MINISTRY FOR
INNOVATION AND TECHNOLOGY
TRANSPORTATION SAFETY BUREAU

FINAL REPORT

2016-037-4

Accident
outside Vértestolna
28 February 2016
Cessna FA152
HA-VOK

General information

This investigation is being carried out by Transportation Safety Bureau on the basis of

- 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,
- Act XCVII of 1995 on aviation,
- Annex 13 identified in the Appendix of Act XLVI. of 2007 on the declaration of the annexes to the Convention on International Civil Aviation signed in Chicago on 7th December 1944,
- Act CLXXXIV of 2005 on the safety investigation of aviation, railway and marine accidents and incidents (hereinafter referred to as Kbvt.),
- NFM Regulation 70/2015 (XII.1) on safety investigation of aviation accidents and incidents, as well as on detailed investigation for operators,
- In absence of other relevant regulation in the Kbvt., in accordance with Act CXL of 2004 on the general rules of administrative authority procedure and service.

The competence of the Transportation Safety Bureau of Hungary is based on Government Regulation № 230/2016 (VII.29.) on the assignment of a transportation safety body and on the dissolution of Transportation Safety Bureau with legal succession.

Pursuant to the aforesaid laws,

- Transportation Safety Bureau Hungary shall investigate aviation accidents and serious incidents.
- Transportation Safety Bureau Hungary may investigate aviation and incidents which – in its judgement – could have led to more accidents with more serious consequences in other circumstances.
- Transportation Safety Bureau Hungary is independent of any person or entity which may have interests conflicting with the tasks of the investigating body.
- In addition to the aforementioned laws, the ICAO Doc 9756 and the ICAO DOC 6920 Manual of Aircraft Accident Investigation are also applicable.
- This Report shall not be binding, nor shall an appeal be lodged against it.
- The original of this report was written in the Hungarian language.

Incompatibility did not stand against the members of the IC. The persons participating in the safety investigation did not act as experts in other procedures concerning the same case and shall not do so in the future.

The IC shall safekeep the data having come to their knowledge in the course of the safety investigation. Furthermore, the IC shall not be obliged to make the data – regarding which the owner of the data could have refused its disclosure pursuant to the relevant act – available for other authorities.

This Final Report

was based on the draft report prepared by the IC and sent to all affected parties (as specified by the relevant regulation) for comments.

Copyright Notice

Translation

This document is the translation of the Hungarian version of the Final Report. Although efforts have been made to translate it as accurately as possible, discrepancies may occur. In this case, the Hungarian is the authentic, official version.

Table of Contents

Definitions and abbreviations

Aerodrome	*means a defined area (including any buildings, installations and equipment) on land or water or on a fixed, fixed off-shore or floating structure intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.*
Company Authorization	*An authorisation issued by the organisation, the holder of which, in the present case, is entitled to fly the aircraft included therein.*
Company Authorization Card	*In this case, the card which indicates which aircraft its holder is authorised to fly within the given organisation.*
EASA	*European Union Aviation Safety Agency*
Flight plan	*Specified information provided to air traffic service units, relative to an intended flight or portion of flight of an aircraft*
GKM	*Ministry of Economy and Transport*
IC	*Investigating Committee*
ICAO	*International Civil Aviation Organization*
Kbvt.	*Act CLXXXIV of 2005 on the technical investigation of aviation, railway and marine accidents and incidents*
LT	*Local Time*
MIT	*Ministry for Innovation and Technology*
MND	*Ministry of National Development*
MTOM	*Maximum Take Off Mass*
NTA AA	*National Transport Authority Aviation Authority (till 31 12 2016) (Hungary)*
Passenger	*The person who said he was sitting in the RH side seat at the time of the occurrence and had been a flight instructor of the Pilot.*
Pilot	*The person mentioned as the pilot-in-command in the case investigated, and who was a student pilot of the Passenger earlier.*
The Organisation	*the organisation which was the continuous airworthiness management organisation and training organisation of the operator of the aircraft involved in the occurrence*
Transponder	*It is an automated transceiver in an aircraft that emits a coded identifying signal in response to an interrogating received signal.*
TSB	*Transportation Safety Bureau (Hungary)*

TTSN	*Total Time Since New*
TTSO	*Total Time Since Overhaul*
UTC	*Coordinated Universal Time*
Visual meteorological conditions	*The weather conditions expressed in visibility, distance from cloud, and cloud base values, equal to or better than the required minima. (VMC)*
WGS-84	*A standard used in geodesy and satellite geopositioning*

Introduction

Occurrence category		Accident
Aircraft	Manufacturer	Reims Aviation SA, France
	Type	Cessna FA152
	Registration sign	HA-VOK
	Operator	CAVOK Aviation Training Kft.
Occurrence	Date and time	28 February 2016, 11:04 LT
	Location	outside Vértestolna (Figure 1)
Number of people fatally / seriously injured in the accident:		1 / 1
Extent of damage to the aircraft involved in the occurrence:		Destroyed

Any clock-time indicated in this report is given in local time (LT). Time of the occurrence: LT= UTC+ 1 hour.

All geographical coordinates indicated in this report is given according to the WGS-84 survey.

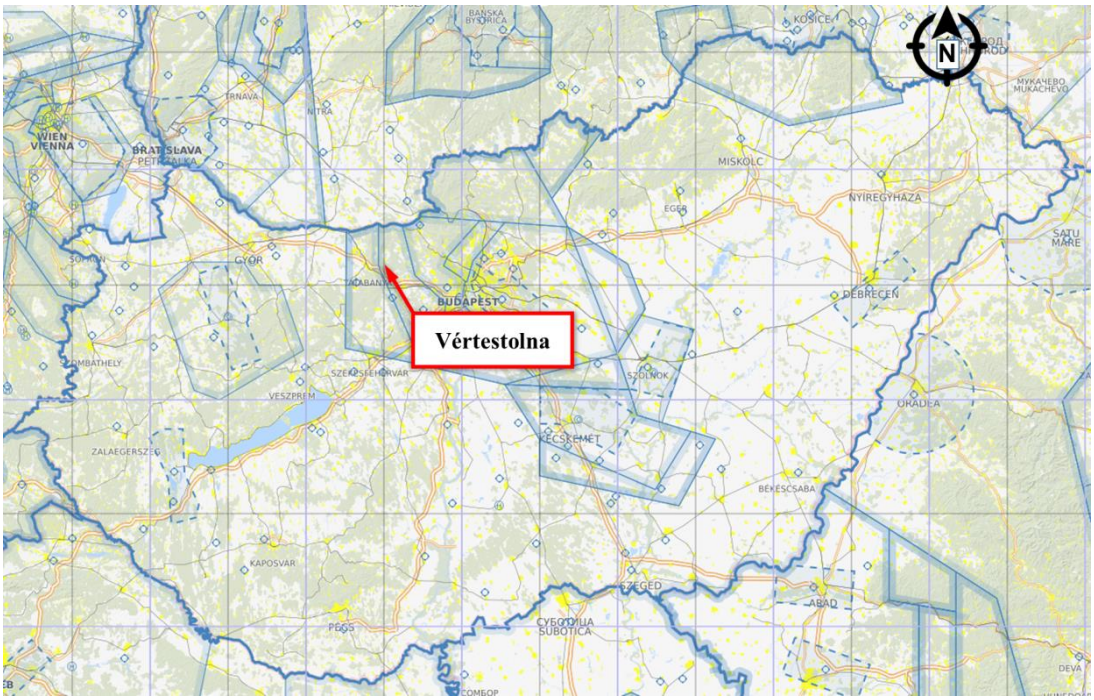


Figure 1: Location of the occurrence in Hungary

Reports and notifications

The occurrence was reported to the dispatcher of TSB on 28 February 2016 at 11:06 am by the duty supervisor of Hungarocontrol Zrt.

The dispatcher service of TSB Hungary notified:

- the European Union Aviation Safety Agency (EASA) on 03 March 2016, at 13:59,
- the investigating organization of the state of the constructor (NTSB), on 03 March 2016, at 14:10,
- Romanian investigating organization (CIAS), on 03 March 2016, at 14:19.

Investigating Committee

The Head of TSB assigned the following investigating committee (hereinafter referred to as the "IC") to the investigation of the case:

Investigator-in-charge	**Gábor Erdősi**	Investigator
Member	**Gábor Torvaji**	Investigator

Overview of the investigation process

During the investigation, the IC:

- Performed a site survey: took photos and made sketches.
- Inspected the aircraft and its engine during the site survey.
- Obtained information and records related to the accident and the weather.
- Obtained copies of document related to the event from the competent authority and the police.
- Obtained radar data and radio communication records of the flight ending up in an accident and the digital radar data of the aircraft involved, from Hungarocontrol Ltd.
- Obtained maintenance data and documents of the aircraft involved from the operating company.
- Obtained the manuals related to the operation and the training organisation from the operating company.
- Obtained the Pilot's flight logbook.
- Interviewed people, including the passenger of the aircraft, who had important information related to the accident.
- Performed additional survey of the wreck and the engine, in a joint effort with the supervisory authority and the police, at the hangar of TSB in Tököl.
- Analysed available data and information, and drafted an investigation report of the accident.

