MINISTRY OF JUSTICE OF THE REPUBLIC OF LITHUANIA
TRANSPORT ACCIDENT AND INCIDENT INVESTIGATION DIVISION

Accident to ultralight aircraft Bristell UL HD, LY-LIS, that occurred on 8 August 2022 Armaniškiai village, Kaunas district, Republic of Lithuania

SAFETY INVESTIGATION REPORT

No. (A-22/08) 1A-167
17 September 2024

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FOREWORD

The safety investigation is conducted in accordance with Annex 13 to the Convention on International Civil Aviation and Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC (hereinafter – Regulation (EU) No 996/2010).

The purpose of the safety investigation is to prevent the occurrence of accidents and incidents in the future, rather than establish blame or liability. The safety investigation is conducted independently of any judicial or administrative proceedings, to apportion blame or liability, are not related to them, and have no impact thereupon.

Each safety investigation shall be concluded with a report in a form appropriate to the type and seriousness of the accident or serious incident. The report shall contain, where appropriate, safety recommendations, which shall in no case create a presumption of blame or liability for an accident or serious incident.

The safety investigation report cannot be used as evidence in a judicial or administrative process seeking to apportion blame or liability, because this was not established in the course of the safety investigation, and it is not compatible with the objective of the safety investigation.

The safety investigation report is based only on the data obtained during the safety investigation. This information is published to inform the aviation industry and the public of the general circumstances of accident or serious incident. Extracts may be published without specific permission providing that the source is duly acknowledged, the material is reproduced accurately, and it is not used in a derogatory manner or in a misleading context.

This is a courtesy translation by the Transport Accident and Incident Investigation Division of the Safety Investigation Report. As accurate as the translation may be, the original text in Lithuanian is the authentic version and the work of reference.

General information

Event	Accident
Date and Time	8 August 2022, 20.04 hrs[1]
Location	Armaniškiai village, Kaunas district, Republic of Lithuania
Aircraft type	Ultralight aircraft Bristel UL HD
Registration	LY-LIS
Year of Manufacture	2020, serial. no. 505/2020
Commander	Citizen of Republic of Lithuania, 71 years
Commander's Licence	Ultralight aircraft pilot licence
Commander's Flying Experience	More than 2485 hours
Type of Flight	Skills improvement flight
Persons on Board	Crew – 2
Injuries	Crew – 2 (fatal)
Nature of Damage	Ultralight aircraft destroyed
Other Damage	Damage to the ground

[1] Times in this report are local times.

Synopsis

On 8 August 2022, at 19.20 hrs, the ultralight aircraft Bristel UL HD, registration marks LY-LIS, piloted by the crew of two citizens of the Republic of Lithuania, took off for the skills improvement flight from S. Darius and S. Girėnas aerodrome. After several traffic circuits at the aerodrome, proceeding the flight in the West pilotage zone of the aerodrome, the aircraft entered a spin and impacted the ground. There was post impact fire and the aircraft was destroyed. The crew was fatally injured.

Safety investigation

On 8 August 2022, at 20.27 hrs, the owner of the ultralight aircraft informed the Investigator-In-Charge of Aircraft Accidents and Incidents appointed by Minister of Justice of the Republic of Lithuania about the accident of the ultralight aircraft Bristell UL HD, LY-LIS.

In accordance with Article 10 of Regulation (EU) No 996/2010, the Safety Investigation Authority of the Czech Republic (Air Accidents Investigation Institute) as a state of design and manufacture of the ultralight aircraft appointed an accredited representative and his technical advisor for the safety investigation.

In accordance with Art. 8 of Regulation (EU) No. 996/2010, the European Union Aviation Safety Agency appointed a technical advisor for the safety investigation.

1. FACTUAL INFORMATION

1.1. History of the flight

Flight preparation and the history of the flight are described based on the statements by eyewitnesses, the data of the Kaunas Air Traffic Control Center air traffic monitoring system, S. Darius and S. Girėnas aerodrome radio records and records of video surveillance cameras, and examination results of the accident site and aircraft wreckage.

On 8 August 2022, at 19.04 hrs, the student pilot and the instructor returned from their flight with the ultralight aircraft Bristel UL HD, LY-LIS (hereinafter – the aircraft) to S. Darius and S. Girėnas aerodrome (hereinafter – aerodrome) and parked the aircraft near Kaunas aeroclub hangar. Pilot A immediately approached the aircraft, and a minute later appeared pilot B, who had rented the aircraft for the planned flight. At 19.06 hrs pilots A and B shook hands and talked together until 19.12 hrs. What was discussed has not been determined during the safety investigation.

At 19.12 hrs pilots A and B (hereinafter – the crew) approached the aircraft and began to inspect it before the flight. Pilot A walked around the aircraft's tail, checked the elevator, then the right aileron, pressed down the tail of the aircraft. Pilot B checked the aircraft's left wing and the aircraft from the front. The amount of fuel was not checked. At 19.13 hrs the crew boarded the aircraft and closed the canopy. At 19.14 hrs the crew started the engine and began to taxi towards the runway.

At 19.14 hrs pilot B reported by radio to the aerodrome's flight coordinator that they were starting to taxi from Kaunas aeroclub hangar to the holding point for traffic circuit training flights in the aerodrome's traffic zone.

At 19.20 hrs the aircraft took off from the aerodrome runway 27 and started left-hand traffic circuits. The crew made three touch-and-gos at 19.25 hrs, 19.30 hrs and 19.35 hrs.

At 19.41 hrs pilot A reported by radio to the aerodrome's flight coordinator a full stop on the runway and a planned take-off afterwards.

At 19.42 hrs immediately after take-off, pilot B reported by radio to the aerodrome's flight coordinator that they were proceeding from upwind leg to the West pilotage zone of the aerodrome's traffic zone.

At 19.44 hrs pilot B reported by radio to the aerodrome's flight coordinator their position in the West pilotage zone and that they would continue the flight at 1200 ft.

At 19.55 hrs, the aerodrome's flight coordinator contacted the crew and asked at what altitude they were flying. Pilot B replied that they were flying at 1400 ft altitude. The aerodrome's flight coordinator reported that the flight altitude currently allowable in the West pilotage zone is up to 1200 ft. Pilot B affirmed that he understood the information.

At 19.57 hrs pilot A contacted by radio the aerodrome's flight coordinator and requested for 10 minutes to climb to 4000 ft altitude. The aerodrome's flight coordinator indicated that it is possible to activate the Temporarily Segregated Area up to 4000 ft only until 20.00 hrs. Pilot A confirmed he understood information and reported that they remained at 1200 ft altitude. The crew did not specify why the higher altitude was requested. This was the last crew radio message, transmitted several minutes before the accident.

At 20.04 hrs pilot C, flying his aircraft from Zapyškis village, Kaunas district, and being a little beyond Kačerginė village, Kaunas district, at about 1000 ft altitude saw the reflection of the aircraft which started to spin and descend vertically before impacting the ground. About 10 seconds after the aircraft impacted to the ground, pilot C noticed the smoke coming from the accident site. The aircraft was L-shaped – the front part was bent, and the rear part was standing upright.

Eyewitnesses driving along the road near the West pilotage zone reported that the aircraft was flying quite low, parallel to their direction of travel. Then the nose of the aircraft went up slightly, the aircraft rolled over the wing and started to dive spinning nose straight down.

1.2. Injuries to persons

2 flight crew members on the aircraft were fatally injured.

1.3. Damage to aircraft

The aircraft was destroyed.

1.4. Other damage

There was damage to the ground.

1.5. Personnel information

1.5.1. Pilot A

Pilot A was a 71-year-old citizen of the Republic of Lithuania, who at the time of the accident held an Ultralight Aircraft (hereinafter – ULO) pilot licence issued by the Lithuanian Ultralight Aircraft Pilots Federation (hereinafter – ULOPF) on 15 May 2006 and valid until 26 April 2024. The RAL class "AA" (qualification without restrictions), "B" (tow pilot qualification) and "C" (instructor qualification) categories were specified in the licence.

Pilot A had a driver's medical certificate issued on 6 March 2019 and valid until 6 March 2024.

Pilot A had a private pilot licence PPL(A) issued by the Civil Aviation Administration[2] of the Republic of Lithuania (hereinafter – CAA). SEP(land) and FI(A)/SEP(land) ratings entered in the licence were valid until 31 August 2020. The licence included aerobatic rating AS. The medical certificate required for the validity of the PPL(A) licence expired 22 October 2018.

