TURBINEPILOT
A SPECIAL SECTION FOR THE TURBINE OWNER-PILOT

## Eclipse 500

# Typed *and* tried


# Test driving the Eclipse 500 and its training program

**BY THOMAS B. HAINES**

Day five of the Eclipse 500 type-rating course. Dick Mertz, my sim partner, and I are at our usual evening spot in the hotel lobby plowing through takeoff and landing data for tomorrow's sim session, reviewing charts and procedures, challenging each other on one technique versus another. My cellphone vibrates and suddenly I feel like a heel. On that tiny screen I see this beautiful, smiling young woman staring back at me. My oldest daughter dolled up for her first prom—and me, 1,500 miles away.

For only about the hundredth time I wonder once again—what am I doing here? I'm out of my league. I'm just Joe GA Pilot—a private pilot who to date has been an occasional jet pilot dilettante, ushered through many a jet flight under the careful watch of a highly trained factory demonstration pilot. But this is the real deal. I'm going after a jet type rating—a single-pilot type rating, which is always more challenging—in a minimally equipped airplane that provides few tools to help the pilot

**PHOTOGRAPHY BY MIKE FIZER**

fly to airline transport pilot standards. As with any other type-rating checkride, this one must be flown to ATP standards, even by a private pilot. The Eclipse 500 replicated in the simulators at the company's Albuquerque training center doesn't include a flight director, a GPS (except as a DME source), or a moving map of any sort. The autopilot can't fly a coupled approach. It's basically raw data all the way—instrument flying, circa 1989.

The good news: There's not a lot left that they can fail on the checkride, and the simple aircraft systems are wondrously managed by the Avio integrated cockpit system.

Still, my self-doubts are not without merit. Dozens have flunked the Eclipse checkride on the first try. Failures were especially prominent over the first year of deliveries when all of the checkrides were conducted in the airplanes. Since January, Higher Power Aviation, the Dallas-based training company hired by Eclipse to manage the training process, has been able to conduct the training in two full-motion Level D simulators. A third was scheduled to come online this summer; another acts as a fixed-base training device. The sims are so capable—with astounding visual systems—that I can earn a type rating without ever touching an airplane. And I do.

Eleven days after meeting the other 10 members of my training class, I am the first to take the checkride.

Driving through the dark desert to the training center at Albuquerque's Double Eagle II Airport on checkride day, I'm nervous, but relieved to know that my designated examiner is Paul Wood, director of operations at Higher Power. Mertz and I flew with Wood several days earlier. Wood and all the Higher Power instructors impressed me with their teaching ability and pragmatic and practical approach to jet flying.

Wood briefs us before the checkride. I feel lucky to be going first while Mertz cools his heels. The ride goes fine and 90 minutes later Wood is filling out my new temporary pilot certificate, noting the "EA-500S" type rating. Because I don't have another type rating or 500 hours of turbine time, the FAA requires me to complete 25 hours of supervised operational experience (SOE) before I can act as PIC in an Eclipse and fly it single-pilot. Once I do that, I will be issued another new certificate without the limitation.

As part of its mandatory training program, Eclipse also imposes a mentoring period on everyone who buys a 500, no matter your experience level. Those with logbooks full of turbine time will only be required to accomplish a few tasks in the airplane, probably doable in a couple of flights. Typical of someone with fewer turbine hours, my mentoring profile is more extensive, requiring me to accomplish 19 events, some multiple times. For example, night flying is one event, but the mentor profile requires five hours of night flying. Another five hours of actual or simulated instrument time is required, along with seven ILS approaches and five missed approaches. Some "events" are only talking points. Of course, multiple events can be combined in any one flight. If I plan efficiently, I estimate it will take 17 flight hours to complete my mentoring process—all of those hours count toward the FAA-mandated 25 hours. Eclipse has a cadre of authorized mentor pilots stationed around the country; owners can contract with any of them for mentoring. Once the mentoring is complete, Eclipse issues the owner a certificate of completion—the ticket to any reasonable level of insurance coverage.

