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# VERTIFLITE

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## AirVenture Takes Off in Oshkosh

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# Return to Oshkosh: EAA AirVenture 2022



Although it was held during the pandemic last year, AirVenture 2022 was a return to full strength for the world's largest fly-in.

The Red Bull Bo 105C gave daily aerobatic displays. (All photos by the author)

By Kenneth I. Swartz

This year's Experimental Aircraft Association (EAA) AirVenture in Oshkosh, Wisconsin, will rank as the world's largest gathering of general aviation aircraft, pilots and aviation enthusiasts in 2022, but the week-long aviation extravaganza also hosted many significant vertical takeoff and landing (VTOL) and electric aviation exhibits and flying displays.

Following immediately after the Vertical Flight Society's 16th Annual Electric Aircraft Symposium in downtown Oshkosh at the University of Wisconsin Oshkosh's Culver Family Welcome Center (see "Engaging Electric Aircraft," pg. 38), this year's AirVenture exhibition attracted a record 650,000 people with more than 10,000 aircraft arriving at Wittman Regional Airport in Oshkosh and other airports in east-central Wisconsin.

AirVenture attracted 803 commercial exhibitors and hosted 1,400 forums, workshops and presentations throughout the week.

The number of show planes totaled 3,226, including 1,375 registered in vintage aircraft parking, plus 1,156 home-built aircraft (up 6% over 2021), 369 warbirds (up 5% from 2021), 137 ultralights, 87 seaplanes, 77 aerobatic aircraft and 25 rotorcraft.

While the total number of rotorcraft was small, many of the VTOL companies had a story to tell and the VFS team was onsite to record it for *Vertiflite*, the VFS **eVTOL.news** website and VFS YouTube channel.

The airshow program included daily aerobatic performances by the Red Bull Messerschmitt-Bölkow-Blohm Bo 105C, flying displays that included a Vietnam-era Hughes OH-6A and Bell

UH-1H Huey, and modern-generation Bell Boeing V-22 Osprey. Examples of both US Air Force and US Marine Corps Ospreys were on static display, as well as a collection of frontline US Army rotorcraft, including a Boeing MH-47G of the 160th Special Operations Aviation Regiment (Airborne), Boeing AH-64 Apache, Sikorsky UH-60 Black Hawk and Airbus UH-72A Lakota.

In addition to a Bell 47G fleet providing daily flightseeing tours, the rarest rotorcraft at AirVenture was a restored US Marine Corps Sikorsky UH-34D Choctaw owned by the YL-37 Group Foundation in Inola, Oklahoma. The aircraft, designated as YL-37, served in Vietnam, and the "coughs" emitted by its Wright R-1820-84 radial piston engine were an audible reminder of the helicopters' pre-turbine history.

## Opener Flies BlackFly

Palo Alto, California-based Opener returned to AirVenture in 2022 with two flying examples of the BlackFly ultralight eVTOL aircraft. The company was represented by a large team led by new CEO Ken Karklin, who joined the company 10 weeks earlier to replace founder Marcus Leng, who remains a shareholder in the company.

Karklin spent the first 25 years of his career in the semiconductor industry and then 13 years in senior management at AeroVironment, which is an American defense contractor headquartered in Arlington, Virginia, that designs and manufactures UAS, originally founded by Dr. Paul B. MacCready, Jr., in 1971.

Opener made four crewed flights of its BlackFly before tens of thousands of people between July 26 and 29. The aircraft were piloted crewed by the company's three current aircraft operators: manufacturing engineer Caleb Goldstein, remote pilot Wyatt Warner and software engineer Bodhi Connolly. All



California-based Opener is accelerating piloted testing of the BlackFly in advance of first deliveries to the first external user group later this year.

three made their first flights in the BlackFly in the month or so before AirVenture and practiced their planned exhibition flights on the company's flight simulator in California before travelling to Oshkosh.

The two BlackFly V3 aircraft were flown at AirVenture (marked BEE and SEA) were also exhibited at the Opener display tent, alongside a third BlackFly aircraft wearing a US N-number (N919EB). Under FAR Part 103 rules, ultralight aircraft don't require a N-number and pilots don't have to hold a pilot certificate.

