Highlights from AirVenture 2024

Pivotal flew its BlackFly in single and dual flight demonstrations each evening. (All photos by the author)

Vertical takeoff and landing (VTOL) and electric aircraft have a growing presence in the annual Oshkosh fly-in.

By Kenneth I. Swartz

Experimental Aircraft Association (EAA) founder Paul Poberezny used to say about the AirVenture fly-in in Oshkosh, Wisconsin, "You come for the airplanes, but you stay for the people."

This year, EAA AirVenture and the Farnborough International Airshow in the UK (see "Farnborough Airshow 2024: Smarter Aviation," pg. 38) occurred during the same week, July 22–28, but there was minimal impact on the shows, which serve complementary markets.

This year more than 10,000 aircraft arrived at Wittman Regional Airport and other airports in east-central Wisconsin, which generated an average of 113 takeoffs and landings per hour when Wittman was open. AirVenture 2024's attendance soared to a record 689,000 people — breaking last year's attendance record of 677,000 — and the show booked a record 861 commercial exhibitors.

AirVenture is always dominated by fixed-wing aircraft, but this year *Vertiflite* noted more than 50 rotorcraft participating in the airshow or on display on the vast 1,500-acre (600-hA) site. As in past years (see, for instance, "A VTOL AirVenture," *Vertiflite*, Sept/Oct 2024), innovations in electric aviation and vertical flight are highlighted in this report.

Electric Aircraft

Advanced air mobility (AAM) is a growing theme at AirVenture with aircraft developers using the opportunity to educate potential customers and the aviation community at large on the coming electric aviation revolution. VFS held the 18th Annual Electric Aircraft Symposium the weekend before AirVenture, with more than 40 executives from AAM companies and organizations (see "18th Annual Electric Aircraft Symposium a Great Success, pg. 50).

Since 2016, numerous eVTOL aircraft have been flown or displayed at Oshkosh, including the AIR ONE, EHang 184, Kitty Hawk Flyer, Pivotal (formerly Opener) BlackFly, TeTra Mk-5, Volocopter 2X, the Wisk Cora and Generation 6 and Workhorse SureFly, as well as electric conventional takeoff and landing (eCTOL) aircraft, such as the Ampaire Electric EEL, Textron eAviation/Pipistrel Alpha Electro and Velis Electro.

This year there were several new participants showcasing their aircraft and innovative concepts.

Pivotal

This year, Pivotal flew two crewed BlackFly eVTOL aircraft in a night airshow at Oshkosh, and the company was actively marketing the Helix, its new-generation ultralight aircraft that went on sale earlier this year.

The BlackFly has become a regular eVTOL performer at AirVenture, and the two women pilots at this year's show are also members of the company's engineering team.

Pivotal COO Kristina Menton explains the details of the BlackFly and the new Helix version.

Last year, Pivotal (previously known as Opener) selected several buyers to receive BlackFly aircraft under its Early Access program, who each received at least two weeks of flight training at the company's facilities in California.

In February, the company delivered the first four of eight aircraft and two flight simulators on lease to Modern Technology Solutions Inc. (MTSI) for evaluation by the US Air Force's AFWERX unit as remotely piloted aircraft.

"This has been another step function change within the organization as we've worked to scale our operation, become customer focused and really prove that there's safety, reliability, quality and extreme enjoyment in having these electric vertical takeoff and landing aircraft out in the real world [and] there's also a market for them," said Kristina Menton, Pivotal's chief operating officer.

Then in May, Pivotal announced it had signed a two-year Other Transactions Authority (OTA) agreement with the US Air Force and AFWERX Agility Prime that provides Pivotal with access to world-class test facilities, expert resources and multiple sites under restricted airspace, which will help accelerate Pivotal's uncrewed and crewed flight testing and system verification. This was the company's first direct-to-government contract with the Air Force and Agility Prime.

A month prior to AirVenture, a BlackFly took off from the waterfront in Sausalito outside San Francisco, California, and flew in uncongested airspace over the Golden Gate Bridge.

Menton said that the early-access customers have provided the company with a lot of feedback, and this has been incorporated into tweaks in the system design. One example saw the aircraft's pre-flight and start procedure modified to be more intuitive.

First deliveries of Helix, the production aircraft, will begin later this year, with prices starting at $190,000.