[2] Since 1 January 2019 the functions of the Civil Aviation Administration are performed by the Public Institution Transport Competences Agency.

Pilot's A total experience as instructor with the training aircraft type according to the ULOPF data on 1 December 2021 was 850 hours. According to the data provided by the training organisation, pilot A flew 51 hours 12 min. in the last 90 days before the accident, and 2 hours 30 min. during the last 7 days. The safety investigation did not obtain the pilot's A logbook neither precise information about pilot A's total flight experience nor flight experience on other aircrafts.

1.5.2. Pilot B

Pilot B was a 37-year-old citizen of the Republic of Lithuania who at the time of the accident held the ULO pilot licence issued by the ULOPF in December 2021 and valid until December 2026.

Pilot B had a driver's medical certificate issued on 10 January 2014 and valid until 10 January 2024.

Pilot's B total flight experience was 61 hours 19 min. During the last 90 days before the accident pilot B flew 21 hours 18 min. and he did not fly in the last 13 days.

1.6. Aircraft information

1.6.1. General

The Bristell UL HD is a single-engine, all-metal, low wing, semi-monocoque aircraft with two seats side by side configuration (Fig. 1). The aircraft is equipped with a fixed tricycle landing gear with a steerable nose wheel. The aircraft is equipped with a four-cylinder Rotax 912 ULS 2 engine and a three-blade propeller. Data of the aircraft are given in Table 1.

Fig 1. Ultralight aircraft Bristell UL HD, LY-LIS (photo of the owner of the aircraft)

Table 1. The ultralight aircraft data

Aircraft manufacturer	BRM Aero s.r.o., Czech Republic
Aircraft type	Bristell UL HD
Serial No.	505/2020
Year of manufacture	2020
Registration	LY-LIS
Total flight hours	1437.8 hrs (as of 20 July 2022)

1.6.2. Maintenance information

The aircraft had an Aircraft Registration Certificate issued by the Public Institution Transport Competences Agency (hereafter – TCA) on 12 August 2020 and a Special Certificate of Airworthiness (hereafter – SCoA) revalidated on 10 August 2021 and valid until 9 August 2022. The aircraft was registered in the Register of Civil Aircraft of the Republic of Lithuania as an aircraft of the experimental category.

The Bristell UL HD Aircraft Maintenance and Inspection Procedures Manual (Document No. ULHD-MIP-2-1-1-LT, issue date July 2022, revision 3) (hereafter – the Service Manual) states that aircraft maintenance must be performed every 100+5 flight hours. The Rotax engine type 912 series Maintenance Manual (hereafter – the Engine Manual) specifies that engine maintenance must be carried out every 100 flight hours. Next-to-last 100 hours aircraft and engine maintenances were performed on 24 June 2022 at 1301 flight hours. The last 100 hours aircraft and 200 hours engine maintenances were performed on 20 July 2022 at 1437.8 flight hours.

1.6.3. Fuel quantity

The aircraft fuel tanks are of aluminium construction, integrated in the cavities of the front parts of the wings. The capacity of each fuel tank is 60 litres.

The owner of the aircraft, who leased the aircraft for the flights, could not provide information about the exact amount of fuel on board of the aircraft before the accident flight but indicated that the fuel tanks were usually filled to full. The aircraft was last refuelled on 7 August 2022 at 21.25 hrs with a total of 65 litres of 95 grade petrol.

Given that fuel tanks were usually filled to full, the fuel tanks had to contain 120 litres or 89 kg[3] of petrol after refuelling. Between the last refuelling and the accident flight, the aircraft was flown three times with a total duration of 1 hour 40 min. The Aircraft Operating Instructions of BRISTELL UL HD (Doc.no.: ULHD-AOI-2-1-1-LT, date of issue February 2018, revision 1) (hereinafter – the Operating Instructions) indicate that the aircraft's minimum fuel consumption is 15 l/h. Taking this into account, during last three flights 25 litres or 18.5 kg of petrol must have been used. Before accident flight fuel tanks were likely to contain about 95 litres or 70.5 kg of petrol.

1.6.4. Weight and balance

Section 2.7 of the Operating Instructions specifies that maximum design take-off weight of the aircraft is 600 kg and maximum take-off weight with a ballistic recovery parachute system for the UL category is 472.5 kg. The empty aircraft weight is 322.3 kg. The established limits of the centre of gravity of the aircraft are between 341.8 mm and 478.5 mm from the datum (wing leading edge between ribs No. 4 and 5, 2071 mm from the plane of symmetry).

During the safety investigation, data of the weight of the crew was not obtained, therefore it was not possible to determine the exact aircraft take-off weight. Considering the pilot's average weight of 75 kg and the fuel weight of 70.5 kg in the fuel tanks before the flight, it is likely that the actual take-off weight of the aircraft was about 542.8 kg. The position of the centre of gravity was within the limits specified in the Operating Instructions.

Aircraft manufacturer BRM Aero s.r.o. on 7 August 2020 issued Safety Directive No ALL-SA-0-0-0-0001-2020 to correct identified errors in the aircraft's weight and balance calculation data in the Operating Instructions for all variants of Bristell NG-5 model aircraft. The aircraft manufacturer indicated that the Bristell UL HD aircraft is one such variant of the Bristell NG-5 model and is subject to the Safety Directive. On 29 July 2021, in order to extend the SCoA of the aircraft, the owner of the aeroplane submitted, together with other documents, a list of the aircraft Airworthiness Directives and Mandatory Service Bulletins or compatible documents compliance records, in which he indicated that the Safety Directive is not applicable to his aircraft. Therefore, the requirements specified in the Safety Directive were not fulfilled - the relevant pages of the Operating Instructions with the corrected weight and balance calculation data were not replaced.

[3] Density of 95 grade petrol is 742 kg/m^3.

1.6.5. Approved maneuvers

The Operating Instructions indicate:

‘V2.9 Approved maneuvers

Airplane category: ULM
The BRISTELL UL HD is approved for normal and below listed maneuvers:
· Steep turns not exceeding 60° bankpilot
· Lazy eights
· Chandelles
· Stalls (except whip stalls)

WARNING

Aerobatics and intentional spins are prohibited!’

The Operating Instructions do not specify the minimum altitudes at which a stall can be performed, or stall recovery should be completed.

1.6.6. Stall speeds

The aircraft was not equipped with a stall warning system. The use of such systems is not mandatory on this type of aircraft.

The Operating Instructions indicate stall speeds of the aircraft at maximum take-off weight of 472.5 kg under International Standard Atmosphere conditions:

‘5.2.2 Stall speeds

Conditions: Max. take-off weight Engine idle run	Wing flaps position	IAS, [km/h]	CAS, [km/h]	KIAS	KCAS	Altitude loss at recovery [ft]
Wing level stall	0°	80	80	43	43	90
	10°	75	75	40	40	120
	30°	64	65	35	35	160
Co-ordinated turn 30° bank	0°	86	86	46	46	120
	10°	81	81	44	44	160
	30°	70	70	38	38	200

1.6.7. Aircraft rescue system

The aircraft was equipped with Magnum 601 ballistic rescue parachute system. When activated with a special handle, a large parachute is fired and the aircraft, together with the flight crew, descends to the ground under the canopy. The Operating Instructions specify:

‘3.9.1 Ballistic rescue parachute system activation

<...>

WARNING

Minimum effective altitude for the use of Magnum rescue system is 200 m (660 ft) above ground. By activating at height under 200 m the swinging oscillation of the aircraft may not stabilize and the crew may be injured by impact with terrain. Additionally, the parachute canopy may not be fully loaded so as to properly reduce the speed of fall.’

1.7. Meteorological information

The Kaunas Aviation Meteorological Station of the Lithuanian Hydrometeorological Service under the Ministry of Environment recorded meteorological conditions at the time of the accident. The station is 259 ft above sea level and 20 km north-east of the accident site.

At the time of the accident air temperature was 20 °C, wind north-west direction 4-6 m/s, no clouds below 5,000 ft above aerodrome level, visibility more than 10 km, atmospheric pressure at sea level 1024 hPa.

1.8. Aids to navigation

Not applicable.

1.9. Communications

During the flight, the crew maintained regular radio communication with the aerodrome's flight coordinator. The transmissions were recorded and obtained during the safety investigation. All transmissions of the crew were entirely routine, the crew seemed calm and collected and there were no unusual background noises on the transmissions.

