NATIONAL BUREAU

OF AIR ACCIDENTS INVESTIGATION OF UKRAINE

FATAL ACCIDENT

FINAL REPORT

GROUND IMPACT
OF
SCHROEDER FIRE BALLOONS GmbH G42/24
HOT AIR BALLOON

AIRCRAFT OPERATOR:	Private person
HOT AIR BALLOON TYPE:	Schroeder fire balloons GmbH G42/24
REGISTRATION NUMBER:	D-OWUE
ACCIDENT SITE:	Outskirts of Kulchiivtsi village, Khmelnytsky region.
STATE OF OCCURRENCE:	UKRAINE
DATE OF ACCIDENT:	22.05.2021

The repot is published with the sole purpose to prevent air accidents in the future

APPROVED

by Acting Director
of National Bureau of
Air Accidents Investigation
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_____ Igor MISHARIN
«__» _____ 2021

FINAL REPORT

on Investigation into Fatal Accident
with Schroeder Fire Balloons GmbH G42/24 hot air balloon,
State and Registration number D-OWUE (Germany), owned by private person,
which took place on 22.05.2021, during its flight in area of Kulchiivtsi village,
Kamianets-Podilskyi district, Khmelnytsky region

Note: This report is a translation of the Ukrainian original investigation report.
The text in Ukrainian shall prevail in the interpretation of the report.

The investigation was conducted subject to the provisions of Annex 13 to the Convention on International Civil Aviation and the Manual on Air Accidents and Incidents Investigation by the Investigation Team of the National Bureau of Air Accidents Investigation (hereinafter – NBAAI.)

On May 22, 2021, the NBAAI received reports of the accident from the Coordination Center for Search and Rescue of the State Aviation Administration, the Command of the Air Force of the Armed Forces of Ukraine (hereinafter – AFAFU) and the National Police.

The NBAAI did not receive any information on the accident from the Ballooning Federation of Ukraine.

Note: *Subject to the Interim Instruction on Submission of Reports of Air Accidents and Serious Incidents with Civil Aircraft to the NBAAI, approved by the NBAAI Order of 06.03.2020 No.19, it is recommended for the aviation activity entities, which are covered by the State Aviation Administration Order of 29.03.2019 No. 396, to submit reports of air accidents and serious incidents to the NBAAI.*

According to the President of the Ballooning Federation of Ukraine, he sent the information about the accident by e-mail to the address of the State Aviation Administration (cds@avia.gov.ua) on 23.05.2021 at 15:30.

Investigation was instituted on 22.05.2021.

Investigation was completed on 22.10.2021.

List of Abbreviations Used in Present Report and Investigation Materials

HAB	- hot air balloon;
UoA	- use of aerospace;
AF	- airfield;
FOM	- Flight Operation Manual;
PIC	- Pilot-in-Command;
AC	- aircraft;
AFAFU	- Air Force of the Armed Forces of Ukraine;
TFH	- Total Flight Hours;
CAA	- Civil Aviation Authority
CAVOK	- Ceiling And Visibility OK;
UTC	- Universal Time Coordinated.

Contents

Synopsis. Brief Description of Accident.

On 22.05.2021, at 17:14 UTC (20:14 local time), during flight operation of the Schroeder fire balloons GmbH G42/24 hot air balloon (hereinafter – HAB), reg. D-OWUE, the HAB ground impact took place.

Note: *The Universal Time Coordinated (UTC) is referred to hereinafter. The difference between the local time and UTC time on the date of the occurrence was +3 hours; the use of UTC time in the report is due to the fact that the records of the air traffic services (ATS), meteorological, aeronautical information contain the Universal Time Coordinated.*

The air accident took place during the daylight, under the visual flight conditions. The flight was performed by a pilot with five passengers.

The HAB collided with the ground with the further passenger basket (gondola) overturn. When the HAB impacted the ground, four passengers were thrown out of the basket, as a result of which one person was killed, and the pilot and four passengers were seriously injured. The AC suffered significant damage.

Accident site coordinates:
48°39'32"N north latitude
26°43'47"E east longitude

Elevation above sea level = +224 meters

The HAB was lying at the distance of 1340 m from Kamianets-Podilskyi - Stara Ushytsia road.

1. Factual Information

1.1 History of Flight

On 22.05.2021, the HAB pilot, under the program of the annual aeronautical fiesta “Podillya Cup – 2021” (the program of HAB flights was copied by the Investigation Team from the web-site of the festival organizers), had planned to perform a free flight in the area of Kamianets-Podilskyi city on Shroeder D-OWUE HAB. The operator – a private person.

In order to prepare for the flight on 22.05.2021, at approximately 15:40, he arrived at the airfield near the village of Tsybulivka (48°39'5.5"N 26°34'40.1"E.)

Upon arrival at the airfield on 22.05.2021, the pilot reviewed the weather conditions and relevant NOTAMs related to the flight, as well as he calculated the HAB take-off weight.

According to the pilot's statement, the flight was planned with five passengers on board and it was of a private nature.

In coordination with the other 9 pilots of hot air balloons, it was decided to launch HABs from the individual pads independently selected by the pilots and to use the centralized informing the relevant control bodies by one selected pilot to comply with the procedures of use of Ukrainian airspace according to the list, which was compiled at the pre-flight briefing on the meteorological conditions and independently filled out by the pilots who took a decision to fly. The list included the names of the pilots and the registration numbers of 10 HABs.

The pilot of UR-LLG HAB informed the Ukrainian airspace use procedure observance authorities, the Flight Information Service (FIS) unit of Lviv ACC and control group of the Armed Forces of Ukraine about the intention to perform a free flight of 10 balloons in G uncontrolled airspace near Kamianets-Podilskyi city.

