

BOSNIA AND HERZEGOVINA
Ministry of Communications and Transport
Commission for investigation of the cause of aircraft accident



FINAL REPORT

***ACCIDENT TO AN ULTRALIGHT AIRCRAFT
VL-3E-1 EVOLUTION, THAT OCCURRED ON 23
JULY 2022 IN THE AREA OF NIŠIĆI PLATEAU,
BOSNIA AND HERZEGOVINA***

Edition: 1.0
Date: 10 November 2022
Markings: ACCID - 1/22



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MINISTRY OF COMMUNICATIONS AND TRANSPORT**

**Commission for investigation of the cause of accident of
ultralight aircraft VL-3E-1 *Evolution*, that occurred on 23
July 2022 in the area of Nišići plateau, Bosnia and
Herzegovina**

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<p>This report presents results of the investigation of the accident of ultralight aircraft VL-3E-1 <i>Evolution</i>, that occurred on 23 July 2022 in the area of Nišići plateau, Bosnia and Herzegovina.</p> <p>Group consisted of 10 aircrafts (7 gyrocopters and 3 ultralight aircrafts), according to a plan of aviation event „Sarajevski tour“ were performing announced and approved group navigation flight, from the airport <i>Becsehely</i> to the airport <i>Pécs</i> (LHPP), the Republic of Hungary, and then continue the flight to the airport <i>Tuzla</i> (LQTZ) and airport <i>Nišići</i> (LQNI), Bosnia and Herzegovina. The flight was performed at the height of 1000ft AGL, in accordance with VFR rules and VMC conditions. Aircraft VL-3E-1 <i>Evolution</i>, was in the last, 10th place in the group.</p> <p>In the area of the airport <i>Nišići</i>, approximately 650 meters east of RWY , the pilot had a stroke during the flight, after which he lost control over the aircraft, the aircraft took unusual attitudes - stalling and in an uncontrolled flight, in a steep angle of slope hit the ground. The aircraft is destroyed, pilot and passenger in the aircraft died.</p>		
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Commission for investigation of the cause of accident of ultralight aircraft VL-3E-1 Evolution, that occurred on 23 July 2022 in the area of Nišići plateau, Bosnia and Herzegovina

Commission for investigation of the cause of accident of ultralight aircraft VL-3E-1 Evolution, that occurred on 23 July 2022 in the area of Nišići plateau, Bosnia and Herzegovina (hereinafter: the Commission), was appointed by the Order of the Minister of Communications and Transport No.: 04-29-8-2183/22 of 23 July 2022. This Report was adopted by the Commission in 10 November 2022.

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CONTENTS

INTRODUCTION	8
1. FACTUAL INFORMATION	10
1.1. History of the flight.....	10
1.1.1 Previous activities	10
1.1.2 Execution of the flight	11
1.1.3. Eyewitnesses of the accident.....	12
1.2. Condition of persons after the accident	14
1.3. Condition of aircraft after the accident.....	14
1.4. Other damage None.....	14
1.5. Data on crew	14
1.5.1. Pilot of the aircraft - PIC.....	15
1.5.2. Passanger on board the aircraft.....	16
1.6. Aircraft information	16
1.6.1. Characteristics of the aircraft	16
1.6.2. Technical documents and condition of the plane and the engine prior to accident.....	18
1.6.3. Examination of the wreckage.....	19
1.7. Meteorological information	20
1.8. Navigation devices	22
1.9. Communications.....	22
1.10. Airport information	23
1.11. Flight recorders and plane devices.....	23
1.12. Wreckage and impact data.....	23
1.12.1. Accident site	23
1.12.2. Site of the accident and impact.....	25
1.12.3. Aircraft parts scateredness on the accident site.....	28
1.13. Medical and pathological information	31
1.14. Fire	31
1.15. Search and rescue	31
1.16. Initial investigation at the accident site	32
1.17. Test and examination	32
1.18. Organisational and management information.....	33
1.19. Additional information.....	33
2. ANALYSIS	34
2.1. Pilot's qualifications and flight conditions on 23 July 2022	34
2.2. Calculation analysis and fuel consumption.....	36
2.3. Organization and management	37
2.4. Reconstruction – Flight operation July 23, 2022.....	39
2.4.1. Preparation for flight operation on July 23, 2022.....	39
2.4.2 Flight operation from the Tuzla Airport on July 23, 2022.	40

2.4.3. Flight operation from the Tuzla Airport to the place of the aircraft ...	42
accident	42
2.4.4. Aircraft accident eyewitnesses.....	46
3. CONCLUSIONS	47
3.1. Findings.....	47
3.2. Accident causes	49
3.3. Contributory factors	49
4. SAFETY RECOMMENDATIONS.....	50

MEANING OF USED ABBREVIATIONS

AFM	Aircraft Flight Manual
AD	Air Port
AGL	Above ground level
AMSL	Above mean sea level
ARO	Air traffic services Reporting Office
ATCO	Air Traffic Control
ATPL(A)	Air Transport Pilot Licence
BHDCA	Bosnia and Herzegovina Directorate of Civil Aviation
BHANSNA	Bosnia and Herzegovina Air Navigation Services Agency
SARSAT	Search and Rescue Satellite Aided Tracking
COSPAS	Cosmicheskaya Sistema Poiska Avaryinich
CTR	Controlled traffic region
CPL(A)	Commercial Pilot Licence (Aeroplane)
L	liter
DSAC	Distance Measurement Equipment
ELT	Emergency Locator Transmitter
FDR	Flight Data Recorder
FIC	Flight Information Center
ft	Feet (0,3048 m)
GPS	Global Positioning System
IFR	Instrument Flight Rules
LHPP	ICAO marking for Pécs airport
kt	Knot – airspeed in knots (1 kt = 1852 m/h)
JPAKL	Area and Aerodrome Control Unit
LB, lb	Pound (1lb = 0.45 kg)
LQNI	ICAO marking for Nišići airport
LQTZ	ICAO marking for Tuzla airport
METAR	Meteorological Aeronautical Report
MTOW	Maximum Take-Off Weight
NDB	Non Directional Beacon
NOTAM	NOTice TO AirMen
NM, Nm	Nautical Mile (1 Nm = 1852 m)
PIC	Pilot in Command
PPL	Private Pilot Licence
POH	Pilot Operation Handbook
QFE	Atmospheric pressure at aerodrome elevation (or at runway threshold)
QNH	Altimeter Sub-scale setting to obtain elevation when on the ground
RCC	Rescue Co-ordination Center
RWY	RanWaY
SAR	Search and Rescue
TWY	Taxy WaY
UL	Ultralight aircraft
UTC	Universal Time Co-ordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Condition

INTRODUCTION

This Report contains results of the investigation of the accident of ultralight aircraft VL-3E-1 *Evolution*, (hereinafter: aircraft VL-3E) that occurred on 23 July 2022 in the area of Nišići plateau, Bosnia and Herzegovina.

Group consisted of 10 aircrafts (7 gyrocopters and 3 ultralight aircrafts), according to a plan of aviation event „Sarajevski tour“ were performing announced and approved group navigation flight, from the airport Becsehely to the airport Pécs (LHPP), the Republic of Hungary, and then continue the flight to the airport Tuzla (LQTZ) and airport Nišići (LQNI), Bosnia and Herzegovina. The flight was performed at the height of 1000ft AGL, in accordance with VFR rules and VMC conditions. Aircraft VL-3E, was in the last, 10th place in the group.

In the area of the airport Nišići, approximately 650 meters east of RWy, the pilot of the aircraft had a stroke during the flight, after which he lost control over the aircraft, the aircraft took unusual attitudes-stalling and in an uncontrolled flight, in a steep angle of slope hit the ground. The aircraft is destroyed, pilot and passenger in the aircraft died.

Basic data on accident

Date/time of the accident:	On 23 July 2022, in 12:57UTC (14:57LT)
Operator:	Private person
State of registry:	The Republic of France
State of the operator;	The Republic of Austria
Aircraft manufacturer:	JMB Aircraft S.R.O. Czech Republic
Model and type of aircraft:	VL-3E-1 <i>Evolution</i>
Serial number of aircraft:	135
Identification markings:	59MDM (According to CAA of the R.France)
Radio call sign	F-JVXJ (According to CAA of the R. France)
Location:	Duševine, Nišići, Municipality Ilijaš, Canton Sarajevo, cca 650 meters east of RWy AD NIŠIĆI
Coordinates of the place of accident:	Place of accident 44°04'20" N 018°31'01" E Y:-2340791.478494 X: 4698384.499135 (WGS84)
Altitude:	Elevation 992m (3255ft)
Crew of the aircraft:	PIC (Pilot in command) and 1 passenger

SAFETY INVESTIGATION

Commission for investigation of the cause of accident of ultralight aircraft VL-3E that occurred on 23 July 2022 in the area of Nišići plateau, Bosnia and Herzegovina (hereinafter: the Commission), was appointed by the Order of the Minister of Communications and Transport No.: 04-29-8-2183/22 of 23 July 2022.

Procedure of investigation of the cause of accident has been performed by the Commission in accordance with the following standards, procedures, requests and regulations:

- a) International standards and procedures:
- Annex 13 ICAO, Investigation of aviation accidents and incidents, twelfth edition, 2020 and
 - Manual on investigation of accidents and incidents (ICAO Doc.9756, parts I, II, III and IV);
- b) Regulations of Bosnia and Herzegovina:
- Law on Aviation of Bosnia and Herzegovina, Chapter III, Aircraft accidents and incidents („BiH Official Journal “, No.39/09 and 25/18) and
 - Regulation on investigation of aircraft accidents and serious incidents („BiH Official Journal “, No. 30/14).

In accordance with Annex 13 to ICAO, state of registry and state of operator were informed on accident.

Accredited/authorised representative of the state of registry was in the place of residence after the receipt of a notice about the accident.

Contact has been established and the activities with competent prosecutor of BiH Justice Department and Police department of Ilijaš municipality, where accident occurred, have been arranged.

All activities were adjusted to conditions of COVID-19 pandemic.

In accordance with Annex 13 to the Convention of International Civil Aviation Organisation, the purpose of accident and incident investigation is not to determine the guilty party or liability. The main goal of investigation and final report is to prevent accidents and incidents. (Reference: ICAO Annex 13, Chapter 3, Paragraph 3.1.)

In accordance with the above stated, the goal of this investigation **IS NOT to determine the guilty party or liability**. The only goal of this investigation and the Report of the Commission is **to prevent aviation incidents and accidents**.

The Commission has delivered the Draft of the Report: to the State of **Registry**, the State of **the Operator**, the State of **Design** and State of **Manufacture** and BHANSA, who delivered their comments after the reading. Commission has considered delivered comments, adopted the justified ones, and included them into the Final Report.

Recommendations stated in this report have been sent to the competent organisations and institutions responsible for the matter of recommendations for further procedure.

Each time period in this report is provided in UTC format, unless stated otherwise, and geographical coordinates in WGS 84.

1. FACTUAL INFORMATION

1.1. History of the flight

History of the flight is based on data and statements of flight group leader, documents on flight delivered from JPAKL (Area and Aerodrome Control Unit) Tuzla i JPAKL (Area and Aerodrome Control Unit) Sarajevo, statements of the crew that was in the air at the time of the accident and witnesses of the aircraft accident on 23 July 2022, provided at the request of the Commission and based on the data of Garmin GDU 460 device equipped in the aircraft.

1.1.1 Previous activities

According to the statement of the initiator of the event and flight group leader, gathering of the group of aircrafts (7 gyrocopters and 2 UL aircrafts), in order to participate in the „Sarajevski tour“ event (term used by the group leader) was at the home airport of the initiator and flight group leader, Becsehely, the Republic of Hungary. In the morning of 23 July 2022, according to the statement of the group leader, pilot of ultralight aircraft VL-3E with one passenger joined the group at the airport at his own request. The aircraft flew from the Fertosentmiklos (LHFM) airport to Becsehely airport that morning.