Short summary of the occurrence

On 28 February 2018, at 10:42, the Pilot and his passenger, who had been the Pilot's flight instructor before, started a flight from Gödöllő Airport in a type Cessna FA152 aircraft (Figure 2) with the registration mark HA-VOK. Their planned route was Gödöllő–Budakalász–Pilisvörösvár–Tatabánya–Tárkány–Pér, and then back to Gödöllő along the same route (Figure 3). Prior to the flight, the Pilot carefully planned the route for the whole flight. During the flight, the Pilot more or less followed the route included in the navigation plan as far as Pilisvörösvár. After that, he deviated from the planned route, and, instead of following the 254° direction towards Tatabánya as planned, he flew, on average, in the 272° direction until the accident, in deteriorating weather conditions. Near Vértestolna village, the aircraft hit some trees at the top of a mountain reaching the clouds, and finally crashed to the ground. The aircraft was destroyed. The Pilot died on the spot, and his passenger survived the accident with serious injuries.

In addition to evaluating the weather at the time of the accident, the IC also reviewed the Operations Manual of the training organisation, with special regard to the system of booking of aircraft concerning the issue and record of company authorisations, and found that specific processes were missing.

In order to find out about the human factors acting during the flight involved, the IC also reviewed the previous flight instructor-student pilot relation between the Pilot and the Passenger.

The IC reviewed the logbook of the aircraft involved as well as the logbook of its engine, and found administrative inaccuracies and entries which generated misunderstanding.

The IC attributes the accident to the fact that the people on board flew into weather circumstances which were not suitable for visual flight (VFR).

The IC regarded the previous flight instructor vs student pilot relation between the Pilot and the Passenger and the shortcomings of the aircraft booking system of the training organisation as factors which contributed to the accident.

The Investigating Committee of TSB found no circumstance which would warrant a safety recommendation. The accident could have been avoided by following the relevant rules.

Figure 2: The aircraft involved in the event (source: the Internet)

1. Factual information

1.1. History of the flight

The Pilot's former flight instructor had reported that he had booked the aircraft with registration mark HA-VOK for the Pilot for 28 February 2016 on the day before the accident. They agreed to take a flight on the following day, *if chance allowed.*

The flight instructor had 2 training flights scheduled for him on the day of the accident: one for the morning hours, and one for the afternoon. After finishing the first flight, the flight instructor saw that the Pilot was already sitting in the aircraft with registration mark HA-VOK. Then, according to his report, he boarded the aircraft and sat in the RH side seat as a passenger (hereinafter: "the Passenger"). It was then that the Pilot submitted his flight plan for a private (VFR) flight to the competent air traffic management service, via mobile phone. The planned route was LHGD–Budakalász–Pilisvörösvár–Tatabánya–Tárkány–LHPR, and then back to Gödöllő along the same route (Figure 3). While submitting the flight plan, the Pilot said he did not intend to land in Pér but only to make a low pass there. The Pilot submitted a flight altitude of 2000 ft. above sea level. On the basis of the documents found, the navigation plan for the whole flight included carefully planned directions, distances, flight speeds, and durations between the turning points. According to the on-board flight logbook, the Pilot started the affected flight with the engine hour meter showing 3040.4 hours of operation, but no other entry was made.

Figure 3: Planned route of the HA-VOK

The Pilot, with the Passenger on board, started take-off from Gödöllő Airport at about 10:42 am on 28 February 2016. The aircraft with reg. mark HA-VOK appeared on the radar screen of the air traffic manager on duty at 10:43 am (at 1600 ft. altitude). The Pilot checked in with the air traffic management on duty at 10:44 am, while flying over Mogyoród, and gave his flight direction (at 1900 ft.) towards Budakalász. He next radioed at 10:52 am, to inform the air traffic manager that he was flying near Pilisvörösvár, at 1900 ft., and the next point on his route will be Tatabánya (with a direction of 254°). As far as that point, the Pilot more or less followed the flight directions specified in the flight plan, namely that he would fly in the 278° direction from Gödöllő to Budakalász, and in the 271° direction from there to Pilisvörösvár. However, from that point, (Figure 4) till the accident, the Pilot did not follow the planned route anymore. Subsequently, the heading of the aircraft was 272°, on average, until the accident. According to the passenger's report, the weather began to get worse after Pilisvörösvár: clouds came from his right hand side, but, as a passenger, he did not care about that fact, not having a glance at the instruments even, but only looked out the window on his right. Several witnesses saw the aircraft flying from east to west below the clouds. All witnesses stated unanimously that all mountain tops around had been in the clouds. According to a witness, the clouds moved roughly from north to south, while

another witness stated: *"The direction of the movement was from the direction of Tardos towards Tatabánya, and it moved very fast. The width of the cloud covered the whole length of the mountain ridge*".

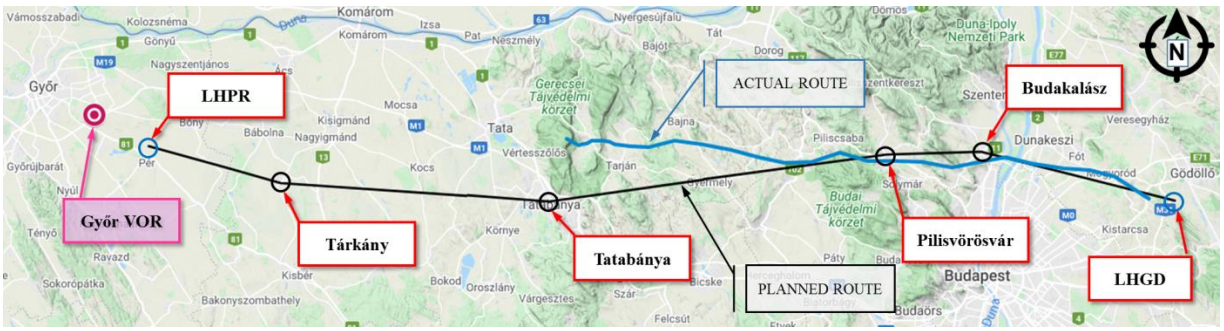


Figure 4: The planned route vs. the actual route of the aircraft

According to radar data, in the last 2 minutes preceding the accident, the flight altitude of the aircraft changed several times from 1800 ft. to values between 1900 ft. and 1600 ft., as well as its speed and direction of flight (Annex 1).

It was the Passenger who contacted the air traffic management service by radio at 11:03:57, reporting them that the weather had been getting bad, and he requesting traffic information. Then the Passenger informed the air traffic management service that they intended to climb to 2000 ft., but the radio communication was suddenly interrupted at 11:04:36, and no more communication occurred, despite several calls attempted by the air traffic management service.

After several unsuccessful radio and telephone calls, the air traffic management service started the alarm process, as a result of which the Search & Rescue helicopter found the wreck of the aircraft, with the people inside, near the village of Vértestolna at 12:30 o'clock. Following a series of crashes to trees, the aircraft had finally came to rest at the geographical coordinates 47.63304°N, 18.43183°E.

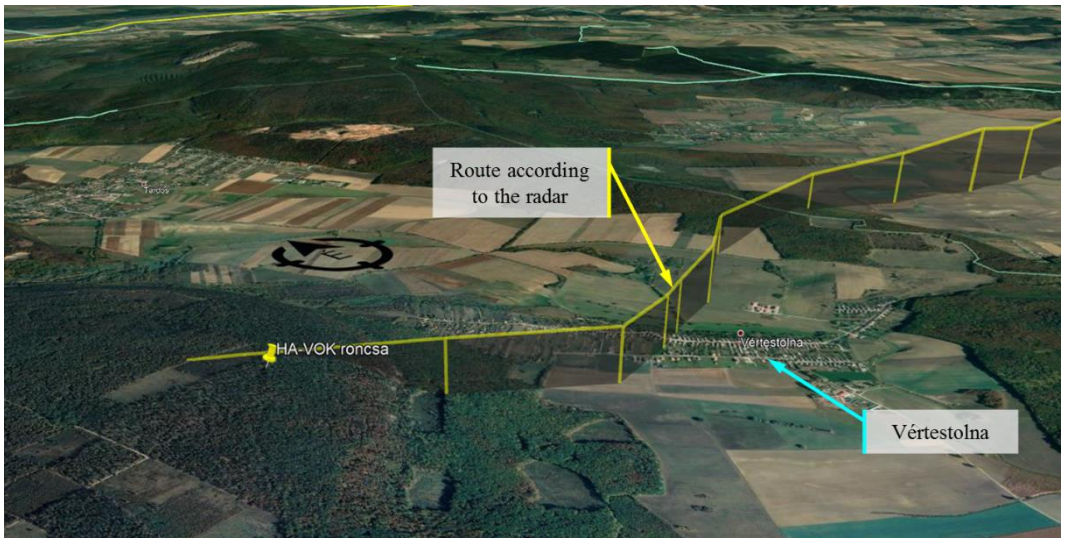


Figure 5: The flight path of the HA-VOK according to radar data

1.2. Injuries to persons

Injuries	Crew		Passengers	Other
	Pilot	Cabin		
Fatal	1	-	-	-
Serious	-	-	1	-
Minor	-	-	-	
None	-	-	-	

1.3. Damage to aircraft

The aircraft was destroyed in the accident. See detailed description of the wreck in Section 1.12.

1.4. Other damage

The IC had got no information on other damage by the completion of the investigation.

1.5. Crew data

1.5.1. Pilot flying (Pilot-in-Command)

Age, nationality, gender		32 years old, Romanian, male
Licence data	Type	PPL (A)
	Professional valid until	30 Oct 2017
	Ratings	SEP (land)
Medical class and valid until		Class 2, LAPL; 03 Mar 2019
Flying hours / take-offs	In the previous 24 hours	No data
	In the previous 7 days	No data
	In the previous 90 days	2 hours 48 min. / 2
	Total:	~53 hours / 194
	in the type involved, total:	2 hours 06 min.