Note: *According to the transcript of communication provided by UkSATSE, the airspace user (the pilot of UR-LLG HAB) informed at 15:44 the deputy flight supervisor (operational duty officer) of the Lviv ATM Center about the start of flights of 10 HABs at 16:20, mentioning one call sign - UR-LLG. At 15:46, the deputy flight supervisor (operational duty officer) of the Lviv ATM Center transmitted the mentioned information to the flight information controller of FIS "Pivden" of Lviv ACC. At 17:21, the airspace user (the pilot of UR-LLG HAB) informed the senior air traffic controller (senior navigator) of Lviv ATM Center about the completion of balloon flights.*

According to paragraph 4 of the Airspace Use Regulations, in case of flights of civil aircraft as GAT outside the ATS controlled airspace, applications for use of the airspace shall not be submitted.

The HAB took off at 16:20 from an individually selected launch pad with a magnetic heading of MHtakeoff = 51º (according to the GPS-navigator), it was the second D-OWUE flight that day (the first flight was performed at 06:00, landing at 07:15 local time).

Note: *GPS Garmin GPSMAP 84s device was installed on the AC.*

The PIC decided to perform the flight and, at 16:20, he performed the take-off from an individually selected launch pad with a magnetic heading MHtakeoff = 51º.

According to the PIC's explanations, the flight took place at an altitude of up to 400 meters at a speed of 10-15 km/h with MH = 50-60º for 30-35 minutes. Subsequently, the wind direction changed, and the balloon increased MHflight = 95º. There occurred also an increase in the speed up to 25 km/h. After that, in flight, the pilot took decision to find a landing pad. The southern outskirts of the village of Kulchiivtsi were chosen as the landing pad. During the landing approach at the altitude of 35-40 m, the HAB flew over the electricity transmission line. During the flight over the cemetery, the balloon entered a downward stream with a speed of about 4 m/s and wind gust up to 11 m/s.

This led to an early surface touchdown and ground impact, as a result of which, a man fell out from the gondola and the balloon continued to move due to inertia on the remaining lifting force and stopped after 1340 meters.

Due to the impact, the HAB was seriously damaged and partially destroyed.

Figure 1.

At the moment, the HAB is located on the site for storage of temporarily detained vehicles in Kamianets-Podilskyi city.

There was a pilot and five passengers on board. All are the citizens of Ukraine.

In accordance with Part 1 of Article 1 of the Air Code of Ukraine and Chapter 1 of Annex 13 to the Convention on International Civil Aviation, this occurrence is classified by the National Bureau of Air Accidents Investigation as

a fatal accident – an accident with human casualties that resulted in a serious HAB damage.

1.2 Injuries

Injuries	Crew	Passengers	Other persons
Fatal	0	1	0
Serious	1	4	0
Minor/None	0	0	0

1.3 Damage to Hot Air Balloon

Upon the ground impact, Schroeder D-OWUE HAB suffered significant damage.

1.4 Other Damage

As a result of the accident, the monuments at the cemetery of Kulchiivtsi village were damaged.

1.5 Personnel Information

a) crew data:

Position	**PIC**
Sex	Male
Nationality	Ukraine
Date of birth	29.04.1993.
Education	Higher, National Aviation University, graduated in 2015
Aviation training	Ballooning Center, city of Feodosiya (AR Crimea), 2010
Total flight hours (TFH)	608 hours 40 minutes
TFH on free balloons	608 hours 40 minutes
TFH for the last 30 days TFH for the last 7 days TFH on the day of the occurence	4 hours 47 minutes 3 hours 03 minutes 2 hours 13 minutes

Meteominimum (for AC captain)	Admitted to VFR flights
Number and validity period of the pilot's license issued by SAAU	PIC Certificate BF No. 009607, Issued on 15.03.2010
Attachment to Certificate BF No. 009607	Valid until 31.12.2021 (at the moment of the occurrence, it was at the SAAU)
Medical Certificate	Medical Certificate МСП (MSP) No. 006980 Valid until 13.07.2021 – provided by PIC
Date of flight check	05.05.2021

The pilot rested before the flights at the 7 Days Hotel (city of Kamianets-Podilskyi.)

1.6 Aircraft Data

AC Type	fire balloons G 42/24
State and registration number	D-OWUE
Serial number	1480
Manufactureing plant	Theo Schroeder fire balloons GmbH
Date of AC manufacture	2011
AC owner	A private person
AC operator	A private person
AC Registration Certificate	Registration Certificate No.37588 of 21.07.2011
Airworthiness Certificate	Airworthiness Certificate TA No. 37588 issued on 21.07.2011
AW Review Certificate	AW Review Certificate DE.CAO.0025 of 31.03 2021, valid until 20.04.2022.
Maintenance and Release to Operation Certificate	Maintenance and Release to Operation Certificate DE.CAO.0025
Total flying time since new	342 hours 28 minutes
Last overhaul	N/A
Total flying time since the last overhaul	N/A

Engine Data

Engine	
Type of engine	FB 6 Burners Unit
Engine serial number	S/N 2.520-1
Total time since new	342 hours 28 minutes
Number of overhauls	N/A
Date of the last overhaul	N/A
Total operating time since the last overhaul	N/A

Luftfahrzeugrolle
Aircraft Register

Band: L
Volume

Blatt: 37588
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BUNDESREPUBLIK DEUTSCHLAND
Federal Republic of Germany
Luftfahrt-Bundesamt
Federal Office of Civil Aviation

Art des Luftfahrzeugs
Class of aircraft
Ballon

EINTRAGUNGSSCHEIN
CERTIFICATE OF REGISTRATION

1. Staatszugehörigkeits- und Eintragungszeichen:
Nationality and registration marks:
D-OWUE

2. Hersteller und Muster:
Manufacturer and manufacturer's designation:
Theo Schroeder fire balloons GmbH
fire balloons G

3. Werknummer:
Serial number:
1480

4. Eigentümer:
Name of owner
Ühla, Willi

5. Anschrift des Eigentümers:
Address of owner
Am Mailand 2 B
95503 Hummeltal
Germany

6. Hiermit wird bescheinigt, dass das vorbezeichnete Luftfahrzeug in die Luftfahrzeugrolle der Bundesrepublik Deutschland in Übereinstimmung mit dem Abkommen über die Internationale Zivilluftfahrt vom 7. Dezember 1944 sowie dem deutschen Luftverkehrsgesetz und den zu seiner Durchführung erlassenen Rechtsverordnungen eingetragen ist.
It is hereby certified that the above described aircraft has been duly entered on the Register of the Federal Republic of Germany in accordance with the Convention on International Civil Aviation dated 7 December 1944 and with the German Aeronautics Act and the regulations issued for its execution.

