Win Win Win

AC-Aero engines offer more power, less weight, and multifuel efficiency

BY BETH E. STANTON

"THERE'S THE OLD ADAGE, if it ain't broke, don't fix it," said Andrew Higgs, EAA Lifetime 884422 and founder and president of AC-Aero, based in Tokyo, Japan. However, with more than 20 years of engineering, consulting, and Formula One racing under his belt, Andrew looks to what can be done, not what has already been done.

It's exceedingly expensive for a manufacturer to make changes to a certified product, and GA powerplants, such as Lycoming engines, still use 1950s technology.

"To be honest with you, for what Lycomings actually do, they do it rather well, even though it's an old package and old format," Andrew said.

AC-Aero was founded in 2007 to create clean sheet aviation engines and components with improved power-to-weight ratios and increased performance, reliability, and fuel efficiency. After years of iteration and design, Andrew has developed the E-Series Higgs Diesel combined-cycle engines and Lycoming performance product upgrades.

WHAT YOU WANT

"Many E-AB [experimental amateur-built] builders out there now are building very modern, forward-paced, glass cockpit, advanced airplanes, and then we go and put an engine on it with magnetos, carburetors, and mechanical fuel injection," said RV-10 builder Tim Huneycutt, EAA 1106970. "It's just not leading-edge technology."

Several years ago while Tim was still working on his RV-10, he was discussing powerplants with Andrew.

"Andy said, 'Do you know about this new engine I'm designing?'" Tim said. "'It kind of sounds like exactly what you want.'"

"I've always been a believer in new technology," said Karl Grove, CEO of AC-Aero U.S., which is responsible for sales and customer support.

Karl built and has raced his Lancair Super Legacy, *GA1*, powered by AC-Aero components for the last several years at the Reno National Championship Air Races as a Sport Gold Class contender.

"I think a lot of experimental builders, like me, are looking for performance and weight savings, and these products provide just that," Karl said.

E-SERIES HIGGS DIESEL

The E-Series Higgs Diesel engines incorporate a unique design for achieving horsepower while keeping the weight of the Jet A burning engine at or below similar avgas versions. The V-4 Hawk generates 300-500 hp and weighs 306 pounds; the V-8 Eagle produces 800-1,000 hp and weighs 512 pounds; and the V-12 Condor cranks out 1,000-1,600 hp and weighs 664 pounds. Turbo options are available for all engines.

These Jet A burning, liquid-cooled, combined-cycle, two-stroke engines use a stepped piston to scavenge air, increasing delivery ratio and improving high-altitude operation.

"Combined-cycle technology is not a brand-new idea," Andrew said. "But no one's really taken it to an advanced level and really made it worthwhile in today's environment for efficiency and power."

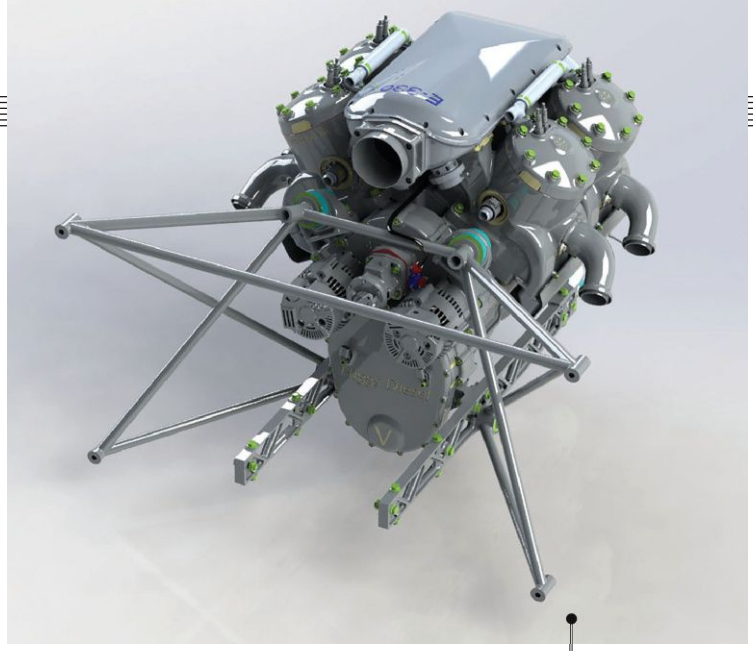
Advantages of the combined-cycle design include the ability to burn a variety of fuels such as Jet A, 100LL, mogas, and ethanol and hydrogen gas. They are simple and reliable with about a third of the moving parts of conventional engines, leading to extended operation and higher time between overhauls.

LYCOMING UPGRADES

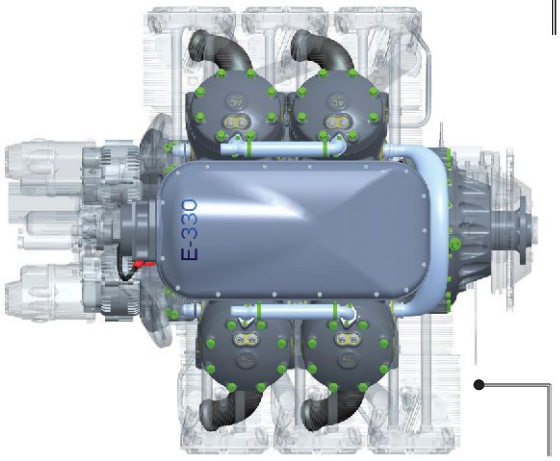
Lycoming performance products provide upgrades for base model Lycoming engines with components for performance increases and weight reduction. Liquid-cooled Gladiator cylinders are available for the four-cylinder Lycoming 320 and 360 engines and generate 200-300 hp. Centurion cylinders convert existing Lycoming 540 engines into lighter and more powerful 350-415-hp machines. All are naturally aspirated with turbocharged options available. Engines reconditioned with AC-Aero components burn less fuel and are designed to run on unleaded aviation fuel.