Later this year, Opener plans to deliver the first BlackFly aircraft to a half dozen US customers as part of its strategy to eventually make the eight-propeller, single-seat, tandem-wing eVTOL aircraft available for sale in the near future. The first deliveries will be followed by a second set of deliveries to a controlled group of customers, with all the aircraft outfitted data recorders so flight data can be transmitted to Opener for real-time and post-flight analysis.

### Enstrom is Back

After 64 years of operation, Enstrom Helicopter had declared Chapter 7 bankruptcy in January after orders dried up and its China-based owner, Chongqing Helicopter Investment Corporation (CQHIC), declined to continue supporting the company. However, the company was rescued in April by entrepreneur, businessman, philanthropist and musician Chuck Surack, founder of Surack Enterprises, about eight weeks earlier (see "Surack Buys Enstrom," *Vertiflite*, July/Aug 2022).

Surack grew up in an aviation family, with his father flying an Aeronca Chief from the family's grass airstrip, but Surack's real passion was music. Around 1980, he started traveling as a musician and then came home to Fort Wayne, Indiana, and started a recording studio.

"And with that recording studio, I soon opened up a retail business, helping my friends with their music equipment," said Surack during a VFS interview at AirVenture. "And those were friends [including] Stevie Wonder, Kenny Rogers and Dolly Parton. And that music business grew and grew and grew up until today where we have about 2,700 employees and nine million customers around the world."



Rescued from bankruptcy, Enstrom has hired back 70 employees to produce spare parts and to start building new aircraft. The company plans to start building aircraft again, like this used 480B demonstrator.

Last year, Surack sold his majority stake in Sweetwater Sound — the largest online retailer of musical instruments and pro audio equipment in the US with revenues of \$1.4B in 2021 — "which allowed me to do some other interesting things, like purchasing Enstrom."

Surack's affiliation with Enstrom began about 15 years ago when he saw a friend fly an Enstrom 480B at an airshow and decided to learn to fly helicopters when he celebrated his 50th birthday. He took his flight training in an Enstrom and bought a brand-new turbine-powered Enstrom 480B for personal use.

With "aviation kind of growing and bubbly in my blood," Surack flew the 480B for a couple hundred hours, upgraded to a Eurocopter EC130 for personal use, and bought a Part 135 helicopter charter operation and flight school, and a fixed-wing charter company — now Sweet Helicopters and Sweet Aviation — based at Smith Field Airport in Fort Wayne, Indiana. He also later established an aviation insurance company, Aviation Specialty Insurance.

Together with pilot friend and Sweet Helicopters Director of Operations Randy Sharkey, who used to be an Enstrom dealer, they co-founded the annual Rotor 'n Ribs helicopter fly-in at Goshen Municipal Airport in Goshen, Indiana, in 2012.

Today, Sweet Helicopters flies three Airbus H130s, an AS350 B3e AStar and two Leonardo AW109S Grands for VIP charter; two Guimbal Cabri G2s for flight training; and Cirrus Vision jets, Pilatus PC-12 turboprops and other piston-powered aircraft.

After Enstrom went into bankruptcy in early 2022, the first person who stepped forward to buy the company "approached me about helping finance it. And I said, I wasn't really interested in being a partner with somebody, but if his portion fell through, I would step up and acquire the company. And frankly, that's exactly what happened, back in late April. And I was able to acquire the company out of bankruptcy and start to bring us back to life," said Surack.

"I think the Enstrom is a great helicopter," he explained. "It's

one of the safest in the world. It's got a high inertia rotor [and] it's really, really easy to fly. It's very forgiving. Autorotations are just so much smoother than some of the other helicopters. And I knew, based on its history and track record, that it's a great company. And I love that it's [now] an American company on American soil with American people working at it. And I just saw great opportunity to save the jobs in Northern Michigan and bring the helicopter back to life. It deserves to be prominent in the helicopter world."

By late July, Enstrom had hired 70 employees to produce spare parts to fill outstanding orders for its global customers. Surack has also challenged the company to build two helicopters by the end of 2022 and plans to build 24 new helicopters in 2023. Surack recently bought back a used 480B for use as a sales demonstrator.

