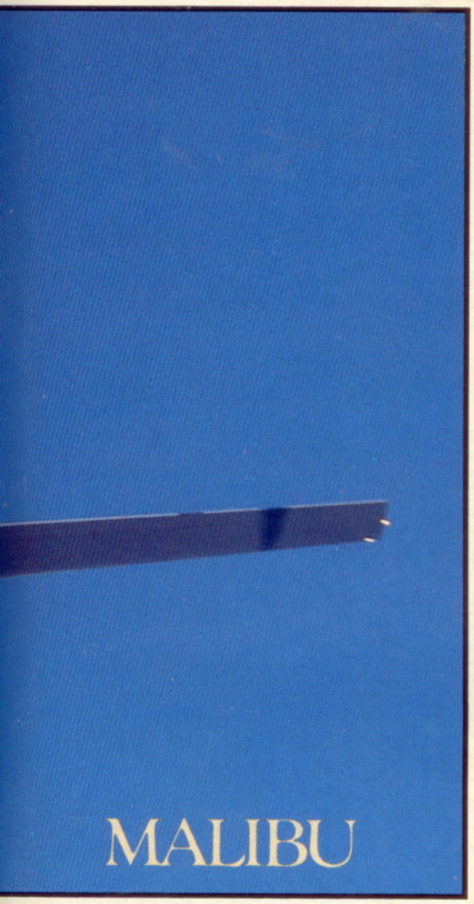
There are other features designed especially for high altitude operations. A two-stage, engine-driven fuel pump ensures that there is sufficient fuel pressure to prevent fuel flow fluctuations at high altitudes, a common problem in some other piston singles and twins. Pressurized magnetos prevent high-altitude arcing and misfiring.

Continental seems content with this very specialized variant of its 520-series engine. In spite of the new technology and the non-standard leaning procedure, the company recommended a 2,000-hour time between overhaul (TBO) of the engine from the outset of the Malibu program.

New certification requirements brought about some significant safety improvements. Those parts of the exhaust system located near flammable fluids have been shielded with aluminum guards. A battery-feeder circuit breaker can be pulled to prevent the alternators from feeding electricity to a short-circuited battery. A new lightning protection circuit (with its own circuit breaker) incorporates a varistor that only conducts electricity at very high voltages. Should a lightning strike send a voltage spike through the airplane, the lightning-protection circuit instantly grounds the main electrical bus to the airframe, sparing the electrical system from major damage.

Lightning protection also is provided for the fuel system and the nose bowl. The fuel caps and drains have been designed to eliminate the chance of arcing. The nose bowl is made of Thorstran, a lightweight composite embedded with a conductive, woven metal mesh. Wing-tip caps, traditionally made of non-conductive fiberglass, have been replaced in the Malibu with aluminum. (For more information on lightning protection, see "Skyvolts," August 1983 *Pilot*, p. 70.)

Another safety feature is the Malibu's emergency bus. Should the alternator(s) fail, the pilot can engage a battery-powered emergency bus that drives much of the essential electrical equipment needed to safely complete a



CAD/CAM, metal bonding, a specially-designed engine and new configuration rules are behind the Malibu's glamour image.

flight, even in instrument meteorological conditions.

The ice-protection system has some unique aspects, too. The deice boot inflation cycle is divided into three six-second segments. This is not unusual, but the wing-boot inflation method is. The wing boots inflate in two stages: First the lower halves of the boots inflate, then the upper. Piper tried 12 different design combinations before finding one that could remove all ice accretions from the leading edges.

The fuel vents have passive anti-icing. The vents are recessed in the underside of the outboard wing panels. Supercooled droplets flow past the recessed areas without adhering.

The cost of the deicing option is $19,880, and it includes dual pneumatic pumps and dual alternators. Thus equipped, the Malibu is approved for flight in known icing conditions.

With all the Malibu's innovations one might expect a good share of problems as the new airplanes pass through the shakedown phase. There have been a few. Twelve service bulletins have been issued on the Malibu. Piper considers compliance with service bulletins mandatory.

One service bulletin, number 781, requires that the rudder cable be checked for misrouting over a cable guard. In one case, a mis-routing caused a rudder cable to fail. Another bulletin, number 786, gives mechanics instructions on how to prevent the toe brake cylinders from sticking after brake release.

A report of a nose-gear steering/rotator horn failure gave rise to bulletin number 793, which contains instructions for reworking the part. The Malibu's nosewheel rotates 90 degrees as it extends and retracts. In one incident, the nosewheel remained in the 90-degree position during an approach and landing.