The Commission did not have data nor have any insight into the organised or individual flight preparations of the crew. According to previous findings, preparations of the crew for this type of flights were performed on an individual basis.

Aviation event „Sarajevski tour“ has been conducted in accordance with the flight schedule delivered by the flight group leader to each participant after the registration. Flight schedule has also been delivered to the pilot of aircraft VL-3E, and it was found on the accident site. For the day of the event 23 July 2022, the flight schedule included:

- route of flight: start Becsehely-Pécs (LHPP) - Tuzla (LQTZ) - Nišići (LQNI)
- distances, take-off and landing airports, airport coordinates distances, flight directions, task, frequencies and planned time for the activities
- The return was planned for 24 July 2022.

Previous preparation of all pilots as well as the pilot of aircraft VL-3E for the flight on 23 July 2022, most likely was conducted through the individual preparations based on data from the delivered flight schedule. Short briefings were performed at stage airports, with the provision of necessary information and short instructions for the next flight stage.

Through the short group and individual briefings before take off, crews were informed on meteorological and flight conditions for that day, manner and schedule of take off, after which they started to execute take offs in accordance with the flight schedule.

1.1.2 Execution of the flight

On 23 July 2022, after gathering at the Becsehely airport, group of 10 (ten) aircrafts (7 gyrocopters and 3 ultralight aircrafts) finished the flight from Becsehely airport to international airport Pécs (LHPP), the Republic of Hungary, in order to conduct passport and customs control, before the exit from the territory of the Republic of Hungary. According to flight schedule, aircrafts refueled at the Pécs airport, except ultralight aircraft VL-3E. According to the statement of the flight group leader, pilot explained that there is no need for that because the aircraft have enough fuel to continue the flight.

On 23 July 2022 around 10:30LT, after performed inspection at the Pécs (LHPP) airport, group in the formation of 10 aircrafts, in accordance with the flight schedule, started to execute take offs from Pécs airport and flights to the international airport Tuzla (LQTZ) in Bosnia and Herzegovina. According to the statement of the flight group leader, the group landed at the airport Tuzla around 11:50 LT. The flight from the Pécs (LHPP) airport to Tuzla (LQTZ) airport lasted around 1 hour and 20 minutes.

According to the statement of the flight group leader, at Tuzla airport, pilot of ultralight aircraft VL-3E, informed the group leader that, for some reason, the fuel does not circulate from the right-wing fuel tank. After two of them check the tank, they have established that the right-wing tank is empty. Pilot was clearly surprised because, according to his statement, he filled up both tanks 2-3 weeks ago at the Fertosentmiklos (LHFM) airport. Having in mind that there was fuel only in left-wing tank, group leader asked the pilot of aircraft VL-3E how much fuel is left in the left-wing fuel tank and is there enough fuel for the last stage of flight approx. 50Km long, from airport Tuzla to airport Nišići. According to the statement of the flight group leader, pilot of aircraft VL-3E stated that the left-wing fuel tank contains approx. 30 liters of fuel which is more than enough for the last stage flight. Stated quantity of fuel should be sufficient for the flight of hour and 30 minutes of reserve (considering maximum consumption of 20 l/h).

Pilots eyewitnesses, colleagues, have told to the group leader that they saw the pilot of aircraft VL-3E checking the quantity of fuel in the tank by a dried string of grass.

It is important to emphasize that the pilot is citizen of the Republic of Austria, and his knowledge of English language was limited while the flight group leader has some basic knowledge of German language, so certain misunderstandings in the communications were also possible.

At the Tuzla airport, the flight group leader submitted to ATCO Tuzla mutual flight schedule for 10 (ten aircrafts) for flight to airport Nišići (LQNI). According to the statement of the flight group leader, around 12:20 UTC, group of 10 aircrafts (7 gyrocopter and 3 UL aircrafts) started the flight from Tuzla airport to Nišići airport (Table No. 1). Aircrafts took off individually from the runway 27 with intervals, one by one. After take off and initial climb the group set a course to airport Nišići (LQNI) and continue the flight at altitudes of 1000Ft AGL. The flight was executed

in accordance with VFR rules, namely VMC conditions. In the ultralight aircraft VL-3E there were PIC (Pilot in Command) in the left seat and passenger in the right seat.

At 12:32 UTC at the border of CTR airport Tuzla, according to the statement of air traffic controller, the group leader signed out from APP Tuzla and signed in to APP Sarajevo.

Table 1. Review of aircrafts in the group on 23 July 2022

No.	Type of aircraft	Class of aircraft	Registration mark/ Call sign	State of registry
1.	Kallithea	gyrocopter	OM-M488	Slovakian
2.	Kallithea	gyrocopter	OM-M874	Slovakian
3.	Kallithea	gyrocopter	HA-GZP	Hungarian
4.	MTO Sport	gyrocopter	HA-GYH	Hungarian
5.	MTO Sport	gyrocopter	HA-GYJ	Hungarian
6.	MTO Sport	gyrocopter	HA-GYC	Hungarian
7.	MTO Sport	gyrocopter	D-MAPU	German
8.	Alpha Trainer	Ultralight aircraft	HA-TAW	Hungarian
9.	Sting S4	Ultralight aircraft	HA-UAL	Hungarian
10.	VL-3E-1	Ultralight aircraft	F-JVXJ	French

According to the statement, radiocommunication has been coordinated by the group leader in dual watch at frequencies of APP Tuzla 120.350 and APP Sarajevo 136.450, and later AD Nišići INFO 123,500. The group used the common frequency 119,7.

Ultralight aircrafts were slightly faster in the group and first reach CTR of Nišići (LQNI) airport. According to the statement of the group leader, one of the pilots in the group informed that one ultralight aircraft *"took unusual attitudes"*.

According to the statement of the flight group leader, other aircrafts in the formation have continued the flight and safely landed one by one at the Nišići airport. After the landing crew found out that, according to eyewitnesses, around 12:55 UTC, the ultralight aircraft VL-3E, has accidented at the location N 44°4'20" E 18°31'01", approx. 650m east of Nišići airport. According to eyewitnesses, pilot and passenger did not show any vital signs. Police and ambulance were called.

1.1.3. Eyewitnesses of the accident

Place of the accident is sparsely populated. There are several vacation homes in the surrounding area and because of the nice weather there were numerous vacationers so there were numerous eyewitnesses of the accident.

Pilot of a plane from the group, the eyewitnesses, located in the holding zone south of the place of accident give a following statement to the Commission:

" On 23 July 2022 around 15:00 LT, I was conducting a flight with aircraft HU-UAL (ultralight aircraft, type STING) near LQNI airport. I was in position "X" in holding, and

circling in left turn, at altitude approx. 250 meters. I saw ultralight aircraft, type VL-3E in position "Y", performing „S" at altitude between 50-100 meters above the terrain. And in one moment wings slightly turned to the left and then to the right, toward the ground in the right reel. All this lasted 2-3 seconds. I am not sure, but the aircraft made some 2,5 turns to the right side until it reached the ground. On the radio communication I heard the pilot saying "Aj, aj, aj" before the aircraft hit the ground. As I can recall the aircraft hit the ground with the nose, but I am not completely sure, because I was busy operating my aircraft". Image No. 1.1.



Image 1.1: Position of eyewitnesses of the accident from the air

Several eyewitnesses on the ground, who saw the aircraft before and after the accident from different positions, provide their statements. Image No. 1.2.

Part of the statement of gyrocopter pilot in the position „E" (on the ground) at Nišići airport: "After the aircraft flew near the antennas, after some 50 meters, it suddenly banked in the left tailspin with left rotation and in one moment it was directed to the ground while the cockpit was directed toward me. It disappeared beyond the horizon,, Image No. 1.2.

There were several eyewitnesses in position „C". All of them stated that they saw aircraft making left turn which looked like stunt and then it went out of sight vertically downwards. After that they heard loud impact. They stated that they did not hear sound of aircraft motor.

In position „C" were located eyewitnesses of the accident and persons that first came to the accident site and alerted police and ambulance. Image No. 1.2.

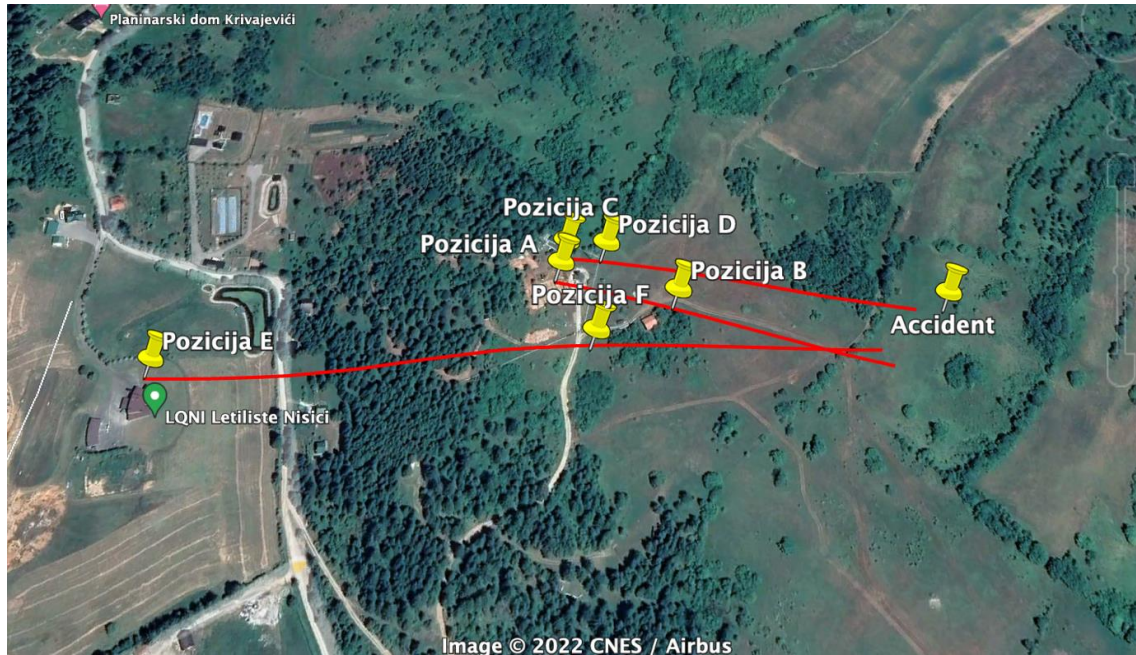


Image 1.2: Positions of eyewitnesses of the accident

1.2. Condition of persons after the accident

Table 2. Review of number of accident victims and severity of injuries

Injuries	Crew	Passengers	Total
Fatal	1	1	2
Serious	0	0	0
Minor	0	0	0
Total	1	1	2

Aircraft PIC - PIC (male, 71 years old), was behind the controls of the aircraft in the left pilot seat, deceased. National of the Republic of Austria.

Passenger (female, 70 years old), was in the right passenger seat, deceased. national of the Republic of Austria.

1.3. Condition of aircraft after the accident

The aircraft was structurally damaged and completely destroyed from the impact to the ground. Complete aircraft wreckage was found at the accident site.

1.4. Other damage None.

1.5. Data on crew

Data on PIC-u are strictly related to data/documentation find in the aircraft at the accident site.

1.5.1. Pilot of the aircraft - PIC

General data: male 71 years old.

Aviation licenses and authorisations: The pilot owned Flight Crew License - Private Pilot License (PPL(A) No.: AT.FCI-24196, issued by AUSTRO CONTROL GmbH, the Republic of Austria, of 02 May 2013, for an indefinite period. License is issued in accordance with Part-FCL conditions. Authorisation SEP(Land) entered in the license on 24 April 2015. Authorisation SEP (Land) expired; it was valid until 30 April 2017.

