

Safety Investigation Report



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ACCIDENT
Lockheed Model 12 ELECTRA JUNIOR
AT GENK-ZWARTBERG
ON 1 JULY 2018

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FOREWORD

This report is a technical document that reflects the views of the investigation team on the circumstances that led to the incident.

In accordance with Annex 13 of the Convention on International Civil Aviation and EU Regulation 996/2010, it is not the purpose of aircraft accident investigation to apportion blame or liability. The sole objective of the investigation and the Final Report is the determination of the causes, and to define recommendations in order to prevent future accidents and incidents.

In particular, Article 17-3 of Regulation (EU) 996/2010 stipulates that the safety recommendations made in this report do not constitute any suspicion of guilt or responsibility in the accident.

The investigation was conducted by the AAIU(Be).

Note:

About the time: For the purpose of this report, time will be indicated in UTC, unless otherwise specified.

SYMBOLS AND ABBREVIATIONS

'	Minute
"	Second
AAIU(Be)	Air Accident Investigation Unit (Belgium)
AIP	Aeronautical Information Publication
AMSL	Above mean sea level
AR	Arrêté Royal (French for Royal Decree)
ATC	Air Traffic Control
BCAA	Belgian Civil Aviation Authority
CAT	Category
CAVOK	Ceiling and Visibility OK
E	East
EASA	European Aviation Safety Agency
EU	European Union
FDR	Flight Data Recorder
FH	Flight hour
FREQ	Frequency
ft	Foot (Feet)
GND	Ground
Hz	Hertz
ICAO	International Civil Aviation Organisation
KB	Koninklijk Besluit (Dutch for Royal Decree)
Kt	Knot(s)
LDG	Landing
LH	Left hand
LT	Local Time
m	Metre(s)
METAR	Aviation routine weather report (in aeronautical meteorological code)
MHZ	MHz
N	North
NE	North-east
NOSIG	No significant change (used in trend-type landing forecasts)
PSN	Position
QFE	Barometric pressure of the aerodrome.
QNH	Pressure setting to indicate elevation above mean sea level
RH	Right hand
RWY	Runway
UTC	Universal Time Coordinated
VFR	Visual Flight Rules

TERMINOLOGY USED IN THIS REPORT

Safety factor: an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence.

Contributing safety factor: a safety factor that, had it not occurred or existed at the time of an occurrence, then either:

- (a) the occurrence would probably not have occurred; or
- (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or
- (c) another contributing safety factor would probably not have occurred or existed.

Other safety factor: a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report in the interests of improved transport safety.

Safety issue: a safety factor that

- (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and
- (b) is a characteristic of an organization or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Safety action: the steps taken or proposed to be taken by a person, organization or agency on its own initiative in response to a safety issue.

Safety recommendation: a proposal by the accident investigation authority in response to a safety issue and based on information derived from the investigation, made with the intention of preventing accidents or incidents. When AAIU(Be) issues a safety recommendation to a person, organization, agency or Regulatory Authority, the person, organization, agency or Regulatory Authority concerned must provide a written response within 90 days. That response must indicate whether the recommendation is accepted, or must state any reasons for not accepting part or all of the recommendation, and must detail any proposed safety action to bring the recommendation into effect.

Safety message: an awareness which brings to attention the existence of a safety factor and the lessons learned. AAIU(Be) can distribute a safety message to a community (of pilots, instructors, examiners, ATC officers), an organization or an industry sector for it to consider a safety factor and take action where it believes it appropriate. There is no requirement for a formal response to a safety message, although AAIU(Be) will publish any response it receives.

SYNOPSIS

Classification:	Accident	Type of operation:	Non-Commercial Cross Country	–
Level of investigation:	Standard investigation	Phase:	Landing	
Date and time:	01 July 2018 15:45 UTC	Operator:	Private	
Location:	Aerodrome of EBZW	Persons on board:	5	
Aircraft:	Lockheed Model 12 Electra Junior	Aircraft damage:	Substantial	
Occurrence category:	Loss of control on ground (LOC-G)	Injuries:	None	

Abstract

The airplane came back from an exhibition in EBUL for a landing on Runway 03 of EBZW. On the moment the tail wheel touched the ground during landing, the airplane turned to the left and frontally hit the doors of a hangar.

