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

FINAL REPORT

THE ACCIDENT INVOLVING THE CITABRIA AIRCRAFT, REGISTRATION NUMBER E7-PDH, WHICH OCCURED ON 31 DECEMBER 2022 AT THE URIJE-PRIJEDOR AERODROME IN BOSNIA AND HERZEGOVINA

Edition: 1.0
Date: 31. March 2023
Marking: ACCID - 2/22

BOSNIA AND HERZEGOVINA
MINISTRY OF COMMUNICATIONS AND TRANSPORT

Commission for investigation into causes of the aircraft accident involving the CITABRIA aircraft, registration number E7 – PDH, which occured on 31 December 2022 at the Urije-Prijedor aerodrome in Bosnia and Herzegovina

Address: Trg Bosne i Hercegovine 1
71 000 Sarajevo
Tel: +387 33 284 750
Fax:+387 33 284 751
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TITLE

The Report of the Commission for investigation into causes of the aircraft accident involving the CITABRIA aircraft, registration number E7 – PDH, which occured on 31 December 2022 at the Urije-Prijedor aerodrome in Bosnia and Herzegovina

Document information		
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Summary

This Report presents the results of the investigation into the aircraft accident involving the CITABRIA /G CBC aircraft, registartion number E7 – PDH, which occured on 31 December 2022 at the Urije-Prijedor (LQPD) aerodrome. The accident occured during a panoramic flight in the airport area. The flight was conducted during day and according to VFR rules and VMC conditions.

While in a climb after taking off at the altitude of 40-50 meters, the aircraft left the angle of climb and made a sudden and rapid right turn. After making a sharp right turn, the aircraft continued to roll over its right wing with the nose being more and more pointed to the ground, and went into steep, almost vertical dive. Before hitting the ground, the aircraft made a 270 degrees rotation. The aircraft crashed into the ground at a steep, almost vertical angle positioned somewhat to its back leaving the pilot and the passenger dead and the aircraft completely destroyed.

Contact person	Telephone	Sector
	++ 387 33 284 750	Cabinet of Minister

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Commission for investigation into causes of the aircraft accident which occurred on 31 December 2022 at the Urije-Prijedor aerodrome in Bosnia and Herzegovina

The Commission for investigation into causes of the aircraft accident involving the CITABRIA aircraft, registration number E7-PDH, which occurred on 31 December 2022 at the Urije-Prijedor aerodrome in Bosnia and Herzegovina (hereinafter referred to as: Commission) was appointed under the Decision No: 02-29-8-57/23 of 4 January 2023 issued by the BiH Deputy Minister of Communications and Transport. The present Report was adopted by the Commission on 31 March, 2023.

POSITION	FIRST NAME AND LAST NAME	
Lead Investigator	Salko Begić	
Investigator	Jusuf Midžić	
Investigator	Mladen Karić	
Secretary	Dinka Maslo	

Representatives accredited/authorised to participate in the work of the Commission

REPRESENTATIVE	FIRST NAME AND LAST NAME
NTSB U.S. Accredited Representative	Sorensen Tim
Aero Club Prijedor - Operator	Vladimir Novaković President of the Management Board of the Aero Club Prijedor

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MEANINGS OF ABBREVIATIONS USED

AFM	Aircraft Flight Manual
AMS	(Licence for) aircraft, engine and (airplane) systems
AK	Aero Club
AMSL	Above mean sea level
ARO	Air traffic services Reporting Office
ATCO	Air Traffic Control
ATPL(A)	Air Transport Pilot/AircraftLicence
BHDCA	Bosnia and Herzegovina Directorate for Civil Aviation
BHANSA	Bosnia and Herzegovina Air Navigation Services Agency
CPL(A)	Commercial Pilot Licence (Airplane)
CRS	Certificate of Release to Service
CTR	Control Zone
COSPAS	Cosmicheskaya Sistema Poiska Avariynich Sudar
SARSAT	Search and Rescue Satelite Aided Tracking
Ft	Feet (0,3048 m)
LQBK	ICAO marking for the Banja Luka aerodrome.
LQPD	ICAO marking for the Urije-Prijedor aerodrome
LB, lb	Pound (1lb = 0.45 kg)
JPAKL	Approach and Airport Flight Control Unit
kt	Knot (1 kt = 1852 m/h)
METAR	METeorological Aeronautical Report
MPH	Statute mile, 1.609344 Km/h
MTOW	Maximum Take - Off Weight
NOTAM	NOtice TO AirMen
NM, Nm	Nautical Mile (1 Nm = 1852 m)
PIC	Pilot in Command
PPL	Private Pilot Licence
PSS	Runway
POH	Pilot Operation Handbook
QFE	Atmosphering pressure at aerodrome elevation (or at runway threshold)
OH	Overhaul
QNH	Altimeter Sub - scale setting to obtain elevation when on the ground
RCC	Rescue Co-ordination Centar
RWY	RunWaY
RL	Flight manager
STC	Supplemental Type Certificate
TWY	Taxy WaY
TWR	ToWeR
US gal.	USA galon, 3,788411784 L
UTC	Universal Time Co-ordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Condition

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INTRODUCTION

This Report presents the results of the investigation of the aircraft accident involving the CITABRIA 7G CBC aircraft, registartion number E7 – PDH, which occured on 31 December 2022 at the Urije-Prijedor (LQPD) airport. The accident occured during a panoramic flight in the airport area. The flight was conducted during day and according to VFR rules and VMC conditions.

While in a climb after taking off at the altitude of 40-50 meters, the aircraft left the angle of climb and made a sudden and rapid right turn. After making a sharp right turn, the aircraft continued to roll over its right wing with the nose being more and more pointed to the ground, and then went into a steep, almost vertical dive. Before hitting the ground, the aircraft made a 270 degrees rotation. The aircraft crashed into the ground at a steep, almost vertical angle positioned somewhat to its back leaving the pilot and the passenger dead and the aircraft completely destroyed.

General information on the aircraft accident

Date/Time of the accident:	31 December 2022, 14:48 LT (13:48 UTC)
Operator/Owner:	Aero Club „Prijedor“ , Prijedor
State of Registration and State of Operator:	Bosnia and Herzegovina
Aircraft Manufacturer:	American Champion Air Craft Comp./USA/
Aircraft Model and Type:	CITABRIA 7G CBC
Aircraft serial number:	278-70
Registration Number:	E7- PDH
Location:	North of the runway treshold 90, Urije-Prijedor aerodrome, Municipality of Prijedor.Elevation 160m
Aicraft Crew:	PIC (Pilot-in-Command) and passenger

SAFETY INVESTIGATION

The Commission for investigation into causes of the aircraft accident involving the CITABRIA aircraft, registration number E7-PDH, which occurred on 31 December 2022 at the Urije-Prijedor aerodrome in Bosnia and Herzegovina was appointed under the Decision No: 02-29-8-57/23 of 4 January 2023 issued by the BiH Deputy Minister of Communications and Transport.

The Commission carried out the aircraft accident investigation under the following standards, procedures and regulations:

a) international standards, procedures and regulations:
- Annex 13 ICAO, Aircraft Accident and Incident Investigation, 12th Edition, July 2020,
- Manual of Aircraft Accident and Incident Investigation (ICAO Doc. 9756,

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Part I, II, III and IV);

b) procedures and regulations of Bosnia and Herzegovina:
- Aviation Law of Bosnia and Herzegovina, Chapter III, Aircraft Accidents and Incidents, ("Official Gazette of BiH", 39/09 and 25/10), and
- Rulebook on aircraft accidents and serious incidents investigation ("Official Gazette of BiH", 30/14).

In accordance with ICAO Annex 13, the country of design and manufacture (USA) and the European Commission EASA have been informed about the aircraft accident.

Accredited representative of the country of design and manufacture (USA), and the representative of the aircraft operator and owner "Aero Club Prijedor" from Prijedor, took part in the work of the Commission.

Contacts were established and activities were agreed upon with the authorised representatives of the Operator (Aero Club Prijedor from Prijedor), the Prosecutor's Office of Bosnia and Herzegovina and the Prijedor Police Department on the territory of which the aircraft accident had occurred.

All work activities were adjusted to the COVID-19 pandemic conditions.

In accordance with Annex 13 to the International Civil Aviation Convention, the sole objective of the investigation of the accident or incident is not to apportion blame or liability. The sole purpose of both the investigation and this Report is to prevent accidents and incidents. (Reference: ICAO Annex 13, Chapter 3, paragraph 3.1.)

The Preliminary Report and Draft Report were submitted by the Commission to the State of Design and Manufacture (USA), to the State of Operator and Registry BIH (BHDCA and BHANSA) and Aircraft Operator and Owner (Aero Club Prijedor from Prijedor) which, after having reviewed both reports, provided their comments. The Commission considered the comments received, adopted those which were reasonable and add them to the Final report.

The recommendations produced in this Report have been submitted to the competent organisations and institutions which are responsible for the matter to which such recommendations apply, for further action.

All times in this Report are in LT (Local Time), unless specifically stated otherwise, while geographical coordinates are expressed in WGS 84.

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1. FACTUAL INFORMATION

1.1. Flight history

The flight history has been reconstructed on the basis of data and statements provided at the request of the Commission by eyewitnesses and responsible persons of the Operator Aero Club "Prijedor" who were at the aerodrome at the time of accident. The flight history gives the interpretation of the situation with respect to activities preceding the flight and in the course of flight execution, given by persons who had different roles before, during and after the aircraft accident.

1.1.1. Preceding activities

Three introductory flights with potentially interested glider training candidates and two scenic flights on the CITABRIA aircraft, registration number E7-PDH, were planned for 31 December 2022 in the area of the Urije-Prijedor aerodrome. The flights were notified in advance and were carried out in daylight under VFR rules and VMC conditions.

Immediatelly before the accident, the CITABRIA aircraft and a SuperCub plane carried out a fifteen minute group flight at the altitude of 2000 ft QFE in the area of the aerodrome. During that flight, the CITABRIA aircraft was operated by an Aero Club "Prijedor" pilot who was a deputy flight manager at the time of the accident. According to his statement, while operating the CITABRIA aircraft he noticed no aircraft irregularities and performed the flight safely. There were no irregularities with respect to aircraft's and engine's performance which would raise any doubts or give indications to technical issues. The aircraft was in airworthy condition when parked. He also stated that he did not use carburetor heat because of the warm weather that day. During and after the landing, the aircraft trimmer was positioned one to two centimetres away from its back position, the aircraft was trimmed to tail. Upon completion of the flight, there was around 40 litres of unleaded automotive gasoline left in the tanks. Upon landing, the aircraft was parked on the apron and then pushed into an Aero Club "Prijedor" hangar.

The deceased pilot was supposed to perform a couple of flights with candidates for theoretical glider training on 31 December 2022, as was agreed on 30 December 2022. After having arrived at the aerodrome on 31 December 2022, the said pilot was curious about the amount of fuel left in the tanks of the CITABRIA aircraft. He was provided with information to that regard. He decided to put more fuel in the tanks, so he went to a gas station and came back with 100 litres of automotive gasoline out of which he put 25 litres in each wing tank. Therefore, before the tragic flight took place, there were 90 litres of fuel in the aircraft tanks which was documented in the Aircraft Maintenance Logbook. The flight plan foresaw that the two pilots should perform two to three flights each on the CITABRIA aircraft, that is five to six scenic and introductory flights with two daughters of the deceased pilot, and three candidates for theoretical glider training. The Commission did not review the pre-flight preparation concerning the flight in question.

