PIPER MALIBU MIRAGE

# THE PA–46: A DOZEN YEARS AFTER

*Turboprop-like performance and comfort at a fraction of the price*

BY THOMAS A. HORNE

THE Piper Malibu Mirage is as close as you can come to a "no excuses" piston single. Its 350-horsepower Lycoming TIO-540 engine lets you cruise at altitudes up to 25,000 feet and true airspeeds as fast as 225 knots. With a full load of fuel and a long-range cruise power setting, Piper claims the Mirage can fly three people about 1,450 nautical miles and land with IFR fuel reserves. At high-speed cruise, maximum range is a respectable 980 nm. ■ New Mirages come with known-icing certification and a Bendix/King RDR-2000 color weather radar, complete with vertical profiling capability. Add lightning detection equipment and you've got a fighting chance at dealing with most adverse weather. ■ The latest Mirages have an extensive roster of standard equipment, including a whole slew of AlliedSignal avionics, complete with slaved compass, KC-291 yaw damper,

KFC-150 flight control system, and KAS-297B altitude alerter and vertical speed selector. Also thrown into the deal are an IFR-certified Bendix/King GPS 90B, copilot flight instruments, dual glide slope indicators, a Mode S transponder, and a six-place PS Engineering intercom with CD player. There's just about everything you'd expect for an airplane with a $682,965 price tag. There's even a relief tube.

Popular factory-installed options include the Bendix/King EHI-40 electronic flight instrument system (EFIS), which consists of an electronic horizontal situation indicator and its associated hardware ($63,060), the Argus 5000 moving map display ($9,050), and BF-Goodrich's Stormscope ($17,175 for standard panels, $19,660 for those with EFIS).

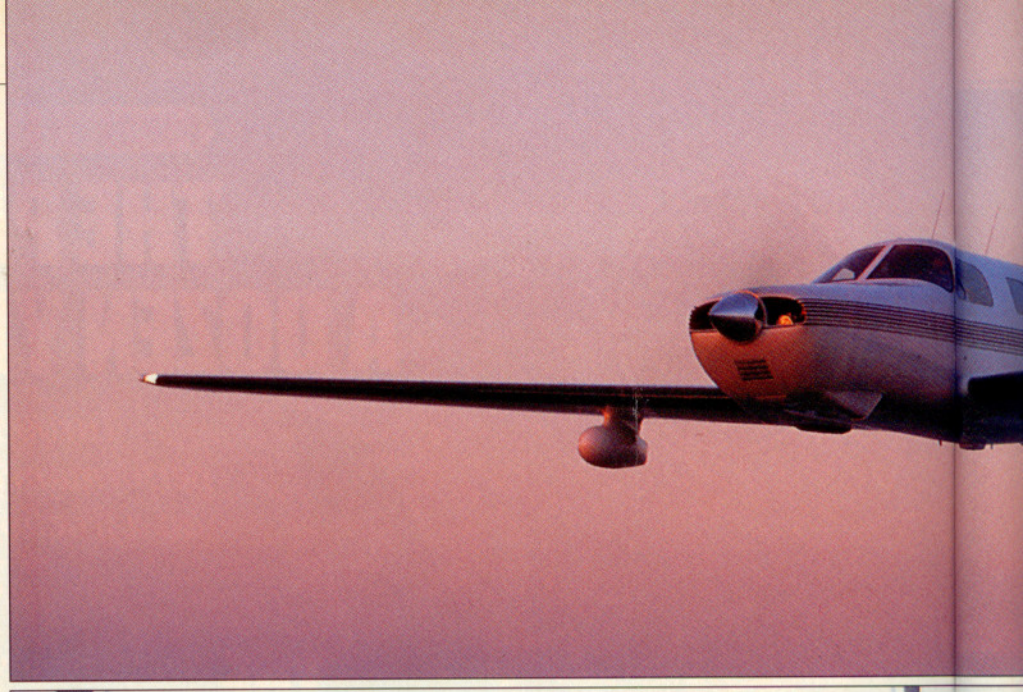
Bleed air from the Mirage's twin Garrett AirResearch turbochargers lets you fly at sea-level cabin altitudes up to 13,000 feet; at the airplane's maximum operating altitude, a 5.5-pounds per square inch pressure differential keeps cabin altitudes at 8,000 feet.