The shock to the doors caused some elements to the door to collapse and fall on parked aircraft, causing additional damage to a Cirrus SR20 and a Piper PA34 Seneca.

There were no injuries.

Cause

The accident was caused by a loss of control during the landing run due to the inadvertent pilot action on the rudder pedals. The deviation of the airplane caused the initiation of the conditions for a ground loop.

1 FACTUAL INFORMATION

1.1 History of the event.

The flight activity for the day was a trip to the airfield of Ursel (EBUL) for the purpose of exhibiting the airplane during the 'Ursel Avia aviation day'.

During the outbound flight from the aerodrome of Genk-Zwartberg (EBZW) to EBUL via the corridor between CTRs of EBAW and EBBR at 1400 ft, the airplane made a low-pass above the Leopoldsburg airfield (EBLE) in the scope of another aviation exhibition, the 'Eleva Days'. Arriving at EBUL, the airplane first flew a low-pass before entering downwind leg and landing at about 08:50 UTC.

The airplane remained at EBUL for about 4 hours.

The airplane took off at 13:55 UTC with one pilot and 4 passengers on board, it did a last fly-by before heading to EBZW again via VOR AFI and the CTR of EBBR. The airplane also performed a low pass at EBLE.

Arriving at EBZW, the pilot adjusted the settings when joining downwind leg of RWY 03 (engine on 2000 RPM). In final: full flaps and speed 80 mph.

From the footage of video recordings it can be seen that the landing happened slightly bumpy. The airplane first touched the runway with the left main wheel before it slightly bounced up back in the air and rolled to the right to finally touch down on first the main right gear and subsequently the left gear. On the moment the tail wheel touched the ground during landing, the airplane turned to the left and frontally hit the doors of a hangar. All occupants could vacate the aeroplane uninjured.

The pilot further stated:

"There was some crosswind from the right, so I counteracted by right bank, left rudder pedal. Landing and roll on the main gear was good but when I dropped the tail (below 40 mph as prescribed) the aircraft suddenly veered to the left. My only reaction was to brake with my RH foot (as was taught to do this by the instructor). After the incident, I realized that I was pushing on the left pedal when braking on the right one."

The occupant on the right hand seat, who holds a license as flight instructor but was joining the flight as a passenger, also tried to correct the situation by pushing on the RH pedal. He had the feeling that the RH pedal was completely pushed forward. Initially he was relaxed as the landing went good. Even the initial veer to the left wasn't considered as abnormal because of the 'P-factor'¹.

¹ At higher angles of attack (as with raising the nose during the final touchdown of the tailwheel) the downward sweeping propeller blade will have a greater angle of attack and thus create more thrust than the upward sweeping propeller blade causing a net asymmetric thrust. 2 clockwise turning propellers will have a yaw to the left as effect.

1.2 Injuries to persons.

Injuries	Crew	Passenger	Others	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	1	4	0	5
Total	1	4	0	5

1.3 Damage to aircraft.

To the Lockheed L-12A Electra Junior.

The airplane sustained damage to the nose, wing leading edge and RH engine propeller



Figure 1: Pictures showing damage to the airplane and the hangar door

1.4 Other damage.

When the airplane crashed into the hangar door, it damaged 2 aircraft parked inside.

a. Cirrus SR20

The airplane showed damages to the nose wheel, spinner cone, and scratches on the fuselage and wing.



Figure 2: Damage to the Cirrus SR20

b. Piper PA34 Seneca

Damage to the RH engine cowl.



Figure 3: Damage to the Piper PA34 Seneca

c. the Hangar.

Several sections of the hangar doors are severely damaged.