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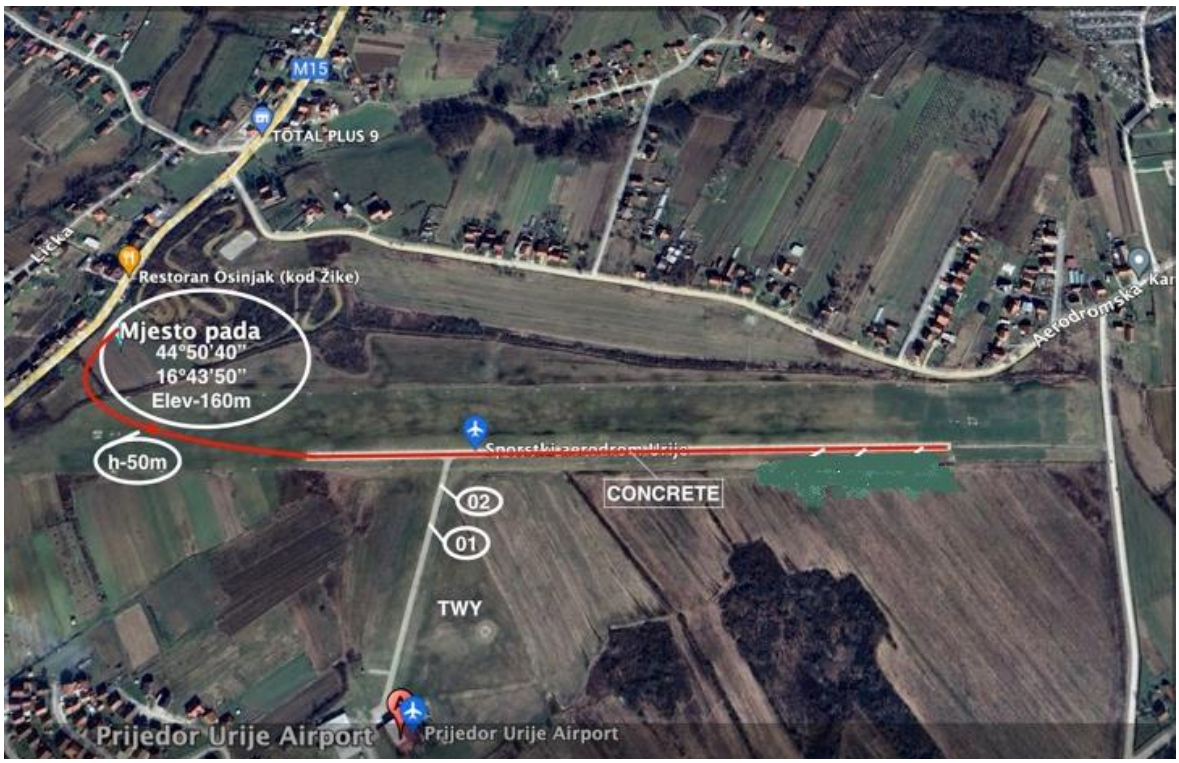
Prior to commencing the flight, the deceased pilot who had, acting as a flight manager, notifed the Approach and Airport Flight Control Unit (JPAKL) at Banjaluka aerodrome about the start of air operations at the Urije-Prijedor aerodrome (Flight Zone Opening), and filled out the Aerodrome Inspection Checklist confirming that the aerodrome was in good condition.

1.1.2. Flight execution

On 31 December 2022, around 14:40 hours, after pushing the aircraft CITABRIA, registration number E7-PDH, out of the hangar onto the airport apron, the pilot, who later died in the aircraft accident, first performed a pre-flight check of the aircraft and then entered the cockpit together with his daughter. He switched on and checked the engine, and then taxied to the threshold PSS 27 on the concrete part of the runway where he stopped at the take-off position. Upon stopping the pilot checked the engine. The pilot deputy flight manager who was in the vicinity said in his statement that he heard the sound which was normal during engine checks when the engine was first run at low rpm than at full throttle on two occasions, after which the plane started taking off from the concrete taxiway in the PSS 27 direction, which is clealy visible in the video.

During the take-off run the aircraft was speeding up normally while according to the statement by an eyewitness and the available video footage the climb angle was somewhat greater than usual after which the plane continued to climb. There is an eight (8) second-long aircraft take-off video footage made by a mobile phone.



Picture 1.1: The aircraft's path, accident's site and locations of eyewitnesses

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According to a pilot who was located at the taxiway at that time and witnesed the accident, the aircraft was at the altitude of 15 meters when it flew by the point where the runway and taxiway meet, which he considered was normal. After taking off and during a climb, the eyewitnesses noticed a minor instability in the aircraft performance. According to him as well as other eyewitnesses, at the end of the runway and at the altitude of approximately 40 to 50 meters moving at the angle of climb, the aircraft rapidly turned right. After taking a sharp right turn, the aircraft continued to roll over its right wing with the nose being more and more pointed to the ground, and then going into a steep, almost vertical dive. Before hitting the ground, the aircraft made a 270 degrees rotation. At the aircraft accident site, the aircraft longitudinal axis was pointed in the north-south direction, and the wings and main legs of the landing gear were in position parallel with the runway longitudinal axis. *See Pictures 1.1 and 1.2*.

The aircraft crashed into the soft ground of a cornfield at a steep, almost vertical angle positioned somewhat to its back. The aircraft's nose struck the ground, whereby the propeller and engine plunged 40-50 cm deep into the ground leaving the pilot and the passenger dead and the aircraft completely destroyed. *See Picture 1.2.*

Picture 1.2: The position of the aircraft after hitting the ground (left side of the aircraft)

According to the available take-off video footage and the statements given by eyewitnesses, the total flight time of the aircraft from taking off to the moment of hitting the ground was approximately eighteen (18) seconds.

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1.1,3. Eyewitnesses of the accident

Eyewitnesses of the accident were located on the aerodrome taxiway near the point where the taxiway meets the runway in the vicinity of the runway, some 430 to 450 meters south-east of the accident site. Eyewitnesses 03, 04 and 05 were also located on the taxiway. *Picture 1.1.*

O1 - A pilot at the airport

" I was some 50 meters away from the point where the taxiway meets the runway when the plane started take-off run. By the sound of it I still did not hear anything out of the ordinary, but I had an impression that the speed during the take-off run and lift off was lower than usual, that is the take off distance was short.
He kept the aircraft at not more than one meter above the runway intending to attain the speed, I guess. After few seconds, in my estimation, he managed to gain additional speed, that is the plane rapidly rose up and took the usual angle of climb. The aircraft was at the altitude of 15 meters when it flew by the point where the runway and taxiway meet, which was normal, in my opinion. I kept on watching it until the moment when it was, in my estimation, at the end of the runway and at the altitude of 40 to 50 meters moving in the angle of climb. I noticed that while in that position the aircraft made a sudden right turn after which it rolled over its right wing with its nose towards the ground. For a moment I thought that he was intending to return towards the runway. However, after that I saw nothing but a steep dive towards the ground and I heard a bang".

O2 – A person who was recording the take-off at the aerodrome

"I was recording the beginning of the flight approximately at 14:49 hours. When there was an interruption in recording, I noticed that the plane was making a strange sound, it was not a usual sound, the plane was running rough, there was an attempt to return the plane towards the runway. I noticed that while moving horizontally the plane's nose first went down then up twice and then it just went straight down in free fall. The sound of the plane could be heard all the time".

O3 - Training candidate at the aerodrome

"Approximately 100 meters before the point where the taxiway meets the runway the aircraft rapidly took off at the large angle of climb. Upon reaching the altitude of 10 meters the pilot straighten the plane. He continued the flight normally. He was flying in a slow climb up to the threshold 09 and then made a sharp right turn. Due to low speed and the turning flight, the pilot lost control over the plane resulting in plane's vertical nose diving".

O4 - Training candidate at the aerodrome

" He took off from the concrete since the grass strip was wet. During the take-off he moved at considerably higher angle, then he straighten the plane but not all the way, so he continued to climb for a few more seconds. It seemed that he made a

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sudden right turn, lost the speed and started to fall down as if the control stick was pushed all the way forward causing the plane to go down and crash into the cornfield".

O5 - Training candidate at the aerodrome

"The plane started without any difficulties and proceeded to the start position 27. Engine test was performed. Nothing was out of ordinary. Following the take-off, the plane was moving in the angle of climb greater than usual, turned right and suddenly started to dive. As far as I can recall he made two turns and crashed into the ground. There was no explosion".

1.2. Condition of persons after the accident

Pilot of the plane - PIC (male, age 48), was operating the CITABRIA plane, fatally injured. National of Bosnia and Herzegovina.

Passenger (female, age 23) was occupying a passenger seat, fatally injured. National of Bosnia and Herzegovina.

Table 1. Number of victims and degree of injuries

Injury	Crew	Passengers	Total
Fatal	1	1	2
Serious	0	0	0
Minor	0	0	0
Total	**1**	**1**	**2**

1.3. Condition of the aircraft after the accident

The CITABRIA aircraft suffered considerable structural damage and was completely destroyed by hitting the ground. The wreckage of the aircraft was complete when found at the accident site.

1.4. Other damage

There is a minor damage to the field at the impact site, a 40 to 50 cm deep crater.

1.5. Aicraft crew data

Data concerning the pilot of the aircraft refer exclusively to the data/documentation which was obtained from the responsible persons of the Aero Club “Prijedor” by

the means of a direct contact or by email, as well as to the documentation on the pilot provided by the BHDCA.

1.5.1. Pilot of the aircraft - PIC

General information: 48-year old male.

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Employment and duties timeline: Long-standing member of the Aero-Club ”Prijedor” from Prijedor. As a sport pilot he operated various types of sport planes and gliders in the Aero-Club Prijedor. He held position of a Glider Section Head. He was an active mountaineer and the President of the Republika Srpska Mountaineering Association. He was employed in the Elektrodistibucija Prijedor company.

Aviation licences and authorisations: Holder of the Private Pilot Licence*, (PPL(*A), no. BA.FCL 0007, issued on 26 October 2018 by the BiH Directorate for Civil Aviation together with the SEP(Lend) authorisation of 05 January 2001, and the Sailplane authorisation of 08 April 2004 and Banner Towing authorisation of 25 September 2013.

Training: Training for PPL (A) licence together with authorisations was conducted in the Aero Club ”Prijedor”.

Checks: The pilot underwent the last ground and air check on the CITABRIA aircraft in the school area and zone on 14 September 2022.

Interruptions to flying: The pilot neither had no unreasonable interruptions to flying nor such interruptions have been registered**.** The pilot's last flight before the accident was on November 4, 2022 on the CITABRIA plane in the role of tow truck. Due to the winter conditions, he had an interruption in flying until December 31, 2022, that is, for a period of 57 days.