Looking to the future, Surack sees all kinds of possibilities to upgrade the product line with glass cockpits, and "there's been a lot of discussion already [regarding] replacing the engine with an electric motor... which might make a more efficient helicopter to fly for flight schools and quieter environments. But right now, we just want to build helicopters!"

### Composite-FX Reveals Electric XE-Volt Mosquito

Composite-FX (CFX) revealed a battery-electric version of its popular XE Mosquito helicopter at EAA AirVenture, four days after it made its first flight at the company factory in Trenton, Florida, on July 21.

"We have been wanting to build an electric helicopter for years in order to see how our drivetrain would work with an electric motor," said CFX general manager Norbert Richter. "One of the challenges with helicopters is having the right amount of torque at the right engine RPM and weight."

Work on the project began in January, and all the components were received by early July. Assembly took a couple of weeks, and the aircraft made its first hover at 8 pm on July 21. It made five subsequent short flights before CFX loaded the aircraft on a trailer for the 1,400-mile (2,350-km) road trip to Oshkosh.

"We knew we were looking for around half an hour of hover time, but we really weren't sure about the torque requirements or battery chemistry when we started out," said electrical engineer Matthew Aborn, who joined Composite FX after interning with the company as a university student.

To power the helicopter, "we selected an EMRAX 228 electric motor, which produces about 100 kW at peak, about 60 kW continuous, and weighs only about 12 kg [26 lb]," explained Aborn. They used a Borg Warner Gen4 Size 8 AC Motor Controller.

LG Chem batteries developed for automotive applications were selected to power the proof-of-concept helicopter, with the batteries placed in water jugs on either side of the helicopter (which were originally developed for use on a drone helicopter sold to a customer).

"We converted the water jugs into battery boxes that contain five modules. The modules are 64 volts apiece with 80 cells,



Composite-FX first flew its electric XE-Volt on July 21 before trucking the proof-of-concept helicopter to Oshkosh for display.

which totals around 340 volts. And the total pack capacity is 15 kW-hours," he said. "We made sure we had an auto governor on the propulsion system. It just ramps up and holds its RPM regardless of a collective position and it will change the torque as required to hold the rotor speed... with the motor running at 2,750 RPM."

The output matches one-to-one the input to the tail rotor drive train system and is reduced to 590 RPM for the main rotor.

"Currently, we're not using that much of the motor's available power. So, we're looking at adding more batteries to see if we can improve the flight time," Aborn said. "And eventually, we're going to transition to a hybrid drivetrain that will be able to totally recharge the batteries in flight and assist the motor." Richter said the XE-Volt aircraft displayed at Oshkosh was the first step in the development of a hybrid-electric helicopter that could meet the requirements of its drone customers who are seeking greater endurance and less weight.

The company has not yet selected an engine to power the hybrid-electric powertrain, but has been looking at some small, compact rotary motors in the 40-kW range currently used to power uncrewed aircraft systems (UAS).

CFX currently produces four models of XE helicopters, with around 400 sold as kits to owner-pilots and about 50 sold as drones to commercial and unnamed government and military customers. The portfolio includes the Part 103 ultralight-class float-equipped XEL; the heavier XE powered by a 64 hp (48 kW) Fiat Aviation MZ202 two-cylinder, in-line two-stroke motor; the XE 290 powered by a 90 hp (67 kW) water-cooled, oil-injected, fuel-injected, electronic programmable-ignition CFX 800 engine; and the XET powered by a modified 95 hp (71 kW) T62-T2A Solar turbine engine.

The helicopter company was established in 2004 when Dwight Junkin teamed up with John Uptigrove of Alberta, Canada, to develop enclosed cockpit versions of Uptigrove's open frame Mosquito (later Mosquito Air) ultralight helicopter.

At AirVenture 2022, the company flew a couple of its kit helicopters daily at the ultralight airport and also displayed a cargo UAS belonging to Delivery Drone Canada, which is

partnered with Air Canada Cargo to develop that Canadian market.

