Diamond Star

Katana +2

Diamond's long-awaited four-placer nears certification

Diamond's Katana trainer has become a familiar sight at many airports around the world. The svelte composite two-seater has even inspired many to become pilots just by its looks alone. The smooth lines and flip-up canopy bring forth to prospective pilots the look and feel of a sports car. When it began production in Austria in 1993, the Katana brought new lifeblood to flight lines that were previously occupied by well-worn trainers. Some flight school operators commented that students—when offered the choice of training steed—would without hesitation choose the Katana over the traditional "Spam-can" trainers. ■ But while the Katana makes a good primary trainer, it is not certified for IFR flight. Many students are forced to abandon their familiar Katana trainer and step into IFR-approved Cessnas and Pipers. Sure, flight schools can fly simulated IFR in VFR conditions, but when actual IFR prevails,

BY PETER A. BEDELL

PHOTOGRAPHY BY THE AUTHOR

The DA40 Diamond Star evokes a sports-car feel with its smooth lines and flip-up canopy. PS Engineering and Bendix/King avionics, including an HSI, are available as is a choice in lightning detectors.

the Katana is effectively grounded.

It is for this reason that the Katana has not been a popular choice for individual owners. Not being able to punch through a fair-weather cloud or a thin layer to on-top conditions greatly reduces the airplane's usefulness as reliable transportation.

The principals of Diamond's manufacturing facility at the foothills of the Austrian Alps south of Vienna are well aware of the issues surrounding the Katana's place in the market. In 1997, Diamond announced plans to introduce a four-place, IFR-certified airplane. Today, Diamond's vision has come to fruition in the form of the Diamond Star, or DA40-180. Sharing the clean lines and sports-car look of its smaller sibling, the DA40 brings two more seats, imminent IFR certification, and an exciting new entry to the popular certified four-place single market.

All Katanas were initially manufactured at the Austria facility until the company opened its London, Ontario, site in 1994. This will be the same course of action with the DA40. The first several airplanes are to be built in Austria and shipped to the London, Ontario, facility for completion. Full production is to move to the London facility late this year.

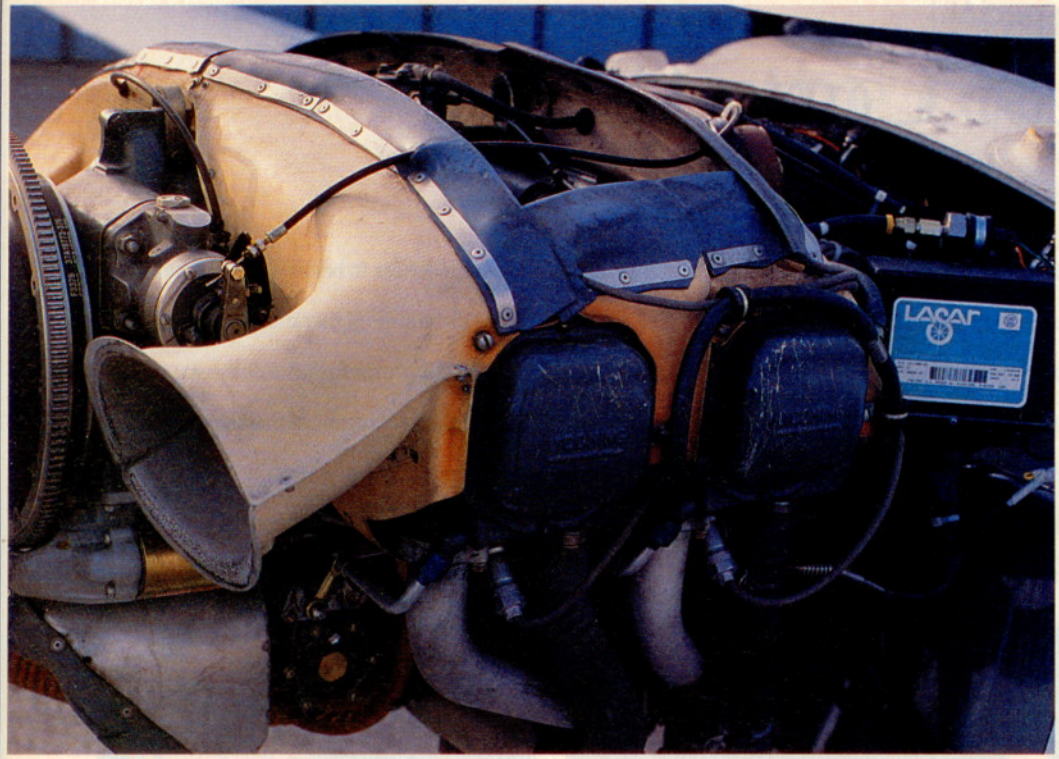
Although certification is not complete, Diamond invited *AOPA Pilot* to evaluate the DA40, briefly interrupting an aggressive test program that puts the airplane through hundreds of touch-and-gos a day. Upon our arrival at Wiener Neustadt's Ost Airport, it was no surprise to see the DA40 performing "circuits." It had already logged more than 40 landings that day when we arrived by 10 a.m. The Best-Tested Aircraft, or BETA, program was designed to put the airplane through the paces as if it were actually in the training environment. New pilots are checked out in the DA40 and turned loose in the pattern to pound as many cycles into a three-hour period as possible. When one pilot lands, another is ready to saddle up for another three hours. Diamond inspects the airplane every 25 hours to see how things are holding up. It also performs more thorough 50- and 100-hour inspections than a flight school would. Diamond has learned much about the DA40 and its future service durability through this testing.