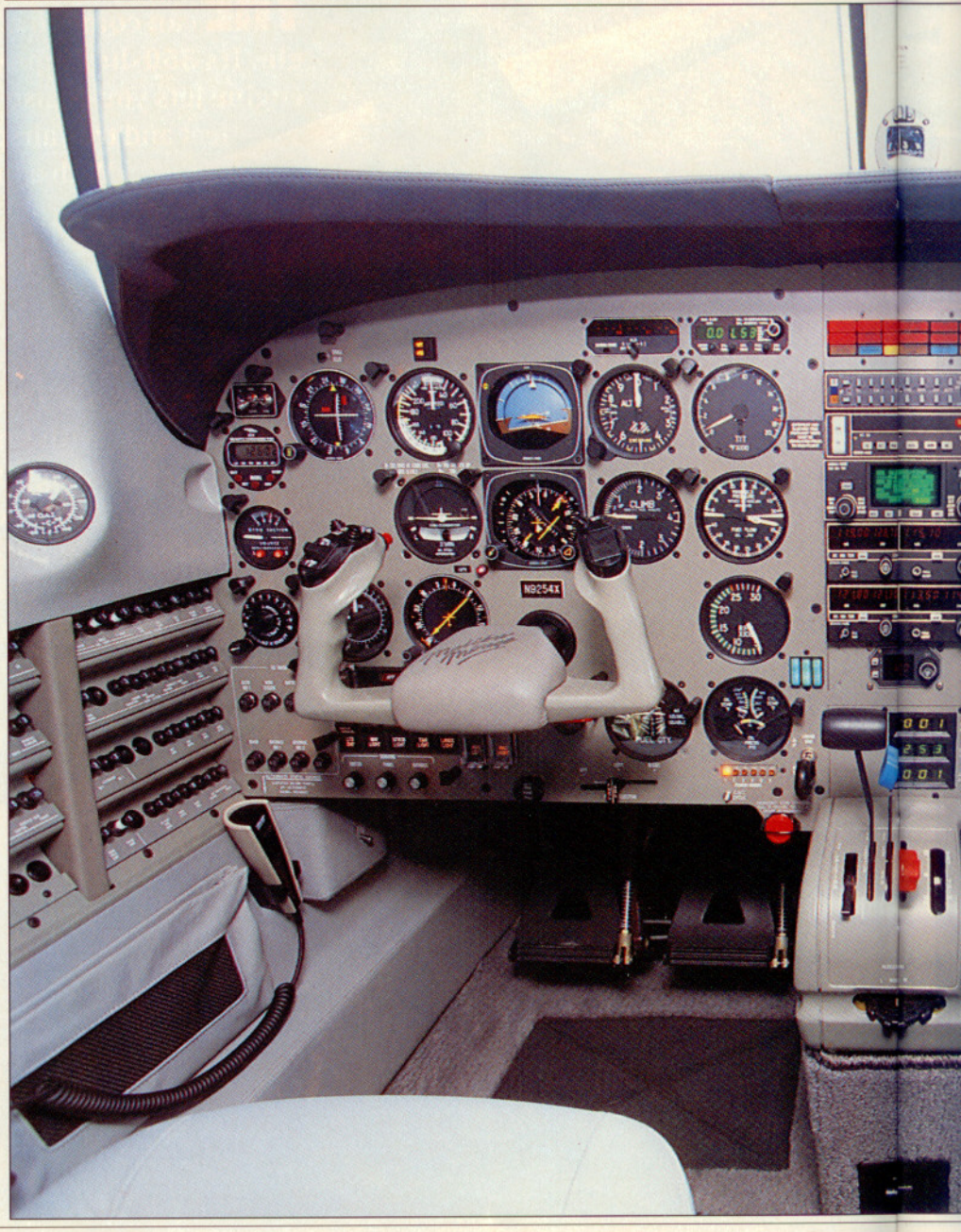
Then there are the aesthetic, ergonomic, and tactile aspects of the airplane. Simply put, the Mirage is one of the best-looking singles ever built. Leather seats, a relatively wide cabin, and inflatable lumbar support for the pilot and copilot seats make for a very comfortable ride. And its handling qualities are admirable. Control forces are light in all axes—surprisingly so in the roll axis, given the 43-foot-long wing span. There is a proclivity to yaw in turbulence, and this is no doubt because of the interactive effects of the wings' high aspect ratios and the longitudinal short coupling. This is where the yaw damper comes in handy.

