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New Era for Flight Training

THE LATEST INNOVATION IN SUSTAINABLE AVIATION

BY MIKE ANDREWS

Slovenia-based Pipistrel Aircraft has sparked a movement in the use of battery-electric aircraft for flight training with their Velis Electro, the world's first type-certified (EASA) fully electric airplane that, for the last four and a half years, has been taking to the skies in more than 30 countries.

The first Velis Electro in Canada took its maiden flight on June 3, 2023, at the Waterloo-Wellington Flight Centre (WWFC) in Southern Ontario. Together with their partners at the University of Waterloo's Institute for Sustainable Aeronautics (WISA), they have been focussed on conducting extensive research, sharing their studies on WISA's website. Since this milestone, Canada has welcomed two additional Velis Electros — another to the partnership in Waterloo, and one to Sealand Flight of Campbell River, British Columbia.

In collaboration with Transport Canada (TC), these two Flight Training Units (FTUs) are pioneering Canadian implementation of commercial electric aircraft. Although both organizations are approved to fly the Electro under their respective operating certificates, Sealand Flight has emerged as Canada's first commercial operator of an electric aircraft for primary flight training and sightseeing.



ALL PHOTOS:
TONY PUERZER

In November 2022, TC issued a groundbreaking nationwide call for participation in a flight training trial program assessing the use of Light Sport Aircraft that met European Union Aviation Safety Agency (EASA) CS-LSA standards.

"Transport Canada is working with a limited number of flight schools as the department moves towards the goal of a green and innovative transportation system," said Ryan Johnson, TC's Chief of Pilot Training and Licensing at the time. "The project is currently evaluating electrically powered aircraft and how they compare to more conventional training aircraft in terms of noise, emissions and effectiveness. Johnson continued, "The long-term vision is to facilitate the operation of zero-emission electric or hybrid aircraft with sufficient endurance to enable teaching all the training exercises including navigation. [TC] is pleased with the progress to date and is looking forward to seeing the trials continue."

TC selected six FTUs to participate, assessing applicants based on their safety culture, ability to plan and manage trials, data collection, reporting capabilities, research partnerships, and potential to operationalize EASA CS-LSA aircraft. As mentioned, two FTUs have purchased and are operating the aircraft so far.

Given the initiative's novelty, Sealand Flight's Velis Electro (C-FPIP) arrived in February 2024, well ahead of the necessary approvals for commercial operations. In March, Sealand hosted a Pipistrel factory-sponsored maintenance course, led by the manufacturer's engineers. The event brought together regional TC representatives, Canadian Pipistrel distributor Apex Aircraft and maintenance personnel from across Canada. This was a critical opportunity for all involved to understand the airplane inside and out, and progress towards the issuance of FPIP's flight authority. By the end of April, Sealand received a Special Certificate of

"THE LONG-TERM VISION IS TO FACILITATE THE OPERATION OF ZERO-EMISSION ELECTRIC OR HYBRID AIRCRAFT WITH SUFFICIENT ENDURANCE TO ENABLE TEACHING ALL THE TRAINING EXERCISES INCLUDING NAVIGATION."

Airworthiness - Limited, permitting the company to fly the airplane for non-commercial use.

At this point, one regulatory hurdle remained: CAR 406.32(a), which requires FTU aircraft to hold a standard Certificate of Airworthiness (C of A). Although the Velis Electro holds an EASA type certificate, TC has yet to certify it for a Canadian standard C of A. Since this was the intended purpose of the trial program, TC granted Sealand an exemption to this regulation, allowing commercial FTU operations.

On June 14, 2024, with all approvals in place, Sealand Flight conducted Canada's first commercial electric flight. With a local flight student on board, this milestone marked the beginning of a new era for Canadian flight training.

Transport Canada oversees the trial program, mandating how Sealand integrates and operates the airplane. At the current stage, Sealand is training ab initio students up to and including their first solo flight. Students are then transitioned into traditional Internal Combustion Engine (ICE) airplanes. Sealand also offers "Electric Aircraft Differences Training" for licensed pilots. The company also provides public sightseeing experiences for hire. With every flight, Sealand is collecting data and feedback to help compare this sustainable alternative to traditional flight training.

Flying the Velis Electro is almost exactly what a pilot would expect. It handles much like any airplane does but has unique EV elements: it is very quiet, it is simple to operate, boasts instant and abundant torque and sports modern cockpit technology.

To maximize efficiency, the airplane is highly streamlined and built primarily out of carbon fibre, fibreglass and Kevlar composites. The result is a high power-to-weight ratio and impressive performance. The high aspect ratio wings resemble those of a glider and produce a glide ratio of 15:1. Together, these can create the potential for "floatier" landing flares.

