HOW TO FIGHT THE FATIGUE FACTOR

FLYING®

THE WORLD'S MOST WIDELY READ AVIATION MAGAZINE / **FEBRUARY 2011**

ECLIPSE EA500

Finally: Full Speed Ahead

NEW ECLIPSE

We get to fly the most controversial airplane in GA history. In the process we learn a lot about the company that was there to pick up the pieces.

>>> STORY AND PHOTOGRAPHY BY ROBERT GOYER

MY FIRST TAKEOFF out of Albuquerque, New Mexico, in the EA500 was anything but an anticlimax. We'd just finished up our pre-takeoff check and Jerry Chambers, Eclipse Aerospace's chief pilot, was giving me some last-minute advice on the takeoff when the tower came with a takeoff clearance, "No delay for landing 737 traffic, three-mile final."

So without delay, I added a burst of power, turned the corner and rolled in the power. We accelerated smartly, and the wide runway at ABQ whizzed by beside us. I smiled and pulled back on the sidestick to rotate. We were flying.

It was a moment for which I'd been waiting for years.

A Little History

It's impossible to talk about the Eclipse 500 without talking about its turbulent history. And it's impossible for *us* to talk about it without going into the history of this magazine's coverage of the airplane.

Like everyone else in GA, we were swept up in the furor that was the introduction, more than 10 years ago now, of the Eclipse 500. While it was my former boss, Mac McClellan, who took the point, I was there on the front lines as well from day one. I looked on and photographed the Burt Rutan-designed Williams V-Jet that begat the Eclipse on its first Oshkosh appearance. Like everyone else I was mesmerized by the idea of a very light jet, an airplane that would distill the spirit of a jet into an airplane sized right for pilots of high-performance GA piston singles and twins.

The hype was overwhelming, and lots of people bought in, literally and figuratively. But no matter how optimistic you were about the economics or the physics, the numbers just didn't add up. Mac came out right off the bat and said in print what many other experts were saying among themselves.

It wouldn't work.

As proposed, the Eclipse jet, he said, would never fly. Its Williams engines were too small to work. The speeds and weights were unobtainable. The FARs, which require a minimum single-engine climb gradient for jets, would submarine the hopes of such a low-powered, light twinjet. And finally, Mac said, the economics proposed by the company — pinning its hopes on building 2,000 jets a year to be used by a yet-to-be-created industry of per-seat charter providers that would shuttle folks all over the United States in Eclipse jets — were pure fantasy. Moreover, he continued, even if it were true that Eclipse would build 2,000 jets a year, it wouldn't achieve even close to the production efficiencies needed to get the cost down to a million dollars, never mind around $800,000, which was the originally proposed price of the jet. (Had someone overlooked the fact that the company had to install not one but two jet

engines on the airplane?)

His honesty cost us, big. While Eclipse was, in Mac's words, "spending lavishly" with its ad dollars around the industry, it snubbed *Flying*.

The problem was, Mac was right on every count. The Williams engines, Eclipse later said, turned out to be a financially disastrous work in progress, one that required a midprogram switch to new engines, from Pratt & Whitney. With the switch to the Pratt engines (which can be rightfully credited with saving the airplane if not the program) came new design changes. Performance goals were slipping, and the weight was increasing. As the program progressed, the company's hopes of meeting the minimum required single-engine climb performance looked bleak. To meet performance guarantees of weight and range, the company had to redo the tip tanks to add fuel and meet lightning strike standards; it had to then rework the aerodynamics, to cut drag.

The good news was, the modifications were working. The performance was on track. But by then it was too late.

It was at that point clear that the central economic premise on which Eclipse's hopes were pinned — high production due to a vast new air taxi market — wasn't panning out. The company at one point claimed around 2,500 orders for the jet, but many of those were big orders placed by start-up air taxi operators, like DayJet, which at one point had orders for 1,400 Eclipse jets — it would eventually take delivery of 28. Even by the time the FAA granted the airplane an extraordinary provisional certificate just in time for Oshkosh in 2006, the design was still a work in progress, and those first customers in late 2006 took delivery of an airplane that cost Eclipse a lot more to produce than it was selling it for. Never mind making up on the initial investment.

Still, we all watched in disbelief as customers and many in the press continued to buy into the dream. The program was even handed the 2005 Collier Trophy, an honor that had been the most prestigious award in aviation, one that supposedly recognized a real-world achievement. At that point, we at *Flying* could only shake our heads. Inextricably mated, hope and denial ran deep.

