



Accident to an aircraft
Piper PA-30 Twin Comanche, LY-ARS,
that occurred on 8 December 2019
in Noreikiškės village, Kaunas district,
the Republic of Lithuania

SAFETY INVESTIGATION REPORT

No. (A-19/19) 1A-331
28 December 2022

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.

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.

In accordance with the above provisions, 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.

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ABBREVIATIONS

ARC	Airworthiness Review Certificate
ASM	Aeroplane Service Manual
ATC	Air Traffic Control Centre
ATO	Approved Training Organisation
CAA	Civil Aviation Administration of the Republic of Lithuania
CAMO	Continuing Airworthiness Management Organisation
C°	Degrees Centigrade
CPL	Commercial Pilot Licence
CTR	Control tower zone
EASA	European Union Aviation Safety Agency
EYKA	Kaunas International Airport
EYKS	S. Darius ir S. Girėnas aerodrome
EYMO	Molėtai aerodrome
EYPI	Įstra aerodrome
EYPR	Pociūnai aerodrome
FAA	Federal Aviation Administration
h	hour
kg	Kilogram
km	Kilometre
l	litre
m	Meter
MEL	Minimum Equipment List
MEP	Multi-engine piston class rating
MEP/IR	Multi Engine Piston / Instrument Rating
METAR	Meteorological Aerodrome Report,
MSL	Mean Sea level
POH	Pilot's operating handbook
TKA	Transport Competency Agency
UTC	Coordinated Universal Time

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SUMMARY

Owner	Private person
Operator	Private person
Manufacturer	Piper Aircraft, Inc., United States
Aircraft Type	Piper PA-30 Twin Comanche
Registration	LY-ARS
Place of accident	Noreikiškės village, Kaunas district, Republic of Lithuania 54°53'08.3" latitude 23°51'09.0" longitude
Date and Time	8 December 2019 13:49 (11:49 UTC) ¹

Synopsis

On 8 December 2019 at 13:47, the aircraft Piper PA-30 Twin Comanche, registration LY-ARS, landed at S. Darius and S. Girėnas aerodrome after a route flight and immediately took off again (performed a touch and go). After take-off, the aircraft deviated to the right side and shortly afterwards struck the ground in the backyard of a private house in Noreikiškės village, Kaunas district. The instructor and the student were fatally injured. The aircraft was damaged beyond economical repair. The control of the aircraft was lost due to the continued climb by increasing the upward pitch angle with insufficient thrust on the engine(s) and inadequate response to the inoperative engine(s) and extended landing gear. As a result, the aircraft initially reached stall speed and, as the airspeed continued to decrease, the aircraft went into a left spin. A safety investigation concluded that both engines of the aircraft lost power due to fuel starvation. The cause of the fuel starvation is attributed to the mismanagement of fuel consumption and a malfunctioning fuel quantity indicating system.

Safety Investigation

On 8 December 2019 at 14:18, SE 'Oro navigacija' Aeronautical Rescue Coordination Centre 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 aircraft Piper PA-30 Twin Comanche, registration LY-ARS. In accordance with the provisions of Art. 5(1) of Regulation (EU) No. 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation

¹ Times in this report are local times unless otherwise indicated.

and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC (hereinafter – Regulation (EU) No. 996/2010), the Investigator-In-Charge of Aircraft Accidents and Incidents immediately initiated an accident safety investigation.

In accordance with the Annex 13 to the ICAO Convention on International Civil Aviation, the National Transportation Safety Board of the United States, representing the State of Design and Manufacture of the aircraft Piper PA-30 Twin Comanche appointed Accredited Representative to participate in the safety investigation. He was supported by advisors from the aircraft manufacturer and propeller manufacturer.

In accordance with to Art. 8 of Regulation EU No. 996/2010, the European Union Aviation Safety Agency and Transport Competency Agency (as national civil aviation authority) appointed advisers to participate in the safety investigation. The approved training organisation and the maintenance organization also assisted to the Investigator-In-Charge of Aircraft Accidents and Incidents.

The safety investigation was conducted under the provisions of Annex 13 to the ICAO Convention on International Civil Aviation and the 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.

Coordination of judicial and safety investigations

Article 12(3) of Regulation (EU) No 996/2010 indicates that safety investigation authorities, on the one hand, and other authorities likely to be involved in the activities related to the safety investigation, such as the judicial, on the other hand, shall cooperate with each other through advance arrangements. This arrangement shall respect the independence of the safety investigation authority and allow the technical investigation to be conducted diligently and efficiently.

In Lithuania, there is no advance agreement between Investigator-In-Charge of Aircraft Accidents and Incidents appointed by Minister of Justice of the Republic of Lithuania and the judicial authorities. As a result, in the event of an accident, it was not possible to take immediate action to preserve evidence and to exam the aircraft at the accident site. The accident occurred on Sunday, while the judicial authorities appointed a prosecutor on Monday afternoon. In coordination with the assigned prosecutor and taking into account the dark time of the day, a more detailed examination of the aircraft at the accident site and the removal of the aircraft and its wreckages took place on Tuesday.

Neither Investigator-In-Charge of Aircraft Accidents and Incidents nor the judicial authorities have suitable premises for the storage and examination of the aircraft and its wreckage, which is why the aircraft and its wreckage during the technical examination were stored in the hangar of the Kaunas Aeroclub, the same place where the aircraft was permanently stored.

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 instructor's mobile communication services, the data of the Kaunas Air Traffic Control Center air traffic monitoring system and air traffic service conversation records, S. Darius and S. Girėnas aerodrome radio records and records of video surveillance cameras, and examination results of the accident site and aircraft wreckage.

1.1.1. History of the first flight

On 08-12-2019 in accordance with the flight schedule of the approved training organisation (hereinafter – ATO), the student together with the instructor had to perform training flights with a twin-engine aircraft Piper PA 30 Twin Comanche, LY-ARS, from S. Darius and S. Girėnas aerodrome (hereinafter – EYKS) in Kaunas.

According to the relatives of the instructor, the instructor at 8 hrs still had breakfast at his home. According to the locations of the mobile communication towers, it was recorded that at 8.12 hrs the instructor used the internet on his cell phone at or near home, and at 8.22 hrs already near the aerodrome or already at the aerodrome. The safety investigation did not determine when the student arrived at EYKS.

8.54 hrs the instructor spoke by cell phone with examiner A.

At 9.05 hrs the crew of the aircraft contacted the EYKS Flight Coordination Centre and informed that they were starting to taxi from the hangar of Kaunas Aeroclub with intention to fly to Kaunas International Airport (hereinafter – EYKA) for training.

At 9.09 hrs examiner A telephoned the instructor. Shortly afterwards, at 9.15 hrs, the accountable manager of the ATO telephoned the instructor and received confirmation that the instructor was starting training flights.

At 9.20 hrs the instructor submitted a flight plan. The flight plan indicated the route from EYKS through the compulsory reporting point ULKIL, Kaunas International Airport (EYKA), point TUSDA, Įstra aerodrome (hereinafter – EYPI), point VEBUS back to EYKS) (Fig. 1). The flight plan indicated that the departure time at 9.25 hrs, the flight duration of 3 hours and that the pilot in command is the instructor.

At 9.25 hrs the aircraft took off from EYKS from runway no. 27 (point 1, Fig. 1) and, having selected the left flight circle, flew out of the aerodrome traffic zone in the eastern part. Then around at 9:30 hrs at point RAPVO (point 2, Fig. 1) the aircraft flew into the EYKA control tower zone (hereinafter – CTR).

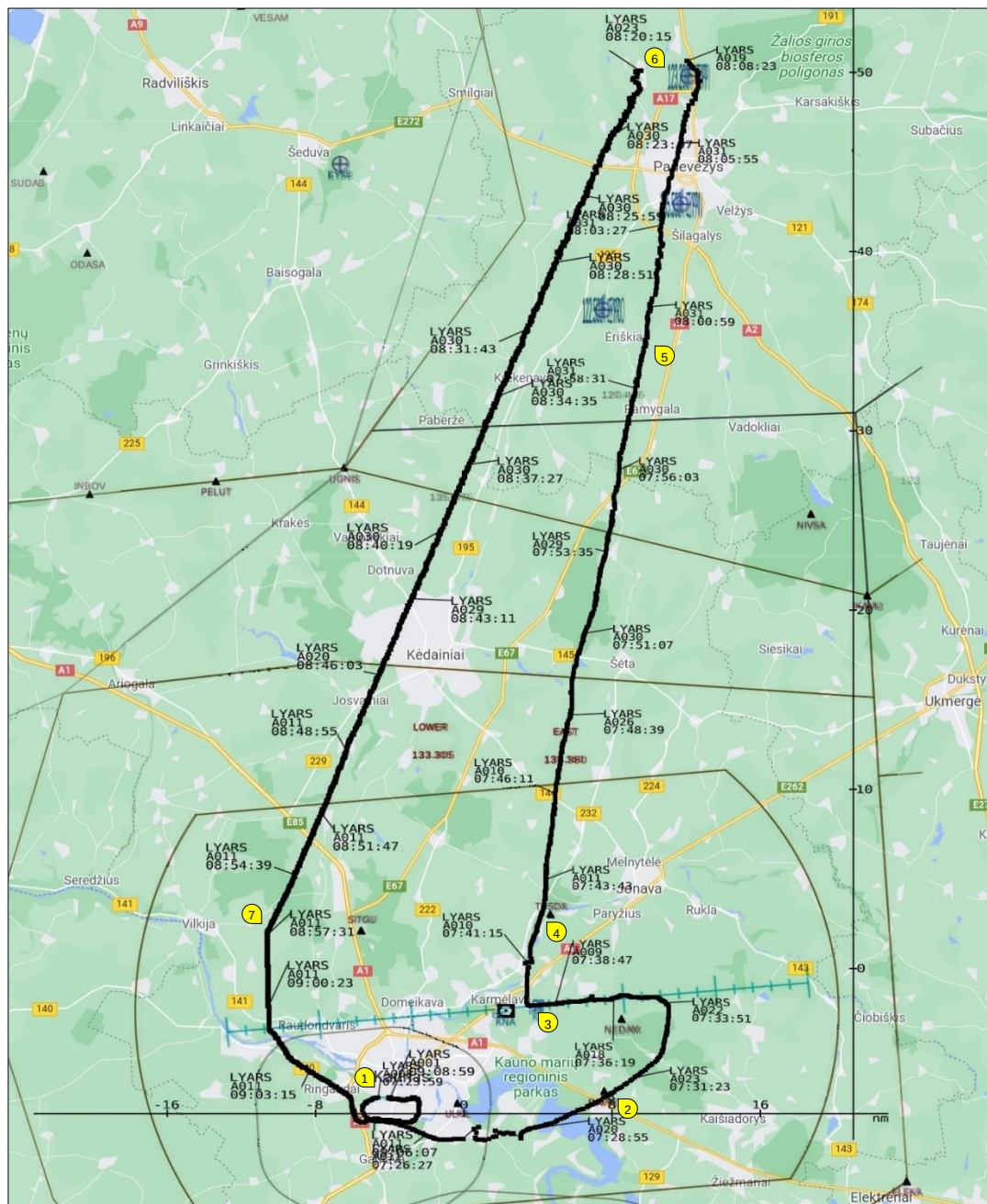


Fig. 1. The route of the first flight (data from SE 'Oro navigacija')²

At 9.40 hrs the aircraft flew at an altitude of about 100 m above the EYKA runway (point 3, Fig. 1). The EYKA air traffic controller could not specify whether the landing gear of the aircraft was extended during the low pass. Then the aircraft turned to north and left EYKA CTR at point TUSDA (point 4, Fig. 1). The aircraft climbed to 915-945 m (3000-3100 ft) above sea level and flew towards EYPI (point 6, Fig. 1).

At 9.59 hrs during the flight (point 5, Fig. 1) the instructor telephoned his friend pilot A and asked if he was at Molėtai aerodrome (hereinafter – EYMO). Pilot A replied that he would not be at the aerodrome. Then the instructor informed pilot A that the landing gear was not extending and asked him what to do. Pilot A advised to check the fuses. The conversation lasted 1 min. 20 sec. and the problems of landing gear were not solved during the conversation. The crew did not inform anyone else about the non-extending landing gear.

² In the figure, the flight time is in UTC time.

At 10.08 hrs the aircraft descended to an altitude of 580 m above sea level and passed over EYPI (point 6, Fig. 1). EYPI did not provide information on whether the flight crew was maintaining radio communication or whether anyone at the aerodrome saw the aircraft. Then the aircraft turned and climbed to an altitude of 915 m (3000 ft) above sea level and flew directly towards point VEBUS (point 7, Fig. 1), which the aircraft reached at 10.57 hrs.

At 11.01 hrs the crew contacted the EYKS Flight Coordination Centre and reported their intention to land on runway No. 27. The aircraft overtaking EYKA CTR landed at EYKS at 11.17 hrs (point 1, Fig. 1).

At 11.20 hrs the instructor spoke by cell phone with examiner A. After the conversation, at 11.24 hrs, the instructor declared a landing at EYKS.

The crew parked the aircraft at the hangar of Kaunas Aeroclub. Pilot B, a member of the Kaunas Aeroclub, stated that he saw the cheerful crew get into a car near hangar and left the aerodrome, in his opinion, for lunch. The safety investigation did not reveal where the crew went and when they returned to the aerodrome.

1.1.2. History of the second flight

At 11.50 hrs the instructor submitted a flight plan for the second flight. The flight plan indicated the route from EYKS through the compulsory reporting point ULKIL, EYKA, points TUSDA and IKAMU, Molėtai aerodrome (EYMO), point ELEKA, Pociūnai aerodrome (hereinafter – EYPR) back to EYKS (Fig. 2). The flight plan indicated that the departure time at 12 hrs, the flight duration of 1.30 hours and that the pilot in command is the examiner A.

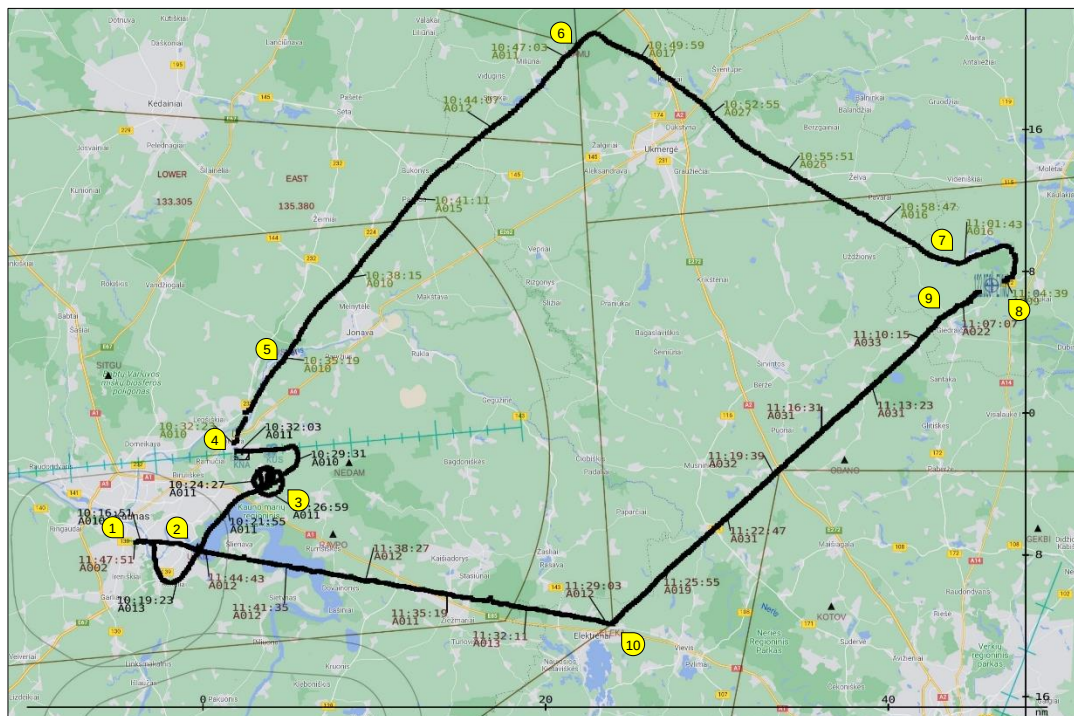


Fig. 2. The route of the first flight (data from SE 'Oro navigacija')³

At 11.52 hrs the instructor edited his electronic pilot logbook⁴ for the last time.

At 12:06 hrs the crew contacted the EYKS Flight Coordination Centre and informed that they were starting to taxi from the hangar of Kaunas Aeroclub and were going to fly to EYKA.

³ In the figure, the flight time is in UTC time.

⁴ The instructor did not have a paper pilot logbook and wrote all flight records in an *Excel* file.

At 12.07 hrs the aircraft entered taxiway B (bravo) (Fig. 3) and stopped near the runway. Shortly afterwards, the crew let through the helicopter and at 12.13 hrs contacted EYKS Flight Coordination Centre and informed about intention to take off.

At 12.14 hrs the aircraft taxied from taxiway B (bravo) to the runway and turned around after taxiing to the beginning of runway No. 09 (point 1, Fig. 2). At 12.16 hrs the aircraft started to take-off roll and took off at taxiway B (bravo). Shortly after take-off, the crew turned the aircraft to the right and, after a half circle, entered EYKA CTR at 12.20 hrs at point ULKIL (point 2, Fig. 2).

At 12.14 hrs the examiner A telephoned the instructor. This was the last conversation between the examiner A and the instructor.

At 12:22 hrs the crew contacted Kaunas Air Traffic Control Centre (hereinafter –ATC). Kaunas ATC instructed the crew to wait for the commercial planes landing at that time. The aircraft made several small circles at an altitude of 260 m (point 3, Fig. 2).

At 12.30 hrs the aircraft low passed over EYKA runway at an altitude of 130 m at a speed of 240 km/h (130 knots) (point 4, Fig. 2). The EYKA air traffic controller could not specify whether the landing gear of the aircraft was extended during the low pass. The aircraft then turned north and leaved EYKA CTR at 12.34 hrs at point TUSDA (point 5, Fig. 2) after climbing to an altitude of 340 m above sea level.

At 12:35 hrs the crew contacted the Flight Information Service of Kaunas sector and indicated the declared flight route.

At 12.47 hrs the aircraft reached the point IKAMU (point 6, Fig. 2). At 12.48 hrs the crew contacted the Vilnius ATC and indicated the declared flight route.

At 13.01 hrs the crew contacted Vilnius ATC (point 7, Fig. 2) and indicated that they were approaching EYMO. At 13.08 hrs, after the aircraft passed EYMO (point 8, Fig. 2), the crew contacted Vilnius ATC again and indicated their declared route of flight.

At 13.28 hrs the crew informed Vilnius ATC that they were approaching the point ELEKA (point 9, Fig. 2). Immediately afterwards, the crew contacted the Flight Information Service of Kaunas Sector.

At 13:44 hrs the crew informed the Flight Information Service of Kaunas Sector that they were approaching EYKS. Immediately thereafter, at 13.45 hrs, the crew contacted EYKS Flight Coordination Centre and reported that they were flying from ELEKA and approaching to land on runway No. 27. EYKS Flight Coordination Centre confirmed that it understood and indicated that there was no traffic in the aerodrome flight area. This was the last transmission from the crew, made just over a few minutes before the accident.

1.1.3. The accident of aircraft

The aircraft started to descend from an altitude of 370 m above sea level. The airspeed decreased from 170 km/h (90 knots) to 130 km/h (70 knots).

At 13.47.40 hrs the aircraft landed on runway No. 27 (point 1, Fig. 3). The landing was performed well, without yaw, and the direction of landing roll was maintained straight. At the aerodrome flight observation point, the airspeed of the aircraft decreased, and it appeared that the aircraft will almost stop after landing. At that time, the maximum thrust of the aircraft's engines was set for take-off.

Pilot C, a member of Kaunas Aeroclub, who knew the instructor well, was near the beginning of runway No. 27 (point 1, Fig. 3) and stated that the landing of the aircraft was well performed. The aircraft touched the runway close, did not roll for a long time and took off early. Pilot C observed the take-off of the aircraft until the aircraft was above the end of the runway and did not see anything unusual. The video shows how at 13.48.22 hrs the aircraft took off from the runway behind taxiway B (bravo) (point 2, Fig. 3). The radar of the air traffic monitoring system of the Kaunas

ATC no longer detected the aircraft.



Fig. 3. S. Darius and S. Girėnas aerodrome and accident site (point 6) (Google Earth)

The crew did not inform the EYKS flight coordinator that they intended to take off. The flight coordinator also did not contact the crew. The EYKS flight coordinator observed the take-off of the aircraft for only a few seconds before it was obstructed by the corner of the flight observation point and did not see anything unusual.

Another member of Kaunas Aeroclub pilot D, who was at the Kaunas Aeroclub building at taxiway B (bravo) (Fig. 3), started to observe the aircraft's take-off from the moment when the aircraft took off from the runway. Pilot D immediately noticed the unusual and strange sound of the aircraft's engines, but he could not identify it. It seemed to him that something was wrong. Either the aircraft was slow to climb, or the aircraft was struggling to climb. Then the aircraft veered off to the right and became invisible. The video shows how at 13.48.29 hrs the aircraft passed the runway threshold and banked to the right (point 3, Fig. 3). The tilt was corrected after 1-2 sec.

At 13.48.33 hrs the aircraft passed the runway threshold and the ditch of river Marvelė, reached an altitude of about 200 m and stopped climbing, and the flight path of the aircraft deviated to the right (point 4, Fig. 3). The aircraft becomes no longer visible in the video record.

The aircraft veered to the right and flew towards the village of Noreikiškės. The eyewitnesses in the village of Noreikiškės said that they first heard the strange sound of the aircraft's engine. One eyewitness stated that the sound was irregular, the tone slow and much lower than the sound of a smooth and well-functioning engine, another eyewitness stated that there was a loud noise with jerks.

The eyewitnesses then saw the aircraft at a low altitude of about 20 m (point 5, Fig. 3). The eyewitnesses felt something had happened to the aircraft because the flight path was very low. The aircraft flew steadily but very heavily, as if trying still to climb. The nose of the aircraft was raised, and the tail was lowered.

Then the rotation of the left propeller decreased and the blades could be seen. As the left propeller rotation decreased, the left wing dropped, and the aircraft rapidly rolled to left and at the same time the aircraft yawed to left. The aircraft lost altitude and started to descend. Soon afterwards the left propeller started rotating again. The aircraft levelled off but could not climb. The nose of the aircraft was raised but the aircraft was descending. The aircraft was over the roofs of two-storey houses.

Then the rotation of the right propeller was decreased, and the blades could be seen. The right wing dropped, and the left wing was raised. The roll was sudden. The aircraft was thrown severely to the right side and the aircraft seemed to fly sideways to the right side. Then the aircraft started to yaw to the right. One eyewitness said that when the wing dropped it looked like a spin.

The aircraft then struck the ground in a nose-down attitude (point 6, Fig. 3). Some eyewitnesses said the sound of the engines was heard all the time and silenced only after the aircraft struck the ground, while other eyewitnesses said the engines of the aircraft shut down before the aircraft struck the ground.

1.2. Injuries to the persons

2 crew members on the aircraft were fatally injured.

1.3. Damage to aircrafts

The aircraft was damaged beyond economical repair.

1.4. Other damage

Damage to the house and lawn (soil).

1.5. Personnel information

1.5.1. The pilot instructor

The pilot instructor was a 65-year-old citizen of the Republic of Lithuania who held a Commercial Pilot Licence CPL(A) issued by the Civil Aviation Administration of the Republic of Lithuania⁵ (hereinafter – CAA) on 2007-02-02. The licence contained valid single-engine piston class rating SEP(land), multi-engine piston class rating MEP(land), aircraft PA-46 SET rating, instrument rating IR(A) and flight instructor rating FI(A) for single-engine and multi-engine SEP/MEP(land)/PA-46 SET.

The instructor held a Class 1 medical certificate for other commercial operations issued by aviation medicine expert of JSC 'Biržai city family doctors centre' on 2019-04-26 and valid until 2020-04-28. The medical certificate contained the limitation 'VML - Correction for defective distant, intermediate and near vision'.

The instructor had flight experience totalling 9191 hours 14 min. Over the last 90 days the instructor has flown 330 hours and in the last 7 days 12 hours 14 min.

1.5.2. The pilot student

The pilot student was a 30-year-old citizen of the Republic of Bulgaria and the Russian Federation, who held a Private Pilot Licence PPL(A) issued by the CAA on 2016-08-11. The licence contained valid single-engine piston class rating SEP(land), night rating N and single-engine piston class instrument rating SEP(land)/IR(A). The licence indicated that the ATPL(A) theory exam was passed.

The student held a Class 1 medical certificate for single pilot commercial operations carrying passengers without limitations issued by Aviation medical centre of Vilnius city clinical hospital on 2019-02-18 and valid until 2020-02-22.

The student had flight experience totalling 190 hours 28 min. of flight experience. Over the last 90 days the student has flown 30 hours 48 min. and in the last 7 days the student has not flown.

⁵ From 2019-01-01 the functions of the Civil Aviation Administration are performed by the Transport Competence Agency.

1.6. Aircraft information

1.6.1. General

The Piper PA-30 was produced in several versions: the original, a B model, and a C model. The C model is six-place twin engine, low-wing monoplane of all-metal construction. The data of Piper PA-30 are shown in Table 1.

Table 1. The data of Piper PA-30

Manufacturer	Piper Aircraft, Inc., United States
Aircraft type	Piper PA-30 Twin Comanche
Serial No.	30-1824
Year of manufacture	1969
Registration	LY-ARS
Total flight hours	6471 hours 49 min.
Landings	2068
Engine type	Lycoming IO-320-B1A
Empty weight	1120 kg
Maximum take-off weight	1633 kg
Aircraft Certificate of Registration issue date	2002-05-16
Certificate of Airworthiness issue date	2019-09-06
Certificate of Airworthiness Review valid	2020-09-05

1.6.2. Fuel system

1.6.2.1. Structure of the fuel system and fuel supply

The aircraft fuel system consists of four rubber fuel cells, two mechanical fuel pumps, two electric auxiliary fuel pumps and two fuel selectors and filters. The aircraft fuel system is shown in Fig. 4.

The fuel system is contained in two independent units that allow each engine to have its own fuel supply. The systems are connected only by a crossfeed that will allow fuel to be drawn from one set of fuel cells to the engine of the opposite side, in the event of an emergency. For single engine landing, fuel must be pumped from the main cell on the same side as the operating engine.

The fuel cell has a fuel outlet located on the lower side of the cell, closer to the centreline of the aircraft. The dihedral wing angle ensures that fuel is drawn from the lowest point of the fuel cell.

Fuel is taken from each cell through a screen located in the cell outlet fitting and then on to a shut-off selector valve. From the selector valve, fuel passes through to a sediment bowl and filters, which are located in the lowest part of the fuel system under the floorboard between the pilot and copilot seats, where fuel is filtered, and any water or foreign particles are trapped. Then the fuel is drawn through an electrically operated auxiliary fuel pump and on to an engine driven pump where it is pumped to the injector unit – to the servo regulators and flow distributors.