PPL(A) license of the pilot included the license to operate radiotelephony only in German language. The pilot owned confirmation of language competence only for German language (Language Proficiency: German Level 6)

The pilot owned pilot license ULM, No.: 0108013514, issued on 13 November 2014 by DGAC (DIRECTION GENERALE L'AVIATION CIVILE), Republique Francaise.

The license included qualifications (authorisation) for transport of passengers in ULM and authorisation to fly in multi-axes ULM. License is issued in accordance with national regulations of the Republic of France and the Commission did not have access to them. Duration periods of the authorisation and license are unknown.

Training: Issue of a licenses PPL(A) in aircrafts C172, C150 and DA20.

Inspections: unknown

Breaks of flight: unknown

Medical certificate: Last Medical Certificate – Class LAPL, was issued by authorised doctor on 21 July 2021, valid until 21 July 2023, with VML limitation.

Working hours, rest and fatigue: On the day of the event 23 July 2022, pilot was actively engaged in the execution of the group flight, from early morning hours until the accident. He had no active rest in between, having in mind the fact that at the stage airports he had to prepare himself and the aircraft for the next flight. Having in mind conditions for the execution of the flight and the engagement it is possible that the pilot was exposed to increased psycho-physical exertion, that he was tired and all that caused stress.

Flight experience and experience regarding the type/class of the aircraft: Logbook of the pilot was found in the cockpit at the accident site. In the period between 2012 and 15 July 2022, pilot has executed 161 hours and 53 minutes of flight as PIC, by day.

Training and initial flights were performed in aircrafts C172, C150 and DA20. From 06 August 2014 to 15 July 2022, he operated only ultralight aircraft VL-3E and executed 125 hours and 53 minutes of flight.

Pilot did not have flying activities in the last 24 and 48 hours, or in the last 7 (seven) days. In the last 30, namely 90 days, he had a flight that lasted 60 minutes (15 July 2022)

The last flight before the accident was on 15 July 2022 that lasted 60 minutes at the Fertosentmiklos (LHFM) airport. Before that flight he had 2 flights on 02 February 2022 that lasted 50 minutes in total. On the day of the accident, he had 4 flights, including the flight when the accident occurred, and he executed 3 hours and 40 minutes of flight in total.

During the inspection of the Pilot Logbook following data were noted (based on the entered flight time):

Flight time per year	Hours of flight time (h.min)
14.07.2017 - 17.12.2017	08.43
05.02.2018 - 29.12.2018	08.54
22.03.2019 – 27.08.2019	24.44
03.03.2020 – 18.11.2020	08.56
24.04.2021 – 03.10.2021	07.35
02.02.2022 – 15.07.2022	01.50
Total flight time from 14 July 2017 to 15 July 2022	60.42

Register of flight time was poorly maintained and it contains numerous mistakes, incorrect time of flights and incorrect adding of flight times.

Knowledge on the area and airports: Pilot was not familiar with the flying area above Bosnia and Herzegovina, nor he was familiar with the airports Tuzla and Nišići. The flight on the day of the accident was his first flight in the airspace of Bosnia and Herzegovina and in the area of airports Tuzla and Nišići.

1.5.2. Passanger on board the aircraft

The passenger on bord the aircraft was an older female, about 70 years old, who occupied the right passenger seat and was killed in the accident. She was a national of the Republic of Austria accompanying the pilot.

1.6. Aircraft information

An ultralight plane VL-3E *Evolution* is a single engine, composite, low-wing aircraft with a retractable tricycle landing gear and a variable pitch propeller fitted with a parachute rescue system. The aircraft is intended for recreational aviation and for personal use.

1.6.1. Characteristics of the aircraft

The basic characteristics of the aircraft are taken from the 2014 POH for VL-3E aircraft and documents. found in the plane at the accident site.

a) Aircraft information:

- Type: Low-wing aircraft
- Category: Ultralight aircraft
- Model: VL3 Evolution
- Type number: VL-3E-1
- Serial number: 135
- Manufacturer: JMB AIRCRAFT S.R.O. Czech Republic
- Identification mark: 59DMD (According to DSAC of the R, France) .
- Radio call sign: F-JVXJ (According to DSAC of the R.France)

b) Basic characteristics:

Dimensions, crew and passenger capacity of the aircraft:

- Crew capacity: one member
- Passenger capacity: one passenger
- Aircraft length: 6.24 m
- Wingspan: 8,44 m
- Aircraft height: 2,05 m
- Cabin width: 115 cm



Figure 1.3: Ultralight aircraft VL-3E-1 Evolution

Aircraft mass:

- Empty aircraft mass: 301 kg
- MTOW: 472,5 kg
- Max. baggage mass: 15 kg
- Min.crew mass: 65 kg

c) Performances:

- Grass surface take-off length: 150 m, and 280 m is required to reach a height of 15 meters
- Max speed (V_{NE}): 280 km/h
- Manoeuvre speed: 165 km/h
- Max cruising speed: 235 km/h
- Stalling speed V_{SO} 55 km/h (30 kt)

d) Engine:

- Manufacturer: Rotax
- Engine model: 912ULS
- Power (max Take-off): 100hp (73,5 kW)
- Fuel: gasoline, min 95
- Consumption: 15-20 l/h
- 2 wing tanks: 118 l (2 X 59 l)
- Propeller: Woodcomp

1.6.2. Technical documents and condition of the plane and the engine prior to accident

Upon inspection of the available aircraft and engine documentation, it was determined that the VI-3E-1 Evolution aircraft, serial number 135, Identification mark 59DMD was properly registered for its category and properly maintained.

The aircraft VI-3E involved is under the annex 1 of UE 1139/2018. According to the national regulations of the Republic of France, the VI-3E aircraft is registered as an ultra-light aircraft (ULM in French). According to the law of the Republic of France, the registration certificate and airworthiness certificate are not applicable for ULM.

The accuracy and validity of the documentation found in the plane at the accident site was checked by an accredited representative, who determined that the documentation was correct and issued by the French Civil Aviation Authority (DSAC).

At the site of accident in the plane found document , Identification card ULM (*Carte d'identification ULM*) document issued by DSAC, to the owner of the plane, on June 27, 2022, which states that the plane VL3 A HPV (P) has an identification code B2033F02057L2 and identification mark 59DMD, which is the "registration mark of the plane ". The first issuance of the identification card was on August 18.2014.

This document is valid only in the territory of the Republic of France. According to EU regulations, member states EU mutually recognize this document as valid, as well as Bosnia and Herzegovina.

An Airplane Log Book (Letadlova Kniha), properly kept since 22 July 2014, that is the time when the aircraft left the factory JMB Aircraft S.R.O. Czech Republic, was found at the plane accident site.

The aircraft has Radio-Station Licence issued on 5 October 2020, valid until 09 September 2026. Marking F-JVXJ is only the radio call sign of the aircraft.

At the site of accident, onboard the plane was the **CRS** (CERTIFICATE OF RELEASE TO SERVICE FOR ENGINE ONLY) **No.1712/2016**, according to which on 17 December 2016 the AUTOGIRO ROTAX SERVIS, Hungaria performed inspection in line with the annual Rotax engine maintenance plan, as follows

- 1) 50 HRS of engine check in line with ROTAX Engine inspection Protocol 912ULS
- 2) CARB Syncroization
- 3) Engine Test Run

At the site of accident, onboard the plane was the **CRS** (CERTIFICATE OF RELEASE TO SERVICE FOR ENGINE ONLY) **No. 041019FJVXJ** according to which on 4 October 2019 the AUTOGIRO ROTAX SERVIS, Hungaria performed inspection in line with the annual Rotax engine maintenance plan, as follows

- 1) 100HRS of engine check in line with ROTAX Engine inspection Protokol 912ULS
- 2) CARB Syncroization
- 3) Engine Test Run.

The above-mentioned certificate is valid until 23 August 2022.

Upon checking the said documents and performing the post-accident inspection of both the aircraft and the engine, the Commission found that both the aircraft and the engine featured no technical issue before the accident.

1.6.3. Examination of the wreckage

The accident site examination, performed on 23 and 24 July 2022, showed that the plane, after hitting the ground, suffered sustainable structural damage to its main parts, with some exterior parts being detached from the plane. All pieces of the plane are scattered and grouped within very narrow radius. The wreckage is located at the position N 44°04'20" E 18°31'01", at 230°, occupying approx. 15 meters in length and 12 meters in width. Despite all the damage and deformation suffered, the frame of the plane and the engine have remained relatively whole thus allowing for the inspection to take place.

Some devices and instruments in the plane cabin suffered minor damage, but it was still possible to check their operational condition and obtain the readings. Since no suspicions were raised with respect to proper operation of certain parts of the plane prior to accident, an expert examination of such parts did not take place.

For the purpose of establishing the facts the plane wreckage was further examined on 8 August 2022, and the devices which were examined at that time together with the findings obtained are provided below:

- Fuel gauges were in place. Fuel system operation was not examined.
- Totaliser was destroyed thus making it impossible to read.
- ELT was in place and intact.
- The pitot tube was in place.
- The battery was destroyed when it was disconnected to transport the aircraft.

1.7. Meteorological information

Meteorological conditions in the FIR Sarajevo on 23.07.2022.

Weather situation: There is an influence of a thermobaric ridge together with stable and warm air. Weak gradient field of high atmospheric pressure at low heights.

Weather: It was mostly sunny and clear weather with some clouds over mountains during day, (1- 3/8) Cu. Very hot.

Nišići Airport uses weather information provided by the Sarajevo Airport Weather Office.



Figure 1.4: SFC situation at 12:00 UTC

Temperatures, clouds (AGL) and wind at 12.00 hours (UTC) in the region of Nišićka plateau, as recorded by weather stations and airports nearby:

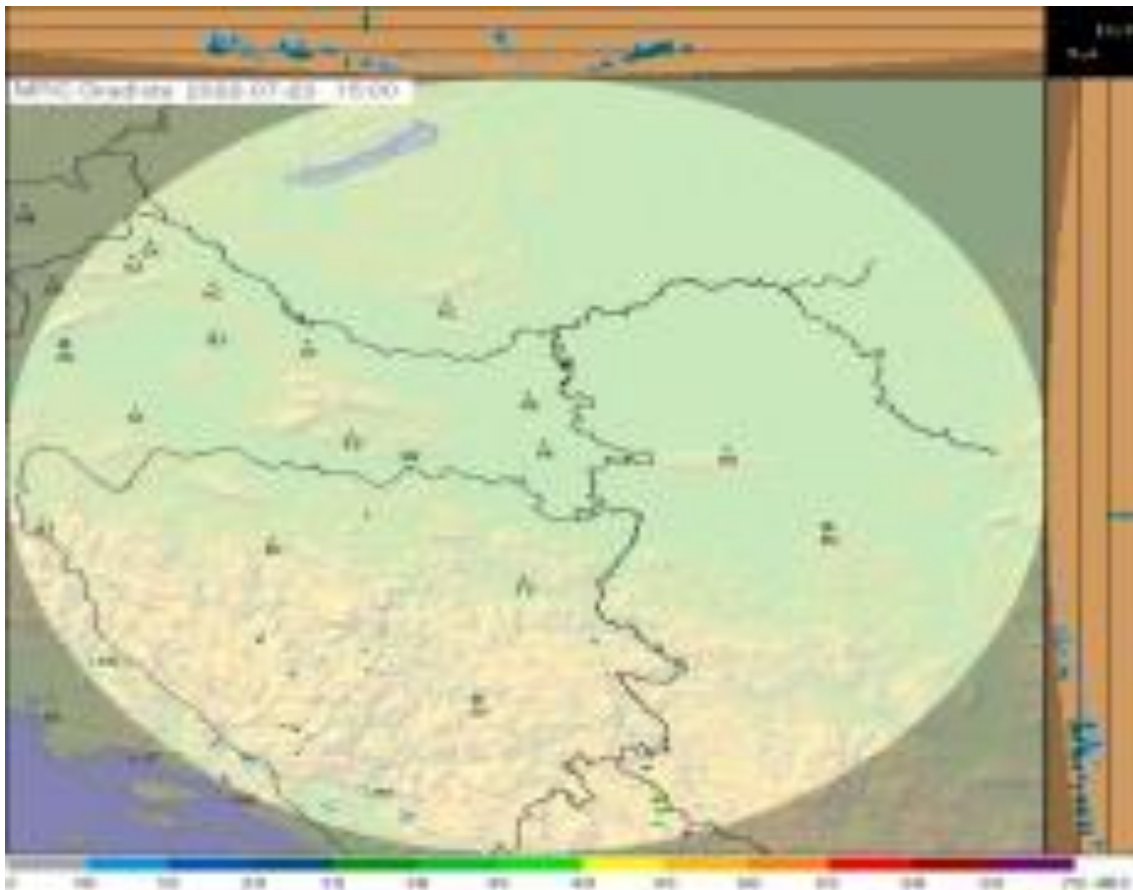
- Sokolac: 31.4°C, wind SW, 2m/s, clouds FEW/SCT 050.
- Han Pijesak: 30.6 °C, wind N 4m/s.
- Sarajevo (LQSA): 37°C, wind vrb/1.5 m/s, clouds FEW060.
- Tuzla (LQTZ): 38°C, wind N 3m/s, clouds FEW040.