Based on exposure to the newest model, someone new to general aviation might never suspect that there are skeletons in the Mirage's closet. But there are.

Its predecessor—the Piper Malibu—was introduced in 1983 as a clean-sheet design. Piper applied computer-aided design and manufacturing to come up with its sleek lines and married a 310-hp Continental TSIO-520-BE to the airframe.

The initial response to the Malibu was universal acclaim. At last, pilots who wanted a pressurized single with high-altitude performance had an alternative to the dowdy-looking, 190-KTAS Cessna P210. The Malibu was not only easy on the eyes, it cruised 20





knots faster than the P210 and had a better pressurization system. At 23,000 feet, its maximum operating altitude, the P210's 3.35-psid cabin would be at 12,100 feet. The Malibu's 5.5-psid cabin would hold a more comfortable 8,000 feet—and at a maximum operating altitude 2,000 feet higher than the P210's.

The euphoria over the Malibu proved short-lived. Scores of engine failures were blamed on the Continental engine. The 520s used in Malibus held just eight quarts of oil, or four quarts less than many other variants of the same engine. This, plus poor flows of engine intake and exhaust air, the absence of cowl flaps, and a fundamental misjudgment of piston-engine thermal stresses at altitude were blamed for many problems—with hot-running cylinders leading the list. As time wore on, more problems surfaced. Starter and air conditioner drives, and over-torqued crankcase through-bolts, caused more engine failures.

Many felt that the published leaning procedures explained at least some of the Continental's problems. Because of the engine's tuned induction system, Piper advised leaning to 50 degrees lean of peak turbine inlet temperature (TIT) for all cruise power settings. Using a richer mixture, Continental said, would cause the engine to run at super-high (better than 80 percent) power settings and cause much higher-than-normal operating temperatures. There is widespread speculation that many Malibu owners operated their engines at rich-of-peak mixture settings, succumbing to habits established with more conventional engines.

There were other service problems. Among them was the hydraulic system, which lacked an accumulator and thus produced pressure spikes that blew O-rings. Low fluid levels would cause the pump to fail. In addition, the hydraulically actuated flaps needed their linkages periodically adjusted.

A spate of wrist pin problems finally prompted Piper to ground the early Malibu fleet in November 1987. In a grandiose act, Piper's then-president M. Stuart Millar promised first-class airline travel to all inconvenienced Malibu owners. On a superficial level, this was perceived as an act of magnanimity. In reality, this gesture was a symptom of the growing financial irresponsibility that would eventually bring Piper to bankruptcy.

Despite a number of fixes intended to keep the Continental from running hot


Piper


*Leather seats and plenty of room distinguish the Mirage's cabin. An AlliedSignal RDR-2000 with vertical profiling is also standard.*

and falling apart, the -BE had been tarred, and the early Malibu with it. For this reason, some Malibu owners have opted for a recent STC that allows the installation of the cooler-running, more powerful Continental TSIO-550C. Though it's capable of 350 hp, the -550C is derated to 310 hp for the Malibu.

By 1987, plans were already in motion to fit the Malibu with a Lycoming engine, and at the 1988 National Business Aircraft Association convention Piper introduced the Mirage—a Malibu airframe with a 350-hp Lycoming TIO-540-AE2A engine. Though the Lycoming's 40 extra horsepower let the Mirage fly seven knots faster at high-speed cruise than the Malibu, its maximum IFR range is 100 nm less.

The extra speed—and reduced range—were the result of higher fuel burns. At high cruise the Mirage will burn approximately 20 gallons per hour; the Malibu used 16 gph. Still, no one seemed to mind. There was great brand loyalty to Lycoming engines, not the least of which belonged to Piper, which traditionally preferred Lycomings. Also, the TIO-540 didn't require a fancy, lean-of-peak mixture setting. Its cylinders run slightly cooler than the Malibu's, too. Given the Continental's stained image (never mind that most of its problems have been fixed), the Lycoming was a wise choice.

