



AIR ACCIDENTS INVESTIGATION
INSTITUTE
Beranových 130
199 01 PRAGUE 99

CZ-17-1037

FINAL REPORT

Investigation of causes of an air accident
ULL EV97 EuroStar SL
reg. mark OK-UUU72
2 km E of Nížkov
on 24 October 2017

Prague,
November
2018

This investigation was carried pursuant to Regulation (EU) of the European Parliament and of the Council No. 996/2010, Act No. 49/1997 Coll., on civil aviation, and Annex 13 to the Convention on International Civil Aviation. The sole and only objective of this report is the prevention of potential future accidents and incidents free of determining the guilt or responsibility. The final report, findings and conclusions stated therein pertaining to aircraft accidents and incidents, or possible system deficiencies endangering operational safety shall be solely of informative nature and cannot be used in any other form than advisory material for bringing about steps that would prevent further aircraft accidents and incidents with similar causes. The author of the present Final Report states explicitly that the said Final Report cannot be used as grounds for holding anybody liable or responsible as regards the causes of the air accident or incident or for filing insurance claims. This report has been translated and published by the Air Accidents Investigation Institute to make its reading easier for English speaking people. As accurate as the translation may be, the original text in Czech is the work of reference.

Abbreviations Used

AC	Alto cumulus
AAII	Air Accidents Investigation Institute
AGL	Above ground level
AMSL	Above mean sea level
ASL	Above sea level
BASE	Cloud base
BKN	Broken
BR	Mist
CS	Cirrostratus
CTR	Control zone
CU	Cumulus
CHMI	Czech Hydrometeorological Institute
DZ	Drizzle
ELT	Emergency Locator Transmitter/Beacon
FL	Flight level
FRS	Fire Rescue Service
FZL	Freezing level
GS	Ground speed
HR	Horizontal rudder
IAS	Indicated airspeed
ICAO	International Civil Aviation Organisation
IRS	Integrated Rescue System
FIR	Flight information region of Prague
LKKU	Non-public international airport
LKKV	Public international airport
LKTB	Public international airport
AA	Air Accident
LW	Landing weight
MSL	Mean sea level
MAC	Mean aerodynamic chord
MTOW	Maximum take-off weight
MLW	Maximum landing weight
NIL	None
OUP	Department of Urgent Admission
PCR	Police of the Czech Republic
PPL(M)	Private pilot licence (Microlight)
REG QNH	Regional pressure, the lowest atmospheric pressure in the area reduced to mean sea level according to standard atmospheric conditions
REDZ	Moderate or heavy drizzle
RWY	Runway
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
SCT	Scattered
RUD	Rudder
SYNOP	Report on surface synoptic observations made by weather station
TAS	True airspeed
TC	Technical certificate
TWR	Aerodrome control tower

TOP	Cloud top
UTC	Co-ordinated Universal Time
ULL	Microlight aircraft
VFR	Visual Flight Rules
VHF	Very high frequency (30–300 MHz), very short/meter wave band, (1–10 m)
VML	Code of medical fitness certificate limitation – Correction for defective intermediate and near vision
WX	Weather

Used Units

ft	Foot (unit of length – 0,3048 m)
hPa	Hectopascal (unit of pressure)
kt	Knot (unit of speed – 1.852 km.h-1)

A) Introduction

Operator: Natural person
Aircraft Manufacturer and Type: Evektor-Aerotechnik, a.s., EV-97 EuroStar SL
Identification mark: OK-UUU72
Location: 2 km E of Nížkov, District of Žďár nad Sázavou
Date and time: 24 October 2017, 10:38 UTC (all times are UTC)

B) Synopsis

Two foreign nationals (hereinafter the “pilot” and the “co-owner”) have bought together a completely new UL aeroplane EV-97 EuroStar SL from Evektor-Aerotechnik, a.s.

The UL aeroplane was handed over on 23 October 2017. On the next day, the pilot and the co-owner planned to fly the UL aeroplane VFR from Kunovice to Karlovy Vary. They planned a flight route north of Brno and over the Bohemian-Moravian Highlands (Českomoravská vrchovina). Upon reaching Bohdalov, they entered weather with deteriorated visibility and reduced cloud base. They realised that they would not be able to continue on the planned route due to weather conditions and therefore decided for precautionary landing in the terrain near Nížkov. During approach to landing, the right half of the wing hit trees and subsequently the aircraft fell down onto the field. The pilot and the co-owner sustained severe injuries.

The critical phase of the aircraft flight was observed by the persons (hereinafter the “witnesses”) who shortly after the aircraft’s fall down on the ground rushed to help the crew and reported the air accident to IRS units via emergency line. Following an IRS operation, the AAI inspectors commenced investigating the AA causes.