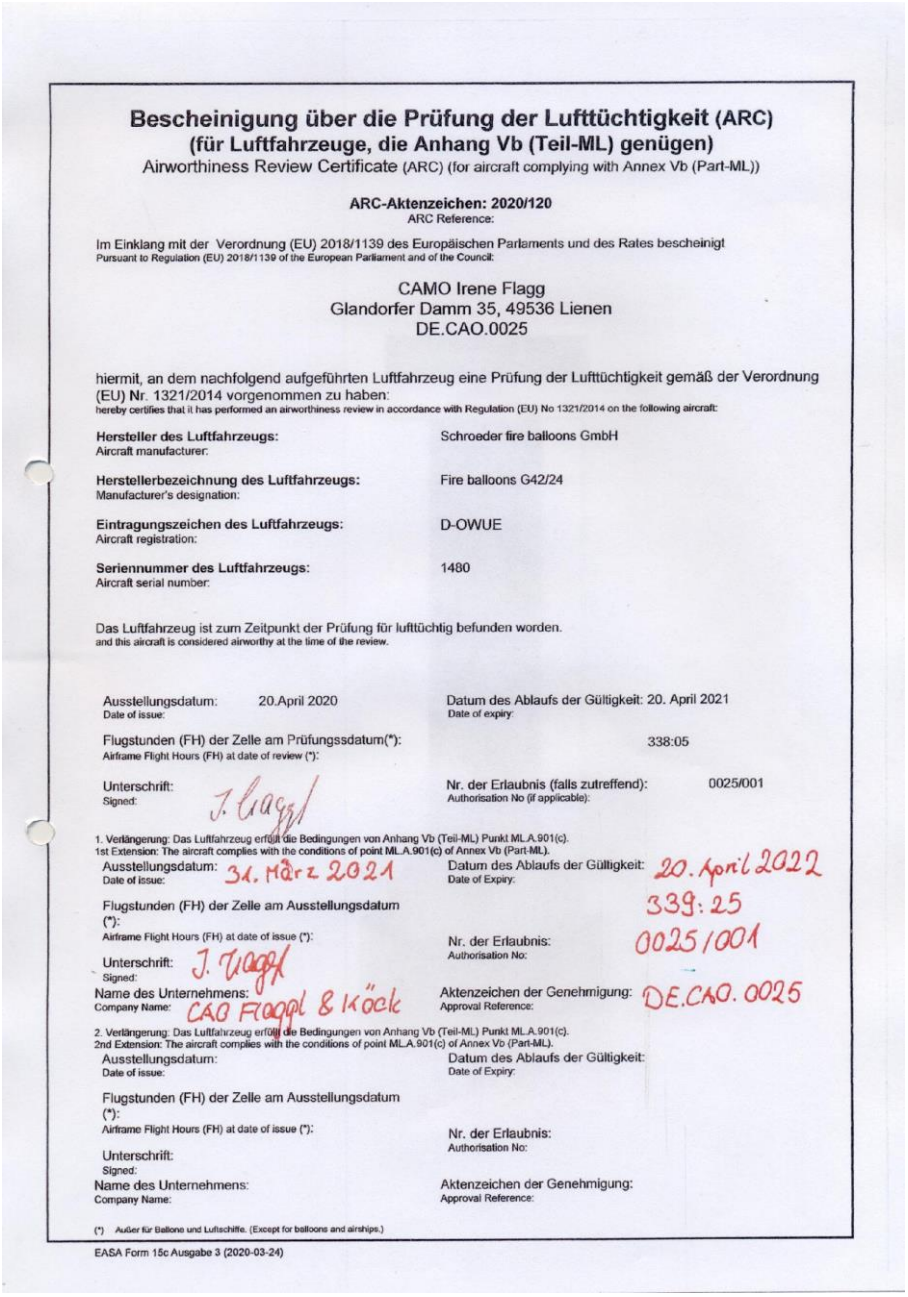
Datum der Ausstellung: 21. Juli 2011
Date of issue:

Unterschrift: Im Auftrag
Signature:

Der Eintragungsschein ist im Luftfahrzeug mitzuführen - This document shall be carried on board

Certificate of Registration of the HAB.

The HAB has the Certificate of Registration and Airworthiness Review Certificate issued by the CAA of Germany. The HAB was shipped to Ukraine from Germany.



Bescheinigung über die Prüfung der Lufttüchtigkeit (ARC)
(für Luftfahrzeuge, die Anhang Vb (Teil-ML) genügen)
Airworthiness Review Certificate (ARC) (for aircraft complying with Annex Vb (Part-ML))

ARC-Aktenzeichen: 2020/120
ARC Reference:

Im Einklang mit der Verordnung (EU) 2018/1139 des Europäischen Parlaments und des Rates bescheinigt
Pursuant to Regulation (EU) 2018/1139 of the European Parliament and of the Council:

CAMO Irene Flagg
Glandorfer Damm 35, 49536 Lienen
DE.CAO.0025

hiermit, an dem nachfolgend aufgeführten Luftfahrzeug eine Prüfung der Lufttüchtigkeit gemäß der Verordnung (EU) Nr. 1321/2014 vorgenommen zu haben:
hereby certifies that it has performed an airworthiness review in accordance with Regulation (EU) No 1321/2014 on the following aircraft:

Hersteller des Luftfahrzeugs: Aircraft manufacturer:	Schroeder fire balloons GmbH
Herstellerbezeichnung des Luftfahrzeugs: Manufacturer's designation:	Fire balloons G42/24
Eintragungszeichen des Luftfahrzeugs: Aircraft registration:	D-OWUE
Seriennummer des Luftfahrzeugs: Aircraft serial number:	1480

Das Luftfahrzeug ist zum Zeitpunkt der Prüfung für lufttüchtig befunden worden.
and this aircraft is considered airworthy at the time of the review.