All seemed right with the world until 1991, when a pattern of similar in-flight Malibu and Mirage loss-of-control events was identified by the National Transportation Safety Board. Of the seven events, six ended with in-flight breakups and fatal injuries to all aboard. The breakups occurred in instrument meteorological conditions, sometimes in moderate to severe turbulence, sometimes above the freezing level, usually in climb or descent, and well outside the airplane's approved operating envelope. The pilots had relatively low time in type and little experience flying pressurized airplanes.

Once again the Malibu/Mirage was the subject of controversy. The FAA put out an airworthiness directive that prohibited flying PA–46s (the Malibu and Mirage share the same type designator) into known or forecast icing, thunderstorms, and moderate to severe turbulence. It also barred the use of the autopilot or vertical trim control for altitude changes and required that alternate engine intake air and pitot heat be used in all phases of flight except takeoff and landing.

Then the FAA initiated a special certification review (SCR) of the PA–46. This involved a complete re-examination of the airplane and its systems, with special focus on the KFC-150 autopilot. The final SCR report contained no less than 60 recommendations for making the Malibu/Mirage a safer airplane. The NTSB got in on the act, too. Its investigations concluded that many of the accidents "involved probable failure to use pitot heat during flight in freezing instrument meteorological conditions, possible misuse of integrated flight guidance and control systems, loss of control, and in-flight airframe failures due to loads and stresses that substantially exceeded design limits."

When the dust settled, an egg-faced FAA withdrew its AD and Piper made a small handful of the SCR's recommendations into service bulletins. In essence, the Malibu and Mirage received clean bills of health after the most thorough scrutiny ever imposed on a general aviation airplane.

One big upshot of the AD/investigation/review/handwringing has been a focus on pilot training. Both the SCR and the NTSB investigation latched onto the notion that Malibu and Mirage pilots are probably not as knowledgeable about their airplanes, and especially their autopilots, as they ought to be. Special courses aimed at a thorough understanding of Malibu/Mirage autopilots would be a very good idea, the government suggested. Of course, the same could be said about the pilots of any autopilot-equipped airplane.

Piper used to conduct type-specific training for Malibu/Mirage customers, but now that function has passed to Attitudes International, Incorporated, a Vero Beach firm headed by Robert D. Scott, former director of Piper's Training Center. Attitudes mixes classroom instruction, time in a custom-configured Frasca visual simulator, and dual flight instruction to provide both initial and recurrent training. Pilot initial courses last five days; recurrent training is a two-and-a-half-day proposition. Piper throws in the pilot initial with the purchase of a new Mirage.

The Mirage appears to have weathered its storms well—and perhaps emerged even stronger. If the design has matured, so, apparently, have the pilots. The review and investigation have heightened pilot awareness of the

airplane's complexity and underscored the need for consistent, high-quality training. A fair amount of self-policing is also at work. Insurers, for one, are clamping down. Without 1,000 total hours and 500 in type, expect to pay an average annual premium of anywhere from $9,000 to $13,000. That figure drops off substantially after pilots accumulate 2,000 hours as pilot in command.

The Malibu/Mirage Owners and Pilots Association (303/399-1440) has also been an important conduit for safety, maintenance, and operational information.

The dealer network can also serve as a safety net. "We just won't sell a Mirage to a pilot whose wallet is bigger than his logbook," says John K. Foster, vice-president of Piper distributor Skytech, Incorporated. "If a low-time pilot comes in here and says he wants a Mirage, I won't sell it to him. I'll try to put him in an Archer instead." Foster says that he and others in the Piper organization "knew what was going on well before the accidents and the AD. It was low-time pilots getting in over their heads, not the airplane's fault."

According to Foster, who claims he "lost count of how many Malibus I've sold after 100," most Mirage customers fit one of three categories. One typical type of customer is retired and flies his airplane on personal missions. Another is an entrepreneur who flies his airplane primarily for business. Other Mirages are sold to businesses that choose the airplane as their first-time, entry-level corporate transportation.

Skytech, based at Baltimore's Martin State Airport, kindly turned us loose on a brand-new Mirage one fine day last May. The airplane we flew—serial number 189—is the 573rd PA–46 to roll off the line, and it was a pleasure to fly. Priced at $681,485, the airplane was typically well-equipped and even had electric trim controls installed on the copilot's yoke—a $960 option.