The PA-30 Twin Comanche Owner's Handbook (Part No: 753 773, issued: November 1968, revised: November 1973) states, that since a fuel injected engine takes an appreciable length of time to start after fuel starvation, it is recommended that you avoid emptying a fuel cell to depletion. If the engine should stop because a fuel cell is depleted of fuel be prepared to wait a while for the engine to start after changing to a fuel cell with fuel in it. If it is necessary to use all the fuel in a fuel cell, carefully monitor the fuel flow meter and quickly change the fuel valve position at the first indication of a decrease in fuel flow. This will enable you to keep the engine operating while using all of the fuel in the fuel cell.

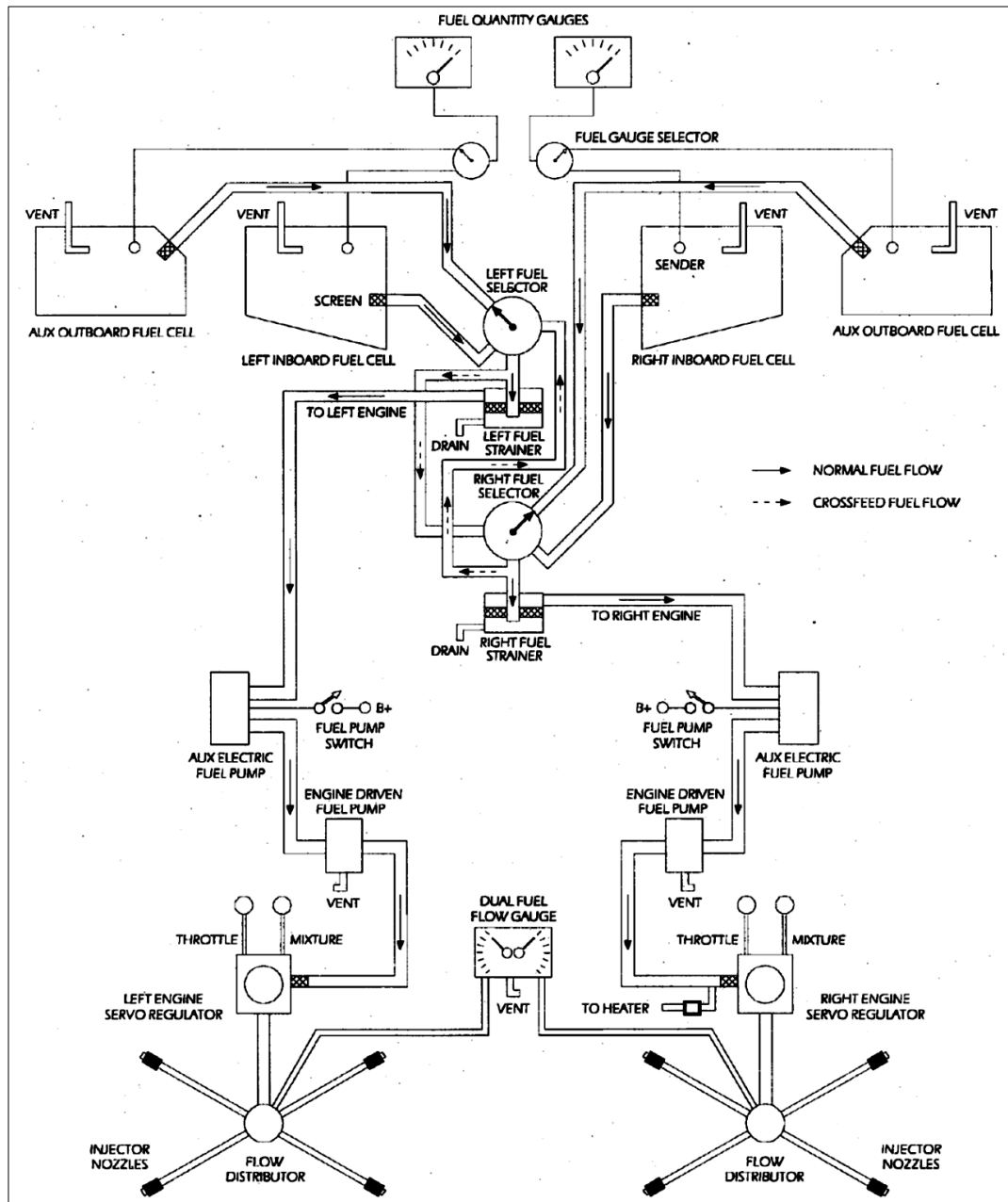


Fig. 4. Fuel system schematic (the POH)

1.6.2.2. Fuel cells capacity

The fuel cells are of the bladder type which are contained in cavities in the forward sections of the wings. Capacity of the two main fuel cells is 30 gallons or 113,56 l each, of which 27 gallons or 102,2 l is usable. The outboard auxiliary cells have capacity of 15 gallons or 56,78 l each.

The Pilot's operating handbook and Federal Aviation Administration (hereafter – FAA) approved airplane flight manual of Piper PA-30 Twin Comanche (second issue, date of revision: 1996-12-31) (hereinafter – POH) stated:

'It is important to note that due to several factors including aircraft attitude while refuelling, many fuel cells do not hold their full rated capacity.'

The POH stated the amount of the unusable fuel:

'Note. The unusable fuel in this aircraft has been determined to be 3 gallons in each inboard tank in critical flight attitudes.'

The POH defined the unusable fuel as the quantity of fuel that cannot be safely used in critical flight attitudes⁶. Also, any residual fuel that will not flow through the aircraft's fuel system. Unusable fuel is not available for the flight planning purpose. Fuel designated as unusable in the aircraft is available, but only in level flight.

1.6.2.3. Fuel quantity indicating system

Fuel quantity is indicated by two electrical gauges located in the engine instrument cluster (Fig. 5). The gauges are connected to a transmitter unit located in each fuel cell. The gauges will indicate the amount of fuel available in the cells that are selected.



Fig. 5. Fuel quantity gauges (electrical power not applied)

The electromechanical float type fuel senders are used in the aircraft. The primary measuring transducer is an empty metal or plastic float which is connected by an arm to the fuel quantity sender. When the float reaches the bottom stop (bottom of the fuel cell), the fuel sender indicates 0.00 to 0.50 Ω resistance. The corresponding signal is transmitted to the fuel gauge which indicates the empty position of the fuel cell. When the float reaches the top stop, the fuel sender indicates 29.6 to 31.3 Ω resistance. Accordingly, the fuel gauge shall indicate the full fuel cell.

The aircraft was not equipped with a fuel loss or fuel consumption warning system.

1.6.3. Landing gear

The aircraft tricycle landing gear system is a fully retractable unit that is electrically operated. The retraction mechanism consists of an electrical motor and transmission assembly, torque tube assembly, push-pull cables to each main gear and a push-pull tube to the nose gear. Limit switches are installed in the system to cut off the transmission motor when the gear is fully extended or retracted. A removable emergency handle is used to manually extend the landing gear in the event of a malfunction of the electrical system.

1.6.4. The propellers operation

The aircraft was fitted with constant speed propellers. Constant speed propellers and control systems (governors) continuously control the propeller blade pitch angle to maintain a constant propeller speed and engine rpm selected by the pilot. The propeller governors supply metered high pressure engine oil to the propeller to control the propeller blade pitch. This system of engine rpm and propeller blade pitch control reduces the pilot's workload by eliminating the need to separately control and monitor propeller blade pitch, engine power and engine speed. However, in the event of engine problems and power loss, in some cases it is difficult for pilots to detect the power loss in time because the speed is kept constant automatically, i.e., if an engine begins to gradually lose power due to a fuel supply or mechanical problem, the propeller control system will automatically maintain engine speed by reducing the blade pitch. In this way, pilot see a constant rpm and it is often difficult for them to know promptly that there is a fault or a loss of power before the engine comes to a complete stop.

⁶ E.g., abnormally high upward or downward pitch, rapidly roll to left or to right.

1.6.5. Maintenance information

1.6.5.1. General

In 2002 the instructor from the Republic of South Africa purchased the aircraft that had flown 5398 hours. From 2008-11-11 until 2016-08-26 the aircraft did not have the Airworthiness Review Certificate (hereinafter – ARC) and has not been flown.

In 2014 the instructor agreed with the ATO to use the aircraft for training. It was also agreed that the maintenance works of the aircraft would be performed by a maintenance organisation under the same ownership as the ATO. The instructor was to deliver the aircraft to the maintenance organisation once it had been repaired. On 2014-06-06 the engines and on 2014-11-26 the propellers and governors were overhauled by two other maintenance organisations in Lithuania and Poland. On 2015-10-14 the remaining maintenance work of the aircraft was performed by an engineer holding a Part-66⁷ aircraft maintenance licence.

On 2015-06-11 the maintenance organization was approved as the Continuing Airworthiness Management Organisation (hereinafter – CAMO) for the Piper PA-30 aircraft series. On 2015-12-08 the CAMO performed an inspection of the aircraft and recorded deficiencies that prevented the ARC from being obtained. On 2016-06-06 the CAMO reinspected the aircraft and made a recommendation to the CAA with a view to obtaining the ARC. On 2016-08-26 the CAA issued the ARC. The application submitted by the CAMO to the CAA on 2016-10-27 indicated that the aircraft is in the CAMO aircrafts list.

The aircraft was in the controlled environment of the CAMO, so the validity of the ARC was extended by the CAMO in 2017 and 2018. On 2019-09-06 the CAMO, after performing an inspection of the aircraft and documents, issued the ARC, which was valid until 2020-09-05.

From 2016-10-20 to 2019-10-23, when the aircraft was in the controlled environment by the CAMO, the aircraft was delivered to the CAMO for maintenance 20 times. Maintenance notes and work orders issued by the CAMO indicated that the aircraft was maintained in accordance with the manufacturer's recommendations and servicing routines. The majority of the recorded maintenance work consisted of routine servicing operations, minor defect rectifications and role equipment changes. In accordance with the PA-30 Twin Comanche Airplane Service Manual (Revised: 01/10/1998) (hereinafter – ASM) the last inspection and 50-hour maintenance was completed in time on 2019-10-23 at 6432.50 airframe hours, which was approximately 35 flying hours before the accident day. 100-hour maintenance performed on 2019-10-08 at 6383.31 airframe hours. No aircraft defects were found during the maintenance.

1.6.5.2. Other information about technical works

Pilot A stated that during the flight he advised the flight instructor to check the landing gear fuses as there had been a problem with the fuses in the aircraft two years ago, which Pilot A had solved in EYMO. Neither the aircraft logbook nor the CAMO documentation contained any record of problems with the landing gear fuses. The logbook indicates that on 2017-03-12 the aircraft flew to EYMO and on 2017-04-23 come back from EYMO.

The aircraft logbook indicated that on 2019-11-15 the instructor with student B flew from EYKS to EYMO and on 2019-11-17 returned from EYMO to EYKS. There is no data as to why the aircraft was at EYMO for two days. The flight on 2019-11-17 of the aircraft was the penultimate flight before the flights on the day of the accident.

⁷ The aircraft maintenance licence delivered in accordance with provisions of Annex III (Part-66) of Commission Regulation (EU) No 1321/2014 of 26 November 2014 on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks.

1.6.5.3. Fuel system maintenance

The scheduled inspection records of the 1000-hours maintenance performed on 2015-10-14 at 5786 airframe hours and signed by an engineer holding a Part-66 aircraft maintenance licence indicates:

‘9. Removed and replaced fuel cells with new: LH main fuel cell p/n 454-334, s/n CR1093; LH auxiliary fuel cell p/n 454-332, s/n CR847; RH main fuel cell, p/n 454-335, s/n CR1126; RH auxiliary fuel cell, p/n 454-333, s/n CR824.

10. Removed and replaced fuel, oil and brake hoses with new <...>’

The entries in the scheduled inspection records are incomplete and does not indicate whether the fuel floats and senders were replaced. It also does not indicate whether the fuel quantity indicating system was adjusted and checked after the fuel cells were replaced.

There is no requirement in the aircraft manufacturer’s published maintenance documentation for adjustment of the fuel quantity indicating system after the fuel cells have been replaced. Nevertheless, the ASM contains guidance on procedures for checking and adjusting the fuel quantity indicating system.

The ASM specifies that the 100-hour, 500-hour and 1000-hour inspections of the aircraft shall include an inspection of fuel lines, valves and gauges for damage and operation and inspection of fuel cells and lines for leaks. Inspections consist of a thorough examination of the aircraft, appliance, component or system; with disassembly as necessary to determine condition. Inspections must be performed only by licensed mechanics. Also, the ASM specifies that the 50-hour, 100-hour, 500-hour and 1000-hour inspections shall include a checking of indications of fuel quantity and pressure of flow gauges. A check consists of an examination to compare and verify condition, accuracy and/or tolerances with stated standards. Check can be performed by pilots and/or mechanics who are qualified on this aircraft.

The maintenance organization during the last 50-hours and 100-hours inspections of the aircraft did not reveal any fuel system failures or malfunctions, nor any fuel leaks. There were also no records of fuel system defects in the aircraft logbook.

1.6.5.4. Landing gear maintenance

The ASM specifies that during the 100-hour, 500-hour and 1 000-hour inspections, the aircraft shall be put on jacks: then the landing gear shall be checking for functional operation by retracting the landing gear; the inspecting emergency operation of gear, inspect landing gear motor, transmission, and attachments, and inspect position indicating switches and electrical leads for security.

The maintenance organization during the last 100-hours inspection of the aircraft did not reveal any failures or malfunctions of the landing gear system. There were also no records of landing gear defects in the aircraft logbook.

1.6.5.5. The propellers maintenance

The right propeller of the aircraft was a Hartzell Propeller HC-E2YL-2B/F7663-4 (serial No. BG3973), the date of manufacture was 1969-03-14 (hereinafter – ‘-2B’), and the left propeller was a Hartzell Propeller HC-E2YL-2BSF/F7663B-4 (serial No. BG4794B), the date of manufacture was 2000-03-16 (hereinafter – ‘-2BSF’). The ASM stated:

‘1-10. ENGINES AND PROPELLERS. <...> The propellers are Hartzell full feathering, constant speed units controlled by a governor mounted on each engine. Some propellers are equipped with a backup spring which allows operation of the propeller in case of loss of air from the air cylinder. These propellers are identified by the letter ‘S’ after the hub dash number, such as HC-E2YL-2BS. The ‘S’ propeller should not be intermixed with the other propellers.’

The aircraft logbook indicated that due to the deformation of the Hartzell Propeller HC-E2YL-2B (serial No. BG3978) propeller on 2003-06-23 due to a ground obstruction, the propeller was replaced on 2003-06-26 by a Hartzell Propeller HC-E2YL-2BSF/F7663B-4 (serial No. BG4794B) propeller. The propellers have not been replaced since then.

Both propeller models are listed on FAA Type Certificate Data Sheet No. P9EA. The 'B' suffix on the F7663B-4 blade of '-2BSF' indicates that it was manufactured with the de-ice boots. The propeller fitted in aircraft was without the de-ice boots.

Both propellers are non-counterweighted, feathering propellers. They rely on the feathering spring and a relatively high air charge pressure in the cylinder to feather the propeller when commanded. The '-2BSF' propeller also incorporates a larger and higher force feathering spring. Hartzell Owner's Manual No. 115N (61-00-15, Revision 23, February 2018) Section 6-3 specifies the air charge pressure values for each propeller. The air charge pressure of '-2B' propeller without the large spring is more than three times greater than '-2BSF' propeller with spring, e.g., at an air temperature of 21 °C, the '-2B' propeller should be charged with 178 PSI air pressure and the '-2BSF' propeller should be charged with 50 PSI air pressure.

Neither the maintenance organisation nor CAMO has identified that the propellers are different and cannot be intermixed. The maintenance organisation charged both propellers with the same air pressure of the '-2BSF' propeller.

1.6.6. Weight and balance

During the accident, the weight and balance of the aircraft were within the prescribed requirements specified in the POH.

1.7. Meteorological information

1.7.1. Information by the meteorological station

The Kaunas meteorological station of the Lithuanian Hydrometeorology Service under the Ministry of Environment recorded the meteorological conditions presented in Table 2. This station is 77 m above the sea level and about 1 km northwest of the accident site. At the meteorological station from 13.23 hrs to 13.43 hrs was light rain, from 13.26 to 13.50 hrs was foggy.

Table 2. Meteorological data

Local time	Air temperature, °C	Average wind speed, m/s	Maximum wind speed in 1 hour, m/s	Wind direction	Cloud cover, okta	Height of cloud, m	Visibility, km
10.00	2,8	3,8	6	Southwest	not measured		20
11.00	3,7	4,5	8	Southwest	7	300	20
12.00	4,6	5,1	8	Southwest	not measured		20
13.00	5,1	6,5	10	Southwest	not measured		20
14.00	4,9	5,5	9	Southwest	8	200	15

1.7.2. METAR reports

12.20-14.20 hrs METAR⁸ EYKA reports indicates:

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081020Z 21008KT 160V250 9999 OVC013 05/03 Q1002 R08/290095=
081050Z 21008KT 160V250 9999 BKN013 OVC048 05/03 Q1001 R08/290095=
081120Z 20007KT 150V250 9999 BKN012 OVC038 05/03 Q1001 R08/290095=
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⁸ Meteorological Aerodrome Report.

081150Z 19007KT 150V250 3900 -RA BR FEW008 BKN012 OVC016 05/04 Q1000 R08/290095=

081220Z 19007KT 150V260 9000 OVC007 05/04 Q1000 R08/290095=

EYKA visibility is 10 km all the time, only 13.50 hrs (11.50 UTC) is observed to decrease to 3900 m. Cloud cover at all times over 1300 feet, only 13.50 hrs (11.50 UTC) is observed to decrease from 800 to 1200 feet. Wind direction 210°–190°, fluctuating between 150°–250°, wind speed 8–7 knots, no gusts. Air temperature +5° C. Light rain 13.20–13.40 hrs (11.20–11.40 UTC).

The records of video surveillance cameras of EYKS and the Search and Rescue Post of Air Force Air Base are in line with METAR EYKA reports. Also in these video records from 13.20 hrs to 14:40 hrs (11.20–11.40 UTC) deterioration of weather conditions is observed, consistent with the 11.50 UTC METAR EYKA. Later, from 13.40 hrs (11.40 UTC) and at the time of the accident at 13.49 hrs (11.49 UTC), an improvement in weather conditions is observed, consistent with the 12.20 UTC METAR EYKA. The air masses were moving from southwest to northeast, so the weather deterioration was initially observed at EYKS and later at EYKA (EYKA is located northeast of EYKS). In addition, METAR reports are only issued at the 20th and 50th minute of each hour.

1.8. Aids to navigation

Not applicable.

1.9. Communications

During the flight, the crew was in constant radio contact with the EYKS Flight Coordination Centre, as well as with the Kaunas and Vilnius Control Centres. 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

Not applicable.

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.

People who knew the instructor stated that the instructor was using a flight planning and navigation application on his tablet and apparently also used it in the accident flight. Due to the model of the tablet, it was not possible to recover the data.

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 record

The records of video surveillance cameras were obtained from the EYKS and the Search and Rescue Post of Air Force Air Base. The video recordings were analysed to determine the aircraft's take-off and landing times, last landing and take-off characteristics, meteorological information, etc.

1.12. Wreckage and impact information

1.12.1. The accident site

The aircraft came down in the yard of a private house (Fig. 6) at 1.9 km from the aerodrome control point and about 550 m to the right of the longitudinal line of runway No. 27 (Fig. 3). The structural elements of the aircraft were not detached from the aircraft and the wreckage was lying in one place.



Fig. 6. The aircraft at the accident site

1.12.2. Wreckage and impact

The impact locations on the ground indicate that the aircraft impacted the ground in a nose-down pitch attitude and a left wing low roll attitude. After the initial impact, the aircraft bounced about 2,5 m to the right side towards the residential house into which it impacted and came to rest. To the left side of the aircraft, on the ground, the mark of impact was made by the left wing tip (arrow 1, Fig. 6), which remained broken, and the engine (arrow 2, Fig. 6). The left engine cowlings were damaged. A wing leading edge mark remained on the ground from the wing tip to the engine impact points. The fuselage was deformed by longitudinal compression. The fuselage nose was broken, and the windows were shattered. The rear fuselage behind the baggage compartment was broken and leaning to the left and was hanging on a tree. The right engine oil leaked from the engine crankcase and was absorbed into the ground. The left engine oil was in the engine crankcase.

1.12.3. Instrument panel

The instrument panel was badly damaged: all instruments have moved out of position. All propeller controls levers, mixture controls levers, and throttle controls levers were in the forward position with the fatally injured student leaning on them. The wing flap position indicator showed the flaps in the up position.

The instrument panel was equipped with Garmin G5 Electronical Flight Instruments instead of the analogue gyro horizon and directional gyro. CAMO was not informed of the installation of the Garmin G5 and had no record of it.

1.12.4. The propellers

Due to the pitch change knob being broken, one blade of left propeller '-2BSF' appears in the feathered position. The pitch change knob of the other blade is also broken. Both blades show bending and twisting damage. One blade has remarkable compound bending and twisting with bending aft and opposite rotation. That blade also has a leading edge abrasion, chordwise/rotational scoring and a gouge 5 cm from tip. A blade impact mark remained on the propeller hub (Fig. 7). The left spinner shows that it is crushed opposite rotation. The damage occurred during an impact with the ground.



Fig. 7. Left propeller '-2BSF' blade impact mark on hub (yellow arrow)

The right propeller '-2B' had only one damaged blade. The spinner is crushed on one side only – at the attachment part of the damaged blade. That damaged blade has some chordwise/rotational scoring and leading edge nicks. The relatively undamaged other blade does not appear to have any leading edge damage or chordwise/rotational scoring on the camber (front) side.

1.12.5. Fuel system examination

1.12.5.1. Fuel quantity in the fuel system

About 3 hours 30 min. after the accident, at the accident site the fuel cells were visually inspected through the fuel filler openings, which turned out to be empty. No damage to the fuel system and no fuel leaks were observed. There was also no smell of fuel at the accident site. This was confirmed by the first firefighters and police officers who arrived at the scene of the accident.

Both fuel cell selector switches were set to main fuel cells. The fuel cell selector switches were operative. The left engine electric fuel pump switch was found in the position 'ON', the right engine electric fuel pump switch was in the position 'OFF'.

The amount of fuel in the fuel system in the engine compartment was checked at the accident site. No fuel was found in the entire fuel system of the right engine compartment – from the exit point of the firewall to the fuel distributor valve. No fuel was found in the left engine compartment fuel system from the exit point of the firewall to the fuel pump and a small amount of fuel was found just from the fuel pump to the fuel distributor valve. Fig. 8 shows in red colour a fuel system where no fuel was found and in blue colour a fuel system where a small amount of fuel was found. No damage to the fuel lines was found.

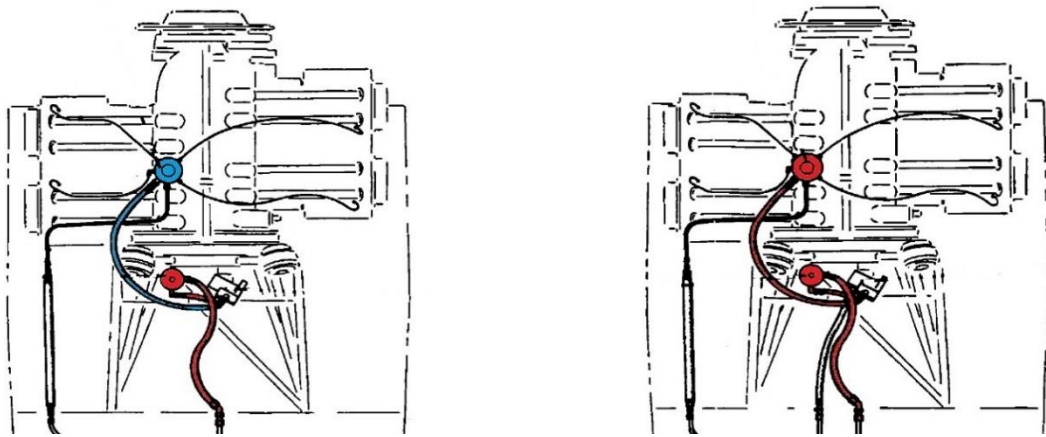


Fig. 8. The fuel system in engine compartments (ASM)

About 40 minutes after the aircraft was transported to its storage location, a trail of spilled fuel was observed on the hangar floor under the centre part of the aircraft. All fuel was recovered after the spillage was observed. Approximately 2 l of fuel were recovered from the right main cell and approximately 2,3 l of fuel was recovered from the right auxiliary cell. From the left side main and auxiliary cells together was collected 16,4 l.

Fuel was also found in the fuel selectors and filters at the lowest point in the fuel system. The quantity of fuel was not measured and was approximately the amount of fuel needed to fill the fuel selectors and filters.

No damage to the fuel system and no leaks were found. The aircraft has been operated with AVGAS 100LL fuel, which leaves a bright blue trace in the event of a leak. Visual inspection of the aircraft did not reveal any fuel leaks around the cells or other fuel system elements – there were no blue fuel traces on the wings and fuselage skin. Blue fuel traces were only observed at the fuel line at the left auxiliary fuel cell connection (Fig. 9). The itself copper fuel line and its connection did not meet the requirements of the aircraft manufacturer according to the ASM.



Fig. 9. Connection of the auxiliary fuel cell of the left wing

1.12.5.2. Fuel floats check

The fuel cell floats were without the corrosion and physical damage. The left auxiliary fuel cell float was plastic, and the other three floats were brass.

The operation of the fuel floats fitted in the aircraft could not be examined due to a damage of the aircraft – cannot be met the requirements of the ASM to level the aircraft longitudinally and laterally, ensure the fuel system is leak-proof by assessing the amount of unusable fuel and connect power supply to the aircraft electrical system. Regarding that, the checking sender unit was fabricated and checked the fuel floats under the ASM. The float check is carried out simply by tilting the float arm. When the float arm reaches the bottom stop, the float should just touch the base of the jig. The results of the fuel float check are shown in Table 3.

Table 3. Results of the fuel float check

Part No. of float	Place of installation	Results of the check
IPC p/n: 13002-00	Right main fuel cell	When the float touches the base of the jig, the arm does not reach the bottom stop – the float is not adjusted correctly.
IPC p/n: 13002-00	Left main fuel cell	When the float touches the base of the jig, the arm does not reach the bottom stop – the float is not adjusted correctly. The float arm was bend in the direction of the wing tip instead of the adjustment direction.
IPC p/n: 20966-02	Right auxiliary fuel cell	When the float touches the base of the jig, the arm does not reach the bottom stop – the float is not adjusted correctly.
IPC p/n: 20966-02	Left auxiliary fuel cell	When the float touches the base of the jig, the arm does not reach the bottom stop – the float is not adjusted correctly. The float arm was bend in the direction of the wing tip instead of the adjustment direction.

1.12.5.3. Fuel senders check

To determine the operation of the fuel senders, the resistance of the fuel senders over the entire operating range was measured under the ASM. According to the ASM, when the float arm reaches the bottom stop, the ohmmeter shall indicate a resistance of 0.00 to 0.50 Ω (empty fuel cell position), and when the float arm reaches the top stop, the ohmmeter shall indicate a resistance of 29.6 to 31.3 Ω (full fuel cell position). The results of the senders check are shown in Table 4.