Ausstellungsdatum: 20.April 2020 (Date of issue)
Datum des Ablaufs der Gültigkeit: 20. April 2021 (Date of expiry)
Flugstunden (FH) der Zelle am Prüfungssdatum(*): 338:05 (Airframe Flight Hours (FH) at date of review (*))
Unterschrift: J. Flagg (Signed:)
Nr. der Erlaubnis (falls zutreffend): 0025/001 (Authorisation No (if applicable):)

1. Verlängerung: Das Luftfahrzeug erfüllt die Bedingungen von Anhang Vb (Teil-ML) Punkt ML.A.901(c).
1st Extension: The aircraft complies with the conditions of point ML.A.901(c) of Annex Vb (Part-ML).
Ausstellungsdatum: 31. März 2021 (Date of issue:)
Datum des Ablaufs der Gültigkeit: 20. April 2022 (Date of Expiry:)
Flugstunden (FH) der Zelle am Ausstellungsdatum (*): 339:25 (Airframe Flight Hours (FH) at date of issue (*):)
Nr. der Erlaubnis: 0025/001 (Authorisation No:)
Unterschrift: J. Flagg (Signed:)
Name des Unternehmens: CAO Flagg & Köck (Company Name:)
Aktenzeichen der Genehmigung: DE.CAO.0025 (Approval Reference:)

2. Verlängerung: Das Luftfahrzeug erfüllt die Bedingungen von Anhang Vb (Teil-ML) Punkt ML.A.901(c).
2nd Extension: The aircraft complies with the conditions of point ML.A.901(c) of Annex Vb (Part-ML).
Ausstellungsdatum: (Date of issue:)
Datum des Ablaufs der Gültigkeit: (Date of Expiry:)
Flugstunden (FH) der Zelle am Ausstellungsdatum (*): (Airframe Flight Hours (FH) at date of issue (*):)
Nr. der Erlaubnis: (Authorisation No:)
Unterschrift: (Signed:)
Name des Unternehmens: (Company Name:)
Aktenzeichen der Genehmigung: (Approval Reference:)

(*) Außer für Ballone und Luftschiffe. (Except for balloons and airships.)

EASA Form 15c Ausgabe 3 (2020-03-24)

The fire balloons G 42/24 aircraft maintenance was carried out by engineer Stefan Handl DE.66.11746, 23.03.2021 (Germany.)

The aircraft pre-flight preparation was performed by the pilot.

1.7 Meteorological Information

The Investigation Team has documents (FW1141 Weather Reports) on the actual weather conditions in the flight area, recorded using the Integrated Sensor Suite Installation Manual, according to which the pilot took the decision to perform the flight. In addition, the pilot used the weather data from free Internet resources.

***Note**: near the pad in the vicinity of the village of Tsybulivka, there is a special equipment, an automatic weather station FW1141, which is located at the UKGK Kamianets-Podilskyi Airfield (AF) (thermometer, wind direction, speed indicator, wind gust indicator, rain, humidity, atmospheric pressure indicators). Records of the actual weather data are kept (the Investigation Team*

has the data records (Wheather Reports) for the time from 15:45 to 21:23 on 22.05.2021). The Investigation Team has no information on the equipment calibration test and certification.

National regulatory documents do not stipulate requirements for certification of the equipment installed on temporary AFs.

In addition, the pilot received the forecast and actual weather via the Internet resource.

According to the information provided by the Ukrainian Hydrometeorological Center: for May 22, 2021, 15.00 to 21.00 UTC from the Kamianets-Podilskyi meteorological station, which is the nearest observation point to the village of Kulchiivtsi, Kamianets-Podilskyi district, Khmelnytsky region:

Actual Weather at the Kamianets-Podilskyi Meteorological Station 15.00 to 21.00 UTC, May 22, 2021.

For 15.00 UTC Kamianets-Podilskyi 22151 33548 42599 71503 10227 20080 40109 57013 83505 55555 1/029=

Total cloud amount 9 points, 4 points of stratocumulus with 600-1000 meter ceiling, 5 point cumulonimbus. Visibility 50 km. Surface wind direction 150º, speed 3 m/s. Air temperature 22.7°C, dew point temperature 8.0°C. Pressure reduced to mean sea level – 1010.9 hPa. Barometric trend - 1.3 hPa.

For 18.00 UTC Kamianets-Podilskyi 22181 33548 32599 83007 10168 20094 40133 53018 8395/ 33333 10232 55555 1/016=

Total cloud amount 10 points, 6 points cumulonimbus with 600-1000 meter ceiling, 4 point altocumulus. Visibility 50 km. Surface wind direction 300º, speed 7 m/s. Air temperature 16.8ºC, dew point temperature 9.4ºC. Pressure reduced to mean sea level – 1013.3 hPa. Barometric trend - 1.8 hPa.

For 21.00 UTC Kamianets-Podilskyi 22211 33548 42997 81702 10154 20103 39870 40131 58003 83031 55555 1/014=

Total cloud amount 10 points, 6 points of altocumulus with 2500 meter ceiling, 4 point cirrus. Visibility 10 km. Surface wind direction 170º, speed 2 m/s. Air temperature 15.4ºC, dew point temperature 10.3ºC. Pressure reduced to mean sea level - 987.0 hPa. Barometric trend - 0.3 hPa.

