Runway Excursion during Touch-and-go on Instructional Flight at Lahti-Vesivehmaa Aerodrome on February 7, 2021

L2021-01

FOREWORD

Pursuant to section 2 of the Safety Investigation Act (525/2011), the Safety Investigation Authority of Finland (SIAF) decided to investigate an aviation accident that occurred at Lahti-Vesivehmaa aerodrome on February 7, 2021, when an airplane conducting an instructional flight departed the runway during touch-and-go and came to rest inverted. The purpose of a safety investigation is to promote general safety, the prevention of accidents and incidents, and the prevention of losses resulting from accidents. A safety investigation is not conducted in order to allocate legal liability.

Air safety investigator Juho Posio was appointed the investigation team leader. The appointed team members were Master of Administrative Sciences Jaakko Niskala, flight instructor and test pilot Timo Kostiainen and airline pilot (retired) Kristian Rintala. The investigator-in-charge was Chief Air Safety Investigator Janne Kotiranta.

The safety investigation examines the course of events, their causes and consequences, search and rescue actions, and actions taken by the authorities. The investigation specifically examines whether safety had adequately been taken into consideration in the activity leading up to the accident and in the planning, manufacture, construction and use of the equipment and structures that caused the accident or incident or at which the accident or incident was directed. The investigation also examines whether the management, supervision and inspection activity had been appropriately arranged and managed. Where necessary the investigation is also expected to examine possible shortcomings in the provisions and orders regarding safety and the authorities' activities.

The investigation report includes an account of the course of the incident, the factors leading to the incident, and the consequences of the incident as well as safety recommendations addressed to the appropriate authorities and other actors regarding measures that are necessary in order to promote general safety, prevent further accidents and incidents, prevent loss, and improve the effectiveness of actions conducted by search and rescue and other authorities.

An opportunity is given to those involved in the accident and to the authorities responsible for supervision in the field of the accident to comment on the draft investigation report. These comments have been taken into consideration during the preparation of the final report. A summary of the comments is at the end of the report. Pursuant to the Safety Investigation Act, no comments given by private individuals are published.

The investigation report was translated into English by TK Translations.

The investigation report, its summary, and appendices were published on the SIAF's internet page at *www.turvallisuustutkinta.fi* on 2021.10.12.

Investigation designator L2021-01
Investigation report 8/2021
ISBN: 978-951-836-604-4 (PDF)

Cover photo: Pilot-in-command of accident airplane

CONTENTS

1 EVENTS

1.1 Sequence of Events

1.1.1 Events Leading up to Accident

In the afternoon on Sunday, February 7, 2021, a student pilot and an instructor pilot were conducting an instructional flight in a Cessna 150 airplane. The student first performed two instructor-assisted touch-and-goes on runway 25 at Lahti-Vesivehmaa aerodrome, while for the third touch-and-go, which took place at 1515 h[1] , the student assumed control of the airplane.

Weather was overcast, and the edges of the snow-covered runway were not clearly discernible.

The airplane was crabbed to the right on touchdown. Since the intention was to perform a touch-and-go, the instructor selected the flaps up during the ground run. The student was expecting to hear from the instructor a call to apply power and deselect inlet air preheat for takeoff and failed to notice that the airplane was drifting to the right towards a snowbank bordering the runway. Neither was the instructor, who was monitoring the flap position indicator located above the left door, aware of the drift.

The right mainwheel ran into soft snow; the airplane yawed right, hit the snowbank and exited the runway. It pivoted about the nose and the left wingtip and came to rest in the snow inverted with the nose facing the direction of arrival. The student and the instructor remained suspended from their seat belts. The instructor told the student to switch off electrical power. They unbuckled the seat belts and vacated the cockpit via their respective doors.

Figure 1. The airplane at 1520 h soon after the accident. (Photo: Blue Skies Aviation)

[1] All times are Finnish time (UTC + 2 h).

The safety manager of the flight school, who is one of its instructor pilots, was outside preparing an airplane for an instructional flight with a student. They heard an unusual sound from the direction of the runway and saw an airplane inverted in the snowbank alongside the runway. While they were wading through the snow towards the airplane, the safety manager tried to call other flight school staff of the flight school. He soon saw the student and the instructor standing next to the airplane. Upon reaching the accident site the safety manager ensured that they were uninjured, reached into the cockpit to close the fuel shutoff valve and attempted to verify whether the emergency locator transmitter[2] had activated automatically on impact.

1.1.2 Post-accident Events

Flight school staff members and other persons present at the aerodrome converged at the accident site, some of them driving vehicles. The student and the instructor were taken by car to the flight school's hangar. The instructor soon returned to the accident site.

Several vehicles were parked on the runway adjacent to the accident site, including the flight school's refueling vehicle[3].

Persons present at the accident site disconnected and removed the ELT. They discussed turning the airplane onto its wheels and moving it from the accident site. They removed the spinner[4] lest it should be damaged during the operation.

While the preparations for turning the airplane upright were ongoing, the safety manager called the emergency response center (ERC) at 1532 h, reporting that an airplane had ended up inverted in a snowbank, but no-one was injured. He added that the airplane's ELT had possibly activated.

Soon afterwards, the sound of an approaching airplane was heard. Some vehicles remained parked in the middle of the runway. When the persons on the runway saw the airplane on the extended runway 25 centerline and coming into land, these vehicles were moved to the right-hand edge of the runway.

The pilot of the approaching Diamond DA40 saw people and vehicles on the runway and inquired on the Vesivehmaa frequency what was happening on the runway but received no response.

He judged that the vehicles parked on the runway did not jeopardize a safe landing, continued approach and landed at approximately 1537 h. Only when he was taxiing past the accident site did he notice an airplane inverted in the snowbank. Once the DA40 had passed, the accident airplane was turned upright. After the safety manager's call to the ERC ended at 1540 h, towing of the airplane to the hangar commenced.

While towing was in progress, another airplane, an RV-6, approached. When on downwind for runway 25, the pilot saw vehicles on the runway and inquired what had happened. He was informed of the accident and told that he would be able to pass the accident site; however, he elected to hold overhead and landed only after the runway was clear.

---

2 ELT.

3 A van fitted with fueling equipment and a tank containing grade 98E gasoline for airplane fuel servicing.

4 A streamlined fairing over the propeller hub.

1.2 Alerting and Rescue

1.2.1 Alerting and Notification

At 1532 h, the ERC at Vaasa received an emergency call from the accident site. The caller was the safety manager who had proceeded to the accident airplane. He said that a light airplane had veered into a snowbank on landing and come to rest inverted; there were no apparent injuries, and the occupants had walked away from the airplane.

At 1535 h, the ERC alerted ambulances from Asikkala and Heinola and a paramedic field supervisor and a paramedic physician from Lahti.

At 1535 h, the ERC initiated a prescribed procedure for alerting rescue units to respond to a serious aircraft accident[5]. The procedure is described in the directives of Päijät-Häme Rescue Department. The alert was sent to the on-duty fire officer at Heinola, to rescue units at Asikkala, Heinola and Lahti, and to a tanker vehicle based in Asikkala. The on-duty fire chief at Lahti was also alerted.

At 1535 h, two patrols were dispatched from the main police station at Lahti.

At 1536 h, the Safety Investigation Authority Finland (SIAF) was notified of the event with an automated text message.

At 1609 h, the Aeronautical Search and Rescue Coordination Center reported the event to the SIAF 24-hour hotline number.

At 1918 h, a flight school staff member called the SIAF 24-hour hotline number.

1.2.2 Rescue

The ambulances from Asikkala and Heinola arrived at the accident site at 1548 h and 1550 h, respectively, and paramedics proceeded to check the occupants of the airplane. No paramedic assistance was needed.

The first rescue unit arrived at 1549 h to discover that the airplane had already been towed to the maintenance hangar. In addition to the on-duty fire officer, three rescue units and a tanker vehicle arrived at the accident site. Rescue department personnel inspected the point where the airplane had exited the runway and the area around the parked airplane and found no signs of leaks. Their task was completed.

At 1556 h, the police patrol arrived from Lahti and breath tested the instructor and the student. Both tested 0.00 ‰ for alcohol.

1.3 Consequences

The instructor and the student were not injured.

The airplane was damaged beyond repair. Damage to the airplane is described in paragraph 2.1.3.

The accident did not result in environmental damage.

---

[5] An accident is classified as serious when the number of persons to be rescued is 5 to 10.

2 BACKGROUND INFORMATION

2.1 Environment, Equipment and Systems

2.1.1 Aerodrome

The uncontrolled Lahti-Vesivehmaa aerodrome (EFLA) is located 20 km north of Lahti, in the Vesivehmaa subsection of the municipality of Asikkala, and is operated by Päijät-Häme Aerodrome Foundation. It is served by two runways. The 1,200 m long by 30 m wide runway 07/25[6] is asphalt-covered, available throughout the year, and equipped with threshold lights and runway edge lights. Runway 07 displaced threshold[7] leaves 940 m of runway length available for landings and touch-and-goes. Runway 25 is fitted with a precision approach path indicator[8]. Snow blowers are used as necessary to remove deposits from the runway and the taxiways. Runway 18/36 is closed in winter.

An automatic weather observation station at Lahti-Vesivehmaa provides AUTOMETAR[9] aeronautical weather information to airmen. This information can be accessed on the internet[10] and can be listened to by selecting the applicable ATIS[11] aeronautical radio frequency. While NOTAMs[12] were in effect for the aerodrome, SNOWTAMs[13] were not available. Several flying clubs and flight schools are based at the aerodrome, and aviation certified Avgas 100LL gasoline is available.