Illness: Most recent Medical Certificate was CLASS 2/LAPL, no. BA-FCL-080042 issued on 13 May 2022 without restrictions, and valid for Class 2 (PPL) until 20 May 2024 and LAPL valid until 20 May 2024.

Working hours, rest period and fatigue: There is no evidence that the pilot failed to comply with requirements concerning working hours and rest periods. On the day of the accident, the pilot attended the funeral of his friend who was a mountaineer.

Flight experience and experience regarding the type/class of the aircraft: The inspection of the Pilot's Logbook found that the total flight time by the end of 2022 inclusive was 403:55 hours and 2874 flights out of which:

- Flight time in 2022: 135 flights and 26:33 hours;
- Flight time in the last three months: 47 flights and 07:13 hours;
- Flight time in the last 24 hours: 00:00 and
- Total flight time on the CiTABRIA 7GCBC aircraft: 432 flights and 59:38 hours.

He was taking an active participation in the glider pilot training, as a flight instructor for glider and as a tug pilot on the CITABRIA plane. He had no other flights on the day of the accident.

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Familiarity with the area and the Urije-Prijedor aerodrome: (LQPD). The "Urije-Prijedor" aerodrome is a pilot's home aerodrome where he provided flight training and performed flight tasks**.**

1.5.2. Passenger

Passenger on the plane was a 23-year old female. She occupied a passenger seat and lost her life in the aircraft accident. She was a national of Bosnia and Herzegovina. She had an unidentified number of prior flights on a glider and on the CITABRIA and PIPER aircrafts as a passanger.

1.6. Aircraft data

1.6.1. General information on the CITABRIA 7G CBC aircraft

The CITABRIA 7G CBC aircraft is a single-engine, high wing airplane with a standard landing gear. This airplane is intended to be used for training purposes, aerobatic, scenic and training flights. It may be also used to tow a glider.
Picture 1.3

a) Basic characteristics:

- Crew: one member
- Capacity: 1 passenger
- Length of aircraft: 6.90 m
- Wingspan: 10.20 m
- Height: 2.40 m
- Empty Aircraft Mass: 1168lb (519,5 kg)
- Maximum Take-off Mass: 1650lb (742,5 kg)
- Driven by 1 four-cylinder air-cooled engine Licoming O-320-A-2B of power 150 hp (110 kW)
- Propeller: Sensenich 74DM658-1-56 standard, S/N K32008
- Fuel tank capacity: 35 US gal (132 L)

b. Performances:

- Maximum speed: 110 kn (210 km/h) at sea level
- Cruising speed: 109 kn(201 km/h)
- Range: 590 Stm
- Flight ceiling: 17,000 ft (5,200 m)
- Climb speed: 200-500 ft/min depending on load and temperature
- Stalling speed: 45 KT (80 km/h), without flaps
- Take-off Run Distance up to 50Ft (15 m): 567 FT
- Landing Run Distance up to 50FT (15 m): 690 FT

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Picture 1.3: CITABRIA 7G CBC airplane

1.6.2. Technical documentation and the condition of the aircraft and the engine before the aircraft accident

The review of the documentation available for the aircraft and the engine showed that the CITABRIA 7G CBC aircraft, serial number 278-70, registration number E7-PDH had been properly registered and maintained. The total flight time of the aircraft was 22150 flights and 2475:41 hours out of which:

- Flight time since the last maintenance works took place on 25 October 2022 was 28 flights and 03:37;
- Flight time in 2022 was 187 flights and 31:02 hours
- Flight time in the last three months was 49 flights and 06:50 hours, and
- Flight time in the last 24 hours was 1 flight and 00:15 hours.

The aircraft has the *Certificate of Registration,* no. 090/1 issued by the BiH Directorate for Civil Aviation (BHDCA) on 9 July 2012 in the name of the aircraft's owner, which is the “Aero Club Prijedor“ from Prijedor.

The aircraft has the *Certificate of Airworthiness* no. 090/02 issued by the BHDCA on 14 July 2016.

The most recent *Airworthiness Review Certificate* was issued on 8 November 2022 valid until 8 November.2023.

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The Operator and the Owner of the aircraft holds the Aircraft Technical Maintenance Program approved by the BHDCA. The last annual, that is 100-hours

regular aircraft inspection was conducted on 25 October 2022. Since that time up to the moment of crash, the flight time of the aircraft was just three hours.

Following the 100-hours inspection of the aircraft conducted by the authorised workshop "GAS AVIATION" Ltd, under Section 145, the *Aircraft Certificate of Release To Service/ACRS* was issued on 20 October 2020.

After the air accident involving the Blanik L-13 glider, registration number E7-5335 which had occurred at the "Urije-Prijedor" aerodrome on 22 June 2021, the CITABRIA aircraft was banned from flying under the Investigation Commission recommendation and the BHDCA Decision until certain safety measures concerning further use of the aircraft have been undertaken. The aircraft was in the "GAS AVIATION" workshop on 5 October 2021.in order to fulfil the earlier accident and lift the ban of using the aircraft.

Following an overhaul, as a special remark of the Form 1 of the CRS issued by the GAS AVIATION workshop on 12 January 2012 was written: **Do not use automotive gasoline and/or oil.**

According to the statements given by pilots and persons in charge of maintaining the aircraft upon its return from the "GAS AVIATION" workshop, 100-octane automotive gasoline instead of 100LL airplane gasoline was used for the aircraft. At the time of the accident, the Aero Club "Prijedor" did hold for the E7-PDH aircraft, that is the engine 0-320-A2B, the AUTO FUEL STS (Supplemental Type Certificate) no. 10211566 issued on 28 October 2021 by the company Peterson Aviation Inc.(*Enclosure 5.1).*

Upon reviewing the documentation and on the basis of the information provided by the BHDCA Air Navigation Safety Department, there were neither mandatory nor voluntary reports prior to the accident concerning technical or any other irregularities with respect to the CITABRIA aircraft which could affect safe performance of operations.

Upon analysis of statements given by the aircraft mechanic who is a person in charge of aircraft airworthiness in the Aero Club "Prijedor", and the pilot who flew that plane half an hour before the accident took place, no issues pertaining to the airworthiness of any system, that is of the aircraft and the engine, prior to the flight during which the accident had occurred were detected.

1.6.3. Condition of the aircraft after the accident

The aircraft suffered major damage when it hit the ground resulting in its complete destruction. For more information on this matter please refer to the point 1.12.3 of this Report *The condition of the aircraft after hitting the ground*.

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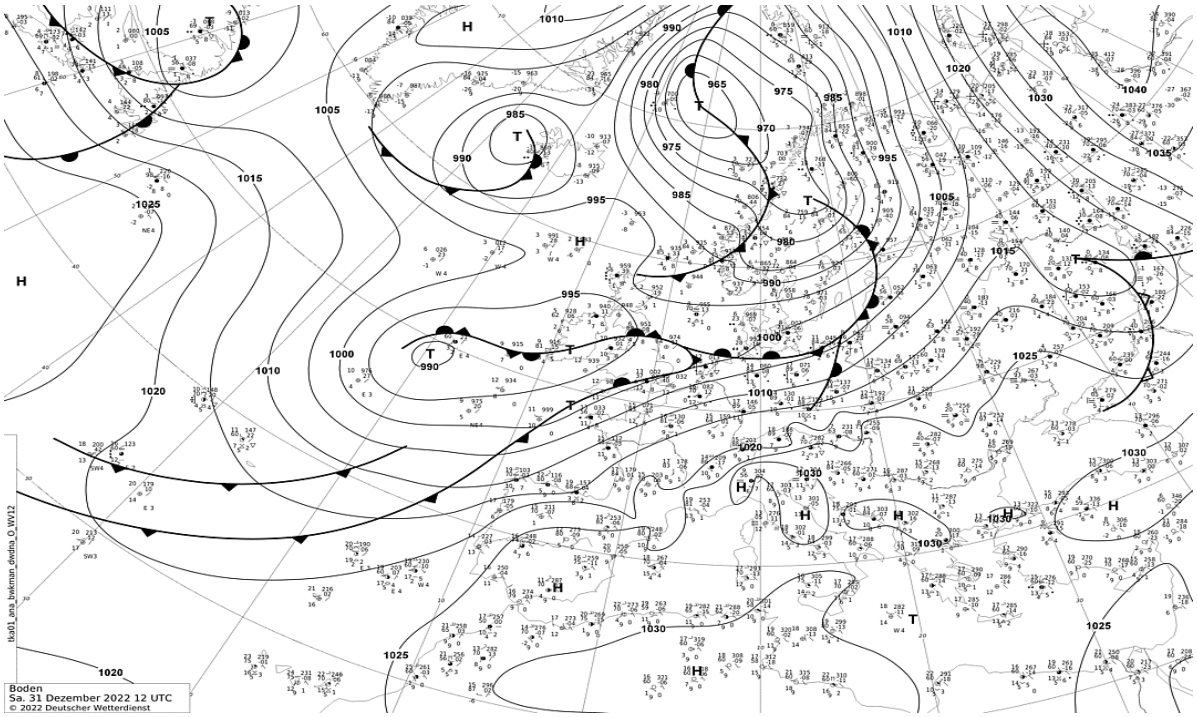
1.7. Meteorological information

Meteorological conditions in the FIR Sarajevo on 31 December 2022

Synoptic situation: There is an influence of a thermobaric ridge continuing to rise along with the presence of stable and warm air. There is a week gradient field of

high atmospheric pressure at low hights. The atmosphere is stable featuring inversion at the altitude of around 1000 meters. Light south-west wind at low hights up to the point of inversion.



A surface weather analysis of Europe at 12.00 UTC

Weather: There was a sunny and clear weather in the north-western part of Sarajevo FIR with temperatures above the average for this time of year.

Meteorological situation at the "Urije-Prijedor" aerodrome and the surrounding area (LQPD)

Temperatures, clouds (AGL clouds database) and wind at 12.00 hours (UTC) in the vicinity of Prijedor, as recorded by synoptic stations:

- Mrakovica: 11.0^{0}C, clouds 3/8 at 7800 ft.
- Novi Grad: 16.6 ^{0}C, wind 0m/s, clouds 1/8 at 3700 ft.
- Prijedor: 14.8^{0}C, clouds 1/8 at 6500 ft.
- Ribnik: 16.4^{0}C, wind 200 degrees 2m/s, clouds 1/8 at 3900 ft.