According to the data of the FW1141 automatic weather station, during HAB take-off, at 16:20, the weather conditions were as follows:

- *air temperature +22ºC, wind direction - 171ºC, wind speed - 1.6 m/s, gusts - 6.4 m/s;*

At the time of the fatal accident, at about 17:14:

- *air temperature +17°C, wind direction - 257°C, wind speed - 17.7 m/s, gusts – 29 m/s.*

According to the UkSATSE, the actual and forecasted weather conditions in the Lviv FIR territory for the period from 12:00 to 18:00 UTC, May 22, 2021, were as follows:

1. GAMET area forecast for Lviv FIR with the period of validity from 12:00 to 18:00 UTC, 22.05.2021.

FAUR52 UKLW 221000
UKLV GAMET VALID 221200/221800 UKLW-
UKLV LVIV FIR
SECNI
SFC VIS: LCA 1500M SHRA BR
MON LCA 0500M SHRA FG
SIG WX: ISOL TSGR
MT OBSC: ABV 600M AMSL
SIG CLD: ISOL CB 540/ABV 3000M AGL LCA BKN 150/450M AGL
MON BKN 600/ABV 3050M AMSL ISOL CB 1500/ABV 3050M AMSL
ICE: MOD 2100/ABV 3050M AMSL
TURB: MOD SFC/3050M AMSL
SECN II
PSYS: 15 N4830 E023 TO N51 E02430 COLD FRONT WITH WAVES
MOV NE 30KMH NC
SFC WIND: 190/07G12MPS LCA 220/10G18MPS
MON LCA 230/15G2IMPS
WIND/T:
300M 230/40KMH PS14
600M 230/50KMH PS 13 1500M220/60KMH PS06 3000M 220/60KMH MS04
SFC VIS: 5000M BR
CLD: BKN SC 450/1500M AGL BKN AC 2100/ABV 3000M AGL
FZLVL: 2100M AMSL
MNM QNH: 1003 HPA / 752 MM HG
RMK: CHECK SIGMET AND AIRMET=

The GAMET area forecast for low level flights was compiled for the Lviv FIR by the UKLV meteorological office, valid from 12.00 to 18.00 UTC, May 22, 2021, issued at 10.41 UTC on May 22, 2021

Part I

Visibility: isolated 1500 meters heavy rain, haze in the mountains, isolated 0500 meter heavy rain, fog

Special phenomena: isolated thunderstorms with hail

Mountain cover: mountains covered by clouds above 600 meters above sea level.

Cloudiness: local cumulonimbus, ceiling 540 meters, cloud top higher than 300 meters above ground level; in some places, broken cloud celing 150 meters, the top is 45 meters above ground level

In Mountains: broken clouds with 600 meter ceiling, cloud top above 3050 meters above sea level; local cumulonimbus ceiling 1500 meters, cloud top above 305 meters above sea level

Icing: moderate, lower limit 2100 meters, upper limit above 3050 meters above sea level

Turbulence: moderate, from the ground up to 3050 meters above sea level.

Part II

Baric system: at 15.00 UTC, a cold front with waves along the line with coordinates N4830 E023 -N51 E 02430, is shifting to the northeast at a speed of 30 kilometers per hour, the trend is unchanged

Surface wind: 190 degrees 07 gusts 12 meters per second, locally 220 degrees 10 gusts 18 meters per second

In mountains: locally 230 degrees 15 gusts 21 meters per second

Wind by altitudes:

300m above sea level 230 degrees 40 km/h temperature +14
600m above sea level 230 degrees 50 km/h temperature +13
1500m above sea level 220 degrees 60 km/h temperature +06
3000m above sea level 220 degrees 60 km/h temperature -04

Surface visibility: 5000 meters haze

Cloudiness: Broken stratocumulus ceiling 450 meters, cloud top 1500 meters above ground level; broken altocumulus ceiling 2,100 meters with cloud top above 3,000 meters above ground level

Freezing level: 2100 meters above sea level

Minimum QNH: 1003 hectopascals or 752 millimeters of mercury

Check for SIGMET, AIRMET information availability.

2. **SIGMET, AIRMET, AIREP SPECIAL Information** for Lviv FIR (information on actual or forecasted occurrence of hazardous weather phenomena along the flight route, which may affect the aircraft safety) during the specified period was not compiled.

3. **WAREP Information** on actual significant weather phenomena was not received from the meteorological stations located along the flight route or nearby.

1.8 Navigation Aids

Radio technical flight support aids at the airfields near the villages of Tsybulivka and Kulchiivka are absent.

There are no radio navigation and landing aids.

1.9 Means of Communication

The crew informed the Lviv Air Information Center by telephone 032 297 2173. Informing of the Air Forces of the Armed Forces of Ukraine on the flight was carried out by the crew by telephone 032 227 7330.

1.10 Airfield (AF) Data

The AF near the village of Tsybulivka is a launch pad for flights of free balloons (par. 9 of the Regulations for the admission to operation of airfields for light aircraft flights, approved by Order of the State Service of Ukraine for Aviation Safety Supervision dated 01.12.2004 No. 205), it is a temporary airfield of sufficient size for the safe takeoff of the aircraft such as fire balloons G 42/24.

1.11 Flight Recorders

Flight recorders are not provided onboard fire balloons G 42/24 HAB by the design.

The HAB is equipped with Fly Tec 3040 device, which includes an altimeter, variometer, temperature indicator in the envelope and compass. The aircraft also had GPS Garmin GPSMAP 84s device.

1.12. Wreckage and Impact Information

Inspection of the HAB crash site and surrounding area showed that there was no scattering of the HAB fragments and parts.

1.13. Medical Data and Brief Results of Post Mortem Studies

According to the information provided by the Main Department of the National Police in Khmelnytsky Region, according to the results of the examination No. 488 dated 24.05.2021, the alcohol content in the pilot's blood was 0.000 ‰.

There is no information that physiological factors or incapacitation affected the crew's performance during the flight.

1.14. Fire

There was no fire during the accident.

1.15. Survival Factors

As a result of the accident, one person died and others were seriously injured.

1.16. Tests and Research

Propane-butane mixture is used as fuel for the burner of the fire balloons G 42/24 aircraft.

1.17. Information on Organizations and Administrative Activities Related to Accident.

HAB classification – Manned Free Balloon.

Note: *Manned free balloon is an aircraft lighter than air, the lift of which is created by heated air (hot air balloon) (Aviation Regulations of Ukraine, part 47 "Regulations for Registration of Civil Aircraft in Ukraine", approved by Order of the State Aviation Administration dated 05.02.2019 No.153 and registered with the Ministry of Justice on 12.03.2019 under No. 240/33211.*

The registration, which is reflected in the Aircraft Registration Certificate, was carried out by the German aviation authorities on 21.07.2011. The aircraft was assigned the registration number D-OWUE.

Airworthiness Certificate for operation was issued by the German aviation authorities on 21.07.2011.