Perhaps the most serious and burdensome service bulletin is number 803. Some Malibu deice systems have had their pressure control valves seize. When this happens, the deice boots will not inflate. The service bulletin requires the disassembly, cleaning and adjustment of the valve every 25 hours. Carbon dust from the pneumatic pumps combines with a waxy residue from the lining of the pneumatic hoses to foul these valves, according to Piper.

Another substantial service bulletin is number 796, which requires replacement of certain lower and upper spar-cap wing rivets. This should have been performed within 100 operating hours of the bulletin's issue date, which was August 20, 1984.

Other bulletins deal with inadvertent illumination of the oxygen-system annunciator light (number 791), electric fuel pump circuit modifications (number 794) and a modification of the landing gear control to prevent inadvertent gear retraction (number 799).

Of the Malibu's eight service letters (compliance not considered mandatory by Piper), several indicate potential problems worthy of mention: passenger seat pan cracking (number 976); shearing door step linkage rods (number 973); failures and cracking of engine baffles (number 971); and poor fits of lower halves of cabin doors (number 967).

The Malibu's 17 service difficulty reports show two vague patterns. One concerns defective electrical parts—avionics power cables, shorted battery-connector diodes and stuck starter contacts. The other concerns cracking engine components. Cracks have been found in an oil cooler mount flange, two intercooler mounting flanges and in turbocharger inlets and transition tubes. One report warns of a problem familiar to many owners of earlier Malibus: The magneto switch guards can contact the starter switch during a magneto check. Newer Malibus have magneto guards hinged at the bottom which lessens the chance of inadver-

tently bumping the starter switch.

There is only one airworthiness directive on the Malibu, and it antedates the airplane. It deals with the Hartzell propeller, and requires its overhaul at 1,500-hour or five-year intervals.

Owners, by and large, are not complaining. The airplane has too many virtues to dwell on shortcomings. Malibu owners say that the airplane lives up to its advertising claims and that it serves well as an upscale alternative to higher-cost piston twins and turboprops.

The performance is superb. At the nominal cruise altitude of 25,000 feet, the Malibu at 75-percent power turns in 215 KTAS (210 KTAS if deice boots are installed). Fuel burn is approximately 16 gph and range is just over 1,325 nm. At lower power settings, range and endurance push human limits. At 55-percent power and 25,000 feet, for example, range is 1,550 nm and endurance is eight hours. A relief tube is a $345 option.

Control feel is quite light and responsive, considering the Malibu's long wingspan and high aspect ratio. Control harmony is well balanced. The wing's efficiency is apparent immediately in several basic procedures. In slow flight, pilots will see that very little power is needed to maintain level flight. Hold the manifold pressure at 15 inches, and the airplane will continue to cruise at approximately 100 knots. During the roundout and land-

MALIBU IN THE CHIPS

What kind of person buys a new Malibu? More often than not, it is an official of a profitable, expanding small business—for example, Art Sherman of Frederick Computer Products, based in AOPA's home town of Frederick, Maryland. Sherman's Malibu, N747AS, is featured on the cover of this month's *Pilot*.

Sherman's business career has been remarkable. After 25 years with IBM, he started a Piper dealership—Frederick Piper Sales—and became the fixed-base operator at the Frederick Municipal Airport. Initial investment: $5,000.

In 1979, he sold Frederick Piper Sales to the current owners for $720,000. Then he reinvested his earnings and started Frederick Computer Products. In his first year of business selling computer hardware and software, he grossed over $800,000. In each subsequent year, he doubled his gross income, staff and inventory. In 1983, his gross receipts were $17 million. In 1984, the figure climbed to $32 million, and Sherman began construction of a larger office building.

He bought his Malibu in November 1984, and he mainly uses it to fly to Pittsburgh, Pennsylvania, and Middletown, Ohio. Sherman praises his airplane's virtues unabashedly, claiming it is an indispensable aid. Says it's fun to fly, too.

Taking advantage of his computer knowledge, Sherman has developed his own programs for his Malibu. He loads his performance data into his desk-top Apple Macintosh XT's memory, then programs his most commonly flown routes. After a weather briefing, he feeds winds aloft information to the computer. Out come the optimum altitudes for each route, fuel burns for each segment, ETEs, ETAs, distances and times remaining. The next steps are printing the stored information, filing it in his flight plan and taking the paper copies to the airplane. —*TAH*

Art Sherman, president of Frederick Computer Products and Malibu owner/pilot.

ing flare, the airplane can float excessively if normal approach airspeeds are used. The short-field landing procedure involves mushing in at idle power with full flaps, holding 77 KIAS on a steep approach profile.