The Pilot started his pilot training with the Organisation[1] in 2014, and, as part of such training, he took an examination in the theory of the Cessna FA152 type, but, with one exception, he performed all his subsequent flights in the type Cessna 172M aircraft with registration mark HA-JDA. During his training, the Pilot flew most of the time with the flight instructor who regarded himself as a passenger during the flight ending up in an accident.

The Pilot completed his licence exam on 29 October 2015. That was the last entry in his flight logbook. During the period between that date and the fight ending up in an accident, the Pilot flew on one occasion, 2 hours and 48 minutes, in December 2015, according to the records of the Organisation.

According to his flight logbook, throughout his career, it occurred only on three occasions, altogether, that the Pilot landed at an airport other than Gödöllő Airport after a

[1] *Organisation: See list of definitions and abbreviations.*

cross-country flight. Such other landing locations were Szeged Airport (twice) and Pér Airport (once).

The Company Authorisation previously issued by the Organisation to the Pilot only included the aircraft type Cessna 172M with reg. mark HA-JDA, therefore he was not authorised to fly the type Cessna FA152 aircraft with reg. mark HA-VOK as pilot-in-command. During the investigation, the IC only found a Company Authorisation issued to the Pilot which had been valid from 01/01/2015 to 31/12/2015.

1.6. Aircraft data

1.6.1. General

Class	Fixed wing aircraft (MTOM<5700kg)
Manufacturer	*Reims Aviation SA, France*
Type	Cessna FA152
Year of manufacture	1978
Serial number	0346
Registration marks	HA-VOK
State of registry	Hungary
Date of registry	22 March 2012
Name of the owner	Private individual
Name of the operator	CAVOK Aviation Training Kft.

	Flight hours
Since manufacture	12798.5 hours
Since last overhaul	1210.6 hours
Since last periodical maintenance	3.9 hours

According to the ATO Operations Manual of the Organisation,[2] the aircraft was also used for basic pilot training and IFR flight training. In addition to standard VFR instruments, that aircraft was also equipped with the instruments required for IFR flights.

1.6.2. Notes relating to airworthiness of the aircraft

Airworthiness Certificate	Number	FD/LA/NS/B/637/2/2012
	Date of issue	22 March 2012
	Valid until	Until withdrawal
	Restrictions	None

Airworthiness Review Certificate	Number	FD/LD/NS/A/2655/1/2015
	Date of issue	25 June 2015
	Valid until	25 June 2016

[2] ATO Operations Manual / 6.17 Appendix Q – Training Aircraft List (Rev 7, 01 JAN 2015)

1.6.3. Engines

Category	Boxer 4-cylinder piston engine with air cooling
Engine manufacturer	Lycoming
Type	O-235 L2C
Serial number	RL-22076-15
Hours / cycles flown	
Since manufacture	No exact data available
Since last overhaul	1210.6 hours
Since last periodical maintenance	3.9 hours

1.6.4. Aircraft loading data

Aircraft loading data had no effect on the course of events therefore no detailed discussion is needed.

1.6.5. Description and data of malfunctioned system or equipment

No information emerged during the investigation on malfunction of the structure or any system of the aircraft prior to the occurrence, thus contributing to the occurrence or influencing the course of events.

1.6.6. On-board warning systems

The aircraft was equipped with a transponder which worked correctly during the flight leading to the accident and the IC did not make or receive any comment relating to any irregularity of its operation.

1.7. Meteorological information

On the day of the accident, our region was at the side of a cyclone above the Mediterranean Sea and at the edge of an anticyclone above the East European Plain. Humid air arrived above the Carpathian basin only at higher altitudes therefore there were no significant rainfalls in our country. In the relevant time of the day, there was no rain in the vicinity of the location of the accident, and the speed of the south-south-east wind reached only moderate to fresh wind speeds.

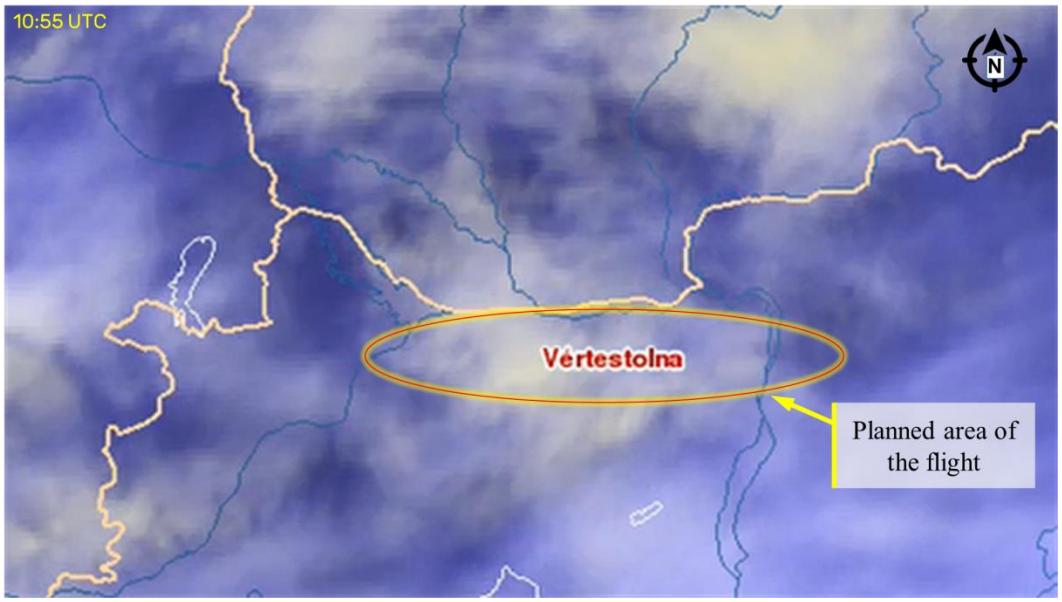


Figure 6: Composite cloud picture (Source: Hungarian Meteorological Service)

At 10:30 am, the meteorology station at Budapest Liszt Ferenc International Airport detected 3/8 v. to 4/8 cloud cover at 400 metres altitude.

According to the camera records obtained from the departure airport, there was a low, 1/8 to 3/8 cloud cover in the Gödöllő area at the time of the take-off of the HA-VOK.

The IC has no information on what kind of weather data or information the Pilot obtained before take-off.

According to the meteorologist expert appointed by the TSB, the report submitted by Hungarian Meteorological Service, and witness reports, a low-level cumulus cloud layer of inversion origin was present with continuous replenishment in the low hill areas lying west of Budapest (Figure 6). According to data collected, the low clouds fully covered the Pilis-tető, the TV tower on the Gerecse (altitude: 2000 ft.), and the Kétágú-hegy (altitude: 1653 ft.) located near Kesztölc village, till 12 am.

At the time of the accident, the top and the eastern side of the affected mountain was certainly in the cloud at the flight altitude of the HA-VOK.

1.8. Aids to navigation

The equipment items specified in the type certificate were installed on the aircraft, and the IC did not make or receive any comment relating to irregularity of their operation.

The aircraft was equipped with VOR navigation equipment, which is part of the equipment required for IFR flight.

The VOR station of Győr city is located ca. 6.9 km from Pér Airport, in the 300° direction.

The IC did not make or receive any comment relating to irregularity of the operation of ground-based equipment.

1.9. Communications

The equipment items specified in the type certificate were installed on the aircraft, and the IC made or received no comment relating to irregularity of their operation.

The IC did not make or receive any comment relating to irregularity of the operation of ground-based equipment.

The communication equipment did not influence the course of events, so it needs no detailed discussion.

1.10. Aerodrome information

The aircraft took off from Gödöllő Non-Public Airport Class IV (LHGD) on 28 February 2016, at 10:42.

The planned destination airport was Gödöllő Airport, after a low pass above Pér Airport.

Gödöllő Airport had a valid operation licence at the time of the occurrence.

Name of aerodrome	Gödöllő Non-Public Airport Class IV
Aerodrome ICAO location indicator	LHGD
Airport operator	Vüszi Kft.
Reference point (ARP)	47 34 25N 019 19 57E
Elevation	218 metres
Runway identification	13/31 (126°/306°), 04/22 (40°/220°)
Runway length	1350x60 metres, 300x60 metres
Runway surface	Grass

The parameters of the aerodromes did not influence the course of events, so they need no detailed discussion.

1.11. Flight data recorders

No data recorder was installed in the aircraft; it is not required for the aircraft type involved.

As regards to the air traffic management equipment, the required data recording systems were at work, and data recorded by them was evaluable.

1.12. Wreckage and impact information

The aircraft was flying horizontal when it arrived at a forested area in a flat part of the mountain ridge and hit the trees. The aircraft lost its kinetic energy gradually in a series of collisions during uncontrolled flight at about 80 metres, and came to rest at the coordinates 47.63304°N, 18.43183°E.

Figure 7: The wreck of the aircraft with some major structural elements separated (Photo: TSB)

The damages to the trees and the pattern of scatter of the separated aircraft parts show that the aircraft moved along an almost fully straight line with no deviation of direction from the point of the first collision to the spot where it came to rest, and that its direction was about 311 degrees (Annex 2).

As a result of the series of collisions, several major structural elements of the aircraft separated from the fuselage (among others, the main landing gears, a piece of the left wing, the LH aileron, the propeller, and the tail part with the vertical and horizontal stabilizers) (Figure 7).

