Investigation Report

Identification

Type of Occurrence: Accident
Date: 23 June 2015
Location: Muehlenberg
Aircraft: Home-built Aircraft
Manufacturer / Model: Home-built Jabiru J430
Injuries to Persons: Two persons fatally injured
Damage: Aircraft destroyed
Other Damage: Damage to fields and buildings
State File Number: BFU 15-0764-CX

Factual Information

History of the Flight

On 18 June 2015 the pilot of a Jabiru J430 registered in France flew from Oehna to Aachen in order to pick up an Extra 300 for an air show in Oehna. The pilot was accompanied by a second pilot who would conduct the return flight with the Jabiru.

The plan was to fly the Extra 300 back on 21 June 2015. Due to the weather the flight was cancelled. During the afternoon of 23 June 2015 it became possible to conduct the transfer flight. Dinslaken was to be the transfer airport. According to a witness statement, both pilots discussed the weather conditions before the flight and came to the conclusion that a flight path staying north of Hanover could be flyable.
With the owner of the Extra 300 it was agreed to meet at 1700 hrs. The Extra 300 landed at 1747 hrs\(^1\) and the Jabiru J430 at 1833 hrs at Dinslaken. The accident pilot accessed meteorological flight briefing on a smartphone for the return flight to Oehna. Departure from Dinslaken was at 1912 hrs.

The radar data shows that at 2006 hrs, Oerlinghausen Airport was passed at approximately 1,000 ft AMSL and the flight continued west toward Bielefeld Airport. In the area of the airport the flight path ran about 2 NM to the south-west and then back toward Bielefeld. Then the flight path proceeded toward Porta Westfalica. At 2029 hrs the flight path continued at 1,400 ft AMSL and a ground speed of 140 kt farther east along the river Weser. At 2035 hrs the power plant Grohnde was passed. The aircraft began to climb from 1,400 ft AMSL to 4,600 ft AMSL in the area of Bodenwerder. At 2045:56 hrs a left-hand turn was initiated in the area of the accident site at the Solling ridge. The indicated transponder altitude was 5,300 ft AMSL and the ground speed 120 kt. After an almost 90° turn speed increased to 140 kt. The last radar target was recorded at 2046:41 hrs in the area of the accident site at 3,800 ft AMSL.

Witnesses had heard engine noises and later found wreckage parts in the town of Muehlenberg. At 2208 hrs the wreckage, including the two occupants, who had suffered fatal injuries, was found west of the town.

**Personnel Information**

The 35 year-old pilot in the left-hand seat held a Private Pilot’s Licence (PPL, Aeroplane) issued in accordance with JAR-FCL German; initially issued on 30 November 2011. The type rating for Single Engine Piston aeroplane (SEP) was valid until 13 April 2016. The licence also listed the rating for aerobatics. His class 2 medical certificate was valid until 3 April 2019. According to his personal pilot log book, he had a total flying experience of 403 hours; 27:56 hours of which were flown on Jabiru J430. In the last 30 days he had flown 18:26 hours on different types.

The 36 year-old pilot in the right-hand seat held a Private Pilot’s Licence (PPL, Aeroplane) issued in accordance with JAR-FCL German; initially issued on 13 May 2005. His licence carried the entries SEP and Flight Instructor (FI) since 9 October 2008. He had a total flying experience of 705 hours.

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\(^1\) All times local, unless otherwise stated.
Witnesses stated that he had an appointment the next day, which he really wanted to keep.

Aircraft Information

The Jabiru J430 is four-seater aircraft in composite construction. It is manufactured as home-built construction kit. The pre-manufactured parts are produced in Australia and sold as construction kits.