Of the 11 members of my class, fewer than half are typical owner-operators. Several are professional pilots who will be flying an Eclipse for a charter company or an individual who has bought an airplane, but isn't a pilot. Two are completing the course in order to become Higher Power instructors. Eclipse and Higher Power are mum on how we do as a group, but rumor has it that one member of our class is not recommended for the checkride. The recommendation—or lack of it—occurs after sim session five of eight. If after five sessions the instructors don't think you can pull it together in time for the checkride, you're sent home to get more training on your own. We hear that overall, the success rate of classes has steadily improved in recent

**My self-doubts are not without merit. Dozens have flunked the Eclipse checkride on the first try.**

**Three level-D full-motion simulators and a third one used as a training device dominate the new Eclipse training center at Albuquerque's Double Eagle II Airport.**

COURTESY OF ECLIPSE

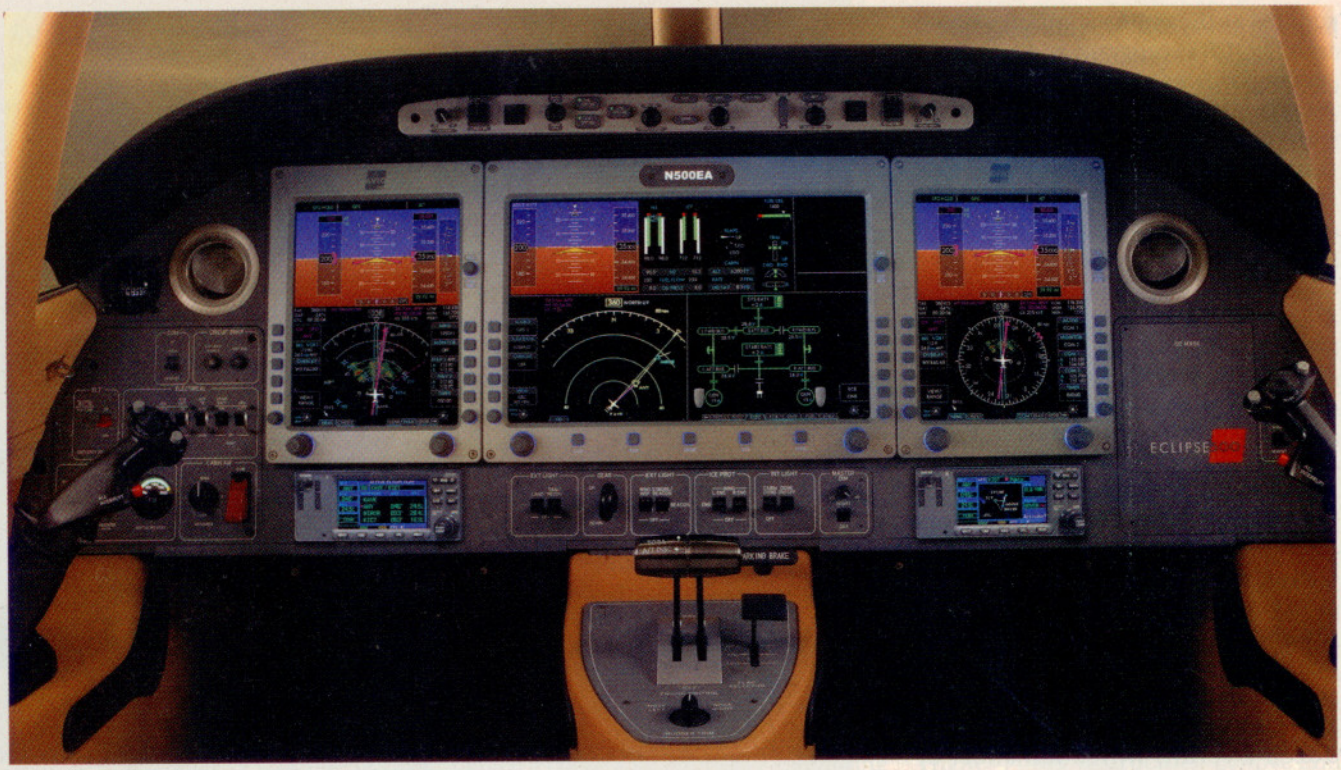
months as the online computer-based training (CBT) program and simulator training become more focused and better organized. The CBT is part of the required 80 hours of study pilots must complete before showing up for the type rating course. Additional prerequisites are a flight skills assessment and upset recovery and hypoxia training (see "Waypoints: Ready for the Eclipse 500?" June *AOPA Pilot*).

