Realizing the Dream

DIAMOND KATANA

Continental Education

Diamond's decidedly Euro trainer gets an American accent

BY MARC E. COOK

PHOTOGRAPHY BY MIKE FIZER

Appearances are deceiving. In the world of automobile design, for example, it's common to introduce a supposedly fresh model that is really a new body atop the old platform—giving what seems to be a clean-sheet design that in fact shares engine, suspension, and other major components with the outgoing version. It's a time-honored way to add sizzle to a well-aged steak. ■ But just the opposite is true regarding Diamond Aircraft's latest version of the two-place Katana trainer, the DA20-C1. It's grown the C1 suffix as a result of a 125-horsepower Continental IO-240-B under the cowling that drives a fixed-pitch propeller. Even when you know that fact, a casual examination of the C1 barely discloses the differences from its predecessor, the Rotax-powered A1. A wasp-waisted empennage still draws the eye, as do the bubble canopy; sailplane-like T-tail; and long, graceful wing. You could check out the airplane on the ramp and conclude that only the cowling and prop have changed in response to the new engine.

■ That's hardly the


Diamond
G-GCTO
TRIM
NOSE UP
NEUTRAL
NOSE DOWN
No smoking!
GPS limited for VFR only.
FUEL
PULL
OFF
PARK
BRAKE
TRIM
NOSE
DOWN
UP

case. Diamond's C1 is a significantly new airplane—with differences that start right at the propeller but certainly don't end at the fire wall. When Diamond certified the A1 Katana in 1994 with the 80-horsepower Rotax 912, mechanics from Presque Isle to Imperial Beach could be heard complaining about this unfamiliar engine that didn't even have a proper magneto. Early predictions of a short-lived engine have come to naught; in fact, the Rotax has had a good service record in the Katana, routinely making the 1,200-hour TBO in typical fly-it-often primary training. Rotax apparently also had poor after-sale support, which left Diamond to pick up the slack. In a way it's easy to understand; Rotax has mainly supplied the experimental market and is a big player in the motorcycle and watercraft fields. Aviation is a comparatively small part of the business.

As if to get off on the right foot, Continental already has sent a technician to Diamond's Ontario, Canada, plant to rectify a small production glitch, and even delivered the same man to Austria, where a pair of the IO-240s were being flown by the parent company. And while it's unlikely that the rank-and-file operators will get such service, it's a dramatic improvement in the eyes of Diamond's brass.

With the Continental, instructors and pilots can look forward to a better-performing Katana.

Taken as a whole, these events have caused Diamond to look carefully at the future of the DA line and conclude that the Rotax's day is, for now, over. Alongside the C1 prototypes and early production models on the line are the last A1s to go out the door; during our April visit, the final A1 (serial number 343) was nearing completion. An empty assembly area was being prepared for an onslaught of Continental-powered C1s. Rotax will remain on board the Xtreme motorgliders and will be welcomed back into the family when the long-promised (but not yet tested or certified) 100-hp 912 variant is ready. (Diamond's four-place DA40 will also use a Continental engine, a version of the 210-hp IO-360-ES.)

While Diamond anticipates better support from Continental, pilots and instructors can look forward to a better-performing Katana. Even with a higher maximum gross weight—1,654 pounds, the limit under JAR-VLA regs and 45 pounds more than the A1—the C1 tromps the older airplane in all performance categories. Maximum stated cruise speed is up to 135 knots, and the sea-level rate of climb is now 1,105 fpm—big jumps over the A1's 117-knot cruise and 680-fpm climb rate.

Prices have increased incrementally with the Continental; base price is $114,260, up about $4,500 from the A1. Included as standard are full instruments (now with pneumatic attitude and directional gyro in lieu of the A1's all-electric ensemble), dual brakes, and a host of smaller items that make the airplane remarkably complete in the fly-away package.

Avionics are part of the base price, too. They include an AlliedSignal Bendix/King KX 125 nav/com, KLX 35A GPS with moving map, KT 76A transponder, PS Engineering PM501 intercom, and blind altitude encoder. Avionics option packages can take the Katana up to a KX 165 nav/com with glideslope, KLX 135A GPS/com, and KMA 24 audio panel with marker beacon. Remember, though, that the airplane is still not legal for IFR flight, in part because it's not lightning hardened. Instrument training can take place under VFR conditions, however.