In the end, the company produced 259 airplanes, many of which weren't close to being completed to the eventual standard. Most were delivered without approved icing protection. Amazingly, for an airplane that pinned its reputation on high technology, many Eclipses came out of the factory without GPS. It's true that for a time Eclipse was delivering its business jets with a handheld GPS for direct-to guidance.

In the end the money ran out, and the crash was spectacular, the largest failure in GA history, a $1 billion failure that devastated investors, suppliers, employees and customers.

Picking Up the Pieces

As Eclipse Aviation was walking out the door, the winning bidder, Eclipse Aerospace, a loose coalition of former customers headed by businessman Mason Holland that paid just $40 million for the company as the only bidder, was walking in. And it got right down to the difficult business of trying to get the company to the point, at least at first, where it could get parts to its customers and bring the fleet up to the still-emerging final configuration.

The philosophical differences between the former and current Eclipse couldn't be more striking. While many existing customers were hoping for the new company to make them whole, to keep the promises of the former Eclipse, the new company went into the process with eyes wide open. It was there to fix airplanes and, it hoped one day, to make new airplanes. As much as it felt the pain of the victims of the first regime, giving away parts or work made no sense if it were to survive. This was, as you might imagine, not a popular stance with many owners and deposit holders, though it's impossible to imagine a scenario in which the new company could have made existing Eclipse owners, not to mention former deposit holders, happy. It was the kind of sober financial calculation that says good things about a company's prospects.

What says even more good things is the company's new relationship with Sikorsky. The United Technologies Corp. helicopter manufacturer has purchased a large share of Eclipse Aerospace — Sikorsky head Jeff Pino is an Eclipse owner. The association brings to Eclipse Sikorsky's world-class parts distribution and service network to supplement Eclipse's existing factory service centers. Perhaps most importantly for many of those who

had questions about the viability of the new Eclipse, the Sikorsky relationship will answer them.

Today Eclipse Aerospace — the company, by the way, owns the name Eclipse Aviation too — claims to be stable and debt-free, two things you could never say about the original.

I spent a couple of days at the factory with the executive team. Aviation veteran and day-to-day head of operations President Ken Ross, who ably flew the EA500 on our photo mission, showed me around the plant, and it is an impressive installation. *Flying,* for the record, had never been invited to Albuquerque to visit or to fly the airplane, I presume because of our editorial stand on the program. So this was my first visit.

The state-of-the-art facility — which consists of a number of hangars, executive offices, a delivery center and more — is beautiful and huge. The current staff of some 120 workers is bouncing around in it. The bottom line is that there's nothing but room for growth.

Right now, like every aircraft manufacturer, Eclipse is in a bit of a holding pattern, doing what work it has but keeping its expenses as low as practical in the process while waiting for the economy to recover and for business to pick up. It does have the advantage of having a lot of work to do in gearing up for an eventual return to production of the EA500, something it hopes for in the foreseeable future, though it is not naming any timetable for that re-entry. This seems smart considering the uncertain nature of the hoped-for economic turnaround.

In the meantime, Eclipse continues to rehab existing Eclipse airplanes for owners, bringing them up to the current production standards, which include a long list of improvements. It's also buying EA500s, including a number that used to belong to per-seat charter provider DayJet, refurbishing them and placing them on the used market. Most have just a couple of hundred hours on them and go to customers with fresh paint and all the

latest modifications. I looked through a couple and flew a third, and I couldn't tell they weren't new airplanes. The quality of the work is top-notch.

What is an Eclipse?

Though it seems in some ways as though the world's smallest production twinjet has been around forever, it's been only 10 years since the project was hatched.

The airplane itself is a remarkable thing. It's small, which is the whole idea behind the model, you know. Weighing in at exactly 6,000 pounds maximum takeoff weight, the EA500 weighs just 500 pounds more than a Beech Baron yet flies at 370 knots, compared with 202. While it might sound like a lot of weight, it's not. Indeed, the engineering accomplishment is unprecedented. To build an airplane that weighs just 6,000 pounds, flies 370 knots, has a long-range cruise of around 1,200 nm, carries five to six people and flies up to 41,000 feet is absolutely remarkable. The wonder isn't that the airplane took so long to get built but that it got built at all.