1.10. Aerodrome information

The crew of the aircraft used to fly regularly from S. Darius and S. Girėnas aerodrome. The Flight Instructions of S. Darius and S. Girėnas aerodrome approved on 7 February 2019 and agreed with TCA on 19 April 2019 (hereinafter – the Aerodrome Flight Instructions) specify the flight altitudes:

> '5.5. All flights in the aerodrome traffic zone must be conducted with the altimeter setting of mean sea level (QNH). Aerodrome elevation above mean sea level is +246 ft (+75 m): <...>
>
> 5.9. The flight altitude in the aerodrome traffic circuit is 1,200 ft by QNH. The minimum allowed flight altitude in the traffic circuit is 800 ft by QNH. <...>
>
> 5.15. If Temporary Segregated Area Aleksotas (hereinafter – EYTSA2A) is not activated, the maximum flight altitude in the pilotage zones (Point, West and South) must not exceed 1200 ft (366 m) by QNH or 954 ft (291 m) by the pressure at the airfield level. <...>
>
> 7.5. Aerodrome traffic zone can be supplemented with a Temporary Segregated Areas EYTSA 2A, B, C which are in controlled airspace. Before using they must be activated according to the provisions set by JSC Oro Navigacija.'

JSC Oro Navigacija publishes information about the use of Temporary Segregated Areas in NOTAM[4] messages. On the day of the accident, according to NOTAM A2981, Temporary Segregated Area EYTSA2A was activated from 8.00 to 20.00 hrs.

The Aerodrome Flight Instructions also specify what information the pilot in command or crew must provide:

> '5.17. In order to ensure flight safety, the crew or pilots in command of the all aircraft maneuvering on the ground or flying in the aerodrome traffic zone must provide information about their actions and intentions on frequency 135.500 MHz: <...>
>
> 5.17.3. before take-off report the runway number and the following specific intentions after departure: <...>
>
> 5.17.3.3. flight to zone, specifying its name (Point, West or South), point of leaving traffic circuit and the intended altitude range to be used in the zone. <...>
>
> 5.17.6. when entering one of the three aerodrome zones, indicating planned time of operation in the zone and intended altitude range (by QNH) to be used <…>'

[4] NOTAM (Notice To Airmen) – notice containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

1.11. Flight recorders

1.11.1. Aircraft flight recorders

The aircraft was not equipped with a flight data recorder and cockpit voice recorder. The use of such devices in such type aircraft is not obligatory.

There was an Ipad tablet with SkyDemon navigation program on board of the aircraft, but the tablet was not used during the flight.

1.11.2. Radar data

The radar data was obtained from Kaunas Air Traffic Control Center air traffic monitoring system. The data received were analysed to determine the flight route, time, speed and altitude of the aircraft.

1.11.3. Video records

The records of video surveillance cameras were obtained from the S. Darius and S. Girėnas aerodrome. The video recordings were analysed to determine the aircraft's preparation for the flight and take-off.

Also, during the safety investigation, a video of the last seconds of the aircraft's flight, filmed by the eyewitnesses, was obtained. The video shows the aircraft diving at a steep angle and spinning around its longitudinal axis. The moment of the impact itself could not be seen due to obstructing trees.

1.12. Wreckage and impact information

The aircraft impacted in a cut crop field 4.2 km southwest of the aerodrome reference point in the aerodrome's West pilotage zone. The accident site was located about 40 meters northwest of the residential house, and the aircraft was lying with its nose oriented towards the house. The structural elements of the aircraft were not detached from the aircraft and the wreckage was lying in one place. The canopy was lying separately from the aircraft at about the span of the wing near the tail (Fig. 2).

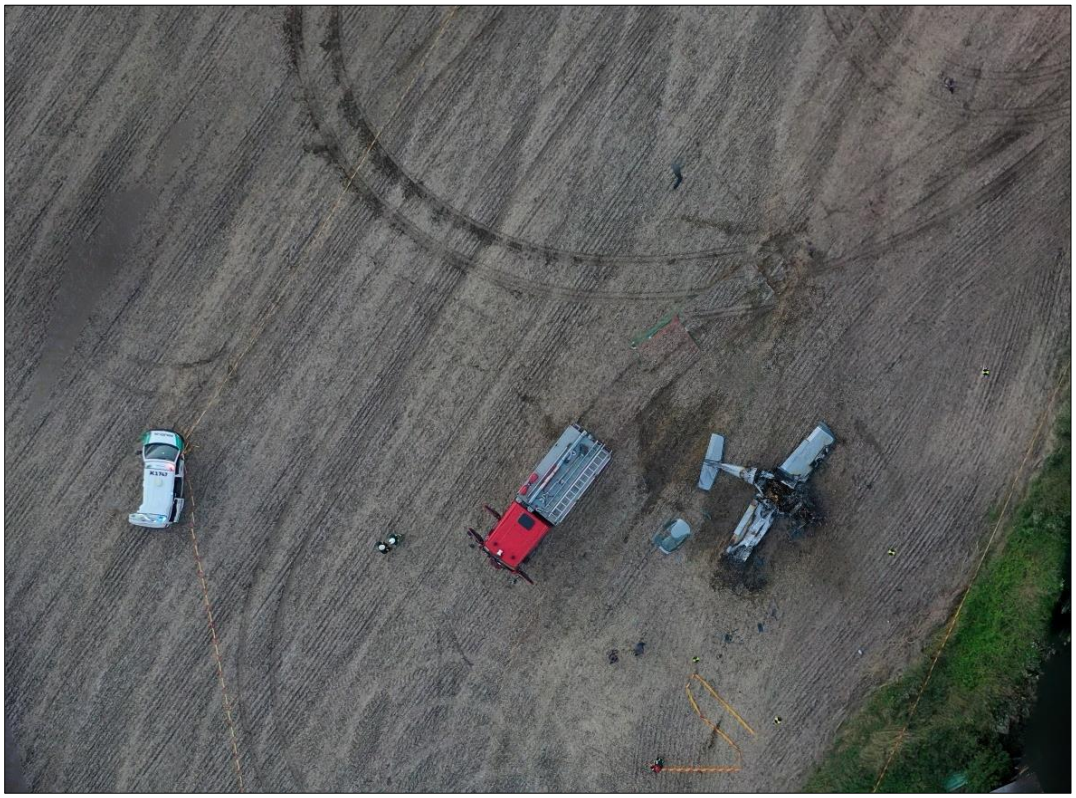

Fig 2. The aircraft Bristell UL HD at the accident site

The leading edges of the aircraft's wings were cracked in the locations of the fuel tanks and the front parts of the wings were burnt. The right wing was severely deformed. The part of the right wing at the fuel tank was burnt, the tip of the wing was burnt out. The leading edge of the left wing was cracked at the place of the fuel tank and burnt. During the impact, the fuel ruptured the wing's leading edge and spilled out in front of the wing.

The vertical part of the tail section of the aircraft – the fin and the rudder visually were intact. The right side of the horizontal stabiliser and the fuselage were crushed at the junction, the right stabiliser was corrugated, the right edge of the elevator was bent upwards.

The landing gear was broken and bent to the left.

The engine was stuck in the ground. The propeller was burnt. The remains of one propeller blade were lying on the ground, the remains (frames) of the other two blades were sticking out.

1.13. Medical and pathological information

The post-mortem examination of the crew was carried out by the Kaunas Division of the State Forensic Medicine Service. The post-mortem examination showed that both pilots died of injuries sustained in the accident impact. Toxicological examination showed no evidence of alcohol or drugs. There were no pathological or toxicological factors which could have caused or contributed to the accident.

1.14. Fire

There was a post impact fire. The front part of the aircraft, i.e. the engine compartment, the cockpit and the central part of the fuselage were destroyed in the post impact fire.

1.15. Survival aspects

The pilot A was sitting in the right seat and the pilot B in the left seat. Both pilots were fastened by their seat belts. The accident was not survivable due to forces of impact into the ground.

1.16. Tests and research

Not applicable.

1.17. Organizational and management information

Not applicable.