Temperatures, clouds (AGL) and wind at 13:00 hours (UTC) in the region of Nišićka plateau, as recorded by weather stations and airports nearby:

- Sokolac: 32.3°C, wind SSE, 3m/s, clouds FEW050.
- Han Pijesak: 30.4°C, wind NNE 6m/s.
- Sarajevo (LQSA): 37°C, wind vrb/1.5 m/s, clouds FEW060.
- Tuzla (LQTZ): 38 °C, wind WNW 3m/s, clouds FEW040.

Weather conditions at the Nišići Airport at the time of the accident on 23 July 2022 at 12:56:

- Temperature 30,6°C, humidity 39%, QNH 1021, density alt 5563.



C)
Figure 1.5: Radar image (DHMZ) at 13:00 UTC

Forecasts for airports LQTZ and LQSA:

TAF LQSA 231100Z 2312/2412 33006KT CAVOK TX39/2314Z TN18/2403Z
TEMPO 2313/2318 27012KT=

TAF LQTZ 231100Z 2312/2412 03006KT CAVOK TX39/2314Z TN17/2403Z
PROB30 TEMPO 2407/2410 - TSRA FEW040CB=



Figure 1.6: Clouds satellite image (13.00 UTC)

1.8. Navigation devices

All navigation devices located on the Tuzla airport of departure as well as those along the flight route were operating properly.

1.9. Communications

Tuzla and Sarajevo JPAKL system of communication was monitored by the Bosnia and Herzegovina Air Navigation Services Agency (BHANSA).

On the day of the accident, there were no issues in communication between the pilot and the air traffic controllers located on departure and destination airports as well as during the flight.

The recordings of conversation made through telephone and radio-station devices were made available to the Commission for examination. The Commission also examined transcripts of communication on frequencies used by APP Tuzla and APP Sarajevo.

The radio communication during flight was coordinated by a team leader in dual watch mode on current frequency of the APP Tuzla, which was 120.350, and APP Sarajevo, which was 136.450, and later on Nišići on INFO 123.500. Radio communication with APP Tuzla and APP Sarajevo was maintained only by the group leader in the language used in BiH. The communication between aircrafts was maintained on the joint frequency, which was 119,7.

The crew had a mobile telephone which was still operational after the impact

1.10. Airport information

At the time of the accident, both Tuzla International Airport (LQTZ) and Nišići Recreational Airport (LQNI) held a valid Airport Operator Certificate issued by BHDCA. On the day of the accident, both airports were operational and there were no issues or limitations with respect to their usage.

Table 3. General airport information

	Airport Nišići	Airport Tuzla
ICAO location indicator	LQNI	LQTZ
Point of reference	44°04'13" N 018°30'32" E	44°42'731.15" N 018°43'29.22" E
Elevation	3155 Ft	239 m / 784Ft
RWY dimensions	540 m x 18 m	2484 m x 45 m (8150 Ft x 148Ft)
RWY direction	178°- 358°	092°- 272°
Runway surface	Grass	Asphalt

The general airport information were taken from the published BiH AIPs. *Table 3.*

1.11. Flight recorders and plane devices

The plane had neither a flight data recorder (FDR) nor a Cockpit Voice Recorder (CVR). The said devices are not mandatory for ultralight aircrafts.

The plane had a radio station and a transponder.

The plane was equipped with a Garmin GDU 460 device which was used during the flight.

The plane was equipped with an ELT which did not go off following the accident.

The ELT switch was in position "OFF"

1.12. Wreckage and impact data

Wreckage and impact data include: the accident location, coordinates, direction, terrain elevation as well as the position and condition of some parts of the wreckage of the plane at the accident scene.

Figures 1.8 and 1.9 show the terrain where the accident took place, that is the location where the plane hit the ground.

Figures 1.9 - 1.13 show the position and condition of some parts of the plane at the accident site.

1.12.1. Accident site

Ultralight aircraft VL-3E accidented on the Nišići plateau in the region of Duševine in the Municipality of Ilijaš in Sarajevo Canton in Bosnia and Hercegovina.

Accident site coordinates: 44°04'20" N and 018°31'01" E, elevation of the terrain 992 m / 3255 ft. The accident site is located approximately 650 meters, course 080°, east of RWy Nišići airport. *Figures 1.7 and 1.8*

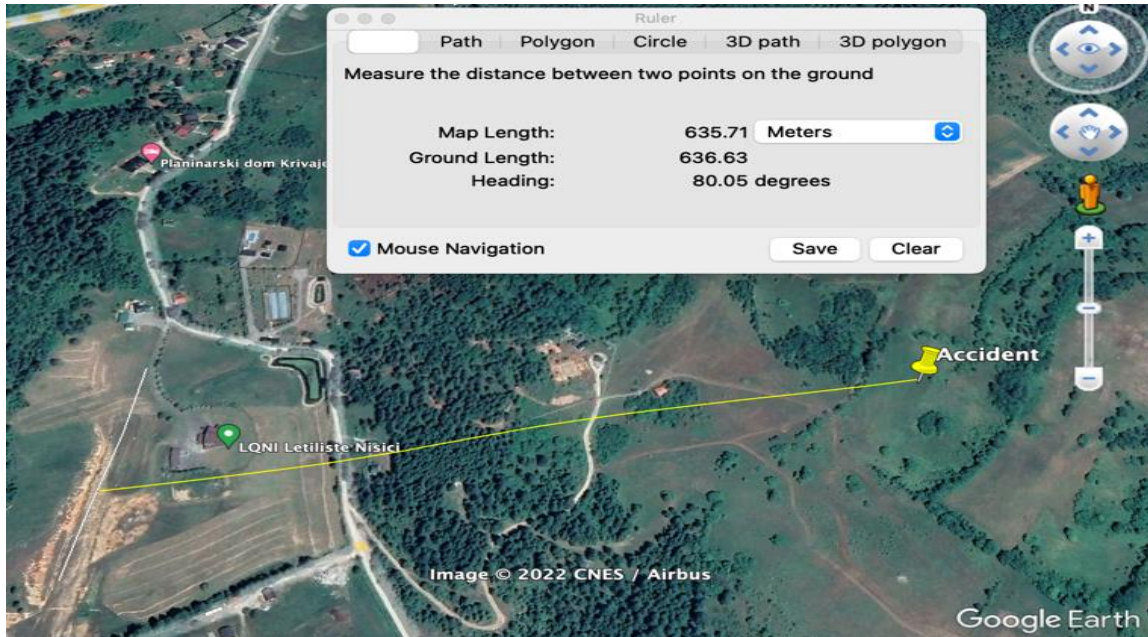


Figure 1.7: Plane accident site

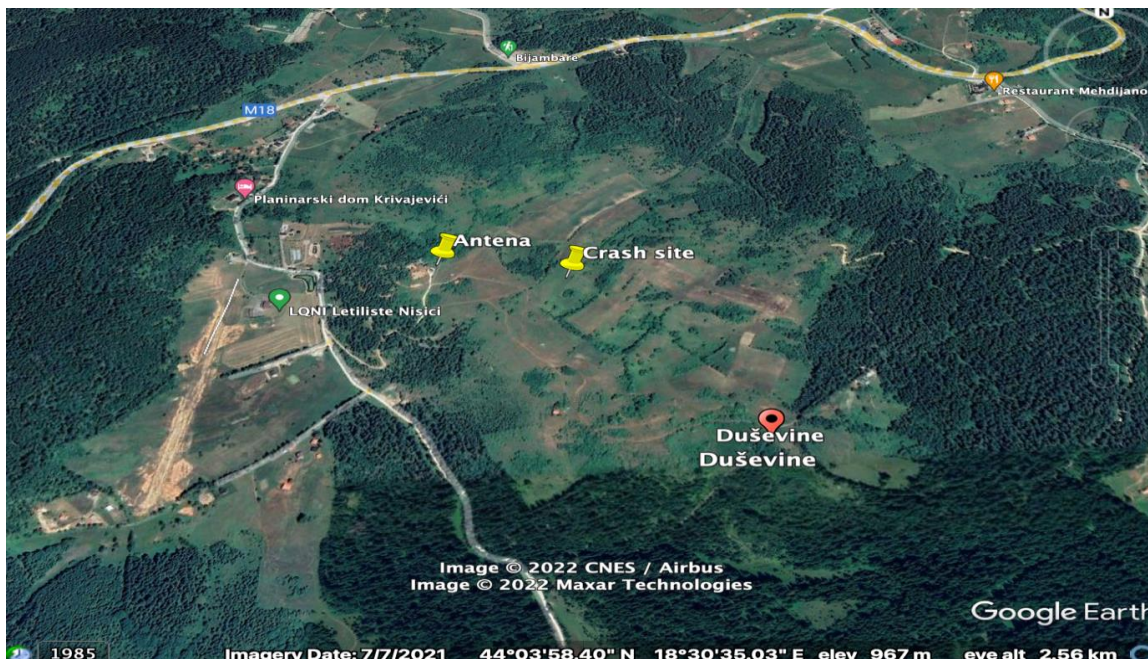


Figure 1.8: The plane accident site

The plane accident site is located on a scarcely populated hilly terrain partly covered with forest consisting of mainly coniferous 12-20 meters high trees as well as smaller ones of 3 to 5 meters in height. The terrain surrounding the accident location has a gentle upward slope in all directions. There is a local forest road

from Šabanci leading to the plane accident site. In terms of topography, the terrain of the plane accident site is a basin that stretches north to south.

1.12.2. Site of the accident and impact

The plane VL-3E-1 hit the ground in U CTR AD Nišići at 12:55 UTC approximately 650 meters east of to the RWY at the location N 44°04'20" E 18°31'01" at the terrain elevation of 992 meters or 3255 ft AMSL. In the last 60 seconds before hitting the ground, the plane was taking an "S manoeuvre", changing the course from 74° to 211° (ground track) while slowly descending (500 ft/min) from 3950 ft to 3460ft AMSL or 205 ft AGL at speed of 65 kt to 40 kt/74 km/h (IAS), according to the readings from Garmin GDU 460.