The inspection of the scene showed that no structural elements had separated from the aircraft before the first collision. It was also found then that the separated propeller, as well as the engine, needed further inspection. For that reason, TSB had the wrecks transported to the hangar of TSB in Tököl for further inspection. Further inspection of the wrecks took place on 18 March 2016, with the participation of the police, the expert invited by the police, and investigators from NTA AA and TSB.

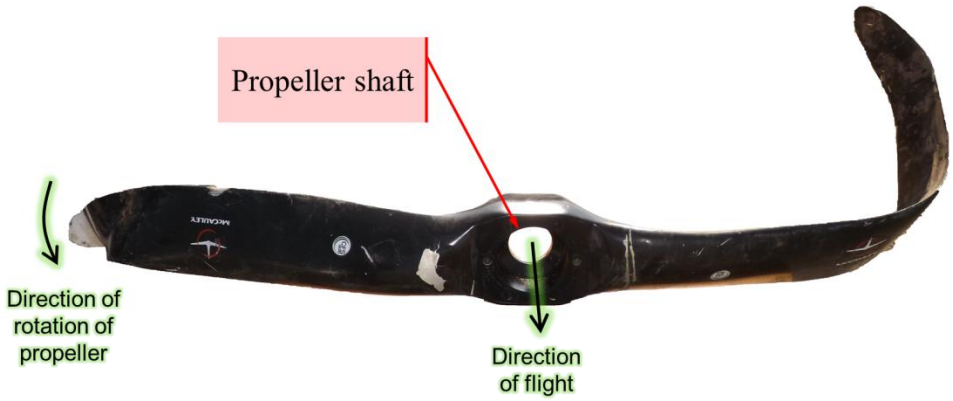


Figure 8: The propeller of the HA-VOK

The investigation of the hub and blades of the propeller found, among others, that the propeller hub separated due to the forces generated by the engine running at high speed and the contacts with the trees (Figure 8).

During the investigation of the site, the IC found the revolution meter and the hour meter of the engine, with the latter indicating the reading 3040.9 at the moment of the crash.

The combustion chamber side of the igniter plugs of the engine were intact. According to the results of the inspection of the engine, the IC thinks that the engine had worked correctly until the crash.

1.13. Medical and pathological information

There was no evidence that physiological factors or other impediments had affected the legal capacity of the Pilot.

1.14. Fire

There was no fire in connection with the occurrence.

1.15. Survival aspects

After the disruption of radio communication, the air traffic management attempted to call the aircraft with the reg. mark HA-VOK by radio several times, and later also by dialling the telephone number given in the flight plan, but with no success.

At 11:29:28, the competent air traffic management service called the departure airport, and then, at 11:35:46, they called Pér-Győr Airport to find out whether the HA-VOK landed there possibly. After repeated failures to establish contact, the air traffic management service initiated an alarm according to the relevant procedure.

The crew of the Search & Rescue helicopter of MH 86 Szolnok Helicopter Base, stationed at Pápa Airport, was alarmed at 11:30 am because of the missing aircraft. The helicopter took off from Pápa at 11:50, and soon after, its crew received the GPS coordinates where the missing aircraft disappeared from the radar of the competent air traffic management service. According to the report of the crew of the Search & Rescue helicopter, they were leaving Pápa when they were informed on radio that smoke was rising from the reeds along the M1 Highway near Vértesszőlős, and the aircraft had also been seen in that area. The helicopter reached the given area at 12:10, but the search & rescue team found no aircraft wreck in that area. Then the helicopter flew to the coordinates received earlier, and found the wreck of the missing aircraft at 12:30. Upon landing, the search & rescue team removed the two people from the wreck, and began medical action. According to their report, one of the two persons had no palpable pulse, and the other person was conscious, and it was possible to communicate with him. In the meantime, the helicopter and medical team of the air ambulance also arrived, and ground ambulance service also came subsequently.

The aircraft had neither integrated nor portable emergency locator transmitter (ELT) but was equipped with a transponder which worked properly during the flight.

1.16. Tests and research

The IC did not perform or order tests or special inspections.

1.17. Organisational and management information

1.17.1. Issue of Company Authorisations

The Organisation's ATO Operations Manual, in effect at the time of the accident, contains information relating to the Company Authorisations. The manual indicates the Flight Operations Manager or the deputy thereof as the person who issues a Company Authorization.

In the case investigated, the administrative requirements for the pilot regarding private flights are included in Section 4.1.2, Part A of the ATO Operations Manual (see Annex 3). It indicates, among others, that a pilot who wishes to perform a private flight in an aircraft operated by the Organisation shall have:

- a valid pilot licence,
- Type and/or Class rating for the given aircraft type in the pilot licence
- a valid medical certificate,
- a valid Company Authorisation issued by the Flight Operations Manager or the deputy thereof.

Section 1.2.3, Part A of the ATO Operations Manual indicates the Flight Operations Manager's tasks and responsibilities, but no task or responsibility is defined relating to the issue of Company Authorizations.

The IC found no procedure in the ATO Operations Manual relating to any process of the issuing and record keeping of Company Authorizations. Therefore it does not indicate who this type of authorization can be issued to, on what conditions; nor is the method of keeping record of such authorizations indicated therein.

Although Annex 3 to the ATO Operations Manual indicates the formal layout of the Company Authorization (Figure 9), but the Manual contain no reference to it, and the Authorization Card requires the signature of a person in such a position ("Chief Pilot") which is not mentioned in any part of the Manual.

Figure 9: A sample of the Company Authorisation Card used by the organisation

During the period of the investigation, the Company modified several parts of its Operation Manual, including the process of issuing company authorizations and the supervision thereof.

1.17.2. Aircraft booking system

The Passenger, who was involved in the accident and who worked as a flight instructor for the Organisation and also had a Company Authorisation for the aircraft involved in the accident could not give clear answers to the IC's questions relating to how the aircraft was booked, rented and hired with the Organisation. According to his report, "*I have not seen any procedure relating to that …… It was done in an ad-hoc way, a little bit*".

What the IC was able to find out about the recording of aircraft bookings is that it was done using a computerised system. Reviewing the documents related to the operation of the organisation, the IC found no procedure relating the booking, renting or hiring of the aircraft.

During the investigation, the Organisation improved its aircraft booking system which inspects both the aircraft and the flight crew on the basis of the following points of view, among others:

- validity of the documents of the aircraft,
- operation hours left until next maintenance,
- validity of the licences, ratings, medical certificates and other documents of the flight instructors/student pilots,
- in the case of expiry of any validity period, the system blocks the release of aircraft,
- use of the booking diary is compulsory: no take-off is authorised in the given aircraft otherwise.

The IC got familiar with the operation of the improved booking system on 19 November 2019, during an unannounced visit.

1.18. Additional information

1.18.1. The Passenger's flight experience

According to the ATO Operations Manual of the Organisation,[3] the Passenger as a flight instructor had a valid contract with the Organisation. The Passenger had a Company Authorization for all aircraft types operated by the Organisation. He also had a pilot licence as a commercial pilot and flight instructor, licence for aircraft with single and multiple engines, and IFR rating.

1.18.2. The Passenger's statement

Relating to the accident, the Passenger said in his statement made to the police that, during the flight, "…. *if I had seen that we were flying too high or too low, I would have told him …..*".

1.18.3. Weather conditions vs. VFR flight

Pursuant to SECTION SERA.5001, Implementing Regulation (EU) 923/2012, horizontal visibility should have been least 5 km during the flight of the aircraft with reg. mark HA-VOK in the given airspace, and the aircraft should have flown free the clouds on a continuous basis, in order to see the terrain.

[3] ATO Operations Manual / 6.5 Appendix E – Instructor List (Rev 7, 01 JAN 2015)

1.18.4. Eye-witness

On 7 March 2016, the police interviewed an eye-witness at Tatabánya Police Station; according to his statement, he was staying in Vértestolna on the day of the accident, when, at about 11 am, he saw a bluish grey aircraft flying in the direction of Agostyán, below the clouds, at an altitude of ca. 250 to 300 metres. The witness said the aircraft had been flying straight into a *"sooty black cloud"*, and, after a few seconds, he had heard a loud bang from that direction. He added that the nearby mountain tops had been in the clouds at that time.

1.18.5. Keeping of logs of the aircraft and of the engine

The IC reviewed the logbooks of the aircraft and engine involved in the accident, and found administrative inaccuracies and unclear entries (not related to the accident) in them in several places.

The flight hours in the logbook of the aircraft was kept as total time since new (TTSN) till 17/06/2015 (Figure 10), but, starting with 18/06/2015, the values entered in the same column shows the time since the last overhaul of the engine as the time since the last overhaul of the aircraft (Figure 11). That change was entered into the aircraft logbook by pen, without any signature.

