Notice of Proposed Amendment 2025-002
Flight Training

Issue Date: March 20, 2025

Part(s) or subpart(s) of the *Canadian Aviation Regulations* (CARs)	Associated standard(s)
CAR 405 - Flight Training	**Standard 425 – Flight Training**
405.12 – Flight Training Approval	425.12 – Flight Training Approval
405.13 – Flight Training Program Outline	425.13 – Flight Training Program Outline
405.14 – Flight Training Program Requirements	425.14 – Flight Training Program Requirements

Until 2025-04-24, comments on this Notice may be addressed, in writing, to
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1. Issue and Objective

As part of a pilot project with a limited number of flight schools, Transport Canada (TC) has been assessing the suitability of electrically powered aircraft in a flight training environment. While results are so far promising, preliminary evaluations highlighted the need to establish a regulatory framework to mitigate potential risks associated with limited battery endurance and other concerns associated with the operation of this novel powerplant.

The objective of the proposed revisions to the standards is to establish that framework by requiring flight schools that are using electrically powered aircraft to develop a TC-approved training program in order to identify the potential risks and describe the mitigation measures they will implement.

2. Background

In 2019, TC was approached by a flight school who expressed an interest in purchasing and using an European Union Aviation Safety Agency (EASA) Certification Standard Light Sport Aircraft (CS-LSA) for flight training. More specifically, the flight school was interested in purchasing the Pipistrel Velis Electro SW128 (electric aircraft) and the Pipistrel Virus SW121 (fuel powered aircraft).

Given that no aircraft of this type has yet been certified for use in Canada, the flight school requested an exemption from the regulatory requirement which stipulates that only aircraft for which a normal certificate of airworthiness has been issued can be used for flight training. The flight school argued that the flight training fleet in Canada are aging (30 to 50 years old), costly to maintain, and use outdated fuel-inefficient engines that burn leaded gasoline, contributing to pollution. Elsewhere, European countries have successfully utilized CS-LSA for flight training. These aircraft were deemed to have the potential to be more affordable, technologically advanced, quieter, and environmentally friendly.

In 2020, TC conducted a risk assessment to determine whether an exemption should be issued. The risk assessment concluded that while this aircraft type could potentially generate significant benefits, additional data was required to assess its suitability for flight training in a Canadian environment given the absence of certification criteria for any CS-LSA in Canada. In addition, given that flight training has never been performed on electric aircraft, there was a need to assess if specific operational measures are required to maintain an acceptable level of safety.

3. Proposed approach

To support innovation and avoid falling behind international partners, TC began a pilot project in 2021 to assess the operational suitability of CS-LSA for flight training in Canada. The type of CS-LSA eligible to participate in the pilot project was limited to those aircraft which had already been certified pursuant to the EASA CS-LSA standard and for which the manufacturer applied for certification in Canada. The objective of the pilot project was to collect data from a limited number of flight schools to determine what operational and regulatory measures are required to support the use of this aircraft for flight training. As part of the learning objectives, TC wanted to:

1) Assess electric aircraft performance compared to traditional training fleet;
2) Gather information on aircraft operational capabilities and limitations in a flight training environment;
3) Gather quantitative data related to noise and emissions;
4) Assess what infrastructure is required to support the use of electric aircraft; and
5) Seek feedback from instructors and students on the quality of training.

This pilot project was also an opportunity for TC to partner with industry to explore new technology and innovation to advance aviation training in Canada. To that extent, TC would obtain data through this pilot project with respect to the reliability and suitability of these aircraft in a training environment as well as on the quality of training they could provide to students. Observations and evaluations on the benefits and limitations of electrically propelled aircraft as well as the comparison with an otherwise similar aircraft with a conventional piston engine was of particular interest to TC. The data collected will support the analyses required for future decisions to amend this area in the Canadian Aviation Regulations (CARs).

4. Analysis

a) Risk Assessment

As a first step, evaluations were performed by TC Flight Training specialists and National Aircraft Certification experts. The purpose of these evaluations was to support the certification work as well as assess the operational suitability through evaluations of aircraft performance and handling in various flight scenarios. The results of those evaluations were key to determine what training lessons could be performed, and which ones couldn't or shouldn't be performed based on aircraft limitations. This first step of the pilot project provided valuable information in terms of what safety measures and conditions would need to be included in the exemptions that would be issued in future phases of the pilot project.

Selected flight school participants were then instructed to follow a phased approach under the supervision of a Selection and Oversight Committee. The first phase involved senior instructors familiarizing themselves with the aircraft through practice flights. For the next phase, TC issued an exemption from section 406.32 of the CARs to allow instructors to begin training students. The exemption included several conditions to maintain an acceptable level of safety throughout the pilot project.

One of the key conditions of the exemption was for each participant to develop a training plan to augment the existing requirements outlined in the existing Flight Instructor Guide (FIG). Amongst other things, the plan had to specify requirements such as ground school training requirements, lesson plans, instructor qualifications, flight restrictions, and approved training areas.

TC collected data through several means. Surveys were conducted with Civil Aviation Safety Inspectors, flight training specialists, and representatives from the participating flight schools to gauge their satisfaction with the aircraft's handling, comfort, noise, emissions, and overall suitability for flight training. Additionally, various reports were submitted by the flight schools, providing detailed insights into their experiences and observations. Studies conducted by the Waterloo Institute for Sustainable Aeronautics (WISA) further enriched the data pool, offering analyses of the aircraft through the various tests they conducted.