1.18. Additional information

1.18.1. International licensing requirements for recreational pilots

The International Civil Aviation Organization (hereinafter – ICAO) Safety Oversight Manual Part A - The Establishment and Management of a State Safety Oversight System (Doc. No. 9734, third edition, 2017) Chapter 3 Critical elements of a state safety oversight system indicates:

> '3.1.1 'Primary aviation legislation' is a legislative instrument known as the 'civil aviation act' or 'civil aviation law' that is applicable to all individuals and organizations subject to the laws of the State concerned. <...>
>
> 3.1.5 Primary aviation legislation should enable the government and its administration, through the establishment of an empowered CAA, to proactively and effectively regulate and supervise civil aviation activities, notably in relation to:

a) the qualifications and competency of aviation personnel, by using a personnel licensing system (e.g., issuance/validation, renewal, suspension or revocation/cancellation of licences and certificates of competency, as appropriate); and <...>

3.1.7 Primary legislation should also contain the legal basis for enforcement, including the ability to impose operating restrictions, suspend or revoke licences, certificates, authorizations or approvals, as well as impose financial penalties.'

Chapter 6: Delegation of Functions and Responsibilities of the ICAO Manual of Procedures for Establishment and Management of a State's Personnel Licensing System (Doc. No. 9379, second edition, 2012) states:

'6.6 Delegation of licensing functions to organisations

6.6.1 Some States have delegated the supervision of recreational flying activities, including the qualification of pilots, to independent bodies such as an aerial sports federation. Such delegation of functions is in most cases compatible with the State's obligation with regard to the Chicago Convention provided that:

a) the flying authorizations issued by the independent bodies are restricted to the national airspace; and

b) these activities do not constitute a hazard to international aviation.'

1.18.2. Training and licensing of ultralight aircraft pilots

The Order of the Director of the CAA No. 4R-214 of 31 October 2016 "On the registration, airworthiness and piloting of experimental aircraft" states:

'6. Experimental aircraft referred to in points (e), (f), (g) and (j) of Annex II to Regulation No 216/2008 and classified in the category of ultralight aircraft, can be piloted by persons holding licences issued in accordance with the rules approved by the Ultralight Aircraft Pilots and Lithuanian Hang-gliders and Paragliders Federations respectively and agreed with the CAA.'

On 31 January 2018, the CAA repealed the Order of the Director of the CAA No. 4R-97 of 6 May 2009 "On the licensing of ultralight aircraft pilots and the accreditation of training institutions", by which it was established that the ULO pilots are trained in training institutions which hold a valid accreditation certificate issued by the ULOPF in accordance with the procedures laid down by the Director of the CAA, in accordance with the training programs approved by the Director of the CAA.

On 19 January 2018, the ULOPF by its council meeting protocol No. 20171130-1ULOPF approved "Ultralight aircraft pilots licencing rules" (hereinafter – the Licensing Rules), which on 26 January 2018 were agreed with the CAA. The Licensing Rules states:

'2. The licensing rules of the ultralight aircraft (hereinafter – the ULO) pilots (hereinafter – the rules) regulate the medical requirements for the ULO pilots, the conditions and procedures of training, examination, issuance and renewal, recognition, suspension, renewal and termination of licences.

3. The ULO pilot's licence (hereinafter – the licence) is issued, revalidated, suspended, recognised, renewed and terminated by the Federation of Ultralight Aircraft Pilots (hereinafter – the ULOPF).'

Article 7 of the Licensing Rules states that the ULO pilots are trained in accordance with programs approved by the ULOPF. The ULOPF has developed a practical training program for ultralight aircraft pilots (RAL class ULO aircraft, ULO PMPA v2.3) (hereinafter – the Training Program).

1.18.3. Pilot B training records

Almost 8 months passed between the issuance ULO pilot license of the pilot's B and the accident, during which the pilot B had flown 25 hours 18 min. During the safety investigation, training records were reviewed to assess the qualification of pilot B.

The Training Programme specifies that the theoretical part of the pilot training shall be at least 21 hours and the practical part at least 26 hours. The Training Program states:

> '2.24 The practical part of pilot training can only be started after completion of at least 21 hours of theoretical training: <...>.'

Pilot B underwent training at the training organisation, which had an accreditation certificate issued by ULOPF on 29 October 2013. The ULOPF inspection report of the training organisation indicates that pilot B was taught the theoretical knowledge subjects from 4 February 2021 to 4 June 2021, including the subject "Human performance and limitations" completed on 17 May 2021, the subject "Radio Communication" completed on 18 May 2021, the subject "Navigation" completed on 2 June 2021 and the subject "Aerodynamics" completed on 4 June 2021. Next to the theory subject's names, there were indicated the teachers of each subject with the signatures of the head of the training organisation. The head of the training organisation signed on the theory examination list as an examiner for all theoretical knowledge subjects.

Pilot's B logbook indicates that flight training was performed from 7 May 2021 until 1 October 2021. From 4 June 2021 until the end of the training, pilot's B instructor was pilot A.

The Training Program does not describe the training procedures, it only states:

> 'Chapter 4: Practical training
>
> Before each practical task of the program, it is mandatory to perform ground training conducted by the instructor. The aim of the training is to ensure that the student has an accurate and clear understanding of the specific task. The fact of ground training is recorded in the practical training sheet. This preparation must be carried out no later than one day before the practical task.'

Also, in Chapter 4: Practical Training of the Training Program, the rather detailed teaching methodology is specified in the exercise descriptions. Evaluation scores are indicated after each exercise. However, the Training Program does not provide the form of a practical training sheet and does not specify how and where the student's scores are recorded.

During the safety investigation, the training organisation did not provide pilot's B practical training sheet and / or any other document that would allow to assess pilot's B flight exercises with evaluation scores. The training organisation stated that it only rents the aircraft for training, and the student decides for himself which instructor to choose for training.

On 1 December 2021, pilot B was issued a training organization certificate on completion of the training course and passing qualifying exams for the issuance of ULO pilot's licence. On 2 December 2021 pilot B passed the skill test. Pilot's B total flight time during the training program was 36 hours 1 min.

1.18.4. General information about the stall and the spin

A stall is an aerodynamic condition which occurs when smooth airflow over the aircraft's wings is disrupted, resulting in loss of lift. A stall occurs when the angle of attack, i.e. the angle between the chord line of the wing and the relative wind, exceeds the wing's critical angle of attack. It is possible to exceed the critical angle of attack at any airspeed, at any attitude, and at any power setting.

The aim of the stall exercises is to teach to recognize the signs of approaching to stall, the stall itself, and how to recover safely from this potentially dangerous situation. When teaching to stall, the aircraft's speed is usually reduced until it reaches the speed at which the stall occurs. Depending on many factors, e.g., aircraft's bank angle, configuration, weight, center of gravity position, etc., the aircraft's stall characteristics may be different. Stalls are practiced to two different levels:

– an impending stall occurs when the angle of attack causes a stall warning but has not yet reached the critical angle of attack. Indications of an impending stall can include buffeting or audible warning.

– a full stall occurs when the critical angle of attack is exceeded. Indications of a full stall are typically that an uncontrolled nose down pitch cannot be easily stopped and may be accompanied by an uncontrolled rolling motion.

A spin occurs when at least one of the aircraft's wings exceeds the critical angle of attack with a sideslip or yaw acting on the aircraft. A spin is defined as a manoeuvre in which the aircraft descends vertically in a narrow corkscrew path. In all spins at least one of the wings is stalled.

Mishandling of yaw control during a stall increases the likelihood of a spin entry. An aircraft will yaw not only because of incorrect rudder application but because of adverse yaw created by aileron deflection and other aerodynamic forces. If the yaw had been created by the pilot because of incorrect rudder use, the pilot may not be aware that a critical angle of attack has been exceeded until the aircraft yaws out of control toward the lowering wing. If the pilot does not immediately initiate stall recovery, the aircraft may enter a spin. During a spin, the aircraft's attitude and spin rate can vary greatly between different types of aircraft. In the case of low nose attitude, the rate of descent is often high, and the higher nose attitude usually results in a lower rate of descent (flat spin). Aircraft flight manuals or pilot operation handbooks usually describe aircraft's stall and spin recovery procedures.