1.5 Pilot information

Age and nationality	56 years - Belgian	Medical:	Class 2 (PPL) LAPL
License:	FAA PPL license (Foreign based) issued 25/9/2007	Injuries:	None
Ratings:	SEP (land) valid until 28/02/2019 <ul style="list-style-type: none"> MEP (land) T-28 	Restraint used:	Lap belt + diagonal strap only at take-off and landing
Flight experience:	<ul style="list-style-type: none"> 700 FH ULM 1000 FH SOCATA TB-20 Trinidad 100 FH Cessna 152 250 – 300 FH North American T-28 Trojan 12 FH Piper PA-34 Seneca 50 FH Lockheed Model 12A Electra Junior <p>In the pilot's log book, only 7 FH are recorded as "Pilot in Command" for the Lockheed Model 12A Junior Electra for a total of 51.5 FH. However, the pilot stated that he flew most of the time during the ferry flight from the US to EBZW and he performed all the take-off and landings (except for 2 of them – short fields).</p>		
Licence:	The FAA licence is issued on basis of and valid only when accompanied by the Belgian License held by the pilot. All limitations and restrictions on the Belgium Pilot license apply.		

1.6 Aircraft information.

The Lockheed Model 12 Electra Junior, more commonly known as the Lockheed 12 or L-12, is an eight-seat, six-passenger all-metal twin-engine transport aircraft of the late 1930s designed for use by small airlines, companies, and wealthy private individuals. The aircraft is a scaled-down version of the Lockheed Model 10 Electra.

The Lockheed Model 12 Electra Junior had its first flight on June 27, 1936.

General characteristics

- Crew:** two, pilot and co-pilot
- Capacity:** Five passengers
- Length:** 36 ft 4 in (11.07 m)
- Wingspan:** 49 ft 6 in (15.09 m)
- Height:** 9 ft 9 in (2.97 m)
- Empty weight:** 5,765 lb (2,615 kg)
- Max. takeoff weight:** 9,200 lb (4,173 kg)
- Powerplant:** 2 x Pratt & Whitney R-985 Wasp Junior SB radial engines, 450 hp (336 kW) each
- Propellers:** Two-bladed Hamilton Standard controllable-pitch or constant-speed propeller, 1 per engine

