DELTAHAWK Engines Working Toward STCs for C-172 and C-182

Doug Tilghman
xjayhawk72@gmail.com

"What would your reaction be if someone told you there could be a light aircraft engine that will never have a magneto or ignition system that fails or needs repair; an intake or exhaust valve that's stuck, broken or burned; a spark plug that's fouled or worn out; or a cylinder that needs replacement? What if there were an engine that would continue to produce 75% of its normal power with a failed fuel pump? What if such an engine had a single mechanical (non-digital) power control with no need for a pilot to control fuel/air mixture? How about an engine that runs on a non-leaded fuel already available at a reasonable price at airports throughout the world, and burns about 40 percent less fuel than the engines we're using now? What if such an engine already exists, has been extensively flight-tested, has been certified by the FAA and will be in production around mid-2024? Would you be interested?"

When I wrote that two years ago as the introduction to my article about DeltaHawk Engines, Inc. and their DHK180 engine [Cessna Pilots, November 2023], it was all true and it still is, except for the part about being in production in 2024.

The DHK180 has numerous advantages over the Lycoming, Continental, and Rotax engines that currently power almost all light aircraft. It is a 180-horsepower V-4 compression-ignition (diesel-cycle) two-stroke engine, direct-drive, supercharged and turbocharged, fuel-injected, piston-ported, and liquid-cooled. Because it is both supercharged and turbocharged, it develops full power from ground level through at least 18,000 feet. Other than a glow plug in each cylinder for use while starting, it has no electrical ignition system—there are no magnetos or spark plugs that need frequent maintenance or replacement.

The compression ratio is 20:1 (compared to 7.2 to 8.7 for most Lycomings), with the cylinders inside the block. It produces 180 horsepower with a much smaller size than a four-stroke; its displacement is only 202 cubic inches, compared to the 360 of most 180-hp gas engines. It is piston-ported and has no intake or exhaust valves, camshaft, lifters, pushrods, rocker arms, valve springs or rotators. It produces full power at the same RPM as its propeller, so there is no need for a reduction gearbox. It has a high-pressure fuel pump for each cylinder and if one of them were to fail, the other cylinders would continue to operate normally.

Since the cylinders are inside the block and the engine is liquid-cooled, the DeltaHawk has much tighter piston/cylinder tolerances than a typical gas engine. Unlike air-cooled engines with external cylinders, it does not waste power overcoming the drag that is created by forcing cooling airflow around cylinders. It operates at much lower temperatures, reducing metallurgical stresses that eventually lead to overhauls, cylinder replacements, or catastrophic failures. DeltaHawk has found that internal parts of their engines such as pistons, cylinders, and crankshaft bearings show almost zero wear after hundreds of hours of testing. They predict that the recommended time between overhaul (TBO) will be at least 3,000 hours, possibly as much as 5,000, and their goal is to recommend overhaul based on test conditions rather than hours.

Craig Saxton's Van's RV-14 with the DHK180 engine and MT prop at the DeltaHawk headquarters for testing and documentation.

Dennis Webb, DeltaHawk's Director of Marketing and Certification, said, "Our cylinders have a nice happy life, because they're not exposed to the extreme variations of ambient temperature like external ones. You can't cook our cylinders because they're liquid-cooled. You simply cannot shock-cool or overheat this engine. There is no wastegate so you can't overboost our engine. Our EGT (exhaust gas temperature) runs about 400°F cooler than a gas engine, and our TIT (turbine inlet temperature) is a max of 1,200°F and about 800°F at cruise power, so that's a very cool exhaust. You can just forget this is a turbocharged engine, just go fast, go slow, high, low, it doesn't matter."

Another side benefit of liquid cooling is that cabin heat is taken from the cooling system rather than air flowing around the hot exhaust system, which means you get heat more quickly and there is no risk of carbon monoxide infiltration.