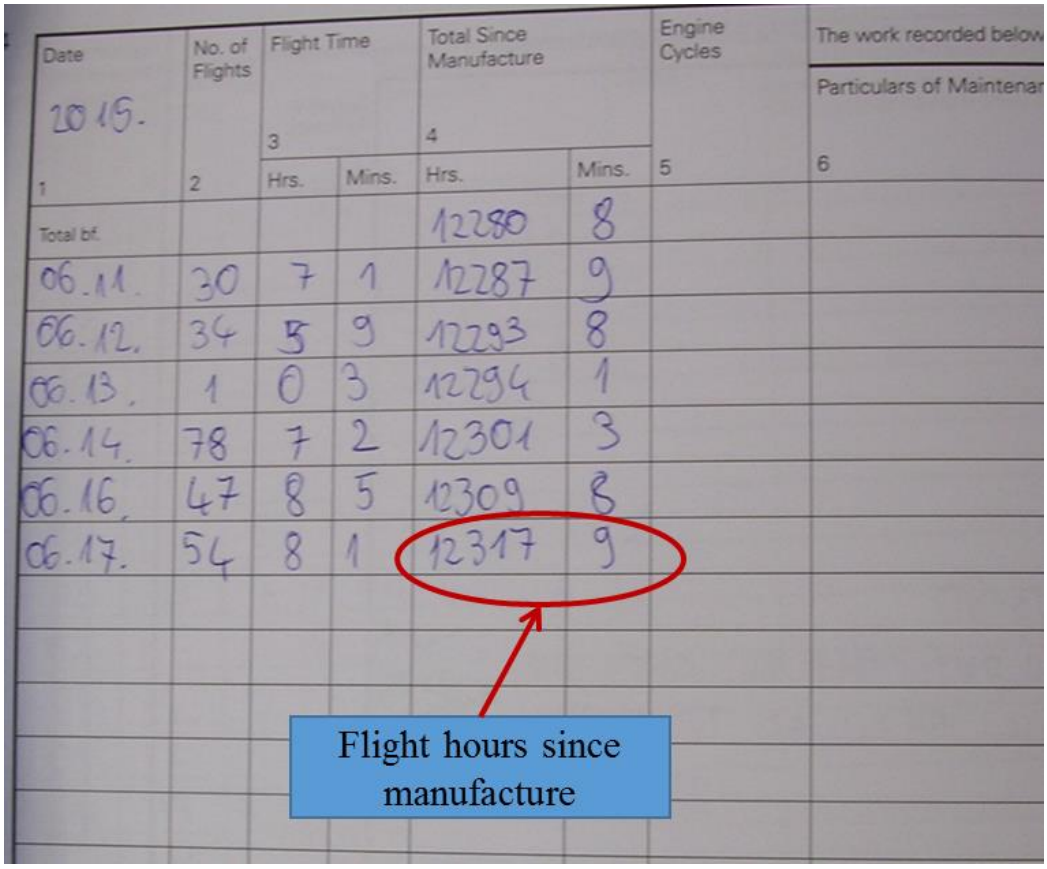


Figure 10: The aircraft logbook till 17/06/2015

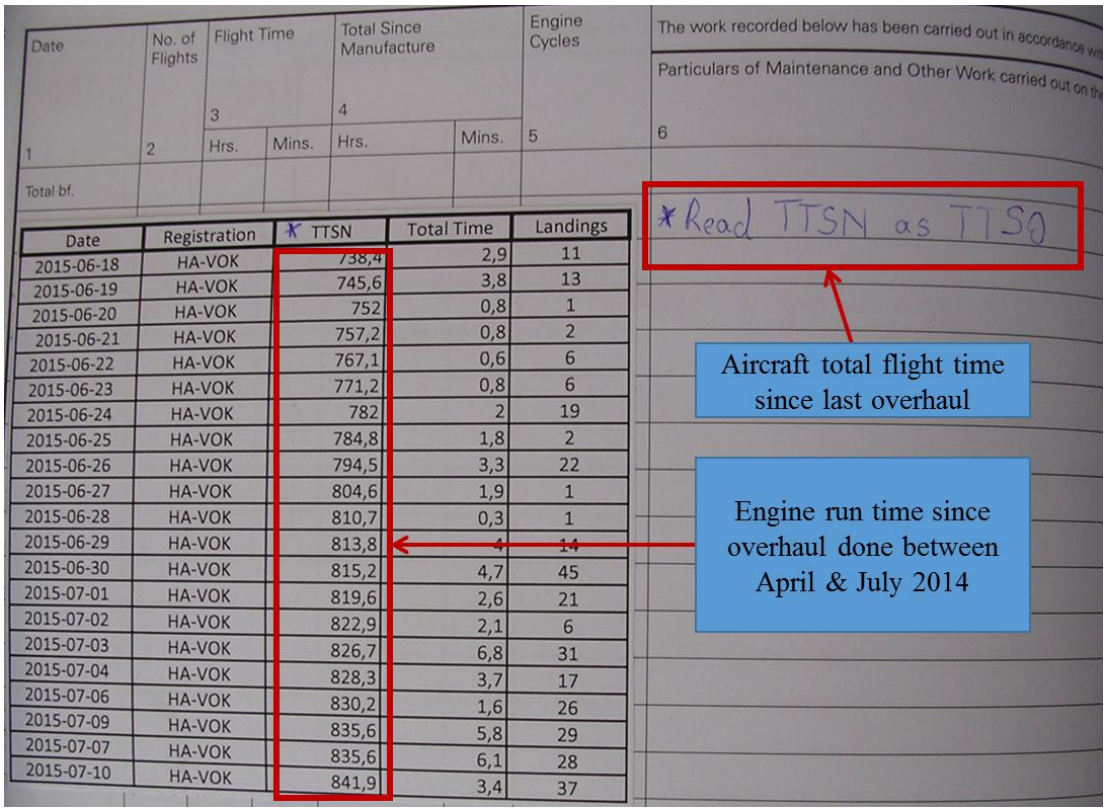


Figure 11: The aircraft logbook as from 18/06/2015

Starting with 18/06/2015 and ending with the last entry preceding the accident, all operation time data shows the hours since last overhaul of the engine as if the values were the flight hours of the aircraft since new (Figure 12).

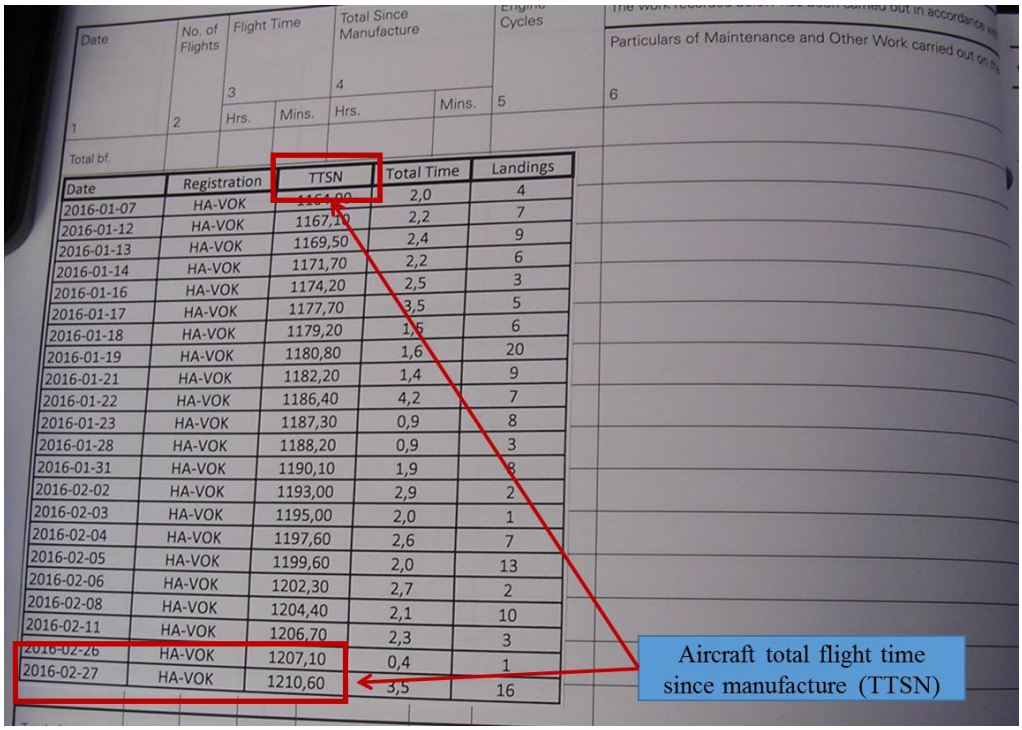


Figure 12: The last entry in the aircraft logbook

Till April 2014, the engine logbook indicated the run time as total time since new. Between April and July 2014, at 1610 hours TTSN according to the engine logbook, a maintenance organisation performed an overhaul of the engine, which they certified by the entry *"Overhaul completed. May run till 2400 hours."* but with no date of such overhaul. In its Service Letter in effect at the time of the event (SL L213), the manufacturer of the engine specified the run time of the engine between two overhauls as 2400 hours, subject to certain conditions.

After the overhaul, the completed run time of the engine starts from zero in July 2014. The run time starting at that time is indicated as TTSO, TTSN and TT in the logbook of the engine.

As of 18/06/2015, the total flight hours "since new" of the aircraft are indicated only with the entry of maintenance sessions performed, in such manner that calculated values are entered in certain cases, and values rounded down or up to 50 or 100 in other cases (Figure 13).