### In the real world

Fast forward a month: Kent Ewing, Eclipse's director of flight operations, rolls N21YP to a stop on the AOPA ramp in Maryland as I capture the moment on videotape. N21YP is Eclipse 500 serial number 174 of just more than 200 aircraft that the company has shipped as of late May. New ones are going out the door at a rate of nearly one a day. N21YP is an "NG" airplane, one of three "levels" of 500s currently flying. The simulator represents the first couple of dozen aircraft, which fall short of Eclipse's promised performance criteria in several ways. At serial number 39 came the "ETT" airplanes, which include extended tip tanks to carry more fuel, a higher maximum gross weight, several airframe cleanups to reduce drag, and numerous other small changes that help the airplane meet all of the performance guarantees except range, where it falls short by about 150 nm. Starting around

**Besides the weather radar system, the nose houses dual batteries, oxygen bottle, and the air conditioning system (above). An inlet door on the right side opens to provide air for the air conditioning system. Rugged trailing link main landing gear help pilots finesse the landings (bottom). The compact Pratt & Whitney engines have proven reliable and robust (below). Oil access is through the door on the outboard side of each engine; the scoop on the bottom is for generator cooling. While the engine inlets are heated with bleed air, the wing and tail surfaces use pneumatic boots for deicing. Most owners slide the seat just inside the clam shell door (bottom, left) aft to ease cabin access.**

MIKE FIZER




serial number 106, Eclipse began shipping the "Avio NG" airplanes. Avio is Eclipse's much ballyhooed all-aircraft control system. The original vision was that the pilot would manage all of the systems through the cockpit displays and two clever pop-out keyboards. Avidyne was to supply the displays and navigation/communication gear while Eclipse developed the rest of Avio, which includes a highly automated electrical system managed through electronic circuit breakers.

As occurred with nearly every major vendor involved in the Eclipse project, the Avidyne-Eclipse relationship soured and ultimately ended in a very public divorce in early 2007. A week later, Eclipse announced Avio NG. This next-generation Avio system included displays from Innovative Solutions & Support, a Chelton flight management system (FMS), Garmin transponders, PS Engineering audio panel, an S-Tec autopilot, and Honeywell radios. While NG development continued at a fast pace, the FMS portion proved challenging.

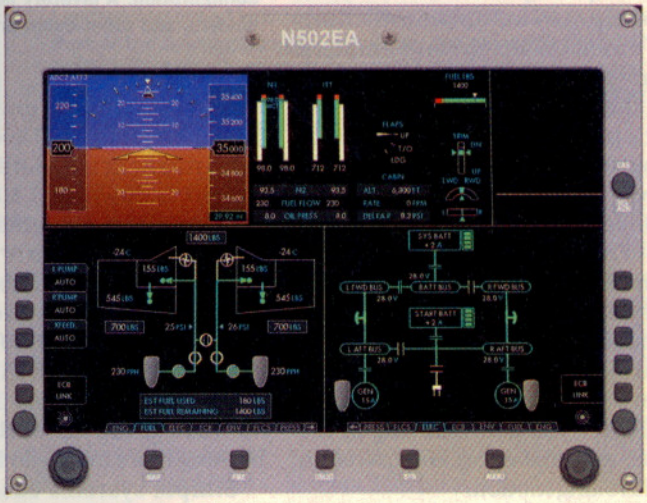
While it was sorting out the FMS issue, Eclipse began delivering NG airplanes. As with the earlier variants, each airplane came with a Garmin 496 handheld GPS as a means of providing datalink weather and long-range navigation.

Such is the capability of N21YP. It doesn't include a flight director, moving map, IFR GPS, or flight management system. The autopilot can be engaged in heading or altitude mode. It will capture and hold an altitude, but it won't fly a coupled approach. The onboard radar works well, as does the terrain awareness and warning system. The 496 supplies datalinked weather. By jet standards, it's minimally equipped.


Garmin 400s (top, just below the PFDs) provide FMS-like capability in the Avio NG 1.5 panel. Graphical weight and balance on the MFD's Ops page (above, left) eases preflight. It can also show navigation mapping. TAWS information can also be overlaid (above, right).

COURTESY OF ECLIPSE


The pilot can choose to overlay weather radar and navaids on the HSI (above).




If the MFD fails, the pilot can choose composite mode on either or both PFDs (left), moving engine, trim, flap and other data to in front of the pilot. In its normal mode (below), the MFD shows a third attitude source, engine and system info and crew alerting system messages across the top. The bottom two MFD tiles can be pilot configured. This photo shows synoptic pages for the fuel system (left side) and electrical system (right side). The pilot interface uses softkeys and knobs around the perimeter of the MFD and PFDs.