Temperatures, clouds (AGL clouds database) and wind at 13.00 hours (UTC) in the vicinity of Prijedor, as recorded by synoptic stations:

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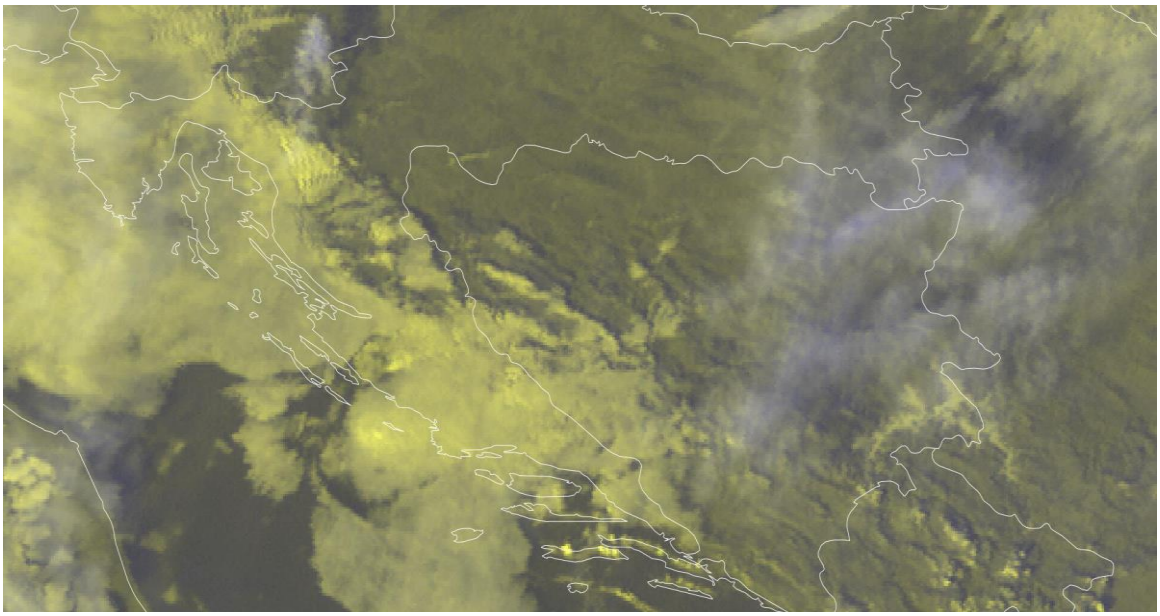
- Prijedor:17.7^{0}C, clouds 1/8 at 8200 ft.
- Novi Grad: 18.8^{0}C, wind 180 degrees 1m/s, clouds 1/8 at 6200 ft.

METAR Reports from the Airport LQBK:
METAR LQBK 311430Z 10002KT CAVOK 18/09 Q1027 NOSIG=

METAR LQBK 311400Z 04004KT CAVOK 18/09 Q1027 NOSIG=
METAR LQBK 311330Z 04005KT CAVOK 18/09 Q1027 NOSIG=



Satellite imagery at 13:45 UTC in visible spectrum.

Measured values of MET parameters, AMS Prijedor (source www.timeanddate.com)

Time (LT)	Temperature (C)	Humidity (%)	Visibility (Km)	Wind (Km/h))	Pressure (mb)
12.00	18	46	16	11	1028
12.30	19	46	16	7	1027
13.00	19	46	16	9	1027
13.30	18	56	16	11	1027
14.00	18/17,7 Sin st.	52	16	9	1027
14.30	18	56	16	9	1027
15.00	**18**	**56**	**16**	**7**	**1027**
15.30	18	56	16	4	1027
16.00	16	63	16	4	1028
16.30	13	77	16	4	1028
17.00	12	77	16	2	1028
17.30	10	88	16	2	1028

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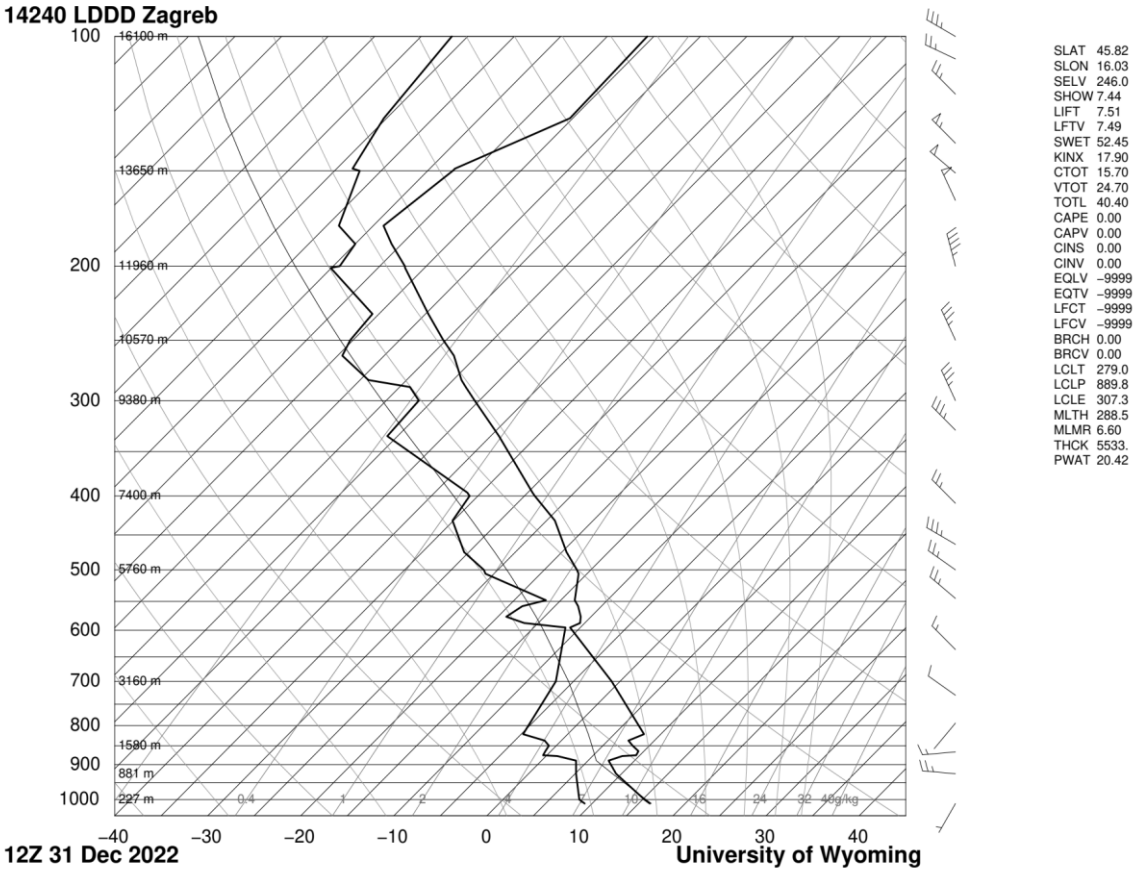

Zagreb Sounding Station Parameters at 13.00 LT

On the basis of available data and the video footage made immediately before the aircraft accident at the "Urije-Prijedor" aerodrome, the weather conditions prevailing on the LQPD location at the time of conducting flight operations may be described by the following MET elements:

- Wind: no wind or ocassional wind 1-3 m/s of variable direction
- Visibility : over 15 km
- Clouds : no clouds
- Weather phenomena : no weather phenomena
- Temperatures : estimation is that temperatures were half degree lower than those presented in the previous table.
- Humidity : estimation is that humidity levels were 5% higher than those presented in the previous table (a part of the runway and the surrounding field was under water a a result of recent rains)

The weather conditions were favourable for the execution of VFR operations that were planned in the Aero Club "Prijedor" for 31 December 2022. The values of air temperature and humidity (dew point) parameters suggested a strong possibility of carburettor icing.

1.8. Navigation devices

There are no navigation devices at the "Urije-Prijedor" aerodrome.

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1.9. Communication system

Communication is possible over landlines and mobile phones at the "Urije-Prijedor" aerodrome. There is also an INFO line on the frequency 123.500 MHZ which was operational at the time of the accident. Radio communication between the pilot of the plane and the flight manager was properly functioning.

With regard to the aircraft accident involving the CITABRIA aircraft - registration number E7-PDH, which occurred on 31 December 2022 at the Urije-Prijedor aerodrome, upon reviewing the voice communication recordings it was found that the radio communication had not been established neither with the FIS BIH nor the JPAKL Banja Luka, but that there was a proper notification made in advance and via telephone to open and close the ATP Zone Prijedor for the given day.

The crew of the aircraft had a mobile phone on them which was considerably damaged after the plane had impacted the ground.

1.10. Aerodrome information

At the time of the accident, the "Urije-Prijedor" aerodrome had a valid Aerodrome Certificate no. E-7-L-003 as well as the Aerodrome Manual issued on 15 March 2022 for which the BHDCA issued the Aerodrome Manual Approval on 18 March 2022.

Table 2. General information on the aerodrome/airfield

	Aerodrome Prijedor	**Remarkclub**
ICAO location indicator	LQPD	
Reference point	44°59'37'' N 016°44'08'' E	
Elevation	555/Ft	
Runway dimensions	900 m x 90 m	Travnata
Taxiway dimensions	TWY 700x10m	Beton
Runway direction	090°- 270°	

General information on the aerodrome have been taken from the Aerodrome Manual of 15 March 2022 and the AIP BiH for the Urije-Prijedor aerodrome (LQPD) of 5 November 2020.

The Aerodrome Operator holds a completely filled out and signed Airfield Inspection Checklist for 31 December 2022.

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BHANSA's BHNOF issued on 13 October 2022 a NOTAM prohibiting the use of the concrete part of the runway for take off and landing at the aerodrome, valid until 14 January 2023.

1.11. Flight recorders and aircraft devices

The CITABRIA aircraft was not fitted with the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR).

The aircraft was fitted with a radio station, a transponder and other devices in accordance with POH.

The aircraft was fitted with the ELT which was activated after the accident.

1.12. Information concerning the aircraft accident site, the impact and the condition of the aircraft after the impact

1.12.1. Aircraft accident site

The aircraft crashed north of the 09 PSS threshold, 98 meters away from the runway axis, that is 60 meters away from the runway's northern edge, and some 48 meters southeast of the main road M 15 Prijedor–Kozarska Dubica.

The aircraft accident coordinates are 44°59'40"N and 016°43'50"E, that is, latitude 44,994652, longitude 16,730677 and elevation 160 meters. *Pictures: 1.1 and 1.4*

Picture 1.4: A*ccident site*

The aircraft accident took place on an agricultural land area, which is a field under 60-70 centimetres tall corn stalks. This is a soft surface terrain. To the north and

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west of the runway, in the direction of the site of the accident, the terrain mildly slopes downward towards the Prijedor-Kozarska Dubica road.

1.12.2. The impact of the aircraft against the ground

While in a climb after taking off at the altitude of 40-50 meters, the aircraft left the angle of climb and made a sudden and rapid right turn. After making a sharp right turn, the aircraft continued to roll over its right wing with the nose being more and more pointed to the ground, and went into steep, almost vertical dive. Before hitting the ground, the aircraft made a 270 degrees rotation.

At the crash site, the aircraft longitudinal axis was pointed in the north-south direction, and the wings and main legs of the landing gear were in position parallel with the runway longitudinal axes.
The aircraft crashed into the ground at a steep, almost vertical angle positioned somewhat to its back *(Picture 1.5*).