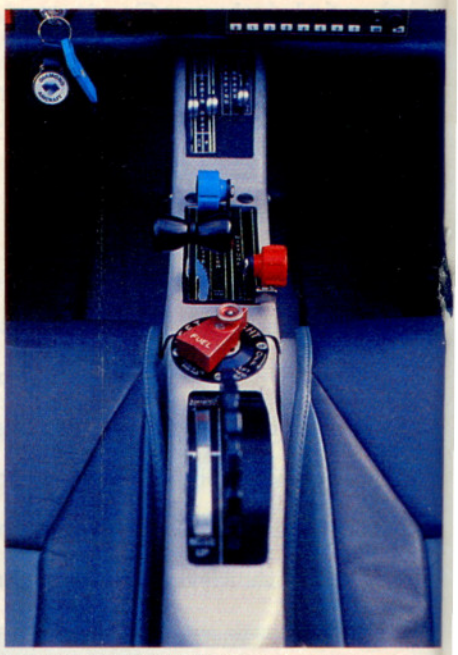
"We are doing this testing now, so that flight schools do not encounter any problems in the field," said Michael Feinig, Diamond's vice president of sales and marketing. As of mid-November, the airplane had logged more than 15,000 hours and 13,400 landings. Diamond has made some minor changes along the way, but nothing to indicate that it did not make the right equipment decisions for the DA40. In addition, the company has learned much from its experience with the DA20 Katana series.

Powerplants have always been a hot issue with Diamond Aircraft. Its decision to use Bombardier's 80-horsepower Rotax 912 in the Katana was precedent-setting, yet not completely successful. The Rotax proved reliable when maintained well; however, individual mechanics and those at large flight schools were forced to learn an entirely new engine and were often left scratching their heads at some issues regarding the comparably oddball engine. This and other problems with the Rotax engine—marginal performance in the Katana being a big one—prompted Diamond to begin installing the 125-hp Continental IO-240 in the DA20-C1 (see "Diamond Katana: Continental Education," June 1998 *Pilot*). The new engine has had its own share of growing pains in its new installation but has given Katana performance a huge boost. Mechanics as well are extremely comfortable with the familiar air-cooled flat four.