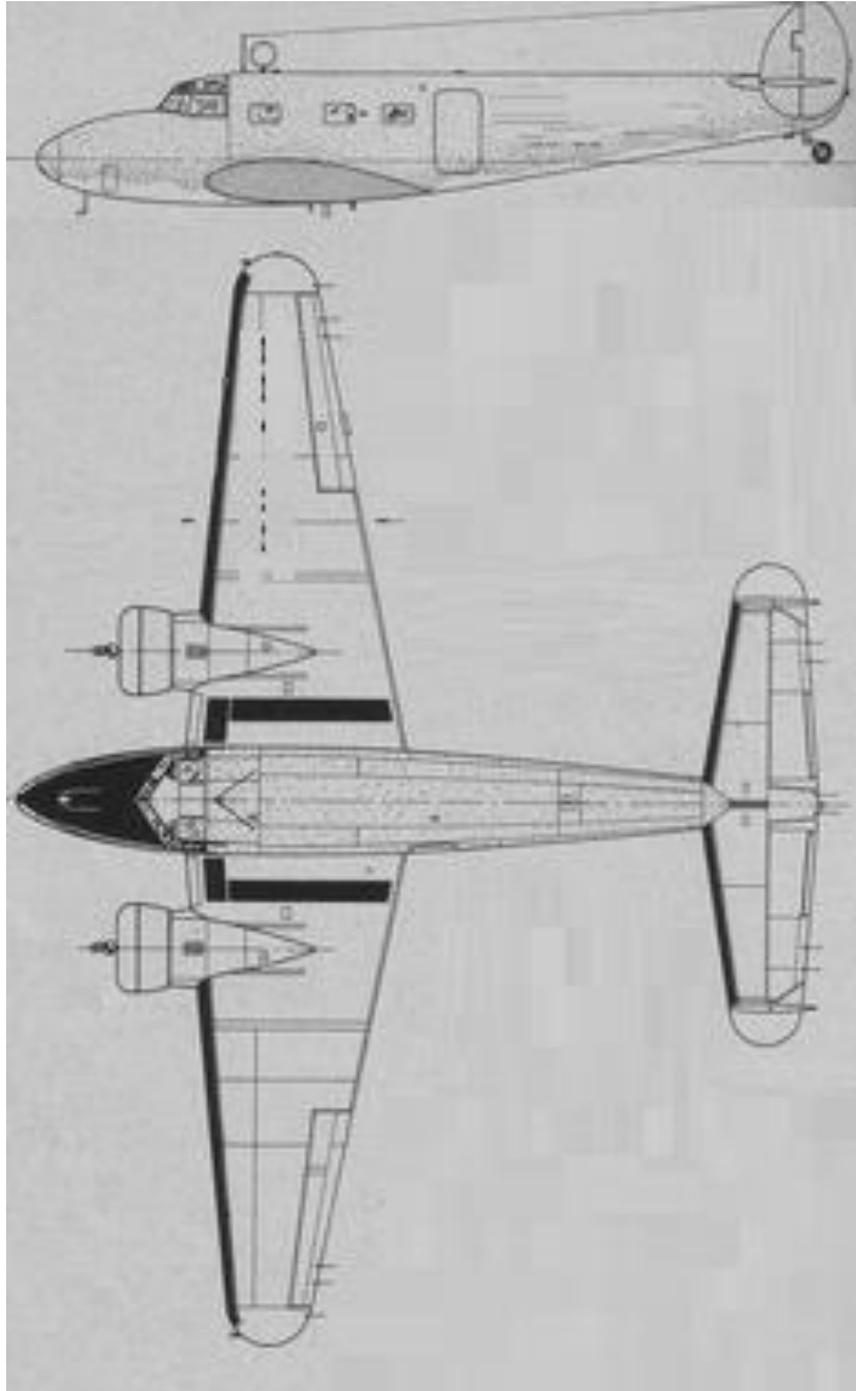


Figure 4: Lockheed L12A Electra Junior

Airplane data.

Type: Lockheed 12 Electra
Serial Nr: 1252
Registration: N14999, issued to Eastern Stearman Inc Trustee on December 29, 2017 valid until December 31, 2020. (the airplane bears a "NC - " registration for historical purposes)
Manufacturing date: 31 October 1938.

1.7 Meteorological conditions.

Source:	Liege Airport	Clouds / Visibility	CAVOK
Time:	15:50 UTC		
Distance from site:	42 km North of EBZW	QNH:	1014 hPa
Wind direction:	050°	Temperature:	27°C
Wind speed:	14 kt	Dew point:	6°C

Source:	Kleine-Brogel Air Base	Clouds:	CAVOK
Time:	15:55 UTC	Visibility	More than 10km
Distance from site:	17km NNW of EBZW	QNH:	1014 hPa
Wind direction:	070°	Temperature:	28°C
Wind speed:	09 kt	Dew point:	3°C

As can be deduced from the above tables, the wind at the approximate time of the accident was around 10 kt from 060°, causing a headwind factor of 8 kt and a crosswind factor of +/- 5 kt



Figure 5: Airfield windsock during landing

1.8 Aids to navigation

Not relevant.

1.9 Communication.

None.

1.10 Aerodrome information.

The Zwartberg airfield (EBZW) is located 5km North of the city of Genk. The aerodrome reference point is at 51°00' 55" N 005° 31' 35" E. It features a 799 m long asphalt runway. Its orientation is 034°/214°.

The use of the airfield is subject to prior permission from the airfield operator. Geography around the airfield: Genk is a former coal mining region, and there is a coal mine spoil tip remaining from these times, located East of the airfield at 1.15 km from the runway, close to the pattern. The spoil tip culminates at 666 ft AGL.

The runway is bordered by trees.

The elevation of the airfield is 279 ft.