The plane hit the soft ground of a harvested cornfield at the vertical angle and at speed exceeding 100 km/h whereby its propeller and engine plunged 40-50 cm deep into the ground. The pilot and the passenger were killed, and the aircraft was completely destroyed. *Pictures 1.4 and 1.5.*

1.12.3. Aircraft condition after the impact

The force of the ground impact caused major irreparable structural damage to the aircraft. When the aircraft hit the ground, both wings were damaged in such a way that the front third of the wings got compressed, the fuselage immediately behind the passenger cabin suffered significant bending, and the engine, together with the engine mount and the propeller, stuck into the ground, leaning to the right of the axis. All parts of the aircraft were found at the accident site. *Picture number: 1.5*

Picture no. 1.5: Position of aircraft after hitting the ground (the right side)

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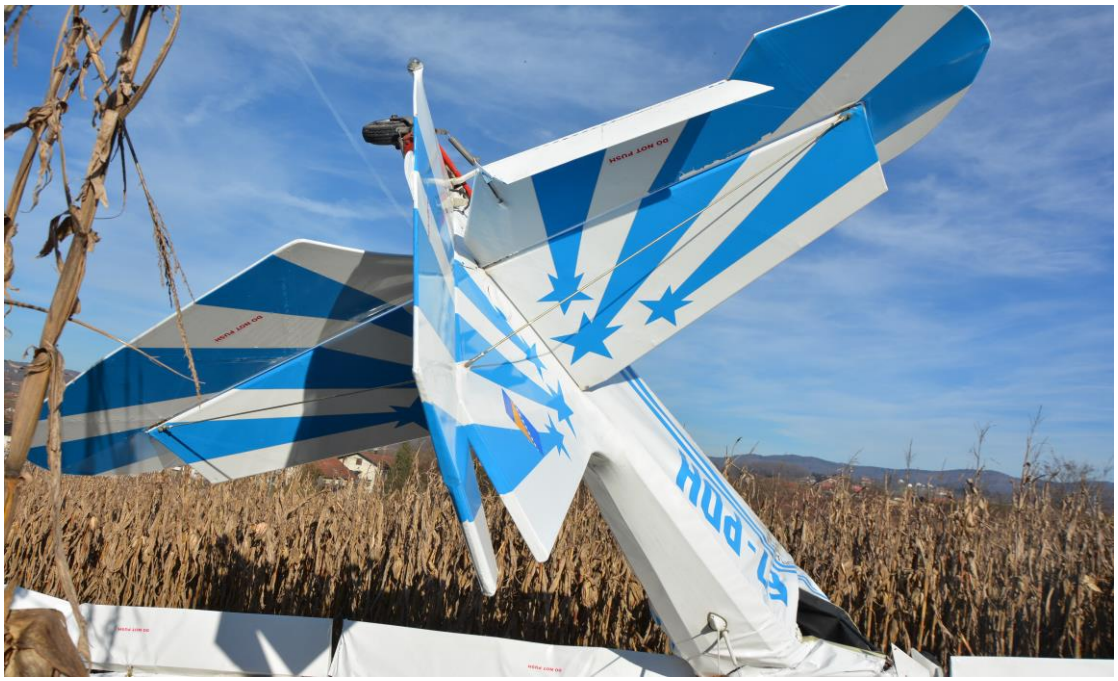
The cabin, fuselage and the wing, particularly the right wing, were deformed significantly. The tail section of the fuselage and the tail surfaces (vertical and horizontal stabiliser) suffered minor damage.

It was determined that the left wing flaps, which were less damaged during the accident, were not extended. *Picture number: 1.5, 1.6 and 1.7*

An inspection of the depth rudder cables revealed that half of one cable strings were broken, while the other half were seamless and connected to the control stick.

The cables showed no signs of wear, but the strings cracking pattern resembled a broom, indicating that the cracking was due to very high stress, which probably occurred during the impact due to the blockade of the control stick, deformation of the fuselage at the location of the cable guide and inertial forces on the rudder.



Picture number 1.6: Tail surfaces

The depth rudder was in the climbing position and the rudder was turned to the right. The flap was found in the retracted position. *Picture number 1.6*

The engine and propeller were plundered into the ground to a depth of about 40-50 cm. After excavating the ground under the engine, a propeller was found with visible traces of rotation while it hit the soft ground where it suddenly stopped. The propeller deformations and visible scraping marks on the surfaces of the propeller suggest that the engine was running at the moment it hit the ground, meaning that the propeller was still rotating. *Picture number: 1.8*

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Picture number 1.7: Left wing and flap in retracted position

Picture number 1.8: Engine propeller

Due to fuselage deformation, the controls in the cabin were blocked and deformed. The throttle control was found in the 30% position, and the carburettor heating was on.

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Picture number 1.9: Aircraft nose, wings and cabin

The pilot's instruments suffered extensive damage. The pointer was in such a state that nothing could be read, and no conclusion could be made.

The female passenger did not have the seat belt on.

1.13. Medical data

The post-mortem examination of the deceased pilot and passenger was conducted at the Institute of Forensic Medicine of the Republika Srpska in Banja Luka, and the report on the examination and autopsy was made. The conclusion of the autopsy report is that the death of the pilot and the passenger were violent and occurred as a consequence of severe traumatic and hypovolemic shock, i.e. shock caused by mass injury and blood loss. Deaths were accidental.

An instrumental analysis was performed, no relevant presence of alcohol was determined in the blood and urine samples.

1.14. Fire

There was no fire on the aircraft at the accident site nor in the surrounding terrain and buildings. Upon ground impact, the wings and fuel tanks were destroyed. Although there were about 90 litres of gasoline in the aircraft tanks, there was no

spark or fire. Tank caps flew ten meters from the impact site. Traces of gasoline and oil were present in the ground crater, some half a meter deep.

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1.15. Search and rescue operation

On December 31, 2022, at 13:51 UTC, a "DISTRESS COSPAS-SARSAT POSITION CONFIRMED ALERT" message was received via AMHS terminal, message number 00398 about the ELT broadcast 406 MHz with HEX ID: BC6A2603AFFBFF, country of registration 478/Bosnia and Herzegovina with "encoded" coordinates: 44° 59'.60"N and 016°43'.73"E.

Based on geolocation of the coordinates, it was determined that the ELT broadcasting location was the runway threshold of the "Urije"Aairport near Prijedor, followed by a communication check, in an attempt to get in touch with the authorised personnel of the "Urije" Airport operator:

- With several phone calls to the "Urije" Airport at 13:55 UTC, the RCC operator attempted to obtain information about the accident, but there was no answer.

- At 13:57 UTC a connection was established with a member of the Aero Club “Prijedor“ who briefly informed that the CITABRIA CH10 plane had crashed on the runway 09 treshold, on the way to Kozarska Dubica, with two people on-board, that the firefighters had already been informed and that there was no need to involve the RCC.

- At 14:02 UTC, the nearest HSJ (HSRS) was called, the crew on duty was given the information known until that time, and they were put on full alert (in case of need).

- At 14:04 UTC, a member of the Aero Club “Prijedor“ confirmed information that the CITABRIA aircraft had crashed with two people on-board, who died. Firefighters and police were in the vicinity of the aircraft accident. He also confirmed that there was no need for RCC involvement.

- At 14:30 UTC, according to prescribed procedure, a "Notice of a crisis situation" was electronically sent to the Office of the BHANSA Director and the Head of the Air Navigation Safety Department.

Due to the situation and conditions in which the accident occurred, there was no need for special involvement of the RCC. Search and rescue operations were not initiated.

1.16. Initial investigation at the accident site

After the accident that took place on December 31, 2022, the Prijedor Police Department, together with a Prosecutor of the Prijedor District Prosecutor's Office conducted a basic investigation at the accidnet site. Fire Department also intervened, who had to destroy part of the damaged cabin in order to get to the bodies of the pilot and female passenger. After the bodies had been pulled out, they were sent for an autopsy. Due to reduced visibility, the investigation was ceased.

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On January 1, 2023, the investigation at the accident site continued and was conducted from 11:00 a.m. to 4:30 p.m. in the presence of two members of the accident investigation Commission, members of the Prijedor Police Department and the prosecutor of the Prijedor District Prosecutor's Office.

After a brief conversation to agree on the method and purpose of the investigation, the implementation of standard activities at the accident site began.

Following the initial investigation, the Operator organised the removal of the aircraft wreckage and its placement in a hangar and safekeeping for the purpose further investigation.

On January 1, 2023, from 10:00 a.m. to 11:00 a.m., upon arrival at the Urije Airport, in the premises of the Aero Club “Prijedor“, the members of the investigation Commission had a conversation with the representatives of the Operator and inspected the documentation on the status of the pilot, the aircraft, the flight organisation and operations on the day of the accident. They also interviewed and took statements from accident eyewitnesses.

1.17. Testing and examination

1.17.1. Testing elevator control cables

Early into the investigation, it was noticed that one cable of the command tail surfaces suffered damage. Four of the steel strands were broken, and the other four were still operational and unblocked. Due to the found condition of the tail surface control cables, the Commission members concluded that it was necessary to examine the condition of the elevator control cables.

On January 3, 2023, the cables were tested on the aircraft wreckage placed in the "Urije-Prijedor" Airport hangar. The examination was attended by a member of the Commission and two members of the Aero Club “Prijedor“. Examination showed that the second rudder cable was not damaged. Moving the stick of the aircraft forward and backward caused the cables to move. The damage caused deformation of the pilot sticks. The cable guides were not blocked. Upon inspection of the aircraft maintenance records, it was determined that the elevator cables were replaced on October 29, 2020, according to the manufacturer's Status List.

After the examination, a written note was made on the test results, as well as a video note with a mobile phone. This removed the suspicion that the cables were defective, and it was confirmed that the aircraft's elevator was functioning properly.

1.17.2. Aircraft engine inspection

After the aircraft accident, at the request of the Commission, on January 17, 2023, the experts of the authorised service "GAS AVIATION" performed at the airport "Urije-Prijedor", in the hangar of the Aero Club “Prijedor“, and in the presence of a member of the Commission and responsible persons of the " Aero Club “Prijedor“

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and the Prijedor Police Station, the disassembly and inspection of the Lycoming O-320-A2B, S/N: 27A engine installed on the CITABRIA aircraft, registration number E7-PDH.

A visual inspection and check of the following were performed:

- engine unit (starter and alternator),
- ignition system, including both magnets (visually and on the test bench),
- cylinders and the inside of the engine block,
- engine spark plugs, and
- crankshaft and camshaft.

After all the checks, the authorised Service Centre "GAS AVIATION" made a report on January 27, 2023, in which the conlucsion was drawn that the engine was in a fully correct condition and operating normally during the flight of December 31, 2022. A note and findings with photo and video materials were submitted to the Commission as proof of all checks. Enclosure number: 5.2.

1.17.3. Fuel quality testing

The STC requirements regarding the standards and content of BMB G-DRIVE 100 vehicle gasoline were checked based on the Quality of Petroleum Derivatives Statement of Compliance from the supplier which had a contract with Aero Club “Prijedor“.

1.18. Organisation and management data

The inspection of the Before Take-Off Checklist showed that it was kept correctly and contained the necessary elements regarding flight management and organisation, such as the appointments of the flight manager and deputy flight manager, who certified the acceptance of the appointment with their personal signatures. On the day of the accident, (January 31, 2022), the deceased pilot was designated as the flight manager, and the pilot of the plane which was on the ground was designated as the deputy flight manager.

On page 7 of the Airport Use Manual, it reads as follows: *"As part of the grass runway strip, a concrete 700m-long and 10m-wide path extends along its southern edge. The concrete part of the runway is not marked with longitudinal lines except for square yellow "X" markings in the red field, and until further notice* *aircrafts are prohibited to take-off and land. The concrete part may solely be used for aircraft taxiing in accordance with the issued NOTAM**.***

On December 31, 2022, the list of runway inspections records was filled in without prior inspection. The section regarding the condition was marked as "OK" despite the fact that the grass runway strip was wet and partially under water after the rain.