The cause of the air accident was investigated by the AAI commission. The investigation team comprised of:

Commission Chairperson: Ing. Stanislav Petrželka
Commission member: Pavel Mráček

AIR ACCIDENTS INVESTIGATION INSTITUTE
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On 19. 11. 2018

C) This Final Report consists of the following main parts:

1. Factual Information
2. Analyses
3. Conclusions
4. Safety Recommendations
5. Annexes

1. Factual Information

1.1. History of the Flight

The pilot and the co-owner decided to purchase EV-97 EuroStar SL because they both knew it well and collaborated on its sale in Ireland. According to pilot's statement, he had in total 300 flight hours on this type of UL aeroplane. On 23 October 2017, both owners took over the UL aeroplane at LKKU, and the pilot did not find any defects. An UL aeroplane inspection was followed by a handover flight lasting 25 minutes. The pilot tested that the UL aeroplane was well controllable and "*had a good feeling about it*". During the handover flight, the factory test pilot identified no major piloting issues in the pilot, only drew his attention to his tendency to ascend during horizontal flight. The pilot and the co-owner then signed a handover report without reservations.

After the handover flight, the pilot consulted the test pilot regarding a flyover route to Karlovy Vary. He wanted to avoid CTR LKTB and CTR LKPR. He planned his flight route north of LKTB and then wanted to continue south of CTR LKPR. He had prepared and printed navigational materials from the Kunovice airport to Karlovy Vary airport with a reserve airport Benešov. During preparation, each of them placed their tablets with navigation application in their piloting space together with GPS Garmin 695 as the main navigation device serving also as flight data recorder. For the planned flight, they refuelled the UL aeroplane tank with Natural 95 motor petrol to the maximum amount of 65 l.

Having departed from LKKU RWY02C, the UL aeroplane exited LKKU CTR via the WHISKY exit point and continued flying on the planned route across Bohdalice and Račice en-route points towards the Bohdalov en-route point. During departure from LKKU, the visibility was more than 10 km and clouds SCT 2,100 ft AGL. At 09:07:44, the pilot flew north of CTR LKTB, while visibility was over 30 km and clouds 2-3/8 CU 1,771 ft AGL. Up to Bohdalov, the flight was trouble-free and was copying the planned route set in the GPS Garmin 695 navigation device.

At 09:35:40, the pilot started a series of left-hand turns due to deteriorating weather in Bohdalov. After 55 minutes of flying in circles over Bohdalov, the pilot evaluated the weather conditions and opted for precautionary landing. At 10:31:28, the UL aeroplane departed from Bohdalov and continued flying towards Nížkov. While flying towards Nížkov, the UL aeroplane crew noticed a man driving a tractor in a field and decided for precautionary landing close to him. The landing took place in fog, in flight configuration without flaps down and with a greater weight than authorised. The course of the flight was recorded by the GPS Garmin 695 navigation device. Flight parameters were used for a graphical representation of significant flight phases during AA investigation. All ALT-GPS and GS-GPS were read from the data recorded by Garmin 695. The recorded ALT-GPS was compared with the LKKU AMSL. While the UL aeroplane was taxiing on RWY02C before take-off, Garmin 695 recorded ALT-GPS, AMSL lower by 20 ft than the AMSL of measured and compared points on RWY02C.



Fig. 1 Approach over Nižkov

Chart 1 Data from GPS Garmin 695

Index	Time	ALT-GPS	Distance	Time	GS-GPS	Azimuth	Position
865	24.10.2017 10:37:49 (UTC)	2,092 ft/637.6 m	154 m	0:00:04	139 km/h	89° True	N49 31.985 E15 48.846
866	24.10.2017 10:37:53 (UTC)	2,068 ft/630.3 m	141 m	0:00:04	127 km/h	63° True	N49 31.986 E15 48.974
867	24.10.2017 10:37:57 (UTC)	2,052 ft/625.4 m	225 m	00:00:07	116 km/h	56° True	N49 32.020 E15 49.078
868	24.10.2017 10:38:04 (UTC)	2,019 ft/615.3 m	64 m	00:00:02	114 km/h	73° True	N49 32.087 E15 49.234
869	24.10.2017 10:38:06 (UTC)	2,022 ft/616.3 m	213 m	00:00:07	110 km/h	90° True	N49 32.097 E15 49.284
870	24.10.2017 10:38:13 (UTC)	2,027 ft/617.8 m	216 m	00:00:07	111 km/h	108° True	N49 32.096 E15 49.461
871	24.10.2017 10:38:20 (UTC)	2,005 ft/611.1 m	205 m	00:00:07	105 km/h	107° True	N49 32.060 E15 49.631
872	24.10.2017 10:38:27 (UTC)	2,035 ft/620.3 m	137 m	00:00:05	98 km/h	95° True	N49 32.028 E15 49.795
873	24.10.2017 10:38:32 (UTC)	2,030 ft/618.7 m					N49 32.022 E15 49.908