---

6 A runway number indicates the compass heading of the runway. For example, 07/25 means that an approach to runway 07 is flown on the heading of approximately 070°, while an approach from the reciprocal direction is flown on the heading of approximately 250°. The true magnetic headings of runway 07/25 at Lahti-Vesivehmaa are 059° and 239°, respectively.

7 A displaced threshold renders the first portion of the runway unavailable for landing.

8 PAPI. A PAPI consists of a set of four lights adjacent to the runway to provide the pilot with vertical guidance for the correct approach angle to the runway.

9 METAR stands for meteorological aerodrome report. The AUTO prefix indicates that data is collected and disseminated by automated means.

10 https://aviamaps.com/metar.

11 Automatic terminal information service, available at Lahti-Vesivehmaa on frequency 135.250 MHz. Unlike at many other aerodromes, ATIS messages are not transmitted continuously. To listen to ATIS, the pilot needs to press the push-to-talk switch three times in quick succession.

12 Notice to airmen. An advisory, distributed by means of telecommunication, that contains information concerning the establishment, conditions or change in any aeronautical facility, service, procedure or hazard, the knowledge of which is essential to personnel concerned with flight operations.

13 A special NOTAM notifying, by means of a specific format, pilots of the presence or removal of hazardous conditions due to snow, ice, slush or standing water associated with these deposits in the movement area.

Figure 2. Lahti-Vesivehmaa aerodrome. The white arrows and numbers indicate the runways. The white circle indicates the touchdown point of the accident airplane, and the red circle indicates the point where airplane flipped over. The white dashed line shows the airplane's track. (Photo: Orthoimage ©National Land Survey of Finland. Overlays: SIAF)

2.1.2 Aircraft

The accident airplane was a Reims Aviation Cessna F150G, a single-engined, two-seat high-wing monoplane. The aircraft has a pedal-controlled steerable nosewheel and pedal-controlled brakes in the mainwheels. The accident airplane bore the registration OH-DBS. The serial number of the 1966-built airplane was 0125. It had accumulated 6,674 h at the time of the accident.

The length of the airplane is 7.2 m, wingspan 10 m, and height to the tip of the vertical tail 2.6 m. The empty gross weight and maximum takeoff gross weight of the accident airplane were, respectively, 515 and 725 kg. Mass and center of gravity were within the allowable limits on the accident flight.

The Continental O-200-A engine, manufacturer's serial number 63630-6-A, had been fitted on the airplane on July 11, 2019, and had a run time of 3,182 h.

The airplane held a certificate of airworthiness[14] issued on June 13, 2014.

The airplane had been maintained and inspected by an approved maintenance organization and held an airworthiness review certificate[15] issued by a continued airworthiness

[14] CofA.
[15] ARC.

management organization and dated March 17, 2018. The validity of the ARC had been continued[16] on March 13, 2019 and March 16, 2020, and the ARC was valid until March 19, 2021.

2.1.3 Wreckage Information

The examination of the airplane showed torn metal in the left wing tip and damage to the vertical stabilizer. The windshield was extensively cracked. The nose landing gear and the engine mount exhibited deformation. Damage to the propeller and the torsional bending of the blade tips were consistent with the engine running at low power on impact. Damage to the airplane is shown in figures 3, 4 and 5.

Before the event was reported to the SIAF, a flight school staff member[17] removed, among other components, the spinner, the ELT, the Global Positioning System[18] receiver and the Garmin G5 electronic flight instrument[19] mounted in the position previously occupied by an artificial horizon and a directional gyro.

---

16 An airworthiness review is carried out at 12-month intervals. It consists of the review of the technical documentation of the aircraft and a physical inspection. When the continuing airworthiness monitoring of an aircraft is subcontracted to an organization that holds a continuous approval, the organization may continue the validity of an ARC twice, one year at a time, without performing a physical inspection of the aircraft.

17 Removal of components does not necessarily require a maintenance organization. However, if an authorized release certificate (EASA Form 1), which permits the installation of a removed component in another aircraft, is needed, removal shall be done by a maintenance organization. Non-critical parts may be installed, provided certain criteria are met, in privately-operated light aircraft without the issuance of an authorized release certificate, in which case removal will not require the participation of a maintenance organization.

18 GPS.

19 Garmin G5 primary electronic attitude display and Garmin G5 DG/HSI display show, among other parameters, heading, bank angle, pitch attitude, speed, altitude, and bearing and range to selected beacons.

Figure 3. The windshield was cracked, and the propeller sustained damage. The red tapes were applied to the windshield after the accident. (Photos: SIAF)

Figure 4. The left wing tip exhibited skin tear and deformation. The tip of the vertical stabilizer was damaged. (Photos: SIAF)

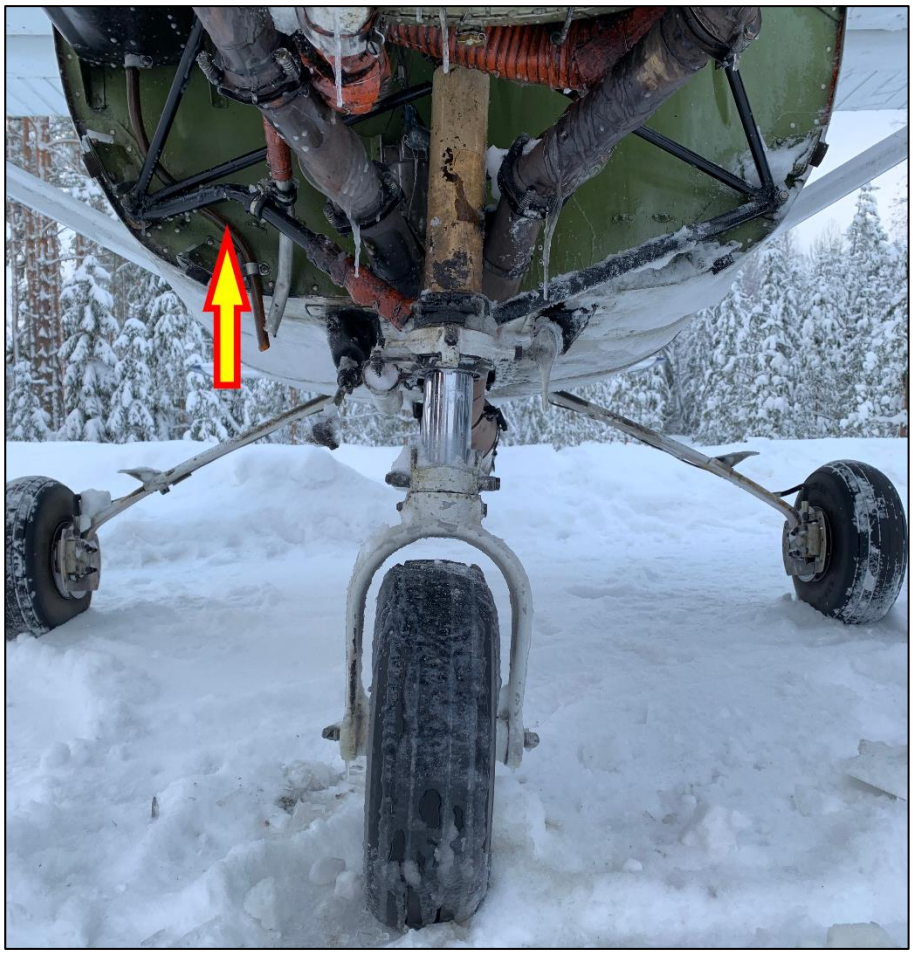

Figure 5. The nose landing gear and the engine mount (arrow) were damaged. (Photo: SIAF)

2.1.4 Fuel and Mass and Balance Calculations

The fuel tanks contained grade 98E5 automotive gasoline. An airplane may be serviced only with approved fuel grades listed in the flight manual or its appendices[20]. The approved fuel grades shall be indicated by placards located adjacent to the fuel filler ports. The placards on the accident airplane corresponded to original flight manual information and indicated that the aircraft could be serviced with aviation gasoline certified for aviation use. Additional placards, in German and in English, had been applied and could have led to the assumption that the use of automotive fuel was allowed (figure 6).

An aircraft type may be issued a supplemental type certificate[21] that allows servicing with automotive gasoline and gives a limitation to the maximum alcoholic content of automotive gasoline[22]. An STC shall be obtained for both the airframe and the engine.

An STC dated October 1, 2009, had been issued for the airframe and the engine, and the related work had been carried out on March 18, 2010.

---

20 Commission Regulation (EU) No 965/2012 para. NCO.GEN.105 (a) (4) (vi) stipulates that the pilot-in-command shall satisfy that the aircraft operating limitations as specified in the flight manual will not be exceeded at any time during the flight.

21 STC.

22 English language Petersen Aviation STC documents state that automotive fuel may contain no alcohol, while the German language documents indicate that fuel may contain no more than 1 % of alcohol and include a note stating that the alcohol content of automotive gasoline (98E5) to DIN EN228 standard may be as high as 5 %. If it cannot be ascertained that a fuel batch contains no more than 1 % of alcohol, fuel in that batch shall not be used and aviation gasoline must be used.

No STC was in effect for the airframe and the replacement engine fitted on July 11, 2019, and none had ever been obtained. However, a metal collar bearing markings associated with an STC[23] was found around the engine oil filler tube, and placards referring to an STC were in place adjacent to the fuel filler ports. It was therefore apparent that parts and markings applicable to the STC issued for the removed engine had not been removed from the aircraft.