Published NOTAM from the BHANSA, BHNOF, dated October 13, 2022, on the prohibition to use the concrete part for take-off and landing, with the validity period until January 14, 2023, was applicable at the time of the airplane accident.

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1.19. Additional information

On June 22, 2021, an aviation accident occurred at the Urije-Prijedor Airport (LQPD), involving the aircraft CITABRIA 7G CBC, registration number E7-PDH, and the glider BLANIK L-13, registration number E7-5335. The accident occurred during the performance of an aerial formation in which the above aircrafts participated, for the purpose of conducting an introductory flight with a potential candidate for training to operate on gliders. The pilot which died on December 31, 2022, was the glider flight instructor. The flight was announced and approved. The flight was performed according to VFR rules and in line with VMC conditions.

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2. ANALYSIS

Following the collection of facts and evidence concerning the flight and their detailed review, the Commission thoroughly analysed the collected facts and evidence that contributed to the accident or contributed to the effectiveness of certain activities that had been conducted.

2.1. Pilot's qualifications and competence

By examining the collected facts, the Commission analysed the pilot's qualifications and competence to perform the flight during which the accident occurred.

The pilot was in a possession of a valid flight license and valid written authorisation to fly in accordance with the applicable regulations.

The last pilot's check on the ground and in the air with CITABRIA aircraft in the school and the school area took place on September 14, 2022. The check was successfully completed and registered in the Pilot logbook.

The pilot's last flight before the accident was on November 4, 2022 on the CITABRIA plane in the role of tow truck. Due to the winter conditions, he had an interruption in flying until December 31, 2022, that is, for a period of 57 days.

The pilot was in good health and relaxed, and fit to conduct the flight. The last Medical Certificate CLASS 2/LAPL, number BA-FCL-080042 was issued on May 13, 2022, without restrictions, with the validity period for class 2 (PPL) and LAPL until May 20, 2024, respectively.

An inspection of the Pilot logbook revealed a total flight time of 403:55 hours and 2874 flights as of 2022, of which:

- Flying in 2022: 135 flights and 26:33 hours;
- Flying in the last three months: 47 flights and 07:13 hours;
- Flying in the last 24 hours: 00:00; and
- Total flying on CITABRIJI 7GCBC aircraft: 432 flights and 59:38 hours.

As a glider and towing instructor on CITABRIA aircraft, he was actively involved in the training of glider pilots. He had no other flights scheduled on the day of the accident.

The pilot was qualified and trained for the execution of the flight planned on December 31, 2022.

2.2. Analysis of pilot’s actions

Based on the data from the Flight history, presented in point 1.1. of this Report, as well as other data and facts about the accident presented above, the Commission carried out the analysis of the pilot’s actions during the flight on CITABRIA aircraft,

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registration number E7-PDH in which the accident occurred on December 31, 2022, during the execution of the panoramic flight.
Only the actions that impacted the accidents were included in the analysis.

2.2.1. Flight preparation

1. Crew flight preparation

The Commission did not inspect the crew flight preparation for the planned introductory flights with potential candidates for glider training, as well as panoramic flights in the area of the Airport.

2. State of the airfield - maneuvering area

After the pilot's arrival to the Airport with the purchased gasoline, in preparation for the flight on December 31, /2022, as the flight manager he filled out the Airstrip Inspection Checklist, in which he marked the runway condition as good. The grass runway strip was partially covered with water and mostly wet, and as such unusable for flying. Therefore, all flying operations should have been cancelled that day, which was not the case. The reason is that it is a common practice in that Aero Club, as well as in the case of other airport users, that the concrete part is used when the grass part is unusable.

The pilot took off from the concrete part of the runway, which was not allowed. According to the Airport Operating Manual and the published NOTAM, it is prohibited to use the concrete part for take-off and landing.

3. MET preparation

In terms of visibility, cloudiness and wind, the weather conditions on the day of the accident were good for planning VFR flying operations and could not have had an impact on the accident. Therefore, special MET preparations of the pilot were unnecessary.

The meteorological preparation that day should have included the analysis of other MET parameters that affect the aircraft and engine characteristics, namely air temperature and dew point, which was omitted.

Pilots in the Aero Club “Prijedor“ using vehicle gasoline lately (in the colder and wetter part of the year) have sporadically encountered symptoms of carburettor icing. That is the reason they preventively used carburettor heating in different phases of flight based only on air temperature or experience from previous flights. Eyewitnesses’ statements confirmed that, prior to the flight, the deceased pilot was interested whether the carburettor heating was necessary during the previous flight.

This and the fact that the carburettor heater knob found in the wreckage was in the “on” position, requires separate analysis of the MET data related to this problem

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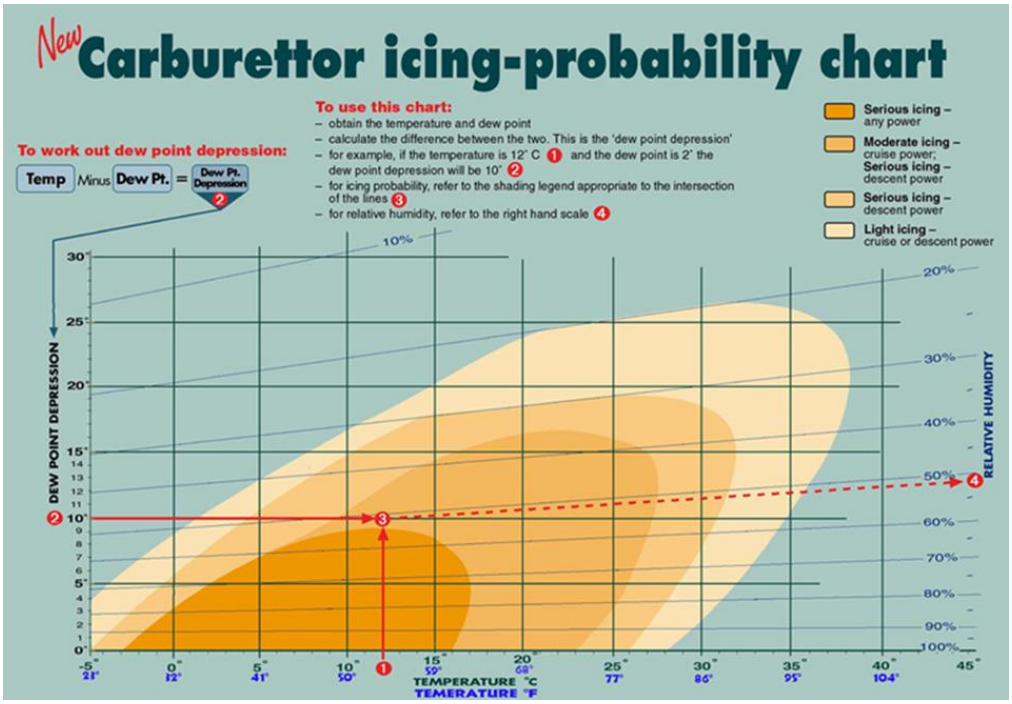
and the pilot's actions. According to the available MET data sources, the air temperature and dew point (humidity) T/Td ratio was 18/9 and 18/8

Using the attached carburettor icing probability chart graph (valid for 100 LL gasoline) and available MET data, the probability of carburettor icing was moderate at 70% engine power (cruise). When gasoline is used, which is more susceptible to icing (STC), the probability is serious and possible at power engine climbing. It is not known whether the pilot used this method. (STC for gasoline states that due to higher volatility, MOGAS is twice as sensitive to carburettor icing compared to AVGAS and that this is a mandatory procedure in pre-flight preparation).



Graph number: 2.1: Temperature and relative humidity range that may cause carburettor icing.

2.2.2. Aircraft preparation

Checklists and POHs for the aircraft were not found in the wreckage at the accident site. This indicates that the aircraft preparation for the flight was carried out in a routine manner. The aircraft was inspected in front of the hangar. Fuel was refuelled (50 litres) and the total amount of fuel in the tank was checked with a wooden stick. It is not known whether the fuel system and the tanks were drained after refuelling, and the presence of water in the tanks was checked. Since the operator does not use tools for these checks, it can be concluded that drainage and sediment checking is not a consistent practice.

2.2.3. Weight and balance

In discussions with the representative of the operator and the pilots who flew the CITABRI aircraft about the practice of weight and balance checks during pre-flight preparation, it is clear that these procedures are not being carried out. POH is not

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used, and the described graphic or calculation procedure for weight and balance checking is not used.

Weight and balance check list was not found in the aircraft at the accident site, nor there was a copy with the operator. The flight preparation was routine according to the established habit with the weight and balance check being omitted.

Based on the estimated weight of the pilot (100–110 kg), passenger (70–75 kg) and gasoline in the tanks (75 kg), the aircraft had a total pre-flight weight of 786–801 kg (1734–1767 lb), 38–53 kg more (84-117lb) than the maximum permissible weight.

The maximum permissible pre-flight weight is 1650 lb. the pilot took off with the total pre-flight weight that was beyond the flight envelope limits.

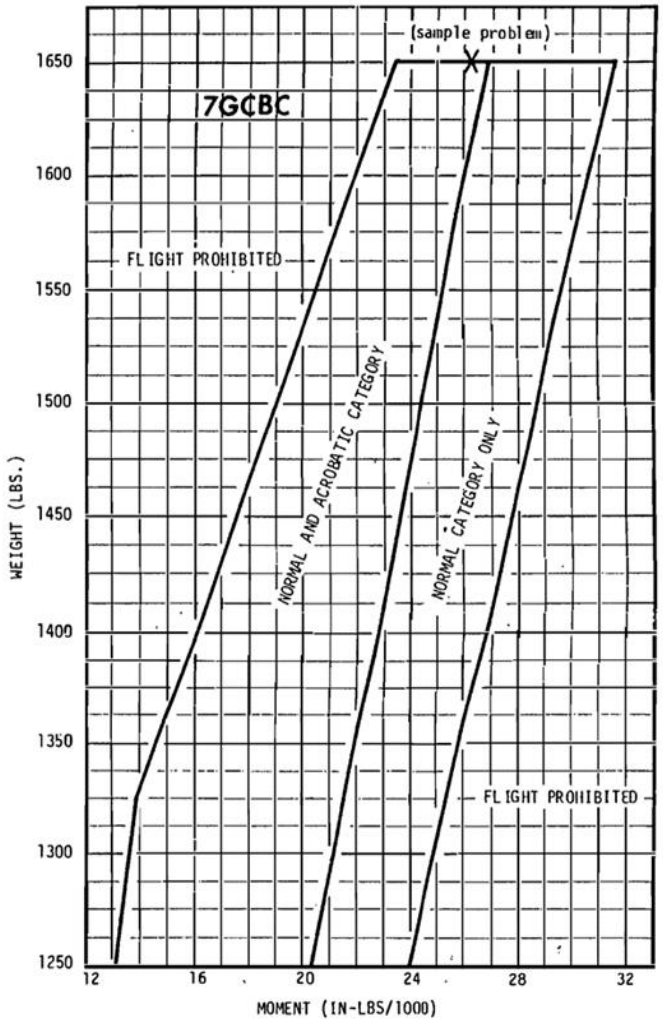

FIGURE 5-5 FLIGHT ENVELOPE - 7GC8C ONLY

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Table number 3: Calculation of aircraft weight and balance

	Weight		Arm (inch)	Moment lb.inch
Weight of empty aircraft	541.5 kg	1,194 lb	15.22	18,170.40
Pilot	105	231	11.5	2,656
Passenger	75	165	42	6,930
Fuel	75	165	24.5	4,042
Oil in engine	6	13.22	-36	-476
Total	802,5	1,768.22		
Center of gravity	31.322: 1.768,22 = **17,71 inch**			
C.G. allowed limits	14.2 – 19.2 inch (for max permissible weight of 1650 lb). For weight beyond envelope, there is no indication of C.G. in the POH			

The gravity centre calculated based on the data from the table was close to the last position for Normal aircraft category.
The gravity centre for the acrobatic category is determined in the interval 14.2 - 16.6 inches.