Airworthiness Review Certificate for operation was issued by the German aviation authorities on 31.03.2021 and is valid until 20.04.2022.

1.18. Additional Information

Actions of rescue and fire teams

No rescue or fire fighting operations were conducted.

There was no fire.

1.19. Useful or Effective Methods Used in Investigation

Standard investigative techniques were used.

2. Analysis

On 22.05.2021, at approximately 17:14 UTC, during the flight, D-OWUE HAB impacted the ground, which resulted in death of one person and serious injuries to the pilot and four passengers. The HAB suffered significant damage.

The investigation has established that the Cup of Podillya balloon fiesta in Kamianets-Podilskyi was held on 22.05.2021 in the format of free individual flights of 10 HABs.

Note*: The Cup of Podillia festival with participation of aerostatical balloons is annual and has been held in mid-May since 1999. The organizers of the festival are Ballooning Federation of Ukraine) and Kamianets-Podilskyi Ballooning Center with participation of the community of the city of Kamianets-Podilskyi.*

Traditionally, if there is a financial opportunity, during this festival, Cup of Podillya sports competitions in aerostatics are held. Therefore, based on the

decision of the meeting of the Bureau of the Ballooning Federation of Ukraine (Minutes No. 9/20), this event was included in the Unified Calendar Schedule of Physical Culture, Health and Sports Events of Ukraine for 2021.

At the same time, due to the lack of funding for the second stage of the Cup of Ukraine in aerostatics, Cup of Podillya, the organizers decided not to hold the sporting event and, based on the calendar plan of festival events in Kamianets-Podilskyi for 2021, to hold only the Podillia Cup festival with a historical reconstruction of the launch of the first balloon.

The information about the event was included into the calendar of the city's festival events.

Certain pilots, who have repeatedly flown on hot air balloons in the area of Kamianets-Podilskyi, were personally proposed by the organizers to perform individual free flights in the uncontrolled airspace on May 21 - 23, 2021, during the Podillia Cup festival.

On 22.05.2021, the HAB pilot planned to perform a free flight in the area of the city of Kamianets-Podilskyi on the HAB with the registration number D-OWUE. The operator is a private person.

***Note**: Subject to paragraph 9 of the Aviation Regulations of Ukraine "Regulations for Use of Airspace of Ukraine", approved by the joint Order of the State Aviation Administration and the Ministry of Defense of Ukraine dated May 11, 2018, No. 430/210, registered with the Ministry of Justice on September 14, 2018, under No. 1056/32508 (hereinafter - UoA Regulations), airspace users shall inform about the flights outside the ATS controlled airspace:*

1) bodies of the United Civil-Military System of Air Traffic Management of Ukraine – in case of filing applications for the use of airspace;

2) control bodies of the Air Force of the Armed Forces – in all cases of flight operations outside the ATS controlled airspace;

3) departmental ATC bodies – in cases of flights within the ATCZ, ATCA.

According to paragraph 11 of the UoA Regulations, applications for the airspace use shall be submitted by users to the Ukraerocenter until 12:00 UTC on the eve of the activity.

According to paragraph 8 of the UoA Regulations, informing of the relevant bodies of the United Civil-Military System of Air Traffic Management of Ukraine and the control bodies of the Air Force of the Armed Forces, which shall exercise control over observance of the UoA procedures and rules, performance of aircraft flights, in particular, of the launch of aerostatic balloons – shall be carried out by specialists of aerostatic balloon launching points.

The report of the command of the Air Force of the Armed Forces of Ukraine on the HAB fatal accident, which the NBAAI received on May 23, 2021, also contained the information about Infringement of the Procedure for Use of Airspace of Ukraine (hereinafter IPUAU) by D-OWUE hot-air balloon.

The information about IPUAU was also contained in the letter of the Air Force of the Armed Forces of Ukraine dated 08.06.2021 No.350/165/3/1844. This is due to the fact that the Air Force of the Armed Forces of Ukraine received the information about the accident time of 17:45-17:50, which exceeded the time of balloon flights (the time of completion of flights was 17:20.) However, the investigation established that the fatal accident occurred during HAB landing at 17:14, and therefore, there was no fact of IPUAU.

Since HAB flights in the warm season are limited to 2 hours after sunrise and before sunset (due to development of cloudiness, increased atmospheric air, presence of wind gusts, turbulence, etc.), the simultaneous application of 10 pilots to the above-mentioned services within a compressed time frame would create occupancy of the information channel, unreliability of such communication, impossibility of informing about each take-off. In addition, the HAB launch pad would be a fairly large area, the quantity of such is not so large in the vicinity of the city. Therefore, a decision is usually taken on HABs launches from individual pads independently chosen by the pilots, and that the centralized reporting to the aforementioned bodies should be conducted by one assigned pilot from the HABs list compiled at the pre-flight briefing on meteorological conditions, and which is independently filled by the pilots, who have taken the decision to fly.

When filing an application at 15:44 UTC, on 22.05.21, controllers received the information about only one HAB with the registration number UR-LLG, which was operated by the pilot assigned at the briefing, and as regards the others – only quantitative data – 10 HABs.

The flight completion report was sent at 17:20 UTC by the pilot assigned at the briefing.