1.18.5. Stall training

During the safety investigation, the Training Program was reviewed to evaluate the stall training methodology of the ULO pilots. The scope of the Training Program practical part of stall dual flight training is 1 hour, and the scope of solo flight training is 30 minutes. The Training Program specifies the recommended flight altitudes for slip and stall training:

> '4.6 Exercise 6: Slip, stall, true (air) speed.
>
> Teaching Methodology <...>
>
> Completion conditions: the student must fly safely in the specified modes. Flight altitudes: from 1000 ft / 300 m to 1600 ft / 500 m. <...>.
>
> 4.17 Exercise 17: Stall, slip.
>
> Teaching Methodology <...>
>
> The student must perform the repetition of the stall and slip task in solo flight. The exercise is performed in the airspace specified by the instructor, not above the aerodrome. The stall task must be completed at an altitude not below 360 ft / 100 m, the slip task must be completed at an altitude not below 175 ft / 50 m. It is recommended that the instructor on the ground, who assesses and monitors the student's flight, maintains radio communication with the student. Flight altitude from 1000 ft / 300 m to 1600 ft / 500 m.'

1.18.6. Other exercises of the Training Program

During the safety investigation, when reviewing the Training Program, attention was also paid to the methodology of performing other exercises.

Exercise 9 ‘Emergency landing training’ of the Training Program states that at least 3 last flights out of the appointed minimum of 15 flights must be conducted with the engine completely shut down. The student must correctly calculate the landing on the specified runway or part of it without using engine power to adjust the approach and landing. The student must be able to control the aircraft safely and perform a calculation for landing with the engine off.

Exercise 18 ‘Calculation for landing training’ of the Training Program states that the student must perform the calculation for landing task solo in the aerodrome traffic circuit, reducing the engine thrust to the minimum according to the instructor’s instructions and making landing in the first third of the runway without further use of engine power.

Also, in Exercise 8 ‘Aerial selection of the landing site, its evaluation and use’ of the Training Program, it is indicated that when selecting a landing site, it is allowed to inspect it flying at an altitude of less than 20 m, after evaluation of the terrain slopes and obstacles on the ground.

1.18.7. Non-certified light aircraft pilots training provisions of other countries

During the safety investigation, the non-certified light aircraft pilots training methodology of other countries was reviewed to assess the minimum flight altitude for stall training exercises.

In Canada, one of the requirements for opening a ULO school is to adapt a private and (or) commercial pilot flight and (or) ground training program approved by Transport Canada, which is responsible for transport policy, or to develop its own training program based on the Part II of the Transport Canada Flight Instructor Guide (TP 975E, revised 9/2004), depending on the type of ultralight aircraft used. The Flight Instructor Guide defines the pilot training program syllabus and training methodology used by flight training units and flight instructors to prepare students for obtaining a pilot licence. This guide specifies low-speed exercises:

> ‘Exercise 11 Slow Flight <...>
>
> Advice for instructors <...>
>
> (4) During the initial demonstration of this exercise, a minimum altitude of 2,000 ft above terrain is suggested.’

Formerly known as the Australian Ultralight Aircraft Federation, Recreational Aviation Australia (RAAus) is the Australian authority responsible for operation administration of ultralight, recreational and light sport aircraft. Its Flight Operation Manual (Issue 7.1.1, 31 March 2021) specifies the requirements and procedures for obtaining and maintaining pilot qualifications, including stall training procedures:

> ‘Section 3.02. Pilot flight training <...>
>
> 5. All ground and flight training must be conducted at an approved RAAus [flight training school] and before solo flight is allowed, the Student Pilot is required to reach the levels of competency in the elements required as indicated in the RAAus Syllabus of Flight Training. Stalls and stall recovery when a wing drop are to be conducted in accordance with the following requirements:
>
> a. When the stall characteristics of the aeroplane are known to be benign, straight and steady stalls may be conducted during dual flight training at a height below 3,000FT [above ground level] at the discretion of the [Chief Flying Instructor], provided the stall recovery is completed by 2,000FT [above ground level].
>
> b. In all other situations, stall recovery is to be completed by 3,000FT [above ground level].’

The Recreational Aviation Australia also recommends the use of The Australian Civil Aviation Safety Authority published Flight Instructor Manual (Aeroplane), (Issue 2, December 2006), for pilot training, which states:

> '09 Stalling <...>
>
> Before carrying out any advanced stalling exercise it is important that sufficient height is gained to ensure recovery by 3,000 feet above ground level and that the aeroplane is in the appropriate training area. <...>
>
> 15 Emergency and special procedures <...>
>
> Note: The engine failure should be simulated only by closing the throttle. Ignition switches and fuel tank selectors should not be moved during practices.'

The Recreational Aircraft Association of New Zealand administers the operation of a similar class of aircraft. For pilot training it recommends to use a general New Zealand Civil Aviation Authority approved Flight Instructor Guide (Revision 2023) which is part of the Civil Aviation Authority good practice material and which states:

> 'Basic stalling / Advanced stalling <...>
>
> H Height (not altitude)
>
> Height sufficient to recover by not less than 2,500 feet above ground level.
>
> <...>
>
> Forced landing without power – the pattern <...>
>
> The engine failure will be simulated from ___ feet by closing the throttle.'

The Irish Aviation Authority indicated the requirements for ultralight pilot training programmes in Ireland, which require a recover to normal flight attitude after a stall exercise to be performed up to 3 000 feet above ground level. For engine failure after take-off training and forced landing off the aerodrome training, the general SERA.5005 rule of a minimum of 500 feet above ground level applies. Engine shutdown is not permitted on a single engine aeroplane flight.

United States Federal Aviation Administration Airplane Flying Handbook (FAA-H-8083-3C, 2021), Chapter 5: Maintaining Aircraft Control: Upset Prevention and Recovery Training, paragraph Stall Training prescribes:

> 'As in all maneuvers that involve significant changes in altitude or direction, the pilot should ensure that the area is clear of other air traffic at and below their altitude and that sufficient altitude is available for a recovery before executing the maneuver. It is recommended that stalls be practiced at an altitude that allows recovery no lower than 1,500 feet AGL for single-engine airplanes, or higher if recommended by the [Airplane Flight Manual] / [Pilot's Operating Handbook]. Losing altitude during recovery from a stall is to be expected.'

1.18.8. Height of a flight

Section 5 of the Annex to Commission Implementing Regulation (EU) No. 923/2012[5] laying down the common rules of the air states:

> 'SERA.3105 Minimum heights
>
> Except when necessary for take-off or landing, or except by permission from the competent authority, aircraft shall not be flown over the congested areas of cities, towns or settlements or over an open-air assembly of persons, unless at such a height as will permit, in the event of an emergency arising, a landing to be made

[5] Commission Implementing Regulation (EU) No 923/2012 of 26 September 2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Implementing Regulation (EU) No 1035/2011 and Regulations (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010

without undue hazard to persons or property on the surface. The minimum heights for VFR[6] flights shall be those specified in SERA.5005(f) <...>.

"SERA.5005 Visual flight rules <...>

(f) Except when necessary for take-off or landing, or except by permission from the competent authority, a VFR flight shall not be flown:

(1) over the congested areas of cities, towns or settlements or over an open-air assembly of persons at a height less than 300 m (1,000 ft) above the highest obstacle within a radius of 600 m from the aircraft;

(2) elsewhere than as specified in (1), at a height less than 150 m (500 ft) above the ground or water, or 150 m (500 ft) above the highest obstacle within a radius of 150 m (500 ft) from the aircraft. <...>'

During the safety investigation, the European Union Aviation Safety Agency stated that flights shall comply with the rule 'SERA.3105 Minimum Altitude' at all times, except when necessary for take-off or landing, or except by permission from the competent authority and therefore especially in training the requirements shall be followed and flights shall not be flown below 150 m unless in case of the exceptions quoted above.

1.18.9. Requirements for maintenance of ultralight aircraft

There are no established national requirements concerning maintenance and / or inspection of experimental category aircraft, including ultralight aircraft.

Article 3 of the Aviation Law of the Republic of Lithuania states:

'5. <...> The requirements for the design, production, registration, technical maintenance, airworthiness, operation and piloting of the experimental category aircraft, except for simple aircraft, and the criteria and conditions for the issuance, revalidation, suspension or revocation of a special airworthiness certificate are approved by the Lithuanian Transport Safety Administration (hereinafter – LTSA), after coordinating with the Transport Competences Agency, taking into account the assurance of flight safety. <...>'

1.18.10. Maximum take-off weight of the experimental category aircraft

Until 31 December 2023, Article 2 (13) of the Aviation Law of the Republic of Lithuania stated that experimental category aircraft are only those listed in Annex I to Regulation (EU) 2018/1139[7] of the European Parliament and of the Council on common rules for civil aviation. Annex I to Regulation (EU) 2018/1139 specifies that the maximum take-off mass of aircraft equipped with a recovery parachute is 475 kg.