Table 4. Results of the fuel senders check

Part No. of sender	Place of installation	Results of the check
IPC p/n: 13002-00	Right main fuel cell	50 Ω resistance is indicated throughout the range – the sender does not work properly.
IPC p/n: 13002-00	Left main fuel cell	Resistance varies unpredictably, usually around 40 Ω resistance – the sender does not work properly.
IPC p/n: 20966-02	Right auxiliary fuel cell	Resistance varies unpredictably, often exceeding the maximum ohmmeter value - the sender does not work properly.
IPC p/n: 20966-02	Left auxiliary fuel cell	Resistance varies smoothly over the whole range from 0 to 31 Ω resistance - the sender work properly.

1.12.5.4. Fuel quantity gauges check

A fuel quantity gauge unit consisting of two gauges (part number 5644386) has been removed from the instrument panel. No damage was found due to operation or accident. The fuel quantity gauges have been checked under the ASM. The left auxiliary tank fuel sender was used for the check as was assessed as fit for use during the check. The fuel quantity gauges were checked, and no deficiencies were found and both gauges are working properly, with the float arm movement from the top stop to the bottom stop the indications changing according to the float positions.

1.12.5.5. Other fuel system components

Fuel distributors and their membranes without damage. Left and right engine driven fuel pumps operating and without damage. Fuel selector valves and fuel filters operating and without damage. No damage was also found on the sediment bowl located in the central part of the fuselage.

The examination included a checking of the switches fitted to the fuel selector valves. The switches switch the electrical signals of the senders according to the position of the sector valve, directing the signal to the fuel quantity gauge. The switches were checked and found without damage and the switches on all four fuel cells are operating properly.

The fuse button for the fuel quantity gauge unit was broken and was in the position 'OFF'. This is likely to be the result of the accident as all fuses were in the position 'OFF' due to the damaged instrument panel. Removed fuse checked, found to be operating.

The wiring of fuel quantity gauge unit was soldered to the switches, with some severe fraying at the solder points. The system operates on the principle of resistance measurement, therefore, as the thickness of the wire decreases, the resistance it generates increases, i.e., the thinner the wire thickness indicates the greater the amount of fuel in the fuel cell than is present.

1.12.5.6. Extraneous equipment

A fuel system examination also revealed extraneous equipment not specified in the ASM and not approved by the Type Certificate. The equipment consists of a hose, two water valves and two tee valves connected to the rear fuel lines (Fig. 10). It is likely that this equipment was used for the installation of self-made auxiliary fuel cells (for the previous flight from South Africa to Lithuania or for the flight across the Atlantic Ocean).



Fig. 10. Extraneous fuel system equipment

1.12.6. Landing gear system

The nose landing gear and main landing gear were broken off. The landing gear switch in instrument panel was broken by the impact of the aircraft to the ground. The emergency gear extension handle was found in extension socket of landing gear retraction transmission (Fig. 11).



Fig. 11. The emergency gear extension handle

1.12.6.1. Retraction transmission motor

The housing of retraction transmission assembly was broken in the accident. The retraction transmission motor was found disconnected from the assembly. No other damage, such as corrosion, old cracks, or mechanical damage, was found.

The disassembled retraction transmission motor (No. 1711920M027MM) was connected to a 12 V power supply – the motor was not operating. The motor has been checked with an ohmmeter. It was found that the stator indicates 5 Ω resistance and the rotor indicates 0 Ω resistance. This suggests a burnt rotor. No damage to the retraction transmission motor was due to the accident.

1.12.6.2. Other landing gear system components

It was not possible to check the operation of the landing gear system components in the system due to damage caused by the impact. The components of the landing gear system have been dismantled and examined. The examination revealed that all components was operational.

The landing gears control fuses were found in the position 'OFF' and with broken switches. After disassembly, all fuses were checked and found to be operating.

1.12.7. Electrical wiring

The aircraft's electrical wiring contained many splices and joints. Some splices connected with terminals, other were soldered, some were covered with black tape as well as heat shrink tubing, and there were splices that did not comply with the requirements set out in the ASM, etc. (Fig. 12).

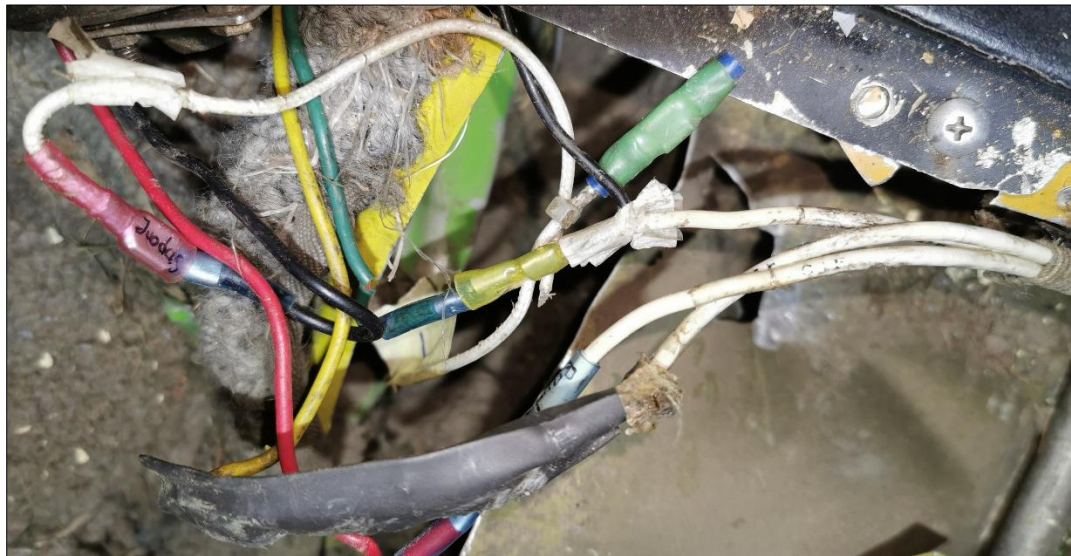


Fig. 12. The splices of the retraction transmission motor

1.13. Medical and pathological information

1.13.1. Medical and pathological information

The post-mortem examination of the instructor and the student 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.

1.13.2. Flight, rest and duty time

1.13.2.1. Instructor work in approved training organisations

The ATO stated that the instructor had been providing instructor services using his own Piper PA-30 aircraft since 2001 and submitted to the safety investigation an aircraft lease agreement concluded with the instructor on 2016-09-28 and an agreement concluded with the instructor on 2016-10-24 by which the instructor undertook to perform the duties of an instructor and to provide flight training in aircraft under a certificate of individual activity.

The instructor has also provided services to another ATO B which acted in several European countries and has had private flights.

1.13.2.2. Flight, duty and rest time regulations

Commission Regulation (EU) No 290/2012⁹ laying down technical requirements and administrative procedures related to civil aviation aircrew Annex VII ORA. ATO subpart which establishes the requirements to be met by organisations providing training for pilot licences and associated ratings and certificates stated:

‘ORA.ATO.130 Training manual and operations manual

<...>

(d) The operations manual shall establish flight time limitation schemes for flight instructors, including the maximum flying hours, maximum flying duty hours and minimum rest time between instructional duties in accordance with Part-ORO.’

⁹ Commission Regulation (EU) No 290/2012 of 30 March 2012 amending Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council.

In accordance with Article 76(3) of Regulation (EU) 2018/1139¹⁰ of the European Parliament and of the Council on common rules in the field of civil aviation, the European Union Aviation Safety Agency (hereinafter – EASA) shall issue acceptable means of compliance and guidance material for the application of this Regulation and of the delegated and implementing acts adopted on the basis thereof. Easy Access Rules for Organisation Requirements for Aircrew (Part-ORA), published by EASA, stated:

‘AMC1 ORA.ATO.230(b) Training manual and operations manual

<...>

The operations manual for use at an ATO conducting integrated or modular flight training courses should include the following:

<...>

(14) flight duty period and flight time limitations (flying instructors);

(15) flight duty period and flight time limitations (students);

(16) rest periods (flight instructors);

(17) rest periods (students);’

However, no guidance has been developed for approved training organisations and flight instructors regarding flight time and duty time limitations and rest requirements for flight instructors.

During the safety investigation of the Swedish Accident Investigation Authority¹¹, EASA has stated that flight training operations are not considered commercial air transport, i.e., transport of passengers, goods or mail for remuneration, but that one of the goals of a training organisations should be to achieve the same level of flight safety as applies to operators who operate in accordance with the provisions for commercial air transport (operators).

Commission Regulation (EU) No 965/2012¹² laying down technical requirements and administrative procedures related to air operations Annex III ORO.FTL subpart set out the requirements to be met by an operator and its crew members with regard to flight and duty time limitations and rest requirements for crew members. EASA has confirmed that this ORO.FTL subpart is not applicable to approved training organisations and flight instructors, but normally the competent authority, which in Lithuania is the Transport Competence Agency (hereinafter – TKA), establishes which requirements must be followed. However, there are no obligations for the TKA to impose such requirements, nor is there any restriction on imposing them.

In the absence of any international and national requirements, each training organization may set different and independent requirements of flight, duty and rest time for flight instructors. The training organizations in which the instructor worked had specified different requirements for the duty and rest time of flight instructors in their operations manuals. By approving the operations manuals, the TKA also endorsed the flight and rest time requirements set by both ATO themselves.

¹⁰ 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.

¹¹ Final Report RL 2017:04e. Accident at Ängsö, Västmanland County, on 22 January 2016 involving the aeroplane SE-LVR of the model Diamond DA42, operated by Airways Flygutbildning Svenska AB. Reference no. L-06/16. 21 March 2017.

¹² Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council.

1.13.2.3. Flight, duty and rest time control

According to the agreement between the ATO and the instructor on 2016-10-24, the instructor undertook to comply with the established duty and rest time requirements. The instructor partly kept his own records of flight, duty and rest time, but there is no evidence that he provided the information to both ATO in which he worked.

During the safety investigation was not received evidence that the ATO monitored and recorded the instructor's flight, duty and rest time and provided information to the other ATO B in which the instructor worked. There was also no evidence that the training organisation requested and received the relevant information from the instructor and ATO B.

The operations manual of the ATO B stated:

'11.2 Flight time and flight time limitations (instructors)

Flight instructors working part-time in training organisation and taking the flights in other organizations must keep the below mentioned work and time limitations evaluating the flight times in all organizations.

Flight instructor has to plan his work and rest periods properly and promptly inform the Head of Training or Chief pilot instructors and adjust changes of flight schedules to ensure that all of the above conditions are met. Each pilot instructor is personally responsible for complying with the rules of work and rest time.'

ORO.FTL stated:

'ORO.FTL.115 Crew member responsibilities

Crew members shall:

(a) comply with point CAT.GEN.MPA.100(b) of Annex IV (Part-CAT); and
<...>

(4) comply with all flight and duty time limitations (FTL) and rest requirements applicable to their activities;

(5) when undertaking duties for more than one operator:

(i) maintain his/her individual records regarding flight and duty times and rest periods as referred to in applicable FTL requirements; and

(ii) provide each operator with the data needed to schedule activities in accordance with the applicable FTL requirements.

<...>

ORO.FTL.245 Records of home base, flight times, duty and rest periods

<...>

(b) Upon request, the operator shall provide copies of individual records of flight times, duty periods and rest periods to:

(1) the crew member concerned; and

(2) to another operator, in relation to a crew member who is or becomes a crew member of the operator concerned.'

1.13.2.4. Assessment of instructor's flight, duty and rest time

The safety investigation assessed the flight, duty and rest time of the instructor while working in two training organisations and having other private flights. The instructor's electronic pilot logbook records and the duty and flight times summaries provided by the training organisations were used to evaluate the instructor's work and rest time. The instructor's actual flight, duty and rest time and the requirements of the training organisations were compared with the flight and duty time limitations and rest requirements for crew members in accordance with ORO.FTL subpart.

ORO.FTL specifies requirements for the duty time:

'ORO.FTL.110 Operator responsibilities

An operator shall:

<...>

(c) specify reporting times that allow sufficient time for ground duties;

<...>

ORO.FTL.210 Flight times and duty periods

<...>

(c) Post-flight duty shall count as duty period. The operator shall specify in its operations manual the minimum time period for post-flight duties.

<...>

ORO.FTL.215 Positioning

The conditions for extending the basic maximum daily flight duty period due to a break on the ground shall be in accordance with the following:

<...>

(b) the break on the ground shall count in full as flight duty period;'

The Operations Manual of the ATO (fifth edition, Revision No 46, date of revision 2019-10-10) (hereinafter – OM) approved by the CAA did not specify how long before the scheduled start of the flight the flight instructor's duty time starts (respectively the time for pre-flight operations in accordance with ORO.FTL.110 subpart) and when it ends after the last flight (respectively the time for post-flight operations in accordance with ORO.FTL.210). The flight schedules of the ATO only included the date and time of the planned flights and the national and registration marks of the aircraft. The flight schedules did not indicate the start time of the duty (pre-flight operations) or the end time of the duty (post-flight operations).

The Paragraph 11 Flight duty period and flight time limitations of the Operations Manual of the ATO B (Issue No 4, Revision No 30, revision date 2019-11-28) (hereinafter – OM of the ATO B) specifies that pre-flight preparation for the flight is 1 hour (respectively the time for pre-flight operations in accordance with ORO.FTL.110 subpart) and the post-flight time is 30 min. (respectively the time for post-flight operations in accordance with ORO.FTL.210) are as part of duty time.

Based on the above, during the safety investigation it was accepted that the instructor's duty time started 1 hour before the start of the first flight of the day, which is necessary for pre-flight operations, and ended 30 min. after the end of the last flight of the day, which is necessary for post-flight operations.

1.13.2.5. Instructor's duty time

The instructor's duty time in the last 28 consecutive days from 2019-11-10 to 2019-12-07 was 194 hours 29 min., when:

- OM of the ATO set out 190 duty hours;
- OM of the ATO B set out 190 duty hours;
- ORO.FTL.210 set out 190 duty hours.

From 2019-09-01 to 2019-12-07 there were 86 cases when the instructor's duty time was exceeded 190 duty hours in any 28 consecutive days.

The instructor's duty time in the last 14 consecutive days from 2019-11-24 to 2019-12-07 was 116 hours 44 min., when:

- Not set out in the OM of the ATO;
- OM of the ATO B set out 110 duty hours;
- ORO.FTL.210 set out 110 duty hours.

From 2019-09-01 to 2019-12-07 there were 50 cases when the instructor's duty time

was exceeded 110 duty hours in any 14 consecutive days.

The instructor's duty time in the last 7 consecutive days from 2019-12-01 to 2019-12-07 was 72 hours 3 min., when:

- OM of the ATO set out 60 duty hours per week;
- OM of the ATO B set out 60 duty hours;
- ORO.FTL.210 set out 60 duty hours.

From 2019-09-01 to 2019-12-07 there were 43 cases when the instructor's duty time was exceeded 60 duty hours in any 7 consecutive days.

From 2019-09-01 to 2019-12-07 there was 26 cases when the instructor's duty time were exceeded 12 hours in 24 hours period, when:

- OM of the ATO set out 12 hours;
- OM of the ATO B set out 12 hours;
- Not set out in ORO.FTL.210.

1.13.2.6. Instructor's flight time

The instructor's total flight time with aircrafts was 1054 hours 42 min. in calendar year of 2018 and 1132 hours 3 min. in calendar year of 2019, when:

- OM of the ATO set out 900 hours of which not more than 700 hours of instructor flight time;
- OM of the ATO B set out 900 hours;
- ORO.FTL.210 set out 900 hours.

The instructor's total flight time in 12 consecutive calendar months from 2018-12-08 to 2019-12-07 was 1156 hours 38 min., when:

- Not set out in the OM of the ATO;
- Not set out in the OM of the ATO B;
- ORO.FTL.210 set out 1000 hours.

From 2019-09-01 to 2019-12-07 there were 56 cases when the instructor's flight time was exceeded 100 hours of flight time in any 28 consecutive days, when:

- OM of the ATO set out 100 hours per month;
- OM of the ATO B set out 100 hours;
- ORO.FTL.210 set out 100 hours.

From 2019-09-01 to 2019-12-07 there were 8 cases when the instructor's flight time was exceeded 8 hours of flight time in 24 hours period, when:

- OM of the ATO set out 8 hours;
- OM of the ATO B set out 8 hours;
- Not set out in ORO.FTL.210.

1.13.2.7. Instructor's rest time

From 2019-09-01 to 2019-12-07 there were 25 cases when the instructor's minimum rest time was less than 12 hours, when:

- OM of the ATO set out that the rest period of instructors shall be at least 10 hours between duty days;
- OM of the ATO B set out that the minimum rest time is 12 hours;
- ORO.FTL.235 set out that the minimum rest period must be at least the preceding duty period but not less than 12 hours.

From 2019-09-14 to 2019-10-18 the instructor flew every day, i.e., 35 consecutive days without rest days, and from 2019-10-28 to 2019-11-08 the instructor flew every day, i.e., 12 consecutive days without rest days, when:

- OM of the ATO set out that the rest time per month should be at least four times of 24 hours;
- OM of the ATO B set out that the minimum of 36 hours rest time must be provided in any 7 consecutive days;

- ORO.FTL.235 set out that the minimum recurrent extended recovery rest period shall be 36 hours, including 2 local nights. The recurrent extended recovery rest period shall be increased to 2 local days twice every month.

1.13.2.8. Instructor's duty and rest time in one week before the accident

On 2019-12-01 the instructor had a rest day.

On 2019-12-02 the instructor had a rest day.

On 2019-12-03 the instructor began work in the training organisation B at 9.00 hrs and finished at 2.30 hrs on 2019-12-04. Full duty time was 17 hours 30 min.

On 2019-12-04 the instructor had 13 hours 45 min. of uninterrupted rest time. The instructor began work in the training organisation B at 16.15 hrs and finished at 2.15 hrs on 2019-12-05. Full duty time was 10 hours.

On 2019-12-05 the instructor had 7 hours of uninterrupted rest time, which includes about 1 hour 30 min. travel by car from workplace in Vilnius to home. The instructor began work in the training organisation B at 9.15 hrs and finished at 2.15 hrs on 2019-12-06. Full duty time was 17 hours.

On 2019-12-06 the instructor had 7 hours 12 min. of uninterrupted rest time, which includes about 1 hour 30 min. travel by car from workplace in Vilnius to home. The instructor began work in the training organisation B at 9.27 hrs and finished at 2.00 hrs on 2019-12-07. Full duty time was 16 hours 33 min.

On 2019-12-07 the instructor had 11 hours of uninterrupted rest time. The instructor began work in the training organisation B at 13.00 hrs and finished at 24.00 hrs. Full duty time was 11 hours.

On 2019-12-08 the instructor had 8 hours of uninterrupted rest time, which includes about 1 hour 30 min. travel by car from workplace in Vilnius to home. The instructor began work in the training organisation at 8.22 hrs.

1.14. Fire

Not applicable.

1.15. Survival aspects

The student was sitting in the left pilot seat and the instructor in the right. Both were fastened in with two-point lap seat belts. The shoulder seat belts were not used. The right side attachment of the instructor's lap strap detached from the structure during the impact. The instructor was thrown out from the cockpit during the impact.

The accident was not survivable due to forces of impact into the ground.

1.16. Test and research

The POH does not specify the fuel consumption when the aircraft is flying with the landing gear extended. During the safety investigation, the aircraft designer and manufacturer stated that flying cruise in an emergency with fully extended landing gear would be an abnormal flight condition and there is no performance data specific to this configuration.

During the safety investigation was performed a test flight to determine the fuel consumption of the aircraft when flying with the landing gear extended. The test flight was performed by the approved training organisation from the Republic of Poland, with a Piper PA-30, registration SP-MAL, which had the same engine and propeller types as the aircraft involved in the accident. The test flight was performed by repeating the last flight of the aircraft involved in the accident, i.e., a flight duration was 1 hour 30 min. and pre-flight operations was 10 minutes. The entire flight was

performed with the landing gear extended at the same speed of 110 KIAS and at the same altitude with two low passes.

The test flight report indicated an actual fuel consumption of 6,6 gph per engine or 50 l/h for both engines at 110 KIAS with the landing gear retracted and 8 gph per engine or 60 l/h for both engines with the landing gear extended. I.e., the aircraft flight with the landing gear extended increases fuel consumption by 20%. During the test flight, a total of 92 litres of fuel was consumed with the landing gear extended.

1.17. Organizational and management information

1.17.1. Training organisation

1.17.1.1. General

The ATO held the approved training organisation certificate issued by the CAA on 2014-07-04. On the day of the accident, the ATO was operating 8 aircraft, of which one was owned by the ATO and the remaining 7 were operated under lease agreements. Of the 8 aircraft, only one was a twin-engine aircraft. The list of flight instructors included 39 instructors, of whom 4 were permanent employees of the ATO and the remaining 35 instructors had service contracts.

1.17.1.2. Regulations governing operations

Flight operations conducted within the European Union are governed by the provisions of Regulation (EU) 2018/1139 of the European Parliament and of the Council on common rules in the field of civil aviation. Compliance with these provisions is supervised at European Union level by EASA, which also supervises the member states' national aviation organisations and supervisory authorities.

The training operations of the training organisation are regulated by Commission Regulation (EU) No 1178/2011¹³ laying down technical requirements and administrative procedures related to civil aviation aircrew, Annex VII, Part-ORA, Subpart ATO. This sets out the requirements to be met by the approved training organisation must fulfil in order to receive authorisation to conduct flight training. These requirements pertain to areas including finance, personnel, training manuals, operations manuals, premises, aircrafts equipped with dual controls, etc. The requirements also stipulate that the organisation shall have a management system, encompassing both a safety management system and compliance monitoring system. The management system shall be adapted to the size of the organisation and the nature and complexity of its operations, considering hazards and associated risks resulting from the operations. The national supervisory authority for aviation has to approve the planned operations and also supervise them while operational. The intention of the compliance monitoring system is to ensure that the operator has a systematic safety management plan that involves operations being continually supervised and discrepancies and risks being captured. The system shall supervise all operations and rectify any safety deficiencies that are identified.

1.17.1.3. Safety management

The safety management system of the ATO was described in the OM and the Organisation's Management Manual (sixth edition, Revision No 1, date of revision 2018-12-12) (hereinafter – OMM).

The OM described the organisation's management system, standard operating procedures and the procedures the organisation has implemented to ensure compliance with applicable national and international rules and regulations.

¹³ Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council Text with EEA relevance.

The OMM described safety management. The safety management organisation consisted of the accountable manager, safety manager, compliance monitoring manager and safety review board with safety action group. The OMM also described a risk management process. This consisted of risk identification, risk assessment and risk reduction. In the ATO, a standard risk matrix was used to define the risk based on severity and probability.

The ATO had a risk management log to record hazards and risks. The risk log described each identified risk, its assessment and identified mitigation measures. Risks were identified by the safety action group.

The risks recorded in 2019 in the risk management log were findings identified during the supervision performed by the TKA. There were no risks in the risk management log related to the activities of external instructors, the use of aircraft not owned by the ATO and the use of a non-base aerodrome. The ATO also had a list of deficiencies identified by the compliance monitoring system.

According to the agreement of 2016-10-24 between the ATO and the instructor, the instructor undertook to conclude third-party liability, aircraft and crew insurance contracts. The ATO has provided a certificate of insurance for the Piper PA-30 dated 2019-03-21 between the ATO and the insurance agency, as well as a document confirming payment by the ATO for insurance services.

1.17.1.4. Operational supervision

According to the provision of Commission Regulation (EU) No 1178/2011, Annex VI, Part-ARA, Subpart ATO, the national supervisory authority, which in Lithuania is the TKA, shall conduct regular supervisions of flight training operations. The supervisions are conducted in accordance with check-list laid down in Part-ARA. The main purpose of supervision is to monitor the organisation's compliance with both the regulations and the procedures and systems that the organisation has described in its manuals. The supervision shall include a review of the organisation's safety management system and compliance monitoring system. The operator shall demonstrate how the organisation assesses and addresses any aviation safety risks that may arise from its operations. The operator shall also provide a plan for a systematic safety management process that includes the continually monitoring of its operations and allows non-conformities and risks to be detected. The aim of this system is to minimise the risks associated with the operation as well as to address identified safety deficiencies.

From 2018-01-01 to 2019-12-31 the TKA performed standard 24-month supervision of the ATO. On 2018-11-23 the TKA conducted an audit, during which it identified one level 1 finding and 12 level 2 findings: for example, the last external training received by the safety manager is more than 3 years old; the staff member conducts internal safety management system training for the staff members without having received external safety management system training himself which would be not older than 3 years; students are not provided with training schedules; no procedure is specified for the establishment and use of schedules. Also, during the audit, the TKA made two recommendations, one of which was given due to the missing of the procedure, which supervises, controls and ensures the adequate rest and flight time of instructors and students, and there is no way to make sure that the instructors comply with the requirements of the procedure. The supervision did not include a more in-depth assessment of the safety management system of the ATO.

The ATO indicated that the deficiencies identified during the audit were corrected by 2019-04-30. On 2019-05-13 the TKA informed the ATO that the deficiencies identified during the audit are considered as corrected.

At the time of the supervision, the TKA had a total of 2.7 full-time equivalent staff for supervising of training organisations. Of these, two main staff accounted for 2 full-

time equivalent staff and three staff accounted for 0.7 full-time equivalent staff. The two main staff had no experience in supervising training organisations and had not received any training related to the safety management system. On 11-15 September 2019 one of the two main staff used services of the ATO and instructor to revalidate his MEP and ME/IR ratings.

In 2019, there were a total of 17 approved training organisations and 6 declared training organisations training pilots in Lithuania.

1.17.2. Flight organization

1.17.2.1. Student training and flights

On 2019-09-19 the student applied to the ATO for admission to the multi-engine piston class rating MEP and multi engine piston class instrument rating ME/IR and the modular training course for the Commercial Pilot Licence CPL.

On 23-24 October and on 2-3 November 2019 the student completed 8 hours flights with instructor and 2 hours 33 min. skill check flight with examiner A in accordance to the MEP and MEP/IR flight exercises of the syllabus in a 'Piper PA-30' aircraft. On 2019-11-03 the student passed the exams for the MEP(land) and ME/IR(A) ratings. The relevant ratings were not added to the licence.

On 2019-11-03 the student signed an agreement with the ATO, under which the ATO undertook to provide the student with 15 hours of training and a 1 hour 30 min. examine for the Commercial Pilot Licence CPL(A) from 2019-11-03 to 2019-12-31.

On 23-24 and 30 November 2019 the student completed 10 hours of flight time with another instructor B in single engine aircrafts in accordance with syllabus exercises CPL 4A, 5, 6 and 7. The student had 5 hours of practical training in a twin-engine aircraft remaining. Annex I, Part-FCL, Appendix 3 of Commission Regulation (EU) No 1178/2011 indicates, that a pilot holding a private pilot license PPL (A) and wishing to obtain a commercial pilot license CPL(A) shall be given at least 15 hours dual visual flight instruction of which at least 5 hours of the flight instruction shall be carried out in an aircraft certificated for the carriage of at least 4 persons and have a variable pitch propeller and retractable landing gear. The Piper PA-30 met the requirements of such an aircraft.

According to flight records, from 2019-11-03 all flights of student took place on weekends. The student's relatives confirmed that the student was only able to learn to fly at weekends and stated that the student intended to arrive in Lithuania on 2019-12-06 but was informed by the instructor that due to maintenance of the aircraft, flights were scheduled for 2019-12-08, so the student arrived in Lithuania late in the evening of 2019-12-07.