The EA500 is an all-metal airplane powered by a pair of Pratt & Whitney PW610F-A fadec engines producing 900 pounds of thrust apiece. The engines, as you'll note the next time you sidle up to an Eclipse, are very small; the inlets are not much larger, in fact, than a medium-size dinner plate. The flight controls — ailerons and elevators — are operated via sidesticks and connect to the controls through mechanical push rods and control cables. No boosted controls here. Trim switches atop the sidesticks operate the elevator and aileron trim. There is a yaw damper as well.

The airplane looks like a bizjet, just scaled down by half or more. The T-tail in back and low wing and fuselage mounted engines all look completely conventional, and in truth, the EA500 isn't about inventing a new shape as much as it is about taking that familiar shape and scaling it down, which turned out to be a billion-dollar exercise. The result is a very pretty airplane, and one that features economies of operation previously unknown in the turbofan world. Eclipse estimates direct operating costs of around $600 an hour, and even if that's a little optimistic, there's no existing jet that comes close.

The airplane sits low to the ground, as countless other airplanes with propellers would if ground clearance weren't an issue. The main gear is trailing link, designed to be tough and to deliver predictably easy arrivals. The brakes are standard hydraulic affairs and deliver at best adequate performance.

Fully approved icing protection is now standard, and before too long the vast majority of Eclipses will have it installed. It uses pneumatic boots for the wing leading edges and horizontal stabilizer, an electrically heated windshield and bleed-air anti-ice on the engine inlets.

The entry door is a thing of beauty, light, compact and easy to operate. The cabin is, as you should expect on a 6,000-pound airplane, compact. The seats, however, are nicely done, and the noise level is low, especially toward the front of the cabin.

The cockpit is impeccably styled. The seats are comfortable and highly adjustable, though the headroom will be tight for tall pilots. My Bose A20s occasionally bumped the ceiling, though the good news is that the airplane is so quiet that you don't need them. Smart pilots will get their seats adjusted just right before buckling in, though, because the fore and aft and riser handles can be hard to reach. Along the side of the headrest are quick-don oxygen masks; they are compact and easy to access, a brilliant solution to a small-cockpit problem. If you like the dozens of rows of switches and breakers on the overheads of vintage airliners, you'll be disappointed with the EA500, which has on its overhead just a pair of switches, the

ones you use to start the engines.

Dominating the cockpit are the three big displays, two portrait-format PFDs and a multifunction display in the center. The system has been updated to the point that it has much of the capability that owners of early airplanes were hollering for, including dual GPS navigators and coupled autopilot. The displays are the centerpieces of Eclipse's integrated cockpit concept, an incredibly innovative and ambitious design for a small airplane. The system keeps track of all the engine parameters, the fuel system, electricals (themselves a tremendously advanced and ambitious design), ice protection, climate control, pressurization and more. Even the majority of the airplane's circuit breakers are electronic.

Flying an Eclipse

The cockpit of the Eclipse was surprisingly comfortable, in part because it's so well laid out. The idea behind the jet was single-pilot operation, so that was a must. And Eclipse has largely succeeded in the design of the pilot interface in reducing pilot workload tremendously. Even though the integrated airplane control and monitoring system is a bit of a hodgepodge of technologies at this point — you still have tacked-on GPS navigators instead of integrated units and there are a few hardware circuit breakers scattered here and there — the end result is that the interface is easy to use and you can do most everything you want to with it. You've got moving map, charts, traffic, TAWS, radar, XM and more. The integrated cockpit concept cost Eclipse untold dollars and precious time, and in the end, it still never got exactly what it envisioned. Look for news of a new integrated cockpit soon.

Start-up couldn't have been easier. We started the No. 2 engine from ground power — we just reached up and turned the start switch to, well, "start," and the fadec system took care of the rest. With the Bose on, if it hadn't been for the display indications, I never would have been able to tell the engine was running. It is that quiet. Even with the headset off, I had to strain to hear.

Taxiing out to the runway, monitoring our progress on the geo-referenced airport taxiway diagram, it was clear that the Eclipse is a jet and that it's a small jet. It is very easy to taxi, and there's plenty of braking power to slow the slight residual thrust of the small Pratts.