In May 2023, WISA conducted ground tests on the Velis Electro to measure its State of Charge (SOC) and Remaining Flight Time (RFT). They found that different power settings significantly impact energy consumption and flight duration. Higher power settings reduced RFT, while lower settings extended it. For instance, at 70% SOC, increasing power reduced RFT from 30 to 15 minutes, and at 50% SOC, decreasing power increased RFT from 22 to 28 minutes. In April 2024, tests evaluated the battery's performance in cooler temperatures between -4 and 9 degrees Celsius. The depletion rate increased by about 10% in lower temperatures and when the SOC was between 65-75%. This indicated that cooler temperatures and SOC significantly affect battery performance, leading to reduced endurance times and impacting flight planning.

In July 2024, WISA also conducted tests related to take-offs, landings, upper air exercises, precautionary approaches, forced approaches, and emergency procedures. These evaluations found that the Velis Electro can effectively handle standard pilot training lessons. While the aircraft offers benefits such as instant torque and a high glide ratio compared to traditional aircraft, it is sensitive to turbulence. One notable challenge for the Velis Electro is its steep power curve, where even a small increase in power demand can significantly reduce flight endurance. Additionally, the aircraft's high-voltage systems, liquid-cooled components, and heavy reliance on software for power management introduce new and potentially serious failure modes. The intricate nature of these systems emphasizes the importance of thorough training and safety protocols to ensure safe operation.

b) Rationale for proposed revisions and outstanding issues

The extensive testing of the Velis Electro from May 2023 to October 2024 demonstrated that the aircraft can be successfully used to deliver about 60 % of the TC specified Canadian Private Pilot training syllabus. It showed consistent performance in different regions and temperatures, modern intuitive powerplant instrumentation and controls, and reliable battery and motor performance. The aircraft's noise reduction capabilities make it a quieter alternative to conventional gasoline-powered planes, benefiting both flight schools and surrounding communities.

Despite its promising features, the aircraft also faces various challenges such as limited battery endurance and the necessity for specialized training due to its advanced systems. These factors necessitate additional training, preflight preparation and in-flight system monitoring over what is required to safely operate existing training aircraft powered by conventional internal combustion engines.

While additional requirements may be introduced in the coming years based on the outcome of the pilot project, results to date have highlighted the necessity to implement, in the short-term, a requirement for flight schools using electric aircraft to develop a specific training program for each type of electric aircraft they will utilize for flight training.

As data is collected over the next few years, additional requirements may be introduced for gasoline-powered CS-LSA, such as the Pipistrel Virus SW121, when utilized for flight training.

c) Potential Impact

There are currently two flight schools in Canada (pilot project participants) that operate electric aircraft as part of their flight training program. Both participants already have a TC-approved training program as this was one of the conditions included in the exemption they received. As such, there is no anticipated impact for these flight schools.

With the impending Canadian certification of the Pipistrel Velis Electro in 2025, additional flight schools may opt to use them for flight training. Flight schools who opt to use them or any other electric aircraft will be required to develop a flight training program for each type of electric aircraft they will utilize for flight training.

5. Consultations

This NPA constitutes the official consultation by which stakeholders and the general public have an opportunity to provide direct feedback on the proposed standard.

6. Anticipated timelines and Implementation

The proposed revisions to Standard 425 are expected to come into force in spring 2025.

7. Proposed Amendments

Division II - Flight Training Program (new text highlighted in yellow)

425.12 Flight Training Program Approval

Electrically powered aircraft used for flight training toward the Recreation Pilot Permit or Private Pilot license shall be operated in accordance with a Transport Canada approved flight training program.

Note: For the purpose of this section, electrically powered aircraft is defined as an aircraft powered by electricity, typically using batteries to power electric motors that drive propellers or turbines. It includes hybrid models that combine battery and fuel.

425.13 Flight Training Program Outline

The flight training program outline provided to each trainee at the time of commencing a flight training program shall include the following:

(a) the name of the program in which the trainee is enrolled;

(b) information in respect of the minimum age, medical fitness, knowledge, experience and skill for which the training is being conducted; and

(c) a copy of the current applicable Study and Reference Guide and Flight Test Standard; and

(d) the minimum weather conditions required for dual and solo training flights during day, night, VFR and IFR operations including:

i. minimum ceiling and visibility for local and cross-country training flights;

ii. maximum cross-wind for conducting a take-off and landing;

iii. minimum temperature for flight training operations;

(e) the fuel/battery charge level reserves necessary for dual and solo, local and cross-country training flights;

(f) the description and use of assigned practice areas;

(g) the reporting of aircraft defects and unserviceabilities;

(h) the securing of aircraft when not in use;

(i) the procedures in the event of an unscheduled or forced landing; ~~and~~

(j) any other safety measures pertaining to the geographic area of operation that the person who conducts the flight training deems necessary for aviation safety; and

(k) a list of specific training measures pertaining to the use of an aircraft that requires an approved training program when training is conducted using such aircraft.

425.14 Flight Training Program Requirements

(1) Flight training that is conducted using an electrically powered aircraft shall have a flight training program that contains:

(a) A list of aerodromes and/or airports where flight training can take place;

(b) A description of the training exercises that are specific to electrically powered aircraft; and

(c) A description of the risks associated with the limited endurance of electrically powered aircraft and the measures established to mitigate those risks. The mitigation measures must include:

i. Ground school modules specific to each electrically powered aircraft type operated;

ii. Appropriate training areas;

iii. A designating training flight profile for each air exercise;

iv. The establishment of suitable preflight planning procedures; and

v. Minimum battery charge levels at flight termination.