The instructor's electronic pilot logbook indicated the flights of the day of the accident with the student:

Date	Departure	Arrival	Total time	Crew	Nature of flight
2019-11 ¹⁴ -07	8.30 hrs	11.30 hrs	3 hours	Instructor and student	CPL training
2019-11-08	9.20 hrs	11.20 hrs	2 hours	Instructor and student	CPL training
2019-11-08	12.03 hrs	13.36 hrs	1.33 hours	Examiner A and student	CPL exam

Neither the aircraft logbook nor the student pilot logbook contained any flights under the CPL (A) syllabus on 2019-12-08. The operations manual stated:

¹⁴ The month of the day of the accident was incorrectly recorded in the instructor's electronic pilot logbook. The last entry before them was on 2019-12-07.

‘(1).(3).(10) Instructors Qualifications & Responsibilities

- To teach and monitor how a student fills out the Aircraft Journey/Simulator Log book after each flight he/she is flying;
- To teach and monitor how a student fills out his own personal logbook after each flight he/she is flying;’

1.17.2.2. Flight planning

There is no data on when, how and about which planned training flights the ATO informed the instructor and the student. According to the post-accident report of the accountable manager of the ATO dated 2019-12-09, the accountable manager of the ATO coordinated the planned training flights of the student with the instructor by telephone on 2019-12-06. The accountable manager also stated that the instructor informed the student by telephone about the planned training flights.

The flight schedule of the training organization on 2019-12-08 indicated the planned training flights on the Piper PA-30 aircraft from at 9-11 and 12-14 hrs. The flight schedule does not specify the time at which flights are scheduled, whether local or coordinated universal time (UTC). A comparison of the flight schedule of the previous flights recorded in the aircraft logbook and the instructor’s flight logbook showed that the flights were scheduled in UTC time and that the local time would be 11-13 and 14-16 hrs respectively. The training organisation explained that due to a technical error, the flight schedule 2019-12-08 were listed in local time.

The flight schedule did not list flight instructors or students. It also does not specify the program and its exercise to be flown. The ATO stated that the following training exercises were planned on the day of the accident:

‘CPL-1 (Traffic circuits, duration 1 hour 30 min.)

Use of checklist, take off, traffic circuit, approach and landing, collision avoidance, checking procedures, post flight procedures. Maximum performance (short field operation and obstacle clearance) take-off and maximum performance (short field operation and obstacle clearance) landing.

CPL-2 (Traffic circuits flight including imitations, duration 45 minutes)

Traffic patterns: simulated engine failure during and after take-off, fire drill, simulated engine failure, alternative landing gear extension

CPL-3 (Cross wind traffic circuits flight, duration 45 minutes)

Cross wind take off, traffic circuit (corrections due to wind), wind limitation and approach speed correction, cross wind approach using different techniques, cross wind landings, go around.

CPL-4B (Upset prevention and recovery, duration 30 minutes)

Upset prevention and recovery training. Flight with relatively critical high airspeed, recognition of and recovery from spiral dives, flight at critical slow airspeeds, spin avoidance, recognition of and recovery from incipient and full stalls.

CPL-8 (CPL flight module completion test, duration 1 hour 30 min.)

CPL flight module completion test’

Easy Access Rules for Organisation Requirements for Aircrew (Part-ORA), published by EASA, stated:

‘AMC1 ORA.ATO.230(b) Training manual and operations manual

<...>

The operations manual for use at an ATO conducting integrated or modular flight training courses should include the following:

<...>

(19) flight planning (general);’

1.17.2.3. Operation facilities

The aircraft was permanently hangered in the Kaunas Aeroclub hangar at EYKS and, according to the aircraft logbook, all flights were operated to/from EYKS.

The OM of the ATO stated:

‘(1).(3).(8) Base Aerodrome

The training organisation uses Paluknis Airfield (EYVP) as its Base Aerodrome. <...>

The training organisation uses all unrestricted Lithuanian airspace for flight training of pilot students. Specifically, for various stages of training, the following areas are used: <...> Aleksotas Airfield¹⁵ <...>.’

Paluknis aerodrome stated that the aircraft did not use the base aerodrome of Paluknis as specified in the OM, because the ground runways at the aerodrome were not suitable for the aircraft.

The ATO did not have a place in EYKS for flight preparation of its students. The ATO stated that the flights preparations were carried out in the room located at the EYKS flight observation point. This room was not provided for in the documents of the ATO and was not prepared for flight planning – it did not have a computer, printer, document forms, maps and other items necessary for flights preparation, also the Internet for receiving meteorological and aeronautical information.

The OM of the ATO stated:

‘(1).(3).(9).(1) Flight Training Facilities

The training organisation Operation Facilities at Paluknis Airfield are in compliance with AMC1 ORA.GEN.215(a). Adequate approved flight planning rooms with current maps, charts, AIS and meteorological information are provided for preparation of training, briefing and debriefing.’

1.17.2.4. Flights preparation

The safety investigation did not reveal how and where flight preparation was being performed out on the day of the accident, or whether it was being performed out at all. During the safety investigation no evidence was received that the student was provided with adequate facilities for flight planning, where meteorological information, maps and all other items necessary for flight preparation, including Internet for meteorological and aeronautical information and flight plan submission could be provided. There is no evidence that the flight crew visited the EYKS at the flight observation point.

The OM of the ATO indicated the main documents to be completed for flight planning, including the navigational log, the minimum required fuel quantity report, the Piper PA-30 load sheet. During the safety investigation no evidence was received that the student had the necessary printed forms for calculating the route, weight and balance, fuel consumption, take-off and landing capability etc.

The ATO had provided the student with access to the e-forms for flight preparation on the ATO website. The safety investigation did not establish whether the student used the e-forms to prepare and whether he was prepared for the flights. The ATO documentation did not foresee the use of an electronic flight bag during the flight.

After the accident, only the student’s navigation plan for the second flight was found in the aircraft, which did not comply the format specified in the OM of the ATO. No other documentation was found to indicate that the student was or was not (partially) prepared for the flight.

¹⁵ EYKS also known as Aleksotas aerodrome, after the part of Kaunas city where the aerodrome is located.

The OM of the ATO stated:

‘(3).(2) Performance & Flight Planning

All the required and complementary performance information applicable to the individual aeroplane is provided in the individual Pilot Operating Handbook (POH).

Proper training to all Flight Instructors and student pilots is provided with respect to all aeroplane performance information <...>

The Flight Instructor will assist the student pilot in the early stages of his/her training, on the proper calculations for the appropriate Navigation Log and Load & Performance Log. Later on the student completes the calculations by himself under the supervision of his/hers Flight Instructor.

Detailed Performance Graphs for individual aeroplanes can be found in their respective Pilot Operating Handbook (POH).’

The safety investigation did not reveal evidence that the ATO controlled and checked where and how in the EYKS was prepared for the flight, that all required documentation is available and so on.

The OM of the ATO stated:

‘(1).(3).(10) Instructors Qualifications & Responsibilities

<...>

To follow Operations & Training Manual of training organisation;

<...>

To ensure that all the documents required are in order, valid & on board of the aeroplane he/she is flying;’

1.17.2.5. Time for pre-flight and post-flight operations

The minimum time for pre-flight and post flight operations were not specified in the ATO documentation. The OM of the ATO stated:

(1).(4).(2).(4) Flight Training

The student undertaking flight training will always:

- Be present at the airport at least one hour before the flight commence, unless otherwise informed by his/hers Flight Instructor.

- Be prepared for the flight training exercise as explained in training organisation Training Manual.’

The safety investigation did not reveal evidence that the ATO regularly controlled and checked that students had sufficient time before the flight for pre-flight operations and after the flight for post-flight operations. The OM of the ATO stated:

‘(1).(3).(10) Instructors Qualifications & Responsibilities

<...>

To ensure that each training session has sufficient briefing & debriefing time; <...>

To teach and monitor how a student fills out the Exercise Report Sheet after each training session he/she is flying;’

1.17.3. Fuel management

1.17.3.1. Refuelling control

Fuel supply services at the aerodrome were provided by a private fuel supplier with which the ATO concluded a fuel supply agreement on 2019-09-12. The fuel supplier undertook to provide 3500 l of aviation fuel AVGAS100LLL. This fuel was used by the ATO in the EYKS for training purposes only on a Piper PA-30 aircraft. The first

refuelling under the agreement took place on 2019-10-09 and the last refuelling on 2019-11-30. A total of 3281 l of aviation fuel was used. After the accident the ATO regained the 219 l of unused aviation fuel from the fuel supplier.

Between 2019-10-09 and 2019-11-30 (inclusive) the aircraft was refuelled in total 17 times: 14 times by the instructor and three times by examiner A. Out of the 17 refuelling's, 10 of the refuelling's coincided with the aircraft's time of flight, i.e., according to the logbook records, the aircraft was flying at the time of refuelling.

The last refuelling on 2019-11-30 was done by the instructor with 180 l of fuel and the penultimate refuelling on 2019-11-06 was done by examiner A with 94 l of fuel. Examiner A did not provide any information on whether he filled only the main fuel cells and whether he filled them completely, as well as how aircraft fuel cells were normally filled.

Instructor and examiner A always refuelled the aircraft independently and noted the amount of fuel refuelled on the fuel supplier's sheet. The fuel supplier was informing the ATO about the amount of fuel used. Neither the fuel supplier nor the ATO performed any other fuel refuelling controls.

The OM of the ATO stated:

'(1).(3).(10) Instructors Qualifications & Responsibilities
<...>

- To always be present during refuelling of the aeroplane he/she is flying;
- To teach and monitor how a student fills out the Refuelling and Aircraft Journey Logbook during refuelling of the aeroplane he/she is flying;'

The fuel used by the Piper PA-30 was paid by the ATO, but according to the instructor electronic pilot logbook, four flights were unrelated to the ATO flights during this refuelling period. The safety investigation did not reveal evidence that the aircraft was refuelled with aviation fuel purchased elsewhere.

1.17.3.2. Fuel consumption control

The aircraft logbook did not contain the mandatory entries on the amounts of fuel and oil added to the aircraft, the amount of fuel and oil in the aircraft prior to each flight, and the tachometer readings of the aircraft.

The CAA Order No. 4R-11 of 2003-02-10 'On the Aircraft Logbook', which was in force until 2021-06-01, approved the aircraft logbook and the instructions for its completion. The approved form of the aircraft logbook specified the requirement to enter entries of amount of fuel fuelled and the total amount of fuel on aircraft.

There was also no evidence of minimum required fuel quantity reports for the first and second flights on the day of the accident.

The OM of the ATO stated:

'(2).(4).(1) Fuel Quantity, Mass and Balance Calculations
<...>

Additionally, before every training flight the form OM 5.39 is used in order to calculate minimum fuel quantity required for that flight.'

In order to detect unexpectedly high fuel consumption or fuel leakage at an early stage, it is common and good practice to regularly check the amount of fuel remaining on the aircraft during the flight and to compare it with the pre-estimated values. There was no evidence of how the crew controlled (monitored) the amount of fuel in the aircraft and its consumption during the flight. The navigational log for the second flight, which was found in the aircraft after the accident and which did not comply with the format specified in the OM of the ATO, did not contain a column entitled 'Fuel' with the actual fuel content of the aircraft at each point along the route.

1.17.3.3. Fuel consumption planning

The OM of the ATO stated:

‘(3).(5) Fuel & Oil
<...>

It is recommended that all cross - country flights commence with full tanks. Circuit and zone flights can be performed even though the fuel tanks are not full, but only when the quantity of the fuel is checked using dipstick.

In any case the requirements given in OM (3).(5).(1) must be complied with.

When the base airport does not have refuelling capabilities, the airport of Kyviškės, or Aleksotas, will be there fuelling hub of all flights. Same restrictions, and responsibilities apply there. Fuel volume in the tanks, are always checked visually by the flight instructor.

(3).(5).(1) Fuel and oil supply

According to NCO.OP.125 requirements, the pilot-in-command shall only commence a flight if the aeroplane carries sufficient fuel and oil for the following:

<...>

By day, to fly to the aerodrome of intended landing and thereafter to fly for at least 30 minutes at normal cruising altitude;

<...>

(5).(39) Minimum required fuel quantity report

<...>

Fuel consumptions

Start-up, taxi (A) + Take-off + Trip

Total trip (B) + Unexpected + Alternate + 45 min.

Total reserve (C)

Minimal fuel quantity (A+B+C)’

The POH specifies preflight check:

‘Fuel tanks: Check Supply Visually – Adjust and Secure Caps’

1.17.3.4. Average fuel consumption

The aircraft had a paper logbook and an electronic logbook, which was in the same file as the instructor’s electronic pilot logbook. The safety investigation assessed the flight records of the aircraft from the first refuelling on 2019-10-09 to the last refuelling on 2019-11-30 based on the agreement concluded between the ATO and the fuel supplier (hereinafter – the assessment period). The flight records in the paper logbook and the electronic logbook were identical and showed that the aircraft flew 80 hours 58 min. The instructor’s electronic pilot logbook contained three additional flights which were not in the aircraft logbooks, and which were not related to the ATO. These additional flights resulted in a flight time of 86 hours 52 min.

3140 l of fuel was used from the first refuelling to the last refuelling. During the assessment period the average fuel consumption was 38,7 l/h in the first case and 36,1 l/h in the second case.

The POH specifies fuel consumption:

‘Fuel consumption	
Fuel flow @ 75% Power.....	17,2 gph (65,11 l/h)
Fuel flow @ 65% Power.....	15,2 gph (57,54 l/h)
Fuel flow @ 55% Power.....	13,4 gph (50,72 l/h)
Fuel flow @ 45% Power.....	11,2 gph (42,4 l/h)’

1.17.3.5. Aircraft flights

According to the flight records, during the assessment period, the aircraft without refuelling on 10-11 October 2019 was flown 7 hours, on 14-15 October 2019 was flown 11 hours 2 min and on 6-30 November 2019 was flown 8 hours 30 min.

The POH specifies flight time depending on engine power:

‘2.) Endurance/Range 54 Gallons:

At 75% Power.....	2.9 hr (2.54 hr) – 906 km
At 65% Power.....	3.3 hr (3.18 hr) – 988 km
At 55% Power.....	3.8 hr (3.48 hr) – 1052 km
At 45% Power.....	4.5 hr. (4.30 hr) – 1086 km

3.) Endurance/Range 84 Gallons:

At 75% Power.....	4.6 hr (4.36 hr) – 1435 km
At 65% Power.....	5.2 hr (5.12 hr) – 1556 km
At 55% Power.....	5.9 hr (5.54 hr) – 1633 km
At 45% Power.....	7.0 hr. (7 hr) – 1689 km

<...>

Note. Range and endurance figures include an allowance for fuel used during start, taxi, take off, climb, and descent plus 45 minutes reserve fuel at a reduced power setting to obtain maximum range or maximum endurance as applicable. Mixture setting is best economy cruise.’

From the penultimate refuelling on 2019-11-06 to the last refuelling on 2019-11-30, the aircraft performed four flights with a total duration of 8 hours 30 min. During the penultimate refuelling the aircraft was refuelled with 94 l of fuel. The time of refuelling coincided with the time of the first flight. During the first flight, the examiner A and pilot E flew with the aircraft 2 hours 32 min. During the second and third flights, the instructor and pilot F flew with the aircraft and the flights lasted 2 hours 30 min. and 1 hour 56 min. respectively. Pilots E and F provided their flight logbook entries, and the coincided with entries of the aircraft logbook. During the fourth flight, the instructor and pilot G flew with aircraft 1 hour 32 min. The purpose of the flight was to revalidate qualification of pilot G. Pilot G stated the purpose and course of the flight but was unable to recall the date of the flight and provide documentary records of proving the flight (e.g., pilot logbook). One part of the revalidation flight had to be performed in controlled airspace and a flight plan had to be submitted for that flight. No flight plan was submitted.

Due to the scope and limited resources of the safety investigation and given that the purpose of a safety investigation is not to carry out an audit, it was not verified that all flights and flight times declared on the aircraft during the entire assessment period were real.

1.17.4. Instructor assessment

1.17.4.1. Proficiency check

The TKA last time revalidated the instructor rating FI(A) on 2019-05-32. The instructor’s application form for the revalidation of the flight instructor rating FI(A) indicated that the instructor was examined by examiner A on 2019-05-30, who assessed the exam as ‘passed’ and without comment.

The TKA last time revalidated the instructor multi-engine piston class rating MEP and instrument rating IR on 2019-09-30. The instructor’s application form for the revalidation of the multi-engine piston class rating MEP and instrument rating IR indicated that the instructor was examined by examiner A on 2019-09-29, who assessed the exam as ‘passed’ and without comments.

1.17.4.2. Requirements for the personnel training of the training organization

In accordance with ORA.ATO.130 subpart of Commission Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew, the approved training organisations shall establish and maintain a training manual and operations manual containing information and instructions to enable personnel to perform their duties and to give guidance to students on how to comply with course requirements.

Easy Access Rules for Organisation Requirements for Aircrew (Part-ORA), published by EASA, stated:

'AMC1 ORA.ATO.230(b) Training manual and operations manual

<...>

The operations manual for use at an ATO conducting integrated or modular flight training courses should include the following:

<...>

(d) Personnel training

(1) appointments of persons responsible for standards/competence of flight personnel;

(2) initial training;

(3) refresher training;

(4) standardisation training;

(5) proficiency checks;

(6) upgrading training;

(7) ATO personnel standards evaluation.'

1.17.4.3. Instructor familiarisation with operations and training manuals

Paragraph (0).(4) of the OM of the ATO indicated that all personnel shall be informed by e-mail of the latest changes to the OM and the training manuals. The ATO stated that it informed the instructor of the latest revision of the OM by e-mail on 2019-10-16. No evidence was received that the instructor was familiar with the changes to the OM.

1.17.4.4. Instructor participation in meetings

Paragraph (4).(3) of the OM of the ATO states that there are scheduled and unscheduled meetings. Also there are official and unofficial meetings. For official meetings, the meeting report must include at least the following information: the date of the meeting, the purpose of the meeting, a list of the personnel attended and the subjects discussed during the meeting. Paragraph (4).(3).(1) of the OM of the ATO states that scheduled meetings are scheduled in the spring and before the winter season to discuss flight safety concerning matters, changes in syllabus and manuals and other information.

The ATO provided lists of attendees of the spring meeting held on 2019-05-07 and the winter season meeting held on 2019-10-21. The attendance lists for both meetings included the instructor. It was not obligatory to collect and did not collect signatures of the participants and there is no other documentary evidence of the attendance of the participants at the meeting. The attendance lists indicate that the meetings lasted for two hours each, without specifying when the meetings started and ended.

The instructor was unable to attend the spring meeting on 2019-05-07. The instructor's electronic pilot logbook indicated that on 2019-05-07 the instructor conducted training at the ATO B on Flight and navigation procedures trainer from 7.00 to 13.15 hrs and had private flights with a Piper PA-34 (D-GMZE) from 14.20 to 20.57 hrs from Paluknis aerodrome.

The instructor could only attend the winter season meeting on 2019-10-21 if the meeting took place in the first half of the day. The instructor's electronic pilot logbook indicated that on 2019-10-21 the instructor flew in a Piper PA-30 from EYKS to EYVI from 8.05 to 8.35¹⁶ hrs and conducted training at the ATO B on Flight and navigation procedures trainer from 16.30 to 23.00 hrs.

1.17.4.5. Instructor assessment

The ATO stated that the students and the personnel of the ATO responded about the instructor as a highly qualified instructor.

The ATO has presented only one instructor assessment report dated 2019-05-07 and completed in accordance with paragraph (5).(6) of the OM of the ATO. The instructor was assessed as 'excellent' with no remarks. The instructor assessment report does not contain any information on what was assessed and how it was assessed, nor does it indicate during which training, theoretical or practical, the instructor was assessed. The assessment report did not have the instructor's signature.

The instructor was unable to attend the assessment on 2019-05-07, as well as the spring meeting.

The OM of the ATO stated:

'(1).(3).(4).(4) Chief Flight Instructor

The person approved by the Lithuanian Civil Aviation Authority who has the responsibility for ensuring the satisfactory level of flying and synthetic training is maintained. <...> Moreover, this person is closely monitoring all Instructors, and he periodically evaluates them in order to ensure training is conducted to the approved standards.'

The OM of the ATO does not specify the frequency of instructor assessments or how often the chief flight instructor shall assess the instructors. It also does not specify what to assesses (theoretical knowledge, completion of documentation, instructing students, piloting technique, etc.) and according to whom to assess, and does not require the person being assessed to be informed of the results of the assessment and to sign the assessment report.

The ATO stated that the chief flight instructor performed the assessments at his own discretion on ad hoc basis, as assessments of instructors are not required by the OM of the ATO, which states:

'(4).(4) Evaluations & Proficiency Checks Procedure

Instructors' skills are tested according to FCL.940.FI and training organisation does not organise additional checks unless there has been an accident or incident. In that case additional check for the instructor is required. The evaluation results of an instructor are presented in OM document (5).(6).'

1.17.4.6. Instructor's flying and instructing proficiency check

The safety investigation did not reveal evidence that the accountable manager and/or the chief flight instructor of the ATO has ever checked the instructor's flying and instructing proficiency. There are no records in the aircraft logbook for the instructor's flights with the head of training and/or the chief flight instructor with the Piper PA-30 aircraft. The ATO stated that the instructor started to provide services since 2001 and the first revision of the OM was approved on 2015-04-13 and there are no extant records of past procedures and checking of the instructor's flying and instructing proficiency.

¹⁶ Incorrect ferry time from EYKS to EYVI. The actual time should be 40-50 minutes.

1.17.4.7. Instructor standardization training

The safety investigation did not reveal evidence of scheduled and unscheduled proficient checks of instructor. There was also no evidence that the ATO checked the instructor's practical skills in piloting and flight instruction in the Piper PA-30, the training procedures and methodology, compliance with the standards of the ATO, scheduled and unscheduled checks, including the completion of the flight and training documentation.

The OM of the ATO stated:

'(4).(2) Standardisation Procedure

Great effort for standardisation of the personnel is made. Standardisation is very important for the training organisation, since the training provided is of high quality, and the standard must be upheld for all students. The Head of Training is responsible of the standardisation of all Instructors, as well as the Chiefs. The Chief Flight Instructor is responsible of the standardisation of all Flight Instructors. The Chief Theoretical Knowledge (Ground) Instructor is responsible of the standardisation of all Ground Instructors.

In order to attain the desired standardisation of all personnel, the following procedures are in place:

- Scheduled and Unscheduled Meetings
- Scheduled and Unscheduled Evaluations
- Scheduled and Unscheduled Proficient Checks
- Scheduled and Unscheduled Safety Training
- Personnel Refresher Courses'

1.17.4.8. Recurrent training

Safety and compliance monitoring managers must provide periodic training and instruction with the purpose to update and maintain personnel's knowledge of the safety and compliance monitoring system and to familiarize them with its changes.

Chapter (4).(6) 'Initial and multiple personnel training' of the OM of the ATO provided information only on initial personnel training and did not describe recurrent training. The ATO provided information that on 2019-02-01 the instructor participated in 4 hours duration recurrent training.

1.17.4.9. Instructor refresher seminar

The instructor had a certificate issued by the ATO on 2019-04-17 which indicated that the instructor had attended the FI/IRI refresher seminar for flight instructors at the ATO in Vilnius from 2019-04-16 to 2019-04-17. Meanwhile, the instructor's electronic pilot logbook indicated that the instructor worked at the ATO B in Spain from 2019-04-14 to 2019-04-18 and on 2019-04-16 from 9.20 to 18.11 hrs and on 2019-04-17 from 12.09 to 14.11 hrs he flew with Tecnam P2006T, registration 5BCLR, at Lleida-Alguaire and Girona-Costa Brava airports.

1.17.5. Designation of examiners

The instructor and the examiner A were good friends. On the day of the accident, the instructor had several telephone conversations with examiner A. The examiner A stated that the instructor had informed that the student would need to be examined at some point, but it is not known what more was discussed. On the day of the accident, the examiner A was working at the ATO B. It should be noted that until 2019-01-01 the examiner A worked in the Flight Operation Division of the CAA.

The ATO did not provide evidence that it planned, organised and communicated the Piper PA-30 training flights. According to the aircraft logbook, in 2018-2019 excluding the instructor only examiner A and examiner B flew the Piper PA-30 and

examined the instructor's students. In 2018-2019, examiner A conducted 45 flight examinations and examiner B conducted 5 flight examinations.

The examiner A examined the instructor. On 2019-05-30 the examiner A examined the instructor for the revalidation of the FI rating and on 2019-09-29 for the revalidation of the MEP and ME/IR ratings.

The instructor also examined examiner A. On 2018-06-25 the instructor examined the examiner A for the revalidation of the MEP and ME/IR ratings in a Piper PA-30 and on 2019-06-22 for the revalidation of MEP and ME/IR ratings.

On 2018-05-20 the instructor also examined the head of training of the ATO for the revalidation of the MEP rating, and on 2018-10-23 and 2019-10-31 the instructor examined the safety manager of the ATO for the revalidation of the MEP and ME/IR ratings. In addition, on 2019-09-11 and 2019-09-15 the instructor examined the senior specialist of the Personnel Licensing Division of the TKA for the revalidation of the MEP and ME/IR ratings and on 2018-06-25 the instructor examined the specialist of the Flight Operation Division of the CAA.

The TKA did not develop and does not have procedures to designate examiners for the conduct of skill tests. The TKA stated that it publishes a list of all examiners from which the training organisations themselves choose the examiner and decide on his/her appointment.

The ARA part of Commission Regulation (EU) No 1178/2011 stated:

'ARA.FCL.205 Monitoring of examiners
<...>

(c) The competent authority shall develop procedures to designate examiners for the conduct of skill tests.'

1.17.6. Maintenance organisation

1.17.6.1. Obligations regarding the organization of maintenance

On 2016-09-28 the instructor and the ATO entered into an aircraft lease agreement under which the instructor was responsible for the maintenance and for the validity of the ARC. The ATO undertook to pay all the costs of operating the aircraft.

On 2016-10-20 the instructor and the CAMO entered into an airworthiness continuity management agreement, under which the instructor undertook to inform about the maintenance work performed without the knowledge of the maintenance organization and to pay for continuing airworthiness management services.

The ATO provided the payments for the last 100-hour maintenance performed on 2019-10-08 and the documents for the last continuing airworthiness management services.

1.17.6.2. Issue of airworthiness certificate

Annex I (Part 21) of Commission Regulation (EU) No 748/2012¹⁷ laying down implementing rules for the airworthiness indicates:

'21.B.326 Certificate of airworthiness

The competent authority of the Member State of registry shall issue a certificate of airworthiness for:

<...>

(b) used aircraft:

¹⁷ Commission Regulation (EU) No 748/2012 of 3 August 2012 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations.

1. upon presentation of the documentation required by point 21.A.174(b)(3) demonstrating that:

(i) the aircraft conforms to a type design approved under a type-certificate and any supplemental type-certificate, change or repair approved in accordance with this Annex I (Part 21) and;

(ii) the applicable airworthiness directives have been complied with and;

(iii) the aircraft has been inspected in accordance with the provisions of Annex I (Part-M) or Annex Vb (Part-ML) of Regulation (EU) No 1321/2014, as appropriate.’