Settling into the driver's seat, one of the first things you notice about the Mirage, apart from the generous array of avionics, is its glass windshield. Malibus have plexiglass windshields with an electrically powered hot plate to prevent ice from obstructing the pilot's view. Embedded in their glass, 1995 Mirages use heating filaments which create a larger ice-free area. It's a much more efficient design.


Conspicuous in its absence is the Low Vacuum light on the annunciator panel. Dual red "pop-out" markers signal a failure of either of the Mirage's two vacuum pumps, but they're within the suction gauge, over on the left side of the panel. The missing annunciator light is fallout from the SCR. The pop-out markers are more sensitive to drops in vacuum. The old annunciator's switch could kick in too long after a vacuum problem begins, so its value came into question. The answer? Remove it.

All Malibus and Mirages have small, 80-inch propeller diameters, and that forewarns you of relatively long takeoff runs (It also reveals a design bias toward higher cruise speeds). While it may not be optimized for short field operations, the Mirage nonetheless stormed down the runway with acceptable vigor at the redlines of 42 inches of manifold pressure and 2,500 rpm. For takeoff, flaps were set at 10 degrees. Eventually the 80-KIAS rotation speed was reached, and we lifted off into a 1,200-fpm initial climb. This was under near-standard atmospheric conditions, and with three passengers and 100 gallons of fuel.

The POH recommends 120 KIAS for a cruise climb. With power set at 37 inches manifold pressure and 2,500 rpm, the mixture was set for a fuel flow of 38 gph. Climb rate stayed at 1,200 fpm, then began to drop towards 700 fpm as we neared 11,000 feet. By this time cylinder head temperatures were at 380 degrees Fahrenheit—well below the 500-degree redline. TIT registered 1,340 degrees Fahrenheit; its redline is 1,750 degrees.

We decided on a cruise altitude of 16,500 feet and reached it 16 minutes after liftoff. With an outside air temperature of minus 6 degrees Celsius and a high cruise setting of 31 inches mp and 2,400 rpm, the leaning process was begun. The mixture control was pulled back until a peak TIT of 1,660 was identified. Cruise operations at peak TIT are authorized, but we leaned to 40 degrees rich of peak to keep things on the cool side. The end product was 150 KIAS, 198 KTAS, a fuel flow of 21 gph, and a cabin altitude of 3,000 feet. Not bad at all.

The hottest cylinder stayed at 380 degrees, as indicated by the optional ($1,105) Alcor six-probe CHT gauge. This gauge can automatically seek out the hottest cylinder, then illuminate one of six lights to give the pilot a quick interpretation of the goings-on.

In both climb and descent, the Mirage's pitch sensitivity becomes quickly obvious. It takes very minor pitch changes to greatly influence both airspeed and rates of climb and descent. The precise pilot is rewarded with book performance. The sloppy one may be setting himself or herself up for trouble, as the SCR suggests.

A word about the KFC-150: To make large altitude changes on autopilot, first disengage the altitude hold feature, then use the vertical trim rocker switch to command either a climb or descent. Believe it or not, there have been cases

where dim-witted captains have tried to make altitude changes with altitude hold engaged—physically fighting the autopilot by muscling the yoke up or down. Pitch forces must have been uncomfortably high. And guess what happens when the pilot reaches his newly-chosen altitude? The autopilot launches the airplane back to the originally selected altitude, often violently. Go ahead and laugh, but Bendix/King officials say it's happened. One irate customer who practiced this "technique" further displayed his ignorance by calling up and demanding to know why his Malibu oscillated so violently after reaching a new altitude.

We, of course, used the proper technique to take us back down to pattern altitude. Speed brakes would be nice, and now they're available from Spoilers Incorporated (800/544-0169) for a mere $8,995. When it comes to maintaining target cabin altitudes during prolonged descents, preventing cylinder shock cooling, or quickly slowing to $V_A$, speed brakes can't be beat. They let you maintain cruise power settings without building speed in a descent.

A good airspeed for short final worked out to be 80 KIAS with full flaps. Anything more and the Mirage will float, and float, and float. Those long wings work well in ground effect, as anyone who's crossed the threshold at 85 can confirm.