Fig. 2 Approach details from the last recorded point 873 by GPS Garmin 695

1.1.1 Course of the flight as stated by the pilot

The pilot said exactly: *“We took the aircraft over on Tuesday morning. We then carried out preparation of the flight route and had a Metar weather report, which we had acquired from the SkyDemon satellite broadcasting. Someone fuelled the tank for us with some 63 litres and we were issued an invoice for it. We wanted to fly to Karlovy Vary. I was piloting myself without handing over to anybody during the flight. It was just me and the co-owner in the aircraft. He was sitting in the seat in the front on the right-hand side and was helping me navigating. We were using the GPS Garmin 695 device for navigation. We did not discover any problem. We also used SkyDemon installed in the tablet for navigation. We had correct information about our position all the time. We were flying from Kunovice to the north of Brno and then we were navigated towards Prague. The weather deteriorated in Bohdalov. The cloud base was falling down. Hilltops were covered with clouds. At that point, we started flying in circles, searching for a safe landing place. While searching for a suitable surface for precautionary landing, we may have lost control over aircraft piloting for a moment. Our attention was partially distracted from aircraft steering. We had to look out while searching for a suitable landing place and we were not concentrating only on aircraft instruments. We had to find a place where there were no electrical lines and other obstacles. We noticed a man in a tractor moving near a suitable landing place. We then flew through a cloud and found no suitable place there and that’s why we decided to return to that man. I remembered where he was and so I was trying to return there. The aircraft was OK. It was probably pilot’s fault, that is: mine. I don’t remember the landing manoeuvre. No acrobatic turnover of the aircraft or any sense of fear. We were landing in a cloud. I saw no forest. And then I don’t remember anything.”*

1.1.2 Course of the flight as stated by the co-owner

The UL aeroplane has been purchased by the pilot and the co-owner, both with the same share. The co-owner was there during the UL aeroplane takeover from the manufacturer. The takeover was issue-free. They performed a test flight. Such flight was conducted by the pilot with the factory test pilot. No defects were identified on the UL aeroplane. Following the UL aeroplane takeover, they were flying to Karlovy Vary. The co-owner was not a pilot licence holder and that’s why the pilot was piloting all the time. During the flight, the co-owner was sitting in the right-hand seat, was helping navigating and was not interfering with the steering in any way. When they reached the Bohemian-Moravian Highlands, they encountered thick fog and strong wind.

The co-owner said exactly: *“We were trying to get out of it but an accident occurred. We were trying to find a way out of the clouds. While flying in circles over Bohdalov, we were searching for a landing place. We then saw a tractor driver and wanted to land nearby but an accident took place. It was because of the weather. The pilot behaved in a very professional manner and was not nervous at all.”* To conclude, the co-owner said that the air accident had been caused by the rapidly changing weather.



Fig. 3 Trajectory of the flight over Bohdalov

1.1.3 Witnesses' statements

The course of the flight was observed by three witnesses. A man and a woman going by a passenger car and the third witness who was driving an agricultural vehicle close to the fall site of the UL aeroplane.

The woman said exactly: *“As we were approaching, I noticed that the aircraft was some 20 metres above the ground over the forest and was strangely rolling its wings from side to side. It looked as if the aircraft wanted to carry out an emergency landing on the meadow. There was no wind but the aircraft was flying in fog over the forest. Then the aircraft went down to the field with its cockpit first at an angle of almost 90 degrees.”*

The man said exactly: *“As I approached closer, I noticed that the aircraft was some 20 metres above the ground over the forest and was strangely rolling its wings from side to side. It seemed as if the aircraft wanted to carry out an emergency landing on the meadow by the forest. I thought the aircraft had run out of fuel. There was no wind then; however, the aircraft was flying in some fog but all of the sudden, the aircraft went down to the field with its cockpit first at an angle of almost 90 degrees. There was a man with an agricultural vehicle on the nearby field. I was screaming at him to go to them so he went to the aircraft and carefully lifted the airplane cockpit upwards using a hydraulic lift. I noticed there was another injured man next to the injured man and he was stuck in the cockpit and was also covered with blood. I asked my friend to call an ambulance as there were two injured persons in the aircraft. So she did. I cut the seat belt of the man in a purple shirt. The man in a purple shirt was overheard crying in English “Help, help” in the cockpit. The other one did not communicate at all. For this, I thought he was as foreigner.”*

The third witness, the tractor driver, said: *“At about 10:34, I noticed an overflying aircraft which caught my attention as it was flying very low. I estimated that the aircraft was flying slightly above the treetops. The aircraft was flying from Žďár nad Sázavou to Přebyslav. Three minutes later, I noticed the same aircraft flying above the same field, but this time in the opposite direction, that is from Přebyslav to Žďár nad Sázavou. At one point, it was as if the aircraft moved from side to side at the height of treetops and then began descending abruptly with the front part first down to the ground. It fell down at the edge of the forest and the field where it bounced off and turned upside down.”*

1.1.4 Test pilot

The factory test pilot said: *“They showed to me that they would place their tablets with navigation in the piloting place. As they did not have a paper copy of the map of the Czech Republic, I gave them the ICAO CR map.”*

1.1.5 Place of the air accident

Having crashed against the treetops, the UL aircraft fell down at the edge of the forest and the field and remained in the upside down position. The geographical location of the impact place is east of Nížkov. The impact place coordinates are as follows:

Geographic coordinates:	49°32'0.131"N
	15°50'3.978"E
Elevation above sea level:	568 m

1.2 Injuries to Persons

Injury	Crew	Passengers	Other persons (inhabitants, etc.)
Fatal	0	0	0
Serious	1	1	0
Light/No injury	0	0	0/0

1.2.1 The pilot and the co-owner were foreign nationals.

1.3 Damage to Aircraft

The UL aircraft was totally destroyed by the fall. The engine and engine cradle were torn away and wedged in under the deformed front part of the fuselage. The leading edges of both wing halves, the cockpit, HR and RUD were seriously damaged.