With the FMS project languishing, Chelton fell out of favor and ultimately in April of this year, Eclipse announced that a pair of Garmin GPS 400s (basically a GNS430 without the nav or comm radios) would supply the flight management capability; Eclipse locates them below the primary flight displays, in slots once housing the keyboards.

Eclipse plans to have NG with the Garmins in it certified this summer and to begin delivering the system shortly thereafter. Actually, by then it will be delivering Avio NG 1.5, which includes not just the Garmins for the FMS, but also a much more capable autopilot and several other enhancements.

## To FL400 and beyond

With Ewing standing next to N21YP I realize just how small this jet is. I flew a developmental 500 back in 2005 (see "Exclusive First Look: Eclipse 500 Debuts," July 2005 *AOPA Pilot*), but this trip to Albuquerque would be my first experience flying a certified Eclipse. The wings are thigh-high. You have to bend over to see the engine oil level in the sight gauge.

Inside, the Eclipse is small, but feels comfortable. Customers can choose a five- or six-seat interior. There is no external baggage space, so removing a seat allows for a bit more room for bags in the aft cabin. I wedge myself between the two front seats and settle into the left one. Once seated, I feel as comfortable as in any of the other small jets I've been in, such as Cessna CJs and even Learjets. Even though it's been a month since the simulator and essentially my first time in the cockpit, I'm instantly comfortable with the panel before me. I flip the MFD to the "Ops" page and enter weights for Ewing and me along with our bags. With a full 1,698 pounds of fuel, Avio says we're still 231 pounds below max ramp weight of 6,029 pounds and 197 pounds below max takeoff of 5,995 pounds. (These weights will be slightly higher starting with serial number 266.) With the fuel weight and the ambient temperature, Avio calculates the rotation speed of 90 KIAS and posts it as a bug on the airspeed tape. Required takeoff distance to clear a 50-foot obstacle is about 2,350 feet. After stepping through a number of start-up checks, we're soon taxiing out.

For takeoff, I check the MFD for the "T/O Config" crew advisory message. The message tells me the airplane is properly configured for takeoff. I stand the thrust levers up to assure the full-authority digital engine control system is managing the engines properly. With

The interior can be configured in multiple ways and is available in a six- or five-seat configuration. A lavatory is in development. Armrests, a refreshment center, cup holders, and other cabin amenities were recently made available.

no exceedence noted, I shove the levers forward and away we go. The twin Pratt & Whitney PW610F engines put out just 900 pounds of thrust per side, so you're not thrown back in your seat, but weighing less than 6,000 pounds we're moving quickly enough. Airspeed is alive and we're soon passing through 90 knots. I pitch up initially to about 10 degrees and then to about 8 degrees and raise the gear. At 400 agl, I raise the flaps, nudge the thrust levers back until the blue "MCT" annunciation comes on for maximum continuous thrust, and punch the yaw damper button. I won't need to touch the thrust levers again until we're ready for the descent.

Potomac Approach is cooperative and we're quickly headed southwest. Avio computes an optimum climb speed based on weight and ambient temperature and shows that as a green bar on the airspeed tape. For the most part it's between 160 and 140 KIAS, yielding around 1,000 feet per minute all the way up to FL360.

I notice that the sidestick is a little easier to manage in the airplane than the simulator. While still heavy in roll, the airplane feels more harmonized than the simulator, which was heavy in roll and light in pitch. It still takes a fair amount of force to unstick the airplane in roll. Once you get it moving in the roll axis, minimal effort is required to stop the rolling motion.

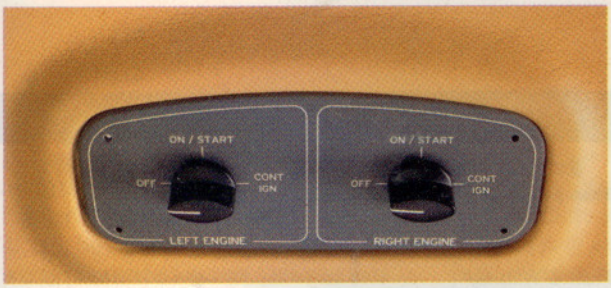
As we reach FL360, ATC asks if we can accept FL380 because there's faster traffic behind us. We do and then ask for FL400 as we head toward Little Rock for our fuel stop. At FL400 the temperature is right at standard. By then, our weight is down to 5,400 pounds. At MCT, true airspeed climbs to 358 knots, or Mach 0.634, while burning 400 pounds per hour—or about 59 gallons per hour. According to the aircraft flight manual, at 5,500 pounds we should be doing 349 KTAS or Mach 0.61 and burning about 365 pounds of fuel. So we're going faster than book and burning more fuel to do it.