From 1 January 2024, an amendment to Article 2 (13) of the Aviation Law of the Republic of Lithuania came into force, which expands the category of experimental aircraft to include aircraft listed in Article 2 (8) of Regulation (EU) 2018/1139, including aircraft with a maximum take-off mass of no more than 600 kg.

1.19. Useful or effective investigation techniques

Not applicable.

[6] VFR – Visual Flight Rules

[7] Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91

2. ANALYSIS

2.1. Airworthiness of the aircraft

2.1.1. Technical investigation of the aircraft

The safety investigation found no signs of structural failure of the aircraft that could have caused the accident. There was also no evidence that the flight control systems were inoperative. The flight crew did not declare any problems during the flight. All the damage resulted from the aircraft impact to the ground and the post impact fire.

2.1.2. Aircraft maximum take-off weight

After taking over the aircraft the crew did not calculate the take-off weight and balance of the aircraft. The inspection of the aircraft lasted less than one minute. Each pilot inspected a part of the aircraft. The crew did not check visually the amount of fuel in the aircraft fuel tanks. The pilot-in-command has the duty before each flight not only to carry out a preflight inspection of the aircraft, but also to calculate the weight and balance of the aircraft.

During the safety investigation the calculated probable take-off weight of the aircraft was 542.8 kg and it was 70.3 kg more than the maximum permissible take-off weight specified in the Operating Instructions. The permissible payload of the aircraft (pilots, baggage, fuel) is 150.2 kg – which is the difference between the maximum take-off weight – 472.5 kg and the weight of the empty aircraft – 322.3 kg. Since full fuel tanks were normally filled, the weight of fuel after filling was 89 kg. In this case, in order not to exceed the maximum take-off weight limit specified in the Operating Instructions, the weight of both pilots should not exceed 63.8 kg. Because of such low possible weight, it is likely that most of the dual training flights were carried out exceeding the maximum take-off weight, e.g., between the last refuelling and the accident flight, the aircraft was flown three times with a crew of two pilots.

At the time of registration of the aircraft in the Register of Civil Aircraft of the Republic of Lithuania, the maximum take-off weight of an experimental category aircraft with a total recovery parachute could not exceed 475 kg. Meanwhile, the maximum design take-off weight of the aircraft was 600 kg. n order to enter the aircraft in the Register of Civil Aircraft of the Republic of Lithuania according to the current legal regulation, the maximum take-off weight of the aircraft was reduced from 600 kg to 472.5 kg. This led to a situation when the permissible maximum take-off weight was exceeded in the accident flight, but the maximum design take-off weight was not.

Safety actions

From 1 January 2024, the amendment of Article 2 (13) of the Aviation Law of the Republic of Lithuania has entered into force, which extends the category of experimental aircraft to include the aircraft listed in Article 2 (8) of Regulation (EU) 2018/1139, including aircraft with a maximum take-off weight of 600 kg.

Taking this into account, in the future there will no longer be a situation where, in order to enter an aircraft with a maximum design take-off weight of 600 kg in the Register of Civil Aircraft of the Republic of Lithuania, the maximum take-off weight must be formally reduced to 475 kg, and the pilot or crew will not formally exceed the maximum take-off weight of the aircraft.

2.1.3. Aircraft maintenance

The Service Manual states that the aircraft maintenance must be performed every 100+5 flight hours and the Engine Manual states that the engine maintenance must be carried out every 100 flight hours. Whereas 136.8 flight hours elapsed between the aircraft's penultimate and last maintenances, which means maintenance was delayed by at least 31.8 flight hours. This conduct was not safety conscious.

The requirements of Safety Directive ALL-SA-0-0-0-0001-2020 were not fulfilled because the aircraft owner decided that this Safety Directive is not applicable to his aircraft. Taking into account the fact that the SCoA was last revalidated by the TCA on 10 August 2021, the TCA, after checking the application for issuing the SCoA and the documents attached to it, did not notice this non-compliance. This missed the opportunity to update and evaluate changes in the weight and balance data.

There are no established requirements for the technical maintenance of experimental category aircraft. It is not clear how the technical maintenance of the experimental category aircraft, including ultralight aircraft, should be organized and what are the requirements for the aircraft used for training and their maintenance. In principle, the owner or operator of the aircraft who uses the aircraft for training purposes, regardless of his/her competence and capability, can perform the maintenance himself according to the requirements set by the aircraft manufacturer. Therefore:

Safety recommendation SR-2024-A-01

It is recommended that the Lithuanian Transport Safety Administration establish requirements for the maintenance of the experimental category aircraft, as specified in Article 3 (5) of the Aviation Law of the Republic of Lithuania.

2.2. The flight

2.2.1. Flight planning

It is not clear whether the crew planned the skills improvement flight and discussed the flight plan in advance. The crew met by the aircraft and talked for about 6 minutes before starting the aircraft preflight inspection. In 6 minutes the crew could agree on the purpose of the flight, but 6 minutes there is too little time to discuss the plan for the flight.

Pilot B held a valid the ULO pilot licence and leased the aircraft for the flight. Before taxiing from the hangar, pilot B reported on the radio that the purpose of the flight was traffic circuit training flights. Pilot B was sitting in the left seat of the aircraft, so it is likely that the purpose of the flight was to refresh or improve some of pilot's B traffic circuit piloting skills in the aerodrome traffic zone. Pilot B had last flown two weeks ago.

Pilot A occupied the right seat of the aircraft, and it is likely that during the flight he was not only the instructor, but also the pilot in command of the aircraft. The plan for piloting skills improvement flight is made by the instructor, so the instructor is also responsible for the implementation of the plan he made. This is evidenced by the radio recordings, in which Pilot A only communicated changes to the course of the flight, such as a full stop on the runway after several touch-and-gos, the readiness to fly to the aerodrome's West pilotage zone, and a request to climb to an altitude of 4 000 feet, presumably for the manoeuvres he had intended to perform.

It is not clear whether the crew planned in advance to perform any flight elements in the aerodrome pilotage zone or decided on this during the flight after the touch-and-gos at the aerodrome. According to the Aerodrome Flight Instructions, unless the EYTSA2A Temporary Segregated Area is activated, the operational altitude in all aerodrome pilotage zones shall not exceed 1200 feet above mean sea level or 954 feet above the aerodrome level. On that day, according to NOTAM A2981, the Temporary Segregated Area EYTSA2A was activated from 8.00 to 20.00 hrs. This information was available to the crew, and they could plan their flights accordingly. Considering that the crew started the flight at 19.14 hrs but requested clearance to climb to 4000 feet at 19.57 hrs, it is unlikely that the crew had a preliminary plan for maneuvers above 1200 feet. Having a plan for a flight in advance and discussing it in detail with another crew member has a significant impact on the safety of flights, especially the flights with instructor.

2.2.2. Course of the flight

The crew made three touch-and-gos at the start of the flight and then a full stop landing on the aerodrome runway. At 19.42 hrs after take-off following the stop, the crew reported that they were proceeding from upwind to the West pilotage zone of the aerodrome, although according to the Aerodrome Flight Instructions, they should have reported before take-off their specific plans, i.e. to indicate the planned aerodrome pilotage zone and the intended altitude range in the zone. The flight crew, as they regularly flew from the airfield, must have known this.

At 19.44 hrs upon arrival at the aerodrome West pilotage zone the crew reported the start of the airwork and the actual altitude of 1200 feet, although according to the Aerodrome Flight Instructions, they should have reported the planned time of operation in the zone and the altitude range to be used.

At 19.55 hrs when the aircraft was at an altitude of 1400 feet, the aerodrome flight coordinator informed the crew that according to the Aerodrome Flight Instructions the permissible flight altitude in the West pilotage zone is up to 1200 feet. The crew confirmed that they understood information, but in a couple of minutes asked about the possibility to climb up to 4000 feet. However, due to Temporary Segregated Area EYTSA2A being not activated from 20.00 hrs, it was no longer possible to climb to 4000 feet altitude, therefore the flight crew reported that they were maintaining 1200 feet altitude. The crew did not specify why they requested the higher altitude. It is likely that the crew intended to perform maneuvers that require a higher altitude margin. Consequently, it cannot be ruled out that, in the absence of an opportunity to climb higher, the crew attempted to perform the desired maneuvers flying at altitude up to 1200 feet.

