









#### FLIGHT INNOVATION HUB

The Waterloo Institute for Sustainable Aeronautics (WISA) was founced by Dr. Suzanne K. Kearns at the University of Waterloo after a student asked her, "Is it possible to love aviation and the planet at the same time?" Students recounted being questioned by their peers, who would ask, "Why would you choose to join an industry that contributes to climate change?" They were told they should feel embarrassed for being passionate and inspired by aviation. At that moment, Dr. Kearns realized the industry's future must be inextricably linked with sustainability.

Since its formation in 2021, WISA has committed to being the world's leading hub for sustainable aeronautical research, technology, and education. In October 2023, WISA and WWFC invested in the construction of a collaborative project, the Flight Sim Centre and Innovation Hub. WWFC invested \$1.8 million for the construction of the building, with equipment and research supported by a \$9.2 million investment from the Government of Canada through the Federal Economic Development Agency for Southern Ontario (FedDev Ontario). The partners officially opened a 3,300-square-foot facility at the Region of Waterloo International Airport on June 21, 2024.

"This new facility is about much more than just pilot training. It exemplifies environmental stewardship, utilizing state-of-the-art air exchange heat pumps, solar energy generation, and off-grid battery storage capabilities," said WWFC chairperson Tony Varga during the grand opening.

Solar panels line the entryway to the Innovation Hub, and the facility features energy-efficient lighting and water conservation systems. These advancements not only reduce the carbon footprint, but also illustrate the facility's dedication to embracing

and promoting sustainable practices.

The cutting-edge centre includes three advanced flight simulators for training future pilots on Boeing 737, De Havilland Q-400, and Airbus A320 aircraft.

"This facility will enhance our collaboration October 2022 from Slovenia, where they with the Waterloo Institute for Sustainable Aeronautics and allow us to provide toptier training focused on environmental sustainability," Bob Connors, WWFC general manager, said at the opening. "It demonstrates our commitment to improving the experience of our pilot graduates and the quality of services

offered to our airline partners."

Following the speeches, the hangar door opened to reveal a Pipistrel Velis Electro on the apron. The first of two aircraft being acquired by WWFC arrived in are manufactured, and on June 9, 2023, became the first Pipistrel Velis Electro to take off in Canada from Waterloo airport. Since then, WISA has collaborated closely with Transport Canada to research and evaluate the Velis Electro, seeking verification of the performance reported for European certification.

### AN ELECTRIC TESTBED

The Velis Electro is the first type-certified electric aircraft fully approved for pilot training in Day VFR (visual flight rules) operations in over 30 countries around the world. It is powered by Pipistrel's own type-certified electric engine, the E-811, supported by an in-house developed dual battery system and Pipistrel's three-bladed composite fixed-pitch propeller, the P-812-164-F3A.

The aircraft features strategically placed battery packs—one in the nose and the other behind the cabin. Charging is made easy through an onboard charging port



using a Pipistrel electric charger. The main computer manages the entire operation, showing relevant information on the Pipistrel EPSI 570C, a 5.7-inch LCD cockpit display. The display serves as the pilot's primary source of information about the operational state of the electric propulsion system, using intuitive graphics to present all necessary parameters. Additionally, the EPSI 570C functions as the gateway for system software updates.

With a useful load of 378 lbs., extensive luggage is not an option, but given the battery limitations, hauling extra weight isn't the primary purpose. The Pipistrel offers 35 to 45 minutes of flight time, allowing for a 30 percent electric power reserve upon landing.









THE TAKE-OFF RUN IN
THE VELIS ELECTRO
FEELS MORE LIKE
THE ACCELERATION
OF A TESLA THAN AN
AIRPLANE."

The standard cruise setting is 25 kW, but for a longer flight, you can reduce the power setting to 20 kW. The top cruise power is 36 kW, which drains the battery faster and shortens the feasible flight time. Therefore, the choice comes down to whether you prefer higher speed or longer flight time.

"The students want to fly without contributing to carbon emissions," noted Paul Parker, a professor at the University of Waterloo. "Electric aviation provides us with the chance to explore that possibility."

Parker is leading the research project at the flight school in collaboration with Transport Canada. "The plane is extensively monitored, collecting data every tenth of a second, measuring voltages, power settings, and attitudes, generating a continuous and detailed data set," he explained.