Hailed, reviled, then resurrected—all against the backdrop of a faltering parent company tainted by bankruptcy—the Mirage's strengths have sustained the marque through thick and thin. Now, with 41 slated for production this year, the Mirage should account for 40 percent of Piper's total anticipated 1995 sales of 173 airplanes and outsell every other model that the company currently produces. It's the strongest player in Piper's efforts to recover from bankruptcy, and it's more popular than ever.

"What else are you going to buy if you want a high-altitude single?" asks Foster. "A used P210 with its oxygen light on at 23,000 feet? Or maybe a TBM 700 for twice the price?" For pilots who follow Foster's line of thinking, the Mirage is still the only game in town. □

**Piper PA–46-350P Mirage**
Base price: $679,900
Price as tested: $681,485

**Specifications**

| | |
|---|---|
| Powerplant | Lycoming TIO-540-AE2A, 350 hp @ 2,500 RPM |
| Recommended TBO | 2,000 hr |
| Propeller | Hartzell two-blade, constant speed, 80-inch diameter |
| Length | 28.6 ft |
| Height | 11.5 ft |
| Wingspan | 43 ft |
| Wing area | 175 sq ft |
| Wing loading | 24.6 lb/sq ft |
| Power loading | 12.3 lb/hp |
| Seats | 6 |
| Cabin length | 12 ft 4 in |
| Cabin width | 4 ft 1 in |
| Cabin height | 3 ft 11 in |
| Empty weight | 2,790 lb |
| Empty weight, as tested | 3,051 lb |
| Max ramp weight | 4,318 lb |
| Gross weight | 4,300 lb |
| Useful load | 1,528 lb |
| Useful load, as tested | 1,266 lb |
| Payload w/full fuel | 808 lb |
| Payload w/full fuel, as tested | 546 lb |
| Max takeoff weight | 4,300 lb |
| Max landing weight | 4,100 lb |
| Zero fuel weight | 4,100 lb |
| Fuel capacity, std | 122 gal (120 gal usable) 732 lb (720 lb usable) |
| Oil capacity | 12 qt |
| Baggage capacity | 100 lb, 13 cu ft (forward), 100 lb, 20 cu ft (aft) |

**Performance**

| | |
|---|---|
| Takeoff distance, ground roll | 1,530 ft |
| Takeoff distance over 50-ft obstacle | 1,964 ft |
| Max demonstrated crosswind component | 17 kt |
| Rate of climb, sea level | 1,218 fpm |
| Max level speed | 225 kt (at optimum altitude) |
| Cruise speed/range/endurance w/45-min rsv, std fuel (fuel consumption) | |
| @ High speed cruise, Peak TIT, 225 KTAS/980 nm/4.8 hr | |
| 25,000 ft | (120 pph/ 20 gph) |
| @ Normal cruise, Peak TIT, 206 KTAS/ 1,040 nm/5.3 hr | |
| 20,000 ft | (108 pph/ 18 gph) |
| @ Long range cruise, Peak TIT, 140 KTAS/ 1,450 nm/10.3 hr | |
| 10,000 ft | (66 pph/ 11 gph) |
| Max operating altitude | 25,000 ft |
| Service ceiling | 25,000 ft |
| Landing distance over 50-ft obstacle | 1,964 ft |
| Landing distance, ground roll | 1,018 ft |

**Limiting and Recommended Airspeeds**

| | |
|---|---|
| $V_X$ (best angle of climb) | 91 KIAS |
| $V_Y$ (best rate of climb) | 110 KIAS |
| $V_A$ (design maneuvering) | 133 KIAS |
| $V_{FE}$ (max flap extended) | 165 KIAS |
| $V_{LE}$ (max gear extended) | 195 KIAS |
| $V_{LO}$ (max gear operating) | |
| Extend | 165 KIAS |
| Retract | 126 KIAS |
| $V_{NO}$ (max structural cruising) | 168 KIAS |
| $V_{NE}$ (never exceed) | 198 KIAS |
| $V_{S1}$ (stall, clean) | 71 KIAS |
| $V_{SO}$ (stall, in landing configuration) | 60 KIAS |

*For more information, contact Piper Aircraft Corporation, 2926 Piper Drive, Vero Beach, Florida 32960, 407/567-4361*

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