Annex I (Part M) of Commission Regulation (EU) No 1321/2014¹⁸ on the continuing airworthiness of aircraft indicates:

‘M.A.201 Responsibilities

<...>

(c) Any person or organisation performing maintenance shall be responsible for the tasks performed.

(d) The pilot-in-command <...> shall be responsible for the satisfactory accomplishment of the pre-flight inspection. That inspection shall be carried out by the pilot or another qualified person and shall not need to be carried out by an approved maintenance organisation or by certifying staff.

<...>

M.A.501 Classification and installation

<...>

(b) Components, standard parts and material shall only be installed on an aircraft or a component when they are in a satisfactory condition, belong to one of the categories listed in point (a) and the applicable maintenance data specifies the particular component, standard part or material.’

1.17.6.3. Aircraft defects

The OM of the ATO stated:

“(1).(3).(10) Instructors Qualifications & Responsibilities

<...>

- To ensure the aeroplane/simulator is in decent condition after each flight he/she is flying;

<...>

(2).(7) Minimum equipment

According to NCO.IDE.A.105 requirements flight shall not be commenced when any of the aeroplane instruments, items of equipment or functions required for the intended flight are inoperative or missing, unless:

- The aeroplane is operated in accordance with the MEL¹⁹, if established; or
- The aeroplane is subject to a permit to fly issued in accordance with the applicable airworthiness requirements.’

The Piper PA-30 did not have the minimum equipment list.

Annex I (Part M) of Commission Regulation (EU) No 1321/2014 on the continuing airworthiness of aircraft defines the actions in the event of an aircraft defect:

‘M.A.403 Aircraft defects

¹⁸ Commission Regulation (EU) No 1321/2014 of 26 November 2014 on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks.

¹⁹ MEL – Minimum Equipment List.

- (a) Any aircraft defect that hazards seriously the flight safety shall be rectified before further flight.
- (b) Only the certifying staff <...> can decide, using maintenance data referred to in point M.A.401 of this Annex, whether an aircraft defect hazards seriously the flight safety and therefore decide when and which rectification action shall be taken before further flight and which defect rectification can be deferred. <...>
- (c) Any aircraft defect that would not hazard seriously the flight safety shall be rectified as soon as practicable, after the date the aircraft defect was first identified and within any limits specified in the maintenance data or the MEL.
- (d) Any defect not rectified before flight shall be recorded in the aircraft continuing airworthiness record system referred to in point M.A.305 or, if applicable in the aircraft technical log system referred to in point M.A.306.'

1.17.6.4. Defect notification

According to the agreement between the instructor and the CAMO on 2016-10-20, the instructor undertook to report to CAMO all defects detected during the operation of the aircraft by means of recording the defects in the aircraft logbook and also undertook to report all events and defects that endanger flight safety.

The OM of the ATO stated:

'(1).(3).(10) Instructors Qualifications & Responsibilities
<...>

- To report immediately any malfunction of the aeroplane/simulator he/she is flying.'

1.18. Additional information

1.18.1. Aircraft flight with asymmetrical thrust

1.18.1.1. Engine inoperative flight principles

The loss of power of one engine affects the control of the aircraft and its flight performance. The propeller of the inoperative engine creates additional aerodynamic drag, the vector of which is some distance from the centre of mass of the aircraft and directed in the opposite direction of flight. At the same time, the thrust vector of the operative engine is also some distance from the centre of mass of the aircraft (just in the other direction) and is directed in the direction of flight. There are two moments acting on the centre of mass of the aircraft, only in opposite directions. This is called 'asymmetric thrust', which produces a torque (yaw) towards the inoperative engine. With an unchanged position of the aircraft's rudders, the aircraft begins to rotate (change direction) towards the inoperative engine (Fig. 13).

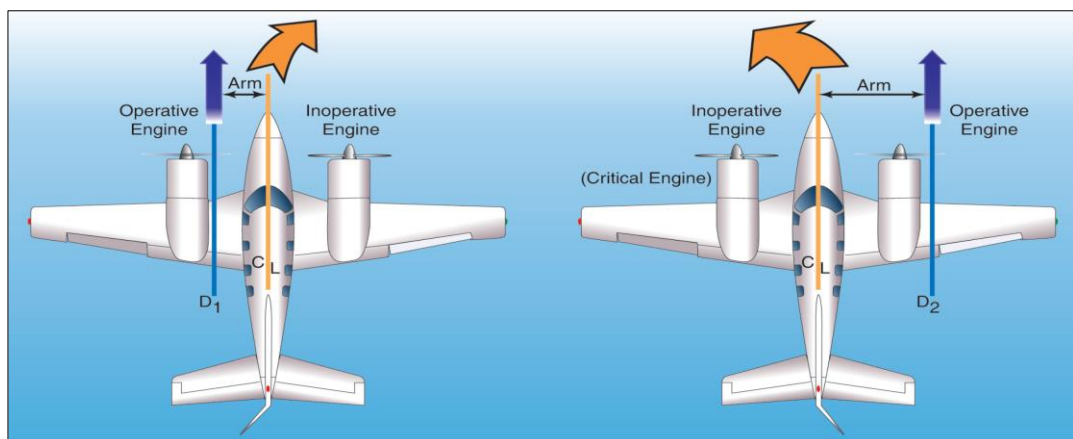


Fig. 13. Forces created during single-engine operation (Airplane Flying Handbook, 2004, FAA-H-8083-3A)

A wing with the operative engine is additionally affected by airflow from the propeller, giving it more lift than a wing with the inoperative engine. The difference in lift between the operative and inoperative wings results in a torque (roll) of the aircraft towards the inoperative engine. With the rudder position unchanged, the aircraft begins to roll towards the inoperative engine (Fig. 14).

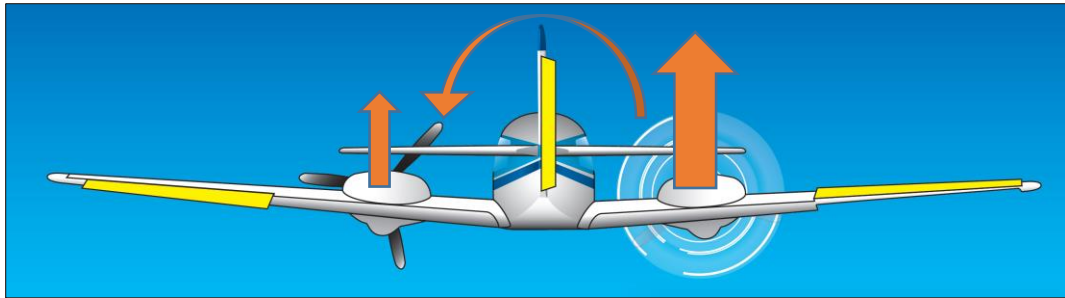


Fig. 14. Forces created during single-engine operation (Airplane Flying Handbook, 2004, FAA-H-8083-3A)

In the event of the one inoperative engine of the aircraft, the pilot must immediately compensate for the resulting asymmetrical thrust torques.

The POH stated:

‘Section 3. Emergency procedures

<...>

Engine power loss during climb

Airspeed.....Establish V_{YSE}^{20} (105 mph or 91 kt)

Inoperative Engine.....Identify and Verify

Rudder.....Apply Towards Operating Engine

Aileron.....Bank 5 Degrees Into Operating Engine

Turn-and Bank Indicator.....Displace Ball $\frac{1}{2}$ Ball With Towards Operating Engine

Operative Engine.....Full Power

Initiate Engine Securing Procedure.’

This means that using the ailerons the aircraft must be banked 5° towards the operating engine and, at the same time, using the rudder must be compensated the yawing of the aircraft so that the slip indicator shows the aircraft slipping ‘half ball’ towards the operating engine and setting the pitch angle with the elevator required to maintain airspeed. With 5° bank of the aircraft and a ‘half ball’ slip towards the operating engine, the aircraft will have the lowest aerodynamic drag and the best climb performance (Fig. 15). Compensating for the resultant asymmetrical thrust torques with the rudder alone or with the ailerons alone, the aircraft will have higher aerodynamic drag and lower climb performance (Fig. 15).

Loss of power on one engine represents a 50 % loss of total thrust of the aircraft. This can result in an 80-90 % loss of climb performance, which is further affected by air temperature, altitude and the weight of the aircraft.

In the event of an engine or propeller control system failure, the propeller must be turn to the feathered position, to minimise drag caused by the propeller. Failure to do so results in high propeller drag, which significantly affects both the flight of the aircraft and its controllability. This is particularly relevant for twin-engine aircrafts, as a stopped engine (propeller) begins generate high torque that needs to be

²⁰ V_{YSE} – best single engine rate of climb speed – the airspeed which results in the greatest gain in altitude in a given period of time when operating a multi-engine airplane on one engine.

compensated by aerodynamic control surfaces, the efficiency of which is highly dependent on the speed of the airflow passing over them. Which is why a minimum airspeed is set for such aircrafts with the one inoperative engine, which is higher than the minimum airspeed with both operative engines.

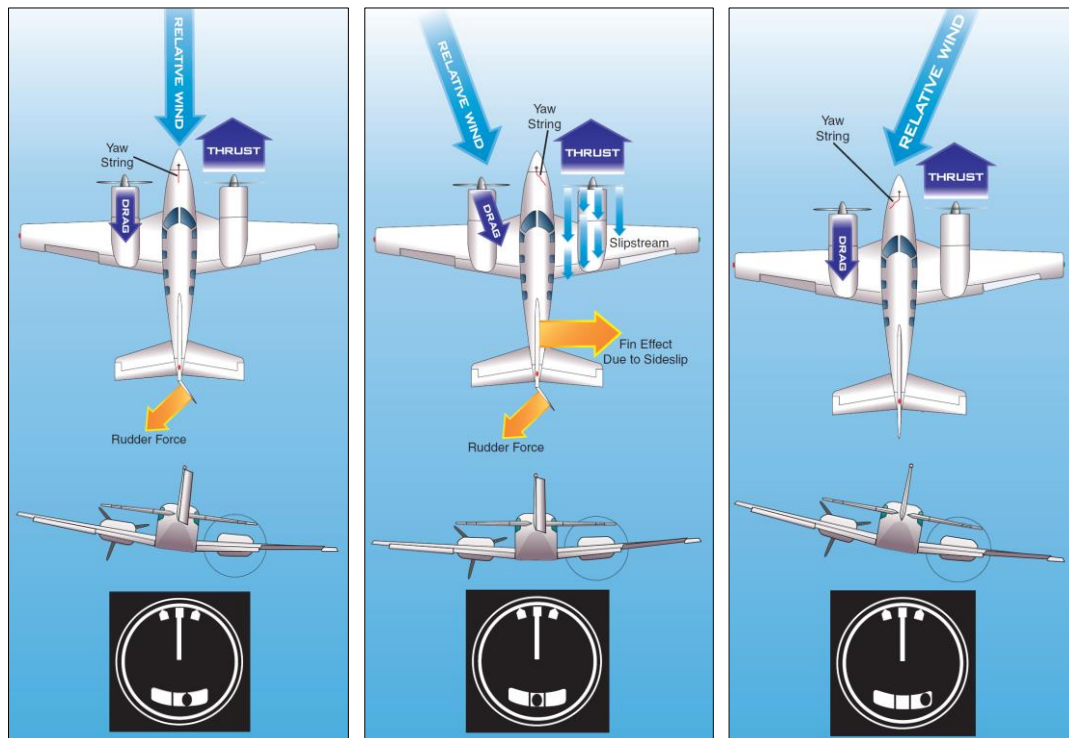


Fig. 15. Engine inoperative flight principles (Airplane Flying Handbook, 2004, FAA-H-8083-3A)

Aircrafts in the multi-engine class are certified with climb performance with one operative engine when the aircraft: flies with the landing gear retracted and flaps retracted; maximum thrust of the operating engine is used; the propeller of the inoperative engine is feathered; flying at V_{YSE} speed.

1.18.1.2. Stall

A stall is an aerodynamic condition that occurs when the laminar airflow over the wings of the aircraft is disturbed, resulting in a reduction of lift. Specifically, the stall occurs when the angle of attack – the angle between the wing chord and the airflow, exceeds the wing's critical angle of attack. The critical angle of attack can be exceeded at any airspeed, any attitude and any thrust setting.

Decreasing the airspeed of the aircraft increases the angle of attack of the wing. As the angle of attack increases, the lift coefficient increases, and the centre of pressure moves towards the leading edge of the wing. As the critical angle of attack is approached, the steady laminar airflow changes to turbulent airflow at certain locations on the wing and the airflow separation occurs. Above the critical angle of attack, the uniform laminar airflow suddenly becomes turbulent over the entire length of the wing, the lift coefficient decreases suddenly and the centre of pressure moves suddenly towards the wing trailing edge. The drag coefficient increases due to the turbulent airflow, which does not generate lift but only drag. This results in sudden moments of force causing the aircraft to pitch suddenly downwards.

This is very well illustrated in Piper PA-30 – the nose suddenly 'drops' down when the critical angle of attack is exceeded. The POH indicates that the Piper PA-30 has a laminar wing profile. The disadvantage of a laminar wing is that its stall is usually much sudden than with a conventional wing profile.

The POH states:

'Section 1 – General
<...>
7.) Stall speeds:
Full Flaps and Gear Extended.....69 mph 60 kt
Clean.....76 mph 66 kt
Section 2 – Limitations
<...>
Other limitations
1.) Loss of altitude in a power off stall with landing gear and wing flaps retracted is 280 ft.'

1.18.2. Emergency procedures

1.18.2.1. Engine failure after take-off

The OM of the ATO does not contain a description of the emergency procedures, but only paragraph (2)(5) of the OM indicates that a detailed description of the emergency procedures for the ATO aircraft is contained in the POH of each aircraft.

The POH does not describe the actions to be taken by the crew in the event of insufficient climb after take-off in the event of failure of one of the engines, or in the event of inadequate thrust of both engines. The POH states:

'Section 3 – Emergency procedures
<...>
Engine failure during takeoff
<...>
3.) If 105 mph IAS (91 kt) has been attained:
If sufficient runway remains for a normal landing, land straight ahead.
If insufficient runway remains:
Landing
Gear.....Retract
Wing Flaps.....Retract
Airspeed..... Maintain V_{YSE} (105 mph or 91 kt)
Initiate Engine Power Loss During Climb Procedure.'

Also, the OM of the ATO does not contain checklists and flight circles diagrams with both engines and one inoperative engine.

The checklist for the Piper PA-30 by the ATO found on the aircraft after the accident did not include a procedure for landing in the field selected from the air in the event of inadequate opportunity to continue climbing. Such procedure, as a separate, are not included in the POH or in the PA-30 Twin Comanche Owner's Handbook.

1.18.2.2. Training methodology of engine failure after lift off

Paragraph (3.)(8).(31) of the OM of the ATO describes a training methodology for the engine failure after lift off of a multi-engine aircraft, which is intended to develop the student's ability to immediately recognise the engine failure after lift off and to make a decision to continue or abort the take-off. This training methodology does not clearly distinguish between the procedures of the crew (pilot) actions in the two different cases where:

- In the event of an engine failure, immediately after take-off, when the landing gear is retracted and the aircraft has the ability to climb;
- In the event of failure of one of the engines, immediately after take-off, when the landing gear is retracted but the aircraft does not have the ability to climb.

Although not distinguished, the first procedure is accurately and adequately described in the training methodology. In contrast, the second procedure is not described as a separate procedure, but is only vaguely mentioned in the first procedure:

‘(3).(8).(31) ENGINE FAILURE AFTER LIFT OFF

<...>

In the event that positive rate of climb cannot be obtained at V_{YSE} , continue increasing pitch up to V_{XSE} if necessary

<...>

Maintain a safe altitude (Traffic Pattern Altitude) and a safe airspeed (88KTS or above if feasible)

<...>

Return for landing at the airport or suitable landing area’

1.18.2.3. Actions when the aircraft does not have the ability to climb

Recent flight training literature describes recommended procedures when the aircraft does not have the ability to climb – e.g., Flying Light Twins Safely, FAA-P-8740-66, AFS-803, 2001, page 9; Handling Sense Leaflet 01: Twin Piston Aeroplanes, UK Civil Aviation Authority, 2011, page 3; The Complete Multi-Engine Pilot Syllabus, ASA, Fourth Edition, 2018.

Chapter 12 of Airplane Flying Handbook, FAA-H-8083-3B, 2016, indicates:

‘Engine Failure After Lift-Off

<...>

Landing Gear Down

If the engine failure occurs prior to selecting the landing gear to the UP position: Keep the nose as straight as possible, close both throttles, allow the nose to maintain airspeed and descend to the runway. Concentrate on a normal landing and do not force the aircraft on the ground. Land on the remaining runway or overrun. Depending upon how quickly the pilot reacts to the sudden yaw, the airplane may run off the side of the runway by the time action is taken. There are really no other practical options. As discussed earlier, the chances of maintaining directional control while retracting the flaps (if extended), landing gear, feathering the propeller, and accelerating are minimal..<...>

Landing Gear Control Selected Up, Single-Engine

Climb Performance Inadequate When operating near or above the single-engine ceiling and an engine failure is experienced shortly after lift-off, a landing must be accomplished on whatever essentially lies ahead. There is also the option of continuing ahead, in a descent at V_{YSE} with the remaining engine producing power, as long as the pilot is not tempted to remain airborne beyond the airplane’s performance capability. Remaining airborne and bleeding off airspeed in a futile attempt to maintain altitude is almost invariably fatal. Landing under control is paramount. The greatest hazard in a single-engine takeoff is attempting to fly when it is not within the performance capability of the airplane to do so. An accident is inevitable. Analysis of engine failures on takeoff reveals a very high success rate of off-airport engine inoperative landings when the airplane is landed under control. Analysis also reveals a very high fatality rate in stall spin accidents when the pilot attempts flight beyond the performance capability of the airplane.’

The flight manuals for the newly produced multi-engine class of aircraft shall also describe such a procedure, e.g., DA42NG airplane flight manual indicates:

‘3.7.5 Engine failure during take-off:

If the remaining runway / surface is inadequate:

- Decide whether to abort or to continue the take-off.

Continued take-off:

WARNING

A continued take-off is not recommended if the steady rate of climb according to Section 5.3.8 - ONE ENGINE INOPERATIVE CLIMB PERFORMANCE is less than 3.3 %. Under certain combinations of ambient conditions, such as turbulence, crosswinds and wind shear as well as pilot skill the resulting climb performance may nevertheless be insufficient to continue the take-off successfully. Therefore a continued take-off with a failed engine has to be avoided if at all possible.’

1.18.2.4. Landing gear system failure

Neither the OM of the ATO nor the POH contained a requirement for crew (pilot) to make an immediate landing (at the nearest aerodrome) in the event of an emergency landing gear extending or an inability to retract the landing gear after take-off.

1.18.3. The aircraft logbook

Commission Regulation (EU) No 965/2012 laying down technical requirements and administrative procedures related to air operations Annex VII NCO.GEN subpart stated:

‘NCO.GEN.150 Journey log

Particulars of the aircraft, its crew and each journey shall be retained for each flight, or series of flights, in the form of a journey log, or equivalent.’

AMC1 NCO.GEN.150 subpart of Easy Access Rules for Air Operations issued by the EASA does not specify that the aircraft logbook shall indicate the amount of fuel fuelled and the total amount of fuel on aircraft prior to each flight. It also does not specify whether the flight time of the aircraft should be indicated in airborne time or in block time.

On 2021-06-01 the Lithuanian Transport Safety Administration repealed the CAA Order No. 4R-11 of 2003-02-10 ‘On the Aircraft Logbook’, which approved the aircraft logbook and its instructions for completion applicable to general aviation. The instructions for completion did not specify how the flight time of the aircraft should be indicated – airborne time or block time.

1.18.4. The safety actions

1.18.4.1. The safety actions of the TKA

On 2021-09-15 the TKA established a new position and employed an examiner inspector, one of whose functions is to periodically inspect and assess the work of the flight examiners to ensure that the exams are actually taking place. The TKA is currently developing a procedure for checking examiners and reporting them of scheduled flight exams, which the TKA expects to approve in the near future.

On 2020-10-16 the TKA director’s order No. 2-254 ‘On the approval of the rules for the supervision of the activities of economic entities supervised by the TKA’, the rules for the supervision of the activities of the operators under the TKA supervision were approved, including questionnaires for approved training organizations: general questionnaire, practical training questionnaire, the safety management

system questionnaire, the meeting with the accountable manager questionnaire and the theoretical training questionnaire. Also, after the accident, the TKA shortened the supervision cycle of the ATO from two to one year and performed two major audits in 2020 and 2021.

1.18.4.2. The safety actions of the ATO

On 07-12-2022 the TKA approved amendments to the ATO Manual (Issue No 1, Revision No 18, revision date 2021-11-23), by which the ATO:

- In Chapter 3.3 ‘Decision-making and emergency management’ specifies the methodology for flight crew decision making in the event of an emergency.
- In Chapter 4 ‘Standardisation training’ specifies that standardisation training shall take place twice a year during the scheduled meetings. In addition, each year (once every 12 months) the chief flight instructor, the deputy chief flight instructor or head of training conducts standardization training flight (by aircraft or simulator) for flight training instructors to standardize flight training methodologies to verify instructors’ compliance with the ATO procedures and standards.
- In Chapter 5 ‘Proficiency checks’ specifies, that the ATO proficiency checks of flight instructors are performed together with the standardization training flight. The ATO proficiency check of flight instructors is valid for a period of 12 months counted from the end of the calendar month when the ATO proficiency check of flight instructors was conducted. In addition, proficiency checks of flight instructors are performed if there has been an accident or incident and such check is required; or if the need for such check arises by decision of the head of training or the chief flight instructor.
- In Chapter 6 ‘Preparation of flying programme’ specifies, that the flight schedule is arranged in electronic document and additionally includes the flight exercise and the scheduled start and end times of the flight. All students are informed of the flight schedule by the flight instructor after he arranges it with the chief flight instructor or head of training.
- In Annex 2 ‘Instructor evaluation report’, the instructor’s assessment report was supplemented with assessment criteria and established the requirement to familiarize the assessed instructor with the assessment results and to sign them.

1.19. Useful or effective investigation techniques

Not applicable.

2

ANALYSIS

2.1. Aircraft technical investigation

The compact nature of the accident site and the relatively intact airframe of the aircraft indicates a low speed at the time of impact with a steeply inclined flight path. The main impact was to the left wing and nose. These are all indications of an incipient left spin.

No defects were identified within the aircraft flight control or fuel systems that directly contributed to the accident before the impact on the ground and there was no evidence of a pre-impact mechanical failure within either engine or propeller or their related control systems.

The damage to the propellers indicates that both propellers were rotating at a low blade angle and were not feathered at the time of impact. This means that the engines were not switched off.

The damage of the left propeller '2BSF' indicates that the left propeller was rotating under some amount of power. The damage to both blades of the left propeller was caused by the impact from bending and twisting. The bending and twisting with bending aft and opposite rotation of one of the propeller blades, as well as the leading edge abrasion, chordwise/rotational scoring and a gouge from tip indicate some amount of engine power at the time of impact. Also, the rotation of the propeller at the time of impact is indicated by the residual impact signature on the propeller hub and completely crushed opposite rotation the left spinner.

The right propeller '2B' had no rotational damage. Only the deformation of one blade with damaged spinner at its attachment point indicates that the rotation of the right propeller stopped quickly after impact. This means that the right engine had a low or no power at the time of impact.

A detailed examination did not reveal any damage to the fuel system leading to fuel leaks. The fuel system in the engines compartments was intact and leakproof. No fuel was found in the left engine compartment fuel system from the exit point of the firewall to the fuel pump and a small amount of fuel was found from the fuel pump to the fuel distributor valve. No fuel was found in the entire fuel system of the right engine compartment. This means that the engines lost power due to fuel starvation.

About 2 l of fuel were collected from the right main cell and about 2,3 l was recovered from the right auxiliary cell. From the left main and auxiliary cells together was collected 16,4 l, but it is likely that not all the collected fuel was in the left main cell. Therefore, the collected amount of fuel was less than the unusable fuel capacity of the main fuel cells, which is 11.36 l each. All this confirms that at the time of the impact the left engine had low power and the right engine had no power at all.

The possibility of a fuel leak occurring during the flight was ruled out for the following reasons: there was no physical evidence for a leak; the crew did not declare an emergency during the flight, did not declare a problem and did not change their course of action (took off after the last touch and go landing at the EYKS); and due to the two independent fuel systems of each engine, a leak would have had to affect both engines at a different time. If there had been a fuel leak, one engine would have run out of fuel earlier than the other (respectively, the fuel cell selector switches position would have been in the crossfeed position) or even spotted by the crew at the parking site after the first flight.

Taking all this into account, the loss of power of both engines during the climb after take-off occurred due to fuel starvation.

2.2. The flight after touch and go landing

During the second flight, the aircraft flew directly and evenly from the compulsory reporting point ELEKA to EYKS. As the aircraft descended and approached the EYKS, the aircraft started to use the unusable fuel. The crew could not have noticed this because the aircraft was flying without a significant downward pitch and the engines were operating at low power. Due to the usage of the unusable fuel that can be consumed during the level flight, the engines had sufficient fuel and were operating without interruption.

The aircraft made touch and go at EYKS. During the climb, the aircraft started to flight with a higher pitch attitude and the engines were operating at maximum power. In this attitude the engines started to run out of fuel, and they started to operate twitchingly. Therefore, the first sign of fuel starvation, as identified by the eyewitness, was a change in the sound of the engines and a twitching sound.

After take-off, the aircraft reached an altitude of about 60 m (200 ft) and stopped climbing and the flight path deviated to the right side. The loss of climb and the deviation to the right side was due to the loss or reduced power in the right engine. The loss or reduced power of the aircraft could have been caused by a fuel starvation and/or a simulated failure of one engine by the instructor, when the engine thrust is completely reduced. If the engine failure was simulated, the crew could not realise that the engine was running out of fuel and was not prepared for this situation.

Despite the constant speed propeller system maintaining a constant rpm, depending on how fast the engine power was lost, the crew could experience a yawing and rolling motion. When one engine lost power, the difference between the lift on the wing with the engine operative and on the wing with the engine inoperative resulted in the aircraft rolling towards the engine inoperative. When the aircraft stopped climbing and rolled slightly to the right, the crew compensated this roll with ailerons.

However, the aircraft could not climb any further. Loss of power on one engine represents a 50 % loss of total thrust of the aircraft and this can result in an 80-90 % loss of climb performance. To climb a twin-engine aircraft with one of the engines inoperative, it is necessary to retract the landing gear, retract the flaps and feathered the propeller of the simulated or inoperative engine, with the operative engine operating at maximum power. However, the crew was unable to retract the landing gear due to the inoperative landing gear retraction motor. It is also not clear whether the crew wanted and tried to feather propeller of right engine. Regardless of whether the crew had tried, the right propeller would be slow to feather, or not feather completely because it was charged with three times less than the required air charge pressure. Therefore, when the engine stopped due starvation of fuel or simulated failure of one engine, it was not possible to climb with the extended landing gear and not feathered propeller of inoperative right engine.

Near Noreikiškės village the aircraft was spotted at a low altitude of about 20 m. The rotation of the left propeller decreased to such an extent that its blades were visible.