1.4 Other Damage

Not reported. At the place of UL aircraft impact, the FRS did not observe any major contamination with working fluids.

1.5 Crew Information

1.5.1 Pilot, personal data:

- Male, aged 63 years,
- Valid class 2 medical certificate,
- Valid PPL(M) – private pilot licence (microlight),
- Valid radio operator licence, English language – Level 6.

1.5.2 Flying experience

Since 1997, the pilot has had in total 450 flight hours during his flying practice. The major part, approx. 300 hours have been flown on the same type of the UL aeroplane. The remaining flight hours have been accumulated on aeroplanes similar to Cessna 172. The pilot was well acquainted with this UL aeroplane type which he was also purchasing and selling while cooperating with an aeroplane dealer in Ireland. The data on flight hours have been obtained from the pilot's statement.

Hours flown over:	24 hours	90 days	Total
Type of aircraft:	0:25 h	-	300 h
All types in total:	-	-	450 h

1.6 Aircraft Information

1.6.1 General Specifications of the Aircraft

UL aeroplane EV-97SL OK-UUU72 belonged to the category of double-seat ARV and was powered by the Rotax 912ULS engine with power of 100 hp (75kW). The design was all-metal. The frame was riveted and also bonded. The fuel tank volume was 65 l and it was fuelled with Natural 95 motor petrol to the maximum amount of 65 l on the day of AA.

The UL aeroplane was equipped with basic equipment for VFR flights. The aircraft was not equipped with an artificial horizon but only with Bank Indicator CHY-1. UL aeroplane was not equipped with ELT.

Model:	EV-97 EuroStar SL
Identification mark:	OK-UUU72
Manufacturer:	Evektor-Aerotechnik, a.s.
Year of manufacture:	2017
Serial number:	20174245
Technical certificate:	valid
Total hours flown:	1 h 35 min
Liability insurance:	valid

1.6.2 Power unit

Engine/Type:	ROTAX 912 ULS 2
Manufacturer:	BRP-Rotax GmbH & Co KG
Serial number:	9 569 273
Year of manufacture:	2017
Total hours flown:	1 h 35 min

1.6.3 Aircraft Operation

The UL aeroplane was issued a TC with a portable identification mark for the purpose of aeroplane flying over to Ireland for subsequent registration. The UL aeroplane was completely new and had not been otherwise used except for the test and handover flights. The UL aeroplane was operated by two natural persons with equal ownership shares. The first test flights of the UL aeroplane took place from 4 October to 9 October 2017, and in total three flights were performed in the total duration of flights of 1 h and 10 min.

1.6.4 Calculation of the UL aeroplane weight

The UL aeroplane was occupied by two persons with the total weight of 180 kg, the empty weight of the UL aeroplane was 297 kg, and the fuel load was 47 kg. The baggage weight was estimated at approximately 10 kg. TOW was 534 kg. After 2 hours of flight, the engine consumed approximately 24 kg of fuel and the UL aeroplane weight dropped down to 510 kg. On 4 October 2017, the recorded weight of the tested UL aeroplane was 403.2 kg¹. The stall speed of 66 km/h IAS corresponded to the weight of 403.2 kg in configuration without flaps down. An increase of the UL aeroplane weight from 403.2 kg to 510 kg accelerated the stall speed from 66 km/h IAS to 74.3 km/h IAS², i.e. by 12.5%. The centre of gravity of 30.29% MAC³ was calculated for the weight of 510 kg. Although the UL aeroplane was overloaded, it did not exceed the back limit of the authorised operating range of the centre of gravity, which is specified in the Aircraft Operating Manual within the range of 20–34% MAC.

Chart 2 Calculation of the UL aeroplane real weight at the time of AA (mass in kg)

Empty Weight	Weight of Fuel (Max Fuel-Burned Fuel)	Crew Weight (2 People)	Baggage Weight	Aircraft Actual Accident Weight	Cruise Stall Speed IAS (km/h)
	47-24	90+90	2x5		
297	23	180	10	510	74.3

1.7 Meteorological Information

1.7.1 CHMI report

According to the report of the Aeronautical Meteorological Service (CHMI), the weather was influenced by a higher air pressure ridge extending over the territory of the Czech Republic.

Ground wind: 280–330°/4–14 kt
Upper wind: 2,000 ft MSL 290°/10 kt, 5,000 ft MSL 300°/14 kt
Visibility: over 10 km, 4–7 km in isolated areas

Present weather: BKN/OVC, mild rain in isolated areas, mist in isolated areas
Cloud: BKN/OVC temporarily SCT CI, AC, CU, sporadically ST, the lowest layer BASE 017-022

FZL: FL060-070
Turbulence: mild over Moravia, mechanical up to FL060
Freezing: NIL
Air pressure: 1,023 hPa, unaltered or mild increase
REG QNH: LKAA 09/12 1,020 hPa

¹ Take-off weight recorded in Test-fly protocol EV-97 EuroStar SL (Serial No.: 20174245) of 4 October 2017

² Calculation was made by an authorised staff member of Evektor-Aerotechnik, a.s.

³ Calculation was made by an authorised staff member of Evektor-Aerotechnik, a.s.

The following charts provide information from SYNOP reports submitted by the land weather stations closest to the flight route, Fig. 4 shows the radar shots.