With the DA40, Diamond did the right thing and asked Katana users what engine they would like to see in the new DA40. Overwhelmingly, the response was the fuel injected, parallel-valve, 180-hp Lycoming IO-360 like that installed in the new Cessna 172SP and a fuel-injected version of what powers the New Piper Archer III. But instead of a fixed-pitch propeller, the Diamond Star will have a three-blade, constant-speed prop. Like the 172SP, the DA40 is likely to find itself used as a trainer much of the time, which lends itself well to the durable Lycoming IO-360. When used for personal trips or for cross-country training flights, the engine will pull the airplane along fast enough so as not to produce too many yawns or too much time on the Hobbs meter. Diamond expects production DA40s to zip along at 147 knots at 75-percent power. At that power setting, the Lycoming will consume about 10 gallons per hour, which produces good fuel economy for a fixed-gear, four-place trainer.

Diamond also is taking input from customers regarding avionics and other instrument panel gear. As of now, the DA40 will come with a stack of AlliedSig-



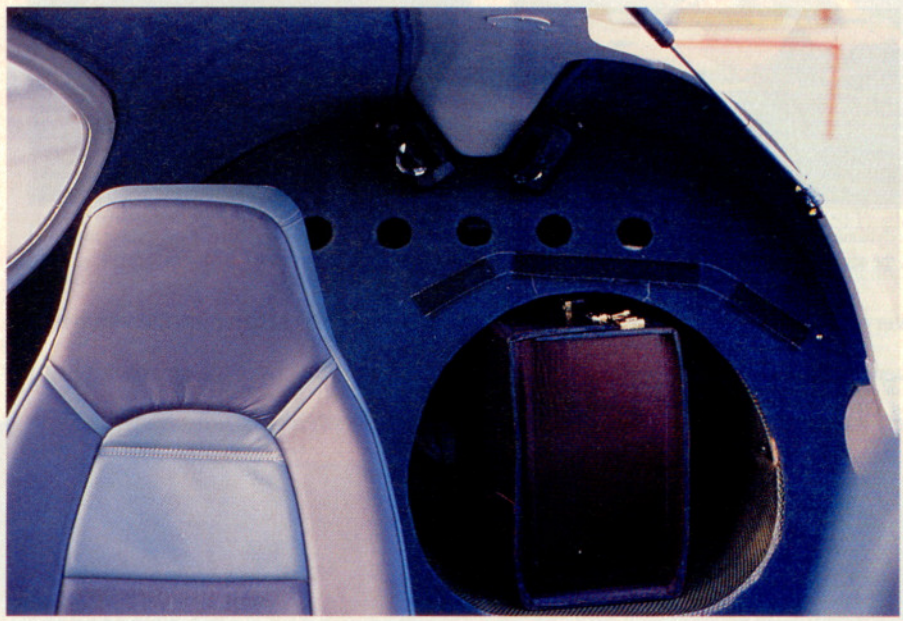


The left cowl inlet (at left) cools all four cylinders of the Lycoming IO-360. The inlet is canted forward to scoop the most cooling air in a climb attitude.

nal Bendix/King avionics with a PS Engineering audio panel and intercom. A choice of lightning detection equipment from Insight or BFGoodrich is to be offered. A Bendix/King HSI will face the pilot, as will an all-in-one Vision Microsystems VM1000 engine monitor. Besides displaying EGT and CHT for all cylinders, the VM1000 monitors manifold pressure, rpm, and fuel status in the DA40's two 19.5-gallon (usable) fuel tanks. Under the cowl, Unison's Lasar electronic ignition system will adjust spark advance in all Diamond Stars.

With the standard fuel tanks filled up and an average fuel burn of 10 gph, you can expect a DA40 to take you about 450 nm in a windless world with IFR reserves. With the 52-gallon optional tanks, you can add another 1.3 hours onto the endurance for nearly 650 nm of uninterrupted travel. Perhaps the best part is that Diamond expects production DA40s to be true four-seaters, capable of carrying four adults and full fuel. A small baggage area resides behind the rear seats, and a large tube protrudes into the empennage for storage of long items like skis or golf clubs. All baggage can be accessed from the cabin.