The stall is very mild. Stall strips ensure that the center sections of the wing stall first. There is no washout in the Malibu's wings, and pitch stability is augmented by an elevator downspring. At airspeeds below trim speed, the spring exerts a nose down force. If the pilot wants to fly at lower and lower airspeeds, he must pull harder and harder on the control column as he fights the downspring.

Without the downspring, the Malibu's pitch control would be too light and responsive near the stall in order to meet the FAA's certification standards. The downspring makes certain that the nose trends downward before the stall. To the pilot, behavior near the stall resembles that of any other single-engine airplane.

A rudder-aileron interconnect is installed to enhance roll stability. The Malibu has a relatively small amount of dihedral (4.5 degrees) and no differential aileron travel. To meet certification guidelines, an interconnect was needed to provide coordinated roll responses with yaw inputs. The interconnect is noticeable during the takeoff run and landing roll. Nosewheel steering is extremely sensitive, particularly if holding aileron into a crosswind.

Less conventional is the leaning procedure. With a little practice, though, it becomes easy to set power. The recommended procedure for 75-percent power is to make an initial setting of 31 inches of manifold pressure, 21-gph fuel flow and 2,400 rpm. After waiting a few seconds to let things settle down, slowly begin leaning until the TIT gauge reaches peak temperature. Continue leaning until you have a 50-degree temperature drop. This works out to a fuel flow of approximately 16 gph. Maximum allowable continuous TIT is 1,750°F. If there is engine roughness at this setting, reduce throttle slightly—do not enrich the mixture.

Above critical altitude (the altitude at which the turbocharging system's wastegate is closed—approximately 23,000 feet), setting the mixture takes finesse. As the mixture is leaned, manifold pressure will rise. The pilot must jockey the throttle and mixture until the proper setting is established.

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MALIBU U

The Malibu is an easy airplane to fly, but it is sufficiently complicated to warrant a session at Piper's Vero Beach, Florida, training center. There, Piper periodically conducts a two-day training program for pilots making the transition to the Malibu. The course is free to purchasers of Malibus and their crews; for others, it is $500. *Pilot* senior editor Mark M. Lacagnina and I attended the session held January 21 and 22, 1985.

The first day and a half of the course consists of nine classes on the Malibu's systems and procedures. These are valuable because Piper's training staff can impart the latest information about systems operation and maintenance. For example, Piper Training Center personnel recommend a full-power climb at 38 inches manifold pressure and 130 KIAS. Though the Malibu operating handbook advocates a 35-inch manifold pressure and 115 KIAS (five knots above the 110-knot best rate of climb speed), our instructors said that the engine runs cooler at the higher climb setting, without any degradation in climb rate. These and other operational tips allow Malibu pilots to extract more performance from their airplanes.

While it is possible to learn about the airplane from the operator's manual, the classroom environment permits the greatest exchange of learning and a higher retention rate. Another advantage is that operators can exchange information about the airplane's characteristics.

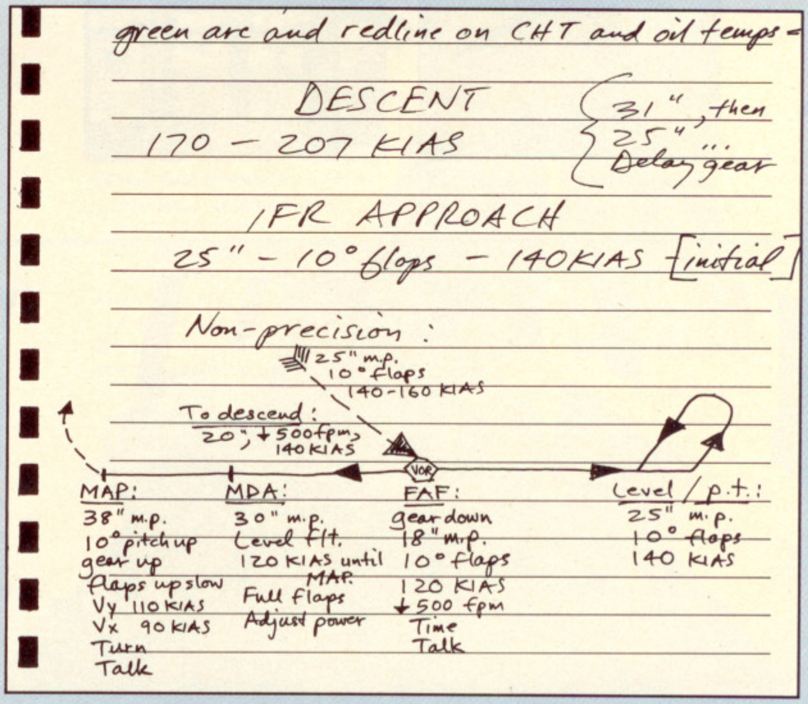
At the end of the second day, pilots put what they have learned into action. Piper instructors accompany the trainees on a familiarization flight. This lasts a minimum of two hours and covers all normal and emergency procedures.