Chart 3 An extract from SYNOP reports from the Přebyslav weather station (532 m ASL)

Time UTC	Total cloud cover	Wind direction and velocity (m/s)	Visibility	WX/Phenomena in the last hour	Cloud/Cloud base height AGL (m)	Temperature (°C)	Dew point (°C)
07:00	7	300°/2	3,200 m	BR	7 ST 0180	6.6	6.1
08:00	8	290°/4	6,000 m	BR	8 ST 0210	7.5	6.4
09:00	8	310°/4	8,000 m	BR	8 ST 0240	8.2	6.7
10:00	8	310°/3	2,500 m	DZ	8 ST 0180	8.2	6.8
11:00	8	290°/3	3,000 m	REDZ	8 ST 0090	8.8	7.8

Chart 4 An extract from SYNOP reports from the Brno weather station (LTB)

Time UTC	Total cloud cover	Wind direction and velocity (m/s)	Visibility	WX/Phenomena in the last hour	Cloud/Cloud base height AGL (m)	Temperature (°C)	Dew point (°C)
08:00	7	330°/6	28 km	NIL	2 CU 1260	10.6	6.7
09:00	7	320°/7	30 km	NIL	1 CU 0540	11.0	6.9
10:00	7	330°/5	30 km	NIL	2 CU 0660	11.7	6.2
11:00	6	350°/6	35 km	NIL	3 CU 0810	12.2	5.8

Chart 5 An extract from SYNOP reports from the Náměšť n. Oslavou weather station (LNA)

Time UTC	Total cloud cover	Wind direction and velocity	Visibility	WX/Phenomena in the last hour	Cloud/Cloud base height AGL (m)	Temperature (°C)	Dew point (°C)
08:00	7	320/6	15 km	NIL	7 CU 0300	8.0	5.8
09:00	7	330/5	20 km	NIL	7 CU 0360	8.6	5.9
10:00	7	330/6	20 km	NIL	5 CU 0450	9.7	5.3
11:00	7	320/4	20 km	NIL	5 CU 0480	10.1	6.4

Chart 6 An extract from SYNOP reports from the Svatouch weather station (SVR)

Time UTC	Total cloud cover	Wind direction and velocity (m/s)	Visibility	WX/Phenomena in the last hour	Cloud/Cloud base height AGL (m)	Temperature (°C)	Dew point (°C)
08:00	8	340°/4	2,000 m	BR	8 ST 0030	5.6	5.5
09:00	8	350°/3	4,000 m	BR	8 ST 0120	6.1	5.6
10:00	8	340°/3	5,000 m	BR	8 ST 0120	6.8	6.1
11:00	8	350°/2	1,300 m	RA	8 ST 0060	6.5	6.4

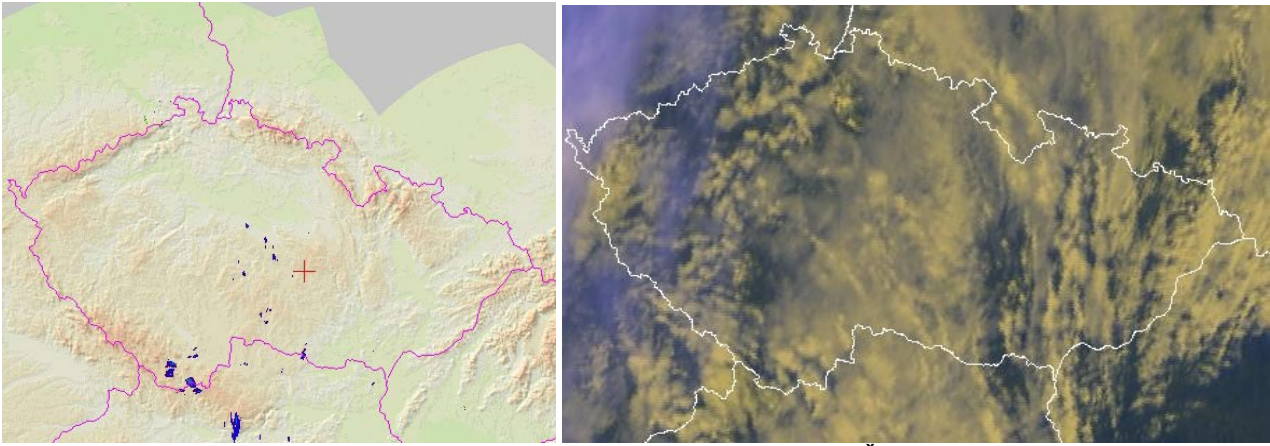


Fig. 4 Radar and satellite shots of 24 October 2017 (the position of Žďár nad Sázavou is marked in red, low and middle-level clouds are marked in yellow)

1.7.2 The weather at the time of take-off from LKKU on 24 October 2017 (08:33 UTC)

RWY	Wind	Visibility	Clouds	QNH
02C	010°/10 kt	≥10 Km	SCT 2,100ft	1,022 hPa

1.7.3 Weather according to the statements of witnesses:

LKKU METEO staff member on duty confirmed that the pilot had not physically come to the METEO office and had not requested the weather forecast for the planned flight.