Excessive weight and the rear position of the weight centre significantly impact the aircraft characteristics and the required power for all flight modes. It is especially relevant that the pilot is aware that in the event of **excessive weight, the breakdown of buoyancy occurs at higher than nominal speeds**, in all flight modes and aircraft configurations, and that **the weight centre position affects the aircraft performance during stall and spin.**

Given that the speed loss and the spin fall occurred during the climb phase, it can be concluded that the pilot failed to adjust the aircraft speed according to the weight and configuration for take-off and climb (retracted flaps).

2.2.4. Take-off and climb

The pre-take-off check was completed at the concrete runway threshold 27, in a routine manner and according to established practice. Eyewitnesses confirmed the magnet being checked. It is unknown whether the carburettor heating check was performed correctly or whether the pilot forgot to return the handle to the cold position, and whether he intended to take-off with the carburettor heating on, to prevent possible icing.

In the aircraft wreckage, the carburettor heating lever was found in the "**heating on**" position. Given that the engine was working normally up to a height of 40-50 meters (eyewitness 1), there is a possibility that for some reason the heating was turned on at that flight stage, and consequently it led to engine power drop. During the flight preparation, there was no seat belt check for the passenger who was found at the accident site, and her seat belt was not fastened.

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According to an eyewitness video, which lasts eight (8) seconds, it is obvious that the take-off was normal. After separating from the runway, the pilot held the plane at the height of the landing gear wheel, accelerating to a position of about 100 meters in front of the place where the eyewitnesses and cameraman were standing. Then he suddenly brought the plane into a climbing position at an angle steeper than the normal, and at about ten meters altitude, lowered the nose and continued to climb on a straight-line path, at a normal climb angle.

The video also shows a very airy and bright atmosphere with good visibility. The sun was low on the horizon to the southwest so that it shed the light on the left side of the aircraft that was flying to the west. The shadow of the aircraft is visible to the rights side during the take-off phase on the ground, approximately at an angle of 60 degrees to the flight direction of the I runway.

The aircraft continued its steady climb and reached its hight of 40-50 meters above the forefield of the grass runway strip threshold 09, where it suddenly turned to the right, and after a second or two, it flipped over the right wing and began to dive at a very steep angle (O1), after which it hit the ground at high speed. The description of the eyewitnesses is fully consistent with the scenario of unintentional asymmetric stalling (loss of lift on the right wing) and falling into a steep spin, as a result of inappropriate speed for the climb mode, configuration (flaps retracted) and total weight of the aircraft or problems with altitude control due to the rear centering. It is unknown whether the pilot could recognise in time the signs of loss of lift in the aircraft that lacked a stall warning device, however, it is known that the pilot did not undergo the mandatory spin training during his PPL (A) training, especially not for the CITABRIA type aircrafts, which is an aerobatic aircraft and known to have a significant number of spin-related accidents.

The reasons that could have contributed to bringing the aircraft to the position of the critical angle of attack, loss of speed, loss of lift and falling into spin:

1. Attention which was not primarily focused on the flight, monitoring and maintaining relevant flight safety elements under given conditions (speed, altitude and engine power settings). Given that the Aero Club “Prijedor“ calls such flights as “driving”, the attention at critical moment could have been directed to the passenger. Such an approach to flight performance significantly reduces the pilot's ability to recognize an emergency situation and react in a timely and proper manner.

2. Possible engine operation interference and seeking solution before an adequate the consequent power loss and subsequent activation of the carburettor heating, or contaminated gasoline.

3. The pilot being blinded by the sun is less likely than the possibility that a poorly maintained and unclean windshield significantly reduced visibility from the cabin by by scattering sunlight, which made it difficult for the pilot to maintain the correct position of the plane in relation to the natural horizon.

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In all of the above cases, the pilot had to control the aircraft in such a way that he had full control of the primary position and speed that enables maintaining buoyancy in all regular and emergency situations (FLY-NAVIGATE-COMMUNICATE) as described in the POHs.

2.3. Aircraft engine exploitation

The analysis of engine use is focused on the facts that indicate whether, following the accident of June 22, 2021, the operator became aware of all the risks related to using gasoline as main fuel for flying operations.

The Accident Investigation Commission then concluded that uncertified gasoline had impacted the accident and that pilots lacked experience in using this type of fuel, and consequently the engine exploitation.

Persons responsible for continuous air navigation and maintenance failed to warn the operator and pilots of the fact that changes of engine characteristics and increased engine maintenance are possible (more frequent replacement of oil, the viscosity of which corresponds to the surrounding temperature, spark plug inspections, etc.).

With the intention of continuing to use gasoline in a regular manner, the operator obtained the STC (Supplemental Type Certificate) for automobile fuel on October 28, 2021, a certificate for the E7-PDH aircraft and the O-320 engine. Since then, unleaded gasoline from the company "Gazprom" has been used in most operations.

The holder of type certificate clearly indicated that it is not valid if operators use gasoline containing ethanol in any amount. Furthermore, the certificate states which types of fuels and standards are acceptable, the procedures for fuel manipulation, warns of situations with blockage of fuel flow due to evaporation, as well as situations with carburettor icing, which occur more often and earlier than with standard aviation fuels. It lists the icing probability check according to the icing probability diagram as part of the mandatory pre-flight preparation.

The Commission is unaware whether the crews of the CITABRIA aircraft, registration number E7-DPH, were fully familiar with the Certificate content, the restrictions that were stated, and the procedures that the operator had to comply with.

It is also unknown whether the operator, the person in charge of the aircraft maintenance and of the continuing airworthiness, have considered and confirmed that gasoline for vehicles that was used for flight operations was in compliance with the Certificate in terms of ethanol content and other requirements, including those set by the engine manufacturer Lycoming, such as:

- Anti-Knock Index (AKI) or (R+M)/2 minimum 93

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- Vapour pressure class A -4
- No ethanol and a maximum 1% of oxygenate
- Compliance with EN228.

Based on the inspection of the Supplier's Statement-Declaration on the conformity of the liquid petroleum fuels quality for BMB G-DRIVE 100 gasoline from the supplier which had a contract with the Aero Club "Prijedor", it was established that the car gasoline used in the aircraft contained less than 0.8% ethanol, that the AKI index was 94.4, that the steam pressure was within the permitted limits and that the quality standard complies with EN 228.

Given the fact that the Statement-Declaration does not state any amount of ethanol below 0.8% (it can be 0 to 0.8%) it may be considered that such small quantity does not affect the standard fuel characteristics, and that the gasoline is acceptable if less strict STC requirement regarding ethanol content are adopted.

Finally, it can be concluded that, with prior knowledge of the limitations and the recommendations stated in STC for gasoline, BMB G-DRIVE 100 could be used as MOGAS and the replacement for 100 LL.

It was established that BMB G-DRIVE 100 gasoline has a slightly higher density (740 g/L) compared to standard aviation gasoline 100LL (720 g/L). An inspection of the engine after the accident revealed a carbon deposit on the spark plugs and on the valve head. It could be attributed to a richer mixture due to the higher density of gasoline.

2.4. Eyewitnesses

Eyewitnesses (E) were at the airport at the taxiway towards the intersection of the runway and the taxiway in the vicinity of the runway strip, 430-450 m southeast of the accident site. *Picture number 1.1.*

Accident eyewitnesses, those with expert knowledge-pilots, and those with no special aviation knowledge, but were present at the taxiway and next to the runway or in the immediate vicinity, confirmed in their statements that the aircraft was at altitude of about 40-50 m above the runway 09 threshold of the grass runway, it suddenly turned to the right and after a second or two, rolled over the right wing with its nose down, and began to dive at a very steep angle, and in a vertical position hit the ground at high speed. According to eyewitnesses and based on the traces left at the point of impact by the rotating propeller – the engine of the aircraft was running the whole time.

In their statemens, the eyewitnesses agreed about the following facts:

- After starting and testing the engine, the pilot headed towards the starting point of the runway 09, at the concrete part of the runway strip;
- At the take-off of the runway concrete part, the pilot tested the engine;
- The take-off was performed from the concrete part of the runway;
- The aircraft take-off was performed at a slightly steeper climbing angle, after which some aircraft instability was observed;

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- During the climbing stage, there was a loss of speed, a sudden turn, and aircraft bent to the right with the nose pitched down, and it hit the ground vertically;
- The aircraft engine was running until it hit the ground.

The descriptions of eyewitnesses are consistent with the scenario of unintentional asymmetric stall (loss of right wing buoyancy) and falling into steep spin, as a result of inappropriate speed to the climbing mode, configuration (retracted flaps) and total aircraft weight or problems with altitude control due to the rear centration.

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3. CONCLUSIONS

After a complete and expert analysis which was carried out on the basis of all available information, the Commission made the following Findings:

3.1. Findings

1) The aircraft pilot was in a possession of a valid flight permit and properly registered flight authorisation in accordance with applicable regulations.

2) The pilot was medically fit and rested for the flight.

3) The pilot had proper qualifications and training to perform the flight.

4) In terms of total flight, the pilot had made a significant number of flights in CITABRIA type aircraft, which can be considered as sufficient experience with this type of aircraft. The pilot's last flight before the accident was on November 4, 2022 on the CITABRIA plane in the role of tow truck. Due to the winter conditions, he had an interruption in flying until December 31, 2022, that is, for a period of 57 days.

5) POH (*Pilot Operation Handbook*) was not part of the documentation that was supposed to be in the aircraft during the flight. The operator does not have original POH but uses those available on the Internet. Failures in the operation of aircraft and engines in regular and emergency situations are the product of poor knowledge of the procedures and norms prescribed in the POH for the CITABRIA type 7G CBC aircraft.

6) CITABRIA 7G CBC aircraft was fit for navigation, regularly maintained at an authorised service and all regular and other checks related to maintenance registered.

7) According to testimonies of eyewitnesses, based on traces left by the rotating propellers at the place where the aircraft hit the ground, and the findings of the expert examination of the engine after the accident, the aircraft engine was running the whole time until it hit the ground.

8) On the day of the accident, approximately an hour before the last take-off, the CITABRIA aircraft had a 15-minute flight. The pilot which operated the aircraft had no complaints and there was no indication of the aircraft deficiencies – which indicated that the aircraft was functioning normally during this prior flight.