At 20.04 hrs pilot C of another aircraft, at that time flying to the aerodrome, saw how the aircraft entered into a spin at about 1000 feet altitude. Regarding the aerodrome elevation of 246 feet above sea level, the aircraft may have been at an altitude of about 750 feet above the ground. In the video filmed by the eyewitnesses, the aircraft can be seen diving vertically nose-down and spinning around its horizontal axis. After a few turns not recovered from the spin, the aircraft impacted the ground.

The Operating Instructions state that the aircraft is approved to perform stalls, but intentional spins are prohibited. The most common cause of entering a spin is an intentional or unintentional loss of speed below stall speed and flying at higher than critical angles of attack. The Operating Instructions provided standard aircraft spin recovery technique. Furthermore, several years ago, pilot A held a valid private pilot PPL(A) licence with the aerobatic rating and had aerobatic flying experience to be able to recover the aircraft from a spin or unusual aircraft attitudes. The Operating Instructions do not specify how much altitude the aircraft loses in one turn of the spin. However, 750 feet altitude is too low to recover safely from the spin.

50 minutes elapsed from the start of the aircraft engine to the accident and during that time on average about 13 litres or 9.6 kg of fuel could have been used. Therefore, the weight of the aircraft at the time of the accident could have been about 533 kg, or almost 61 kg above the permissible maximum take-off weight of 472.5 kg specified in the Operating Instructions.

The Operating Instructions specify stall speeds for the aircraft maximum take-off weight of 472.5 kg. As the weight of the aircraft increases, the stall speed also increases. Due to the 61 kg increase in weight of the aircraft, the stall speed should have been 85 km/h, or 5 km/h higher than the stall speed specified in the Operating Instructions. The crew’s omission to perform pre-flight calculations of the aircraft's weight and balance, resulted in a loss of the possibility to assess the effect of the increase in the aircraft’s weight on the stall speed, and if they followed the stall speed specified in the Operating Instructions for a maximum take-off weight of 472.5 kg, they reached the stall speed sooner. The aircraft was not equipped with a

stall warning system and there is no requirement to install it on this type of aircraft.

At the time of the accident, the aircraft must have contained about 82 litres or 60.9 kg of fuel. This is two-thirds of the capacity of the aircraft fuel tanks. This amount of fuel is also proved by the rupture of fuel tanks on the impact and the fire outbreak. If the fuel tanks of the aircraft are about half full, then the centrifugal force of the aircraft entering the spin will cause fuel to flow into the outboard parts of the fuel tanks creating a centrifugal moment, which makes recovery from the spin even more difficult. In such situation, the aircraft may need to make a few more turns before it gains the necessary speed to regain control, which requires additional altitude.

Entering a spin at low altitude is very dangerous, because the lack of altitude usually leaves no time and possibility to recover. The minimum effective altitude for the use of aircraft's ballistic rescue parachute system is 660 feet above the ground, and at low altitudes pilots have very little time to make a decision and activate the system. Therefore, it is likely that either the crew did not have enough time to deploy the aircraft rescue system or the crew or pilot A had confidence in his abilities to recover the aircraft from the spin.

2.3. Training and licensing of ultralight aircraft pilots

2.3.1. Pilot B training and licensing

Pilot B held the ULO pilot licence issued by the ULOPF in December 2021. Pilot B started his practical flight training on 7 May 2021 and continued his theoretical training thereafter. The last module ‘Aerodynamics’ was completed on 4 June 2021. Meanwhile, point 2.24 of the Training Program states that the practical part of pilot training can only be started after the theoretical training has been completed. This raises the question of how the practical training of pilot B was conducted when even the ‘Aerodynamics’ subject was completed almost one month after the start of the practical training. Although the documents showing this were submitted for the purpose of obtaining the ULO pilot licence, the ULOPF did not identify the fact that the practical training of pilot B started before the theoretical training had been completed, did not question the qualification of pilot B, did not assess its own requirement to start the practical training after the theoretical training part and issued the ULO pilot licence.

Chapter 4 of the Training Program states that a practical training sheet must be filled during the training and that the practical exercises evaluated with evaluation scores, but the form of the practical training sheet is not provided, and it is not specified how and where the evaluation scores are recorded. During the safety investigation, the training organisation did not submit a pilot’s B practical training sheet or any other document that would allow to evaluate pilot’s B practical training and flight exercises. In the absence of a requirement to check or submit these documents to the ULOPF, it is likely that the requirements in the Training Program for the completion of the practical training sheet and evaluating the practical exercises were more of a formal requirement than an active ongoing training practice.

Although the ULOPF has established the form for the inspection report of the training organisation, the role of the training organisation in the pilot training process is not defined and the inspection report is more of a self-declaration of the training organisation itself rather than a real inspection document. It should also be noted that the Training Program refers to the instructor’s responsibility of the training process but not to the training organization’s responsibility, although there it is no provisions as to who controls the instructor’s work. The statement of the training organisation that pilot B himself decided which instructor to choose for training, would seem to confirm that the instructor is responsible for the training. However, the inspection report of the training organisation, the theoretical exam sheet, and the certificate of completion of the training course and passing the qualifying exams were issued to pilot B not by the instructor but by the training organisation. This

shows that the training organisation organised and coordinated pilot B training. On the other hand, it is not established who can perform the ULO pilot training and who must submit documentation.

The CAA, having agreed the Licensing Rules approved by the ULOPF, repealed the previous procedure that the ULO pilots are trained in accordance with the programs approved by the Director of the CAA in training institutions which hold a valid accreditation certificate issued by the ULOPF in accordance with the procedures laid down by the Director of the CAA, and did not raise any questions as to who will conduct the ULO pilots training. The Licensing Rules state that in addition to the licensing of the ULO pilots, the training of the ULO pilots is also regulated. However, there is no established legal basis entitling the ULOPF to regulate the training of the ULO pilots. Therefore, the ULOPF can neither set requirements nor control the training of the ULO pilots. It should be noted that it is not specified at all who should regulate the training of the ULO pilots. Therefore, after the CAA repealed the CAA Director's Order No 4R-97 of 6 May 2009 "On licensing of ultralight aircraft pilots and accreditation of training institutions", since 31 January 2018, the situation arose that ULO pilots training was conducted in an unregulated and uncontrolled manner, and the ULOPF was forced to issue ULO pilot licences. This is proved by pilot's B training, when it is not clear who organised and conducted pilot's B training and the ULOPF issued the ULO pilot licence.

According to Article 3 (5) of the Aviation Law of the Republic of Lithuania the LTSA is obliged to establish requirements for the design, production, registration, maintenance, airworthiness, operation and piloting of experimental category aircraft. Although ULO are classified as experimental aircraft, there is no designated entity responsible for ULO pilots training.

According to the ICAO Manual of Procedures for Establishment and Management of a State's Personnel Licensing System, the licensing of recreational flying pilots is permitted to be delegated to independent bodies, provided that the flying authorizations issued by these bodies are restricted to the national airspace and these activities do not constitute a hazard to international aviation. In Lithuania, the CAA has delegated the licensing of the ULO pilots to the ULOPF. However, this delegation is only specified in the substatutory legal act, i.e. in the order of the Director of the CAA. Whereas, the ICAO Safety Oversight Manual, Part A - The Establishment and Management of a State Safety Oversight System, emphatically states that the regulation and oversight of the aviation personnel licensing must be laid down in the primary aviation legislation that applies to all persons and organisations, that is in the Aviation Law of the Republic of Lithuania. Primary legislation should also contain the legal basis for enforcement. Therefore:

Safety recommendation SR-2024-A-02

It is recommended that the Ministry of Transport and Communications of the Republic of Lithuania take measures to regulate the licensing system of ultralight aircraft pilots is in accordance with Part A of the International Civil Aviation Organization's Safety Supervision Manual 'Establishment and Management of the State Safety Oversight System' (Doc. No. 9734, 2017, third edition), including licensing of crew members, medical requirements, requirements for training organizations and regulatory authorities.

2.3.2. Stall training

The practical part of the Training Program totals 26 hours. Of these 1 hour training with an instructor and 30 minutes of solo practice is assigned for stall training. It is difficult for students to acquire sufficiently steady stall recovery skills in such a short training time. In solo flights students with little experience may find it hard to recognise an approach to stall, especially since not all the ULO have a stall warning system. Therefore, it is not safe to practice stalling in solo flights.