Transplanting the Continental into the Katana's engine bay set off a lengthy chain-reaction of alterations to the airframe, so much so that there are remarkably few directly interchangeable parts between the C1 and the A1. A new engine mount was constructed from steel tubing. It is, in fact, simpler and lighter than the Rotax's because the smaller engine used a bed mounting scheme. A new cowling with standard air inlets was penned, as well as provisions for the Continental's fuel-injection system. That Diamond sweated serviceability details is evident. A new oil-filter adapter makes the element easily accessible, and the use of a 40-amp Nippondenso alternator driven by a belt off the prop shaft—in place of the accessory-case-driven alternator common to the IO-240/360 family—also frees up space between the engine and fire wall. Overall, it's a neat and tidy installation that should quell the caterwauling from the shop floor.

In order to accommodate the extra 70 pounds of the IO-240, Diamond's engineers went on a quest both to balance the heavier engine and to draw nonstructural weight out of the airframe. The Katana's battery now lives behind the baggage bay, for example, to help move the empty cg aft, and the wing sweep has been changed from 1 degree aft to just 0.5 degrees back to shift the center of lift forward. Previous Katanas had simple hinged flaps—but at the higher maximum weight, more sophisticated slotted flaps were necessary to bring the stall speed to the JAR-VLA-specified 45 knots.

Diamond switched from a spring-steel to aluminum main landing gear during the A1's tenure, and keeps the arrangement for the C1. Now, however, 5.00 × 5 tires on those Cleveland wheels and brakes replace the odd-sized tires of the A1. Similarly, the castering nosewheel remains much as before, except that the rubber-puck spring medium is much stiffer to handle the heavier engine.

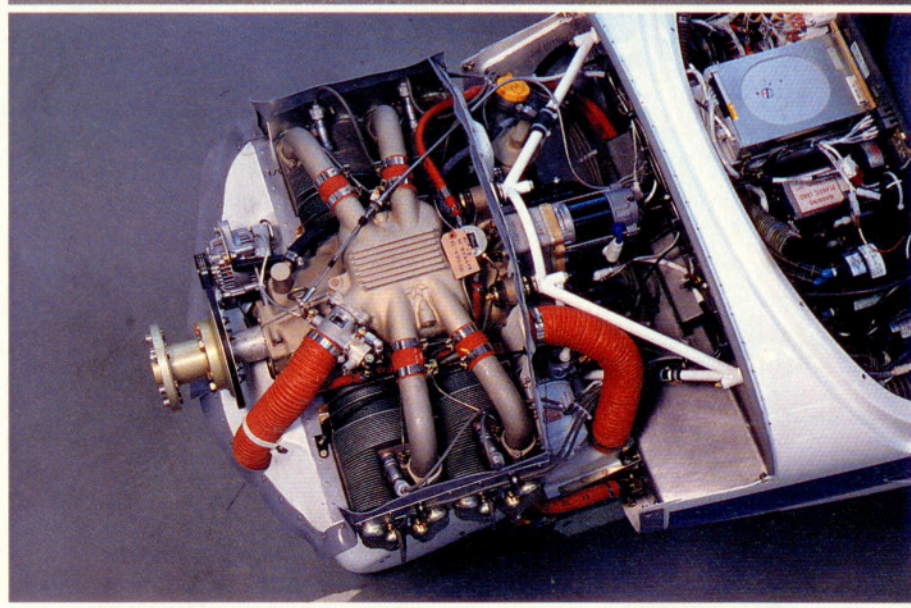
A revised tail section is also part of the C1 transformation. Gone are the anti-servo tabs—often mistaken for trim tabs—and their associated hardware. A stronger spring pack provides longitudinal trim; the electric servo driving this setup is now mounted on the aft side of the vertical stabilizer's main spar, for better accessibility. Horizontal stabilizer and elevator area are both up by 10 percent, and the stabilizer's incidence is increased slightly.

Inside the Katana's side-by-side cockpit are a host of modifications as well. The all-metal instrument panel—introduced as the Canadian-built DA20s came on line in 1995—has been rearranged and moved forward and up by a couple of inches. This frees some legroom while maintaining the same overall panel size. As before, the engine instruments are grouped to the right of the radio stack—although the large tach is now among the primary flight instruments—and the electrical switches are repositioned to minimize hand-changing from the stick for critical items like the fuel pump or master switch. The guarded preselect flap switch has been shifted over slightly to keep from fouling the knees of long-legged pilots.