9) Maximum Designated Take-Off Weight (MTOW) was not in line with the permissible one. At take-off, the aircraft had a higher total weight than allowed. This significantly impacted the deterioration of take-off

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aerodynamic performances, initial climbing after the take-off and aircraft stability at low speed.

10) At the time of the accident, for the E7- PDH aircraft and engine number 0-320-A2B, the Aero Club “Prijedor“ possessed the gasoline AUTO FUEL STS (Supplemental Type Certificate) supplement to the type certificate number 10211566 issued by the Petersson Aviation Inc Company on October 28, 2021.

11) On the day of the accident, gasoline purchased at a petrol station in Prijedor city was used. It was established that BMB G-DRIVE 100 gasoline contains less than 0.8% ethanol and meets other STC and engine manufacturer requirements.

12) On January 17, 2023, at the request of the Commission, representatives of the authorised service GAS AVIATION Ltd, in presence of a Commission member and a Aero Club “Prijedor“ representative, checked the condition of the engine after the accident, made and submitted a report on the results of the inspections and checks. Following the inspection, it was determined that the engine was working normally until it hit the ground.

13) The weather conditions on December 31, 2022, were favourable for the execution of VFR operations planned for that day. The air temperature and humidity (dew point) had such values that indicate significant probability of carburettor icing.

14) On the day of the accident, the start of aviation operations was announced. Opening of the flight zone at the Approach and Airport Flight Control Unit at Banja Luka Airport (LQBK). The announcement was made by the CITABRIA pilot himself.

15) The pilot took off from the concrete part of the runway strip, which is not allowed. According to the Airport Operating Manual and issued NOTAM, the concrete part of the runway was forbidden for take-off and landing. The concrete part can solely be used for aircraft taxiing in accordance with the issued NOTAM.

16) Considering the fact that the loss of speed, stalling breakdown of buoyant force, and fall into the cavity occurred during the climb phase, it can be concluded - assumed that, in the critical phase of the flight, the pilot failed to adjust the speed based on the weight and configuration for take-off and climb (retracted flaps).

17) In case of excessive weight, the loss of lift occurs at higher nominal speed, in all flight modes and aircraft configurations, and the position of weight centre, which was in the rear position, affects the aircraft performance in stalling and spinning.

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18) At the accident site, the throttle control was found in the position at 30%, and the carburettor heating was on.

19) Due to the failure to retract the flaps during take-off, the airplane's maximum take-off weight (MTOW) and the possible activation of carburettor heating, the aerodynamic performance of the aircraft's airfoils and engine power during take-off and the initial climb after take-off were deteriorated.

20) Based on the analysis of the take-off video footage and statements of eyewitnesses, it was established that the flight itself lasted for eighteen (18) seconds.

21) Accident eyewitnesses, the experts and those without special flying knowledge, who observed the accident from the taxiway and in the immediate vicinity to the runway, confirmed in their statements that, during the climbing stage there was a loss of speed, sudden turn and rolling to the right, overturn of the nose down and vertical impact to the ground.

22) Due to the situation and the conditions in which the accident occurred, there was no need to engage RCC. Search and rescue operation was not initiated.

23) The Urije-Prijedor Airport had a valid Use permit certificate. The List of airport inspection records on December 31, 2022, was made without any inspection. The List states that the condition was "**OK**", although the grass runway was wet and partially under water, after the rain, and as such was not to be used.

24) The radio link between the on-duty flight at INFO and the aircraft crews, as well as the telephone link, functioned properly.

3.2. Accident causes

Based on the conducted investigation, analysis of gathered evidence and available information about the accident, the Commission has concluded that the primary cause of the accident is as follows:

Loss of aircraft control at low altitude, and its fall into a spin due to buoyancy force breakdown (exceeding the critical angle of attack) caused by the pilot's error in maintaining the speed and the climbing angle during the take-off and climb phase).

The accident was impacted by:

a) Irregular (non-standard) vertical profile of the take-off phase and the climb phase with large changes in the aircraft angle and speed.
b) Aircraft speeds for flaps settings (retracted) and aircraft pre-take-off weight were not adjusted.

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c) Exceeded aircraft weight at take-off, i.e. greater aircraft weight at take-off than allowed.
d) Possible carburettor icing and an attempt to de-ice, which, as a consequence led to a decrease in engine power and speed.

e) Extremely low height at which the loss of lift occurred, insufficient for a safe exit from the spin.
f) Relatively large interruption in flying.

"The identification of the cause does not imply the establishing culpability or determination of administrative, civil, or criminal liability."

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4. SAFETY RECOMMENDATIONS

1. It is recommended that BHDCA consider taking additional measures to raise “safety” awareness in aviation operations.

2. It is recommended to the Aero Club “Prijedor“ to prescribe and adopt the criteria and procedure for the execution of especially panoramic and similar flights at the Airport.

3. It is recommended to all Aero Clubs in BiH to conduct, with authorised FI(A) or in flying schools, training of pilots – members of Aero Clubs in practicing towing (different flight regimes) and how to avoid spinning.

4. The recommendation to the BHDCA is to intensify the inspection at aero clubs and of individuals who independently perform flight operations regarding compliance with the application of prescribed requirements, internal procedures and application of aeronautical information.

5. It is recommended that, in the process of extension of airworthiness, BHDCA carries out the operator compliance checks that use AUTO FUEL STC certificate in terms compliance with requirement regarding AKI number value, the content of ethanol and oxidants in the gasoline they use. Moreover, through maintenance programmes, to make it mandatory for operators to intensify engine maintenance.

6. It is recommended to the Aero Club “Prijedor“ to check the compliance with all requirements of engine manufacturers and STC for gasoline, when using gasoline.

5. ENCLOSURES

Enclosure 5.1 AUTO FUEL STS (Supplemental Type Certificate) supplement to the type certificate no. 10211566 issued on October 28, 2021, by the Peterson Aviation inc.

Enclosure 5.2 The Post-Accident Engine Inspection Report

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Enclosure 5.1 AUTO FUEL STS (Supplemental Type Certificate) supplement to the type certificate no. 10211566 issued on October 28, 2021, by the Peterson Aviation inc.

Petersen Aviation, Inc.
984 K Road
Minden, NE 68959
Automotive & Aviation Fuel STC's

Phone 308-832-2200
info@autofuelstc.com
www.autofuelstc.com

Permission Certificate

This certificate constitutes permission for: AeroClub Prijedor

to apply Supplemental Type Certificate (STC) number: SA1970CE

to one Aircraft serial number: 278-70

Registration number: E7-PDH

and Engine Supplemental Type Certificate (STC) number: SE1931CE

to engine(s) serial number: L-44428-27A

Permission for use of the airframe STC for autogas is granted only if the currently installed engine has a Petersen STC for autogas applied directly to it.

This certificate is required by order 8110.69 and as such is to remain part of the permanent aircraft maintenance records along with the STC paperwork. This document is invalid without an **original** signature of the STC holder and the corporate seal of Petersen Aviation, Inc.

Petersen Tracking Number: 10211566

Date: 10/28/2021

T.L. Petersen
Petersen Aviation, Inc.

DO NOT USE FUEL
CONTAINING ETHANOL

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Ethanol is **not** approved for use with auto fuel STC's. You must avoid fuel containing any type of alcohol. Alcohol is corrosive and can damage the fuel system. Alcohol makes vapor lock more likely and reduces range. Gasoline containing ethanol is frequently sold throughout the US without the fuel pumps being labeled as containing ethanol. Be very careful to only use conventional, non-ethanol gasoline. If you cannot find conventional gasoline, you must revert to using 100LL aviation gasoline. Run the alcohol test on all the fuel you intend to use. Check our web site (www.autofuelstc.com) for updates on ethanol.

CARB ICE - The higher volatility of auto fuel allows the fuel to absorb more heat from the mixing air when vaporizing, resulting in ice accumulation at higher ambient temperatures. Therefore the likelihood of carb icing is higher on automotive gasoline than on aviation gasoline. The severity of carb icing and the methods for dealing with it are similar for both aviation and automotive gasoline, but its onset is likely to occur at higher ambient temperatures and at lower humidity with auto fuel. This may result in the need to select "carb heat on" in less severe icing conditions and for a longer duration when using automotive gasoline. Total carburetor ice accumulation with automotive gasoline is no worse than with aviation gasoline. Existing standard cockpit instrumentation is adequate to detect carb ice formation with automotive gasoline or aviation gasoline. You should select carb heat at the earliest onset of icing whether or not the obvious symptoms of loss of power are experienced. Review the procedures outlined in your owners manual for dealing with carb ice. Consult the carb ice probability charts during your preflight planning.

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Enclosure 5.2 The Post-Accident Engine Inspection Report

GAS AVIATION	**Engine Inspection Report**	W/O No.	4129/23
		Rev.	0 (Initial)
		Date	17 January 2023
Aircraft	American Champion Aircraft Citabria 7GCBC, S/N: registration: E7-PDH		
Engine	Lycoming O-320-A2B, S/N: L-28341-27A		
Subject: Inspection of the engine requested by the Aircraft Accident Investigation Commission			

At the request of the BHDCA Commission for investigation into causes of the aircraft accident, the authorized mechanics Dejan Milivojević and Kiril Kirilov, currently employed in the company GAS AVIATION, were also included in the work of said Commission. Following the fatal accident, the said mechanics dismantled and inspected the aircraft engine Lycoming 0-320-A2B, S/N L-28341-27A fitted to the aircraft E7-PDH. Prior to starting the inspection, the mechanics found that the engine was detached from the body of the aircraft.

1. During dismantling of the engine, no irregularities which could affect proper functioning of the engine were detected at visual inspection of the engine aggregates (starter and alternator) and the ignition system, including both magnets (S4LN-20, S/N: 10-51360-37, S4LN-21, S/N: 10-51360-37). Please note that since it was not possible to inspect magnets in detail on the field, both of the magnets were upon approval of the Commission delivered to the premises of the GAS AVIATION company where the magnets underwent functionality testing on a test bench. The tests confirmed that the magnets are in good working order. Also, a video recording of the magnets' performance has been made.
2. Cylinders 2 and 4 were dismantled and visually inspected together with the inside of the engine block, crankshaft and camshaft and their componential parts. Pistons, piston rings, connecting rod, valves and rocker arm of the mentioned cylinders were also visually inspected. The inspection confirmed that all of the mentioned engine components comply with mandatory standards and feature no detected irregularities.
3. Color of electrodes of all spark plugs subjected to visual inspection confirmed that the engine combustion was satisfactory.
4. No damage or defects to the camshaft and crankshaft were detected during the inspection meaning that both the camshaft and crankshaft are spinning freely in their seatings.

For more details, please refer to the GAS AVIATION W/O 4129/23 and the attached photographs and video recordings.

Taking into consideration all the findings mentioned above which were obtained during the inspection of the engine, it may be concluded that the engine Lycoming 0-320-A2B, S/N: L-28341-27-A was in full working order during the flight concerned.

Dejan Milivojević Kiril Kirilov

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Done at Smederevska Palanka, on 27 January 2023

GAS AVIATION d.o.o.

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