## Rotor X Revives Kit Helicopter Line

In December 2020, the Rotor X Aircraft Manufacturing Company purchased most of the assets of RotorWay International Helicopter Manufacturing Company (see “Industry Briefs: Rotor X Acquires RotorWay,” *Vertiflite*, March/April 2021). RotorWay was founded by inventor B.J. Schramm in 1967 to build the single-seat Scorpion kit helicopter.

The assets were acquired by Don Shaw and partners, who was already active in the VTOL industry as CEO and CTO of Advanced Tactics, Inc. (AT), a research and rapid-development company based in Torrance, California. AT was founded in 2007 and has extensive experience developing unmanned air/ground mobile robotic vehicles for the US defense agencies.

AT previously developed the Black Knight Transformer, a 2-ton crewed or uncrewed air/ground vehicle with VTOL flight and off-road driving capabilities designed for casualty evacuation and transportable in a C-130 Hercules cargo aircraft (see “Industry Briefs: Black Knight Prepares for Flight,” *Vertiflite*, May/June 2014).

Rotor X’s immediate task was to resume helicopter parts production following financial challenges that led to the company winding down operations in 2019-2020. RotorWay’s former China-based owners retained the rights to the name and logo after the company was sold, explained General Manager David Rousseau, who joined Rotor X in 2020 after a 41-year career doing technology development for the Department of the Navy.

“Once we opened the doors again, the first thing we did was sell all the parts to the existing owners that were becoming desperate since RotorWay had shut down,” said Rousseau. “Then we started ramping up making parts and getting the vendors turned on again. And then we started making new helicopter kits. In the last 12 months we’ve probably produced and sold more helicopters than in the previous seven years.”

“When we took over the defunct company, we moved back into the same factory building at Stellar Airpark in Chandler, Arizona, that had been the company’s long-time home and the employees started coming back to us because they just wanted to be building these great helicopters again.

“The guys that we have doing the welding and the machine work and the tail booms have 20, 25 and 30 years of experience building these ships,” he said, adding that “if it hadn’t been for all these guys begging to come back to build helicopters, we would’ve been in bad shape.”

The Rotor X customer base of about 2,500 helicopter kit customers around the world has always been active when it comes to suggesting various product improvements. Shortly after the purchase, Rotor X started going through its files documenting all the feedback it had received.

After the single-seat Scorpion, the company introduced the two-seat Scorpion Too in 1971, and then the “grandfather” of the current product line, the Exec 90, in 1980, which evolved



Rescued from bankruptcy after Chinese owners, RotorWay kits are now being supported and built by Rotor X.

into the Exec 162 and the 162F, with a turbocharged engine. The A600 was originally launched in 2011, and seven examples in three countries by 2013.

At AirVenture 2022, the new Rotor X focused on the launch of the new Phoenix A600 Turbo, which is offered with three engine options: The A600 Standard with a naturally aspirated 168-hp engine, the A600 Turbo Classic with a 168-hp turbocharged engine, or the new A600 Turbo Premium with a new 180-hp turbocharged engine and an extended-range fuel tank, which allows the aircraft to fly 320 miles (515 km).

Major changes included lowering the seats by three inches (7.6 cm) to increase the headroom of the helicopter for taller pilots and passengers, updating the electronic control units (ECU) and airframe design, and a new landing gear design with a torsion bar that spreads during a hard landing, rather than the prior version that would bend and require replacement. Kits are also now available with complete wiring harnesses, which are much easier to install.

“One of the big things about Rotor X is that we are in-tune with our community. We go to fly-ins regularly where we exchange thoughts and ideas, which become product improvements,” said Stan Collins, head of sales and marketing, adding that some design changes have been introduced in a matter of days or weeks.

Expanding the product line is definitely one of Rotor X’s near-term aspirations, said Rousseau.

“Aside from making improvements to the old RotorWay designs and coming out with A600 Turbo, we’re looking at the possibility of making an all-electric version and we’ve done all the math on it. We’ve identified the motors and how it’ll all go together, and we may be producing a flight prototype [of the eA600] before the end of the year,” he noted (see also “Electric VTOL News: Rotor X Goes Electric,” *Vertiflite*, Sept/Oct 2021).