The cooperation with Transport Canada "has been nothing short of phenomenal," he added.

While electric flight has the potential to reduce flight training costs, Connors noted that "electricity costs much less than avgas, but the cost of replacement batteries must be considered."

Given the operational costs of running the flight school, it seems unlikely that electric aviation will lead to a training price reduction any time soon.

"Part of my objective is to explore the business case for a fleet of electric airplanes of some size," he said. "The Pipistrel is a very nice plane, but its major limitation is the battery."

However, one advantage of the Pipistrel fleet, which includes both piston and electric aircraft, is that the bodies and fuselages of the three aircraft are identical. This design consistency allows students to seamlessly transfer between different airplanes, enhancing their training experience.

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# FLYING THE VELIS ELECTRO IS NO JOKE

The Pipistrel Velis Electro may not look different from Pipistrel's piston fleet, but first-time battery-powered fliers will notice stark differences around the time they need to conduct a run-up. Instead of the traditional piston run-up, you perform a "power check," confirming the batteries are active and operational. Say goodbye to RPM and hello to "kilowatts" as you increase power. An eerie sensation washes over you as you taxi to the hold-short line and come to a complete stop—the propeller stops dead in front of you while you wait for clearance.

The take-off run in the Velis Electro feels more like the acceleration of a Tesla than an airplane. Pushing the throttle to max power instantly presses you back against your

seat, and as the airplane lifts off, you can't help but feel a bit confused by how quickly it all happens. The E-811 electric engine is no joke—compared to its cousin, the Virus, the electric motor generates a maximum torque of 162 ft/lbs (220 Nm) versus the piston counterpart's 94 ft/lbs (127 Nm). And there's no waiting for that torque either—it kicks in immediately.

Traditionally, pilots consider fuel, but with battery-powered flights, the main concern is the remaining battery charge. At WWFC, students are expected to land with 30 percent battery remaining, providing ample reserve for a go-around if necessary. Keeping a keen eye on the power supply is critical when flying the Velis Electro. Pilots have to rewire their thinking when flying this aircraft.

## IS THE FUTURE ELECTRIC?

So, does the Velis Electro have a place in the future of aviation? All signs point to yes. Transport Canada has granted WWFC and Sealand Aviation a specific regulatory exemption to allow training brand-new student pilots on the electric airplane. On June 14, 2024, Canada's very first commercial electric flight took off from Sealand Aviation's base in Campbell River, B.C., marking the beginning of operations with the electric airplane. WWFC expects to have the same special operations certificate this summer. Anna Pangrazzi, president of Apex Aircraft Sales, Canada's exclusive distributor for Pipistrel, played a crucial role in supporting WWFC and WISA in acquiring the Velis Electro aircraft. She emphasized the importance of innovation in achieving longterm environmental goals.

"The [Canadian] government has put out a plan for net zero by 2050, so over the next 25 years, things are going to be changing, and we're going to be looking at a lot of new technology," she said. "This may not be the solution, but what I say is, we're taking that step."

Drawing parallels with rapid advancements in early aviation, Pangrazzi noted. "When you look at what happened in the early 1900s with Wilbur and Orville Wright, it was such a short time between that first flight and going across the ocean in an airplane. Could they have imagined that in 20 years, they'd be taking these rickety, old airplanes across the ocean, and then we were going to the moon within 60 years?"

The strides made by WWFC, WISA, and their partners in pioneering electric aviation demonstrate a bold commitment to sustainability and innovation in the aviation industry. The successful integration of the Pipistrel Velis Electro into their training fleet marks a significant step towards reducing carbon emissions and noise pollution, while also adapting to the evolving demands of the next generation of pilots.

With support from Transport Canada and visionary leaders like Connors and Kearns, the future of aviation looks promising. This dedication to sustainable practices and cutting-edge technology sets a strong example for the global aviation community. As WWFC continues to lead by example, the dream of flying on sunshine is becoming a reality, inspiring a new era of eco-friendly aviation.



Annie Vogel is a private pilot based out of Collingwood, Ontario. She owns a Piper Cherokee 140 and has accrued over 500 hours on dozens of aircraft types.

In 2021, Annie joined the *Skies* team as social media manager. You can follow her adventures through Instagram @pilotannie.