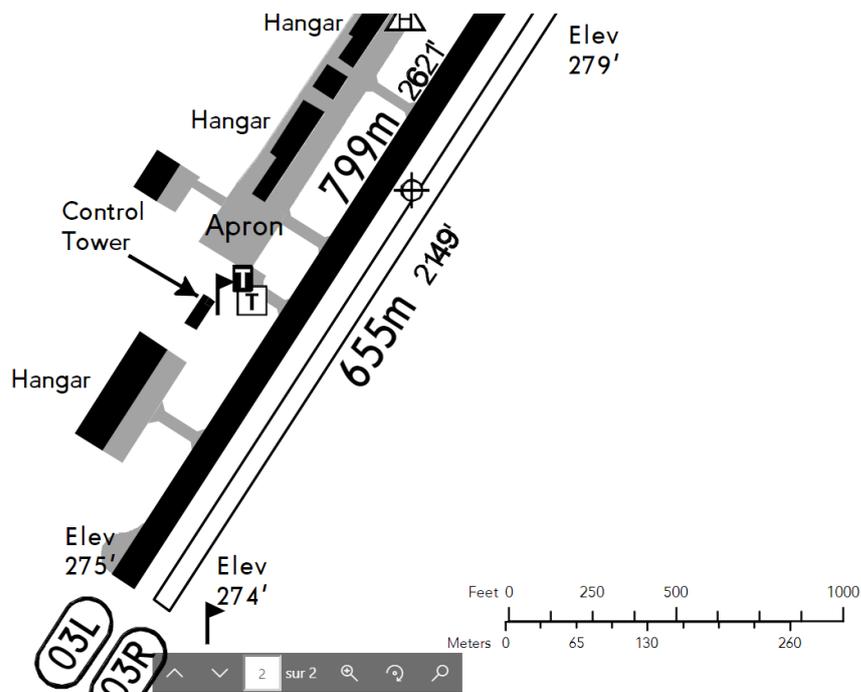


Figure 6: Airfield lay-out

1.11 Flight recorders.

There was no flight recorder installed, nor was it required.

1.12 Wreckage and impact information.

From a video taken by a person standing at the bar terrace at the moment of the landing:

<p>The touchdown occurred very close to the threshold.</p>	
<p>The initial part of the landing roll</p>	
<p>Both rudder deflection to the left.</p>	
<p>From the moment the tail wheel touches the ground, the airplane deviates to the left. The rudder control surfaces are deflected to the left.</p>	
<p>The airplane is turning to the left, exiting the runway. The traces of the tail wheel on the ground shows it is outside the path of the two main wheels.</p>	

<p>Pilot reports he applies braking to the right wheel. The sound of braking is clearly audible on the video.</p>	
<p>Airplane at 90° from the runway</p>	
<p>Airplane entering the apron</p>	
<p>Airplane crash entering the hangar. The pilot reported the shock was felt very light.</p> <p>Several sections of the hangar door were pushed out of their hinges. One door section was thrown inside the hangar, above the wing of a parked Cirrus SR20 and crashed to the ground behind the parked aircraft. Another aircraft, a Piper Seneca was also damaged</p>	

All occupants evacuated the airplane safely, without any injury. There was nobody in that section of the hangar at the time of the occurrence.