The factory test pilot stated: *“They didn’t come to see me on the day of take-off and they were checking the weather from their own sources en route. I assume they only had METARs, which unfortunately do not cover the planned route over the Highlands (Vysočina). They had only talked with the business department staff member who told me later that they had been checking the weather.”*

Another witness, sport-aircraft pilot, at the time of the air accident flying from west from Žďár nad Sázavou to east above the stated clouds, confirmed that the area between Polná and Žďár nad Sázavou was covered 4-8/8 ST from the ground up to approx. 1,000 ft AGL.

1.8 Radio Navigational and Visual Aids

The manufacturer equipped the UL aeroplane with a built-in navigation device housing, and the crew applied GPS Garmin 695. The crew was obtaining the further data regarding the position of the UL aeroplane from the two tablets placed in the cockpit. At the place and time of approaching the terrain in a considerably worsened weather conditions, the crew was attempting to obtain a visual reference to terrain and obstacles.

1.9 Communications

The UL aeroplane was equipped with KRT-2 VHF radio station. The pilot was communicating with the TWR LKKU in accordance with the rules for VFR flights without the flight plan. When leaving the CTR LKKU, he was provided with the 127.350 Brno Radar frequency.

1.10 Aerodrome Information

Kunovice aerodrome is a non-public international aerodrome operated by Aircraft Industries, a.s. It is located 4.5 km to the south-west of Uherské Hradiště. The elevation of the aerodrome is 581 ft (177 m). It has a concrete 2,000 x 30 m RWY02/20 C.

Two more turf RWYs are used for the Aero club and ARV operations which are located to the left – RWY02/20 L, and to the right – RWY02/20 R from the concrete RWY02/20 C. The RWY02/20 L dimensions are 1,690 x 60 m. The RWY02/20 P dimensions are 1,480 x 80 m. The aerodrome provides services for the IFR and VFR flights. The pilot performed VFR take off from 02C RWY via the Whisky exit point and continued further in the flight along the planned route.

1.11 Flight Recorders and Other Means of Recording

The UL aeroplane was not equipped with FDR. Navigation device GPS Garmin 695 was used, and the downloaded data were used for displaying the parameters of the individual phases of the flight.

1.12 Wreckage and Impact Information

The UL aeroplane AA location is located at the borderline of a forest and a field approx. 35 m from Gigantský rybník (pond), in the vicinity of an access field road. The approach trajectory led across the high-voltage power line with steel towers with height of approx. 9 m above the ground; the line leads exactly between the recorded points No. 872 and No. 873 from the navigation device GPS Garmin 695. The first hit by the UL aeroplane was – considering the flight trajectory – very likely into the tree crowns with the leading edge of the right half of the wing. It was probably followed by rotation of the UL aeroplane to the right accompanied by the hit of the left half of the wing into the trees again. After the impact, the UL aeroplane turned over around the longitudinal axis and fell to the ground on its back from an altitude higher than 10 m on the engine part of the fuselage. The engine part of the fuselage was deformed symmetrically and the engine was forced out of its embedding and wedged into the cockpit. The leading edge of the right half of the wing bore significantly less noticeable traces of a direct hit into an obstacle than the left half which showed traces of a heavy damage to the leading edge following the impact into the trees. Both the wing halves had the flaps retracted and the lever controlling the flaps was in the retracted position. The control sticks were slightly bent. The foot controls were deformed by the impact and moved in the direction inwards into the cockpit. The values on the engine gauges were all 0. The altimeter was set to the value of 1,023 hPa. The altimeter was damaged due to the impact and the altitude indication did not correspond with the actual AA altitude. The power unit control lever was in the fore position. The carburettor preheating was on. The circuit breakers on the panel in the cockpit were forced out of their slots, some were missing. Avionic Master Switch was in the OFF position. The propeller blades were broken off at the cap. The HR and RUD tailplanes were seriously damaged. After the AA, only approx. 26 l of fuel was pumped out from the aeroplane tank.



Fig. 5 Crash site location and UL aeroplane debris.

1.13 Medical and Pathological Information

After the IRS response, the pilot and the co-owner were transported with serious injuries to the DUA of the University Hospital in Brno. Their follow-up medical care required more than one month of hospitalisation at various other specialised wards of hospitals in Brno. Blood test for alcohol came with negative results.

1.14 Fire

After the UL aeroplane fall, there was no fire of the debris.

1.15 Survival Aspects

A witness reported the AA to the IRS emergency line. The man with the agricultural vehicle played a crucial role in saving the lives of the crew as he immediately arrived to the AA location. Using the hydraulic loading mechanism attached to his tractor he lifted the turned over UL aircraft, released the people stuck inside and thus made it possible for them to be subsequently extricated. At 11:28 – after the IRS response operation – the operating PCR officer in Jihlava dispatched a police unit to the AA location.

1.16 Tests and Research

NIL

1.17 Organisational and Management Information

The UL aeroplane was co-owned by the pilot and the co-owner in equal shares. The incident flight was the first flight after the takeover from the manufacturer. The aircraft was provided with the transfer TC for this transfer flight and was supposed to be registered in the country of origin of the two owners.

1.18 Supplementary information

Fig. 6 from the EV-97 EuroStar SL Aircraft Operating Manual describes the stall speeds at MTOW 450 kg in flight configurations. Chart 7 shows an excerpt from Rule L 2 determining the VMC minimum values.