Like its US competitors, Rotor X only sells helicopters in kit form to meet the requirements of the US Federal Aviation Administration (FAA) AC 20-27G “major portion rule” (aka “the 51-percent rule”) for experimental/amateur-built aircraft

that requires that more than 50% of the time required to build the aircraft is completed by the owner/pilot.

Rotor X has also teamed up with Advanced Tactics on other types of rotorcraft that AT is developing as part of a US Air Force research contract or a company project. The first is a relatively small uncrewed VTOL aircraft with a 500-lb (225-kg) payload capacity. The other project is a larger, optionally piloted multi-rotor aircraft with a 3,000-lb (1,360-kg) payload that utilizes four Rotor X rotor systems and can be powered by fossil fuels or electric motors.

In 2021, the two companies announced they were collaborating on a four-rotor, six-passenger VTOL aircraft known as the RX eTransporter, and a year ago they revealed their design concept for the Barracuda high-speed military VTOL (HSVTOL) aircraft for the US Air Force's AFWERX unit (see "Air Force Challenges Industry for High-Speed VTOL," *Vertiflite*, Sept/Oct 2021).

"And there's another project that we hope to have flying in a couple of months that I can't really talk about just yet," said Rousseau, hinting that it might be a new electric vertical takeoff and landing (eVTOL) design.

Rotor X also displayed a RotorWay 162F modified with the only FAA-approved device to allow people with paraplegia to fly helicopters. The mechanic and inventor is a former UK Royal Air Force/US Air Force fighter pilot Captain (ret.) Stewart McQuillan, who was paralyzed when his RAF Tornado GR-1 jet fighter broke up on take-off, crushing his spine.

After he requalified as a fixed-wing pilot using an aircraft with hand controls, McQuillan developed a device called an Aeroleg to become the first paraplegic to fly a helicopter in 2001. The exhibit was co-sponsored by the National Veterans Vocational Village (NV3) Foundation, a charity headquartered in Colorado Springs, Colorado.

### **Mirocopter Displays Coaxial Ultralight**

Slovenian ultralight helicopter designer Miro Crv displayed his Small Coaxial Helicopter SCH-2A at AirVenture 2022 for the first time. Bringing the aircraft to AirVenture 2022 was done in cooperation with Mark Rumsey of Rototrek, LLC, of Murrieta, California, an official reseller of the aircraft, which is compliant to the FAA's Part 103 Ultralight Vehicle rules.

Crv told VFS that he long dreamed of flying near his home, which is located 1,600 ft (500 m) up in the mountains of western Slovenian near the Italian border. Working as an electrical engineer, he designs automation systems for large vessels like cruise ships and oil platforms for a living.

The development of the SCH-2A began 12 years ago, with the desire to have an aircraft with a small footprint driving the coaxial design, which was kept as simple as possible.

The cyclic and collective controls of the SCH-2A are similar to most helicopters, but some of the unique aspects of the rotor system include a pair of 14.3-ft (4.4-m) diameter fully articulated rotors that use only a single spherical bearing with a special kind of damper, and a simplified transmission that uses

The Mirocopter Small Coaxial Helicopter SCH-2A ultralight may be the lowest-cost production helicopter in the world.



a pair of belt drives to drive the rotors in opposite directions, eliminating the need for a heavy gearbox. The rotor downwash on the tail vanes also provides yaw control while hovering.

Like the XE Mosquito, the helicopter is powered by a Chinese Fiat Aviation Co., Ltd., MZ202 air-cooled, inline two-cylinder, two-stroke gasoline engine originally developed by Zanzottera Technologies of Italy. The MZ202 engine provides more than 60 hp (44 kW) at 5,800 rpm, with the engine package — including the electric starter, electric generator, dual ignition, exhaust system and modified fan cooling system — weighing only 66 lb (30 kg).

Crv began by designing his own metal main rotor blades, which are of a modified NACA 0012 aluminum composite design. The leading spar is made of extruded and anodized high-quality aluminum and inserted stainless steel bars are used for reinforcement and to correct the balance.