To more easily satisfy strict crashworthiness requirements, the DA40's seats are fixed. Diamond has made the rudder pedals easily adjustable to accommodate pilots of varying sizes. The result of this engineering allows DA40 occupants to sustain a 26-G forward impact and a 21-G downward impact.



Three-point inertia-reel harnesses are found at every seat.

After a brief and straightforward preflight, three of us boarded one of the prototype DA40s for an evaluation flight. Entrance to all seats is easy. The forward canopy tilts forward toward the cowl (as with the DA20), and the single rear door is a gull-wing type on the left side that opens wide and overcenter. Stepping on the seats is allowed but not required to mount the DA40. In production airplanes, Diamond expects to have a ground ventilation position for the forward canopy to provide relief for the sun-soaked front-seaters . All seats in the prototype seemed roomier than those of the competition. Perhaps adding to the roomy feel is the expanse of acrylic that surrounds all of the DA40's riders. Taxiing is accomplished by differential braking, which acts upon a castering nosewheel.

With its 39-foot wingspan, the DA40 spends little time on the runway during takeoff. Using half flaps, the DA40 normally rotates at about 60 kt, which was achieved in about 700 feet on this 10-degree-Celsius day with a density altitude of 500 feet.

With the composite, three-blade propeller pulled back to 2,500 rpm for noise abatement, the DA40 climbed at 1,000 feet per minute. The high-aspect-ratio

All seats are designed to protect occupants in a 26-G forward impact and a 21-G downward force (above). Riders enjoy a spectacular view through the DA40's expanse of acrylic.

wing provides a good rate of climb all the way to 10,000 feet, where the airplane was still climbing at 600 fpm.

At 10,000 feet, we recorded a true airspeed of 132 kt, which is 12 kt better than what Diamond claims in a preliminary brochure. At 6,000 feet, full throttle, and 2,400 rpm, we saw 139 kt, which falls shy of the brochure's claimed 147 kt cruise speed. These numbers place the DA40 in its own class between the 172SP/Archer III and the Cirrus SR20.

Engineers at Diamond came up with a unique cowl design that is simple yet innovative. The left cowl inlet supplies cooling air for all of the Lycoming's four cylinders, while the right inlet supplies air for the oil cooler, alternator, and cabin heater. When viewed from the side, the inlets are canted downward; in other words, the tops of the inlets are farther forward than the lower edge. This design allows the inlets to scoop more cooling air at high angles of attack, such as in a climb, and the least amount of cooling air in a descent. The net effect is intended to reduce the amount of thermal shock that the engine receives.

During our test climb to 10,000 feet, CHTs peaked at 438 degrees Fahrenheit with a warmer-than-standard outside air temperature of 5 degrees C. Diamond expects CHTs on production airplanes to be lower. In the descent, the cowling appeared to do its job of maintaining the warm CHTs. We noted 425 degrees at 8,000 feet and 400 degrees when passing through 4,500 feet.

Since the DA40 will likely be used as a trainer, we leveled off to try some stalls. Power-off stalls were not as docile as those in a 172 or Archer but plenty tame for a student to grasp the concept. Rudder effectiveness is limited at such slow airspeeds when there is no thrust blowing over the tail, but ailerons were effective throughout the stall, thanks to the DA40's upturned wing tips. The DA40 can be held in a level stall attitude by using large rudder inputs and some aileron, but the prototype eventually departed controlled flight by rolling off

on the left wing. Recovery was a simple matter of releasing back pressure to lower the nose and righting the airplane with rudder and aileron while adding power. Full-power departure stalls were easily brought under control as well, with little or no altitude loss.