As the power of the left engine decreased, the difference between the lift on the wing with the engine operative and on the wing with the engine inoperative resulted in the aircraft rolling towards the engine inoperative and the right wing of the aircraft started to rise. Also, the inoperative propeller created more aerodynamic drag, resulting in asymmetrical thrust that started to yaw the aircraft toward the inoperative engine. All of this resulted in a loss of altitude and descent of the aircraft.

The fuel cells are rubber chambers that do not have baffle plates to prevent fuel flowing from one side of the fuel cell to the other during rolling of the aircraft. After reducing the angle of pitch of the aircraft and levelling the aircraft, fuel remaining from the one side of the cell flowed to the lowest part of the cell. Soon after the engine received fuel, the left propeller began to rotate again.

The crew had already lost altitude and airspeed, and when the left engine started to operate, there the right engine immediately lost power. The rotation of the right propeller decreased to such an extent that its blades were visible. Now occurred the similar situation but with the right engine. The loss of right engine power was unexpected, and the crew was not prepared for it. Due to the loss of right engine power the aircraft rolled towards to the inoperative engine. The right wing dropped, and the left wing raised. The roll was sudden, and the aircraft was thrown severely to the right side. Also, the asymmetrical thrust due to the inoperative propeller began to turn the aircraft to the right. Due to the roll of the aircraft towards the inoperative right engine, fuel residue in the main cells flowed to the right side and the right engine was unable to receive fuel at all. This is confirmed that no fuel was collected after the accident in the fuel system of the right engine compartment. Meanwhile the left engine received fuel, as the fuel flowed to the lowest part of the left main cell from which the engine is fed. All this is confirmed by the damage to the propellers, which shows that the left propeller had more power than the right propeller.

The nose of the aircraft was raised, and the tail was down. It is likely that the crew was still trying to climb by instinctively increasing the upward pitch angle until the aircraft reached the critical angle of attack. Above the critical angle of attack occurred a stall, which due to the type of a laminar wing profile, caused the aircraft to pitch sharply downwards. The aircraft went into a left spin. This situation is confirmed by the absence of any sign of horizontal ground motion at the accident site. The aircraft impacted the ground on an almost perpendicular trajectory.

The aircraft was at too low above the ground to allow the crew to recover the aircraft from its initial spin. The loss of altitude of the aircraft in a power off stall with landing gear and wing flaps retracted is 280 ft or 85 m and the aircraft was in a maximum altitude of 200 ft or 60 m after take-off, and in the last seconds of the flight the aircraft was over the roofs of a two-story houses. Given that the situation developed very quickly, it is not clear whether the crew understood the nature of the problem.

2.3. Aircraft serviceability

2.3.1. Fuel system technical issues relevant to the accident

The fuel floats were not correctly adjusted. The floats arms of all four fuel cells did not reach the bottom stop. In addition, the floats arms of both auxiliary fuel cells were bended in the direction of the wing tip instead of the adjustment direction. As the positions of the fuel float arms were not properly adjusted, the fuel gauges should have indicated a higher fuel amount than actually was.

Of the four fuel senders, only the fuel sensor on the left auxiliary fuel cell worked properly. The float of this sender was plastic and newer than the other three brass floats. The results of the checking of all three other brass fuel floats senders showed that the resistance was higher than the set resistance or varied unpredictably. The higher resistance and the variated resistance mean that the fuel senders indicated a higher fuel amount than actually was.

Also, the wiring of the fuel quantity gauge was not in good condition and with severe fraying at the solder points. The reduced wire thickness generates a higher resistance, which indicates a higher amount of fuel in the cells than actually was.

Due to incorrectly adjusted floats, incorrectly operated fuel senders and incorrectly condition of wiring, the fuel quantity gauges should always have indicated full fuel cells. Therefore, the technical condition of the fuel quantity indicating system was not in accordance with the requirements set by the aircraft manufacturer and was not checked as specified in the ASM. At the time the Piper PA-30 was manufactured, the standards of maintenance and flight manuals were very low. Older mechanics, with relatively little data, intuitively or by experience knew how to maintain the aircraft. Pilots who operated the aircraft checked everything visually and used fuel gauges only for reference. The old analogue fuel indicating systems were simply existing car fuel systems installed in aircraft. These systems are simply different from modern digital systems with capacitance sensors for calibration standards. It is likely that the instructor was aware of the incorrectly indications of fuel quantity but, as is common in general aviation, calculated the fuel consumption based on the flight time.

No repairs were performed to the aircraft's fuel floats and senders in the period of controlled environment by the CAMO. In order to use the aircraft for training and before the aircraft entered in to controlled environment by the CAMO, an engineer, holding a Part-66 aircraft maintenance licence, performed maintenance works of the aircraft on 2015-10-14, including the replacement of the fuel cells. Because the entries in the scheduled inspection records are incomplete, there are no evidence, that the procedures for checking and adjusting the fuel quantity indicating system were carried out after the replacement of the fuel cells. Therefore, it is likely that when the fuel cells were replaced, unusable fuel quantity senders were installed with improperly adjusted fuel float arms. Although there is no requirement in the aircraft manufacturer's published maintenance documentation to perform an adjustment of the fuel quantity indicating system after the fuel cells have been replaced, in accordance with the Parts M.A.201 and M.A.501 of Annex I of Commission Regulation (EU) No 1321/2014 on the continuing airworthiness of aircraft, the person or organisation performing maintenance and installing a component in an aircraft shall ensure that that component can be used on a specific aircraft and shall be responsible for the tasks performed

2.3.2. Propellers technical issues relevant to the accident

Since 2003-06-26 the aircraft has been fitted with different models of propellers – the left propeller '2BSF' had a larger and higher force feathering spring then the right propeller '2B'. The ASM specifies that the "S" propeller should not be intermixed with the other propellers. Neither the maintenance organisation nor the CAMO identified that the propellers were different models and charged both propellers with the same air pressure which was only appropriate for the '2BSF' propeller, therefore the propeller '2B' was always charged with more than three times less air pressure. The '2B' propeller would feather slowly, may not completely feather, or may not feather at all due to the low air charger pressure.

2.3.3. Undeclared maintenance

During the period of controlled environment by the CAMO, the CAMO was not informed and did not have data on the aircraft maintenance being performed elsewhere, even though the instructor undertook to inform the CAMO.

The safety investigation revealed that such maintenance may have been performed at the EYMO, where, according to the aircraft logbook, the aircraft was from 2017-03-12 to 2017-04-23 and just before the accident from 2019-11-15 to 2019-11-17. Only one flight was recorded in the aircraft logbook between 2019-11-17 and the accident, but the safety investigation did not provide evidence that it actually took

place (see further in section 2.4.2.). Also, before the accident, the instructor informed the student about the rescheduled training flights from Saturday to Sunday due to the aircraft maintenance. There is no information about these possible maintenance works.

The CAMO was not informed about the installation of Garmin G5 Electronical Flight Instruments in the aircraft's instrument panel instead of the analogue gyro horizon and directional gyro, although it had the opportunity to identify it during maintenance.

2.3.4. Airworthiness of the aircraft

The safety investigation found that the aircraft was not in compliance with relevant airworthiness requirements: the fuel floats were not adjusted properly; fuel senders did not operate properly; the wiring of the fuel quantity gauge was untidy; the wiring of the aircraft was untidy; the aircraft has been fitted with extraneous equipment of fuel system, that does not comply with the aircraft type certificate; the aircraft was fitted with a different model of propellers and did not comply with the aircraft type certificate. While in operation of the aircraft the defects were not recorded, and performed maintenance works and replacement of instruments were not identified without the knowledge of the maintenance organization.

This raises doubts not only about the proper and quality maintenance of the aircraft, but also about the airworthiness review. Under the Parts M.A.201 and M.A.501 of Annex I of Commission Regulation (EU) No 1321/2014 on the continuing airworthiness of aircraft, person or organisation performing maintenance and installing a component in an aircraft shall ensure that that component can be used on a specific aircraft and shall be responsible for the tasks performed. Under the Part 21.B.326 of Annex I (Part 21) to Commission Regulation (EU) No 748/2012 laying down implementing rules for the airworthiness, the ARC shall only be issued if the aircraft conforms to the type design and has been inspected in accordance with the provisions of Part M of Annex I to Commission Regulation (EU) No 1321/2014.

Nevertheless, and despite the CAMO oversight during the relevant period, the ARC had been issued four times. Taking this into account and in order to provide greater confidence in the airworthiness status of the aircraft in the future:

Safety recommendation no. SR-2022-A-01

It is recommended that the approved continuing airworthiness organisation JSC 'ELSA' review and renew its procedures to ensure that the Airworthiness Review Certificate is valid when it is issued.

2.4. Fuel management

The safety investigation sought to establish why the aircraft's fuel cells were critically low of fuel. Due to the absence of mandatory records in the documentation, the aim was to assess the average fuel consumption, the amount of fuel on board prior to the last refuelling and the amount of fuel consumed on the day of the accident.

2.4.1. Average fuel consumption

Actual average fuel consumption cannot be calculated and estimated. Based on the fuel consumption of the aircraft and the flight hours flown during the assessment period, the average fuel consumption per block flight hour was 38,7 l/h or 36,1 l/h depending on the different entries made in the aircraft logbook and the instructor electronic pilot's logbook. In any case, such fuel consumption is not in line with the minimum fuel consumption of 42,4 l/h at a minimum 45 % power as stated in the POH. It should also be noted that the aircraft was used for training purposes and was not operated at the minimum power.

The POH states that the average fuel consumption per block flight hour, depending on the engine operating mode at 55-75 % power, is 50,7-65,1 l/h. The actual average fuel consumption of 50 l/h is also given in the test flight report. Examiner A indicated that the average fuel consumption for the block flight hour was 60 l/h.

During the assessment period, there were three cases when the aircraft was flown without refueling 7 hours, 11 hours 2 min. and 8 hours 30 min., which is more than the maximum flight time of 7 hours with at least 45 % power as specified in the POH. The POH states that the maximum flight time depending on the engine mode of operation at 55-75 % power, is between 5 hours 54 min. and 4 hours 36 min.

Moreover, the flight records of the assessment period indicates that the flights from EYKS to EYVI and back take 22 minutes and 25 minutes respectively, when in reality the actual time should be at least twice as long.

It is also difficult to assess why 10 of the 17 refueling during the assessment period coincided with the flight time of the aircraft, but it cannot be ruled out that the flights did not take place but were simply recorded in the aircraft's logbook.

Summarizing all that, it can be said that part of the recorded flights was not flew, or the aircraft's block flight time is 64.5% of the airborne flight time and 35.5% of the aircraft's ground time. That is, 35.5% of the flight time was simply recorded. Due to that, it is not possible to estimate what the real average fuel consumption was.

Neither the national aircraft logbook and its instructions for completion in force at the time of the accident, nor the AMC1 NCO.GEN.150 subpart of Easy Access Rules for Air Operations issued by the EASA specify whether the flight time of the aircraft should be indicated in airborne time or in block time. This creates a situation where not only is it not clear to aircraft operators which time of flight to record, but also, even when using the same aircraft, several aircraft operators may record and assess flight time differently in the same aircraft logbook. Therefore, for the sake of clarity, at what time should the logbook be completed:

Safety recommendation no. SR-2022-A-02

It is recommended that the European Union Aviation Safety Agency assesses and determines the time at which the aircraft's flight time should be recorded in the aircraft logbook, whether it should be the airborne time or the block time.

2.4.2. Fuel consumption between last refuelling's

From the penultimate refuelling to the last refuelling the aircraft performed four flights with a total duration of 8 hours 30 min. The POH states that the maximum flight time with full main and auxiliary fuel cells and at least 45 % power is 7 hours.

As the time of the penultimate refuelling coincides with the time of the first flight, it is not clear whether the aircraft was refuelled before or after the flight. Examiner A, who refuelled the aircraft, could not state when he refuelled. If the aircraft was refuelled after the flight, the flight time of three remaining flights between refuelling would be 5 hours 58 min. This would be consistent with a flight time of 5 hours 54 min. with the main and auxiliary fuel cells fully fuelled and engine 55 % power. Given the purpose of the flights, it is unlikely that the aircraft flew the training flights in this mode. It would also imply that the fuel cells were completely empty after the flights.

The safety investigation did not reveal that the fourth flight of 1 hour 32 min. during this period actually occurred. Although the purpose of the flight was to revalidate qualification of pilot G, no flight plan was submitted for this flight and pilot G did not provide documentary records of proving the flight.

If the aircraft was refuelled before the first flight and the fourth flight was not performed, the flight time between refuelling would be 6 hours 58 min. This flight time would be consistent to the flight time of 7 hours with the main and auxiliary fuel

cells fully fuelled and engine 45 % power. Given the purpose of the flights, it is unlikely that the aircraft flew the training flights in this mode. It would also imply that the fuel cells were completely empty after the flights.

In this context, it is probable that the aircraft was refuelled after the first flight and the fourth flight was not operated. In this case the flight time between refuelling would be 4 hours 26 min. This flight time would be consistent to the flight time of 4 hours 30 min. with only the main fuel cells fuelled and engine 45 % power or with the main and auxiliary fuel cells fuelled and engine 75 % or less power. It is unlikely that the aircraft flew the training flights in the first case mode, which would also imply that the aircraft would have landed after the flights with completely empty fuel cells.

Taking all this into account, the aircraft could only have flown the second and third flights from the penultimate refuelling to the last refuelling, i.e., 4 hours 26 min. This would meet the objectives of the training flights and the average fuel consumption specified in the POH. In any case, on the penultimate occasion, as on other occasions, the aircraft's fuel cells must have been empty or nearly empty, when the aircraft was refuelled. This indicates that it was not the first time that a flight has been completed with empty fuel cells. Otherwise, all records of flight hours and refuelling of the aircraft may be questioned in total.

2.4.3. Fuel quantity on the day of the accident

The aircraft was last refuelled with 180 l of fuel. In general aviation it is common practice to refuel to full tanks, so it is likely that the main fuel cells have been fuelled. Adding 6 gal or 22,72 l of unusable fuel, the total amount of fuel in the main fuel cells must have been at least 203 litres. Although the full rated capacity of the main fuel cells should have been 60 gal or 227 l, the POH indicates that due to several factors including aircraft attitude while refuelling, many fuel cells do not hold their full rated capacity. Therefore, the fuel in the main fuel cells should have been between 203 l and 227 l.

2.4.4. Fuel consumption on the day of the accident

After the last refuelling, it was only flown on the day of the accident. The block flight time for the first flight on the day of the accident was 2 hours 19 min. and the airborne flight time was 1 hour 52 min. The block flight time for the second flight was 1 hour 43 min. and the airborne flight time was 1 hour 33 min.

During the first flight the airborne flight time of the aircraft with the landing gear retracted from EYKS to EYKA was about 15 minutes. The landing gear is extended for both the landing and the low pass. Therefore, the crew had to notice that the landing gear is not extending during the preparation for the landing or low pass at EYKA. If the landing gear does not extend in the main mode, it is therefore logical to try to extend the landing gear manually as early as possible in order not to postpone it to the end of the flight and to use all the possible remaining flight time to solve the problem. Therefore, it is likely that the landing gear was extended manually prior to the low pass at EYKA. The test flight report indicates that the actual fuel consumption with retracted landing gear is 50 l/h and with the landing gear extended is 60 l/h, i.e., a 20 % increase in fuel consumption when landing gear is extended. Therefore, with an average fuel consumption of 50 l/h, the fuel consumption during the first flight from EYKS to EYKA should have been 12,5 l. The subsequent flight with the landing gear extended lasted 1 hour 37 min. and with an average fuel consumption of 60 l/h the fuel consumption from EYKA to return to EYKS should have been 97 l. The total fuel consumption for the first flight should have been 109,5 l. The second flight was supposed to use 93 l of fuel.

The total fuel consumption for both flights should have been 202,5 l, or almost all the fuel in the 204,4 l main fuel cells, without the unusable fuel. This is also 22,5 l more than the amount of fuel fuelled on board before the flights.

The block flight time on the day of the accident was 4 hours 2 min. and the airborne flight time was 3 hours 25 min. It is therefore necessary to estimate that 37 min. were spent on starting the aircraft engines, warming up engines before each flight, checking, taxiing, waiting on taxiway B (bravo), and etc. Fuel was also used during this time. The POH does not indicate the fuel consumption from the start of the engines to the take-off (start-up, warm-up, checking, and taxiing). It can be assumed that the fuel consumption from engine start-up to take-off would be 10 % of the average hourly fuel consumption, which would be 1,6 gal (0,8 gal per engine). For two flights, approximately 3,2 gal or 12 l of fuel would be required.

The total fuel consumption for both flights should have been at least 214,5 l. Estimating that the capacity of the main cells is 204,4 l, this means that the unusable fuel on board (22,72 l), which can be used during the aircraft's level flight, was also used. Without underestimated the full rated capacity of the fuel cells, there could have been approximately 12,5 l of fuel remaining in the main fuel cells of the aircraft.

After the accident, the fuel cells selectors switches were in positions of the main fuel cells. About 2 l of fuel were collected from the right main cell and about 2,3 l was recovered from the right auxiliary cell. From the left main and auxiliary cells together was collected 16,4 l, but it is likely that not all the collected fuel was in the left main cell. Therefore, the collected amount of fuel was less than the unusable fuel capacity of the main fuel cells, which is 11.36 l each. A total of 20.7 l of fuel was collected.

2.4.5. Fuel consumption planning

Before each flight the crew was required to make the required fuel quantity report and to control (monitor) the amount of fuel on board and its consumption during the flights. There was no evidence that prior to the first and second flights, the crew calculated the minimum fuel required for the flights as specified in paragraph 2.4.1 of the OM, and that they had made the minimum required fuel quantity report as specified in paragraph 5.39 of the OM.

The safety investigation did not reveal any evidence of the use of pre-arranged e-forms. In addition, the EYKS did not have the possibility to print the e-forms and the ATO documentation did not foresee the use of an electronic flight bag during the flight. It should be noted that even if the e-forms were prepared in advance, there would still have been no preparation for the actual flights as the actual flights were different from the training programme.

The lack of preparation or inadequate preparation is confirmed by the fact that after the accident, only the navigation plan for the second flight was found, which did not comply the format specified in paragraph 5.11 of the OM. It also did not include a column indicating the actual fuel consumption of the aircraft at each point along the route. To train students and develop their skills, it is necessary to monitor the fuel consumption during the flight (how much has been used and how much is left) and to record in the navigational flight plan the actual amount of fuel at each point along the route. If the crew had monitored the fuel used, the fuel remaining and the fuel required to complete the flight, they would have been able to notice that the aircraft was running out of fuel. It should also be noted that the increase in fuel consumption due to the flight with the landing gear extended was not taken into account.

The POH states that the fuel level must be visually checked before the flight. Even if the crew has checked the fuel cells, it is still necessary to calculate the amount of fuel required for the flights. In addition, the fuel indicating system may indicate a full or empty fuel cell due to electrical or mechanical malfunctions. Therefore, if the fuel level is not visually determined, the readings of the gauges have no value.

Under the requirements of paragraphs 3.5.1, 5.11 and 5.39 of the OM, the minimum amount of fuel for the second flight should have been calculated as follows: for 1 hour 45 min. of block flight time – 105 l; 10% for contingency – 11 l; for approximately

30 min flight to the alternate aerodrome (EYKA or EYVI) – 30 l; for 45 min reserve – 45 l. The total fuel on board for the second flight should have been 191 l or full main cells. Therefore, without refuelling after the first flight, there was insufficient fuel left for the second flight. Consequently, before the second route flight, the main fuel cells of the aircraft were not fully filled, the recommendation of paragraph 3.5 of the OM to start cross country flights with full fuel cells was not implemented.

The aircraft logbook did not contain the mandatory entries on the amount of fuel added to the aircraft, the amount of fuel in the aircraft prior to each flight as was specified by the national aircraft logbook and its instructions for completion. AMC1 NCO.GEN.150 subpart of Easy Access Rules for Air Operations issued by the EASA does not specify that the aircraft logbook shall indicate the amount of fuel fuelled and the amount of fuel on aircraft prior to each flight. Nevertheless, and for pilots to estimate not only the fuel required for the flight and whether this will result in the maximum take-off mass and balance being exceeded, but also to be aware the amount of fuel fuelled and the amount of fuel on aircraft prior to each flight:

Safety recommendation no. SR-2022-A-03

It is recommended that the European Union Aviation Safety Agency assesses and, if necessary, determines the requirement that the amount of fuel fuelled and the total amount of fuel on aircraft prior to each flight would be indicated in the aircraft logbook.

On 2021-06-01 the Lithuanian Transport Safety Administration repealed the CAA Order No. 4R-11 of 2003-02-10 'On the Aircraft Logbook', which approved the aircraft logbook and its instructions for completion applicable to general aviation. However, the national aircraft logbook contributes to improving the safety culture of general aviation aircraft operators and therefore:

Safety recommendation no. SR-2022-A-04

It is recommended that the Transport Competence Agency assess whether it is appropriate to have a national aircraft logbook form for general aviation aircrafts and, if necessary, take measures, in cooperation with other authorities, to approve the form of the aircraft logbook and the instructions for its completion.

2.4.6. Fuel consumption control

The ATO did not have a fuel management process and did not monitor fuel consumption, refuelling and fuel consumption. The ATO allowed the instructor and examiner A to decide independently on all matters related to the refuelling of the aircraft.

As fuel consumption was not managed, the requirement to fill an aircraft logbook with the mandatory entries of the amount of fuel fuelled and the total amount of fuel on aircraft prior to each flight was not complied with; during the assessment period, out of the 17 refuelling times 10 refuelling times coincided with the flight time of the aircraft; the ATO fuel was also used for the instructor's private flights; it was not known whether the training flights were actually performed and how much fuel was used; the average fuel consumption was not clear; the total amount of fuel on board before each flight was not known; the fuel consumption was not planned and reports on the minimum amount of fuel required for the flight were not prepared; and etc. To better manage fuel consumption in the future:

Safety recommendation no. SR-2022-A-05

It is recommended that the approved training organisation 'Pilotų mokykla' establish requirements for the fuel consumption management.

2.5. Decision making

2.5.1. Decision to continue the flight

During the first flight, 19 minutes after the low pass at EYKA and on approach to EYPI, the instructor telephoned pilot A to inform him that the landing gear could not be extended in the main mode and to ask if pilot A is at EYMO. The instructor may not have been expecting technical assistance from pilot A for the first time and intended to make an emergency landing at EYMO. However, upon knowing that pilot A was not at EYMO, the instructor made the decision to continue the flight according to the submitted flight plan and with inoperative landing gear.

Due to inoperative landing gear, the crew did not take the decision to land immediately at EYKA, return to EYKS, or fly to EYVI, where the CAMO which was performing maintenance of the aircraft were based.

Paragraph 2.7 of the OM states that a flight shall not be commenced when any of the aircraft instruments, items of equipment or functions required for the intended flight are inoperative or missing. However, there is no indication of what to do if instruments, items of equipment or functions required for the intended flight is inoperative during flight. The ATO documentation did not specify an immediate landing at the nearest aerodrome in the event of an emergency extending of landing gear or inability to retract the landing gear after take-off. Such a situation and action are also not described in the POH.

Safety actions

After the accident, the ATO specified in the ATO Manual the methodology to be used by the flight crew to make decisions in the event of an emergency situation.

2.5.2. Decision to continue training flights

The student did not live and work in Lithuania and could only come to Lithuania at weekends to train for MEP and ME/IR ratings and CPL licence. The student had 5 flight hours remaining from the CPL course and skill test for the CPL licence. This would have completed all the student's training to obtain a CPL license. All these remaining flights had to be carried out in an aircraft certificated for the carriage of at least 4 persons and have a variable pitch propeller and retractable landing gear. The Piper PA-30 met these requirements and was the only aircraft of that type in the ATO available for the completion of the CPL course and to pass the CPL license.

The ATO was undertaken to provide the student with 15 hours of training and a 1 hour 30 min. examination for the Commercial Pilot Licence CPL(A) to 2019-12-31. As the student could only come to Lithuania on weekends from the date of signing the contract, there were only two weekends to complete the flights before the contractual deadline (December 14-15 and 21-22).

To repair the landing gear release mechanism, the aircraft would have had to be transported to Vilnius, where the maintenance organisation was based. Due to the unknown cause of the failure of landing gear retraction mechanism, it was also not known how long it might take to repair the aircraft. In addition, all remaining flights were to be conducted in accordance with visual flight rules. In Lithuania, during the winter, there are rarely suitable meteorological conditions for flights according to visual flight rules, because usually the cloud base is too low, the visibility is too low, precipitation prevails (rain, fog, snow, etc.), icing conditions occur, etc.

Therefore, it is likely for these reasons, it was decided to continue the training flights, and no one was notified about the inoperative landing gear retraction mechanism, even though the paragraph 1.3.10 of the OM indicates that the instructor must ensure that the aircraft is in decent condition after each flight and immediately report any malfunction. The instructor was also undertaken to report to the CAMO all

defects detected during the operation of the aircraft and all events and defects that endanger flight safety. The defects were to be recorded in the aircraft logbook. Under the Part M.A.403 of Annex I (Part M) of Commission Regulation (EU) No 1321/2014 on the continuing airworthiness of aircraft, only the maintenance organisation could decide whether an aircraft defect hazards seriously the flight safety and therefore decide when and which rectification action shall be taken before further flight and which defect rectification can be deferred.

2.5.3. Decision to take the exam

The first flight plan submitted by the instructor indicates that the pilot-in-command was the instructor himself. The second flight plan submitted by the instructor at 11.50 hrs indicated that the pilot-in-command is examiner A. Immediately afterwards, at 11:52 hrs the instructor last time edited his electronic pilot logbook indicating that the second flight was a 'CPL exam' and that the crew were the student and examiner A. The instructor also indicated in his electronic pilot logbook that on 2019-12-08 he flew with the student 2 hours and on 2019-12-07 he flew with the student 3 hours. However, no training flights took place on 2019-12-07, because the instructor had informed the student by phone that the training flights would take place only on 2019-12-08, which is why the student arrived in Lithuania late in the evening on 2019-12-07. Such untrue 3 hours training flight on 2019-12-07 was recorded because the remaining 5 flight hours were required to obtain a CPL license. All these training flights were supposed to be performed on 2019-12-08, but due to the unexpected failure of landing gear retraction mechanism, the decision was taken to conduct the exam and make the untrue entries in the documentation.

Safety actions

After the accident, the TKA established a new position and employed an examiner inspector, who periodically inspects and assesses the work of the flight examiners to ensure that the exams are actually taking place. Also the TKA is developing a procedure for checking examiners and reporting them of scheduled flight exams, which the TKA expects to approve in the near future.

The ATO did not provide evidence that it planned, organised, and communicated the Piper PA-30 flight exams.

The instructor and examiner A were good friends. In essence, apart from the instructor, the only person who flew the Piper PA-30 was examiner A, who examined the instructor's students. Also, examiner A examined the instructor and the instructor examined examiner A. On the day of the accident, the instructor and examiner A spoke on the telephone four times. The conversations also focused on student examinations. Despite the inoperative landing gear retraction mechanism, the instructor and examiner A agreed to conduct the exam without notifying the ATO and falsely stated in the documents that the exam was conducted by examiner A and did not fear that the ATO could object to the designation of examiner A, control the flight documents and the instructor and examiner A working hours. All this shows that the decisions regarding the students' exams on the Piper PA-30 aircraft (the date, the time, and the designation of the examiner) were not made by the ATO, but by the aircraft owner/instructor and examiner A personally.