In the center console, you'll find that the prop and carb-heat levers have been supplanted by mixture and alternate-air controls, and that the climate-control panel has been simplified. As a carrot for northern operators, Diamond has given the C1 a heater/defroster system with much more capacity. The electric pitch trim switch resides behind the throttle/mixture levers; a lot of pilots would probably prefer that this control be repeated on the stick.

New in the C1 are revised seating arrangements, too. Where the old fixed backrests were essentially straight from the shoulder to the floor, the new ones have a slight cutout that is said to make the position more comfortable for the long haul. The previous setup didn't seem particularly trying, so it's hard to say whether the C1's will be an improvement.

In spite of having made comprehensive changes to the engine, airframe, control system, and ergonomics, the C1 Katana flies pretty much like, well, a Katana. Ground steering by differential braking is familiar, and now the brakes seem more powerful and responsive as well. Diamond is experi-



menting with a number of different nosewheel friction settings to minimize brake use during taxi. One complaint remains from the older Katana, though—the rudder pedals are squeezed into a rather small footbox, so pilots with double-digit shoe sizes will want more room. The adjustable rudder pedal setup has been improved with a more positive locking latch.

On the runway, the C1's extra power is immediately evident. The C1 accelerates to the 55-knot rotation speed briskly, even with the cruise-oriented prop out front. Once airborne—the departure still benefits from use of the recommended 15-degree takeoff flap setting—the C1 really gets down to business. At 80 knots indicated, about 5 knots above the best-rate climb speed, we saw a steady 1,000 fpm from 1,000 feet msl, 800 fpm through 3,500 feet, and 500 fpm climbing through 5,000 feet; fuel flow is about 8.5 gph. In cool Canadian springtime weather, the Continental was, if anything, slightly overcooled; the cylinder-head temperature never even got into the lower portion of the green arc during the climb.

Cruise performance is also noteworthy—although many flight schools won't much care. At a density altitude of 7,000 feet, with the engine turning over 2,700 rpm and consuming 7.7 gph, the C1 indicated 130 knots, for a true airspeed of 144 knots. These figures were obtained in the prototype airplane with the Hoffmann propeller and flight-test instrumentation, which is assumed to be reasonably accurate. Pulled back to a more reasonable 2,500 rpm, the C1 still indicated 119 knots on 7 gph, for a true airspeed of 132 knots.

Generally, the IO-240 is well-behaved in flight, but the fuel-injection system is likely to give beginning pilots reason for head scratching. Unlike a carburetor—or even the Bendix-style injection system used on the new Cessnas—Continental's injection setup bases fuel flow on throttle position and engine speed. Originally designed to be used with constant-speed props, the TCM setup occasionally operates counterintuitively with a fixed-pitch prop. For example, if you lean the mixture for high cruise conditions, and then change the throttle position to obtain a lower-speed cruise, it's likely that you will have to enrich the mixture to maintain the same reference to peak EGT. More commonly this adjustment would call for a further leaning of the mixture at the lower power setting.

Handling qualities have been influenced by the change to the Continental engine, too. With greater longitudinal stability and higher stick forces in pitch, the controls are now better harmonized; we complained of heavy roll forces in the Rotax airplane. Now

the Katana's roll forces are about the same, but far less objectionable because of the improved balance. Compared to the other axes, the rudder feels stiff and uncommunicative; and, with the more powerful engine, you'll be using more of the rudder during takeoff and climb. The airplane is, nonetheless, easy to keep in coordinated flight.

Slow flight and stalls—two flight regimes the Katana will no doubt see plenty of—show a good compromise between being too benign to teach anything and too sharp for neophyte pilots. The T-tail remains responsive throughout all normal slow flight, and the stall comes with so much aerodynamic warning that you'd have to be fast asleep to miss impending loss of lift. It stalls straight ahead with little fuss, amazing when you consider that the wing has no washout at all save for the upswept tips. The Katana is approved for spins.