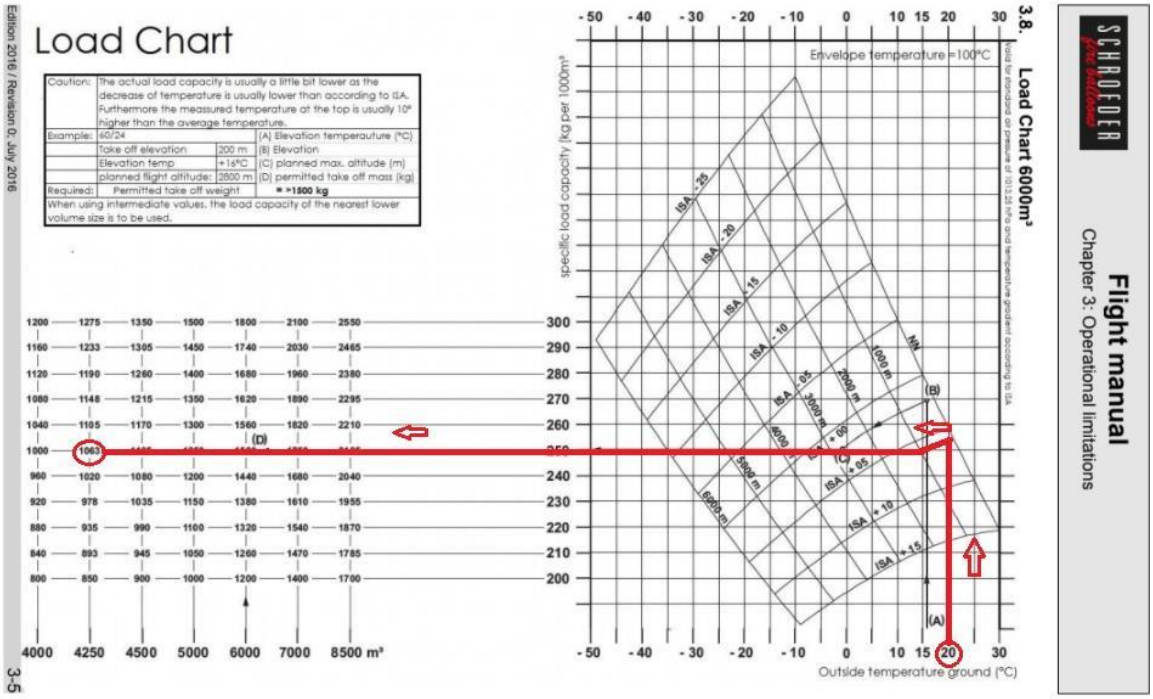
According to the PIC's statement, in order to prepare for the flight, he arrived on 22.05.2021 at the airfield near the village of Tsybulivka (48°39'5.5"N 26°34'40.1"E).

Upon arrival at the airfield on 22.05.2021, the PIC familiarized himself with the weather conditions and corresponding NOTAM reports related to the flight, and also made a calculation of the HAB take-off weight.

As fuel for the HAB burner, a propane-butane mixture was used, which was filled into HAB in the amount of 63 kg (there were 3 cylinders on board HAB with 63 kg of the mixture filled. As a result of the fatal accident, the police seized them as material evidence. One cylinder was full, the second one contained 8 kg of the mixture. This is sufficient to perform a 1-hour flight.) The flight was planned with five passengers on board and was of a private nature.

Actual takeoff weight was:

Empty HAB weight	310 kg.
Crew weight (1 crew)	90 kg.
Passenger weight (5 pax)	450 kg.
Fuel weight	63 kg.
Total aircraft takeoff weight	913 kg.



Note:

According to the Flight Operation Manual, the maximum take-off weight under these conditions shall be 1063 kg.

Before the flight operation, the pilot performed a pre-flight preparation (airfield inspection, study of meteorological conditions, determination of take-off weight, determination of the fuel amount for the flight, etc.) – but the Investigation Team did not receive the recorded (documented) documentation (materials) that would confirm this.

At the time of taking decision to take off, the weather was CAVOK, the wind regime, according to Ukrainian Center for Hydrometeorology, as of 15:00, was: wind speed – 3 m/s. According to the data of the FW1141 automatic weather station, which is located at the UKGK Kamianets-Podilskyi Airfield, which was installed by pilots of free HABs independently on the airfield, as of 16:20: wind 1.6 m/s, gusts 6.4 m/s.

According to the PIC's explanations, during the ground testing, the balloon parameters were normal and were checked immediately before takeoff.

Having checked that the total weight of the balloon with people did not exceed 1063 kg, the launch site and weather conditions were favorable, the PIC, according to his statement, gave the command to the ground crew to begin preparing for the HAB climb. During preparation for the flight, the PIC checked all the necessary HAB equipment and the burner. The basket was assembled in a vertical position, the propane cylinders were filled in advance, and he began the process of connecting them to the burner. As soon as all the cylinders were connected and tied to the basket, he prepared the burner to its operation

condition, checked the system and pressure gauge serviceability, after that he locked the cylinders and released the remaining propane.

After the basket was placed in a horizontal position, the PIC with the ground crew continued to prepare the HAB. The basket was connected to the envelope, and the PIC checked all the snap hooks for connection correctness and safety, connected the "detachment" system from the balloon to the car hitch to avoid unauthorized HAB takeoff during the start.

At the time of inflating the envelope, he entered the balloon and personally checked the canopy valve for proper operation and connected the parachute valve to the envelope. After that, he gave the command to prepare for the start. The envelope was filled with hot air in the normal mode, weather conditions did not prevent the flight. After checking that all conditions were conducive to the flight, the PIC asked people to enter the basket. According to the PIC, immediately after that, he conducted a pre-flight briefing with the passengers.

***Note**: The Investigation Team does not have documentary information about the pre-flight preparation and pre-flight briefing of passengers for the flight in the area of the city of Kamianets-Podilskyi before the flight.*

According to the PIC, the flight was planned along the route of Tsybulivka-Olenivka. HAB take-off was conducted at 16:20 from an individually selected launch pad with a magnetic heading MHtakeoff = 51º, this was the second flight of this pilot on this HAB on this day (the first flight was performed at 06:00 and landing at 07:15.) According to the PIC's statement, between the first and second flights, he rested at the "7 days" hotel.

The climb and flight to the landing site took place without complications.

The flight took place at an altitude of 50 to 400 meters at a speed of 10-15 km/h with MH = 50-60º for 30 minutes. Later the wind direction changed, the weather worsened, it started to rain, and the balloon increased the flight MH up to 95º. There was also an increase in speed up to 25 km/h. According to

the PIC's statement, having observed from afar that other HAB began to land, the PIC took the decision to search for a landing site.

The Kulchiivtsi southern outskirts were chosen as the landing site. During the landing approach at an altitude of 25-30 m, te HAB flew over the electric power transmission line. During the flight over the cemetery, according to the pilot, the balloon entered a downdraft of about 4 m/s and a gust of wind up to 11 m/s.

