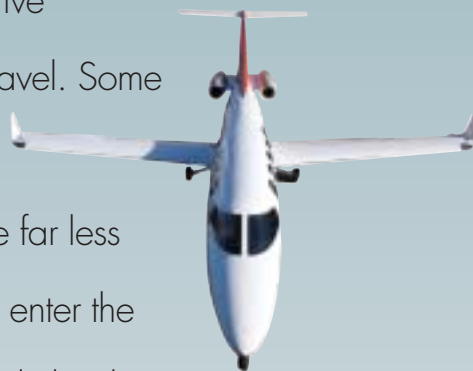





Very lightweight advanced-technology jet aircraft could soon supplant the roles played by the small prop planes. They might also begin fulfilling NASA's vision of a point-to-point air taxi network that would boost usage of rural airports and give business passengers an alternative to airline travel. Some experts foresee a boom that could continue in this sector for several years, while others are far less sanguine. With the first such aircraft poised to enter the market, the results will be watched closely.



Very light jets Boom or blip?



by **John Croft**
Contributing writer



The first of a new wave of pint-sized advanced-technology jet-powered personal and business aircraft will begin hitting the market this summer, giving propeller-laden pilots and business owners a realistic means of joining the jet crowd. The development may also give weary business travelers the chance to punt the airline grind for a low-hassle point-to-point jet taxi.

The entry of the very light jet (VLJ) comes as general aviation (GA) recorded its highest billings ever—\$15.1 billion, up 27.2% in 2005 over the previous year, according to the General Aviation Manufacturers Association. The industry delivered 2,465 piston-powered aircraft, 365 turboprops, and 750 business jets, with exports accounting for 19.5% of the shipments and 30% of the billings.

There is optimism the boom will continue, fueled by a large number of relatively low-cost VLJs on the “low” end of the jet market coupled with continued strong demand for high-value long-range business jets at the other end of the cost spectrum.

Most of the buzz in the industry at the moment, however, is focused on the “low” end, as a handful of manufacturers set out to build their own versions of the aircraft. The optimism is due in part to NASA’s long-heralded vision of a VLJ air taxi network designed to boost access to rural airports while giving business travelers a modestly priced alternative to airline travel. NASA also contributed to the various engine and avionics technologies that are key features of these new aircraft.

Predicting the impact

Forecasts for how big an impact the VLJ will make vary considerably. By definition, a VLJ is generally considered an aircraft with a maximum takeoff weight below 10,000 lb and certified for single-pilot operations. The already established “light jet” category, by contrast, includes jets such as the Cessna Citation CJ1 and Beechcraft Premier 1A, aircraft that typically weigh in at more than 10,000 lb fully loaded and cost \$4 million–\$5 million or more.

VLJs are expected to cost anywhere from less than \$1 million to about \$3 million. Though expensive relative to automobiles, the new jets will not be all that unreasonable by lightweight piston-powered aircraft standards—new top-of-the-line four-seat, propeller-driven Cessna 172s or Cirrus SR22s are priced at \$250,000 and \$450,000 per copy, respectively. Most VLJs are slated to provide twice the cruise speed (around 350 kt) and twice the cruise altitude (41,000 ft) of their piston-powered brethren.

Those performance numbers and relatively low buy-in costs will lure a certain percentage of piston-powered aircraft owners up into the jet ranks, in addition to drawing air taxi providers and so-called “fractional” operators into the sector. Under a fractional program, owners buy a share of an aircraft, typically as small as 1/16, and pay fixed monthly costs and per-flight-hour costs to have the aircraft piloted, maintained, and managed by a fractional provider.

Bears vs. bulls

Richard Aboulafia of the Teal Group predicts a bear market for the VLJs. He says the high end of the business jet market—aircraft like the \$45-million ultra-long-range Gulfstream 550 and Bombardier Global 5000—are a “much safer bet” than the low end—the million-dollar Diamond D-Jets or \$1.5-million Eclipse 500s. He predicts deliveries of 1,265 VLJs over the next 10 years, 17% of the 7,417 new aircraft delivered. Aboulafia says VLJs will account for less than 2% of the \$106.7 billion in total value of aircraft delivered over the period.

“Bottom line?” says Aboulafia, “VLJs will not provide the next revolutionary stimulant that transforms the industry.”