The Training Program specifies that flight altitude for the stall exercise shall be between 1000 ft and 1600 ft. The Training Program also specifies that the student shall perform solo stall exercise repetition at an altitude between 1000 ft and 1600 ft and complete it not below 360 ft. These altitudes are unacceptably low and should even be prohibited for training operations and solo flights without flight experience. The Federal Aviation Administration's Airplane Flying Handbook specifies that the stall should be completed no lower than 1500 feet above the ground level. The ULO stall training methodology of other countries (Section 1.18.4) recommends that stall training manoeuvres should be planned in such a way that a stall recovery is completed at an altitude not below 2000-3000 ft above the ground level. This is as much as 5.5 to 8 times higher than the altitudes specified in the Training Program.

When the Training Program recommends or specifies to perform low-speed manoeuvres at low altitudes, both students and instructors develop the attitude that it is safe. Therefore, after becoming a licensed pilot, there is a high likelihood that new pilots will fly in a similar manner and at low altitudes, as this is the approach that has been developed during training. In addition, the fact that previous flights have passed without consequences or incidents is often accepted as a proof that the flights were safe. Therefore, pursuant to the Training Program, which specifies stall exercises practice between 1000 ft and 1600 ft, and completion of this practice at an altitude not below 360 ft, it was possible for both Pilot B, who had recently obtained his ULO pilot's licence in accordance with the Training Programme, and Pilot A, who used tom instruct on the Training Programme, to have the mistaken belief that, when flying in the aerodrome's West pilotage zone up to an altitude of 1200 ft, such an altitude is safe or sufficient for stall exercises.

The Aircraft Operating Instructions do not specify the altitude at which stall exercises can be performed, even though stalls are an approved manoeuvre. In the absence of a minimum stall altitude or a stall recovery altitude, the crew had no possibility to assess the altitude at which the aircraft could be flown for stall exercises.

Taking all this into account:

Safety recommendation SR-2024-A-03

It is recommended that the Lithuanian Ultralight Aircraft Pilots Federation modify the Practical training program of ultralight aircraft pilots (RAL class ULO aircraft) (ULO PMPA v2.3) establishing a safe altitude for stall training.

2.3.3. Other Training Program Exercises

Exercise 9 'Emergency landing training' of the Training Program specifies that at least three flights must be performed with the engine completely shut down and the student must be able to safely control the aircraft and perform a landing calculation with the engine off. The training practices of other countries (section 1.18.4) do not recommend, for safety reasons, to conduct emergency landing training in single-engine aircraft in initial pilot training programs with the engine shut down. The difference in the aircraft flight performance between gliding with the engine completely off and gliding with the engine running at minimum rpm is negligible. At the same time, when the engine is switched off there is possibility in a failure to start it in due moment. These additional risks increase the chances of turning a simulated emergency situation into a real emergency, which both the student and the instructor may not be able to handle due to lack of experience and skills.

Exercise 18 'Calculation for landing training' of the Training Program states that the student must solo perform the calculation for landing task, setting engine thrust to idle according to the instructor's directions and making the landing without further use of the engine power. Calculation for landing training should not be conducted during solo flights because the student's experience is not yet sufficient to evaluate all conditions correctly and to decide himself when it is the proper moment to minimise engine thrust and commence the approach to the runway, and when, if

necessary, to terminate the approach and apply thrust to correct the situation.

Taking all this into account:

Safety recommendation SR-2024-A-04

It is recommended that the Lithuanian Ultralight Aircraft Pilots Federation modify the Practical training program of ultralight aircraft pilots (RAL class ULO aircraft) (ULO PMPA v2.3) so that the emergency landing training procedures are performed without shutting down the aircraft engine.

Exercise 8 'Aerial selection of the landing site, its evaluation and use' of the Training Program states that it is allowed to inspect the landing site flying at an altitude of less than 20 m. Whereas the Visual Flight Rules state that flights shall not be conducted below 150 m above ground level. During the safety investigation, European Union Aviation Safety Agency also emphasized that flights must comply with SERA.3105 'Minimum heights' at all the time, except when necessary for take-off or landing, or except by permission from the competent authority, therefore the requirements must be followed especially during training and flights must not be conducted below 150 m. Taking this into account:

Safety recommendation SR-2024-A-05

It is recommended that the Lithuanian Ultralight Aircraft Pilots Federation modify the Practical training program of ultralight aircraft pilots (RAL class ULO aircraft) (ULO PMPA v2.3) to comply with the Visual Flight Rules.

3. CONCLUSIONS

3.1. Findings

- Pilot A held a valid Ultralight Aircraft Pilot License and had sufficient flight experience.
- Pilot B held a valid Ultralight Aircraft Pilot Licence and did not have extensive flight experience.
- Pilot's B training to obtain the Ultralight Aircraft Licence did not comply with the requirements of the Training Program.
- The aircraft had a valid Special Certificate of Airworthiness.
- The last maintenance of the aircraft was overdue by 31.8 flight hours.
- No evidence was found that the aircraft had malfunctions before impact to the ground.
- The aircraft was destroyed by the impact to the ground and the post-crash fire.
- The take-off weight of the aircraft at the time of the accident was estimated at 542,8 kg and exceeded the permissible maximum take-off weight of 472,5 kg specified in the Operating Instructions, but the design maximum take-off weight of 600 kg was not exceeded.
- The maximum take-off weight of the aircraft was reduced from 600 kg to 472.5 kg in order to register the aircraft in the Register of Civil Aircraft of the Republic of Lithuania in accordance with the current legal regulation.
- Due to the increased weight of the aircraft, the stall speed was 5 km/h higher than the stall speed specified in the Operating Instructions.
- There is no evidence that the crew prepared for the flight and planned manoeuvres.
- It cannot be determined whether the crew intentionally performed the stall exercise or entered the stall inadvertently at an altitude of about 1,000 feet or 750 feet above the ground.
- It cannot be excluded that, in the absence of the possibility to climb higher the

crew tried to perform intended manoeuvres while flying at an altitude up to 1,200 ft.

- The Operating Instructions do not specify the altitude at which stall exercises can be performed or the altitude by which the aircraft must be recovered from the stall.
- Meteorological conditions did not contribute to the accident.
- There is no determined entity responsible for establishing the training requirements for ultralight aircraft pilots.
- There are no training requirements for ultralight aircraft pilots.
- The regulation and supervision of the licensing of ultralight aircraft pilots is not laid down in the primary aviation legislation, but in the substatutory legal act.

3.2. Causes

The crew lost control of the aircraft at low altitude and the aircraft entered a spin. Due to insufficient altitude and time, it was not possible to recover the aircraft from the spin and to use the parachute rescue system.

4. SAFETY RECOMMENDATIONS

The safety investigation authority, in order to prevent accidents and incidents, drew up a proposal – safety recommendations, based on the information collected on the basis of the safety investigation. Safety recommendations shall in no case create a presumption of blame or liability for an accident or serious incident.

The following Safety Recommendations are made in this report:

Safety recommendation SR-2024-A-01

It is recommended that the Lithuanian Transport Safety Administration establish requirements for the maintenance of the experimental category aircraft, as specified in Article 3 (5) of the Aviation Law of the Republic of Lithuania.

Safety recommendation SR-2024-A-02

It is recommended that the Ministry of Transport and Communications of the Republic of Lithuania take measures to regulate the licensing system of ultralight aircraft pilots is in accordance with Part A of the International Civil Aviation Organization's Safety Supervision Manual ‘Establishment and Management of the State Safety Oversight System’ (Doc. No. 9734, 2017, third edition), including licensing of crew members, medical requirements, requirements for training organizations and regulatory authorities.

Safety recommendation SR-2024-A-03

It is recommended that the Lithuanian Ultralight Aircraft Pilots Federation modify the Practical training program of ultralight aircraft pilots (RAL class ULO aircraft) (ULO PMPA v2.3) establishing a safe altitude for stall training.

Safety recommendation SR-2024-A-04

It is recommended that the Lithuanian Ultralight Aircraft Pilots Federation modify the Practical training program of ultralight aircraft pilots (RAL class ULO aircraft) (ULO PMPA v2.3) so that the emergency landing training procedures are performed without shutting down the aircraft engine.

Safety recommendation SR-2024-A-05

It is recommended that the Lithuanian Ultralight Aircraft Pilots Federation modify the Practical training program of ultralight aircraft pilots (RAL class ULO aircraft) (ULO PMPA v2.3) to comply with the Visual Flight Rules.