Inside the cockpit, the Electro offers a standard flight control column, adjustable rudder pedals, electric elevator trim and



Sealand's ground crews actuate the Pipistrel's portable charging station.

mechanical flaperons. Alongside the traditional flight instruments, the panel includes a digital attitude indicator, a variometer and a Crew Alerting System (CAS) with annunciators. The primary uniqueness in this cockpit, however, comes in the powerplant controls. Four main on/off switches govern the operation: Master, Avionics Master, Battery Enable and Power Enable. A power lever digitally controls the power output, while an Electric Power Plant System Interface (EPSI) display provides key performance data including:

- Battery State of Charge (SOC)
- RPM
- Kilowattage
- Remaining Flight Time (RFT) [based on current power consumption]
- Temperatures of the batteries, inverter and motor
- Battery State of Health (SOH)

The ease of operation while training new students is remarkable. To the transitioning licensed pilot, there are three cognitive differences to learn: systems, emergencies and energy management. The importance of understanding the aircraft's systems is fairly straightforward.

The mental map of emergency procedures changes significantly in electric aircraft. With the simplicity of electric propulsion, actual component failure is even less common than in its ICE counterpart. However, like any digital product, devices can be susceptible to software glitches and system communication failures. A pilot must determine if abnormalities could be resolved with a simple restart (the classic IT fix), look for signs of communication error (without functional error), or decide if immediate action is necessary. For instance, among other procedures, instructors train by simulating power lever communication failures in which the powerplant is functioning normally, but the ability to control it is lost.

For fellow aviators, the concept of managing electrical energy should seem familiar, as it's not unlike fuel management. Nevertheless, there are significant differences:

- The rate at which energy is consumed varies more significantly, depending on power setting.
- Normal descending and approach to landing consume little to no energy. (There's no regenerative braking/windmilling like EVs, though this was previously attempted*).
- While taxiing, with the power lever idled, the propeller stops spinning.
- Margins are smaller with current energy density. Considering this, rather than requiring a 30-minute reserve, our approval stipulates a reserve of 30 percent battery SOC.
- Below 20 percent SOC, the power plant will begin derating available power to prevent potential overheating.
- The SOH of batteries gradually declines over time, decreasing energy storage ability.
- When flying from airport to airport, wind significantly affects the ability to turn around and return. Point-of-no-return calculations are common practice.

What lies ahead? With several organizations pioneering exciting innovations, the foundation of Canadian sustainable aviation

THE "BAT"

Founded by aeronautical engineer Ivo Boscarol in 1989 in what was then Yugoslavia, the company's first production aircraft was an ultralight trike, which he named "Basic." However, Boscarol had been experimenting with ultralight years before, at a time when Yugoslavia did not allow for this type of flight. So Boscarol, together with friends, would flight test his hang glider-shaped designs during the hours of darkness. This resulted in his aircraft being nicknamed the "Bat." Boscarol embraced this name for his company by slightly modifying and adopting the Italian word for bat — pipistrello.

Pipistrel, based in Ajdovščina, Slovenia, about 20 kilometres east of the Italian city of Gorizia, went on to develop several models of powered hang gliders over the years and was an early adopter of composite materials in light aircraft. Its first all-composite production ultralight was the Sinus. In the mid-2000s Pipistrel branched into electric-powered aircraft, initially motor gliders and then basic trainers. The May/June, 2018 issue of *Canadian Aviator* published a flight review of a Pipistrel Alpha Trainer, the first electric airplane to be registered in Canada.

In 2022, the Slovenian company was acquired by Textron eAviation, a division of Textron Inc., underscoring its significance in the foundation of sustainable aviation.

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PIPISTREL VELIS ELECTRO FAST FACTS

Gross weight	600 kg (1,322 lb)
Empty weight	428 kg (943 lb)
Maximum takeoff power	64 kW (85 hp)
Maximum endurance	50 minutes
Average charge time	1 hour (at 20 kW charge)
Average noise level	60 dB
Service ceiling	12,000 feet MSL
Never exceed speed	108 knots
Average cruise speed	90 knots (at 20-25 kW)
Batteries	Two liquid-cooled, lithium-ion
Total battery capacity	22 kW/hour

is underway. From the increasing Velis Electro adoption and Harbour Air's eBeaver, to Helijet's BETA Technologies ALIA eVTOLs and Air Canada's Heart Aerospace ES-30s, the momentum — and significant global investments — are undeniable. Collaboration through Canadian Advanced Air Mobility (CAAM) has unified this niche industry, fostering synergy at every level. Together, these companies are initiating the implementation of next-generation aircraft. Areas that are being collectively addressed include:

- *Current regulations* — they do not permit alternative power plants. Laws requiring aircraft to have fuel/oil gauges, minimum fuel reserves, etc. need updating. Aircraft certification is determining safety threshold standards for new technology to meet, while training and/or licensing standards between propulsion systems are forming.

- *Charging infrastructure.* Electric aircraft require this for commercial feasibility. Most regional aerodromes don't yet have this capacity and producing energy in sustainable methods need to be prioritized. Standardization of charger software and delivery specifications are also necessary for universal compatibility.

- *Battery technology.* This is advancing rapidly, more rapidly than the rate of certification. The Velis Electro exhibits technology from the start of development in 2017, and it's just now being commercialized. Greater energy density will lead to greater utility, provided it can be efficiently brought to utilization.

As this unique aviation sector continues to achieve major milestones and technological innovations advance, it is inevitable that more of aviation will grow around and adopt these increasingly practical and sustainable alternatives.