Forecast International, by comparison, is predicting a more bullish market. “Indeed, it is the low end that may hold the key to the overall prospects of the market itself,” writes analyst Ray Jaworowski in the company’s “World Market for Business Jet Aircraft” report. The company is forecasting 10,895 business jets over the next 10 years, a 96% increase over the 5,560 deliveries made during the period from 1995 to 2004.

VLJs, says Jaworowski, will account for more than 30% of the deliveries—about 3,000 jets—and 5% of the dollar value for the forecast period. “The VLJ segment is expected to be one of the most dynamic segments in the business jet market during the

next 10 years,” he says, “and will drive much of the growth in the market.”

Other forecasts are similarly optimistic about VLJ potential: Rolls-Royce, in its 20-year forecast through 2023, says 8,000 VLJs will be built; Pratt & Whitney Canada, maker of the PW600-series engines that power several VLJs, is forecasting more than 5,000 VLJs to be produced through 2012.

The air taxi question

Key differences in the forecasts relate to whether the VLJ air taxi market will take off. Aboulafia says Teal Group remains an air taxi “agnostic,” and Forecast International caveats its predictions by saying the emergence of on-demand air taxi services “utilizing hundreds of these jets to fly their customers from airport to airport” is critical to the VLJs’ realizing their full market potential.

Perhaps the best known impending air taxi service is DayJet. The company expects to launch its business later this year with the arrival of the first of its 239 Eclipse 500s on order. The Eclipse 500 is one of three VLJ models that manufacturers expect to have certified by the FAA this year or early next year. Florida-based DayJet plans to have two pilots in each aircraft and three available passenger seats for trips of up to 600 n.mi., though it has not yet said in what part of the country the air taxi service will be launched.

The company’s per-seat, on-demand model relies on in-house software that optimizes how the fleet moves between destinations, minimizing the amount of time the aircraft will fly with no paying customers on board, a problem that has historically been a bane to the profitability of air taxi operators.

Another air taxi provider waiting in the wings is Pogo, which has 75 Adam Aircraft A700 VLJs on order.

Making flying easier

While opinions vary on how the market will respond to the new aircraft, there is general consensus that the vehicles themselves have been the focal point for best of breed in aircraft advances, including highly integrated avionics and advanced engine design.

“It’s really the elements of technology that have blended together” to make the VLJ, says John Olcott, president of consulting firm General Aero and former president of the National Business Aviation Association. “It ought to be simpler to fly than a piston-powered aircraft.”

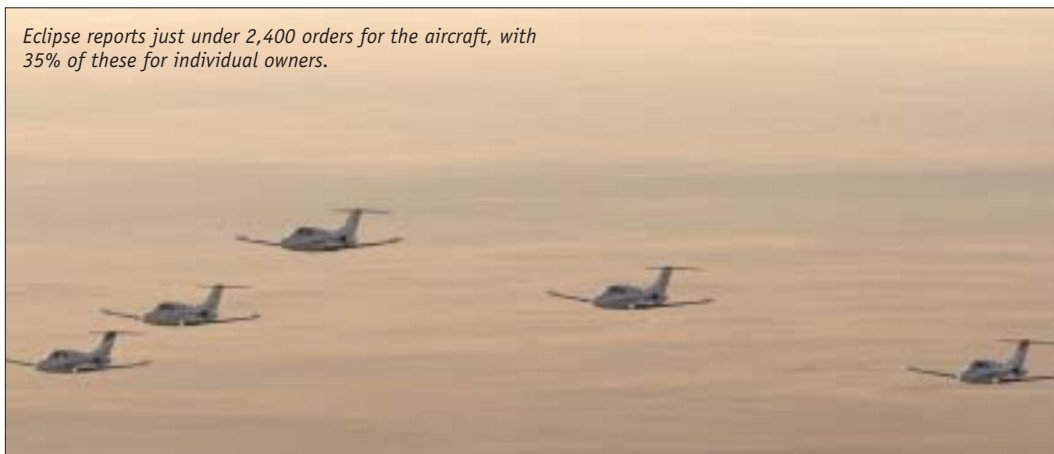
Examples can be found in the Eclipse 500, which is expected to be the first of the VLJs to be certified by the FAA, with deliveries arriving by summer. The aircraft comes equipped with a redundant “total aircraft integration” avionics package called Avio. Designed in-house, Avio controls the avionics, engine operation, fuel systems, flaps, landing gear, cabin pressure and temperature, and other systems via the aircraft’s main computer and electronic power distribution systems.