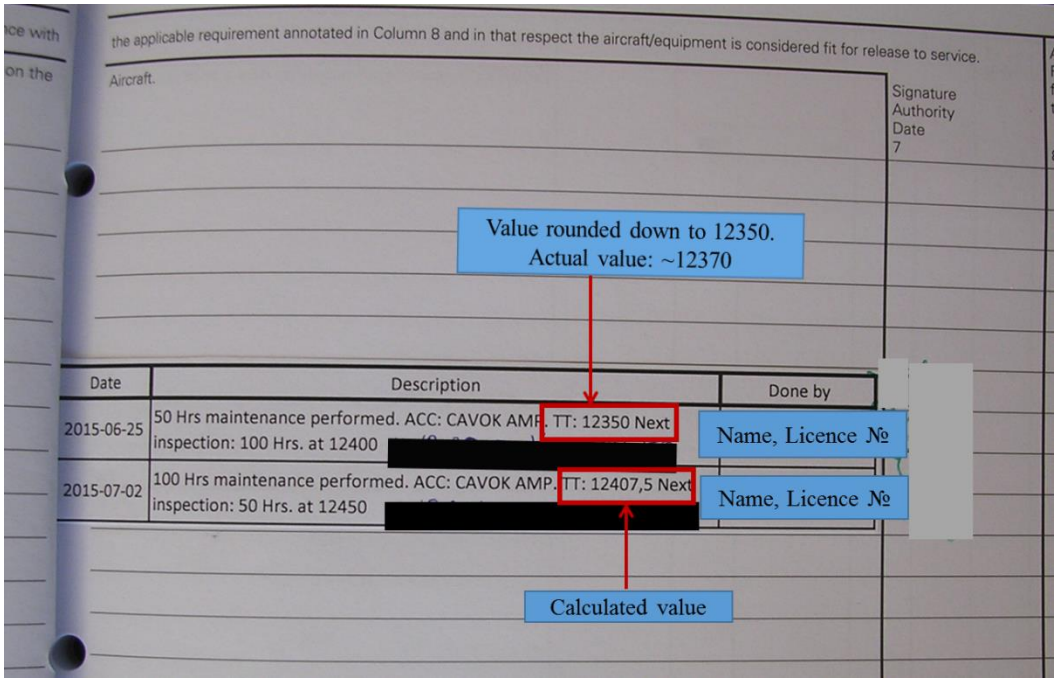
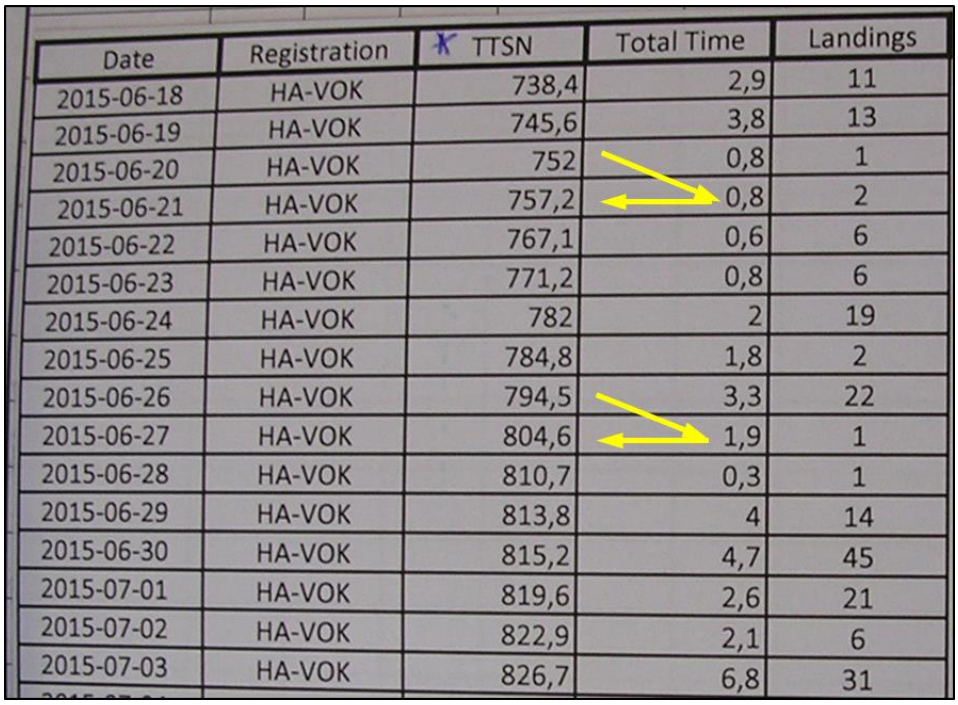


Figure 13: Indication of flight hours in the aircraft logbook

The daily completed flight hours/operation hours in the logbook of the aircraft, and accordingly, in the engine logbook as well, show huge inaccuracy.

The IC was hardly able to find consistent data entered between 18/06/2015 and 19/11/2015 (Figure 14).



Date	Registration	TTSN	Total Time	Landings
2015-06-18	HA-VOK	738,4	2,9	11
2015-06-19	HA-VOK	745,6	3,8	13
2015-06-20	HA-VOK	752	0,8	1
2015-06-21	HA-VOK	757,2	0,8	2
2015-06-22	HA-VOK	767,1	0,6	6
2015-06-23	HA-VOK	771,2	0,8	6
2015-06-24	HA-VOK	782	2	19
2015-06-25	HA-VOK	784,8	1,8	2
2015-06-26	HA-VOK	794,5	3,3	22
2015-06-27	HA-VOK	804,6	1,9	1
2015-06-28	HA-VOK	810,7	0,3	1
2015-06-29	HA-VOK	813,8	4	14
2015-06-30	HA-VOK	815,2	4,7	45
2015-07-01	HA-VOK	819,6	2,6	21
2015-07-02	HA-VOK	822,9	2,1	6
2015-07-03	HA-VOK	826,7	6,8	31

Figure 14: Inaccuracies of flight hour calculation

1.19. Useful or effective investigation techniques

The investigation did not require techniques differing from the conventional approaches.

2. Analysis

2.1. Weather

With regard to the expert report and the official weather reports discussed in Section 1.7, the IC considers that the weather situation recorded at Budapest Liszt Ferenc International Airport at the time of the start of the flight under review was also relevant for Gödöllő Airport at the time of the take-off of the aircraft with reg. mark HA-VOK.

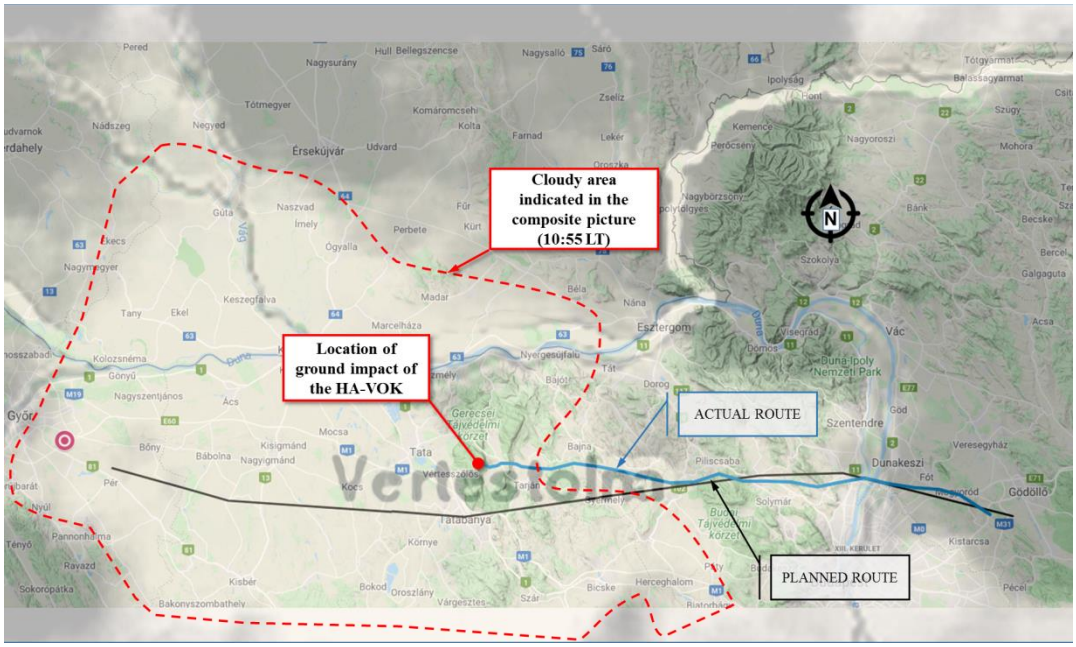


Figure 15: Matching of the composite cloud map and the flight path

According to the IC's position, the Pilot and the Passenger were aware of the weather situation. Therefore, it cannot be excluded that the turning point at Győr also influenced the selection of the route, due to the VOR navigation station which allowed IFR flight as well, based on the instruments installed in the aircraft (1.6.1).

The IC matched the flight path obtained from the radar with the composite cloud map recorded by Hungarian Meteorological Service at the time of the accident. The matching of these two data items shows that the last minutes of the flight took place in an area covered with clouds (Figure 15).

2.2. Aircraft crew

From the following facts, namely that:

- the aircraft was booked for the Pilot by the Passenger (Section 1.1), and
- the Pilot was not entitled to fly the aircraft (Section 1.5.1), and
- the Passenger had known the Pilot and had been aware of his capabilities and level of training as a pilot, as well as his ratings (Section 1.1, 1.5.1), and
- the Pilot had known the Passenger (Section 1.1, 1.5.1), and had been aware of his position as flight instructor with the Organisation, and
- neither the Organisation nor the airport staff indicated that the Pilot removed the aircraft with reg. mark HA-VOK from Gödöllő Airport unlawfully,

and not supposing that if the Pilot had been on his own he would have flown the aircraft with reg. mark HA-VOK without having proper training and Company Authorisation for such aircraft, the IC's position is that the flight ending up in the accident was of training nature.

The IC regards the shortcomings of the aircraft booking system as a contributing factor to the accident.