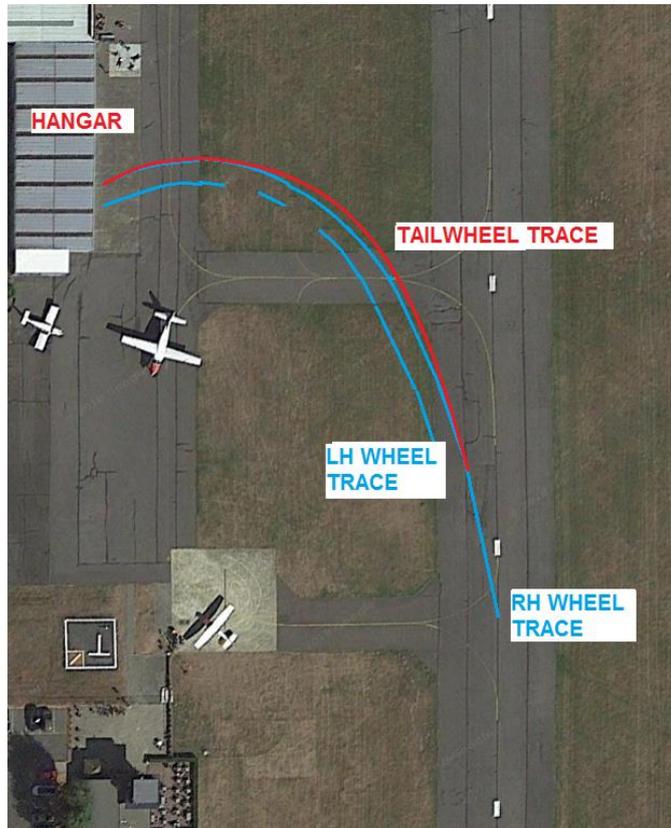


Figure 7: Wheel traces

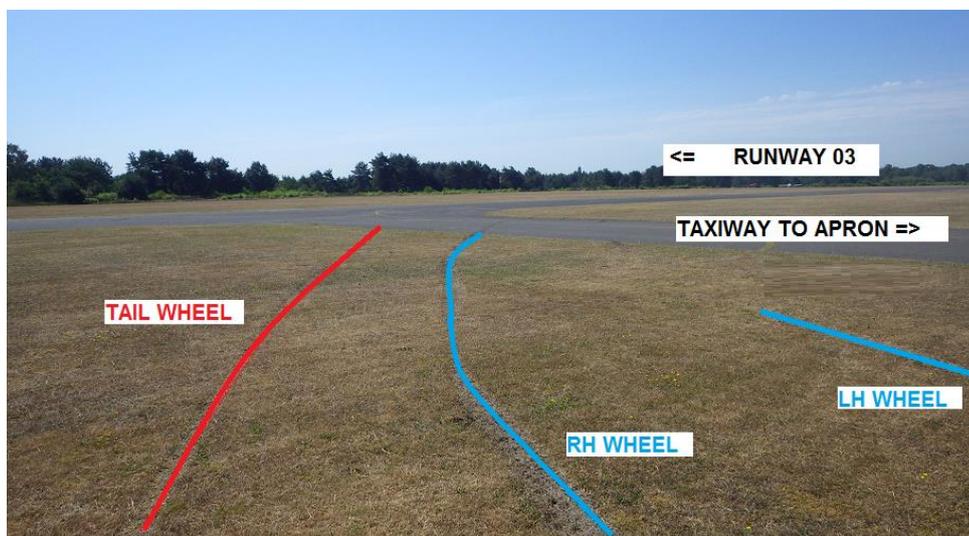


Figure 8: Wheel traces seen from the impact location



Figure 9: Wheel traces towards the impact location

Aircraft inspection.

The airplane was inspected at EBZW by the AAIU(Be) investigators on the 3rd July. No defect or anomaly that could cause the occurrence was found.

Nevertheless, the rudder control pedals of the pilot (left position) were found misaligned. The pedals are adjustable on ground. The pedals, when in neutral position, caused the rudder to deflect slightly to the right.