Many people cringe when they hear "two-stroke" because it brings to mind things like chain saws and string trimmers that use a gas/oil mix for lubrication, emit oily exhaust fumes, have terrible fuel efficiency and short lifespans, are hard to start, and sound like demented killer bees. But two-strokes have several advantages: they are lightweight, compact, simple to operate, and have high power density. The DeltaHawk has all of the advantages and none of the disadvantages of a two-stroke. It is compact, fuel-injected, much more fuel-efficient than a four-stroke, and easy to start at temperatures down to at least -20°F. It also burns jet fuel, is liquid-cooled, has very low emissions, and sounds like a diesel. One of the design goals was to make it simple to operate, and it has single-lever power control with no mixture control. The supercharger and turbocharger constantly force as much air into the cylinders as possible, and power is controlled by fuel flow alone.

Another advantage of the DeltaHawk design is high relight altitude. Some previous diesels in aircraft have had a maximum relight altitude of approximately 8,000 feet, depending on air density, which meant that if you starved the engine of fuel at a higher altitude, you had to make a prolonged glide before the engine would restart. The DeltaHawk easily relights at altitudes much higher than that, up to at least 18,000'.

The panel of Craig's RV-14. Note the absence of a mixture control. The switch on the left goes down to heat up the glow plugs for start, then up for start.

At AirVenture 2025 I talked at length with Craig Saxton, who had flown in from Kirkland, Washington, with his DHK180-powered Van's RV-14 and had it on display with the cowling removed. Craig had previously built another RV-14 with a Lycoming IO-360 engine. He had first flown his DeltaHawk-equipped version in June, had completed the mandatory test flights and was thus able to provide solid numbers for comparison of his two planes. His numbers bore out exactly what the company had predicted for the DHK180-equipped version: much better performance in climb and cruise, much lower operating temperatures, and about 40% better fuel efficiency compared to the Lycoming with the same power rating. Craig is planning to build yet another RV-14 with a DeltaHawk engine; some guys just love to build planes that are truly experimental.

A few weeks later Dennis invited me to make a follow-up visit to the DeltaHawk plant in Racine, Wisconsin, so I blasted up there to get

DeltaHawk cowlings will have two primary air intakes with dividers that direct air to the engine and three heat exchangers, engineered to minimize resistance to send the right amount of air to each component.

the inside story about the company's progress and plans. Dennis offered an irresistible inducement: a ride in Craig's RV-14, which was there for a month of more intensive testing and analysis. Connor Maeve, Test Manager and chief test pilot, took me for a short flight in it and demonstrated the operation of the engine.

Everything I had heard and read was borne out during that ride: easy starting, single-lever control, smooth power application, low temperatures and very economical fuel consumption. There was a little vibration, as you would expect in any propeller-driven plane, but the frequency of it was double that of a four-cycle and it felt different in that respect. We didn't work it hard or climb far, so I didn't observe the difference in climb or high-altitude performance. This plane has no muffler and I was surprised by how noisy it was, but after we landed I found that the headset I was using had come apart and wasn't noise-cancelling, so the noise level is probably about the same as my unmuffled RV-8. There's plenty of room inside the cowling for a muffler, which will be included in installations on certified aircraft like Cessnas and Pipers that must comply with noise standards.

When DeltaHawk achieved certification of the DHK180 by the FAA in May 2023, it had already devoted twenty years to design, development, redesign, and testing. A less disciplined company might have rushed into production and sales soon after that in order to create cash flow. Instead, the company has taken a cautious and painstaking approach, one that they intend will pay off with even greater reliability and lower maintenance costs. They have continued to improve the designs, added several new engine models, expanded the scope of applications for their engines, developed agreements with manufacturers and service centers, and continued their intensive testing program to iron out details of installation and operation.

The DHK180 engine has been improved by replacing some of the external fluid lines with internal galleys, thus reducing complexity and the risk of leaks. Some of the components such as the block and the reserve coolant tank have been

The beginning of an installation of the DHK180A4 on the PA-44 Seminole DX.

made lighter, reducing the weight of the engine and its primary accessories by 22 pounds. The new versions of the engine are designated "A4."