2.3. Human factors

During a flight with passenger(s) it is a generally accepted behaviour that the pilot takes his passenger's requests into account, but makes his decisions within the frameworks of his level of training and capabilities within the frameworks of compliance with the relevant regulations as far as possible to maintain a safe flight.

The IC's investigation of the human factors was based on the fact that the person seated as "passenger" in the aircraft had been a flight instructor of the Pilot. On that basis, the IC thinks that while on board, the Pilot might have developed a mental image in which it was not him that had to make decisions (e.g. whether to turn back due to impair of the weather) or, owing to the false safety provided by the presence of the flight instructor, he (the Pilot) had the chance to make decisions which were well beyond the limits of his level of training and capabilities.

The IC's position is that, in the case of the flight concerned, one cannot state clearly that there was just a usual pilot-and-passenger relation in the cabin. The IC's position is that, in the case of the flight concerned, a pilot-and-flight instructor relation prevailed.

The IC excludes that the Passenger played no part in the Pilot's decision making process, and it is only an assumption that the critical decisions made during the flight were made by the Passenger. This is supported by the Passenger's statement made as witness to the police: *"…had I seen we were too low or too high, I would have told him …"* (1.18.2). The IC regards those above as a factor which contributed to the event.

2.4. Flight

The difference between the engine counter values read between the start and the ground impact shows 0.5 hours (1.1, 1.12) i.e. 30 minutes of engine run time.

The analysis of radar data shows that after reaching the area covered with low clouds (described in section 1.7) the aircraft did not follow the planned route but, slightly deviating from it to the right, it flew more or less in the direction of the VOR station in Győr, which resembled the typical picture of a beginner radial tracking.

According to the IC, the fact that the last radio communication was performed by the Passenger means that the Passenger fully took over of the control of the aircraft – except for the physical control –, thus placing himself into a decision making position.

According to the IC, the pilot was aware of the weather situation at the start, and the weather continuously got worse during the flight.

It was not revealed during the technical investigation what the purpose of the concerned flight had been exactly. Taking into account that the Pilot had already flown type Cessna C172 aircraft, it would not be didactically justified to start with a cross country flight in the case of conversion training.

2.5. Aircraft

Starting with 18/06/215, the "total time since new" (TTSN) flight data of the aircraft indicated in its aircraft logbook (mentioned in Section 1.18.5) was changed to the run time data of the engine "since last overhaul". By that change, the run time since manufacture of the aircraft decreased from 12317 hours to 738 hours in a documented manner. The IC cannot tell the exact cause of such change but assumes that it was introduced for the sake of a presumably simpler run time calculation. The IC's position is that such change may result in inaccuracy and ambiguity in the process of run time calculation. Should any logbook be replaced, the actually completed flight hour number of the aircraft may become untraceable even if it is recorded in another system. The fact that the columns in aircraft log for flight time include the engine run time data, while the columns for maintenance completed include (with a TT entry) the counted or rounded flight time of the aircraft implies the possibility of inaccurate recording of the flight time of the aircraft, which in turn may lead to missed maintenance actions. This factual statement is supported by the huge inaccuracy of the total run time data calculated as the total of daily run times (Figure 14).

The run time log of the engine indicates a documented overhaul at 1610 hours of run time (TTSN) between April and July 2014, which the maintenance organisation certified with the entry *"Overhaul completed. May run till 2400 hours."* According to such entry, the engine may run 790 hours in total till the next overhaul, despite the fact that the manufacturer specified 2400 hours of run time between two overhauls. In the IC's opinion, this is the result of inaccurate wording of the entry, because it is not typical after an engine overhaul that the organisation performing the overhaul allows only 1/3 of the runtime specified for the period between two overhauls. However, the zero hour starting time was not entered as the total time since overhaul (TTSO) but as the total time since new (TTSN) of the engine. Due to that erroneous entry, 1610 hours of run time of the engine got lost in a documented way in the logbook of the engine.

The run time columns in the engine logbook include the engine run time data since last overhaul as if such data was the run time hours since new, while the columns for maintenance completed include (with a TTSN, TTSO and TT entry) the counted or rounded flight time of the aircraft or run time of the engine. This implies the possibility of inaccurate record keeping of the run time, which in turn may lead to missed maintenance actions.

The IC finds all the total time (TT) entries in the logbooks uninterpretable because the TTSN, TTSO and TT entries are used inconsistently.

2.6. Chances of survival

In the IC's opinion, the chances of surviving similar accidents are fairly low. Right before coming to a rest, the aircraft hit the lower part of a tree and the structure of the fuselage was damaged so badly that the space for its occupants was reduced to a minimum. In this case, however, the aircraft lost its kinetic energy gradually, through a relatively longer period of time. Each of the structural elements which separated one after the other played important role in absorbing the kinetic energy of the aircraft. Such relatively slow and even deceleration gave a chance of survival, although at the cost of very serious injuries.

The serviceable transponder largely increased the chances of survival because it helped the competent air traffic management service initiate the Search & Rescue of the aircraft after the event, according to the relevant procedure, and later on, they were able to inform the Search & Rescue service, giving them a relatively accurate location data of the accident.

3. Conclusions

3.1. Findings

3.1.1. Aircraft

The aircraft was airworthy. (1.6.2)

The aircraft had a valid airworthiness certificate. (1.6.2)

The aircraft was destroyed in the accident. (1.1, 1.3, 1.12)

No structural elements were separated from the aircraft prior to the collisions. (1.12)

No information emerged during the investigation on malfunction of the structure or any system of the aircraft prior to the accident, thus contributing to the event or influencing the course of events. (1.6.5,1.12)

The equipment specified in the type certificate was installed in the aircraft, and the IC did not find or received any comment relating to the operation thereof. (1.8,1.9)

The aircraft logbook included several administrative inaccuracies and ambiguous entries. (1.18.5, 2.5)

The engine logbook included several administrative inaccuracies and ambiguous entries. (1.18.5, 2.5)

3.1.2. Crew

At the time of the accident, the Pilot had a valid pilot licence and appropriate medical certificate, but he was not authorised by the organisation to fly the aircraft type involved in the accident. (1.5.1, 2.2)

The Passenger had a valid pilot licence and appropriate medical certificate, as well as a Company Authorisation issued by the Organisation for the aircraft type involved in the accident. (1.18.1)

The Pilot and the Passenger had a student pilot–flight instructor relation prior to the flight concerned. (1.1, 1.5.1, 2.2, 2.3, 2.4)

3.1.3. Air operation

The mass and centre of gravity of the aircraft were within the specified limits. (1.6.4)

The navigation plan, the directions of flight, the distance, ground speed and the flight time were carefully planned for the whole flight. (1.1)

Initially the actual flight followed the flight plan, but then deviated from it significantly. (1.1, 2.4)

In the last two minutes of the flight, the flight altitude of the aircraft deviated from 1800 ft. several times, changing between 1600 ft. and 1900 ft. (1.1)

The last radio communication prior to the accident was performed by the Passenger. (1.1, 2.4)

The flight took place at daytime, in deteriorating visibility. (1.1, 1.7, 2.1)

The weather conditions specified for VFR flight were not available in the last phase of the flight.

3.1.4. Organisation

The Organisation's Operations Manual in effect at the time of the accident included no procedure for the issuing and recording of company authorisations. (1.17.1)

The Organisation's Operations Manual in effect at the time of the event included no procedure for the booking of aircraft. (1.17.2)

The Organisation modified its Operations Manual during the investigation. (1.17.1, 1.17.2)

3.1.5. Air traffic management service / airport

No information emerged on the activity of the air traffic management service or the characteristics of the aerodrome which could be associated with the event. (1.10,1.11)

The IC did not make or receive any comment relating to irregularity of the operation of ground-based navigation equipment. (1.8)

The IC made or received no comment relating to irregularity of the operation of the ground-based communication equipment: it proved to be suitable for the task. (1.9)

The aerodrome involved in the occurrence had a valid operation licence. (1.10)

3.1.6. Data recorders

The required data recorders required for air traffic management were at work and the data they recorded was evaluable. (1.11)

3.1.7. Medical examinations

There was no evidence that physiological factors or other impediments had affected the legal capacity of the Pilot. (1.13)

3.1.8. Chances of survival

The chances of surviving similar accidents are fairly low. (2.6)

The on-board transponder in operation increased the chances of survival. (1.15, 2.6)

3.2. Causes

During the investigation, the IC came to the conclusion that the direct cause of the accident was that the people on board flew into such circumstances which were not suitable for the weather conditions specified for VFR flight.

According to the IC, the following factors might also have contributed to the event:

- the previous student pilot–flight instructor relation between the Pilot and the Passenger,
- the shortcomings of the Organisation's aircraft booking system used at the time of the accident.

4. Safety recommendations

4.1. Actions taken by the training organisation during the investigation

During the investigation, the training organisation modified its operations Manual, relating to Company Authorisations and the system of booking of aircraft, among others.

4.2. Safety recommendation(s) issued during the investigation

TSB issued no safety recommendation during the investigation.

4.3. Safety recommendation(s) issued on completion of the investigation

The Investigating Committee of TSB identified no circumstance which would warrant issuance of a safety recommendation. The accident could have been avoided by following the relevant rules.