It's clear that Diamond has listened to the schools and made worthwhile changes to improve utility and reliability. The move to a conventional aircraft engine should only drive the Katana further into the training mainstream. How the comparatively beefy Continental fares in the dog-eat-dog world of flight training remains to be seen. But with more than 300 airplanes flying in the United States and Canada, Diamond's designers think they know how to build a better trainer; the C1 is the embodiment of this hard-won experience. □

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Diamond Katana C1
Base price: $114,260
Price as tested: $118,107

Specifications

Powerplant	Teledyne-Continental IO-240-B, 125 hp @ 2,800 rpm
Recommended TBO	2,000 hr
Propeller	Hoffman two-blade, fixed-pitch, 69-inch-diameter wood/composite
Length	23 ft 6 in
Height	7 ft 2 in
Wingspan	35 ft 8 in
Wing area	125 sq ft
Wing loading	13.2 lb/sq ft
Power loading	13.2 lb/hp
Seats	2
Cabin width	42.5 in
Cabin height	39 in
Empty weight, as tested	1,166 lb
Maximum gross weight	1,653 lb
Useful load, as tested	487 lb
Payload w/full fuel, as tested	337 lb
Fuel capacity, std	25 gal (24.5 gal usable) 150 lb (147 lb usable)
Oil capacity	6 qt
Baggage capacity	44 lb, 10 cu ft

Performance

Takeoff distance, ground roll	952 ft
Takeoff distance over 50-ft obstacle	1,263 ft
Max demonstrated crosswind component	15 kt
Rate of climb, sea level	1,105 fpm
Max level speed, sea level	142 kt
Cruise speed/endurance w/45-min rsv, std fuel (fuel consumption) @ 75% power, best power mixture	
7,500 ft	132 kt/2.6 hr (45 pph/7.5 gph)
Max operating altitude	13,123 ft
Landing distance over 50-ft obstacle	1,235 ft
Landing distance, ground roll	550 ft

Limiting and Recommended Airspeeds

V_X (best angle of climb)	66 KIAS
V_Y (best rate of climb)	75 KIAS
V_A (design maneuvering)	106 KIAS
V_{FE} (max flap extended)	78 KIAS
V_{NO} (max structural cruising)	118 KIAS
V_{NE} (never exceed)	164 KIAS
V_{S1} (stall, clean)	42 KIAS
V_{SO} (stall, in landing configuration)	34 KIAS

For more information, contact Diamond Aircraft Industries, Inc., 1560 Crumlin Sideroad, London, Ontario, Canada N5V 1S2; telephone 888/359-3220 or 519/457-4000, fax 519/457-4021. 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.

engine in flight without a sailplane rating.

The Xtreme can be ordered in either taildragger or tricycle-gear versions, powered by either the trusty 80-horsepower Rotax 912 or its turbocharged, 115-hp stablemate, the 914. Diamond assembles the Austrian-constructed motorgliders for U.S. and Canadian consumption at its London, Ontario, plant and expects to have some success selling the airplane to flight schools and FBOs who want to add a bit of spice to the rental line. Prices start at $106,000 for the basic 912 airplane, and top out at $120,000 for the turbo model.

With the 914 engine, the Xtreme has excellent climb performance at amazingly low airspeeds, a result of those long, thin wings doing what they do best. The turbo Xtreme will ascend at 1,200 fpm at just 63 knots indicated.

Cruise performance tops 120 knots with the 914 aboard, which is good, but the A1 Katana, with 20 fewer horsepower, can do nearly as well. But going from place to place isn't really in the Xtreme's syllabus, so its miserly 225-fpm minimum sink rate with the engine off is of greater interest.

Transforming the airplane to a sailplane is an easy task. Slow down and let the Rotax cool a bit from the climb. Pull the throttle to idle and haul back on the prop control, through the feather detent...and wait. The two-blade Hoffmann will eventually align itself with the wind and the Rotax will ker-chunk to a stop. Silence engulfs the Katana-size cabin. Then, the penalty in cruise and the nervous moments maneuvering a 53-foot-wingspan airplane around the ramp vanish. Now you've got a satisfying, no-worries semi-sailplane that's perfectly willing to crank around in steep turns looking for lift. That you can just wake up the engine if the lift fails to arrive, or if you've misjudged the distance back to the airport, is just so much icing on the cake. Yes, there's plenty of adverse yaw from those ailerons *way* out there on the wing—that's what those rudder pedals are for, after all—and you'll need to be watchful of those slender wingtips during crosswind landings.

Hardcore sailplane types will curl their lips at this demi-glider, citing its subpar soaring capabilities and the inherent tradeoffs of drag and weight that accompany a motorglider as examples of why this type of airplane has never caught on here. They're missing the point. Chances are good that the pilot of an Xtreme will be sailplane-curious but unwilling to jump with both feet into the seemingly inscrutable world of *pur sang* sailplanes. You never know—the pilots who give the Xtreme a try might later populate the ranks of serious soaring enthusiasts. —*MEC*