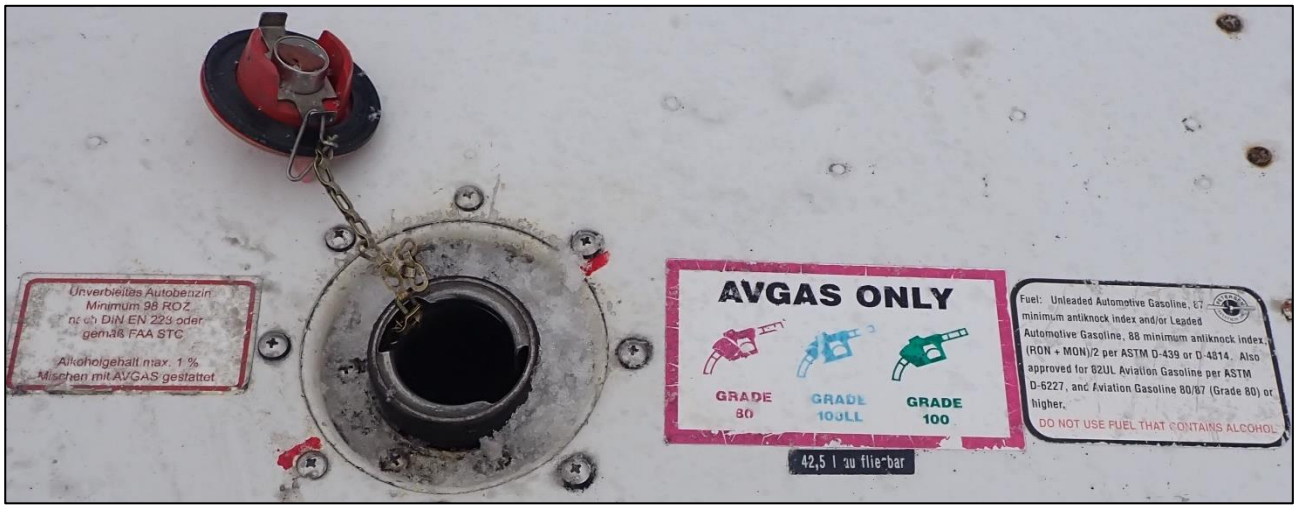

Figure 6. Placards on top of a wing adjacent to a fuel filler port. (Photo: SIAF)

The aircraft had been weighed in Germany[24]. The **mass and balance form**, dated March 14, 2014, also bore the stamp of a Finnish maintenance company. The study of the form revealed that incorrect conversion factors had been used when converting SI units to imperial units.

Table 1. Starting values and their conversions in the mass and balance form.

	Starting values	Incorrect values	Correct values
Mass	515 kg	2,093 lb	1,136 lb
Moment arm	0.87 m	12.2 in	34.3 in
Mass moment	449 kgm	25,540 lbin	38,900 lbin

The mass and center of gravity (CoG) tables and the CoG envelope graph in the flight manual are based on pounds and pound-inches. The values of mass and moment given in the mass and balance form were outside the flight manual limits. It was not possible to perform mass and balance calculations using exclusively the flight manual and the values given in the form.

These errors had not been addressed in the annual airworthiness review of the aircraft. The validity of the mass and balance form and its compatibility with the aircraft configuration shall be verified during the review.

Blue Skies Aviation used a flight preparation form dated February 24, 2020. The mass and CoG graph in the form was based on kilograms and kilogram-meters. Combining this information with data from the mass and balance form made the aforementioned calculations possible.

---

[23] Code SE2031CE was displayed on the collar.
[24] H&S Aviation LTB, Itzehoe, Germany

2.2 Conditions

The weather at Lahti-Vesivehmaa was cloudy at the time of the accident. The local automatic weather observation station reported[25] ceiling at approximately 1,750 m and scattered clouds at 330 m. Wind was from 310° variable between 270° and 350°. Wind speed was variable between 1.5 and 3.5 m/s. Visibility was over 10 km, temperature -7 °C and QNH[26] 1,019 hPa. The weather did not change significantly during the day. A NOTAM in effect indicated "Between January 3, 2021, and April 2, 2021, runways 18 and 36 are closed. Runways 07 and 25 are available, advance notice is required."[27]

The runway at Lahti-Vesivehmaa is not cleared of snow deposits to expose the pavement, and a few centimeters of dry snow was therefore present on the runway on the day of the accident. Orange-colored snowplow marker stakes indicated the location of the snow-covered runway edge lights, and the approximately 25 m wide cleared area extended to within a few meters of these stakes. Wind and blowing snow constantly reshaped the edges of the cleared area.

Also, cloudy weather and the snowy environment made it hard to distinguish the runway. Sunrise was at 0820 h. Sunset was at 1644 h. Figure 7 shows the conditions prevailing at the time of the accident.

Figure 7. A view along the runway soon after the accident. (Photo: Blue Skies Aviation)

Cockpit Ergonomics The student occupied the left seat. To see the flap position indicator located above the left door (figure 8), the pilot needs to turn his head approximately 90° left from the aircraft's direction of travel and he is therefore unable to simultaneously scan the

[25] The AUTOMETAR weather report in effect at the time of the accident read: EFLA 071250Z AUTO 31005KT 270V350 9999 FEW011 ///M07/M08/ Q1019.

[26] With a QNH pressure setting selected, the altimeter shows the aircraft's height above mean sea level.

[27] EFLA Lahti-Vesivehmaa. RWY18/36 CLSD. RWY07/25 AVBL PN, CTC TEL +35844700xxxx OR +35840018xxxx. FROM: 03JAN21 0900 TO: 02APR21 2359 (D0003/21).

environment ahead of the aircraft. He also needs to focus on the flap selector switch. The switch toggle is spring-loaded to center and must be held in the selected position until the flaps reach the desired position. When the switch is released, it returns to center, and flap movement stops. The electrically operated flaps travel from the 40° landing position to the 0° takeoff position in approximately 8 s.

Figure 8. The flap position indicator above the left door. (Photo: SIAF)

Two push-to-talk[28] switches are mounted on the left yoke. The left switch is normally connected to the communication system, but was inoperable in the accident airplane, and therefore the right switch needed to be operated to transmit on the radio (figure 9).

The left-seat pilot normally grips the yoke with the left hand and operates the PTT switch with the left thumb. With the right hand he controls the airplane and operates the trim controls[29], the flap selector switch, engine power and mixture control levers, the inlet air preheat lever and other airplane controls. However, in the accident airplane the PTT switch needed to be operated with the right hand – which is contrary to common practice – and therefore transmitting while simultaneously manipulating other controls with the right hand was not possible.

[28] PTT. Switches are normally thumb-operated.

[29] Trim systems are included in the flight control system to neutralize control forces once the desired flight regime is achieved.

Figure 9. The left yoke. (Photo: SIAF)

2.3 Recordings

The contents of the emergency call, the times and the contents of the alerts, and the notifications to other authorities were extracted from the data stored at the ERC and from the logs and databases of the rescue authorities.

The airplane's GPS device stored speed, position and altitude data among other parameters, but its memory capacity had been exceeded on previous flights, and data from the accident flight was unavailable. The Garmin G5 electronic flight instrument could have recorded flight data on removable memory cards. The flight school, however, stated that memory cards had not been installed, and data was therefore unavailable.

Track data from the Flightradar24 service was available and yielded information derived from responses generated by the transponder of the airplane. Although this data is not entirely accurate due to time lapses that vary between transmissions and can be of considerable length, data from the accident flight contained information about the touch-and-goes that preceded the accident. The data revealed that the airplane touched down approximately 270 m from the end of the runway and exited the runway after a ground run of approximately 330 m at an estimated speed of 60 to 70 km/h. This corroborated the findings of an internal investigation conducted by the flight school.

2.4 Personnel, Organizations and Safety Management

2.4.1 Crew Information

The 17-year-old **student** was at the initial stage of flight instruction. He had completed the first flight of the LAPL(A)[30] training syllabus on December 7, 2020, and had accumulated approximately 5.5 h of flight time on seven dual instructional flights. The accident took place during the student's first landing under his own control. The learning objectives of the flight, which was exercise no. 13 of the syllabus, were circuit work, approaches and landings.

[30] Light aircraft pilot license (airplanes).

The student and the instructor had flown the same exercise earlier on the day, conducting four instructor-assisted circuits including three touch-and-goes and a final landing.

The 73-year-old **instructor** had logged approximately 12,970 h and 25,300 landings. He had approximately 3,500 h and 7,000 landings on the Cessna 150, of which 3,200 h as instructor. He held a class 2 medical certificate and a PPL(A)[31] license with single-engine piston[32] and flight instructor ratings. The breakdown of his flying experience is in Table 2.

The accident flight was his fourth flight of the day. The first and the third flight – which had not included circuit practice – had been with another LAPL(A) student.

Table 2. Breakdown of the instructor's flight experience.

Flight experience	During last 24 hours landings/hours	During last 30 days landings/hours	During last 90 days landings/hours	Total landings/hours
All types	10 / 4 h 15 min	33 / 14 h 40 min	49 / 22 h 35 min	25,302 / 12,970 h
Accident type	10 / 4 h 15 min	32 / 13 h 50 min	42 / 18 h 20 min	7,000 / 3,500 h
Instructor, all types	10 / 4 h 15 min	32 / 13 h 50 min	46 / 20 h 25 min	10,000 / 5,000 h
Instructor, accident type	10 / 4 h 15 min	32 / 13 h 50 min	42 / 18 h 20 min	6,600 / 3,300 h

2.4.2 Blue Skies Aviation

Blue Skies Aviation is an approved training organization[33] holding a training organization approval updated on June 18, 2020. Its main facility is at Lahti-Vesivehmaa. It holds a privilege to offer and deliver theoretical knowledge instruction and flight training instruction for a commercial pilot license (CPL), for a competence-based instrument rating (CB-IR), for a private pilot license (PPL) and for a light aircraft pilot license for airplanes (LAPL(A)). The privilege also permits training on various courses and for various ratings, such as flight instructor, aerobatic, and night ratings.