The pilot suffered a stroke while flying causing him to lose control over the plane. The aircraft entered a flight regime outside its normal envelope and uncontrollably and at steep angle hit the ground. The plane was destroyed while the pilot and the passenger lost their lives.



Figure 1.9: The location where the plane hit the ground and stopped

According to eyewitness accounts, the plane suddenly took a left turn at angle and as the angle was gradually increasing the plane first entered into a descending turn and then started to spin at descending angle of 70 while rapidly losing the altitude.

Based on the clues found on the ground at the impact site and the wreckage, it is evident that the plane first hit the ground by its propeller hub, propeller and nose and then by the winglet. Due to the impact force, the plane bounced back for 4,55 meters.



Figure 1.10: First impact into the ground, engine case debris, a propeller blade and parts of plexiglass

The distance between the debris of the plane nose cladding (engine) and the propeller and the detached wing tip on the ground exactly matches their distance when installed on the plane (4.55m). Figure 1.10. and 1.11

The plane first hit the ground after getting into a spin nose down at 70° and at speed of 80 to 90 km/h. While spinning around its longitudinal axis, the plane hit the ground which caused damage to the right-wing leading edge and to the point of connection between the wing and the fuselage resulting in pilot being ejected from the cabin to the left. The passenger occupying the right-side seat was moved to the left. Figure 1.12.

The body of the pilot occupying the left seat was found outside the cabin next to the left side of the fuselage. The seat belt buckle was locked but the seat belt anchorage was ripped out together with a part of the composite fuselage cladding. The body of the pilot first went through the cabin canopy and then was brought back by the safety belt resulting in the seat belt anchorage being ripped out. The body of the female passenger remained in place due to having less body mass and its position closer to the point of impact thus building up less momentum than the pilot's body.



Figure 1.11 Plane's nose, engine, proppeler hub and proppeler blade after the accident

Following the impact, the wreckage due to impact force moved backwards resulting in partial decomposition of some parts of the aircraft. First to fell off were a proppeler blade, plane nose cladding parts and parts of the engine. Most of the fuselage, engine, wings, tail, and cabin suffered considerable damage.



Figure 1.12: Right wing, plain body and tail

The cabin canopy frame was out of place with cabin canopy plexiglass being completely shattered to tiny pieces over wide radius located mainly behind the wreckage.

The tip of the right wing and the leading edge cladding suffered major damage when the plane hit the ground. Part of the fuselage between the cabin and the tail was badly damaged due to the torsion force once the plane bounced back after hitting the ground. Following the first hit, the plane bounced back for 4.55 meters and then hit the ground for the second time with the whole its weight causing the major damage to the area between the cabin and the tail.

The tail areas also suffered damage. The rudder had separated from the vertical stabilizer. Figure 1.12. Neither gasoline smell nor gasoline leaks was detected on the accident site. Likewise, there was no fire caused by fuel.

Examination of the fuel system showed that there was no fuel in neither left nor right fuel tank. Both tanks were completely empty. Endoscope camera was inserted into the tanks all the way to the bottom and once extracted it was completely dry. There was 10 ml of fuel in the right carburetor chamber and 8 ml of fuel in the left carburetor.

1.12.3. Aircraft parts scateredness on the accident site

Main parts of the plane are scattered and grouped in a quite narrow space having the length of approx 15 meters and the width of approx. 12 meters and north-south orientation.



Figure 1.13: Wreckage on the accident site

The fact that the plane parts are scattered in such a narrow space suggests that the plane hit the ground in a steep dive. *Figure 1.13 and 1.14.*

The location of the wreckage is on the coordinates N 44°04'20" E 18°31'01", axis of direction 060°-240°. The wreckage was found to be compact featuring major damage to the main parts of the plane and minor separation of exterior parts. The joints between the fuselage and both wings are found to be loose.

The right wing suffered major damage to the leading edge cladding in the length of about 2 meters starting from the end of the wing, as well as damage to the wing tip (tremizon). The engine, together with the firewall, was also separated from the cabin backward. The cabin canopy was broken and separated from the cabin. One blade of the propeller was completely torn away while the other was broken and bended straight backward at angle of 90°. This suggests that the propeller was not spinning at the time of impact. A part of the fuselage located behind the cabin was damaged. There was minor twisting of the fuselage structure. Tips of the vertical stabilizer got detached on impact. One is located adjacent to the fuselage and the other is five meters behind the wreckage. The rudder is separated backwards from the vertical tail stabilizer.



Figure 1.13: The wreckage at the accident site

The body of the passenger at the right-side seat remained in place, moved to the side, with the seat belt fastened. The body of the pilot was positioned adjacent to the left side of the fuselage on its back with the head facing the plane nose. The safety belt was ripped out from the anchorage together with a bolt and part of the composite. The body of the pilot went through the canopy of the cabin and then

was pulled back by the safety belt strings which caused for the safety belt anchorage to be ripped out.

Landing gear control was in “**geardown**” position which matches the position of the main wheels which were found to be outside the wheel well. The nose wheel was partly (75%) in the wheel well which was caused by the impact. The main wheels are bent frontwards as a result of the second impact causing the plane to bounce back after hitting at initial point of impact. This suggests the intensity of the second impact force which caused for the body of the pilot to be moved backwards and to the left.

Flaps handle was in “**Down**” position, and flaps on both wings were extracted.

According to the position of the landing gear and flaps observed at the scene, the plane was in the landing configuration. The speed recorded by Garmin GDU 460 was 74km/h. According to the POH for this type of aircraft, the stalling speed at landing is 57 km/h.



Figure 1.14: Plane cabin and torn pilot seatbelts

The positions of cabin switches and control handles were as follows:

- Magnets position: “**BOTH**”,
- Master SWITCH in the position: **ON**,
- Fuel tank selector in the position: “**OFF**”,
- Throttle lever: “**Throttle FULL**”
- Landing gear control in the position “**Geardown**”

- Flaps lever control handle: “**DOWN**“
- ELT switch “**OFF**“

Altimeter and airspeed indicators showed (0).

The aircraft was equipped with the Parachute Rescue System which did not go off.

1.13. Medical and pathological information

Medical examination of the deceased pilot and the passenger was performed in the pathological department of the Bare JKP „Pokop“ in Sarajevu , followed by the preparation of an Examination and Autopsy Report. It was found that the pilot died instantaneously, that is in a short period of time, after suffering a stroke and multiple injuries and body parts fractures from the plane accident. The victims of the plane accident were not subject to toxicological analysis.

1.14. Fire

After the plane hit the ground, no fire started on the plane nor on the surrounding trees at the site. Fuel tanks located on the wings were completely empty. It was found that there was no spark due to neither short circuit in the battery nor friction against ground surface.

After the accident site had been located, the Ilijaš Fire Service travelled to the scene. No intervention was needed given the fact that there was no fire.

1.15. Search and rescue

Information concerning search and rescue operations were taken from the BiH Rescue and Coordination Centre Activity (RCC) Report, Accident Scene Initial Examination Report of the Commission, eyewitness accounts and Ilijaš Police Department Accident Scene Examination Report.

RCC BiH did not receive any information from COSPAS-SARSAT about the ELT signal being emitted so as to launch a search and rescue operation. The plane was equipped with the ELT, but it did not go off after the plane hit the ground.

There was no need to launch a search and rescue operation given that the information containing accurate details about the accident occurrence were made available really fast.

The plane's flight and fall at 12:53 UTC was first noticed by eyewitnesses on the ground in private houses and at the Nišići airport as well as the pilot who was in the air at that time.

Eyewitnesses immediately informed the police and competent personnel at the Nišići airport who passed on the information to the respective ARO Offices of Sarajevo and Tuzla Airports and the RCC BiH.

The accident site was secured by officers of the Ministry of Internal Affairs of Sarajevo Canton. For the purpose of performing an initial examination, a prosecutor of the BiH Prosecutor's Office and an investigator from the BiH Ministry of Communications and Transport took to the scene of the accident.

1.16. Initial investigation at the accident site

On 23 July 2022, after the accident site had been located, a prosecutor of the BiH Prosecutor's Office, investigators from the BiH Ministry of Communications and Transport Dana and officers from the SC MIA (PD Ilijaš) carried out an initial investigation and made a record of the existing situation.

The investigation started at 18:44 hours. Upon BiH Prosecutor's Office authorisation, the remains of the deceased were removed from the scene at 19.20 hours and sent to the Bare JKP „Pokop“ in Sarajevo for autopsy. The investigation was temporarily suspended through night with the accident scene being secured by SC MIA officers.

On 24 July 2022, investigation activities resumed at 10:15. Upon completion of the investigation, the wreckage was taken to a hangar in Rajlovac.

During the investigation, all relevant parts of the plane were jointly identified and marked, the site of the accident was measured and documented photographically, and a sketch and photo documentation of the accident site were produced. The sketch and photo documentation of the accident site were delivered to the Commission by the BiH Prosecutor's Office.

1.17. Test and examination

No special tests or examinations were conducted given the condition of the wreckage at site. Flight data stored on the devices presented below, and recovered from the wreckage on 23 July 2022, were analysed:

- Navigation device **Garmin GDU 460**, for the purpose of obtaining the exact flight information for that particular day. The data have been read from the device, analysed and presented within flight reconstruction in point 2.4 of this Report.
- ELT Emergency Locator Transmitter **Kannad AF INTEGRA** – which did not go off after the accident. Supplemental investigation found that the ELT had been in place and intact.

For the purpose of fact-finding, further supplemental inspection of the wreckage was carried out on 8 August 2022, the findings of which were presented in point 1.6.3, confirming that no irregularities or deviations were found with respect to the inspected parts and installations of the aircraft.

1.18. Organisational and management information

Registration of pilots and aircrafts for the air show “Sarajevo Tour“ was voluntary. Each participant is responsible for preparing their crew and aircraft. Each participant accepts risk of any damage or harm that may happen during the show or flight.

Upon registering to the air show “Sarajevo Tour”, the participants were provided with the flight schedule. The flight schedule was also given to the pilot of the VL-3E-1. The flight schedule for 23 July 2022 included: route, airports of departure and destination, distance, assignment, coordinates, frequencies and the times planned for the execution of activities.

Having flown from Fertőszentmiklós (LHFM), the pilot of the ultralight aircraft VL-3E landed at the airport in Becsehely at 07:44 hours and joined the “Sarajevo Tour“ group in the morning of 23 July 2022 LT.

After all groups had been formed, the group, in line with the flight schedule, proceeded to the Pécs Airport (LHPP) at 08:30 LT. After landing at the Becsehely Airport, the pilot of the VL-3E aircraft had 47 minutes to prepare himself, the plane and the group to continue the flight. The pilot had 52 minutes for customs and passport control at the Pécs airport.

Information concerning both the criteria for selection of participants in this show and the group's collective and individual preparations for the flight, was not made available to the Commission.

1.19. Additional information

The ultralight aircraft VL-3 Evolution (*Fig. 1.3*) was designed by the engineering company Vanessa Air. s.r.o. and initially produced by Aveko s.r.o. Later JMB Aircraft s.r.o. took over the production that continued in the same facility in the Czech Republic. The ultralight aircraft VL-3 Evolution has been certified according to regulation UL-2 of Light Aircraft Association of the Czech Republic, for maximum take-off weight of 450 kg for the version without and 472.5 kg with a rescue system. The ultralight aircraft VL-3 Evolution is an aerodynamically directed, single-engine, low-wing airplane of classic design with fore-type retractable or fixed landing gear and with two pilot seats next to each other. The length of the aircraft is 6.20 m, height - 2.05 m, wing span - 8.44 m, wing area - 9.80 m². The aircraft VL-3 Evolution was provided with a specific Pilot Operating Handbook for aeroplane VL-3E-1 dated 07 February 2014.