Simple systems ease pilot workload, especially convenient in a single-pilot situation. Graphic synoptic pages on the MFD for every major system show precisely what is happening. The electrical system, for example, has automatic load shedding capabilities. The crew alerting system (CAS) alerts the pilot to any anomalies, but mostly the systems take care of themselves. If a fuel imbalance occurs, the fuel system automatically reconfigures itself—turning on pumps and opening and closing valves to feed both engines from the fuller tank until balance is restored. In a critically low fuel situation, boost pumps automatically turn on to provide all of the remaining fuel, leaving the pilots free to fly the airplane. The pressurization system's only requirement is that the pilot set the elevation of the destination airport. Avio automatically switches the altimeter to 29.92 while ascending through FL180—another pilot-friendly feature.

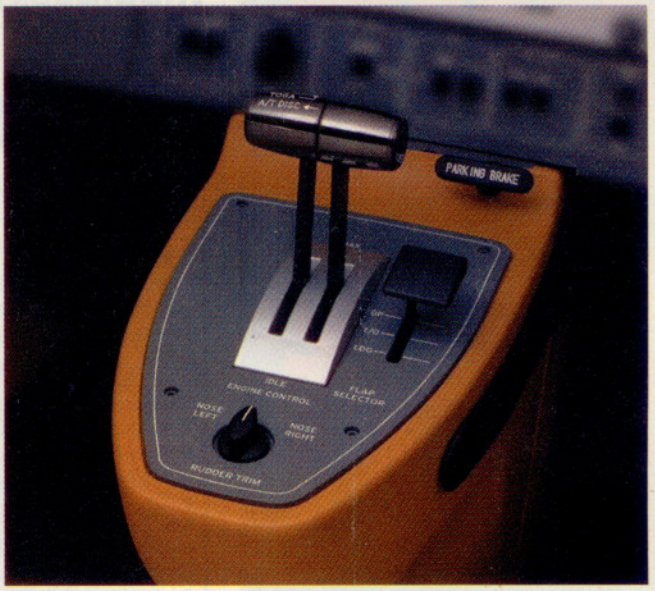
I start the descent to Little Rock from about 80 miles out. With the thrust levers at idle and pitched over to a 2,000 fpm descent, fuel flow dropped to 75 pph. Leveling off about 15 minutes later at 5,000 feet, we had burned 45 pounds, or just six gallons of fuel in the descent.


Eclipse uses long-life, low-power LEDs for navigation and many other lights throughout the airplane. The air conditioning inlet/exhaust doors are open here (bottom of the nose).

MIKE FIZER








**Thanks to FADEC, engine start is a simple turn of a knob on the overhead (above, left). A deft touch is necessary on the thrust levers to eke it out of takeoff thrust to max continuous (above). Landing flap speed was recently increased from 120 to 140 knots. Part of the training includes mastering the sidestick (left), which is festooned with buttons for autopilot disconnect, gear horn silence, trim interrupt, transponder ID, push-to-talk, and a hat switch for elevator and aileron trim.**

$V_{REF}$ on approach to Little Rock is 89 knots with a runway requirement for crossing a 50-foot obstacle calculated to be about 2,700 feet. On touchdown, I wait until the airspeed drops below 80 knots before braking and then manage the brakes carefully. Numerous Eclipse pilots have blown tires on landing. Owners grumble that the brakes are not powerful enough—there is no antiskid braking system, and that the radial tires are not robust enough. Since there are no speed brakes, lift dumps, or thrust reversers, the brakes are the only way to slow the airplane on the ground. Besides blowing out, especially when the sidewalls are stressed—such as in a crosswind landing—the tires only last 70 or 80 landings, according to owners.