Helix has the same aero structure as the BlackFly but has a lot of design improvements "under the hood," said Menton. This includes 15–20% more thrust, a 10% higher operator weight limit — now 220 lb (100 kg), more command authority, some weight reductions, a larger flight deck and the installation of an Automatic Dependent Surveillance–Broadcast (ADS-B) Out system so the aircraft will show up on flight trackers and alert people that there is an ultralight flying in the area.

The company's initial focus is on the US where the BlackFly and Helix can fly as Part 103 ultralight aircraft. Earlier this year, Pivotal CEO Ken Karklin said that the ultralight Helix will weigh about 348 lb (158 kg); this exceeds the ultralight weight limit of 254 lb (115 kg) but takes the safety weight credits for the full-aircraft parachute system, the amphibious hull floats and outrigger wing floats.

Karklin firmly believes the aircraft has a lot to offer when it comes to first response and defense applications, where it could be deployed as a "manned, unmanned, optionally manned... and unmanned teamed."

AIR

Chen Rosen, founder and CTO of AIR, gave an update on the latest developments of the company's AIR ONE eVTOL.

Earlier this year, Pardes Hana, Israel-based AIR VEV Ltd delivered its two-seat, winged AIR ONE eVTOL prototype (AIR ZERO) to a customer for evaluation as an uncrewed cargo aircraft with a capacity to transport a 550-lb (250-kg) payload faster and with more endurance than a pure multicopter (see "Electric VTOL News," pg. 72).

Two years ago, VFS introduced AIR to the leadership of AFWERX Agility Prime at the 16th Annual Electric Aircraft Symposium. AIR was subsequently accepted into the Agility Prime program in late 2022, and opened an office in Fort Worth, Texas.

The company is now building a second aircraft for delivery to a new company test site in the US later this year to conduct flight tests for Agility Prime, and it is expanding its production capacity to delivery 10 cargo aircraft to an undisclosed customer in 2025.

Like Pivotal, AIR's primary market is individuals who would like to own and fly an eVTOL aircraft for recreation, adventure or commuting, but the cargo and defence markets have both shown early interest in the simple aircraft, which has four pairs of electric propellers in a quadcopter arrangement plus a wing.

Harbour Air

Harbour Air didn't receive a permit to fly from the FAA but demonstrated high-speed taxis with its magniX-powered DHC-2 eBeaver eCTOL seaplane.

Vancouver, British Columbia-based Harbour Air and Everett, Washington-based magniX teamed up this year to significantly raise their profile by shipping two De Havilland Canada DHC-2 Beaver seaplanes retrofitted with magniX electric motors to Oshkosh. One eBeaver that will be used in the supplemental type certificate (STC) certification program was prominently displayed near the high-traffic Boeing Plaza at Oshkosh and a second flyable aircraft was at the EAA seaplane base on Lake Winnebago.

Harbour Air reached out to VFS for assistance to resolve a charging issue and an issue with the US Federal Aviation Administration (FAA), but unfortunately the agency didn't issue a flight permit for the aircraft in time for the eBeaver to fly in the airshow. Nevertheless, both eBeavers generated a lot of interest in the aircraft and magniX's engine technology.

Companies pursuing STC programs to reengine existing helicopters and aircraft are some of the most transparent in the AAM industry, and the lessons learned are valuable for eVTOL and eCTOL developers alike. This is especially true for Harbour Air, which is a scheduled airline with an engineering capability. The company wants to introduce electric aircraft into its scheduled passenger and sightseeing business that currently flies 450,000 passengers a year on up to 300 short-haul seaplane flights a day.

At the 18th Annual Electric Aircraft Symposium and a subsequent EAA forum, Erika Holtz, Project Manager and Engineering Lead for the eBeaver program, presented an in-depth case study of the electrification journey at Harbour Air. VFS video-recorded the latter and posted it to our YouTube channel (**www.youtube.com/VTOLsociety**).

magniX

Harbour Air partner magniX has flown its electric engines on five different helicopters and eCTOL aircraft since 2019. It's also one of two companies (the other is GE Aerospace) contracted by NASA's Electrified Powertrain Flight Demonstration (EPFD) project to conduct ground and flight tests of hybrid-electric propulsion systems.