There is no evidence that this process has been controlled by the ATO or by the competent authority TKA. Although the part ARA.FCL.205 of Annex VI, paragraph ARA.FCL.205 of Commission Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew states, that the competent authority shall develop procedures to designate examiners for the conduct of skill tests, but the TKA did not and has not developed the procedures to designate examiners for the conduct of skill tests. The TKA had only published a list of all the examiners, from which the approved training organizations themselves choose the examiners and decided on their appointment.

The absence of a procedure for the designation of examiners for the skills test and no control process allowed the instructor and examiner A to decide on the examination. The absence of a procedure for designating examiners was also appropriate for the ATO themselves, as they avoided additional costs in planning and organization. In view of this:

Safety recommendation no. SR-2022-A-06

It is recommended that the Transport Competence Agency develop procedures to designate examiners for the conduct of skill tests as specified in part ARA.FCL.205 of Commission Regulation (EU) No 1178/2011.

To avoid closed groups of individuals, non-transparent processes for the designation of examiners and conflicts of interest, and to ensure greater transparency and trust in the designation of examiners:

Safety recommendation no. SR-2022-A-07

It is recommended that the Transport Competence Agency consider the possibility that the competent authority Transport Competence Agency designates or participates in designations of the examiners for the conduct of skill tests, and where appropriate, set the necessary requirements.

2.5.4. Decision to perform a touch and go landing

At 13:45 hrs, 3 minutes before landing, the crew contacted the EYKS Flight Coordination Centre and reported that they were flying from the compulsory reporting point ELEKA and approaching to land on runway No. 27. This was the last transmission from the crew. The crew did not indicate what they planned to do after landing: either a touch and go or a full stop landing. At 13:47 hrs the aircraft landed on the runway. The landing was performed well and there was no apparent reason why the crew would have been forced to abort the landing and take-off again. There was sufficient runway length for the aircraft to stop safely. In the absence of any flight planning documentation, it is unclear whether the decision to take-off immediately after landing was taken as planned or was made spontaneously.

At an airspeed speed of approximately 90 knots, the notification to the EYKS Flight Coordination Centre was made about 4.5 miles or 8-9 km from the runway threshold, approximately at the compulsory reporting point ULKIL (point 2, Fig. 2). Meanwhile, the usual glide for visual flight rules flights is about 1.5 miles. It is likely that the crew met the deterioration of the weather conditions observed at EYKS aerodrome between 13.20 and 13.40 hrs. As a result, the crew did not decide what to do – the touch and go or the full stop landing. It is also possible that the crew did not report the approach because the radio recordings of the EYKS would be recorded the touch and go or landing in meteorological conditions below the visual meteorological conditions required by the visual flight rules.

2.5.5. Decision to simulate engine failure

The flight schedule provided for a simulated engine failure during take-off and after take-off, but in the absence of any documentation on flight preparation, without knowing what exercises were carried out and why the decision was taken to perform touch and go landing and without announcing the intended action, the simulation of a single engine failure cannot be ruled out or confirmed.

To climb with a multi-engine aircraft with one engine inoperative, it is necessary to retract the landing gear, to retract the flaps, to feather the propeller of the simulated or inoperative engine, and the operative engine must be operating at maximum power. Therefore, the potential simulation of a single engine failure with the not retracted landing gear raises issues of instructor proficiency, exceeding aircraft limitations, and non-compliance with safety requirements.

Also, if the loss of climb and the deviation to the right side after the landing were related to a single-engine failure simulation by the instructor, the situation was further complicated by the fuel starvation. The crew could not understand that the aircraft could run out of fuel during the single-engine simulation and were not prepared for such an unexpected situation.

2.5.6. Decision to climb

When the engine became inoperative, the crew may have had difficulty to feather the right propeller because the propeller was charged with three times less than the required air charge pressure, or the crew did not attempt to feather the propeller(s) and tried to restart the engine(s). Perhaps the crew was hoping to do something to quickly restore power, or perhaps they got distracted trying to understand why the power was lost and feathering the propeller. Due to the extended landing gear and not feathered propeller(s), the aircraft's drag increased and was lost control.

An aircraft with a fuel injection system takes an appreciable length of time to start after fuel starvation. The PA-30 Twin Comanche Owner's Handbook recommends avoiding emptying a fuel cell to depletion. If the engine should stop because a fuel cell is depleted of fuel, be prepared to wait a while for the engine to start after changing to a fuel cell with fuel in it.

Neither the POH nor the OM provides the actions to be taken by the crew after take-off in the event of insufficient engine thrust (s) and inability to climb. Therefore, the crew attempted to climb, as specified in the Section 3 Emergency Procedures of the POH – Engine failure during take-off and in the part 3.8.31 of the OM – Engine failure after lift-off – return for landing to the airport or to land in suitable landing area. In this context, the crew attempted to climb until the stall speed was reached, which is higher with the extended landing gear than with the retracted landing gear due to the higher drag. The POH only states stall speed of 60 KIAS with full flaps and landing gear extended. The stall speed with only extended landing gear is not specified. Normally, Flight manuals do not specify stall speeds with flaps retracted and landing gear extended because, as the aircraft designer and manufacturer stated, the flying with fully extended landing gear would be an abnormal flight condition and there is no performance data specific to this configuration.

The OM did not contain checklists and flight circles diagrams with both engines and one inoperative engine. Nor are there procedures for pilots to act in the event of insufficient climb after take-off in the event of inoperative of one of the engines, or in the event of insufficient thrust of both engines. Therefore, the crew was not prepared for this situation and was not prepared to take the appropriate correct action: to reduce the pitch angle to maintain the airspeed V_{YSE} and to make an emergency landing on the airfield at minimum rate of descent. Due to the crew's incorrect decision to continue the take-off with insufficient thrust on the engine(s) and inadequate response to the inoperative engine(s), the airspeed was reduced, and the control of the aircraft was lost. In this context:

Safety recommendation no. SR-2022-A-08

It is recommended that the approved training organisation 'Pilotų mokykla' establish procedures for pilots in the event of inadequate climb after take-off in the event of failure of one of the engines, or in the event of insufficient thrust of both engines.

2.6. Flight organisation

2.6.1. Flight planning

The ATO accidental day flight planning and flight operations do not comply with the exercise descriptions of the CPL modular syllabus, with inconsistencies in flight times, exercise durations and descriptions. The planned training flights and the

actual flight sequence are also different, so that it is not possible to understand what flight elements were to be trained on the day of the accident and what the flight duration should have been.

The total duration of the training flights planned by the ATO in the flight schedule was 4 hours, while the duration of the same training flights according to the CPL program exercise description was at least 5 hours. According to the flight plans submitted by the instructor, the first flight was planned to last 3 hours and the second flight 1 hour 30 min., for a total of 4 hours 30 min. The actual duration of the first flight was 2 hours and of the second flight until the accident was 1 hour 43 min.

The ATO flight schedule did not include training flight exercises. According to the descriptions of exercises, all flights had to be conducted at the aerodrome circuit and in the area, except for the last exercise – the exam, which must be route flight. In fact, both flights on the day of the accident were route flights. The instructor has the right to increase the number and duration of flights, change the sequence of exercises, etc., but cannot fly in a way not specified in the training program and change all exercises in the aerodrome circuit and area to route flights.

Only, according to the post-accident report of the accountable manager of the ATO dated 2019-12-09, it is known that the accountable manager coordinated the planned training flights of the student with the instructor by phone on 2019-12-06. This indicates that the ATO does not have a flight planning, organisation, and control system. There is also no internal communication between the head of training, the chief flight instructor, and the instructor. There is also no information system for students and instructors. In the ATO, everything is coordinated by word of mouth.

During the audit on 2018-11-23, the TKA also identified findings that students are not provided with training schedules and there is no procedure for the establishment and use of schedules.

The training organisation must plan and control the training process: the student, the instructor, the date of the planned flight, the aircraft itself and the exercise to be performed must be clearly identified. The student and the instructor must know in advance which exercise/training to prepare for. If for any reason the instructor is unable to perform the exercise, he/she may perform another exercise at that time, but with the prior agreement of the training organisation, or cancel the planned flight. The need for flight planning is also specified in point 19 of AMC1 ORA.ATO.230(b) of the Easy Access Rules for Organisation Requirements for Aircrew (Part-ORA).

Safety actions

After the accident, the ATO specified in the ATO Manual that the flight schedule is arranged in electronic document and additionally includes the flight exercise and the scheduled start and end times of the flight. All students are informed of the flight schedule by the flight instructor after he arranges it with the chief flight instructor or head of training.

2.6.2. Flight preparations

After the accident on the aircraft, only the navigational log of the second flight was found, which did not comply with the format specified in paragraph 5.11 of the OM. Neither paper nor electronic filled documents (the navigational log, the required fuel quantity report, the aircraft load sheet) were found as specified in the OM.

The safety investigation did not reveal any evidence of the use of pre-arranged e-forms. In addition, the EYKS did not have the possibility to print the e-forms and the ATO documentation did not foresee the use of an electronic flight bag during the flight. It should be noted that even if the e-forms were prepared in advance, there would still have been no preparation for the actual flights as the actual flights were different from the training programme.

The lack of preparation or inadequate preparation is confirmed by the fact that after the accident, only the navigation plan for the second flight was found, which did not comply the format specified by the ATO.

EYKS, from which the Piper PA-30 was always operated, was not a base aerodrome of the ATO and EYKS could only be used for training of the flight phases, i.e. as an intermediate or supplementary aerodrome. As EYKS was not a base aerodrome, the ATO was not obliged to provide, and did not provide, adequate facilities for flight preparation. Therefore, the student did not have adequate facilities for flight preparation, such as a suitable flight planning room with a computer, printer, document forms (for route, weight and balance, fuel consumption, calculations of the take-off and landing characteristics (performances) of the aircraft, etc.), maps and other items necessary for flights preparation, also the Internet for receiving meteorological and aeronautical information.

It is possible that documents such as calculations of the aircraft weight and balance, fuel consumption, etc. have never been prepared because of the human factor – if there are only two crew members flying (instructor and student), the balance will always remain within the limits, regardless of the amount of fuel in the aircraft, and it does not make any sense to carry out the same calculations every time.

After the first flight, the required documents such as the aircraft logbook, the student pilot logbook and the exercise report sheet were not completed and therefore the requirements of paragraph 1.3.10 of the OM were not met, that the instructor shall teach and monitor the student on the completion of the required documents after each flight.

2.6.3. Flight preparation time

The safety investigation revealed that the crew did not carry out detailed flight preparations. Both before the first and second flight, there was insufficient time for flight preparation and the instructor was unable to pay sufficient attention to both the student's preparation and to the flight preparation itself.

Although the time of arrival of the instructor at the EYKS is not established, the instructor should have been at the aerodrome at 8.22 hrs. It is not known when the student arrived at the aerodrome. At 9.05 hrs the aircraft started to taxi from the hangar of Kaunas Aeroclub towards the runway. Not more than 43 minutes is not sufficient time to prepare for the flight. Normally, at least one hour is required for flight preparation: at least 30 minutes the instructor together with the student had to prepare for the training flight – to assess the meteorological conditions, to discuss the upcoming flight etc., check the student's preparation for the flight and the student's flight documentation (navigational log, fuel calculations, balance calculations, aircraft performances calculations); about 15 minutes the crew had to start preparing the aircraft for the flight: to take it out the aircraft from the hangar and to check it according to the checklist; about 15 minutes the crew had to take seats in the cockpit and start performing procedures before starting the engines, warming them up, setting the radio frequencies, atmospheric pressure, conducting a departure discussion. In principle, it is not possible to reduce the time spent preparing the aircraft for flight, so the preparation and planning of the flight could have taken around 13 minutes. This confirms once again that it was not possible to prepare the necessary flight preparation documents during this short time.

The time between flights should include time to discuss the first flight and time to prepare for the second flight. According to the ATO flight schedule, a time interval of 1 hour was planned between flights. In fact, there were 42 minutes between the first and second flights, which is not enough time to discuss the first flight, complete the necessary documents and prepare for the second flight. Also, during this time, the crew had left the aerodrome by car and could not conduct the flight discussion.

Normally at least 30 minutes are needed for a flight discussion and 1 hour for proper preparation for the next flight.

The OM does not specify the minimum time for pre-flight and post flight operations. The OM states, that the student shall be at the aerodrome at least one hour before the flight commence, unless otherwise informed by the instructor, and the instructor shall ensure that each training session has sufficient briefing and debriefing time. It is not defined what the student is doing at the aerodrome an hour before the flight and when the instructor arrives. In addition, the minimum time to prepare and discuss the flight was left to the discretion of the instructor. Given that the ATO did not assess and check the instructor conducted the training flights, it is not clear how much time the instructor normally allocated for that and how conducted the flight preparation and discussion. One instructor can do the same work for 5 hours and another for 10 minutes and they will both be right. But the training organisation needs to assess the realistic acceptable timeframe in which the instructor should perform his/her to control the flight, rest, and duty times of the personnel.

Accordingly, in accordance with the parts ORO.FTL.110 and ORO.FTL.210 of the Commission Regulation (EU) No 965/2012, in order in the future to ensure that both the instructor and the student to be properly prepared for the flights and will discuss the flights after the flights and to have sufficient time to do so:

Safety recommendation no. SR-2022-A-09

It is recommended that the European Union Aviation Safety Agency establish a requirement for approved training organisations to set minimum periods of time intended for pre-flight operations before the flight and for post-flight operations after the flight.

2.6.4. Meteorological conditions

On the day of the accident, the cloud cover and amount of clouds were variable, cloud cover was from 700 to 1300 feet, and cloud coverage was from few (1-2 oktas) to overcast (8 oktas). The aircraft flew both flights at altitudes up to 3000 ft. Both flights had to be between, above or sometimes in clouds. The total time of both flights was over 4 hours, so the long flights between, over or sometimes in clouds could have tiring the crew but could not have had an impact on the accident.

At the end of the second flight, between 13.20 and 13.40 hrs, there was a deterioration in weather conditions, with reduced visibility to 3900 m, reduced cloud cover to 800-1200 ft or 243-365 m (from scattered to broken) and light rain prevailed. These meteorological conditions were not in accordance with the visual meteorological conditions for the visual flight rules. The crew returning to the EYKS from the direction of Elektrėnai had to meet this deterioration of weather conditions at approximately Žiežmariai - Rumšiškės. It is likely that, due to the deterioration of the meteorological conditions, the crew decided not to fly from the compulsory reporting point ELEKA to EYPR, as indicated in the submitted flight plan, but to return to EYKS. These meteorological conditions could have caused some, and for a short period of time, bothering and stressful for the crew. The student pilot had already passed the test for the ME/IR rating and the instructor had valid ME/IR and IR ratings. In general, the instrument meteorological conditions encountered on the return from the route to the EYKS did not affect the accident.

Later, from 13.40 hrs and at the time of the accident at 13.49 hrs, the improvement in the weather conditions was observed, corresponding to that of Kaunas International Airport at 13.50 EYKA METAR report. During the final approach, touch and go landing and climb, it was overcast (8 oktas) and the cloud cover was about 700 ft or 200 m from the ground. There was also light rain or fog at the time. The wind was about 190° direction and 7 knots speed. These meteorological conditions had no influence on the accident.

2.7. Instructor

2.7.1. Instructor qualification

The instructor held a valid CPL(A) with the appropriate ratings and medical certificate and had sufficient flight experience to conduct pilot training in the CPL (A) modular program including MEP(land) class aircrafts.

Part AMC1 ORA.ATO.230(b) of Easy Access Rules for Organisation Requirements for Aircrew (Part-ORA), published by EASA, states that the training organisation must carry out initial training, refresher training, standardisation training, proficiency checks and upgrading training and standards evaluation of the personnel. During the safety investigation, no evidence was found that the ATO checked and assessed the instructor's piloting skills and flight training methodology. It is also not possible to ascertain whether the instructor has actually participated in standardisation training, refresher training and upgrading training.

The head of training and/or the chief flight instructor of the ATO never checked the instructor's piloting and instructional (flight training methodology) skills in the Piper PA-30, the instructor's training procedures and methodology, and whether they comply with the ATO standards. No planned or unplanned inspections of the instructor's Piper PA-30 flight training were carried out, including the completion of flight and training documentation.

The ATO has presented only instructor assessment report dated 2019-05-07, which stated that the instructor was assessed as 'excellent' and no critical remarks or recommendations for improvement were recorded. The assessment report form presented in paragraph 5.6 of the OM does not specify what is to be assessed, based on which criteria, and does not require the person being assessed to be informed of the results of the assessment and to sign the assessment report. In principle, the format of such an assessment report would be suitable for anyone and for any situation. According to the instructor's electronic pilot logbook, the instructor was physically unable to participate in the assessment on 2019-05-07. The lack of the instructor's signature on the assessment report also indicates that the assessment can be written at any time (e.g. after an accident) without the instructor being present. The instructor must be evaluated while he/she is directly performing the duties and functions of an instructor, i.e., while observing theory lectures or flight instruction. Appropriate entries shall be made in the theory logbook or flight records. In view of all this, the assessment report presented by the ATO does not prove that the instructor was actually assessed.

Although the ATO did not check or assess the instructor, it described the instructor as a highly qualified instructor. No matter how highly qualified or how much flight experience an instructor may have, the training organisation is obliged to assess and check the instructor. Otherwise, the organisation blindly trusts the personnel and does not control him/her, and the personnel who is not controlled feels superior to the rest of the organization, and often tends to relax, act only at own discretion, tend not to follow certain procedures, or follow own personal procedures rather than the organization. This is confirmed by the flights on the accidental day, which revealed that the flights were not conducted in accordance with the procedures of the ATO and did not comply with the principles of safe flying, such as: flight were arranged without sufficient time to prepare and discuss the flights, without preparing and completing all the necessary documentation, flying with extended landing gear, conducting an illegal exam and etc. Also, the planned training flights and the actual flight sequence were different, so that it is not possible to understand what elements of the flight were to be trained and how the training was performed. When the landing gear retraction mechanism became inoperative during the flight, the instructor did not notify the defect to the ATO as required by paragraph 1.3.10 of the OM, and by asking his friend pilot A on the telephone what to do, he showed that

he did not know the actions to take in an emergency. Without checking and assessment of the instructor, was missed opportunity to make instructor aware of his non-compliance with safety rules.

The OM does not specify the frequency of instructor assessment or how often the chief flight instructor must assess the instructor. It is also not specified what should be assessed and according to whom to assess.

The paragraph 4.4 of the OM states that instructor's skills are tested according to FCL.940.FI, therefore no additional checks shall be organised, unless an instructor check is mandatory in the event of an accident or incident. Accordingly, the chief flight instructor may check the instructor only in the event of an accident or incident, or during the revalidation/renewal of the instructor's rating if the chief flight instructor is himself an examiner authorised by the TKA. In principle, this applies to the revalidation/renewal of an FI(A) qualification with an examiner authorised by the TKA. This provision of the paragraph 4.4 of the OM is not consistent with provision of paragraph 1.3.4 of the OM that the chief flight instructor shall closely monitoring all instructors, and he periodically assess them to ensure training is conducted to the approved standards, and with the paragraph 4.2 of the OM that, to attain the desired standardisation of all personnel, both scheduled and unscheduled proficiency checks shall be conducted. This creates a situation with incompatible requirements. The chief flight instructor may check the instructor only in the event of an accident or incident or during the revalidation/renewal of the instructor's rating, but at the same time the chief flight instructor shall closely monitoring all instructors, and he periodically assess them to ensure training is conducted to the approved standards and shall conduct scheduled and unscheduled proficiency checks.

Each training organisation must verify how its instructor adheres to/implements the training standards, training procedures, documentation completion, requirements, standard procedures, etc., set by the training organisation itself. The chief flight instructor shall periodically check the instructor. The periodicity should be specified in the training organisation's documentation and should not be related to the revalidation/renewal of the instructor's qualification. It should be noted that periodic assessment does not necessarily mean that the assessment must be in-flight in all cases, but that the pilot's piloting skills or flight training must be assessed in-flight.

Safety actions

After the accident, the ATO specified in the ATO Manual that the proficiency checks of flight instructors are performed together with the standardization training flight. The proficiency check of flight instructors is valid for a period of 12 months counted from the end of the calendar month when the ATO proficiency check of flight instructors was conducted. In addition, proficiency checks of flight instructors are performed if there has been an accident or incident and such check is required; or if the need for such check arises by decision of the head of training or the chief flight instructor. The standardisation training shall take place twice a year during the scheduled meetings. In addition, each year (once every 12 months) the chief flight instructor, the deputy chief flight instructor or the head of training conducts standardization training flight (by aircraft or simulator) for flight training instructors to standardize flight training methodologies to verify instructors' compliance with the ATO procedures and standards.

Also, the ATO specified in the ATO Manual that the instructor's assessment report was supplemented with assessment criteria and established the requirement to familiarize the assessed instructor with the assessment results and to sign them.

In accordance with paragraph 4.3.1 of the OM, the ATO held official meetings in the spring and before the winter season to discuss flight safety concerning matters, changes in syllabus and manuals and other information. For these official meetings, a list of attendees must be kept in a meeting report, but there was no requirement

for the attendees to sign. Although the ATO provided lists of attendees at both meetings in 2019, which included the instructor, there is no evidence other than these lists that the instructor attended the meetings. According to the instructor's electronic pilot logbook, the instructor could not have physically attended the spring meeting and could only have attended the meeting before the winter season if the meeting took place in the first half of the day. This shows that such attendance lists produced by the ATO and without the signatures of the attendees themselves do not prove that the instructor attended the meetings and was informed of the changes to the training programmes and manuals, as well as flight safety issues, etc.

According to paragraph 4.2 of the OM, the ATO had the standardization procedure described and undertook to organize scheduled and unscheduled meetings, assessments, proficiency checks, safety training and refresher courses for all personnel. There is no evidence that the instructor participated in the standardization procedures, except the list of attendees of the meeting before the winter season, which included the instructor, could only have attended the meeting if the meeting took place in the first half of the day.

On 2019-04-17 the ATO issued a certificate to the instructor stating that the instructor had attend the FI/IRI refresher seminar for flight instructors at the ATO in Vilnius on 2019-04-16 – 2019-04-17, which was signed by the instructor. However, the instructor could not attend in them, because at that time the instructor worked in the ATO B in Spain and was not in Lithuania at the time.

Such unrealistic records by the ATO raise questions as to whether the other records and documents of the ATO are also genuine and whether the standardisation procedures as referred to in paragraph 4.2 of the OM and the recurrent training as referred to in paragraph 4.6 of the OM, in which the instructor last participated on 2019-02-01, have actually taken place. It should also be noted that chapter 4.6 'Initial and multiple personnel training' of the OM provided information only on initial personnel training and did not describe recurrent training. It is therefore not possible to ascertain whether the trainer actually attended the recurrent training.

All this shows that the ATO formally looked at the instructor's familiarisation of documents, standardization procedures, mandatory meetings, refresher training, recurrent training, and so on. It also demonstrates that the instructor was allowed to decide on the training himself without interfering with his activities.

2.7.2. Flight, rest and duty time

At the time of the accident, the instructor was not rested as he did not have the opportunity during the last 24 hours to rest for 12 hours and sleep for 8 hours. On the last night, the instructor had a total of only 8 hours of uninterrupted rest time, which includes about 1 hour 30 min. travel by car in the night from workplace in Vilnius to home, time for breakfast, and time to arrive at the aerodrome in Kaunas.

The safety investigation found that this was not the only case. During the last three months, the instructor's flight and duty time exceeded the set requirements and as a result, the instructor did not have sufficient rest and sleep time.

During the last four days before the accident, the instructor's rest time was less than the required 12 hours, i.e., 8 hours, 11 hours, 7 hours 12 min. and 7 hours respectively. This rest time includes the instructor's travel by car of 1 hour 30 min. in the night from his workplace in Vilnius to his home. In the last three months there were a total of 25 cases where the instructor's continuous rest time was less than 12 hours.

In the last 7 days, the instructor's duty time was 72 hours 3 min., when was set 60 hours. In the last three months there were a total of 43 cases, when instructor duty time exceeded 60 hours in the last 7 consecutive days.

In the last 14 days, the instructor's duty time was 116 hours 44 min., when was set 110 hours. In the last three months, there were a total of 50 cases, when instructor duty time exceeded 110 hours in the last 14 consecutive days.

In the last 28 days, the instructor's duty time was 194 hours 29 min., when was set 190 hours. In the last three months, there were a total of 86 cases, when instructor duty time exceeded 190 hours in the last 28 consecutive days.

Respectively, in the last three months, there were 26 cases when instructor daily duty time was longer than was set 12 hours, 8 cases when instructor daily flight time was longer than was set 8 hours, and 56 cases when instructor flight time in the last 28 consecutive days was longer than was set 100 hours.

The instructor's total flight time with aircrafts was 1132 hours 3 min. in calendar year of 2019, when was set 900 hours.

In the last 12 consecutive months, the instructor's total flight time was 1156 hours 38 min. None of the training organizations where the instructor worked had set a total flight time for 12 consecutive months. For example, part ORO.FTL.210 of the Commission Regulation (EU) No 965/2012 specifies a limit of 1000 hours of flight time for an operator and its crew members.

All of this indicates that the instructor's flight and duty time consistently and significantly exceeded the requirements set by the ATO and, as a result, the instructor did not have sufficient rest and sleep time to rest. The best way to avoid or eliminate fatigue is to get adequate sleep. Sleep gives the body a period of rest and recovery. Insufficient sleep leads to serious physical and psychological problems. Fatigue is one of the most insidious hazards to flight safety because it may not be noticed by the pilot until serious mistakes are made. Fatigue negatively affects pilot evaluation and decision making, which can lead to unjustified risks. This is evidenced by the underestimated risks and decisions taken by the instructor on the day of the accident to fly without using shoulder seat belts, with inoperative landing gear retraction mechanism, to perform an illegal exam, not considering fuel consumption and the increase in fuel consumption due to the extended landing gear, etc. The improper decision to continue the take-off in the presence of inadequate thrust from the engine(s) and the inadequate reaction to the inoperative engine(s) resulted in the loss of control of the aircraft. And even a basic mistake was made before the second flight by entering the wrong month of the day of the flight in the instructor's electronic pilot logbook. All of this shows insufficient rest time, fatigue and distraction.

The instructor provided services (worked) in two training organisations and worked (flew) individually. As the requirements of the two training organizations were different, this created a situation where you could not work full-time in one training organization without wanting to exceed the requirements of another training organization. There are no common international or national requirements for approved training organisations and instructors regarding instructors' duty and rest times. Each approved training organisation may set different and independent requirements for instructors' duty and rest times.

The national competent authority could only impose national requirements that would not apply in other countries. The national requirements imposed would not necessarily be the same as those imposed by competent authorities in other countries. As a result, approved training organisations operating in several countries, such as the ATO B where the instructor worked, could face not only different requirements in the countries in which it operates, but also certain restrictions on its activities or conditions of unfair competition.