Approaches are flown at 65 to 70 kt and slipping works well to salvage botched attempts. Cross the fence at anything more than about 60 kt, and the DA40 will float down the runway like a Mooney. As with any airplane, it takes a little getting used to, but if anything, the DA40's floating will reinforce a student's need to learn airspeed control.

Like Diamond's Xtreme motorglider, the DA40 will have a glider-tow package available. Feinig hopes the DA40 will be an airborne "jack of all trades" by offering many opportunities for its owner to utilize all of the airplane's capabilities. For example, if a particular windy Saturday grounds student flights, the DA40 could be used to loft gliders all day or tow banners around a local sports event. Feinig sees the DA40 turning a profit for its owner every day, if he desires. And with IFR certification, the DA40 doesn't have nearly as many excuses to not be in the air.

So far Diamond has nearly 300 orders for the DA40. The demographics cover a broad cross-section of buyers, from individuals to flight schools. List prices currently range from around $140,000 for a basic VFR airplane with the glider towing device to $185,000 for an IFR package with an HSI, two-axis S-Tec autopilot, and IFR-approved KLN 94 GPS. (Prices are approximations based on the mid-November 1999 exchange rate between the U.S. dollar and the Austrian schilling.)

If the prices stay where they are, the DA40 represents an excellent value in the four-place single market. Few other new airplanes can provide this kind of performance for so little money. This trait, combined with the "real-airplane" status achieved by IFR certification and four seats, will make the DA40 a serious contender in this crowded market. □

Links to other information about Diamond Aircraft can be found on AOPA Online (www.aopa.org/pilot/links.shtml). E-mail the author at pete.bedell@aopa.org

Diamond DA40 Diamond Star
Base price: $165,000
Price as tested: $185,000

Specifications

Powerplant	180-hp Lycoming IO-360-M1A
Recommended TBO	2,000 hr
Propeller	MT 3-blade, constant speed, 71-in dia
Length	26 ft 4 in
Height	6 ft 6 in
Wingspan	39 ft 5 in
Wing area	145 sq ft
Wing loading	17.4 lb/sq ft
Power loading	14 lb/hp
Seats	4
Empty weight	1,543 lb
Maximum gross weight	2,535 lb
Useful load	992 lb
Payload w/full fuel	746 lb
Maximum takeoff weight	2,535 lb
Fuel capacity, std	41.2 gal (39.1 gal usable) 247.2 lb (234.6 lb usable)
Fuel capacity, w/opt tanks	54.1 gal (52 gal usable) 324.6 lb (312 lb usable)
Oil capacity	8 qt

Performance

Takeoff distance, ground roll	720 ft
Takeoff distance over 50-ft obstacle	1,150 ft
Rate of climb, sea level	1,070 fpm
Maximum level speed, sea level	155 kt
Cruise speed/endurance w/45-min rsv, std fuel (fuel consumption)	
@ 75% power, best power	147 kt/3.2 hr 6,500 ft (54.6 pph/9.1 gph)
@ 50% power, best economy	120 kt/4.1 hr 10,000 ft (40.2 pph/6.7 gph)
Landing distance over 50-ft obstacle	1,030 ft
Landing distance, ground roll	480 ft

Limiting and Recommended Airspeeds

V_X (best angle of climb)	60 KIAS
V_Y (best rate of climb)	63 KIAS
V_A (design maneuvering)	107 KIAS
V_{FE} (max flap extended)	110 KIAS
V_{NO} (max structural cruising)	128 KIAS
V_{NE} (never exceed)	178 KIAS
V_R (rotation)	58 KIAS
V_{S1} (stall, clean)	47 KIAS
V_{SO} (stall, in landing configuration)	45 KIAS

For more information, contact Diamond Aircraft, 1560 Crumlin Road, London, Ontario N5V1S2, Canada; telephone 888/359-3220 or 519/457-4000; fax 519/457-4021; or visit the Web site (www.diamondair.com).

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.