Liquid-cooled cylinders are game-changing for the cooling challenges associated with increased power. Fins on air-cooled engines add mass and weight. A liquid-cooled jacket wrapped around nickel-coated aluminum cylinder sleeves creates a significantly lighter product than standard Lycoming engines, even with radiator cooling and plumbing.

"Sometimes people come out with a wonderful product, but it's actually quite stressed," Andrew said. "So, even though you have higher performance, you end up with a much shorter lifespan. AC-Aero products have the advantage of higher performance and extended life."



***Above**: RV-10 mount with the Hawk V4.*



***Left:** Lycoming superimposed on E-Series engine.*

RV-10 PACKAGE

The cross-country RV-10 was a perfect platform to test the E-Series V-4 Hawk engine.

"This offers people who have a four-place aircraft and want to fly economically long distances with greater reliability and less weight," Andrew said. "RV-10s can cruise at around 12,000 feet, which is sort of upper limit in [the] experimental market."

For homebuilders looking for an alternative firewall forward package, the turnkey RV-10 package will contain every part needed for a bolt-on solution. The different dimensions of the V-4 Hawk engine compared to a Lycoming will require some cowl modifications. Due to its lighter weight, AC-Aero is working with vendors to ensure components are placed to maintain CG and keep as close to Van's stock specs as possible.

A V-4 Hawk engine mount for the RV-10 has been designed and manufactured and will be integrated onto a test stand for testing to begin this summer.

"I want to be very public with it to share not only the successes but also the challenges that we're coming up against it," Tim said. "There are a lot of people out there with great ideas. That's part of why we all get into experimental aviation. I'm looking forward to getting people's input."

VARIETY OF SUPPORT

As of May 2020, AC-Aero entered the United States market with Karl running the stateside operation creating infrastructure and logistics to provide customer support. Collaboration with new distributors has created the opportunity to establish build centers on the West Coast and potentially in Alaska. Supporting customers with full-service FBOs will make it easy for people to fly in for their upgrade work and firewall forward installs.

AC-Aero is leveraged to provide a variety of horsepower requirements with its range of products. The E-Series Higgs Diesel engines on the lower end of the horsepower spectrum will meet the needs of homebuilders and original equipment manufacturers (OEMs) alike. The upper end appeals to OEMs interested in the two-cycle technology and multifuel burning solutions. The Falcon V-4 multifuel engine with 210-250 hp and a weight of 165 pounds is a bolt-on replacement for Rotax engines for the light-sport aircraft market.

AC-AERO AT AIRVENTURE 2019

On display at the Innovation Showcase at EAA AirVenture Oshkosh 2019 were the Centurion cylinders and the V-4 Hawk with the RV-10 engine mount. Andrew described people's response as "staggering."

"I had not expected the interest that we generated," he said.

Andrew believes it was the combination of an engine configuration that nobody had ever seen before — a piston engine that uses spark plugs to ignite jet fuel plus a combined-cycle two-stroke engine that doesn't put out blue smoke.

"People were looking at the size, performance, and weight of the engine, which is almost the same as a 360 but with more power than a 540 and running on jet fuel," he said. "These things together created a lot of enthusiasm."

A liquid-cooled jacket wrapped around nickel-coated aluminum cylinder sleeves creates a significantly lighter product than standard Lycoming engines, even with radiator cooling and plumbing.

FOUND THE FORMULA

Throughout the design phase, compliance with current FARs for commercial aviation was maintained with a future goal of obtaining STCs for certain parts.

It's never easy to come to market with a new engine, but after several years of preparation and design improvements, AC-Aero is ready to deliver its products to the industry. Several hundred people have already indicated they are interested in the engines, and AC-Aero is now in full production.

According to Karl, improved technology that provides performance gains in an easy to install, small, lightweight package is a "winner, winner, chicken dinner" for any builder.

"As a racer, or an aerobatic pilot, an experimental builder, or as any pilot really, those are the missing elements in the formula to save weight and to have better performance," he said. "Who doesn't want that?" EAA

Beth E. Stanton, EAA 1076326, majored in English because it involved the least amount of math. She finds it hilarious that now she is a pilot and writes stories about airplanes and technical stuff. She can be reached at bethestanton@gmail.com.

PHOTOGRAPHY COURTESY OF **AC-AERO**

EAA
Sport Aviation
The Spirit of Aviation® | www.eaa.org
Vol.69 No.7 | July 2020

+

Good Samaritans
How GA is making a difference in the villages of Papua New Guinea

One Piece at a Time
How an Ohio couple rescued an Ercoupe

Generations
One family's decadeslong connection to EAA

BROTHERHOOD
An opportunity that changed lives

P.54