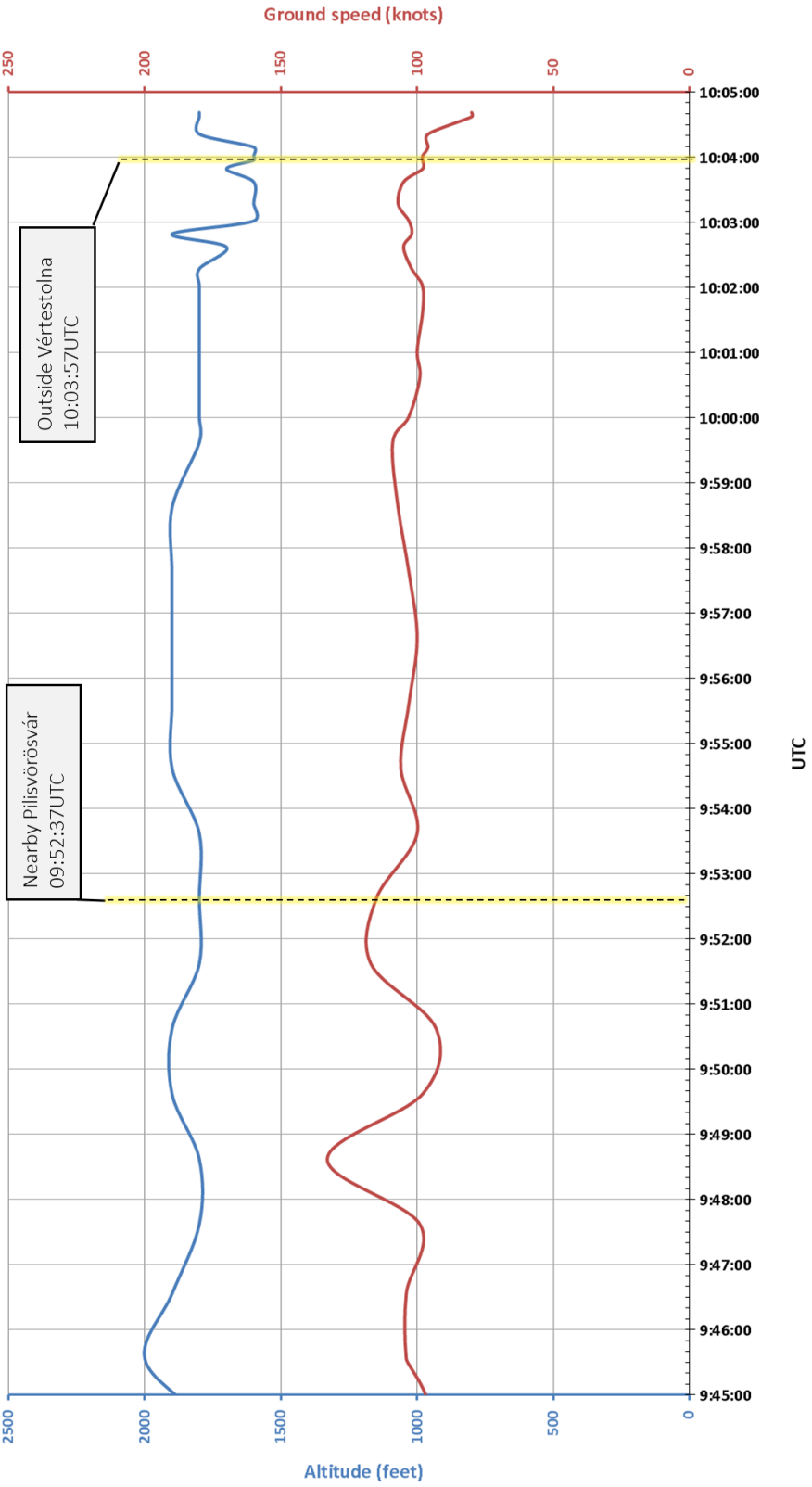
Budapest, "14 " April 2021

Gábor Erdősi
Investigator-in-charge

Gábor Torvaji
IC Member

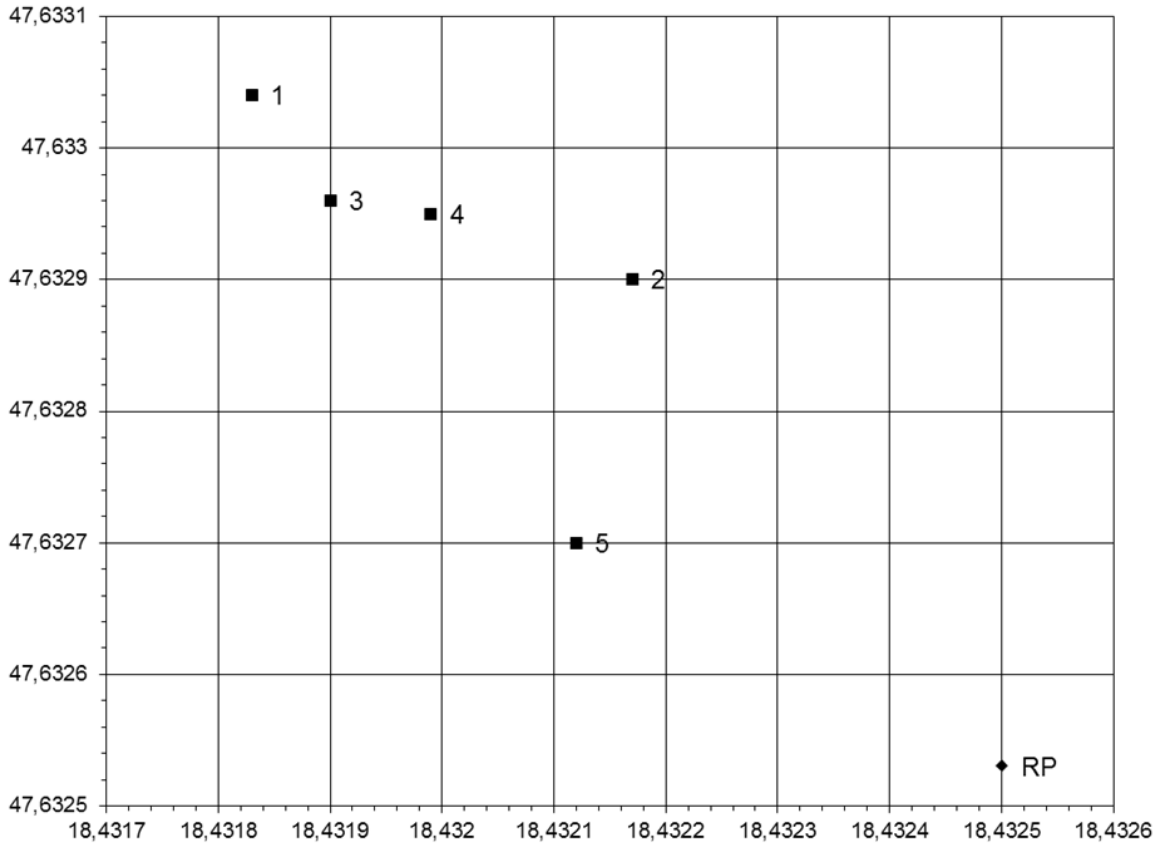
ANNEXES

Annex 1:



Annex 2:

№	Designation	Longitude	Latitude	Distance (m)	Direction (deg.)
RP	First collision with trees	47.63253	18.4325	--	--
1	Wreck of aircraft	47.63304	18.43183	75.74050318	311.0862592
2	Propeller	47.6329	18.43217	48.00208934	322.0894117
3	Tail	47.63296	18.4319	65.63253457	309.3820234
4	LH wingtip	47.63295	18.43199	60.34560772	313.3268547
5	LH aileron	47.6327	18.43212	34.17818737	297.1284009



Annex 3:

[redacted]	OPERATIONS MANUAL PART A CREW COMPOSITION	SECTION 4; CHAPTER 1 PAGE 2 Rev 1, 25 April 2013

1. Type of operations and type of aircrafts being used by [redacted]

Company is performing the following flight activities,

- pleasure flights;
- training flights;
- private flights;

[redacted] is operating under Air Operator Permit and using the following aircrafts for the operations

- single engine piston aircrafts;

2. Minimum cockpit crew for non-commercial operations

Minimum cockpit crew for non-commercial operations shall be assigned as follows,

- minimum crew numbers for pleasure flights, private flights, and training flights are one pilot unless Airplane Flight Manual requires more than one pilot;

2.1. Qualification of the crew members

Flight crew license requirements are detailed in 1178/2011 PART-FCL or equivalent international orders. Present chapter the additional requirements in order to qualify as a flight crew member on flights operated by the company in commercial operations not under the force of EEC No. 859/2008 regulations as amended and non-commercial flights.

2.1.1. Commander on single pilot airplanes

All pilots assigned to Commander on single pilot airplanes operated by company shall be rated qualified as follows,

- pilots assigned to Commander on single pilot airplanes operated by company have to hold minimum a valid Commercial or in case of private flights a Private Pilot License issued on the basis of 1178/2011 PART-FCL Part D or equivalent international orders;
- pilots assigned to Commander on single pilot airplanes operated by company have to hold a valid I. Class or in case of private flights a valid II. Class medical certificate;
- pilots assigned to Commander on single pilot airplanes operated by company have to hold a valid Type Rating or Class Rating for the appropriate type of airplane issued on the basis of 1178/2011 PART-FCL Part F or equivalent international orders;
- pilots assigned to Commander on single pilot airplanes operated by company according to Instrument Flight Rules has to hold a valid Single Pilot Instrument Rating for the class of the airplane issued on the basis of 1178/2011 PART-FCL Part E or equivalent international orders;
- pilots assigned to Commander on single pilot airplanes operated by company have to be authorized in a form of valid Company Authorization signed by the Flight Operations Manager or his deputy,