Theoretical knowledge instruction for a license is accomplished primarily as self-study using the web-based Aviatron management system and theory modules accessible via a training portal. However, the Blue Skies Aviation Training Manual[34] requires that a minimum of 10 % of theoretical knowledge instruction for a license shall be contact learning in a classroom.

2.4.3 LAPL(A) Privileges and Training Syllabus

The privileges of an LAPL(A)[35] holder are to act as a pilot-in-command on general aviation airplanes with a takeoff mass of less than 2,000 kg, carrying a maximum of 3 passengers. While they do not allow aviation for commercial purposes, cost-sharing with passengers is permitted.

The minimum time requirement for theoretical knowledge instruction for a license is 100 h. The subjects of this instruction are human performance and limitations, meteorology,

---

31 Private pilot license (airplanes).
32 SEP. The class rating for airplanes powered by a single piston engine.
33 ATO. A flight training organization approved to provide flight training in accordance with Commission Regulation (EU) No 965/2012 EU (2012) laying down technical requirements and administrative procedures related to air operations.
34 TM.
35 Requirements for aviation licenses and ratings are based on Annex 1 (Part-FCL) to Commission Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew.

communications, principles of flight, operational procedures, flight planning and performance, aircraft general knowledge and navigation. Although training can be commenced at the age of 16, the minimum age to get a license is 17 years. An applicant must pass theoretical knowledge examinations administered by the Finnish Transport and Communications Agency Traficom before a skill test.

The minimum requirement for flight instruction is 30 h. The student first conducts dual flights with an instructor, and as training progresses, he undertakes solo flights. The student shall hold an LAPL medical certificate or higher before the first solo flight, that usually takes place after 10 to 15 flight hours. At the end of flight instruction, the student shall pass a skill test received by an examiner.

Blue Skies Aviation TM describes the training syllabi for the licenses offered, scheduling requirements, arrangements for theoretical knowledge instruction and the syllabus of flight instruction. The TM states that the numbering of the exercises in the flight instruction syllabus is primarily an exercise reference list and does not necessarily need to reflect the actual scheduling of the flights, which will depend on the student's progress and ability, weather conditions, flight time and aircraft availability, instructional technique considerations and the local operating environment. The above TM text pertaining to the exercise numbering in the LAPL(A) flight instruction syllabus is in accordance with Part-FCL. In Blue Skies Aviation, the order in which the exercises are conducted is at each instructor's discretion.

The TM also points out that theoretical knowledge instruction and flight instruction should be synchronized whenever possible by uploading the contents of the theoretical studies into flight instruction and vice versa.

Observing Special Characteristics of Winter Operations in LAPL(A) Training Syllabus

Part-FCL establishes the requirements for all pilot licenses and their implementation. It includes detailed lists of subjects that must be addressed in theoretical knowledge instruction and in flight instruction. Compulsory subjects in the former include air law, human performance, meteorology and communications, but no requirements are given for instruction in aerodrome-specific matters such as operations from snow-covered runways and the effects of cold weather on aircraft performance – which could both be factors in Finland. Familiarization with local conditions and operating environment is expected to take place during the flight instruction phase, and its content is not elaborated. The listed sequence of the air exercises is for reference and may be modified due to local circumstances or other reasons.

The Blue Skies Aviation training syllabus is based on Part-FCL, and therefore its TM does not include a separate theoretical knowledge instruction module that would exclusively address the special features of winter operations. Theoretical knowledge instruction includes several topics, particularly in the meteorology, principles of flight and operational procedures modules, that discuss the effects of winter conditions and related considerations.

Practical winter operations training during the flight instruction phase remains the responsibility of the instructor and is dependent on the season of the year an individual student's flight instruction takes place. For example, if a student completes all air exercises during the summer, he or she is deprived of a chance of getting hands-on experience of winter operations.

Training Syllabus and Accident Flight

Printouts of Blue Skies Aviation training records showed that the student had commenced an ePPL[36] theoretical knowledge instruction course on November 20, 2020. By the time of the accident flight, he had studied 5 h of air law of the 100 h course contents but had not started studies on other subjects appropriate to the privilege. Even though there are no requirements for theoretical knowledge instruction to be completed prior to the flight instruction phase, the student must pass an exam in air law and principles of flight before the first solo flight.

The student's flight instruction was in accordance with the LAPL001V00 syllabus included in the Blue Skies Aviation TM. The syllabus is for students who hold no previous license. Its scope is a minimum of 30 flight hours including 6 h of solo flight. Figure 6 is a breakdown of the exercises included in the syllabus and their durations. The exercises highlighted in yellow had been completed by the student prior to the accident flight.

BREAKDOWN OF HOURS FOR THE FLIGHT INSTRUCTION SECTION OF THE LIGHT ARCRAFT PILOT LICENCE (AEROPLANE) COURSE.				
Ground exercises				
1	Familiarisation with the aeroplane or TMG			
1E	Emergency drills			
2	Preparation for and action after flight			
Air exercises		**Duration**	**DUAL**	**SOLO**
3	Air experience	0:30	0:30	
4	Effects of controls	0:30	0:30	
5	Taxiing	0:30	0:30	
5E	Emergencies	0:30	0:30	
6	Straight and level	0:45	0:45	
7	Climbing	0:30	0:30	
8	Descending	0:30	0:30	
9	Turning	0:45	0:45	
10A	Slow flight	0:45	0:45	
10B	Stalling	1:00	1:00	
11	Spin avoidance	0:30	0:30	
12	Take-off and climb to downwind position	0:30	0:30	
13	Circuit, approach and landing	4:30	4:30	
12/13E	Emergencies	0:30	0:30	
SOLO	Solo check flight	0:45	0:45	
14	First solo	3:00		3:00
15	Advanced turning	0:45	0:45	
16	Forced landing without power	0:45	0:45	
17	Precautionary landing	0:45	0:45	
18A	Navigation	8:00	5:00	3:00
18B	Navigation problems at lower levels and in reduced visibility	1:00	1:00	
18C	Radio navigation (basics)	1:00	1:00	
19	Stopping and restarting the engine (in the case of TMGs only)	0:45	0:45	
	Refresher training (contents of skill test)	1:00	1:00	
COURSE TOTAL:		**30:00**	**24:00**	**6:00**

Figure 10. LAPL(A) flight training syllabus.

The student completed the ground exercises (1, 1E and 2) on December 7, 2020, and on the same day he conducted air exercise no. 3 (air experience). According to the training records, exercise no. 4 (effects of controls) was included in this flight.

Exercise no. 6 (straight and level) was repeated on three separate days between January 6 and 16, 2021. On January 16, the student also conducted exercise no. 5 (taxiing). His next flight

[36] Theoretical knowledge instruction training course required for PPL and LAPL privileges, completed remotely via the ATO's training portal.

took place on the day before the accident. It consisted of exercises no. 10A (slow flight) and 10B (stalling).

The training syllabus contains a detailed breakdown of the learning objectives of each instructional flight. For exercise no. 13 (circuit, approach and landing), these include normal traffic circuit procedures and related items such as the effect of crosswind on approach and landing speeds and on the use of flaps, crosswind landing technique, powered landing, glide landing, short landing, flapless landing and go-around. The expected total duration of the exercise is 4 h 30 min of flight time.

The Blue Skies Aviation operations manual[37] states that on a crosswind landing the airplane should be decrabbed no later than during flare by applying rudder to align its longitudinal axis with the runway and simultaneously applying opposite aileron as required to prevent the airplane drifting away from the runway centerline. The OM does not specifically discuss landing on short and/or narrow runways and resulting challenges in winter.

The student's flight instruction did not follow the numerical order of exercises given in the LAPL(A) syllabus. The following exercises, which preceded exercise no. 13 in the sequence, had been postponed to a later date:

- 5E (emergencies)
- 7 (climbing)
- 8 (descending)
- 9 (turning)
- 11 (spin avoidance)
- 12 (takeoff and climb to downwind position)

The records show that between 1200 h and 1256 h on the day of the accident the student conducted exercise no. 13. In addition to normal circuit work, approach and landing, other learning objectives were merged with the exercise, which ended in four landings. Blue Skies Aviation flight instructors explained that takeoff and landing techniques are taught by conducting touch-and-goes, in which the airplane transitions from landing to takeoff during the ground run without stopping. In this way the number of repetitions within a specified timeframe can be increased compared to a method wherein the airplane is slowed down to taxiing speed or brought to a stop after the landing rollout and then taxied to a normal takeoff position at the end of the runway.

A touch-and-go on a short runway, such as that at Lahti-Vesivehmaa, requires a nearly faultless landing from a Cessna 150 pilot due to the performance characteristics of the type. In addition, pilot actions during a touch-and-go need to be carried out in an expeditious manner because of remaining runway availability and possible obstacles near the runway edge.

The student departed on another exercise no. 13 at 1452 h. On the first takeoff and touch-and-go, the instructor demonstrated the technique, while the second circuit and touch-and-go were flown by the student under instructor assistance. The student completed the third circuit and landing independently with the instructor providing verbal advice. During the ground run the instructor operated the flap switch, which resulted in a situation where neither pilot was controlling the airplane, and the airplane departed the runway.

[37] OM.