The European Union established the common aviation agency EASA to meet the high standards of aviation safety within the Union. This work cannot simply be

targeted at the existing commercial aviation sector but must also focus on the training of those individuals who will manage and improve general aviation safety in the future. In this context, EASA can play an important role in improving the safety of training activities in the member states of the European Union. According to EASA, student pilots must be provided with the same level of flight safety as applies to passengers of commercial air transport. It can be concluded that the activities of the ATO in which the instructor worked did not meet this objective.

Part ORO.FTL of Commission Regulation (EU) No 965/2012 was set the requirements to be met by an operator and its crew members with regard to flight and duty time limitations and rest requirements for crew members. Taking into account that student pilots must be provided with the same level of flight safety as applies to passengers of commercial air transport, and considering that approved training organisations may operate in more than one state:

Safety recommendation no. SR-2022-A-10

It is recommended that the European Union Aviation Safety Agency establish flight and duty time limitations and rest requirements for flight instructors of approved training organizations.

The ATO did not record and monitor the instructor's duty, flight and rest time and did not provide information to other organisations where the instructor was working and did not request relevant information from the instructor and the other organisations where the instructor was working. This was not foreseen in the OM approved by the CAA. The instructor partially kept his own records of duty, flight and rest time, but did not provide the information to the organisations where he worked, although he was undertaken to comply with the established duty and rest time requirements in accordance with the agreement signed with the ATO.

There are no national and international requirements to allow approved training organisations to provide copies of individual records of flight times, duty periods and rest periods to the instructor concerned or to another approved training organisation for an instructor who is or becomes an employee of that organisation. Therefore, the ATO did not have and could not have data on the instructor's flight and duty time at the ATO B and followed the requirements set out in its own OM.

Approved training organisations operating in several states should have the right to receive and the obligation to provide such information:

Safety recommendation no. SR-2022-A-11

It is recommended that the European Union Aviation Safety Agency establish the requirement that upon request the approved training organisation shall provide copies of individual records of flight times, duty periods and rest periods to the instructor concerned or to another approved training organisation for flight instructor who is or becomes an employee of that organisation.

Safety recommendation no. SR-2022-A-12

It is recommended that the European Union Aviation Safety Agency establish the requirement that the flight instructor when undertaking duties for more than one approved training organisation maintain his/her individual records regarding flight and duty times and rest periods and provide each approved training organisation with the data needed to schedule activities in accordance with the applicable requirements.

Taking into account that the national competent authority has to supervise compliance with the established general requirements concerning flight and duty times and rest periods for instructors of approved training organisations:

Safety recommendation no. SR-2022-A-13

It is recommended that the European Union Aviation Safety Agency establish the requirement for the national competent authority to establish requirements for the maintaining and controlling of flight instructors' flight and duty times and rest periods.

Safety recommendation no. SR-2022-A-14

It is recommended that the European Union Aviation Safety Agency establish the requirement for the national competent authority to control how approved training organizations and flight instructors maintain and control the flight instructor's flight and duty times and rest periods.

The OM did not specify how long before the scheduled start of the flight the instructor's duty time for flight preparation to begin and when it ends after the last flight to discuss the flight. The ATO flight schedules do not specify either the beginning of duty time (pre-flight operations) or the ending duty time (post-flight operations). In contrast, the ATO B had a requirement to include 1 hour of pre-flight preparation and 30 minutes of post-flight time. Taking into account that the same instructors may work in the same approved training organisations:

Safety recommendation no. SR-2022-A-15

It is recommended that the European Union Aviation Safety Agency define the requirement, that each approved training organization to have a minimum time period for pre-flight and post-flight duties of flight instructors.

2.8. Safety management

2.8.1. Safety management system

The ATO had a safety management system, which was described in the manuals. This accident just proves that the quality of the safety management system depends not only on compliance with the procedures set out in the manuals, but also on whether information about the risk is reported to the organisation and whether risks are assessed. The proper functioning of the system also depends on the qualifications, competence, and experience of those responsible for its implementation.

One part of the safety management system was the risk management process. The ATO had a risk management log in which new risks were recorded. However, in 2019 the risks identified were the same as those found in the TKA's standard 24-month supervision of the ATO. The fact that the ATO did not assess the risks itself indicates that the risk model presented in the ATO manuals was a formal rather than an active part of day-to-day operations. As a result, the ATO lost the opportunity to assess the risks of its activities and to plan mitigating measures. The lack of attention to risk management and the safety management system itself is also illustrated by the fact that at the time of the TKA's standard 24-month supervision of the ATO, one of the most important positions for safety was that the safety manager's last external training was more than 3 years old, and that the staff member who had conducted the internal training on the safety management system for other staff members had not received external safety management system training himself which would be not older than 3 years. These deficiencies were corrected by the ATO only after it had been identified by the TKA.

However, the ATO, although not carrying out a risk assessment, had opportunities to capture the risks from other parts of the safety management system, e.g., risks could be reported by both instructors and students. Unfortunately, there is no evidence that the reporting system actually worked.

Although it was known that the non-base aerodrome did not have adequate conditions for flight preparation and could not operate from it, no action was taken to make EYKS an aerodrome where flight preparation could take place. Due to the lack of control, the ATO did not know where the flight preparation was taking place, whether the instructors and students had sufficient time before the flight to prepare for the flight and to discuss the flight after the flight, whether all the necessary documentation had been completed prior to the flight, whether the flights were being carried out in accordance with the training plan, and whether the flights had taken place at all. Also, the ATO did not assess the risks arising from independent and uncontrolled refuelling and use of fuel in the non-base aerodrome, thus missing the opportunity to assess the risks associated with flight unpreparedness.

The crew's lack of flight preparation and flight plans also meant that they lost the opportunity to assess the risks of the flight and, and in the event of unforeseen situations, the crew also lost time to properly assess the situation and actions. When the crew encountered a landing gear retraction mechanism failure during the flight and extended the landing gear in an emergency manner, they decided to continue the training flights without assessing the risk that the extended landing gear would lead to a significant increase in fuel consumption and that the aircraft would not be able to climb in the event of inoperative one of the engines. During the flight, both the instructor and the student did not use the shoulder seat belts. The accident was not survivable due to forces of impact into the ground and the safety belts would not have helped, but the non-use of the shoulder seat belts also indicates deficiencies in the flight preparation, non-compliance with safety requirements and a lack of risk assessment. Adequate flight preparation and sufficient time for preparation would have been a typical way to manage a threat and reduce the risk. The ATO has never checked and assessed the instructor's skills and activities. The instructor did not participate in the ATO meetings and refresher seminars, which were probably only formally held. And this may explain why the instructor also did not assess the risks.

No documented risk assessment has been carried out in the ATO regarding the not compliant instructor assessment requirements in the OM, where the chief flight instructor may inspect the instructor only in the event of an accident or incident, or during the revalidation/ renewal of the instructor's rating, while at the same time the chief flight instructor shall closely monitoring all instructors, and he periodically evaluates them. Thus, the safety management system procedures were not used to identify potential risks associated with different procedures. Differences in procedures were also not observed or reported by personnel.

Also, the ATO did not assess the risks related to the examination of the instructor and the persons being examined by him. The instructor examined not only examiner A, but also the head of training and safety manager of the ATO, as well as the staff members of TKA as the competent authority. Such flights and flight tests are not prohibited or restricted, but there is always a risk that a personal conflict of interest may arise in order to pass the flight proficiency test not only on those particular days, but possibly also in the future. The ATO itself should try to avoid such situations of conflicts of interest, which would not allow the personnel of the ATO to assess and question the skills of the instructor.

The idea of a risk management log is that information on all risks is gathered in one place to provide an overall overview and manage the risks in a way that is acceptable for flight operations. The fact that all measures to mitigate the risk were not implemented means that the ATO has not assessed the current level of risk.

The nature of the activity, where the instructor undertook to perform the duties of an instructor and to provide flight training in aircraft under a certificate of individual activity within the ATO and the ATO does not interfere with the instructor's activities, indicates deficiencies in the risk assessment of such activities. The fact that the ATO does not or cannot assess such activities may be considered as a serious deficiency

in the safety management system of the ATO. In practice, this means that such a system places all responsibility for maintaining the required level of safety on one person, the instructor, who is not effectively monitored by anyone. During training flights, the instructor is always the pilot in command. In addition to the training content, the flight format and the exercises to be performed must be designed by this person in such a way that flight safety is ensured at all stages of the flight. Meanwhile, according to the EASA, student pilots must be provided with the same level of aviation safety as passengers in the commercial air transport, which naturally cannot be achieved by the instructor alone.

Taking all this into account, the level of aviation safety in the ATO was deficient, which ultimately resulted in the accident. The basic premise of a safety management system as a safety barrier is that it identifies potential risks and safety deficiencies in an organisation. Therefore, activities in the ATO at all levels must be characterised by the safety awareness necessary to ensure the highest possible level of aviation safety. It can therefore be concluded that the performance of the ATO did not meet this objective.

During the safety investigation, it became clear that the risk related to the service model provided by the instructor was never raised and analysed, even though only 4 of the 39 instructors listed in the ATO were permanent employees of the training organization. The TKA has never requested such a risk assessment either. Therefore, it was not possible to develop and apply remedial action to reduce this risk. Such action had an influence on this accident.

According to the concluded agreements, the instructor was responsible for the maintenance and for the validity of the ARC of the aircraft and had to pay for continuing airworthiness management services. At the same time, the ATO had to pay all the costs of operating the aircraft. In fact, the maintenance and continuing airworthiness management services were paid for by the ATO. In addition, according to the agreement between the ATO and the instructor, the instructor undertook to conclude third-party liability, aircraft and crew insurance contracts, but in fact the insurance certificate was actually drawn up and paid for by the ATO itself. So, once again, there is no order in the ATO – one way is stipulated in the agreements, another is done in practice.

Safety recommendation no. SR-2022-A-16

It is recommended that the European Union Aviation Safety Agency define the requirements and conditions under which flight instructors shall provide services to an approved training organisation if they are not permanent employees of that organisation.

The ATO did not assess the risks associated with the use of aircraft not owned by the ATO. The TKA has never requested such a risk assessment either. Of the 8 aircrafts used by the ATO, only one aircraft belonged to the ATO itself.

Under these conditions, the use of the aircraft is not clear. For example, the ATO paid for the fuel used by the aircraft but did not control the fuel consumption or the flights performed by the aircraft, therefore, the instructor used the ATO fuel for his private flights. On the other hand, the maintenance of the aircraft was the responsibility of the instructor, not the ATO. This leads to a situation where the instructor, as the owner of the aircraft, sees the need to carry out certain work (e.g. replacing fuel floats) but does not do it because he has to pay for it, or looks for a place to do cheaper and does not contact the maintenance organisation. Aircraft malfunctions or technical problems are concealed. The instructor did not report the failure immediately to the ATO as specified in the OM and did not notify the maintenance organization of the failure as he was obligated to do. Also, the CAMO was not previously informed and did not have any data about maintenance work performed elsewhere on the aircraft, although the safety investigation revealed that

such work may have taken place. This led to a situation when the ATO was not responsible for the use of the aircraft and the use of the aircraft for the needs of the ATO was decided not by the ATO itself, but by the instructor. Taking into account:

Safety recommendation no. SR-2022-A-17

It is recommended that the European Union Aviation Safety Agency define the requirements and conditions under which approved training organisations use, control and are responsible for non-owned aircrafts used for training.

2.8.2. Supervision

While the EASA says students of training organisations must be provided with the same level of aviation safety as passengers on commercial air transport, this accident shows that there are deficiencies in the existing systems that need to be corrected in order to achieve this. At the same time, questions are raised as to whether smaller organizations are able to create, maintain and develop safety management systems that are reliably and fully functional. Risk assessment is not an exact science and the assessment of the level of risk of any given factor may vary not only from one organisation to another but also from one assessor to another. The fact that previous flights have been conducted without consequences or incidents is often accepted as evidence that flights are safe.

The TKA is responsible for the application of European Union aviation regulations in Lithuania and must ensure that the operators under its supervision ensure the highest possible level of aviation safety. The initial inspection, which is also carried out at the ATO, verifies that the organisation is able to conduct flight training in a proper and safe manner. The initial inspection and supervision of the TKA could not identify existing risk factors either during the initial inspection or during the ongoing supervision. Although it should be noted that the TKA supervision of the ATO activities revealed some deficiencies, such as the lack of procedures for the establishment and use of training schedules, or the lack of procedures for the supervision, controlling, and ensuring adequate rest and flight times for instructors and students. However, the safety investigation showed that the TKA supervision and inspections could not realistically reflect the actual activities or processes of the ATO. Supervision was largely formal and ineffective, especially due to the lack of human resources at the TKA. At the time of the supervision, the TKA had essentially only two main staff members supervising a total of 17 approved training organisations and 6 declared training organisations. These two main staff had no experience in supervising training organisations and were not able to assess the safety management systems, as they had not themselves received any training in the safety management system. One main staff member participated in the supervision and audits of the ATO and during the supervision period used the services of the ATO and the instructor to revalidate his MEP and ME/IR ratings. With only two main staff members, it is not possible to ensure the interchangeability of staff members in the event of a potential conflict of interest. Therefore, the TKA could not carry out effective supervision of the ATO. All this shows that the TKA did not ensure during its supervision that the ATO it itself certified was operating in accordance with the applicable requirements. Taking into account:

Safety recommendation no. SR-2022-A-18

It is recommended that the Transport Competence Agency assess the need and competence of the necessary human resources in order to carry out supervision and, if necessary, take measures to increase human resources and their competence.

If the ATO is unable to identify such a risk itself through systematic flight safety management, the TKA must have methods to identify and prevent it through regular supervision.

Safety actions

After the accident, the TKA approved the rules for supervision the activities of the operators under its supervision, according to which supervision questionnaires are drawn up in electronic format, including general questionnaire, practical training questionnaire, the safety management system questionnaire, the meeting with the accountable manager questionnaire and the theoretical training questionnaire.

During the safety investigations, deficiencies were found in the activities of the ATO, and the safety investigation is not an audit, therefore, in order for the ATO to meet the requirements set for it, TKA, as a supervisory authority, must properly assess the ATO activities.

Safety actions

After the accident, the TKA shortened the supervision cycle of the ATO from two to one year and performed two major audits in 2020 and 2021.

3

CONCLUSIONS

3.1. Findings

Operational aspects

1. The student was properly qualified and entitled to take the CPL(A) modular programme.
2. The instructor was properly qualified and entitled to conduct pilot training on the CPL(A) modular syllabus, including the MEP land class.
3. The EYKS was not a base aerodrome of the training organisation, it did not have the conditions for flight preparation and flights could not be conducted from it.
4. There is no evidence that the crew prepared for the flights.
5. There was not enough time to prepare for the flights.
6. During the first flight, the landing gear retraction mechanism became inoperative and the aircraft's landing gear was extended in an emergency manner.
7. The crew made the decision to continue flights, although flights could not be performed due to inoperative and extended landing gear in an emergency manner.
8. The crew did not consider the increase in fuel consumption due to the extended landing gear and that the aircraft would not be able to climb in the event of one engine becoming inoperative.
9. The loss of power of both engines after take-off occurred due to fuel starvation.
10. When the engine stopped due to starvation of fuel it was not possible to climb with the extended landing gear and not feathered the propeller of inoperative right engine.
11. Perhaps the crew was hoping to do something to quickly restore power, or perhaps they got distracted trying to understand why the power was lost and feathering the propeller. Due to the extended landing gear and not feathered propeller(s), the aircraft's drag increased and was lost control.
12. The crew tried to climb by instinctively increasing the upward pitch angle until the aircraft reached the critical angle of attack. Above the critical angle of attack occurred a stall which caused the aircraft to pitch sharply downwards.
13. In the case of a single-engine simulation, the crew may not have realised that the aircraft had run out of fuel and may not have been prepared for an unexpected situation.

14. There were no described crew actions after take-off in the event of insufficient engine thrust (s) and inability to climb.
15. The compact nature of the accident site and the relatively intact airframe of the aircraft indicates a low speed at the time of impact with a steeply inclined flight path. These are all indications of an incipient left spin.
16. At the time of the impact the left engine had low power and the right engine had no power at all.
17. The crew were fastened in with two-point lap seat belts. The shoulder seat belts were not used.
18. The accident was not survivable due to forces of impact into the ground.
19. The aircraft was at too low an altitude above the ground to allow the crew to recover the aircraft from its initial spin.
20. All transmissions of the crew were entirely routine, the crew seemed calm and collected and there were no unusual background noises on the transmissions.

Technical aspects

21. The aircraft had a valid registration certificate, airworthiness certificate and airworthiness review certificate, and mandatory scheduled maintenance was performed.
22. No defects were identified within the aircraft flight control or fuel systems that directly contributed to the accident before the impact on the ground and there was no evidence of a pre-impact mechanical failure within either engine or propeller or their associated control systems.
23. The aircraft has been fitted with different models of propellers, which should not be intermixed.
24. Neither the maintenance organisation nor the CAMO identified that the propellers were different models
25. The right propeller was always charged with more than three times less air pressure, which may have affected its ability to feather.
26. CAMO was not informed of the installation of the Garmin G5 in the aircraft's instrument panel and had no record of it.
27. During the period of controlled environment, the CAMO was not informed and did not have data on the aircraft maintenance being performed elsewhere.
28. The fuel floats of all fuel cells were not adjusted properly.
29. The fuel senders of three fuel cells did not operate properly.
30. The aircraft's electrical wiring contained many splices and different joints.
31. Due to incorrectly adjusted floats, incorrectly operated fuel senders and incorrectly condition of wiring, the fuel quantity gauges should have shown full fuel cells.
32. The aircraft has been fitted with extraneous equipment of fuel system, that does not comply with the aircraft type certificate.
33. The technical condition of the fuel quantity indicating system was not in accordance with the requirements and was not checked as specified in the ASM.
34. The landing gear retraction transmission motor did not work due to a burnt rotor.
35. The aircraft was not in compliance with relevant airworthiness requirements and the type certificate and could not be issued an airworthiness certificate.

Fuel management

36. The aircraft logbook did not contain the mandatory entries on the amount of fuel added to the aircraft, the amount of fuel in the aircraft prior to each flight and the tachometer readings of the aircraft.
37. The training organisation did not have a fuel consumption control process in place and did not control fuel consumption.
38. During the assessment period, out of the 17 refuelling times 10 refuelling times coincided with the flight time of the aircraft.
39. During the assessment period, there were three cases when the aircraft was flown without refuelling beyond its maximum flight time.
40. During the assessment period, based on the fuel consumption of the aircraft and the flight hours flown, the average fuel consumption per block flight hour was one third lower than indicated in the POH.
41. There is no evidence, that before the factual flights the minimum fuel required for the flights was calculated and the minimum required fuel quantity report was made.
42. There was no evidence of how the flight crew controlled (monitored) the amount of fuel in the aircraft and its consumption during the flight.
43. Before the last refuelling, the aircraft's fuel cells should have been empty or nearly empty.
44. After the last refuelling, the main fuel cells should have contained between 203 l and 227 l of fuel.
45. Before the second cross-country flight, the aircraft's main fuel cells had to be fully filled. Because this was not done, there was too little fuel left for the second flight.
46. The total fuel consumption for both flights should have been at least 214,5 l. Considering that the capacity of the main cells is 204,4 l, this means that the amount of the unusable fuel on board (22,72 l), which can be used during the aircraft's level flight, was also used.
47. After the accident, a total of 20.7 l of fuel was recovered. The collected fuel amount 1212 in the cells were less than the amount of the unusable fuel of the aircraft.
48. The small amount of fuel was found in the fuel system of the left engine compartment only from the fuel pump to the fuel distributor valve. No fuel at all was found in the fuel system of the right engine compartment.

Organizational aspects

49. In the last 24 hours the instructor did not have 12 hours to rest and 8 hours to sleep, so the instructor was not rested at the time of the accident.
50. During the last three months, the instructor's flight and duty time exceeded the set requirements, so the instructor did not have sufficient rest and sleep time.
51. The training organisation did not record and monitor the instructor's duty, flight and rest time and did not provide information to other organisations where the instructor was working and did not request relevant information from the instructor and the other organisations where the instructor was working.
52. The instructor partially kept his own records of duty, flight and rest time, but did not provide the information to the organisations where he worked, although he was undertaken to comply with the established duty and rest time requirements.

53. There are no common international or national requirements for approved training organisations and instructors regarding instructors' duty and rest times.
54. There are no national and international requirements to allow approved training organisations to provide copies of individual records of flight times, duty periods and rest periods to the instructor concerned or to another approved training organisation for an instructor who is or becomes an employee of that organisation.
55. The flights on the day of the accident did not comply with the training programme.
56. The crew made the decision to conduct the exam, even though the instructor did not have right to examine the student.
57. There is no evidence that the training organisation coordinated the date and time of the exams with the aircraft owner, the examiner and the student.
58. The absence of a procedure for the designation of examiners for the skills test and no control process allowed the instructor and examiner A to decide on the examination.
59. There is no evidence that the examination process has been controlled by the training organisation or by the competent authority TKA.
60. The TKA did not have and does not have procedures to designate examiners for the conduct of skill tests as specified in part ARA.FCL.205 of Annex VI of Commission Regulation (EU) No 1178/2011.
61. The training organization did not check and assess the instructor's skills and activities.
62. The instructor did not participate in the training organisation's meetings and refresher seminars, which were probably only formally held.
63. The training organization issued the FI/IRI certificate to the instructor, although the instructor did not participate in refresher seminar.
64. The instructor, together with his aircraft, provided instructor services to the training organisation under a certificate of individual activity.
65. The risk related to the service model provided by the instructor was never raised and analysed.
66. There were no defined requirements and conditions under which instructors shall provide services to an approved training organisation if they are not permanent employees of that organisation.
67. Risks associated with the use of aircraft not owned by the training organization were not assessed.
68. There were no defined the requirements and conditions under which approved training organisations use, control and are responsible for non-owned aircrafts used for training.
69. The risk model presented in the training organization's manuals was a formal rather than an active part of day-to-day operations.
70. The activities of the training organization did not ensure the same level of aviation safety for student pilots as for passengers of the commercial air transport category.
71. TKA supervision and inspections could not realistically reflect the actual activities or processes of the training organisation.
72. TKA supervision was largely formal and ineffective, especially because during

the supervision the TKA had essentially only two key staff members performing supervision, who did not have experience in supervising training organisations and were not in a position to assess the safety management systems of the training organisations, as they had not themselves received any training in the safety management system.

3.2. Cause factors

- The crew lost control of the aircraft after the aircrafts' engines lost power one after the other and, with the landing gear extended, the aircraft reached a critical stall speed, which caused the left spin of the aircraft. Due to insufficient height and time, it was not possible to avoid impact with the ground.
- The control of the aircraft was lost due to the continued climb by increasing the upward pitch angle with insufficient thrust on the engine(s) and inadequate response to the inoperative engine(s) and extended landing gear.
- Both engines lost power due to fuel starvation caused by mismanagement of fuel consumption and a malfunctioning fuel quantity indicating system.

3.3. Contributory factors

- The aircraft was not in compliance with relevant airworthiness requirements.
- The instructor did not have enough rest and sleep time and was not rested.
- The crew was not prepared for the factual flights and did not assess the risks of the flight.
- The training organization did not assess the instructor's skills and activities.
- The level of aviation safety in the training organisation was deficient.
- The TKA did not ensure during its supervision that the training organisation it itself certified was operating in accordance with the applicable requirements.

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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 no. SR-2022-A-01

It is recommended that the approved continuing airworthiness organisation JSC 'ELSA' review and renew its procedures to ensure that the Airworthiness Review Certificate is valid when it is issued.

Safety recommendation no. SR-2022-A-02

It is recommended that the European Union Aviation Safety Agency assesses and determines the time at which the aircraft's flight time should be recorded in the aircraft logbook, whether it should be the airborne time or the block time.

Safety recommendation no. SR-2022-A-03

It is recommended that the European Union Aviation Safety Agency assesses and, if necessary, determines the requirement that the amount of fuel fuelled and the total amount of fuel on aircraft prior to each flight would be indicated in the aircraft logbook.

Safety recommendation no. SR-2022-A-04

It is recommended that the Transport Competence Agency assess whether it is appropriate to have a national aircraft logbook form for general aviation aircrafts and, if necessary, take measures, in cooperation with other authorities, to approve the form of the aircraft logbook and the instructions for its completion.

Safety recommendation no. SR-2022-A-05

It is recommended that the approved training organisation 'Pilotų mokykla' establish requirements for the fuel consumption management.

Safety recommendation no. SR-2022-A-06

It is recommended that the Transport Competence Agency develop procedures to designate examiners for the conduct of skill tests as specified in part ARA.FCL.205 of Commission Regulation (EU) No 1178/2011.

Safety recommendation no. SR-2022-A-07

It is recommended that the Transport Competence Agency consider the possibility that the competent authority Transport Competence Agency designates or participates in designations of the examiners for the conduct of skill tests, and where appropriate, set the necessary requirements.

Safety recommendation no. SR-2022-A-08

It is recommended that the approved training organisation 'Pilotų mokykla' establish procedures for pilots in the event of inadequate climb after take-off in the event of failure of one of the engines, or in the event of insufficient thrust of both engines.

Safety recommendation no. SR-2022-A-09

It is recommended that the European Union Aviation Safety Agency establish a requirement for approved training organisations to set minimum periods of time intended for pre-flight operations before the flight and for post-flight operations after the flight.

Safety recommendation no. SR-2022-A-10

It is recommended that the European Union Aviation Safety Agency establish flight and duty time limitations and rest requirements for flight instructors of approved training organizations.

Safety recommendation no. SR-2022-A-11

It is recommended that the European Union Aviation Safety Agency establish the requirement that upon request the approved training organisation shall provide copies of individual records of flight times, duty periods and rest periods to the instructor concerned or to another approved training organisation for flight instructor who is or becomes an employee of that organisation.

Safety recommendation no. SR-2022-A-12

It is recommended that the European Union Aviation Safety Agency establish the requirement that the flight instructor when undertaking duties for more than one approved training organisation maintain his/her individual records regarding flight and duty times and rest periods and provide each approved training organisation with the data needed to schedule activities in accordance with the applicable requirements.

Safety recommendation no. SR-2022-A-13

It is recommended that the European Union Aviation Safety Agency establish the requirement for the national competent authority to establish requirements for the maintaining and controlling of flight instructors' flight and duty times and rest periods.

Safety recommendation no. SR-2022-A-14

It is recommended that the European Union Aviation Safety Agency establish the requirement for the national competent authority to control how approved training organizations and flight instructors maintain and control the flight instructor's flight and duty times and rest periods.

Safety recommendation no. SR-2022-A-15

It is recommended that the European Union Aviation Safety Agency define the requirement, that each approved training organization to have a minimum time period for pre-flight and post-flight duties of flight instructors.

Safety recommendation no. SR-2022-A-16

It is recommended that the European Union Aviation Safety Agency define the requirements and conditions under which flight instructors shall provide services to an approved training organisation if they are not permanent employees of that organisation.

Safety recommendation no. SR-2022-A-17

It is recommended that the European Union Aviation Safety Agency define the requirements and conditions under which approved training organisations use, control and are responsible for non-owned aircrafts used for training.

Safety recommendation no. SR-2022-A-18

It is recommended that the Transport Competence Agency assess the need and competence of the necessary human resources in order to carry out supervision and, if necessary, take measures to increase human resources and their competence.

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