Our instructor, Training Center manager Robert Scott, was especially helpful in pointing out certain target power settings for various IFR procedures. Initial portions of an instrument approach should be flown with 25 inches manifold pressure and 10 degrees of flaps. This yields approximately 140 KIAS. To descend, reduce power to 20 inches manifold pressure for a 500-fpm descent at the same airspeed. At the final approach fix inbound, lower the gear and reduce power to 18 inches. This produces a 500-fpm descent at 120 KIAS.

(Our flight check airplane, N4375P, is owned by Robert Newton, AOPA 853583, of the Newton Development Corporation in Lufkin, Texas. He generously allowed us to spend four hours training in his airplane. Usually, owners must bring their airplanes to the training center.)

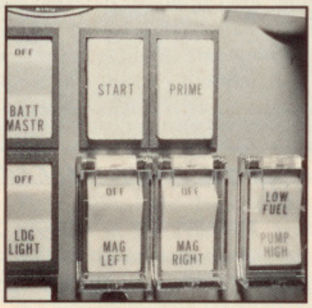
Piper has scheduled Malibu training through June 1985. Courses are scheduled for March 25 through 28, April 29 through May 2, May 20 through 23 and June 24 through 27. Additional course dates will be determined this spring.

To sign up, contact the Piper Training Center, Piper Aircraft Corporation, Vero Beach Division, Vero Beach, Florida 32960; telephone 305/567-4361. —*TAH*

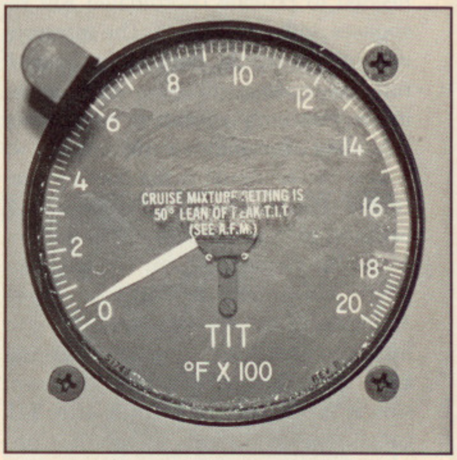


Extract from a student's notebook. At Malibu U, knowledge goes beyond the handbook.

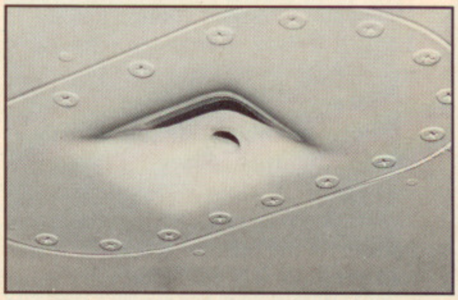
Fuel selector arms two-speed fuel pumps submerged in each wing tank.



Original magneto guards can hit the starter, and have been replaced.



TIT gauge replaces an EGT. Here, TIT measures ambient conditions—40°F.



Fuel vents incorporate passive anti-icing. Recessed design lets droplets flow by.

The airplane has been designed principally to operate at 75-percent power. This is the setting that provides the best specific fuel consumption, the best engine cooling and the best cabin heating. For short flights at lower altitudes, Piper recommends a setting of 25 to 28 inches of manifold pressure, 19 gph and 2,300 rpm.

The Malibu's cockpit is well designed and as spacious as that of many cabin-class twins. Storage pockets for charts, approach plates or check lists are installed in the sidewalls. The seats are comfortable, visibility is good, and noise levels are low, partly because of the pressurized cabin and partly because of the insulation provided by the nose baggage compartment. The instruments and switches are well-arranged, with the exception of the auxiliary fuel-pump switch. It is hidden from view, directly below the pilot's control column.

MALIBU

Technological improvements have stronger appeal than cosmetic changes. Consumers will not accept sluggish engineering.

The landing gear and flap controls are buried deep in their detents. It takes a healthy yank to unseat them, and it is possible to nudge the throttle when operating the gear lever.

A complete King avionics package is standard. This includes a King KAP 150 flight control system with longitudinal electric trim and compass slaving for the horizontal situation indicator. A full range of optional avionics, including Sperry WeatherScout I color radar, a 3M Stormscope, Texas Instruments' TI9100 Loran C and a Wulfsburg Flitefone V is available.