Under a $74.3M contract awarded in 2021, magniX will replace two of the four Pratt & Whitney Canada PT6A-50 turboprops on a DHC-7 airliner with a pair of magni650 electric motors to test a megawatt-class hybrid-electric powertrain at altitudes of up to 27,500 ft (8,400 m).

When magniX first entered the aviation market, its electric motors were too large for many distributed electric propulsion (DEP) applications. But the magni350 was selected by Tier 1 Engineering to power the Robinson e-R44 helicopter conversion it was developing for Unither Bioelectronics (see "Tier 1 Teams with magniX for New e-R44," *Vertiflite*, Jan/Feb 2022).

In June, magniX announced that it was expanding its product line with the development of its Samson line of batteries for aviation and industries or applications that require high levels of performance, safety and reliability. Reed Macdonald, magniX's new CEO, told *Vertiflite* that the company is very interested in engaging with eVTOL companies to see how the Samson battery can meet their needs.

In a company press release, magniX said it is developing battery packs with an energy density of 300 Wh/kg and a battery cycle life of over 1,000 full-depth discharge cycles to reduce operating costs.

NUNCATS

Community-interest company NUNCATS displayed its electric Zenith CH 750 Sky Jeep.

NUNCATS, from the UK, displayed its Electric Sky Jeep. The group's name is indicative of its intentions: "No Unnecessary Novelty Community Air Transport Services." NUNCATS shipped their prototype electric aircraft to Oshkosh to showcase the charity and help raise funds to develop their short-range medical support aircraft.

Technical director Tim Bridge told *Vertiflite* that the goal of the project is to develop a low-cost, rechargeable aircraft that can quickly deliver medical supplies or a medical practitioner to a

remote region in minutes — rather than hours or days — to help save lives.

Bridge said that the UK charity raised enough money to build a minimum viable product (MVP) during COVID-19 that combined a short takeoff and landing Zenith Aircraft Company CH 750 kit donated by the manufacturer with an electronic propulsion unit forward of the firewall that used many of the same suppliers as Pipistrel Aircraft.

The aircraft is being flight tested at Old Buckenham Aerodrome in Norfolk, England.

Bridge believes that the battery-electric aircraft will complement drone services now developing in regions like Africa to serve remote communities.

Aeromarine LSA

Chip Erwin, a serial entrepreneur with 40 years in the light aircraft market, believes that electric propulsion is going to bring many benefits to the ultralight aircraft market, which historically uses two-stoke engines that are noisy and unreliable. His company, Aeromarine LSA, has focused on Light Sport Aircraft (LSA) and has been exploring electric propulsion for more than a decade.

Chris Erwin's Merlin ultralight aircraft with his Aeromarine Merlin Parallel Hybrid Drive.

At AirVenture 2024, Erwin displayed a Merlin ultralight aircraft with an Aeromarine Merlin Parallel Hybrid Drive. The parallel hybrid drive unit features the use of a lighter, smaller and more efficient piston engine supplemented by a lightweight electric engine for takeoff and climb, with a small battery that can be recharged in cruise. The electric motor can also provide emergency power if the piston engine fails.

Erwin is developing a number of hybrid-electric systems that use small, industrial piston engines.

Rotorcraft

Helicopters were constantly in the sky at AirVenture with a total fleet of five vintage Bell 47Gs flying passengers from the Pioneer Airport near the EAA Museum over a part of the exhibit grounds, even when the airshow was underway. The helicopters fly an average of 700 passengers a day — which translates into about 4,900 passengers total — or 350 daily flights in the two-passenger Bells from what is probably the world's busiest heliport for one week a year.

Enstrom Helicopters is a longtime supporter of AirVenture, with Oshkosh only 91 miles (146 km) southwest of the 173,000-ft² (16,100-m²) factory at Menominee Regional Airport, Michigan. This year the helicopter maker had three aircraft on display, including the first Enstrom 280FX equipped with a lightweight, all-electric Kelly Aerospace Thermal Systems air conditioning system. Kelly is a longtime supplier of air conditioning systems for general aviation aircraft, with Enstrom being its first entry into the rotorcraft market. The system will get an STC by Kelly and be available for installation in factory-new aircraft as well as for field installation.

Enstrom delivered two 280FX models to the Peruvian Army in early August and is building two more for the Peruvian Air Force, which are both long-time customers.

