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Diamond DA42-L360: Lycoming Reborn

When Thielert's diesel engines tanked, Diamond needed a hurry-up option for new buyers and beached diesel owners. The L360 delivers.

When Diamond was hard into its certification of the DA42 Twin Star in 2005, it knew it was taking a big chance on the untried Thielert 1.7 diesel engines. But it also hedged its bets by running a near parallel certification effort of the same airplane fitted with Lycoming's angle-valve IO-360, a well proven powerplant. It back-burnered the Lycoming project once it appeared that the diesel engines were both preferred and were gaining ground in the market.

It now appears as though the Lycoming hedge is paying off, by necessity. As is well known by now, the Thielert diesels turned out to have a spotty service record at best, a disastrous one at worst. The engine required numerous periodic replacement parts—mainly gearboxes and clutches—but also lots of unscheduled (and expensive) maintenance that all but tanked the 1.7 diesels as serious contenders.

As we go to press this month, Diamond is finishing certification details on the resurrected Lycoming project under its new version of the airplane, the DA42-L360. (The trade name Twin Star has been dropped because of a trademark dispute with a helicopter manufacturer.) The Lycomings will be offered as an option in place of the newly certified Austro AE300, which Diamond also brought to fruition by launching a company just for that purpose. The new engines will be available for both new aircraft and owners of existing Thielert diesel models who may wish to convert. (We suspect many will.)



Fish or Fowl?

Diamond would prefer that the L360 be compared with other twins in the training market, namely Piper's Seminole, the only real competition. We see the point, but we also maintain that this comparison simply won't fly, at least for our purposes. That's because the original DA42 was born as a Thielert diesel-powered airplane. Just as the airplane was developed for the diesel, it's also true that if the Thielert engines hadn't done so poorly in the field, the Lycoming version of the airplane wouldn't exist.

Response to the diesel was so strong in 2005 that Diamond saw no need to continue with the Lycoming version. There was no interest in it in Europe and even in the

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U.S., where you can hardly find, much less buy, an automotive diesel, interest was also flat. Still, Diamond knew that the 180-HP Lycs were a good match for the DA42.

Fully dressed, the gasoline engines are about 50 pounds lighter than the Thielert diesels and the installation is accordingly simpler. There's no plumbing for a cooling system, no FADEC and its associated wiring, no gearbox and no backup battery. Lycoming four-bangers are what they've always been: Gray lumps of rotating parts that turn out torque.

With the original DA42 as the starting point, the Lycomings are attached to the same firewall, albeit through a Dynafocal mount rather than the four-point mount the Thielert used. The L360 airplanes get new upper and lower cowlings, but Diamond generally retained the look of the diesel cowlings, with a closed lower nacelle and a functional upper outlet grate. There are also small vents on the upper cowling structure.

Unlike most conventional gasoline engine cowlings, which draw air through front inlets and vent it out the bottom cowling, the L360 routes it serpentine fashion through the front inlets, down through the cylinders and back up behind the accessory case where it flows overboard topside. This scheme seems to produce well-cooled cylinders, but oil temps that are on the low side. We would prefer to see 180 degrees-plus on the oil, but we saw less. Some baffling tweaks would fix this and that will be needed for serious winter flying.



Systems

Speaking of which, for heaters, the airplane uses conventional heat mufflers, not the combustion heaters typically found in twins. Diamond is considering that option if customers request it. There appears to be more than enough room in the engine nacelles behind the accessory case for a combustion heater. As it obvious from the photo on page 6, accessing the engine for maintenance is a mechanic's dream. The L360 is also fitted with the PowerFlow exhaust system, which Diamond has used with good results on the DA40.

To simplify both conversions and the manufacture of new airplanes, the L360 retains the systems found in the original diesel airplane with only minor changes. The FADEC wiring harness is gone, along with the diesel's return fuel line. But the fuel system itself remains unchanged, with aluminum cells lodged between the wing main spars for good crash protection and aux tanks in each nacelle. Counting the two 13.2 gallon aux tanks, fuel capacity is 76 gallons, same as the diesel. Because of its miserly fuel burn, the diesel airplanes had excellent range for a light twin. The Lycoming version, by comparison, will have endurance of about 3.5 hours, with reserve. Call that 550 miles in still air compared to a solid 1000 miles for the diesel. That's more than adequate for most training and is acceptable although not exceptional for a traveling airplane.

The engines are Lycoming's IO-360-M1A, a four-banger with a sterling reputation for durability. The right engine is counter-rotating so there's no critical engine on the L360,

something the diesel version couldn't claim, although both variants have as benign V_{mc} and single-engine behavior as we've seen in any twins.

Diamond tested Hartzell two-blade metal props for the L360 and may make these available as an option, but the standard props will be three-blade feathering MTs, which are carbon-clad wood-core props with metal leading edges. These provide better static thrust than two-blade props and Diamond's test data shows that cruise differences between the two props are a wash. The props have an oil-charged accumulator for unfeathering a caged engine.