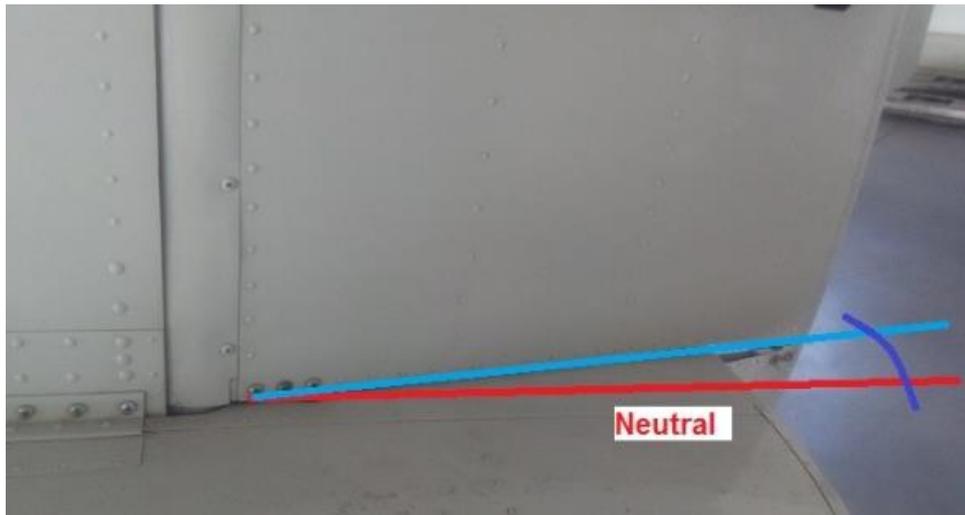


Figure 10 : Rudder pedals when left hand control pedals in neutral position

The rudder control pedals of the right position (co-pilot) were found correctly aligned.

<p>Pilot's (left seat) rudder pedals position when rudder control surfaces are in neutral position.</p>	
<p>Co-pilot's (right seat) rudder pedals position when the pilot's (left seat) rudder pedal position are aligned.</p>	

Figure 11: Pictures showing the misalignment of the left seat rudder pedals

1.13 Medical and pathological information.

Not applicable.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

About the seatbelts:

During the complete flight the pilots wore their lap belts. At take-off and landing (before entering downwind) they also made use of the diagonal strap. This isn't done during the rest of the flight because it hampers the pilot's movement and reachability of the instruments (radio). It is an adjustable strap without a reel.

Evacuation:

After the crash, the pilot instructed the occupants to evacuate the airplane out of fear that aircraft would catch fire. But as the latch of the (only) door in the back has to be turned clockwise upwards to open, which is for many people 'against nature', it took some time to get it open.

The pilot stated that, in the future, he will make a cabin safety briefing to point out the specificities in case of an emergency and subsequent evacuation.



Figure 12: Position of the latch to open the back door

1.16 Tests and research.

Not applicable

2 ANALYSIS

At the time of the landing on RWY 03, the wind was coming from 60 degrees, on the right side of the aircraft. To counteract the effect of the wind, the pilot lowered the right wing and compensated by pushing on the left rudder pedal. As the EBZW airfield is bordered by trees, the wind conditions would change close to the ground, with possible turbulent effect.

Nevertheless, from the video taken of the airplane during landing, it is obvious that the pilot maintained the left rudder pedal input upon touchdown and after the tailwheel contacted the runway.

When the tailwheel, mechanically connected to the rudder, contacted the ground, it pushed the airplane tail sideways.

For aircraft with tailwheel, if the aircraft heading is different from the aircraft's direction of motion, a sideways force is exerted on the wheels. If this force is in front of the center of gravity, the resulting moment rotates the aircraft's heading even further from its direction of motion. This increases the force and the process reinforces itself. Landing an aircraft with tailwheel can be difficult since the pilot must line up his approach very carefully while making constant rudder adjustments to keep the plane on a straight path until it comes to a stop. To avoid a ground loop, the pilot must respond to any turning tendency quickly, while sufficient control authority is available to counteract it. Once the aircraft rotates beyond this point, there is nothing the pilot can do to stop it from rotating further.

The pilot stated his reaction was to apply brakes on the right side, but this was too late and ineffective to prevent the deviation of the airplane.

The low experience of the pilot on aircraft with tailwheels is considered to be a contributing factor to the loss of control.

During inspection, the pilot's rudder pedal were found misaligned. To put the rudder in neutral position, the left rudder pedal needed to be more deflected than the right pedal, however the investigation determined that this finding had no direct bearing on the event.

3 CONCLUSIONS

3.1 Findings

- The airplane had a valid airworthiness certificate delivered by the FAA.
- The pilot was duly qualified and licensed by the FAA.
- The airplane was inspected and the flight controls showed no anomaly except that the rudder pedals position of the pilot were found misaligned, but this had no direct bearing on the event.
- The pilot has a low experience on this aircraft type and on aircraft with tailwheels.

3.2 Cause

The accident was caused by a loss of control during the landing run due to the inadvertent pilot action on the rudder pedals. The deviation of the airplane caused the initiation of the conditions for a ground loop.

4 SAFETY ACTIONS AND RECOMMENDATIONS

None issued.

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