VL-3E-1 Evolution has new horizontal tail, retractable landing gear, R912ULS (100hp engine), variable pitch propeller

On the CAA database of the Republic of France, it is said there is a change owner of the ultralight aircraft VI-3E, identification mark 59DMD, on 27/06/2022.

2. ANALYSIS

Introduction

The Commission looked at each information, fact and evidence provided during the investigation individually and in relation to all others combined. The analysis carried out was comprehensive, objective and undertaken by experts. In line with established relevant facts and analysis thereof, the content of analysis presented here represents the logical whole associated with statements and conclusions contained within this Report.

Upon collecting the information and evidence pertaining to the flight, the Commission thoroughly analysed the facts and evidence thus obtained which led to the plane accident or affected performance of certain actions.

2.1. Pilot's qualifications and flight conditions on 23 July 2022

By analyzing collected information and facts, the Commission determined pilots qualifications and flight conditions which most likely influence the occurrence of the accident. Pilot qualifications were assessed on the basis of documents found in the plane on the accident site, while the assessment of flight conditions was carried out on the basis of available flight organisation and performance data of 23 July 2022.

The pilot held a valid pilot licence, a Private Pilot Licence (PPL) and a ULM Pilot Licence in line with applicable regulations.

The entitlement to operate radio-telephony in the German language only was added to the Pilot's PPL (A) Licence. The pilot also held a German Language Proficiency Certificate - Level 6.

The pilot held an ULM pilot licence, number: 0108013514, issued on 13 November 2014 by DGAC (DIRECTION GENERALE L'AVIATION CIVILE) Republique Francaise. The authorisation for transport of passengers by ULM and authorisation to operate multiaxes ULM are documented in the licence. The licence is issued under national regulations of the Republic of France not available to the Commission.

The pilot held a Medical Certificate – Class LAPL, issued by a competent doctor on 21 July 2021, valid until 21 July 2023 with VML limitation entered on.

In the period from 2012 to 15 July 2022, the pilot made a total of 161 hours and 53 minutes of day flight time as pilot in command (PIC). The pilot performed the training and initial flights on C172, C150, and DA20 aircrafts. In the period from 6 August 2014 to 15 July 2022, the pilot operated exclusively the VL-3E-1 aircraft making 125.53 hours of flight time. The last 1-hour flight prior to the accident the pilot performed on 15 July 2020.

In the period from 14 July 2017 to 15 July 2022 (five-year period), the pilot had a total of 60 hours and 42 minutes of flight time, which is 12 hours of flight time in average per year. The pilot did not fly during three-four months of winter.

The flight time records were poorly kept featuring a lot of mistakes, incorrect flight time hours entries and flight times aggregation errors

The pilot's overall flight time can be considered as modest, even insufficient for such type of flying. The pilot was trained to perform flights with UL aircraft according to VFR rules and VMC conditions.

On the day of the accident, the pilot had 4 flights (including the flight in which the accident occurred) and made the flight time of 3 hours and 40 minutes. Considering the pilot's age, flight experience and flight conditions, the pilot's flight stress was extremely high.

The pilot was unfamiliar with the flight area above Bosnia and Herzegovina. The flight on the day of the accident was the first flight in the airspace of Bosnia and Herzegovina, as well as in the region of Tuzla and Nišići.

There are indications that the pilot was exposed to increased psychophysical stress due to the flight conditions on July 23, 2022, causing fatigue, stress, which, to the significant extent, ultimately contributed to the cause of the accident.

The pilot's exposure to increased psychological and physical strain due to the flight performance conditions had a significant impact on the reduction of the pilot's ability to perform flights.

The increased strain probably caused pilot's fatigue and stress, which significantly impacted the reduction of his abilities and thus on the cause of the accident, that is confirmed by the following facts:

- According to the total flight achieved, the pilot had modest and insufficient flying experience for this type of flying;
- The pilot's preparation for flying was insufficient and superficial, considering the pilot's flight experience and the conditions of the flight;
- The pilot flew over unknown terrain and from unknown airports;
- Flying in a group requires increased psychophysical strain during the flight, the type that the pilot was exposed to during the flight;
- The flight was carried out under the conditions of high external temperatures, 36°- 38°C;
- The pilot flew over unknown terrain and from unknown airports;
- The pilot's stress on July 23, 2022 was not appropriate to his age, he made 4 flights with the total flight of 3 hours and 40 minutes and spent the time in the aircraft cabin from early morning until the time of the accident, which indicates the presence of fatigue;
- The problem faced with the amount of fuel in the tanks significantly burdened the pilot during the flight;

- Probably a partial or complete failure of the engine due to lack of fuel in the area of the accident, most contributed to the condition in which the pilot found himself.

On the day of the aviation event, July 23, 2022, the pilot was engaged in the preparation and execution of the group flight, from early morning until the time of the accident. He did not have an active vacation, since during the breaks at the landing and take-off staging airports, he had the obligation to undertake personal flight preparation and the aircraft preparation for continued flight. Considering the flight conditions, it can be concluded that the pilot was fatigued. This is also confirmed by the fact that during the flight the pilot made obvious mistakes in the aircraft and engine operation. An example is fuel control during flight.

2.2. Calculation analysis and fuel consumption

After flying over Tuzla airport, the pilot of the UL VL-3E aircraft noticed that, for some reason, no fuel was coming from the right-wing fuel tank. After having checked the fuel tank, it was found that there was no fuel in the right fuel tank, which surprised the pilot, since according to his statement, 2-3 weeks ago, he filled both fuel tanks at Fertosentmiklos Airport (LHFM). Since the fuel was only available in the left-wing tank, the pilot checked the remaining amount of fuel in the left tank and determined that there were 30 liters of fuel left, after which he believed that it was enough for the last stage flight, at a distance of about 50 km, from Tuzla Airport to Nišići Airport.

By inspecting the aircraft logbook (Bordbuch), it can be noted that the last fueling was recorded on February 6, 2022. in the total amount of 60 liters. According to the same logbook, in the period from February 6, until July 15, 2022, the aircraft had the total flight period of 10 hours and 15 minutes; and by calculating the average consumption per hour in the amount of 17 l/h, the conclusion is that the pilot used up the specified amount of fuel and had to refuel it sometimes during the above-mentioned period, however, there is no record of it found.

Eyewitness pilots, colleagues, group leaders have witnessed seeing the pilot of the VL-3E-1 aircraft checking the amount of gasoline in the tank with a dry blade of grass. According to the flight data from the Garmin GDU 460 device, the fuel level (Fuel level L-R) remained unchanged during the entire flight, which indicates that the fuel level measurement was not in operation.

According to the flight data from the Garmin GDU 460 device, removed from the aircraft on the day of the accident on July 23, 2022, the projected fuel consumption of 17 l/h gives the total calculated fuel consumption during the flight on the day of the aircraft accident of 61.6 liters *Table no. 4:*

According to table no. 4, fuel calculation, it is evident that the actual fuel consumption on the flight to Tuzla Airport was 51.52 l, which means that the aircraft had fuel in both tanks, as the pilot of the aircraft declared.

Likewise, if there were only 59 liters of fuel in the left-wing tank, according to table no. 4, the fuel consumption on the flight to Tuzla Airport was 51.52 l, meaning that some 8 l of gasoline should have remained in the left tank upon arrival to Tuzla Airport.

There was no smell of fuel at the scene of the accident, and no fuel leaks were noticed anywhere. Also, there were no fires caused by the presence of fuel.

Table no. 4: Estimated fuel consumption July 23, 2022.

R/b	Flight phase	Distance travelled (KM)	Flight time (minutes)	Fuel consumption (litres)
1.	Fertosentmiklos (LHFM)-Becsehely	135.6	42	11.76
2.	Becsehely - Pécs (LHPP)	150.4	67	18.76
3.	Pécs (LHPP)- Tuzla LQTZ	186.6	75	21
4.	Tuzla LQTZ - Nišići LQNI	81.9	36	10.08
TOTAL		554.5	220	61.6

By checking the fuel at the accident site, no fuel was detected in the left- and right-wing tanks. It was found that both reservoirs were completely empty. With the introduction of the endoscopic camera, no fuel was detected in the tanks. The camera was pulled out absolutely dry from the bottom of the tank. In the carburetor bowls, the content was 10 ml in the right and 8 ml in the left carburetor.

According to the flight data from the Garmin GDU 460, in the last 60 seconds of the flight, the engine revolutions (RPM) were very variable and ranged from 2690 - 5350 RPM (Normal value for 55% power is about 4300 RPM according to information given on the aircraft cabin sticker).

Manifold pressures during the above time were also very variable and ranged from 7.1 – 20.3 inch Hg. (Normal value for 55% power is about 24 inch Hg according to the information given on the aircraft cabin sticker).

Based on the above, it is most likely that due to the lack of fuel, there was a problem with the engine during the last part of the flight path, i.e., causing the engine to partially, and then possibly completely, stop running.

The Commission was unable to establish the pilot's statement that 2-3 weeks ago he was refueling in both tanks at Fertosentmiklos Airport (LHFM).

2.3. Organization and management

A group of pilots and aircraft in the preparation and execution of the aviation event, functions according to specific rules. There is no responsible organizer or manager

of the event, nor is it to be determined. There is an initiator of event and a leader of the group in the air, who coordinates radio links in the air in dual mode on the current frequencies; however, there is a common frequency that groups use during flights.

Registration aviation event is voluntary. Each participant is responsible for the preparations of crews and aircrafts. Everything that occurs during flights is at the participant's own risk and damage.

All decisions are made individually by each participant who joins the group. Each participant is responsible for preparing the flight and aircraft within the group.

After registering to the "Sarajevo Tour" aviation event, participants were provided with a flight plan. The flight plan was also delivered to the pilot of the VL-3E-1 aircraft. The following information was stated in the plan for July 23, 2022: route, landing and take-off airports, distances, coordinates, task, frequencies, and schedule of planned activities. The submitted flight plan, which was found in the aircraft cabin at the scene of the accident, does not contain the flight delivery date. The Commission could not determine when exactly the plan was provided and whether the pilot had enough time to prepare himself.

The pilot of the VL-3E-1 ultralight aircraft joined the group for the "Sarajevo Tour" on the morning of July 23, 2022, after flying from Fertőszentmiklós (LHFM) and landing at the airport in Becsehely at 07:44. After gathering of the groups, according to the flight plan, at 08:31 the group continued the flight together to Pécs Airport (LHPP). After having landed at the Becsehely airport, the pilot of the VL-3E-1 aircraft had a total of 47 minutes for personal preparation, preparation of the aircraft and to agree and prepare with the group to continue flying. He had 52 minutes at Pécs airport for passport and customs control. Considering the qualifications and experience of the pilots, the stated times were insufficient for good-quality performance of the necessary activities, which resulted in failures in the preparation and execution of the flight.

The event participation criteria in this event for crews and aircraft are very low, as demonstrated in the case of the pilot of the VL-3E-1 aircraft, considering the flights so far and experience of the pilot.

The group includes different types of aircraft with different performances. In group flights, this represents a specific issue and significantly fatigues the crew in flight. Crews with aircraft with better flight performances must constantly maneuver their aircraft in order to maintain their place in the group. Considering that these types of flights are performed at low altitudes, flight safety can easily be compromised.

Organization, management and execution of aviation events of such character is adventurous by itself. Flight safety is not given enough attention, therefore, unforeseen incidents in flight are also possible.

2.4. Reconstruction – Flight operation July 23, 2022.

The flight reconstruction was carried based on the results and data on the flight of the aircraft, by analyzing the on-board navigation device, Garmin GDU 460, the flight documentation from the JPAKL Tuzla, data and statements collected from the flight group leader, statements of the crews members who were in the air at the time of the accident and eyewitnesses from the ground on the day of the accident.