Textron displayed a Bell 429 and Airbus had an H125 at their corporate displays, with most of the certified helicopter models in the exhibitor area associated with university flight training programs, missionary organizations and trade organizations like Vertical Aviation International (formerly Helicopter Association International).

The warbird display included at least three former military helicopters, including two Vietnam War-era Bell UH-1H Hueys and a former French Army Aérospatiale Gazelle SA.341F (N341KJ). The Wisconsin National Guard also showcased its battlefield capabilities in a demonstration of 10 UH-60 Black Hawks.

Several new recreational rotorcraft also debuted at Oshkosh, each with an interesting backstory.

Skyryse

Skyryse CEO Mark Groden highlighted its R66 Skyryse One, which they called "the world's first production aircraft operated with just a single control stick and two touch screens."

Skyryse debuted Skyryse One, an instrument flight rules (IFR)–capable Robinson R66 Turbine helicopter featuring a reimagined cockpit with the company's SkyOS fly-by-wire (FBW) "operating system." It replaces conventional mechanical controls with a single, four-axis control stick similar to that found on advanced fighters like the F-35B Lightning II.

CEO Mark Groden founded Skyryse in 2016 with the goal of introducing the simplified vehicle operations (SVO) concept to make it safer and easier to fly general aviation airplanes and helicopters.

Skyryse was founded with the belief that you could take fly-by-wire technology and bring it to conventional general aviation to provide a significant safety benefit. The company first considered buying off-the-shelf technology, but all the systems used in military and commercial aircraft were too expensive and too complex for general aviation applications.

That's when Groden decided to "take on the hardest problem first" and develop a fly-by-wire SVO control system for helicopters first, because "if you can solve the technical challenges of bringing fly-by-wire… to a helicopter, you certainly can solve them in an airplane."

The scope of work was tremendous and included developing a suitable control stick; triple-redundant, jam-proof actuators; motor controllers; and flight control computers. Groden said, "we had to design all of that from scratch… with the exception of a couple [standard] boxes like nav and comm, which are piped in on the back end."

In July 2023, Skyryse performed the first fully automated helicopter autorotation emergency landing procedure using an R66. "It's incredibly challenging to build a flight [control system] plant model of an aircraft like this and really understand what it's going to do," he said, especially when you get to the edges of the envelope or enter an autorotation, "where you're flaring and you have tremendous amount of nonlinearities happening all at the same time."

For the past eight years, Skyryse has been doing a lot of "system identification flying [to] figure out exactly how the rotorcraft was going to perform and respond to certain control inputs… and write the control laws around that."

Skyryse completed its first production-conforming R66 last year and the aircraft will soon enter flight test to replicate a lot of the tests performed on the company's experimental category R66 for FAA credit. The company's first goal is to obtain an STC for the system in the R66 and start delivering aircraft to customers in 2025. Skyryse then plans to pursue STCs for almost a dozen other airplane and helicopter models.

Skyryse is just one recent example of Robinson Helicopters partnering with technology innovators. Other examples include partnering with Rotor Technologies to deliver remotely piloted R22s and R44s to the utility and aerial application market (see "Rotor Launches Autonomous R44s," pg. 32), and a new partnership with Unither Bioelectronics powering helicopters with hydrogen fuel cell technology (see "Unither Bioelectronics and Robinson Helicopter Partner on Hydrogen," pg. 54).

Cicaré

The Cicaré 8 kit helicopter made its debut at AirVenture 2024, with distributor Keith Barr of Cicaré USA displaying a two-seat aircraft he completed last year.

The Cicaré 8 kit helicopter is now available in the US and may soon be qualified as a Light Sport Aircraft under the proposed MOSAIC rules.

Argentinian inventor Augusto "Pirincho" Cicaré built and flew his first helicopter in 1961. He established Cicaré Aeronáutica in Saladillo, Buenos Aires Province, in 1972 and developed the CH-3 prototype with the support of the Argentine Air Force and private investors. This was followed by the CH-4, one of the first ultralight helicopters.

In 2015, the company developed the new side-by-side, two-seat Cicaré 8, which was upgraded to a more powerful 140-hp (100-kW) Rotax 915 iS engine in 2020.

When Augusto Cicaré died in January 2022, his sons continued the business and signed up new regional distributors, with Barr securing the rights to sell helicopters in North America.