The instrument panel features a Smarteh 7-inch (17.8-cm) LCD color-resistive touch screen. The aircraft complies with the 254-lb (115-kg) FAA empty-weight limit in the ultralight aircraft and is delivered fully built from the factory and is not a kit.

Mirocopter started serial production in February 2022. By the time of AirVenture, the company had aircraft already flying in Korea, France, Slovenia, Germany and three delivered to the US.

Priced at \$35,000, the SCH-2A is probably the lowest-cost production helicopter in the world, with shipping costs adding about \$4,000.

## Israel's AIR Reveals Development Plans



The AIR team from Israel displayed a mockup of its two-seat AIR ONE eVTOL.

After developing its eVTOL aircraft largely in secret, AIR of Pardes Hanna, Israel, displayed a mockup of its two-seat AIR ONE aircraft at AirVenture. It attracted a lot of attention, following its debut at the Kentucky Derby earlier this year as part of efforts to expand product awareness in the US.

Company CTO Chen Rosen has spent 20 years working in Israeli's advanced UAS on various defense projects. About six years ago, he set out to improve the aerodynamic efficiency and range of a typical quadcopter by giving it wings. Starting with scale models, Rosen flight tested numerous aircraft configurations while developing flight control software that would take the aircraft from cruise to forward flight.

The test flights involved progressively larger models, and then about two years ago, the company bought a Zenair short takeoff and landing (STOL) CH801 light aircraft and transformed it into an eVTOL test bed by adding four lift rotors on outriggers to the fuselage and hover-testing the aircraft with and without its wing.

In early 2021, AIR started to develop a prototype aircraft using local subcontractors to help build the test airframe.

The full-size aircraft was ground tested tied to the ground of the parking lot behind the company offices and mounted on top of gimbal to fine tune the flight control software. Then on June 21, the aircraft hovered for the first time at Megiddo Airfield, which is in the Jezreel Valley, about 18 miles (29 km) southeast of Haifa.

With an emphasis on simplicity, the Air ONE has a pair of electric propellers on each of four booms extending from the cabin, coupled with a large wing and twin vertical stabilizers. A major focus of the development team has been designing the aircraft for high-volume manufacturing, so that production can keep pace with future sales.

A full report on AIR's efforts will appear in a future issue of *Vertiflite* and a video interview on the VFS YouTube channel, [www.YouTube.com/VTOLsociety](http://www.YouTube.com/VTOLsociety).

## teTra Plans eVTOL Kit Sales

Born out of the Boeing-sponsored GoFly Prize competition in 2018, teTra Aviation Corp. made another appearance at



The AIR ONE made its first tethered hover flight on June 21 in northern Israel. (AIR photo)

AirVenture promoting its single-seat Mk-5 eVTOL aircraft that it is planning to sell in the US as a kit plane. Tokyo, Japan-based teTra was the only GoFly competitor to be selected for an award, when its teTra 3 personal flying device won GoFly's \$100,000 Pratt & Whitney Disruptor Award (see "GoFly Inspires Innovation," *Vertiflite*, May/June 2020).

The Mk-5 has 33 propellers, 33 electric motors, tandem wings (with winglets on the rear wing), a single vertical stabilizer and a fixed tricycle wheeled-landing gear. The landing gear is designed for vertical takeoff and landings; the aircraft has not been designed for horizontal takeoffs using a runway, said CEO Tasuku Nakai during an interview at AirVenture.

The aircraft is quite large with a 21.3-ft (6.5-m) long front wing and 28.9-ft (8.8-m) long rear wing and an overall length of about six metres. The company expects the aircraft to have a range of 60–100 miles (100–160 km) and have a maximum cruise speed of 90 mph (145 km/h).

Last year, at AirVenture 2021, teTra displayed one of its full-scale Mk-5 aircraft that has been remotely flown at Byron Airport, 60 miles (100 km) east of San Francisco. This year, it displayed a cabin mockup, which was used to get visitor input into the design of the sidestick controller system that will be used to control the aircraft.



teTra Aviation displayed a cabin mockup of its Mk-5 eVTOL kit aircraft to get visitor input.