SECTION 5

5. PERFORMANCE

5. 2. 2 Stall speeds

		PILOT'S OPERATING HANDBOOK		Euro Star		
5.2.2 Stall speeds						
Stall	Flaps setting	Power setting	Warning speed	Stalling speed-		
				IAS [km/h]	CAS [km/h]	
Wing level stall	"RETRACTED"	idling	No distinctive warning.	71	77	
		MCP*		59	66	
	"TAKE-OFF"	idling		67	73	
		MCP*		54	62	
	"LANDING" 1 st position	idling		Aeroplane downward motion without pitching.	63	70
		MCP*			49	57
"LANDING" 2 nd position	idling	Aeroplane is fully controllable.	58	65		
	MCP*		46	54		
Turning flight (coord. turn with 30° banking)	"RETRACTED"		idling	73	79	
			MCP*	63	70	
	"TAKE-OFF"		idling	No excessive loss of altitude during recovery.	69	75
			MCP*		57	64
	"LANDING" 1 st position	idling	*) MCP – maximum continuous power	64	71	
		MCP*		52	60	
"LANDING" 2 nd position	idling	60	67			
	MCP*	50	58			

Fig. 6 The stall speeds from the EV-97 EuroStar SL Aircraft Operating Manual

Chart 7 Rule L 2 regarding the VMC minimum values for visibility and distance from cloud for flight visibility

Altitudinal zone	Airspace class	Flight visibility	Distance from cloud
300 m (1,000 ft) AGL	G	5 km	Clear of cloud and in sight of the surface

1.19 Useful or Effective Investigation Techniques

Air accident investigation was carried out in compliance with Rule L-13.

2. Analyses

The following facts were principal in assessing and determining the causes of the air accident: the flight data recorded from the main navigational device GPS Garmin 695 used during the flight, the statements of the pilot and the aircraft co-owner, the statements of the witnesses of the AA, description of the AA location, detailed analysis of the weather at the time of the AA, assessment of the UL aeroplane piloting, and calculations of the UL aeroplane load and speed.

2.1 Crew Qualifications

The pilot had in total 300 flight hours on this type of UL aeroplane and was familiar with this type of UL aircraft as a frequent user. Together with the aircraft co-owner, he has been in the business of selling this type of UL aircraft to other users in his home country. After the transfer of the UL aeroplane during the handover flight, the factory test pilot had no significant objections to the piloting.

2.2 Flight Performance

The UL aeroplane was refuelled by the aerodrome staff member with the Natural 95 motor petrol to the maximum level at 65 l. The pilot programmed the flight route into the GPS Garmin 695 navigational device. He planned for a reserve aerodrome in Benešov, and printed out maps for approach at the destination aerodrome. He obtained the weather report for the planned flight, according to his own statement, from the SkyDemon navigational application. The pilot did not request a weather report, neither was he trying to find out any information on weather for the planned route at the METEO LKKU office. The UL aircraft after the departure from LKKU RWY02C at 08:43:35 continued via the WHISKY exit point and later to the north of Bohdalice on the planned route in the direction to the Bohdalov en-route point. During departure from LKKU, the visibility was more than 10 km and clouds SCT 2,100 ft / 640 m AGL. At 09:07:44, the pilot flew north of CTR LKTB, while visibility was over 30 km and clouds 2-3/8 CU 1,771 ft / 540 m AGL. The flight up to Bohdalov continued in accordance with the flight planning as trouble-free. At 09:35:40, at location Bohdalov (point No. 280) due to deteriorating weather conditions the pilot commenced at 2,331 ft ALT-GPS at the speed of 157 km/h GS-GPS a series of left-hand turns. After 55 minutes of flying in circles over Bohdalov (Fig. 3), the pilot evaluated the weather conditions and made decision for precautionary landing. At 10:31:28 (point No. 805), at 2,282 ft ALT-GPS at the speed of 137 km/h GS-GPS, the UL aeroplane left the location over Bohdalov by left-hand turn and turned into the 310° course towards Nížkov. At 10:34:59, at 2,177 ft ALT-GPS in the 314° course, the UL aeroplane reached position 1 km to the west of Matějov 1,939 ft / 591 ASL and 0.5 km to the south of Rosičky 2,116 ft / 645 ASL; the UL aeroplane further continued in flight towards Nížkov 1,729 ft / 527 ASL.

Between 10:00 and 11:00 UTC visibility 2,500–3,000 m and cloud 8/8 ST 090–180 m AGL was measured at the Přebyslav weather station, 1,745 ft / 532 ASL, located approx. 8.9 km to the north of the AA location. Nížkov is surrounded by three hills: in the south by Blažkov 2,276 ft / 694 ASL, in the west by Srážky 1,981 ft / 604 ASL, and 3 km to the east by Rosička (2,116 ft / 645 ASL) with a watchtower on top.

While flying towards Nížkov, the UL aeroplane crew noticed a man driving a tractor in a field and decided for precautionary landing close to him.

The pilot performed a turn over Nížkov and subsequently began to decrease the flight speed from 139 km/h GS-GPS all the way down to 98 km/h GS-GPS. At 10:38:27, the pilot overflew with the UL aeroplane at 2,035 ft ALT-GPS the power towers holding the high-voltage lines at 1,923 ft ASL.