The Cicaré 8 has a two-bladed main rotor system featuring composite blades, with control rods that pass through the hollow rotor mast. The Rotax 915 iS consumes about 4.5 gallons (17 liters) of automotive fuel per hour, giving the helicopter a range of more than 300 miles (480 km) with reserves. It cruises at 80 kt (148 km/h) and can hover out of ground effect at more than 6,000 ft (1,830 m), with a service ceiling of 10,000 ft (3,050 m).

Cicaré is also introducing several new innovations on the helicopter. For example, it's available with four external video cameras to provide a pilot with 360-degree situational awareness, and Barr said the company is developing a "vortex ring state warning system… that will warn the pilot when to take action and initiate a Vuichard maneuver."

The Cicaré 8 was certified in 2023 under the German Airworthiness Requirements for Ultralight Helicopters (LTF-ULH) for aircraft under 600-kg (1,320-lb) maximum takeoff weight, granted by the Deutscher Ultraleichtflugverband e.V. (DULV) and it's also certified under Italian rules. A total of about 30 Cicaré 8 helicopters have been delivered.

The Cicaré 8 is now sold in the US as a kit, but Barr expects that the sale of factory-built aircraft will follow if the proposed Modernization of Special Airworthiness Certification (MOSAIC) rules take effect, which include helicopters as Light Sport Aircraft (LSA) for the first time.

Argo AK1-3 Helicopter

The Argo AK1-3 helicopter.

Another first-time participant at Oshkosh was the Aerokopter AK1-3, designed in Poltava, Ukraine, and today produced by Manufaktura Lotnicza (also known as Argo Aero) in Warsaw, Poland, as the Argon AK1-3 Sanka.

The new North American distributor is Brooks Cooley of Custom Aircraft LLC, based in Wilmington, Delaware. He is a corporate-jet flight instructor and serial builder of 19 kit helicopters, including four that were turbine powered.

After building and flying RotorWay helicopters for three decades, Cooley discovered the AK1-3. He spent a year and a half negotiating an agreement to sell the aircraft as a kit in the US.

The AK1-3 has a 22.4-ft (6.84-m) diameter, three-blade articulated main rotor system with a unique torsion-bar blade mounting system, a belt-driven main transmission and a shaft-driven tail rotor. The AK1-3 was certified in 2006 under Ukrainian AP-27 rules and entered production in 2015; it's a derivative of the earlier Aerokopter ZA-6, which had a five-bladed main rotor.

The AK1-3 is powered by a four-cylinder, air-cooled, four-stroke, 156-hp (116-kW) Subaru EJ25 automotive engine (a new version powered by a Rotax 916 iS is now in development). It has a 1,428-lb (648-kg) maximum gross weight, an 838-lb (380-kg) empty weight and a useful load of 595 lb (270 kg).

More than 102 helicopters have been sold in over 20 countries, including South Africa. An aircraft was imported into the US from Canada in 2018 that flies under the Experimental–Exhibition category.

Cooley imported his first kit earlier this year and exhibited it at the SUN 'n FUN Aerospace Expo in Lakeland, Florida, in April. The kit version sells for $179,000.

The Argon AH 2.2 helicopter, first revealed at AERO Friedrichshafen 2024 (see "AERO Friedrichshafen Reaches New Heights," *Vertiflite*, July/Aug 2024), is a further refinement of the AK1-3 gyroplane.

Trans-Atlantic Argo Gyroplane

Christophe Gonin (left), with Lucien Angrand and the Argo Aero Argon GTL, celebrating the world's first eastbound crossing of the Atlantic Ocean in a gyroplane.

At the AERO Friedrichshafen tradeshow in Germany in April (see "AERO Friedrichshafen Reaches New Heights," *Vertiflite*, July/Aug 2024), Argo Aero founder Krzysztof Wronowski announced that one of his gyroplane customers planned to fly across the North Atlantic to attend EAA AirVenture in Oshkosh. Nevertheless, it was a surprise to see an Argo Aero Argon GTL (F-JLEK) on the grass at Oshkosh after almost no publicity regarding its 10,000-mile (16,000-km) flight from France to Oshkosh.