In the engine department, Avio can activate an “automatic power reserve” if the system senses that one of the Pratt & Whitney Canada PW610F turboprops is operating below its expected performance. With power reserve, the normal operating engine gets a boost of up to 10% more thrust, while ultimate constraints of permissible power are maintained by the full-authority digital engine control, or FADEC, system. The Eclipse 500 will also use a new engine first suppression system that the company says is “more effective, simpler, lighter, and less expensive” than conventional Halon systems.

Watching the Eclipse

The first glimpse of empirical data on VLJs will not be long in coming. Albuquerque-based Eclipse Aviation is slated to complete its FAA

Eclipse reports just under 2,400 orders for the aircraft, with 35% of these for individual owners.



New players in the VLJ game

While VLJs belonging to Eclipse, Cessna, and Adam will be first on the scene, a handful of other manufacturers are building, designing, or pondering their own entrants for the market. Five such aircraft are presented here, in alphabetical order.



Diamond Aircraft D-Jet

Announced in 2003, the D-Jet represents the next step in the evolution of the Austrian company's all-composite GA product line that started with powered sailplanes and progressed to single- and multiengine two- and four-seat aircraft. Powered by a single 1,400-lb-thrust Williams International FJ33-4 turbofan engine, the D-Jet is expected to cruise as fast as 315 kt, as far as 1,352 n.mi., and as high as 25,000 ft, carrying up to five people, including those in the front seats. The company says the aircraft will be priced at less than \$1 million a copy for deliveries expected to begin in 2008. First flight, more than a year later than first predicted, was slated to take place in March or April from the company's facility in London, Ontario. Diamond expects to complete the D-Jet's FAA and Transport Canada certification in 2007.



Embraer Phenom

Embraer, maker of the popular regional jets for the airline industry, announced last year that it would enter the lower end business jet market with the Phenom 100 and 300 models. The nine-passenger Phenom 300 will be considered a "light" jet while the 100 will be in the VLJ class. Priced at \$2.75 million, the twin-jet, powered by Pratt & Whitney PW617F engines, will carry as many as eight passengers more than 1,000 n.mi. at speeds as fast as 380 kt and altitudes up to 41,000 ft. Embraer says the aircraft could enter service by mid-2008. While the Brazil-based manufacturer has not yet built a proof-of-concept aircraft, it has built a full-scale cabin mockup and commissioned BMW Group DesignworksUSA to create a unique interior design.



HondaJet

Mum's the word on whether Honda will parlay its flight-proven HondaJet design into a production aircraft. The four-to-five-passenger jet, powered by two GE/Honda HF118 turbofans, first flew in 2003 and last August took part in the Experimental Air Association's annual air show in Oshkosh, Wisc. Honda quotes a maximum speed, range, and operational altitude of 420 kt, 1,100 n.mi., and 41,000 ft, respectively. The design innovations on the jet, including over-the-wing engine mounts, a natural-laminar flow wing and fuselage nose, and advanced all-composite fuselage, are the result of 10 years of research on small aircraft, the company says. The aircraft has an aluminum wing and empennage. To date, Honda has completed more than 156 hr of flight tests, starting in December 2003. During that testing, the HondaJet achieved an altitude of 43,000 ft and a speed of 393 kt. Honda is currently building a second prototype of the jet.



Spectrum Aeronautical Spectrum 33

Spectrum Aeronautical's Spectrum 33 carbon-graphite proof-of-concept twinjet made its first flight January 7 from Spanish Fork, Utah, home of project partner Rocky Mountain Composites. The company says the weight savings gained from using advanced materials for the structure will allow the aircraft to carry eight to nine passengers yet consume just half the fuel of current production aircraft in that size range. The six to nine-seat, Williams FJ-33-powered aircraft is designed to cruise as fast as 415 kt and as far as 2,000 n. mi. at a maximum cruise altitude of 45,000 ft. Spectrum says once comprehensive testing of the proof-of-concept aircraft is complete this year, the company will freeze the Spectrum 33 design and build production-conforming aircraft for an FAA certification program, slated to be complete by late 2007 or early 2008. Customer deliveries are anticipated by mid-2008. The aircraft, with a 7,300-lb maximum takeoff weight, is expected to cost about \$3.65 million.