During the overflight of this obstacle, the UL aircraft flight speed dropped from 105 km/h GS-GPS to 98 km/h GS-GPS. The UL aeroplane then continued in flight configuration without flaps down with backwind (310°/11 km/h) in the course 101° for about 200 m more. Upon retracting the backwind component of 8 km/h from the speed 98 km/h GS-GPS, the flight speed would be as follows:

$$98 - 8 = 90 \text{ km/h TAS.}$$

Speed of 90 km/h TAS is at 2,035 ft ASK by approx. 3 km/h higher than the IAS speed, which, in this case, would be:

$$90 - 3 = 87 \text{ km/h IAS.}$$

The UL aeroplane was flying with a speed margin of approx. 12.7 km/h over the calculated stall speed 74.3 km/h IAS for the weight of 510 kg. The g-load factor of the UL aeroplane with a low speed margin above the stall speed, and very likely due to the low engine power output, led to – according to the factory test pilot – typical manifestation in wing rolling. This statement corresponds with the statements of the witnesses who observed the wing rocking phenomenon in the UL aircraft shortly before the AA. It was not feasible to objectively assess any further circumstances of the flight course and the engine mode. From the weather conditions on the AA site, low visibility was ascertained manifesting itself also in the treetops being covered by low clouds. The pilot lost the visual reference to the true horizon. Significant wing rocking of the overloaded UL aeroplane was a manifestation of low speed margin during flight above the stall speed. The UL aeroplane probably hit trees with the right half of the wing and subsequently the aircraft fell down from a height of more than 10 meters onto the field.

2.3 Weather assessment

The pilot did not get acquainted with the orographic profile of the given area over which he had planned the flight, nor did he consult the METEO LKKU staff member regarding the weather development over the planned flight route. The pilot likely assumed the weather information from METARs was sufficient and thus underestimated the influence and significance of the orographic conditions in the Bohemian-Moravian Highlands (Českomoravská vrchovina) on the course of the flight. The Bohemian-Moravian Highlands rank among the critical areas of the Czech Republic with rapid changes in weather conditions; the preparations for VFR flight require thorough knowledge of weather development over the planned flight route on the part of the pilot. The pilot with UL aircraft not equipped with artificial horizon was trying to fly over the area where major visibility deterioration, loss of true horizon, and, considering the terrain ASL, also covering of the hilltops by low cloud had taken place. The pilot did not acknowledge the deteriorating weather in time and continued in flight into weather conditions for which he had not been trained and for which the UL aircraft operation was not approved.

2.4 Aircraft

The UL aircraft was completely new and approved for performing VFR flights. The stall speed of 74.3 km/h IAS was calculated as corresponding to the UL aircraft weight of 510 kg in configuration with flaps up. The behaviour of the overloaded UL aeroplane was described in recorded statements of witnesses as “*wing rolling*”. The test pilot described this known typical phenomenon as a flight of an overloaded UL aircraft with a low speed margin in the range of approx. 10–15 km/h above the stall speed combined with a low engine output. The pilot stated that during the whole flight he did not notice any defect or fault in the systems and that the UL aircraft was fully manoeuvrable. The UL aircraft MTOW of 450 kg was exceeded at the time of take-off by 84 kg, and the MLW was exceeded by 60 kg at the time of landing.

3. Conclusions

3.1 Investigation conclusions

The AAI Commission concludes as follows.

Pilot

- was medically fit;
- had a valid private pilot licence;
- had a valid radio operator licence;
- had sufficient flight experience on the given UL aeroplane type;
- had performed the navigational and meteorological flight preparations in the SkyDemon application;
- had not studied available current weather reports and forecasts for the planned flight and overflight of the Bohemian-Moravian Highlands at the LKKU METEO office;
- during the flight, the pilot did not acknowledge and assess in time the deteriorating weather conditions which deteriorated below the minimum levels for performing VFR flights;
- did not opt for flying out of the stated weather conditions and continued in flight;
- attempted precautionary landing without any visual reference;
- the statements of the witnesses and the subsequent analysis confirmed the low speed margin of the UL aircraft above the stall speed in the final phase of the flight before the AA;
- the UL aircraft was totally destroyed by the fall;
- the pilot and the co-owner were seriously injured.

UL airplane

- had a valid technical certificate and was airworthy;
- had a valid liability insurance;
- had a sufficient fuel supply for the given flight;
- the pilot did not find any defects on the UL aircraft during flight;
- the power unit was in operation throughout the whole flight;
- the MTOW of 450 kg was exceeded by 84 kg, and the MLW of 450 kg was exceeded by 60 kg;
- the stall speed of the UL aeroplane with the weight of 510 kg with flaps up was 74.3 km/h IAS.

3.2 Causes

The air accident was caused by underestimation of the Bohemian-Moravian Highlands orographic conditions and erroneous decision-making process on the part of the pilot at the moment of flying into weather conditions that were worse than the conditions stipulated by given rules for safe conduct of VFR flights.

4. **Safety Recommendations**

Given the cause of the air accident, the AAI issues no safety recommendation.

5. **Annexes**

NIL