Eclipse management has placed much of the blame for the blown tires on the operators. The 500 has a sophisticated data recording system built into it. The data is downloaded when the airplanes come in for maintenance and sent to Eclipse for analysis. Eclipse analyzed the flights that resulted in blown tires and noted that in many of them, pilots were flying too fast on approach and at touchdown, and touching down well beyond the usual 1,000-foot point on the runway. The frequency of blown tires seems to be declining with better pilot education. Meanwhile, Eclipse is test flying replacement bias ply tires to determine whether they result in longer tire life. There are also reports that an anti-skid braking system is under consideration.

On subsequent flights, I saw true airspeeds of 351 knots at FL370 on a day 5 degrees Celsius warmer than standard. Fuel burns were 420 pph. A climb from Albuquerque, at 5,400 msl, to FL360 took just 27 minutes and required 250 pounds of fuel. At FL230—an altitude you might expect in the busy Northeast, for example—fuel burns climbed to 586 pph while providing a true airspeed of 337 knots.

While in Albuquerque I received a briefing on the Avio NG 1.5 panel and flew a developmental airplane with the system installed. Among the features are improved knobology, reducing the number of button pushes and knob turns to change radio frequencies, transponder codes, and to enter minimum altitudes, for example.

Other additions include a flight director and more capable autopilot. The autopilot can be coupled for ILS/localizer, GPS, and VOR approaches. It will fly the ILS glideslope. The next upgrade, Avio 1.6—due out late this year or in early 2009—will allow it to also fly the vertical element of a WAAS approach; in 1.5 the pilot has to manage the descent, although it can be done with the autopilot engaged. In addition, the autopilot can be engaged to fly a climb or descent profile using airspeed or rate. Eclipse hopes to certify a go-around feature that allows the autopilot to remain engaged during a missed approach.

During preflight, the 1.5 system provides a graphical weight-and-balance screen. The pilot enters passenger and baggage weights and the system shows him where he is in the CG envelope. The owner can pick up to 10 cabin configuration profiles to be stored in the airplane.

On the PFD, a wind indicator shows wind speed and direction. The new version also shows the flight planned route and its associated waypoints on the HSI. A similar map can be depicted on the lower left side of the MFD; there the pilot can choose to add nearby airports and navaids as points of reference. TAWS information can also be overlaid.

The panel upgrade eliminates the two keyboards, which are not compatible with the Garmins. Most customers moving up to the Eclipse have accepted the change with minimal complaints, according to Eclipse. Pilots moving down from larger aircraft that typically have keyboards are the ones who miss them the most.

COURTESY OF ECLIPSE

## SPECSHEET

### Eclipse 500 with Avio NG

**Base price: $2.15 million (June 2008)**

#### Specifications

| | |
|---|---|
| Powerplants | Two Pratt & Whitney Canada PW610F-A, 900 lb |
| Length | 33 ft 5 in |
| Height | 11 ft 0 in |
| Wingspan | 37 ft 11 in |
| Seats | 5 std, 6 max |
| Cabin length | 148 in |
| Cabin width | 56 in |
| Cabin height | 50 in |
| Empty weight | 3,634 lb |
| Max ramp weight | 6,034 lb |
| Max takeoff weight | 6,000 lb |
| Useful load | 2,400 lb |
| Payload w/full fuel | 702 lb |
| Max landing weight | 5,600 lb |
| Zero fuel weight | 4,922 lb |
| Fuel capacity, std | 254 gal (251 gal usable) 1,722 lb (1,698 lb usable) |
| Baggage capacity | 260 lb, 16 cu ft |

#### Performance

| | |
|---|---|
| Takeoff distance over 50-ft obstacle | 2,345 ft |
| Max demonstrated crosswind component | 30 kt |
| Rate of climb, sea level | 3,424 fpm |
| Single-engine ROC, sea level | 989 fpm |
| Long-range cruise/range w/NBAA fuel rsv | 335 KTAS (Mach 0.58)/1,125 nm at FL410 |
| High-speed cruise/range w/ NBAA fuel rsv | 370 KTAS (Mach 0.64)/930 nm at FL350 |
| Max operating altitude | 41,000 ft |
| Landing distance over 50-ft obstacle | 2,250 ft |