2.4.1. Preparation for flight operation on July 23, 2022.

On July 23, 2022, a group of 10 (ten) aircrafts (7 gyrocopters and 2 UL aircrafts) gathered at Becsehely airport, Republic of Hungary, to participate in the aviation event "Sarajevo Tour". On the morning of July 23, 2022, the pilot with a passenger and the ultralight aircraft VL-3E, coll sing F-JVXJ, joined the group, by own choice, that had gathered at the airport. The aircraft flew from Fertosentmiklos Airport (LHFM) to Becsehely Airport that morning. A total of 10 aircrafts (7 gyrocopters and 3 UL aircrafts) took part in the flight at the aviation event. *Table no. 1*

After the registration, each flight group leader handed out the flight plan to each participant of the "Sarajevo Tour" aviation event. The pilot of the VL-3E aircraft also received the said flight plan. The plan for July 23, 2022, provided the following: flight route, take-off and landing airports, distances, airport coordinates, the task, the frequencies and planned schedules of activities. The return was planned for July 24, 2022.

Table no. 5: Flight dana collected from Garmin GDU 460 device, July 23, 2022.

R/b	Flight phase	Flight time (minutes)	Duration (minutes)	Distance (Km/h)	Average flight speed (Km/h)
1.	Fertosentmiklos (LHFM)- Becsehely	07:02 - 07:44	42	135.6	193.7
2.	Becsehely - Pécs (LHPP)	08:31 - 09:39	67	150.4	150.4
3.	Pécs (LHPP)- Tuzla LQTZ	10:31 - 11:47	75	186.6	149.3
4.	Tuzla LQTZ - Nišići LQNI	14:19 - 14:55	36	81.9	136.5
TOTAL			220 (3h and 40min)	554.5	

The analysis of the actual ultralight aircraft VL-3E flight path, was carried out based on the flight data collected from the Garmin GDU 460 device, removed from the aircraft on July 23, 2022. *Table no. 5*

2.4.2 Flight operation from the Tuzla Airport on July 23, 2022.

On July 23, 2022, after gathering at Becsehely Airport, a group of 10 (ten) aircrafts (7 gyrocopters and 3 UL aircrafts) flew from the Becsehely Airport to the Pécs International Airport (LHPP), Republic of Hungary, for customs and passport clearance controls, before leaving the Republic of Hungary. According to the plan, the aircraft were refueled at the Pecs airport, except for the UL aircraft VL-3E, as the pilot claimed it was unnecessary, because there was enough fuel to continue the flight.

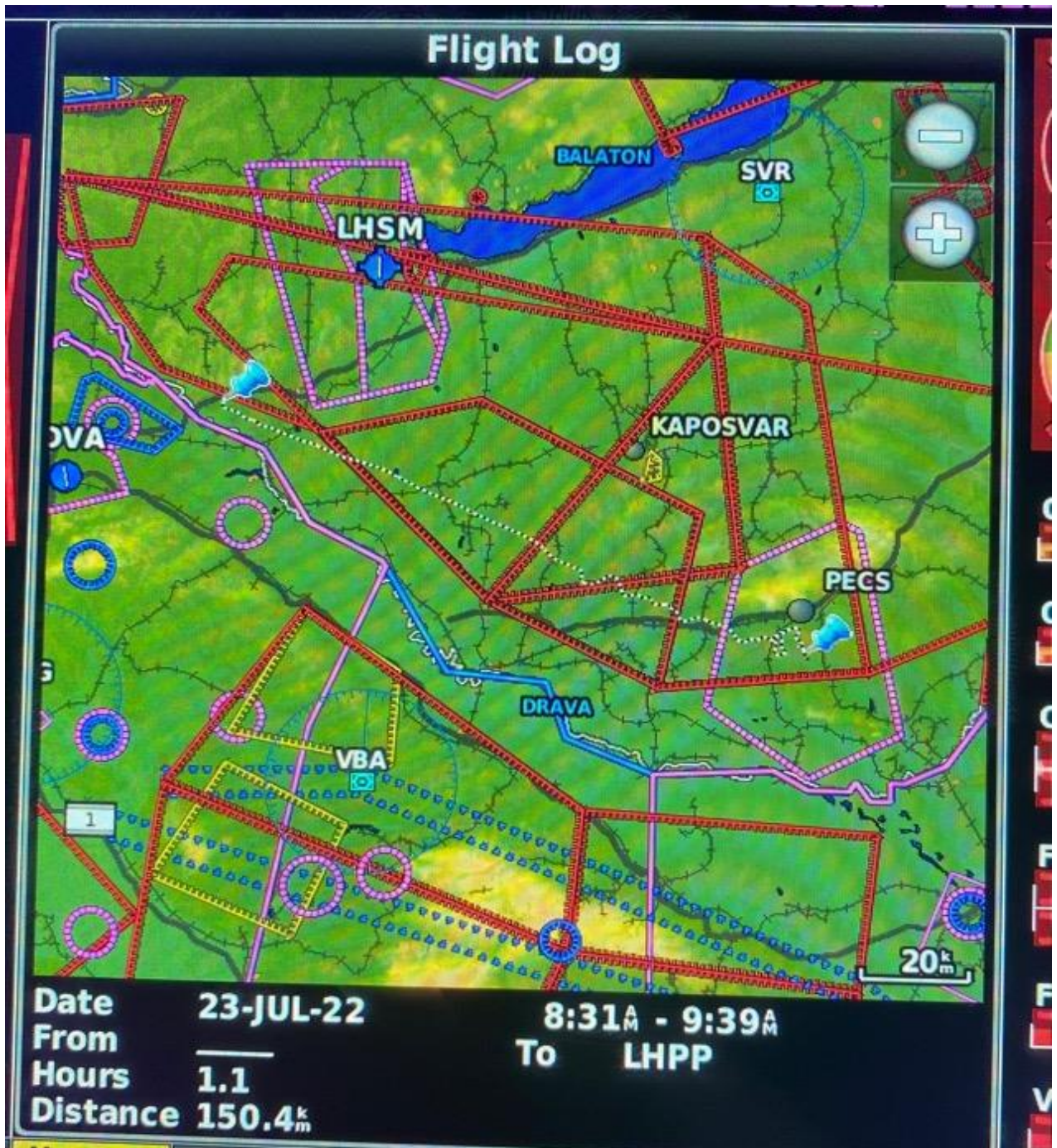


Figure no. 2.1 : Flight path from the Becsehely Airport to the Pécs Airport (LHPP)

According to flight data collected from the Garmin GDU 460 device, removed from the aircraft on July 23, 2022, the flight path from the Becsehely Airport to the Pécs Airport (LHPP) is shown on the Figure no. 2.1

Following the inspections at the Pécs airport (LHPP), according to the flight plan, a group of 10 aircraft approached the take off from the Pécs airport and the fly to the Tuzla International Airport (LQTZ) in Bosnia and Herzegovina.



Figure no. 2.2 : Aircraft flight from Pécs Airport (LHPP) to Tuzla Airport (LQTZ)

The UL VL-3E aircraft, carrying a pilot and a passenger, was also part of the group. The group took off from Pécs Airport (LHPP) at 10:31 a.m. and landed at Tuzla airport (LQTZ) at 11:47 a.m.

According to flight data from the Garmin GDU 460 device, removed from the aircraft on July 23, 2022, the flight path from Pécs Airport (LHPP) to Tuzla Airport (LQTZ) is shown in *Figure 2.2*

2.4.3. Flight operation from the Tuzla Airport to the place of the aircraft accident

At Tuzla Airport, the pilot of UL aircraft VL-3E complained to the group leader that for some reason fuel was not coming from the right-wing fuel tank. After a joint check of the tank, the pilot and group leader determined that there was no fuel in the right tank. The pilot was visibly surprised, given that according to him, 2-3 weeks ago he was refueling in both tanks at Fertosentmiklos Airport (LHFM). Since the fuel was present solely in the left-wing fuel tank, according to the statement, the group leader asked the pilot of the VL-3E-1 aircraft how much fuel was in the left-wing fuel tank and whether it would be enough for the last stage flight at a distance of about 50 km, namely from Tuzla Airport to Nišići Airport.

The pilot of the VL-3E aircraft stated that there were still about 30 liters of gasoline in the left-wing tank and that it would be more than enough for the last leg. The specified amount of fuel should be enough for the duration of flight of 1 hour and 30 minutes of reserve (if one takes into account the maximum consumption of 20 l/h).

At the Tuzla Airport, the flight group leader submitted the joint flight plan for 10 (ten) aircrafts for the flight to the Nišići airport (*Table no. 1*). At 12:19 UTC, a group of 10 aircrafts (7 gyrocopters and 3 UL aircrafts) took off from the Tuzla Airport towards the Nišići Airport. The aircraft took off individually, in intervals one after the other, from runway 27. After the takeoff and initial climb, the group took a course in the direction of the Nišići Airport (LQNI) and continued the flight at an altitude of 1000 Ft AGL. The flight was carried out according to VFR rules, i.e. under VMC conditions. In the VL-3E-1 plane, there was a PIC on the left seat and a passenger on the right seat.

Radio communication during the flight was coordinated by the group leader in dual mode (dual watch) on the existing frequencies APP Tuzla 120.350 and APP Sarajevo on 136.450, and later Nišići on INFO 123.500. The group used the common frequency 119.7.

At 12:32 UTC at the CTR border of the Tuzla Airport, the group leader signed off from APP Tuzla and switched to operation with APP Sarajevo.

According to flight data from the Garmin GDU 460 device that removed from the aircraft on July 23, 2022, the flight path from Tuzla Airport to the accident site is shown in *Figure*.

The aircraft VI-3E took off from Tuzla Airport (LQTZ) at 12:28 UTC. After the take-off, the flight continued along the route according to the flight plan towards the Nišići Airport (LQNI). After the left turn in the direction of Đurđevik, the aircraft moved along a rather unstable path in the climb. At 12:33 UTC, at an altitude of approx. 4300ft AMSL, the aircraft made a left turn at 1800, back towards Đurđevik and descended to 1700ft AMSL.