2.4.4 Safety Management

ATOs are responsible for the safety of their operations in accordance with the requirements of Commission Regulation (EU) 1178/2011.

The safety management system (SMS) of Blue Skies Aviation is described in the Organization Management Manual (OMM). OMM revision no. 9, dated December 4, 2020, and inspected and approved by Traficom on December 22, 2020, was in effect at the time of the accident. The OMM includes a Safety Management Manual (SMM), an Operations Manual (OM), and a Training Manual (TM) among other documents. The manuals are in English.

The safety management manual contains the description of the SMS. The ultimate responsibility for safety is with the safety committee tasked, among its other responsibilities, with verifying and updating a flight instruction hazard log and safety performance indicators, with supporting the safety manager in his assigned tasks, and with appraising the functioning and effectiveness of the SMS.

The SMM requires that the committee convenes at least twice during a year. The committee members are the accountable manager of the ATO, the safety manager, the head of training, the chairman of the board, and two other members.

Safety occurrences are reported, and reports are processed in the Aviatron system. The SMM gives detailed information of the events that are to be reported and of reporting methods and explains how to extract benefits from the reported data. Between January 29, 2016, and February 6, 2021, the ATO submitted to Traficom one report of an accident and 19 reports of serious incidents or occurrences. None of these had any bearing on runway conditions at Lahti-Vesivehmaa.

The ATO submitted a flight safety report of the February 7, 2021, accident to Traficom at 1234 h on February 8 as prescribed in Advisory Circular GEN T1-4, classifying the occurrence as a serious incident. The ATO also produced a report for internal use using the established SMS procedure.

The SMM includes **an emergency response plan**[38] for various types of accidents, not only for aircraft mishaps. The ERP contains the following list of immediate post-accident actions:

1) Alert rescue services (when applicable) by calling 112.

2) Take care of injured persons and other casualties.

3) Prevent further damage if possible.

4) Give first aid as required until the arrival of rescue services.

5) Alert the accountable manager and the safety manager. If you cannot contact them, alert the manager of Lahti-Vesivehmaa aerodrome.

The list is followed by a table of the ATO's authorized persons and their phone numbers. These persons shall be called in the event of an accident. The table also mentions the ERC and SIAF with the note "if necessary" inserted. The SIAF number given is available during office hours only.

The ATO's accident response card dated September 4, 2014, listed only the emergency number.

---

[38] ERP. Version dated December 4, 2020, was in use.

Staff members' responsibilities in an accident are detailed in the ERP below the alerting instructions. The list describes, in separate sections, actions before the arrival of rescue services, during the arrival of rescue services, and after the accident during recovery to normal operation.

The ERP contains no mention about the handling of the wreckage and no instructions for cordoning-off the accident site or preventing the intrusion of bystanders before the arrival of the authorities.

However, a concluding statement says that any staff members whose presence at the accident site is not necessary should be advised to not enter the site lest they hamper the work of rescue authorities or accident investigators.

Neither does the ERP mention a need to notify airborne aircraft of an accident and of possible temporary runway unavailability. The ERP concludes in a note reminding that the procedures shall be reviewed and tested annually in order to determine any needs for an update.

The most recent revisions of the hazard logs[39] of Blue Skies Aviation were examined. Revision 4 is dated on March 26, 2020, whereas the date of revision 5 is the day of the accident, i.e., February 7, 2021. Revision 4 designates the pilot-in-command as the risk owner (person who is responsible for risk-related actions) on several occasions, while in some cases risk ownership is allocated to the student pilot. In revision 5, designated risk owners are members of the responsible staff of the ATO, primarily the accountable manager or the head of training.

Both revision 4 and revision 5 put **the risk of runway excursion** at a tolerable level (4) in terms of probability and severity and list the following risk management actions:

- determining in advance weather conditions suitable for students
- conducting skill tests before solo flights
- inspecting the conditions of the movement area before flight
- ensuring the good technical condition of the airplane

These actions lower the risk to an acceptable level (3). Risk management and related actions are not included in the ATO manuals apart from a mention of using common sense[40] in analyzing potential risks. In revision 4, the pilot-in-command / flight instructor / head of training are listed as the risk owners, while in revision 5 risk ownership is vested in the head of training.

The hazard log looks separately at the risk of runway excursion due to crosswind or a slippery surface and emphasizes pilots' safety training as a risk management action. According to the hazard log, risk management actions are incorporated in the TM and flight manuals and related materials. In revision 4, the pilot-in-command and flight instructor are listed as the risk owners for crosswind and slippery runway hazards, whereas revision 5 transfers this ownership to the accountable manager.

Several items in the hazard log lack a risk classification or the related numerical descriptor of probability and severity. In some cases, the descriptions of consequences are also missing.

The front page of both hazard logs examined contain a mention that the logs will be reviewed at 6-month intervals in safety committee meetings. Furthermore, the documents state that all

[39] Also called risk register.
[40] Good sense and sound judgement in practical matters.

identified risks will be reviewed no later than during the first quarter of each year or in the first safety committee meeting.

Blue Skies Aviation SMM annexes include descriptions of the safety performance indicators (SPI) and safety goals. Documents dated between 2018 and 2021 were reviewed. It was discovered that revision 1 documents had been in effect until revision 2 was issued on the day of the accident, i.e., February 7, 2021. SPI entries showed that the safety committee had not convened in 2018, while in 2019 the committee had held two meetings, both in February, whereas no meetings were held in 2020. However, a flight school representative stated that four committee meetings were convened in 2020.

2.4.5 Required Fuel and Lubricant Reserves

Regulations[41] stipulate that the pilot-in-command shall only commence a visual flight rules (VFR) flight if the airplane carries sufficient fuel and lubricant for the following:

- By day, taking off and landing at the same aerodrome and always remaining in sight of that aerodrome. Fuel shall be sufficient to fly the intended route and thereafter to fly for at least 10 min at normal cruising altitude.
- By day, to fly to the aerodrome of intended landing and thereafter to fly for at least 30 min at normal cruising altitude.
- By night, to fly to the aerodrome of intended landing and thereafter to fly for at least 45 min at normal cruising altitude.

The purpose of the fuel and lubricant reserve is to enable flight to an alternate aerodrome or holding to wait for the runway to be cleared during an emergency, like one that might occur when an accident precludes the use of a runway. The nearest three alternate aerodromes are located 60 to 73 km from Lahti-Vesivehmaa.

Blue Skies Aviation OM is in compliance with the second of the foregoing requirements for day VFR flights, i.e., aircraft always carry sufficient fuel and lubricant for 30 min flight at normal cruising altitude.

2.5 Preventive Actions of Authorities

As a competent aviation safety authority Traficom oversees the compliance of ATOs and flight training syllabi and issues related approvals.

It collects safety data from several sources. One primary source are flight safety reports that air operators shall submit of any aviation-related occurrence that will or may constitute a safety hazard. Traficom saves the collected data in the Eccairs database of the European Commission, which serves as a tool for monitoring flight safety standards at the European level.

Other sources include occurrence and safety analyses that EASA-compliant ATOs prepare and process based on information obtained through their internal reporting systems. Occurrences that would affect flight safety are also reported to Traficom.

Still another source is the findings of audits and inspections. Traficom performs regular audits and investigations at ATOs. The investigation examined the findings of audits conducted at Blue Skies Aviation on September 11 and 12, 2017, and on August 21 and 22, 2019.

---

[41] Commission Regulation on air operations (EU) No 965/2012 para. NCO.OP.125 applicable to EASA aircraft (except non-commercial operations with complex motor-powered EASA aircraft, NCC) and nationally regulated aircraft.

The 2017 audit looked at the OMs, management system and student training records. A flight instructor was also interviewed. The audit yielded eight findings including five minor deviations and three comments. One of the comments was related to the ATO's hazard log and remarked that also risks recognized in daily operations should be included in the document.

The 2019 audit looked at the management system, theoretical knowledge instruction and flight instruction, aircraft documents and standardization training. The audit yielded 13 findings including one deviation, four minor deviations and eight comments. The deviation resulted from the discovery that the ERP had not been tested and gave rise to a remark that the ERP shall be tested at 12-month intervals in the future. Traficom also recommended that ERP-based accident response cards be issued to the staff members and students. One comment pointed out that the review and update procedures of the hazard log were not entirely traceable. Traficom also reminded that a review leads to a rise in the revision number even though the contents remain unchanged.

2.6 Rescue Services and Preparedness

The Emergency Response Center Agency provides nationwide ERC services by alerting rescue units in accordance with procedures established by the competent authority.

Päijät-Häme Rescue Department is in charge of rescue operations at Lahti-Vesivehmaa and its vicinity. The department has not prepared a contingency plan for the aerodrome. The nearest fire station is at Asikkala, 8.5 km from the aerodrome.

Häme Police Department is in charge of police operations in Päijät-Häme region. The nearest police station is in Lahti.

Päijät-Häme Welfare District oversees paramedic operations at Lahti-Vesivehmaa and its vicinity. The nearest ambulance is based at Asikkala, 8.5 km from the aerodrome.

2.7 Rules, Regulations, Guidance and Procedures

2.7.1 Aviation Safety Programs

Finland's national aviation safety program is based on the **European Aviation Safety Programme**[42] and its annexed **European Plan for Aviation Safety**[43]. The EPAS identifies the key risks affecting the flight safety system, sets out actions to mitigate those risks and defines a safety level for the Union that should be attained through cooperation between the European Commission, EASA and the member states.

The Finnish Aviation Safety Programme[44] describes Finland's aviation safety management system structures and gives goals and guidelines for safety work. The central risk assessment tools are a risk picture generated by the process described in the FASP[45] and operator profile data obtained during performance assessments of the management systems of aviation stakeholders. The FASP is written, updated and published by Traficom.