The passengers are not neglected, either. The dimensions are those of a cabin-class twin. There is very little cabin taper, so passengers have more room. With the optional writing table and refreshment and storage cabinets, the ambience is businesslike—it gives the illusion of a much larger airplane.

At a base price of $300,000, though, one would expect something more than a run-of-the-mill airplane. A more realistic sales price, one reflecting the

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operational realities of an airplane of this class, would be in the neighborhood of $380,000. The Malibu's competition—the pressurized Cessna P210—sells for approximately $50,000 less when comparably equipped. Still, with more than 120 total sales of the airplane, the Malibu seems to have secured a strong niche in the pressurized-single marketplace.

The reason? The Malibu's technical innovation, styling and ergonomics come together in a revolutionary new package. The airplane captures the imagination of those who have been numbly watching a steady annual stream of reconstituted 40-year-old designs. The buyer's conscience is changing, too. If he is to pay $300,000 for a single-engine airplane, he had better get his money's worth—in both performance *and* image.

Here, perhaps, we draw a lesson from automotive history. If we can learn anything from Detroit's inability to compete with imports from Europe and Japan, it is that sophisticated consumers no longer will accept sluggish engineering. Cosmetic alterations no longer play such a large part in a purchaser's decision. Technology—and a vision of the future—does. □

MALIBU

Designed for speed and economy at altitude

Piper PA-46-310P Malibu

Base price $300,000

AOPA Pilot Operations/Equipment Category*: All-weather $357,040 to $389,365**

**Price includes required equipment for all-weather flight if known icing certification is required

Specifications

Powerplant	Teledyne Continental TSIO-520BE 310 hp 2,600 rpm
Recommended TBO 2,000 hr	
Propeller	Hartzell, two-blade, constant speed, 80 in dia
Length	28 ft 4 in
Height	11 ft 3 in
Wingspan	43 ft
Wing area	175 sq ft
Wing loading	22.3 lb/sq ft
Power loading	12.6 lb/hp
Seats	6
Cabin length	12 ft 4 in
Cabin width	49.5 in
Cabin height	47 in
Empty weight	2,606.9 lb
Empty weight as, tested	2,772 lb
Max ramp weight	4,118 lb
Zero fuel weight	3,900 lb
Useful load	1,509.1 lb
Useful load, as tested	1,344 lb
Payload w/full fuel	789.1 lb
Payload w/full fuel, as tested	624 lb
Max takeoff weight	4,100 lb
Max landing weight	3,900 lb
Fuel capacity, std	732 lb (720 lb usable)
Baggage capacity	
Forward	100 lb, 14 cu ft
Aft	100 lb, 20 cu ft

Performance

Takeoff distance, ground roll	1,750 ft
Takeoff distance over 50-ft obst	2,550 ft
Max demonstrated crosswind component	17 kt
Rate of climb, sea level	1,100 fpm
Max level speed	
Sea level	183 kt
23,000 ft	234 kt

Cruise speed/Range w/45-min rsv, std fuel (fuel consumption, ea engine)

75% power, best economy	
25,000 ft	216 kt/1,327 nm (96 pph/16 gph)
10,000 ft	186 kt/1,205 nm (96 pph/16 gph)
65% power, best economy	
25,000 ft	206 kt/1,420 nm (84 pph/14 gph)
10,000 ft	173 kt/1,295 nm (84 pph/14 gph)
55% power, best economy	
25,000 ft	195 kt/1,555 nm (72 pph/12 gph)
10,000 ft	160 kt/1435 nm (72 pph/12 gph)
Max operating altitude	25,000 ft
Max pressure differential	5.5 lb/sq in
Landing distance over 50-ft obst	1,780 ft
Landing distance, ground roll	1,175 ft

Limiting and Recommended Airspeeds

Vx (Best angle of climb)	90 KIAS
Vy (Best rate of climb)	110 KIAS
Va (Design maneuvering)	135 KIAS
Vfe (Max flap extended)	
10 degrees	170 KIAS
20 degrees	135 KIAS
36 degress	120 KIAS
Vle (Max gear extended)	200 KIAS
Vlo (Max gear operating)	
Extend	170 KIAS
Retract	130 KIAS
Vno (Max structural cruising)	173 KIAS
Vne (Never exceed)	203 KIAS
Vr (Rotation)	77 KIAS
Vs1 (Stall clean)	69 KIAS
Vso (Stall in landing configuration)	58 KIAS

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, at sea level and gross weight, unless otherwise noted.

**Operations/Equipment Categories are defined in June 1984 Pilot, p. 108. The prices reflect the costs for equipment recommended to operate in the listed categories.*