The company is now preparing an Amended Type Certificate (TC) for the DHK180A4, which will be rated at 180 max continuous horsepower, and this amended TC will also include a 200-hp version of the same engine to be called the DHK200A4. The additional power will be achieved with changes to the fuel system; the basic engine size will remain the same. This project is currently open with the FAA. Following that will be another project: a new TC for a 235-hp engine, again with the same block.

Another amended TC will be for a six-cylinder 350-hp engine. According to Dennis, this will not be a huge certification effort; it will have twin turbochargers and six fuel pumps instead of four. The cylinders and fuel system will be same as in the 180 and have the same mechanical and thermal loads, so Dennis can approve them by "previous use." The company will of course perform the same endurance testing, but that amended TC will be "a lot easier than a new TC," he said. One customer has already been announced for the DHK350A6: Bushliner, makers of the 1850 Cyclone experimental amateur-built backcountry plane. Another application could be the Bearhawk 5, and this engine would also fit easily in a Cirrus SR-22 or a Cessna 206 or 210, in place of big-bore 6-cylinder Lycomings or Continentals. John Heup, President of DeltaHawk, anticipates having a runnable test version of the DHK350A6 by the end of 2026.

DeltaHawk announced at AirVenture that they have partnered with Piper Aircraft, Inc. to create the PA-44 Seminole DX with two DHK180 engines, and work has begun on development of the new firewall-forward installations on a Seminole in the DeltaHawk hangar. According to the DeltaHawk website, Piper anticipates global demand for this aircraft "to be between 25 to 40 aircraft per year over the next 10 years." The partnership began taking orders for it in July, and interest is reportedly very high. Piper sees the DX as primarily a trainer, but with its increased range and performance, this aircraft could have many other missions.

Of greater interest to our readers, DeltaHawk is taking the first steps toward development of Supplemental Type Certificates (STCs) for installation of their engines in the Cessna 172 and 182. The Skyhawk will get the 180-hp engine, and Dennis anticipates that testing will be completed and the STC for that combination will be ready by the end of 2026. The STC for the 182 will take longer because it will get the 235-hp engine, which is not yet certified. These will be complete firewall-forward replacements plus the necessary modifications of engine controls, fuel tank ports, etc. The packages available from DeltaHawk will have propellers and spinners as options, in case a customer finds a better deal elsewhere. Details regarding installation locations will be available when the STCs are finalized.

The company is taking orders now for the 172 STC, but the price will not be determined until deliveries are ready, at which point the customer can decide whether to proceed with the purchase or cancel the order and reclaim their deposit. The current estimated price for the DHK180A4 package for the 172 is $110,000. That covers the engine, mount, heat exchanger, turbocharger and exhaust pipes, pumps, filters, new cowling and air ducts, and all necessary hardware. This engine comes with a Sky-Tec 24V starter and Plane Power 70-amp alternator with higher power options available. Add about $25,000 for an MT composite propeller, spinner, and installation.

If that seems expensive, and of course it is, compare it to the price of a new 180-hp Lycoming IO-360-L2A from Airpower, Inc., which is roughly $117,000 including only magnetos, ignition harness and spark plugs. That price has increased by about 18 percent in the past two years. This is the engine that is installed in every new Cessna 172.

Let's say in a couple of years you own a 172 with an engine that needs to be overhauled or replaced for another reason, a prop strike or whatever. You have options, including the purchase of a factory-overhauled IO-360-L2A for about $47,000, a factory-remanufactured one for about $55,000 with a core exchange, or an overhaul by a specialist engine shop. Again, these are current prices from Airpower, subject to daily inflation. If you go the route of keeping the same engine model, you have a non-turbocharged powerplant designed in the 1950s that is, admittedly, fairly bulletproof in terms of failure rate but still requires manual mixture control and regular maintenance of magnetos, spark plugs, and other components. After another 2,000 hours or so, you will have to consider yet another overhaul.