The Finnish Plan for Aviation Safety[46] is annexed to the FASP and describes actions that Traficom and aviation stakeholders are required to take as part of a national risk management

---

42 EASP
43 EPAS.
44 FASP. Version 7.0 dated December 10, 2020, was in effect at the time of the accident.
45 FASP process. In use since 2016 for hazard identification and risk assessment.
46 FPAS. Version 6.0 dated April 23, 2020, was in effect at the time of the accident. Version 7.0, which is dated March 17, 2021, and covers years 2021 to 2025, was issued after the accident.

effort, the parties responsible for the actions and the time frames for the implementation of the actions between 2020 and 2024. The FPAS is published on an annual basis.

Finnish Aviation Safety Performance Indicators and Targets is another document annexed to the FASP. Versions 5.0 and 5.1[47] were in effect at the time of accident.

2.7.2 Monitoring within Approved Training Organizations

Each aviation stakeholder must, in compliance with the FPAS and within the scope of its SMS, identify hazards and threats and assess risks in its operations, determine the acceptable risk level and take necessary actions to eliminate risks or to reduce them to an acceptable level.

The ATOs shall be able to demonstrate the performance of their SMS to the supervising authority, i.e., Traficom. Monitoring should focus on the assessment of the functioning and performance of the SMS. The FPAS for 2020–2024 requires that the ATOs address the following operational-level risks as part of their safety management function:

- loss of control in flight
- runway excursions
- runway incursions
- mid-air collisions
- controlled flight into terrain.

One of the actions assigned separately is related to safety in the flight training domain, more specifically to shortcomings in lookout that may lead to a risk of collision, especially during solo flights to and from uncontrolled aerodromes.

FASP annex Finnish Aviation Safety Performance Indicators and Targets describes strategic-level safety targets and performance indicators along with related performance goals in those domains that are to be monitored by the ATOs.

The paragraph that describes runway excursions -related performance goals and risk management does not specifically mention runway conditions, runway maintenance in winter, the length or width of the available runway or students' training progress.

2.7.3 Notification of Accidents and Serious Incidents

An EU regulation[48] obliges any person involved who has knowledge of the occurrence of an accident or a serious incident to notify without delay the competent safety investigation authority of the state of the occurrence thereof.

The Aviation Act and a Traficom advisory circular[49] require that the pilot-in-command shall, without delay, report any accident or serious incident to the appropriate air traffic services (ATS) unit and to the SIAF. The report to the ATS unit shall be made on the relevant radio frequency or by telephone, and to the SIAF by telephone. The SIAF 24-hour hotline number is given in an appendix to the circular.

An accident, a serious incident or an occurrence shall be reported to Traficom using an electronic form. Staff in aviation organizations should preferably report through their own organization's safety management system. A report to Traficom shall be submitted as soon as

---

47 Version 5.0 was published on October 17, 2018. Version 5.1 was published on August 12, 2020, in conjunction with a reorganization in which Trafi was renamed Traficom. Version 5.1 was included in the Traficom series of publications after editorial changes.

48 No 996/2010, Article 9.

49 Act 864/2014, Traficom Advisory Circular GEN T1-4 dated January 11, 2019.

possible after the event, but within 72 h of the event. The Safety Investigation Act[50] prescribes that also authorities involved in rescue operations shall submit a similar report without delay.

The aforementioned EU regulation[51] prescribes that, for the purpose of preservation of evidence, the state of an accident site shall not be modified pending the arrival of safety investigators. No person shall undertake any movement of or sampling from the aircraft, its contents or its wreckage, or move or remove it, except where such action is required for safety reasons or to assist injured persons, or under the express permission of the authorities in control of the site and in consultation with the safety authorities if necessary.

The Safety Investigation Act also states that, in order to preserve evidence, objects and other material that may be of significance to the investigation, shall not be removed from an accident site or moved without a permission from the SIAF if not strictly necessary.

2.8 Other Investigations

Blue Skies Aviation conducted an internal investigation based on observations made and photographs taken on the day of the accident and on the following morning. The resulting report states that a snow layer of approximately 5 cm in thickness had been present on the runway. The report describes visible damage to the airplane, marks the airplane had left in the snow during landing and excursion, the GPS coordinates of the touchdown and exit points and of the location where the airplane had come to rest, and resulting conclusions. The investigation found that the airplane had traveled 333 m along the runway after touchdown, impacted the snowbank at approximately 20° to 30° angle relative to the runway and traveled over the distance of 47 m outside the cleared area before coming to a halt.

The SIAF investigation looked at the history of similar accidents in Finland using information from the Traficom occurrence database and limiting the study to accidents and incidents that had occurred between 2013 and 2021.

Forty runway excursions had been reported during the winter months between October and April. Seven had been attributed to a slippery runway or wintry weather conditions. Since all events had occurred at a low speed, no injuries had occurred, and the airplanes had sustained only minor damage. None of the events had led to an SIAF investigation.

Since 2000, the SIAF has conducted eight safety investigations related to runway excursion or loss of control. Seven of these involved a transport-category airplane and one was related to an ultralight airplane.

Seven investigations led to safety recommendations, many of which prompted changes in the internal procedures of airlines or technical improvements, while in two cases the SIAF recommended that the airline enhance the training of its pilots in winter operations and in associated special considerations. Two recommendations were directed at Finavia and were related to information provided of runway conditions because investigation into both occurrences showed that the operators involved had been unaware of the actual condition of the runway. Finavia has implemented these recommendations.

---

50 Act 525/2011.
51 No 996/2010, article 13.

3 ANALYSIS

A SIAF-developed format of the AcciMap approach[52] was used to support the analysis of the occurrence. The following text is arranged in accordance with an AcciMap diagram created during the investigation and shown in Figure 11. The occurrence is depicted as a chain of events along the bottom of the diagram. Contributing factors at various levels can be examined by moving up and down the diagram.

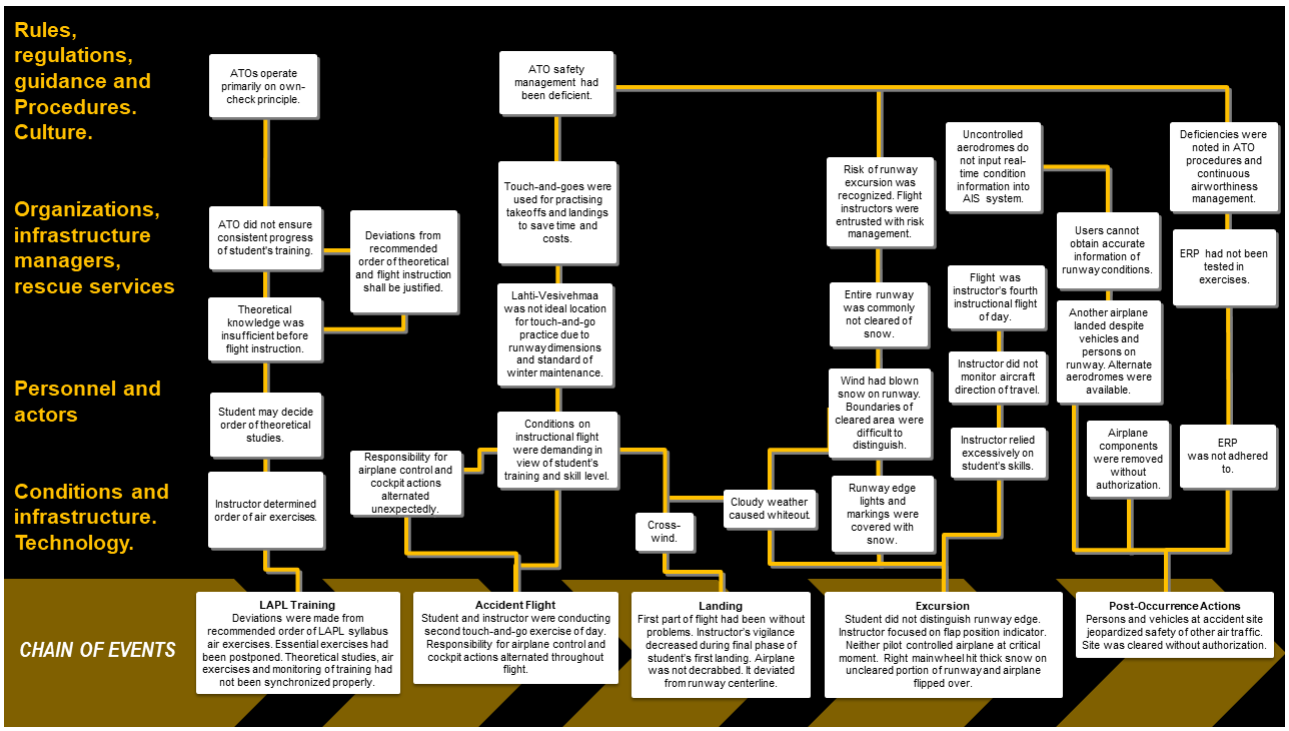

Figure 11. AcciMap diagram, investigation L2021-01. (Photo: SIAF)

3.1 Analysis of Occurrence

An LAPL training syllabus includes theoretical knowledge instruction and flight instruction. The minimum time requirement for theoretical knowledge instruction is 100 h. The instruction consists primarily of on-line self-study according to each student's preferred order and schedule. However, before moving to the solo flight phase, the student must, as the minimum requirement, pass an examination covering the modules on air law and principles of flight. The student on the accident flight had been working only on the air law module.