#### Limiting and Recommended Airspeeds

| | |
|---|---|
| $V_Y$ (best rate of climb) | 169 KEAS |
| $V_{YSE}$ (best single-engine rate of climb) | 133 KEAS |
| $V_{FE}$ (max flap extended) Approach | 200 KEAS |
| $V_{FE}$ (max flap extended) Landing | 140 KEAS |
| $V_{LE}$ (max gear extended) | 285 KEAS |
| $V_{LO}$ (max gear operating) | 200 KEAS |
| $V_{MO}$ (max operating speed) | 285 KEAS |
| $M_{MO}$ (max Mach number) | 0.64 Mach |
| $V_R$ (rotation) | 91 KEAS |
| $V_{REF}$ (reference speed, final approach) | 86-94 KEAS |
| $V_{S1}$ (stall, clean) | 87 KEAS |
| $V_{SO}$ (stall, in landing configuration) | 69 KEAS |

*For more information, contact Eclipse Aviation, 2503 Clark Carr Loop SE, Albuquerque, New Mexico 87106; 505-245-7555; fax 505-241-8800; www.eclipseaviation.com*

*All specifications are based on manufacturer's calculations for aircraft beginning with serial number 266. KEAS is knots equivalent airspeed. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.*

Avio 1.6 will include access to datalink weather; activation of the autothrottle system; a radar altimeter; ability to access a "progress" page that shows expanded flight plan information; greater integration of systems through the MFD, such as interactive takeoff and landing information that will calculate runway requirements; vertical navigation planning; and Jeppesen charts on the MFD.

FMS-like features missing for the foreseeable future include airway-to-airway flight planning and en route coupled vertical navigation. Flight into known icing certification was received in June.

Customers ordering an Eclipse can expect to pay $2.15 million in June 2008 dollars, up from the original price when the program launched in 2000 of less than $900,000. Pilots ordering today can expect to receive their airplane in 2010. There are opportunities to buy earlier delivery positions as cancellations occur.

Owners we have spoken to generally enjoy their airplanes. They acknowledge the 500's current panel weaknesses and are anxious for their upgrades. Eclipse has committed to upgrading the entire fleet to the Avio 1.6 level at no charge to the owners. Eclipse CEO Vern Raburn estimates this will cost $35 million to $40 million, money he has set aside for that purpose. He estimates the upgrades will be completed by the end of the first quarter of 2009.

Owners are especially pleased with the fuel economy of the 500, noting that they are burning less fuel than turboprops while going as much as 100 knots faster at higher altitudes. Owners say they consistently see performance numbers as good as AFM projections or better. Manufacturing and system issues that plagued some early airplanes are less prevalent in later airplanes.

As with any rapidly growing company, Eclipse is struggling to ramp up its training and customer service departments at a rate that is consistent with the growth of its customer base. Meanwhile, production ramp up is also slower than forecast, which is partly responsible for the recent $450,000 price increase. Raburn had anticipated that a higher

production rate would allow enough efficiencies that he could hold prices.

The Eclipse 500 project has taken more time and much more money than Raburn or anyone else might have predicted, but, in the end, the airplane that will be delivered later this year with Avio 1.6 will be at least 95 percent of what the company set out to accomplish in 2000. Meanwhile, Eclipse has announced the 400, a four-place, single-engine jet. With just one engine and an even smaller fuselage, it promises to be even more fuel efficient. Already the new model has garnered dozens of orders.

Here's what *AOPA Pilot* Editor Mike Collins wrote in February 2001 about Eclipse: "Company officials believe that the five-place jet (a sixth seat is optional)—with an expected 4,700-pound maximum takeoff weight, 355-knot cruise speed, and $837,500 price tag (in June 2000 dollars)—will revolutionize air travel." Based strictly on inflation, the current 5,995-pound airplane with a maximum 370-knot cruise speed should cost $1.05 million. At $2.15 million, the price is higher than anticipated, but it's still the least expensive new certified jet available and less expensive than most new turboprops while delivering more performance. The company has been a lightning rod for controversy over the years, but it's hard to argue with the success of more than 200 deliveries of an airplane that meets its performance numbers and will provide most panel features you can expect in a very light jet. Revolutionize air travel? Maybe not yet for the air travel industry, but many owners say their Eclipse 500s have revolutionized their travel. AOPA

*E-mail the author at thomas.haines@aopa.org. See a video report about the Eclipse 500 on the author's blog at www.aopa.org.*

**INTERACTIVE ▶**

***AOPA PILOT* ONLINE**


View Tom Haines' flight in the Eclipse 500 on *AOPA Pilot* Online.
**www.aopa.org/pilot/eclipseflight**