Table 1	DeltaHawk DHK180	Lycoming IO-360-L2A (C-172R, C-172S)
Rated power	180 HP @ 2600 RPM	180 @ 2700 RPM
Torque	363 ft-lbs	350 ft-lbs
Displacement	202 cu in	361 cu in
Bore x Stroke	4 x 4 in	5.125 x 4.375
Dimensions (LxWxH, inches)	33 x 24 x 22	29.8 x 33.37 x 24.84
Dry Weight DeltaHawk includes starter, alternator, turbo, exhaust. Lycoming includes starter, alternator, magnetos, spark plugs, ignition harness, intercylinder baffles.	335 lbs	278 lbs
Fuel Types	Jet A & Jet A-1 Certification Fuels. Will burn JP8, D1, D2, F-24	100LL Avgas
US national average fuel prices per gallon (AirNav.com 10/20/25)	$ 5.66	$ 5.97
Fuel Consumption, max power, 180 HP	10.8 gph @2600 rpm	14.0 gph
Fuel Consumption, economy power, 135 HP	7.3 gph @ 2200 rpm	9.67 gph
Fuel Consumption, gallons, 2000 hours @ 135 hp	14,600	19,340
Fuel cost, 2000 hrs @ 135 HP	$ 82,636	$ 115,460
Fuel cost difference, 2000 hours @ 135 HP		**$ 32,824**
Fuel Consumption, gallons, 3000 hours @ 135 hp	21,900	29,010
Fuel cost, 3000 hrs @ 135 HP	$ 123,954	$ 173,190
Fuel cost difference, 3000 hours @ 135 HP		**$ 49,236**
Fuel Consumption, gallons, 5000 hours @ 135 hp	36,500	48,350
Fuel cost, 5000 hrs @ 135 HP	$ 206,590	$ 288,650
Fuel cost difference, 5000 hours @ 135 HP		**$ 82,060**
Plus: Magnetos, plugs, valves, cylinders, overhauls…		**?????**

If you take a longer-term perspective, the DeltaHawk engine would make better economic sense, if the projected numbers pan out, especially for owners whose planes are heavily used for training or other commercial purposes. Take a look at Table 1 for a comparison of the DHK180A4 to the Lycoming IO-360-L2A. This shows that in 2,000 hours of flight at economy cruise power (135 hp), the Lycoming will cost $32,824 more for fuel alone, at today's relatively low prices. Over 3,000 hours, you would spend an extra $49,236 on fuel for the Lycoming compared to the DeltaHawk, plus the cost of an overhaul during that span. If the DeltaHawk engine actually does run toward 5,000 hours before it needs an overhaul, the savings will mount up even more; a Lycoming would probably need two overhauls to fly that many hours.

There's also the cost of routine engine maintenance. The Lycoming's magnetos will be serviced every 500 hours or so, spark plugs will be replaced, and you may even have to replace one or more cylinders or valves before you reach that next overhaul. There's also the downtime while any needed repairs are being carried out and you're waiting for parts. DeltaHawk engines will require oil changes, air and fuel filter replacements and... that's it. For flight schools, FBO rental centers, and commercial operators who rely on their planes for business purposes and operate their own maintenance shops, this is a no-brainer. Even for recreational pilots this probably makes sense, but the return on investment is much longer-term.

Just as I wrote two years ago, it remains to be seen whether DeltaHawk, Inc. can achieve the full potential of the engines they are developing and testing. Much depends upon economic factors over which they have little control. Several things are absolutely certain though: (1) this company has demonstrated remarkable staying power and is unlikely to be deterred from its goals; (2) the prices of their competitors' engines have increased at shocking rates; and (3) there is still no widely accepted replacement for leaded aviation fuel, nor is it widely available in many parts of the world. These factors will continue to exert market pressures in favor of a revolutionary diesel engine that is very efficient, is simple to operate and maintain, develops full power at cruise altitudes, burns jet fuel, and requires very little maintenance. In short, my opinion hasn't changed – DeltaHawk is going to have a huge impact on the aviation propulsion market. We'll just have to wait a bit longer to see it happen.

Right: *The DHK180 installed in the Cirrus SR20 test aircraft.*

Doug Tilghman is a retired software systems consultant who had a 1975 C-172 for thirty years until he bought a Van's RV-8 in 2020. He flies out of Lawrence, Kansas (LWC) and welcomes ideas for stories at xjayhawk72@gmail.com.


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