The order of the exercises laid down in the flight instruction syllabus is essentially a sequencing guide, and therefore exercises need not be given in the order listed if a deviation is considered justified. A decision to deviate from the prescribed sequence is made by a flight instructor based on an overall consideration. In this case, the instructor determined the order but postponed some essential exercises – such as climbing, descending, turning and takeoff and climb to downwind position – to be completed at a later date after the circuit, approach and landing exercise. An important benefit of conducting the postponed exercises before the circuit, approach and landing exercise is that they increase the student's preparedness for performing touch-and-goes for the obvious reason that he or she will have accumulated more normal takeoffs and landings.

---

52 Rasmussen, J. & Svedung, I. (2000) *Proactive Risk Management in a Dynamic Society*. Karlstad, Sweden. Swedish Rescue Services Agency.

The ATOs operate primarily on the own-check principle and are therefore responsible for the compliance of training and safety management using procedures described in the OMM and its annexes approved by the competent aviation authority. In this case, the ATO did not ensure the consistent progress of the student's training, which led to his moving to the flight instruction phase after a limited amount of theoretical knowledge instruction. Therefore, since he lacked theoretical knowledge of the subjects of air exercises, learning outcome was non-optimal, and the responsibility for teaching the fundamentals of theoretical subjects lay heavily on the instructor during pre-flight briefings.

On **the accident flight** the student and the instructor practised circuits, approaches and landings. During the first and second circuit, responsibility for controlling the airplane and executing the required actions alternated between the student and the instructor, while on the third, the student flew the airplane and the instructor assisted him by providing verbal guidance. The resulting landing, the first that the student performed himself, was reasonably successful apart from the fact that he did not decrab the airplane, and because no control inputs were applied during the ground run the airplane drifted towards the right edge of the runway.

The student had experienced difficulties understanding changes in the sharing of the responsibilities between himself and the instructor and he had been uncertain of what he was expected to do. In the touch-and-go that resulted in the accident he was apparently expecting orders from the instructor; these were not coming, because the instructor assumed that the student's observational capability and skill level were sufficient for maintaining centerline alignment during the maneuver.

The foregoing notwithstanding, the prevailing winter conditions with runway markings hidden by snow were demanding in view of the student's training and skill level. The runway lights were turned off and partly covered by snow. Lahti-Vesivehmaa was not an ideal location for initial flight training in winter due to its runway dimensions and the standard of winter maintenance.

Flying a low-powered airplane from a short runway adds pressure on the pilot and generally raises the risk level. This is because the touchdown for a successful touch-and-go must be made close enough to the approach end of the runway to allow time for reconfiguring the airplane by retracting the flaps and for other cockpit actions during the ground run. Upon completion of these actions, enough runway must still remain for the attainment of the liftoff speed. Poor cockpit ergonomics of the accident airplane required increased attention from the pilot during flap operation. On a short runway the pilot must be aware of a point by which power must be applied for takeoff; otherwise, touch-and-go must be aborted by applying brakes to bring the airplane to a stop. The purpose of touch-and-goes was to increase the number of takeoffs and landings within a specific time frame.

The ATO's hazard log put the risk of runway excursion at a tolerable level. Risk management actions included determining in advance weather conditions suitable for students and inspecting the conditions of the movement area before flight. Winter conditions were not considered an additional factor that would have increased the challenge to students. The instructor opined that the safe conduct of the flight was possible under the prevailing conditions.

Landing and excursion. Although the first part of the flight had been without problems, the instructor's vigilance lapsed during the final phase of the landing that was conducted with the student flying the airplane. One reason for this was perhaps the fact that the accident flight was the instructor's fourth flight of the day. Because the airplane, which had been crabbed to

compensate for crosswind, was not realigned with the runway, it began to deviate from the centerline after touchdown since neither pilot was controlling it at the critical moment. The student was expecting the instructor to take control or give orders to carry out any required actions. The instructor was occupied with operating the flaps and because of poor cockpit ergonomics was unable to pay attention to the airplane's direction of travel. The student, on the other hand, could not distinguish the runway from its edges because blowing snow had reshaped the boundary of the plowed area. To exacerbate the problem, cloudy weather and the resulting whiteout eliminated all contrast between the snowbanks and the runway.

Post-Occurrence Actions

It soon became apparent that rescue efforts were not needed. Persons who had congregated at the accident site did not realize that vehicles parked on the runway were a potential hazard to other air traffic. Since none of them carried an aeronautical radio, they were unable to notify approaching aircraft of the accident and the temporary closure of the runway.

Upon ensuring that the student and the instructor were unharmed, the persons at the accident site began planning the expeditious turning of the airplane and removal of components. They regarded the event more as a serious incident than an accident. In either case, the pilot-in-command should have reported the occurrence without any delay to the nearest ATS unit and the SIAF. This was not done; instead, they embarked upon unauthorized removal of components from the airplane and clearing the accident site, even though the immediate removal of the airplane was not necessary.

The first airplane that approached the aerodrome proceeded to land even though the runway remained occupied by vehicles and persons. Safer options would have been to discontinue the approach and hold over the aerodrome for a maximum of 30 min to build situational awareness and wait for the vehicles and persons to vacate the runway or divert to an alternate aerodrome. Assuming that the airplane had the prescribed fuel and lubricant reserve, both options would have been available. Three alternate aerodromes were located within an approximately 70 km radius.

Uncontrolled aerodromes do not input real-time information of runway conditions into the Aeronautical Information Service[53] system. A pilot planning a cross-country flight to such an aerodrome shall obtain information of runway conditions by calling a number listed in the NOTAM service or by other suitable means. A pilot-in-command shall ensure that the airplane has the prescribed fuel and lubricant reserve and should determine the conditions at all alternate aerodromes before departure.

The ATO had implemented its ERP haphazardly, and actions in the event of an accident had not been exercised adequately. An obsolete accident response card remained in use, and the ERP in effect at the time of the accident did not list the SIAF 24-hour telephone number.

The ATO procedures were not in full compliance with the Traficom-approved SMM. Room for improvement was identified in the preparation and updating of the hazard log and the descriptions of the safety performance indicators and safety goals.

Several items of the hazard log in effect at the time of the accident listed the pilot-in-command or the flight instructor as the owner of a recognized risk. However, it should be noted that inexperienced students undergoing training for a privilege are pilots-in-command on solo

[53] AIS.

flights. In any ATO, risk ownership shall be assigned to higher-level staff members instead of pilots undertaking their duties in aircraft cockpits.

The hazard log listed runway excursion as a safety risk, but related risk management actions were not included in the ATO manuals apart from a hazard log mention of using common sense. The level of winter maintenance and lack of a runway lighting system at uncontrolled aerodromes are examples of factors that may affect flight safety on instructional flights. Instead of relying on common sense, practical instructions for the special features of winter operations should be included in the manuals.

During the years preceding the accident, safety committee meetings had been irregular and at intervals longer than prescribed in the ATO manuals.

The accident airplane had been serviced with grade 98E5 automotive gasoline for cost saving. Automotive gasoline was not listed as an approved fuel in the flight manual, and the related STC had expired. However, the use of automotive gasoline was not a factor in the accident.

Touch-and-goes are used extensively to provide instruction in takeoff and landing techniques because they save time and thereby costs when compared with normal landings and takeoffs.

ATO staff members removed components from the airplane after the accident, and therefore the removed components were not eligible for the issuance of an authorized release certificate (EASA Form 1). It should also be noted that an EU regulation[54] states that a component shall be considered unserviceable if it has been involved in an incident or accident likely to affect its serviceability. However, the removal of components was not a factor in the accident.

Discrepancies related to **continued airworthiness management** of the accident aircraft were found. The continued airworthiness management organization had failed to notice errors that had persisted in the mass and balance form since 2014. Neither had airworthiness reviews addressed the fact that no STC had been applied for the use of automotive gasoline in the replacement engine and placards advising of the use of automotive gasoline remained in place adjacent to the fuel filler ports. These discrepancies were not a factor in the accident, however.

[54] No 1321/2014, para. (a) 5.

4 CONCLUSIONS

Conclusions encompass the causes of an accident or a serious incident. Cause means the different factors leading to an occurrence as well as relevant direct and indirect circumstances.

1. The LAPL(A) student had completed only a small part of theoretical knowledge instruction before starting the flight instruction phase, and this deficiency existed throughout the early phase of flight instruction. There are no requirements for theoretical knowledge instruction to be completed prior to the commencement of flight instruction.

   Conclusion: *The approved training organization did not ensure that the student had sufficient theoretical knowledge before starting flight instruction. Moving to the flight instruction phase without sufficient theoretical background does not support the attainment of desired learning objectives and increases risk levels.*

2. Flight instruction did not follow the recommended order laid down in the training syllabus. The instructor decided the order of the exercises. Basic skills needed during touch-and-goes had not been practised.

   Conclusion: *The own-check procedures of the approved training organization were not applied successfully in flight instruction. Deviation from the order of air exercises laid down in the training syllabus and postponing air exercises containing takeoffs and landings until after touch-and-go exercises increases risk levels.*

3. The characteristics of the accident airplane, runway availability, winter conditions and touch-and-goes all combined to present increased challenges to the student who was practising landings and takeoffs.

   Conclusion: *Touch-and-goes are conducted during flight instruction to minimize flight hours and costs. Local conditions were not given sufficient consideration during initial flight instruction.*

4. Task-sharing between the pilots was inconsistent during the flight and was not clear during the touch-and-go that led to the accident, which resulted in a situation where neither pilot was controlling the airplane during the ground run.