Gyroplane enthusiast Christophe "Tof" Gonin of France began planning the adventure two years ago and selected the Polish-built Argo GTL (Grand Tour, Long) because it was a two-seat, side-by-side gyroplane with good range and a large cabin that could accommodate all the required equipment and survival gear for the trip. This is believed to be only the third time a gyroplane had flown across the Atlantic, and the first time a gyroplane has made an east–west crossing, which has higher headwinds.

Gonin set off on April 14 from La Tour-du-Pin-Cessieu airfield in southeast France to AERO Friedrichshafen (on the southern border of German) with gyroplane enthusiast Aurelie Riviere Surzur. Then the epic trip began on April 21, which included a crossing of the English Channel on April 24, departing Wick, Scotland, for the Faroe Islands on May 1, and flying from Vagur, Faroe Islands, for Eglisstadir, Iceland, on May 4.

The team flew across Iceland to Hólmheiði, a small airport near Reykjavik. After Riviere Surzur returned to France as planned, Gonin flew to Greenland on his own. On May 14, he departed Isafjordur, Iceland, to Kulusuk, Greenland, which was a challenging five-hour, 400-mile (641-km) overwater flight in strong headwinds.

Gonin was grounded in Kulusuk by weather and paperwork until May 21, when he took off for Narsarsuaq, which was

another 400 miles (650 km) away near the southern tip of Greenland. On May 22, he flew 300 miles (465 km) northwest to the Greenland capital of Nuuk.

Unfortunately, the gyroplane was severely damaged at Nuuk Airport when a 90-kt (167-km/h) windstorm caused it to flip over on May 28. Manufaktura Lotnicza immediately shipped replacement parts by truck from Poland to Denmark, and then by ship to Greenland. Eight days after the accident, the parts arrived in Nuuk and the gyroplane was repaired in a garage in the town.

On June 18, the repairs were completed and the trip resumed, with Lucien Angrand, a friend of Gonin and a member of the aircraft repair crew, joining the flight to Oshkosh.

On June 24, they departed Nuuk on a 200-mile (320-km) flight north to Sisimiut, and crossed the Davis Strait into Nunavut, Canada, on June 25. Following several more long flights — up to 400 miles (645 km) and five hours at a time — they flew south across the Hudson Strait to Quaqtaq in northern Québec, then onward to Kuujjuak and Schefferville, Québec, east to Goose Bay, Labrador, and then to St. Augustine, Québec. They then flew west along the Gulf of Saint Lawrence to Sept-Îles and Forestville before heading inland with stops in Saint-Honoré, Roberval, Saint-Cuthbert and Maniwaki, Québec, and North Bay, Ontario.

The aviators then crossed the US-Canada border at Sault Ste. Marie and followed Michigan's Northern Peninsula to Wisconsin, with the final leg from Kenosha to Oshkosh completed on July 14, with just a week to spare before AirVenture began.

The record-setting Argon GTL is now being offered for sale.

Composite-FX

A Composite-FX Mosquito XET ultralight with the Solar T62-T2A turbine engine. The company has paused its electric Mosquito XE development.

Composite-FX of Trenton, Florida, continues to pursue the development of an electric and hybrid-electric version of its Mosquito XE helicopter series for uncrewed cargo missions, but has paused work as it seeks a new supplier for electric motor inverters.

Operations manager Norbert Richter believes that one of the biggest benefits of the upcoming MOSAIC rule change will be the ability for helicopter customers to obtain bank financing to purchase a factory-built aircraft, which is almost impossible for anyone buying a rotorcraft sold as a kit.

Looking Forward

The Wisconsin National Guard flew 10 Black Hawks in assault and medevac demonstrations.

AirVenture has always provided a platform for aviation innovators, and this year was no exception.

VFS plans to continue its support of rotorcraft and electric aircraft innovation at next year's AirVenture, planned for July 21–27, 2025.

*Additional photos by the author have been posted in the VFS Photo Gallery at **www.vtol.org/gallery**.*

About the Author
Ken Swartz is a senior aerospace marketing and communications strategist, running Aeromedia Consultants. A long-time consultant to the aviation, aerospace and vertical flight industry, he's held management positions in the regional airline, helicopter and aircraft manufacturing industries for 30+ years, and has reported on vertical flight since 1978. In 2010, he received the Helicopter Association International's "Communicator of the Year" award. He can be reached at **kennethswartz@me.com.**