Despite weak GA sales in general, Diamond's factory in London, Ontario, was wall-to-wall with Lycoming L360s being built up.

Choices

In moving forward with this project, Diamond is giving customers unprecedented choice in powerplants to fit the same airframe. Customers buying new DA42s can choose between the Lycoming engines and the recently certified Austro AE300 170-HP diesel. The latter is not yet certified in North America, but Diamond's Peter Maurer told us the company hopes it will be by late 2009 or early 2010.

Customers who now own Thielert-powered DA42s have three options: They can stick with the Thielert 1.7 or 2.0 engines, convert to Austros or convert to Lycomings. Presumably, all Thielert customers will reach this decision point because those engines simply haven't proven durable. At best, they require frequent clutch replacements and gearbox inspections and replacement. At worst, many owners have experienced premature failures that require complete engine replacement.

As it works through its insolvency, Thielert—now called Centurion—is providing engines and parts, but costs are high and warranties are iffy, if they exist at all. Owners sticking with Thielert/Centurion will need to be exceptionally patient, in our view.

The competing deal from Diamond? Owners can convert to Lycoming engines for a flat \$125,000, all in. For Austro diesels, the bill will come to \$140,000 to \$145,000. Both options are immediately available, or will be once all of the certification paperwork is completed.

Judging the value of these three options is muddled by the fact that we don't know when or even if Centurion will deliver on its promise of a life extension program that will make the 2.0 engines more durable and less expensive to operate. Second, although the Austro will come out of the blocks with a modest TBO—probably in the 1000-hour range—we don't yet have an inkling of how its life extension program will unfold. Similarly, its service history is a blank page.

Flying It

But the IO-360's service history is well known and quite positive. So how does it perform in the L360? To find out, we flew a brief demo with Diamond production



test pilot Rob Johnson. For anyone transitioning to twins, the L360 will be as good a trainer as any. Engine operation is unremarkable piston-engine standard stuff. Of course, where there used to be two levers in the diesel, there are now six for the DA42-L360.

We give Diamond high marks for making this forest of steam levers as unobtrusive as possible. The levers occupy a narrow console between the pilot seats and have no outward splay, so they don't obstruct the view of the Garmin G1000. Fit and finish of the airplane we flew—inside and out—were typical of Diamond, which is to say first rate.

When we flew the Lycoming test article in Austria back-to-back against the diesel in 2005, we were impressed with its robust runway acceleration and sprightly climb. That's still the case. The thing doesn't quite leap off the runway, but it leaves the diesel for dead. Initial climb is 1500 FPM and it will do 1000 FPM higher without breathing hard.

The diesels were fly by wire and silky smooth while the Lycomings have traditional cable controls. They're not quite as smooth to operate—especially the mixture knobs, which have locking levers and felt a little stiff to us. Some tweaking here would help. Rather than a simple percent power indicator, the L360 reverts to MAP, RPM and fuel flow, all displayed on the G1000. Cockpit sound level is moderately high—you can converse without a headset in a slightly raised voice.

Cruise is a little faster than the diesel, but not much faster. At 5500 feet, we noted 155 knots and 10.8 gallons per side, leaned rich of peak. The engines will run lean of peak, albeit with effort required to keep them smooth. Fuel flow drops to the low nines and speed to about 150 knots—a perfectly acceptable setting for training.

Single-engine performance is noticeably better than the diesel version which was, in our view, somewhat anemic. The Thielert-powered airplane will climb on one, but it takes precise handling and speed control. The L360 is more forgiving. Without trying too hard, Johnson coaxed a reliable 350 FPM climb from the right engine with the left caged. Of course, this requires the usual flurry of dead-foot-dead-engine-verify-secure to achieve, but that's why we have trainers, no? With the diesels, it's all automatic.

Johnson's V_{mc} demo was a yawner. V_{mc} is a remarkably low 65 knots and pitching the airplane up to that value yielded an unenthusiastic, barely discernable roll moment into the dead engine. You'd have to be brain dead to miss it.

Conclusion

So what's Diamond got here? Straight to the chase, it has a credible, aggressive response to the bag of hammers it got handed by Thielert. In a little over a year from Thielert's bankruptcy, Diamond has this airplane ready to sell and owners so inclined can convert. Although many DA42 owners are righteously steamed at having to spend so much to maintain their Thielert diesels and yet another pile of cash to convert to something better, we think Diamond's conversion pricing is realistic and reasonable and makes the best of a bad situation.



With its improved bubble canopy, top, the L360 retains the best cockpit visibility of any GA single or twin. Mechanics will love easy access to the IO-360's accessory case, lower.

As for flyability, we might trade the Lycoming's better performance for the diesel's

more leisurely but refined single-lever operation. Regardless of the Thielert engines' show-stopping shortcomings, Diamond got the installation right and it proved that diesels can fly and that single-lever not only works, it's a better way to fly, in our view.