   Conclusion: *Unclear task-sharing or ambiguous communication are often cited as probable causes of aviation accidents. During flight instruction it is particularly important to assign tasks that should be carried out by the instructor and by the student during all phases of the flight, and the related communication procedure should be known in detail by both pilots.*

5. The instructor did not notice the airplane's drift towards the edge of the runway since he was operating the flap select switch and was focused on monitoring the flap position indicator.

   Conclusion: *Loss of situational awareness often results in a hazardous situation or an accident. Situational awareness can be lost when the crew member feels rushed, under demanding conditions, or when he or she becomes fixated on a single matter or on anything that is secondary in the prevailing situation.*

6. Risk management actions related to runway excursions did not sufficiently address conditions on an uncontrolled aerodrome. These actions were neither put into practice nor included in the manuals of the approved training organization.

   Conclusion: *Risk mitigation actions will lead to a desired effect only when they are presented in an unambiguous manner, are measurable and are included in operational procedures.*

7. The emergency response plan of the approved training organization was not adhered to after the accident. Deficiencies were noted in the plan, which had not been tested in exercises.

   Conclusion: *The emergency response plan of the approved training organization had not been assimilated.*

8. Persons converged at the accident site. Some of them drove vehicles onto the runway. No notification was made on an aeronautical radio frequency about the fact that the runway was occupied, and no consideration was given to arriving traffic. Another airplane landed on the occupied runway.

   Conclusion: *Failure to notify of an accident or an occupied runway may put the safety of other aviators in jeopardy and lead to further damage.*

9. The airplane was moved from the accident site and components were removed before the occurrence had been reported to an air traffic services unit and the Safety Investigation Authority Finland.

   Conclusion: *Regulations are not known, or they are disregarded. Unauthorized clearing of an accident site will undermine the conditions of an on-site safety investigation.*

10. Own-checking in the approved training organization was insufficient. The organization did not always adhere to its internal instructions. Continued airworthiness management was entrusted to a partner. Discrepancies in the documents of the airplane remained unnoticed.

    Conclusion: *Deficiencies existed in the safety management system of the approved training organization.*

5 SAFETY RECOMMENDATIONS

5.1 Accident Reporting and Actions at Accident Site

Persons involved in aviation do not always act appropriately in the event of an accident. Rules and regulations for accident reporting and actions at an accident site are not known, or they are disregarded.

The Safety Investigation Authority Finland recommends that

the Finnish Transport and Communications Agency Traficom informs persons and organizations involved in aviation of the reporting procedure that is described in Advisory Circular GEN T1-4 and should be followed in the event of an accident or a serious incident. It is also recommended that these persons and organizations are reminded of an appropriate course of action in order to preserve evidence related to the accident site and the accident aircraft. [2021-S32]

5.2 Emergency Response Plans of Approved Training Organizations

Approved training organizations use mostly own-check procedures to monitor their operation. The effectiveness of risk management actions shall be reviewed on a regular basis. Putting into practice and regular testing of safety-critical procedures is of particular importance.

The Safety Investigation Authority Finland recommends that

the Finnish Transport and Communications Agency Traficom reviews the update status of the emergency response plans of approved training organizations, the arrangements of emergency training, the correctness of the prescribed reporting procedures, and instructions related to the preservation of evidence. [2021-S33]

5.3 Observing Effects of Winter Conditions in Flight Training

Although the theoretical knowledge instruction modules of flight training discuss winter conditions as a sideline, responsibility for winter conditions training was with the flight instructor. Hazard logs shall pay particular attention to the training environment. Risk management actions did not address winter conditions on an uncontrolled aerodrome.

The Safety Investigation Authority Finland recommends that

the Finnish Transport and Communications Agency Traficom instructs approved training organizations operating from uncontrolled aerodromes to review and if necessary update their hazard logs for the effects of winter conditions. It is also recommended that the agency ensures that risk management actions mentioned in hazard logs are included in the manuals and operation of the training organizations. [2021-S34]

5.4 Scheduling of LAPL(A) Theoretical Knowledge Instruction and Training Syllabus Exercises

There are no requirements for theoretical knowledge instruction to be completed prior to the commencement of flight instruction. Deviations from the prescribed order of air exercises, which was for reference, were permitted for justified reasons such as the student's progress, weather conditions and the local operating environment. The internal instructions of the approved training organization state that theoretical knowledge instruction and flight instruction should progress in a synchronized manner.

The Safety Investigation Authority Finland recommends that

the European Aviation Safety Agency (EASA) establishes the minimum requirements for theoretical knowledge instruction before the commencement of flight instruction. It is also recommended that the agency lays down a requirement that approved training organizations shall describe, in writing and in an unambiguous manner, acceptable reasons for deviations from the prescribed order of air exercises before the solo flight phase. These reasons shall be based on risk assessment. [2021-S35]

5.5 Implemented Measures

The Finnish Transport and Communications Agency Traficom has decided to include as part of the FASP process additional information to the 2021–2022 Winter Operations Bulletin, or issue a separate supplement, to cater for the needs of approved training organizations and general aviation operators and add these groups to the distribution list. The agency has also decided to make the related contents of Advisory Circular GEN T1-4 and an appropriate course of action at an accident site the themes of the next aviation information bulletin.

REFERENCES

Written Material

EASA (2020) The European Plan for Aviation Safety (EPAS 2020–2024).

Commission Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew.

Regulation (EU) No 376/2014 of the European Parliament and of the Council EU (2014) on the reporting, analysis and follow-up of occurrences in civil aviation.

Commission Regulation (EU) No 965/2012 EU (2012) laying down technical requirements and administrative procedures related to air operations.

Regulation (EU) No 996/2010 of the European Parliament and of the Council on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC.

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

Aviation Act (864/2014).

Rasmussen, J. & Svedung, I. (2000) Proactive Risk Management in a Dynamic Society. Karlstad, Sweden. Swedish Rescue Services Agency.

Trafi (2013) Regulation AGA M1-1. Construction, Operation, Services and Equipment of Uncontrolled Land Aerodromes Intended for Airplane Use.

Trafi (2014) Recreational Aviation Safety Survey. Traficom publication series 15/2014.

Traficom (2018) Finnish Aviation Safety Performance Indicators and Targets, version 5.0. Appendix 2 to Finnish Aviation Safety Programme. Traficom publication series 18/2018.

Traficom (2019) List of Examples of Serious Incidents, Appendix 1 to Advisory Circular GEN T1-4.

Traficom (2020) Advisory Circular GEN T1-4, Reporting of Accidents, Serious Incidents and Occurrences in Aviation.

Traficom (2020) Finnish Aviation Safety Performance Indicators and Targets, version 5.1. Appendix 2 to Finnish Aviation Safety Programme. Traficom publication series 223/2020.

Traficom (2020) Finnish Aviation Safety Programme 2020, version 7.0. Traficom publication series 231/2020.

Traficom (2020) Finnish Plan for Aviation Safety 2020–2024. Appendix 1 to Finnish Aviation Safety Programme. Traficom publication series 8/2020.

Traficom Occurrence Categories
https://www.traficom.fi/sites/default/files/media/file/Poikkeamien%20kategoriatyypit.pdf. Accessed March 11, 2021.

Safety Investigation Act (525/2011).

Investigation Material

1) Photographs and other material from on-site investigation.
2) Interviews.
3) Weather information.
4) Häme Police Department investigation notice and photographs.
5) Emergency response center alert logs and related reports.
6) Related recordings of alert calls and radio communications and logs from Vaasa Emergency Response Center.
7) Blue Skies Aviation investigation report and photographs.
8) Blue Skies Aviation manuals: OMM, OM, and TM.
9) LAPL(A) and PPL(A) training syllabi.
10) Maintenance documents and other documents of OH-DBS airplane.
11) Track data from Flightradar24 website.

SUMMARY OF COMMENTS TO DRAFT FINAL REPORT

The Safety Investigation Authority Finland requested comments to the draft final report from the Finnish Transport and Communications Agency Traficom, the European Aviation Safety Agency (EASA), Lahti-Vesivehmaa aerodrome, and Blue Skies Aviation. Pursuant to the Safety Investigation Act, no comments given by private individuals are published.

The Finnish Transport and Communications Agency Traficom endorsed safety recommendation 5.2 with minor clarifications added. The agency found recommendations 5.1 and 5.3 fully appropriate. The agency will continue its policy of intensive communication about occurrence reporting and has decided to make the related contents of Advisory Circular GEN T1-4 and an appropriate course of action at an accident site the themes of the next aviation information bulletin. Recommendation 5.2 was clarified accordingly.

The European Aviation Safety Agency (EASA) commented safety recommendation 5.4. In the agency's opinion the contents of training syllabi are adequately prescribed in the current EU regulations, and there is no apparent need to initiate an amendment process based on a single occurrence. Recommendation 5.4 was clarified accordingly.

Lahti-Vesivehmaa aerodrome operator stated that the winter of 2021 presented challenges to runway maintenance. Blowing snow and whiteout conditions frequently rendered ground features indiscernible. No attempts are made to remove snow deposits all the way to the pavement.

The operator added that that the expedient clearing of the accident site and the removal of the damaged aircraft were justified in view of opening the runway for traffic with a minimum of delay.

Blue Skies Aviation commented that according to the provisions of the organization's operations manual the conditions on the day of the accident did not preclude flying to any extent. The existing conditions had been verified and a risk assessment had been conducted. Risks related to winter flying were being observed at the operational level. The accident airplane was suitable for operations under the prevailing conditions.

The organization highlighted the fact that operating in Class G airspace at Lahti-Vesivehmaa does not require a radio, and therefore visual observation is the sole method of verifying runway condition and freedom of obstructions.