***Note**: according to the Ukrainian Center for Hydrometeorology's data, as of 18:00, the wind speed was 7 m/s. According to the data of the FW1141 automatic weather station, which is located at the UKGK, Kamianets-Podilskyi Airfield, as of 17:14 - 17.7 m/s with gusts of 29 m/s.*

Most likely, HAB entered into the vortex flow (rotor).

***Note**: during the transitional periods of the season (spring, autumn), the formation of vortex flows is significantly influenced by the daytime heating of*

the underlying surface, especially arable land, dark areas of fields. When heated, strong vertical air jets arise, which leads to vortex formations, the so-called rotors. In such zones, local weather conditions are observed, which differ from the weather conditions outside these zones. Vortex formations are a closed system that can determine local formation of the weather, which differs from the weather conditions established by the synoptic situation.

This led to the HAB basket ground impact, as a result of which a man fell out of the gondola. According to the PIC's statement, during an unplanned ground impact caused by the "rotor", natural phenomenon, he acted in accordance with the FOM, namely, closed the cylinders and opened the valve, at that, focusing all his attention on the HAB control, and considering that these events were instantaneous in time, he did not see how and when the passenger fell out. The hot air balloon, by inertia, continued to move on the remains of the lift force, having made another ground impact at the point with coordinates 48°39'37"N 26°43'9"E (elevation above sea level = +299 m) after 550 m, where 2 more people fell out of the gondola, and stopped after 790 m at the point with coordinates 48°39'32"N 26°43'47"E (elevation above sea level = +224 m.)

The distance from the first HAB basket ground collision (impact) to the place, where HAB came to rest, is 1340 meters.

At inspection of the accident site, the investigation found that the balloon gondola collided with a ground obstacle – a grave monument, where one person fell out of the balloon gondola and died.

Passenger safety belts are not provided for this HAB type.

There was no fire during the emergency landing.

The accident site is located in the area of a dried-up pond located in the east of the village of Kulchiivtsi.

As a result of the impact, the HAB suffered significant damage.

The total duration of the flight, from the start of movement till the ground impact, according to the pilot and witnesses of the accident, was 53 minutes.

There was no scattering of the HAB parts.

The investigation found that during the landing approach (by the nature of the HAB movement at the ground impact, by the distance of the HAB movement on the ground and by the nature of the HAB damage), the HAB probably entered into a descending vortex flow – a "wind rotor" at a low altitude, which led to loss of hot air balloon controllability and to its further fall (hard touchdown uncontrolled by the pilot).

3. Conclusions:

3.1. General Conclusions:

1. The HAB had a valid Airworthiness Review Certificate issued by the German CAA. The PIC conducted the pre-flight preparation of the HAB.

2. The PIC has a valid Free Balloon Pilot's License, but the attachment to the license was at the State Aviation Administration at the time of the accident.

3. HAB has the Airworthiness Certificate issued by the CAA of Germany.

4. The HAB flight weight conformed to the established limits.

5. At taking a decision to perform the flight, the meteorological conditions corresponded to the conditions for performing a flight under the visual flight rules.

6. The crew received the meteorological information (forecast and actual weather) using a tablet via an Internet resource and from the meteorological station located in the vicinity of the airfield.

7. The PIC had a valid medical certificate (a copy was submitted for consideration of the Investigation Team). At the same time, at the NBAAI's request dated 27.05.2021 No.1.3-1.8/243 to provide information about the pilot, the State Aviation Administration of Ukraine (SAAU) sent by its letter dated 10.06.2021 No. 1.19-3609-21 a copy of the Class 2 Medical Certificate issued on 13.07.2016 No. 065482 (MC No. 063168), which expired on 01.01.2020. Thus, according to the documents provided by SAAU, the pilot was performing flight operation without a valid medical certificate.

8. The aircraft was not equipped with safety belts for passengers.

3.2. Causes/ Contributing Factors

3.2.1. The most probable cause of the accident – i.e. a ground impact, which prompted the death of one person and serious injuries to the PIC and 4 passengers, and significant damage to the HAB structural components – was the HAB entering into a strong downdraft wind. The abscence of safety belts caused falling of three passengers out from the HAB gondola and fatal injuries to one of them.

3.2.2. The contributing factor to the accident was absence of the radio communication between the HAB pilot and ATS unit, which caused failure to receive in a timely manner the information on a significant wind increase.

Factor: Environment.
Category: WSTRW, UIMC.

4. Safety Recommendations:

4.1. To: Airspace users operating flights in Class G airspace:

- Officially decide how to inform the air traffic control units and airspace use control bodies about simultaneous operation of flights of several aircraft of the general aviation, including HABs, within the common flight area;

- During the pre-flight preparation, receive the information on restrictions and prohibitions of use of the airspace along the route and in the flight area, aeronautical information, including NOTAMs and meteorological information – exclusively from the official sources established by the State Aviation Administration, in particular, from the air traffic service unit and from the official website of the Aeronautical Information Service of Ukraine.

4.2. To: Educational institutions that provide training for pilots; to manufacturers of general aviation aircraft, including light, ultralight, aerostatic and amateur ones:

- Clearly indicate in the relevant flight training manuals, instructions, programs: what actions a pilot should take to perform a safe landing, having encountered strong wind gusts.

- Specify in the relevant documents: how and where (the technology) an owner (operator) shall perform HAB filling with gas.

4.3. To: State Aviation Administration of Ukraine:

- Provide the NBAAI with copies of valid documents on flight personnel;

- Take effective measures as regards fulfillment by the aviation activity entities of Ukraine of the requirements of the Order of the State Aviation Administration of Ukraine dated December 27, 2019, No. 1817 concerning timely and reliable reporting of air accidents.

4.4. To: Ballooning Federation of Ukraine:

- Submit to the NBAAI reports on air accidents and serious incidents subject to the recommendations of the Interim Instruction on Reporting to NBAAI of Air Accidents and Serious Incidents with Civil Aircraft, approved by the NBAAI Order dated 06.03.2020, No.19.

4.5. To: HAB manufacturers:

- Equip the aircraft basket with safety belts for the pilot and passengers.