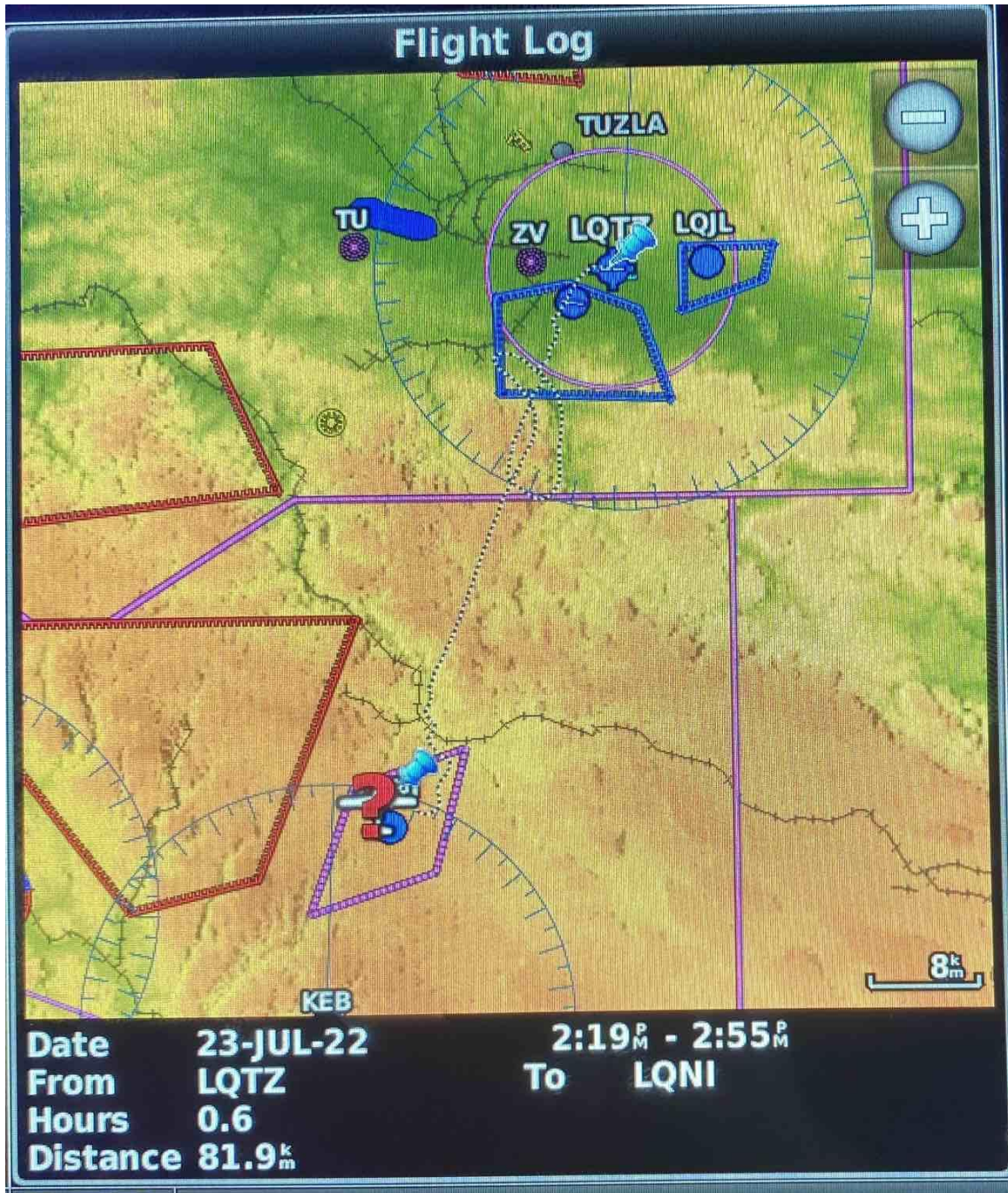


Figure no. 2.3 : Aircraft flight from the Tuzla Airport (LQTZ) to the Nišići Airport (LQNI)

Above place Đurđevik, the pilot continued with the left turn and climbed back to the original path. Between Stupar and Kladanj, it climbed to the highest altitude of

4889ft AMSL. From that altitude, in the vicinity of Olov, it descended again to 1787ft AMSL, and then continued the flight towards the Nišići Airport, climbing to 3900ft AMSL. At about 2 km from the drop site, he descended to about 3460ft AMSL. *Figure no.: 2.3 and 2.4.*

Probable reasons for these maneuvers were to maintain the distance in the group or due to the need to cool the engine during the flight.

According to the flight data from the Garmin GDU 460 device that was removed from the aircraft on July 23, 2022, the last part of the aircraft's path is shown in *Picture no. 2.4*

In the last part of the route, the aircraft made several slight letter "S"-shaped turns, probably to maintain the distance in the group. By the time of the accident, the plane was descending to about 3460ft/1055m AMSL, or 205ft/63m AGL. The last record shows the sudden dive, the probable moment and time the aircraft fell into an irregular position, *Picture no. 2.4*

According to Garmin GDU 460 measurements, the pitch was up to $-62,05^{\circ}$ in the last recording.



Figure no. 2.4: The last part of the aircraft path

In the last seconds of recording (the last 11 sec), the roll moved in the negative direction (to the left) to -66° when there is an uncontrollable increase in pitch and

the rotation of the aircraft around longitudinal axis in a steep spiral. This is consistent with the statements of eyewitnesses that the aircraft made a sudden tilt to the left.

In the last recording of the last part of the flight path, the aircraft speed was 40kt/74km/h. The plane was in the area of the Nišići Airport and was preparing for landing, since the landing gear and flaps were in the extended position, meaning that the aircraft configuration was prepared for landing. The stalling speed of this type of aircraft in landing conditions is 30kt/55km/h.

Given that at the scene of the accident and during subsequent supplementary inspections, it was established that there was no fuel in the fuel tanks, it is likely that in this phase of the flight a problem with the engine occurred, a partial and then possibly a complete shutdown of the engine due to lack of fuel.

The accident into the ground of the VL-3E aircraft took place in the U CTR AD Nišići, at 12:57 UTC at a distance of approx. 650 meters east of RWy, at the location N 44°04'20" E 18°31'01 " , at an altitude of approx. 992m/3255ft.

Prior to the impact (in the last 60 seconds of the flight), the plane flew the "S maneuver", changing the flight direction from 74° to 211° (ground track) and in a slight dive (500 ft/min) from a height of 3950 ft descended to a height of 3460 ft /1055 m AMSL or 205 ft / 63 m AGL and at a speed of 65 kt to 40 kt/74 km/h (IAS), according to the Garmin GDU 460 GPS device measurement.

The pilot suffered a stroke during the flight, after which he lost control of the aircraft. Due to the uncontrolled aircraft operation, the aircraft fell into an irregular position (steep spiral), and in an uncontrolled flight, hit the ground at a steep dive angle. Aircraft destruction followed the ground impact, and the pilot and the passenger in the plane got killed.

According to the statements of eyewitnesses and the flight records from the Garmin GDU 460 device, the aircraft suddenly made a left bank, when a gradual increase in the bank occurred and the aircraft made a descending turn, and then into a steep spiral, sending the plane into a dive with an angle of about 70 degrees, and with sudden loss of height.

The places of the first impact of the fuselage front part, the hub, the propeller and the tip of the right-wing (thermison) were determined on the ground, which indicates that the plane came into contact with the ground with the nose (propeller hub) and then the tip of the right wing, and bounced back. The distance between the place where the remains of the propeller can be seen and the place where the broken tip of the wing is located correspond exactly to the distance between their positions on the plane (4.55m).

2.4.4. Aircraft accident eyewitnesses

In the immediate vicinity of the accident site, there were several eyewitnesses on the ground and in the air who, due to the small distance from the accident site and favorable weather conditions, could clearly see the plane in the air, in the last part of the path and when it fell in the area of the accident site.

Eyewitnesses provided the Commission with their statements. All the statements were accepted by the Commission as credible. The statements of the pilots who were in the flight and near the accident site, who are mentioned in point 1.4 *Plane Accident Eyewitnesses*.

3. CONCLUSIONS

Following a thorough, objective and expert analysis, conducted on the basis of all available information, the Commission determined the following findings:

3.1. Findings

- 1) The pilot was a holder of a private pilot's license (PPL(A)) with expired SEP(Land) and a ULM pilot's license, in accordance with the applicable regulations.
- 2) The pilot was medically fit to perform the flight. The autopsy report showed that the pilot suffered a stroke during the flight.
- 3) The pilot had appropriate qualifications and training to perform flights according to VFR rules and VMC conditions.
- 4) The pilot was exposed to increased psychophysical stress due to the flight conditions on July 23, 2022, causing fatigue and distress, which ultimately significantly contributed to the cause of the accident.
- 5) The pilot suffered a stroke during the flight, after which he lost the ability to control the aircraft.
- 6) Pilot's exposure to increased psychological and physical stress due to the conditions of flight performance had a significant impact on the reduction of the pilot's ability to execute the flight. The increased strain probably caused fatigue and stress in the pilot, that significantly impacted further reduction of his ability and ultimately the cause of the accident, as confirmed by the following facts:
 - Based to the total flight time, the pilot had modest and insufficient flying experience for this type of flying.
 - The pilot's preparation for the flight was insufficient and superficial, considering the pilot's flight experience and the flight conditions
 - Flying in a group requires pilot's increased psychophysical stress, to which the pilot was exposed during the flight.
 - The flight was conducted in conditions of high external temperatures, 36-38°C
 - The pilot flew over unknown terrain and from unknown airports
 - The pilot's daily strain on July 23, 2022, was not not appropriate to his age; he conducted 4 flights with flight time of 3 hours and 40 minutes and spent in the plane from early morning until the time of the accident, which indicates the presence of fatigue
 - Problems with the fuel, was a burden for the pilot during the flight
 - Probably a partial or a complete failure of the engine due to lack of fuel in the area of the accident, mostly contributed to the condition in which the pilot ended.

- 7) The pilot was not acquainted with the flight area over Bosnia and Herzegovina and at Tuzla and Nišići Airports. The flight on the day of the accident was the first flight in the airspace of Bosnia and Herzegovina and in the area of Tuzla and Nišići airports.
- 8) The pilot's calculation and control of fuel consumption was done improperly and extremely superficially.
- 9) The aircraft was in airworthy condition, equipped and maintained according to valid regulations and approved procedures.
- 10) The aircraft and engine were regularly maintained at an authorized service center and all regular and other maintenance works had been recorded.
- 11) The aircraft suffered structural damage by the ground impact and was completely destroyed. Due to the steep angle of landing and impact with the ground, the scattered parts of the aircraft were grouped in a very narrow elliptical space, with the the north-south direction of the axis.
- 12) Due to the lack of fuel in the aircraft, probably a partial or complete failure of the engine occurred during the flight.
- 13) Before taking off from the Tuzla Airport, the crew was aware of the weather conditions and the trend of weather developments.
- 14) The weather conditions on the route and in the region where the accident occurred were favorable for the flight conduct and did not affect the accident. The outside temperature was 36° to 38° C.
- 15) The aircraft was not equipped with flight recorders (FDR and CVR). The aircraft was equipped with a Garmin GDU 460 device, which the pilot used during the flight.
- 16) The aircraft was equipped with an ELT that failed to activate and to emit a signal following the accident, because it was not switched on.
- 17) The Tuzla and Nišići Airports operated under proper conditions, as were all navigation and communication means and devices at the Airports and along the flight route.
- 18) The radio link between the controller and other aircrews, as well as the telephone link for coordination, functioned properly.
- 19) Communication between aircrafts in the group during the flight was on frequency 119.7, and the group leader monitored APP Tuzla and APP Sarajevo on dual watch, and later INFO LQNI on 123,500.

- 20) The RCC search and rescue operation was not initiated since the information about the accident site was reported very quickly and accurately.
- 21) During the investigation, no special tests and examinations were carried out, as no conditions for that existed due to the aircraft condition found at the site, as well as due to the fact that in the previous analysis of the cause of the accident, it was determined that a mistake in the control of the aircraft had led to the accident.

3.2 Accident causes

Based on the conducted investigation and analysis of the collected evidence and available information, with respect to the accident of the plane VL-3E (Evolution), call sing F-JVXJ, the Commission made the following conclusion:

The main cause of the accident was the aircraft fall into an unusual attitudes, due to the loss of control over the aircraft, caused by the pilot's stroke.

3.3. Contributory factors

The accident was affected by:

- a) Great psycho-physical strain, fatigue and probably pilot stress
- b) Probably a partial or complete failure of the engine due to the lack of fuel in the area of the accident, which contributed the most to the condition in which the pilot found himself
- c) Inadequate organization and preparation for the flight
- d) Neglecting the aircraft technical conditions, especially the amount of fuel during the flight preparation
- e) Flight performance conditions: insufficient flying experience, flying in a group, high outside temperatures, pilot's high daily stress, etc.
- f) Incorrect calculation and control of in-flight fuel consumption and reserves
- g) Insufficient knowledge of the region where the airports are situated and the flying

“The identification of the cause does not imply determining of guilt or determining of administrative, civil, or criminal liability.”

4. SAFETY RECOMMENDATIONS

4.1. In order to improve flight safety during the preparation and execution of aviation events in which several of the same or different aircrafts take part, it is necessary to adopt an adequate regulation that will precisely regulate: the manner and conditions of organizing and conducting of such events, obligations of organizers and participants, as well as other matters of event organization and management.