TAM-AIR Epic Jet

This \$1.9-million, seven-seat VLJ is the result of a partnership between Air Investor Resources (AIR), located in Bend, Ore., and Tbilisi Aerospace Manufacturing (TAM) in the Republic of Georgia. The aircraft is a derivative of the AIR's Epic LT carbon-fiber turboprop aircraft, sharing 80% of the same components. Plans call for both companies to build the aircraft, Epic at its 90,000-ft² facility in Bend and TAM in Tbilisi. Powered by two Williams International FJ33-A4s, the aircraft is designed to have top speed of 390 kt, cruising as high as 41,000 ft and as far as 1,600 n.mi. TAM-AIR is forecasting certification late this year or early next year, first in Brazil. As of mid-March, the prototype Epic Jet had not yet taken its first flight.

certification for the \$1.5-million Eclipse 500 imminently, and two others—Cessna and Adam Aircraft—are not far behind.

Eclipse's fleet of seven certification test aircraft—five flight, one static test airframe, and one fatigue airframe—had surpassed 1,000 hr of flight test time by mid-January. Powered by a pair of 900-lb-thrust PW610Fs, the six-seat aircraft has a maximum takeoff weight of 5,640 lb and is designed to cruise as fast as 375 kt, as high as 41,000 ft, and as far as 1,280 n.mi.

Company spokesman Andrew Broom says Eclipse has just under 2,400 orders for the aircraft, with 35% of these for individual owners who will fly it for business or pleasure. Broom says the first customer delivery is slated to take place before the end of June. Eclipse expects to produce fewer than 200 aircraft this year, ramping up to 800 in 2007 and 1,000 a year thereafter.

Customer training for Eclipse 500 owners will be provided by United Airlines in what the company calls "the most comprehensive training program ever offered in general aviation." The FAA requires pilots of jet aircraft to receive a "type" rating in the aircraft. The company says coursework will include "significant" pre-classroom training that features an introduction to jet aircraft operation, Eclipse 500 systems, and unexpected situations. United will use full-motion simulators to evaluate pilots' flying skills and to provide training, and will furnish "mentor pilots" to fly with Eclipse 500 owners for a certain period of time after the training is complete. Follow-up training will take place every six months or 12 months, depending on the pilot's proficiency.

Cessna and Adam

On the heels of the Eclipse 500 will be the six-seat Cessna Mustang, with a demonstration aircraft out later this year and first customer deliveries in early 2007. The \$3-million aircraft,

Cessna has reported orders for over 230 aircraft, 80% of which are for individual owners.



Adam Aircraft will require new A700 pilots to fly with a mentor pilot for 50-125 hr.

powered by twin PW610F turboprops, will cruise as fast as 340 kt, as high as 41,000 ft, and as far as 1,500 n.mi. The Wichita-based company reports orders for more than 230 aircraft, 80% of which are for individual owners who will fly the aircraft for business or pleasure.

Cessna is preparing a specialized training program through FlightSafety International, a training company with 230 FAA-certified flight simulators in 43 locations in the U.S., Canada, France, and the U.K. Like Eclipse's program, Cessna's will include mentoring of new Mustang pilots by experienced business jet pilots for a certain number of hours. Cessna says the Mustang's "single-pilot design philosophy will make the transition from a single- or multi-engine propeller-driven aircraft very easy." The company plans to build 50 aircraft in 2007, 100 in 2008, and 150 in 2009.

About the same time that the first Mustang is delivered, Adam Aircraft expects to deliver its first six- to eight-seat, \$2.1-million A700 Adam-Jet, a derivative of its A500 twin turboprop. Powered by two Williams FJ33-4A turboprops, the aircraft is designed to fly as fast as 340 kt, as high as 41,000 ft, and as far as 1,400 n.mi. The company, based in Englewood, Colo., says it has orders for 61 aircraft for owner/operators and 225 for fleets.

Pilots transitioning to the aircraft will be required to have a private pilot's license, instrument and multiengine ratings, and total flight time of 500 hr or more; they must also attend an A700 type rating course lasting a minimum of 20 hr. Like the others, Adam will also require new A700 pilots to fly with a mentor pilot for 50-125 hr, depending on the new pilot's skills. Air taxi startup Pogo has orders for 75 aircraft, and European fractional operator Nexus has orders for 100 planes, according to company founder and CEO, Rick Adam. Adam plans to build 70 aircraft in 2007 and 120 a year after that. 75