We'll reserve final judgment on comparing the L360 to Piper's Seminole. But we're biased toward the L360 because it's a modern airframe with better creature comforts, superior visibility and impressive single-engine performance, especially the benign V_{mc} demo. If potential Diamond customers don't get flummoxed by having a choice of engines, Diamond will sell some L360s, especially in the fleet training market.

On the other hand, predicting whether this project will have legs is complicated by the fact that if the Austro engine pans out, we'll bet that it will be the preferred powerplant, perhaps even in the U.S. We'll know more in a couple of years. By then, Lycoming may have its IE engines available and the gasoline engine could actually become single-lever easy again.

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POINTS OF COMPARISON

Thanks to the miracle of modern air cooling, the Lycoming IO-360 installation in the L360 has less plumbing and is about 50 pounds lighter than the Thielert it replaces, top inset. Rather than the Thielert's dual ECU controls (bottom inset), the Lycs have two conventional mag switches, middle inset.

Diamond did a superb job of shoehorning six levers (lower right) into a space formerly occupied by the Thielert's two levers, lower left. This photo shows the split lever condition during engine shut-down.



Diesel vs. Gas: Round Two

In 2005, when Diamond was certifying the Thielert-powered DA42, we did a straight-up comparison between the two engines and airplanes. In that review, we found that the diesel airplane won on efficiency, ease of operation and flyability, but the Lycoming came out ahead on demonstrated durability (TBO), simplicity, power-to-weight ratio and overall aircraft performance. The appearance of the L360 invites a second analysis, this time between the Lycoming IO-360 and the new Austro AE300. Here's how they compare.



| SPECIFICATION | LYCOMING IO-360 | AUSTRO AE300 |
|------------------------|--------------------------|--------------------------|
| HORSEPOWER | 180-HP | 170 HP |
| WEIGHT | 455 LBS FIREWALL FORWARD | 637 LBS FIREWALL FORWARD |
| POUNDS/HP | 2.4 | 3.16 |
| FUEL SPECIFICS | .45 LBS/HP/HR | .33 LBS/HP/HR |
| FUEL TYPE | 100LL | JET-A |
| INDUCTION | NORMALLY ASPIRATED | TURBOCHARGED |
| MAX PRACTICAL ALTITUDE | 18,000 FEET | 18,000 FEET |
| ENGINE CONTROLS | MAGNETO/THREE LEVER | FADEC/SINGLE LEVER |
| EASE OF OPERATION | CONVENTIONAL | SIMPLE |
| PROP/FINAL DRIVE | DIRECT DRIVE, MT PROP | 1.69 TO 1 GEAR, MT PROP |
| TBO/TBR | 2000 HOURS | 1000 HOURS (INITIAL) |

| AIRCRAFT SPECS | DA42-L360 (LYCOMING) | DA42 NG (AUSTRO) |
|----------------------|----------------------|------------------|
| EMPTY WEIGHT | 2837 LBS | 2970 LBS |
| GROSS WEIGHT | 3935 LBS | 4189 LBS |
| TYPICAL PAYLOAD | 1098 LBS | 1219 LBS |
| MAX CRUISE | 178 KTS | 185 KTS/18.2 GPH |
| CRUISE @ 75% | 165 KTS/19.8 GPH | 169 KTS/13.6 GPH |
| CRUISE @ 65% | 160 KTS/17.6 GPH | 160 KTS/11 GPH |
| RANGE HIGH CRUISE | 499 NM | 809 NM |
| RANGE ECONOMY CRUISE | 552 NM | 1054 NM |
| FUEL CAPACITY | 74 GAL | 74 GAL |
| V _{YSE} | 82 KTS | 85 KTS |
| V _{MC} | 65 KTS | 75 KTS |
| V _{LO/E} | 194 KTS | 192 KTS |
| V _{LO/R} | 156 KTS | 156 KTS |
| V _{SO} | 61 KTS | 61 KTS |
| TAKEOFF/50 FT. | 2229 FT | 2405 FT |
| LANDING/50 FT. | 2410 FT | 2027 FT |
| BASE PRICE | \$599,500 | \$731,850 |

FIELD NOTES

That data for the specs above were derived from several sources, including our test flights in Austria and London, Ontario, Diamond's Web site and an evaluation which appeared in the January 2009 issue of the German publication *aerokurier*. Diamond confirmed as accurate the data provided by that publication. Specs for the L360 are preliminary—the POH hadn't been finalized as we went to press.

C H E C K L I S T



With 180 HP per side, the L360 hops off the runway and climbs well.



Build quality and ergonomics are typical Diamond superb.



Justifiably unhappy diesel owners are being offered reasonable conversion packages.



Despite ill-starred Thielert service history, the diesels were easier to manage and monitor.



For a video demonstration of the new Diamond DA42-L360, log onto our sister publication, www.avweb.com, then click the video button in the upper right of the home page and scroll down to the Diamond Lycoming twin video.