On rotation, you get an idea right away of how the Eclipse feels. I hand-flew the vectors Departure gave us. The airplane felt heavier on the controls than it seemed a 6,000-pound airplane should, and the trim was too slow to be able to keep up with my requests of it, though I'm guessing that with more experience I'd get better at anticipating the need for trim as we flew.

The airplane climbs well. Leaving from nearly mile-high Albuquerque on a cool day, we were seeing a rate of climb approaching 3,000 fpm, and our climb to 28,000 feet that day took just 12 minutes. Eclipse claims a 22-minute climb from sea level to 41,000 feet.

At Flight Level 280, we were truing out at better than 360 knots. Best true airspeed, 370 knots, comes at 37,000, according to the book — we did not fly higher than 280 that day, since the airplane wasn't RVSM-certified — though every airplane that Eclipse delivers is RVSM-ready.

Back down at 16,500 and VFR, I flew the airplane through a series of steep turns and stalls. The airplane handles very honestly, though hand-flying it is a bit of a workout, in part because the sidesticks don't give you as much leverage as conventional yokes do.

The autopilot performed well, even on a gusty day, as we flew an ILS to a low approach to a nearby airport with a huge quartering tailwind and wind shear galore into a blinding sinking sun. It was a tough test and it handled it well.

Heading back into ABQ, I hand-flew the arrival and an ILS to Runway 3 with a sidestep to Runway 30, since the winds were better aligned with it. The book VREF speed for the 500 is around 85 knots, but for training the manual adds 10 knots, so we came down the pike at 97, according to book. The flare, touchdown and rollout were all very easy to manage, and the brakes got us stopped just fine, though my right seatmate was clearly nervous that I might be a bit heavy-footed on them. I knew to tread lightly, and in truth, there's little reason not to. Getting a 6,000-pound airplane that touches down in the 70s stopped is not a huge feat, and we were turned off the runway in a few thousand feet, despite it being my first landing in the airplane.

When my flight was done, I got it. The EA500 is an airplane that speaks to me. Does it have a few rough spots? Yes, it does. But what airplane doesn't? What it will do is take the family and me 1,000 miles in less than three hours in pressurized comfort, while a King Air B200 will still have an hour's flying to do.

Eclipse is selling its FIKI-certified, like-new Total Eclipse refurbished airplanes with service plan and fresh inspections, Pratt & Whitney ESP engine service plan and RVSM certification for $2.15 million. That's a price at which the company will make money.

For more information, visit eclipseaerospace.net. Check out extended coverage for the iPad by visiting the iTunes store, where you can purchase the iPad edition of Flying, *with extended coverage of the Eclipse saga.*

ECLIPSE
AEROSPACE

Eclipse Aerospace EA500

The airplane flown for this report was a refurbished 2008 Eclipse EA500 with the latest 1.7 revision completed. The airplane features dual Garmin G400 navigators, integrated system monitoring and alerting, coupled autopilot, extended-range tip tanks and flight into known icing approval. The airplane was RVSM equipped and ready. All data is from the flight manual and reflects standard day, sea level conditions at maximum gross weight, unless otherwise noted.

Price as tested:	$2.15 million
Certification	FAR Part 23
Engines	Pratt & Whitney PW610F-A, fadec
Thrust rating	900 lbs
Flat rating	ISA plus 25 C (ISA +15)
TBO	3,500 hrs
Seats	4/5 plus 1/2 crew
Cabin length	12.3 ft
Cabin width	4.7 ft
Cabin height	4.2 ft
Length	33.5 ft
Height	11 ft
Wingspan	37.9 ft
Wing area	144.5 sq ft
Wing aspect ratio	8.88
Max zero fuel weight	4,922 lbs
Max payload	1,288 lbs (optional 2,400 lbs)
Max useful load	2,400 lbs
Max usable fuel	1,698 lbs (251 gallons)
Payload with max fuel	702 lbs
Max wing loading	41.5 lbs/sq ft
Max range (NBAA reserves)	1,125 nm (1 pilot w/ (3 passengers)
Max ramp weight	6,034 lbs
Max takeoff weight	6,000 lbs
Max landing weight	5,600 lbs
Takeoff distance (sea level)	2,345 ft
Landing runway (sea level)	2,250 ft
Certified ceiling	41,000 ft
Pressurization	8.3 psi
High-speed cruise	Mach .64 (370 knots)
Long-range cruise	Mach .57 (330 knots)
MMO/VMO	Mach .64/285 knots