Manufacturer: Home-built
Type: Jabiru J430
Manufacturer's Serial Number (MSN): 757
Year of manufacture: 2011
MTOM: 700 kg
Engine: Jabiru 3300 A
Manufacturer's Serial Number (MSN): 2236
Total airframe hours: 150 hours

The aircraft was home-built in Germany. It was registered in France as kit aircraft (Connaitre la liste des kits eligbles en CNSK, 2A-0009). It was operated with a French Certificat de Navigabilite, Special de Aeronef en Kit (CNSK) dated 2 August 2011. The airworthiness certificate was valid until 20 August 2015. Between 7 July 2012 and 21 August 2013 the aircraft was operated without a valid CNSK. The French registration was limited to flights in accordance with visual flight rules during the day and without commercial purpose. The aircraft was equipped with the analogous engine monitoring instruments: altimeter, variometer, turn and bank indicator, radio, and transponder. According to the weighing report of 13 May 2011 the empty mass was 369.5 kg.

The French registration stated the maximum speed ($V_{NE}$) as 132 kt. The Flight and Operations Manual of the kit manufacturer stipulated 138 kt. The manufacturer listed the Design Diving Speed ($V_D$) with 170 kt. During type certification the wings were stressed with 6.8 g.

According to the manufacturer, the Jabiru had to be operated with AVGAS. The engine was designed for Mogas and AVGAS. According to the owner the aircraft was
operated with Mogas and AVGAS. The website of the owner listed the Jabiru for charter flights.

In the aircraft continuing airworthiness records a report dated 12 May 2014 was found. According to the report leakage of the right wing tank in the area of the seam of the fuel tank bonding had been determined. The fuel tank was removed and the surface condition replaced.

**Meteorological Information**

According to witnesses’ statements the pilot accessed GAFOR weather report with a smartphone prior to departure from Dinslaken Airport for the flight to Oehna. Sunset at Berlin was at 2133 hrs.

**Weather forecast**

According to the flight weather forecast for the aviation area north valid from 23 June 2015 at 1500 UTC to 24 June 2015 at 0300 UTC the following weather prevailed:
A low pressure system at Gotland guided cool and unstable stratified maritime air with a westerly to north-westerly flow into the area. The low pressure system moved slowly to the north-east, so that in the evening stabilising high pressure influence began to determine the weather.

In the east thundery rain still occurred, in other areas showers and individual thunderstorms prevailed, which should lessen in the evening from the north-west. The wind came from west to north-west with 7 to 12 kt, gusts 15 to 20 kt. Close to the showers gusts would increase to 25 to 35 kt.

Up to Flight Level (FL) 100 slight to moderate turbulence, below 3,000 ft AMSL and close to showers and thunderstorms moderate to heavy turbulence was forecast.

For the GAFOR area Weserbergland cloud bases with 1,000 to 2,000 ft GND and visibilities of more than 5 km with individual thunderstorms and rain were predicted.

Weather Observations in the Vicinity of the Accident Site

According to the radar image of the Deutscher Wetterdienst (German meteorological service provider, DWD) of 1900 UTC heavier precipitation echoes in the Solling area were recorded at the time of the accident. It is highly likely that the highest peaks of the Solling ridge were in clouds or just barely free of clouds.

The weather observation stations in the vicinity reported the following values:

METAR EDLP 231850Z 28009KT 240V320 7000 SHRA BKN003TCU 11/10 Q1015=
METAR EDVK 231850Z 28010KT 9000 FEW016 BKN020 11/11 Q1014=
19:00 UTC Bückeburg 29010kt 13 km RESHRA SCT010 BKN018 13/11=
Radio Communications

There were no radio transmissions between the aircraft and Flight Information Service (FIS) or with airports in the area.

Flight Recorders

Both occupants carried a tablet pc for navigation purposes on board. The flight path data was not recorded.

The air traffic service provider radar data recording was available to the BFU for evaluation purposes. The analysis of the radar recording from 1845:31 UTC to 1846:41 UTC showed that the aircraft had been at an indicated altitude of 5,200 ft AMSL initiating a left-hand turn. After 35 seconds a change of direction of approximately 180° had been accomplished; ground speed was 110 to 120 kt. After a change in direction of about 270° the turn radius become smaller, the rate of descent rose and the ground speed increased to 140 kt. The last radar target was recorded at 1846:41 UTC at 3,800 ft AMSL. The last 150° of the left-hand turn were flown in 15 seconds; altitude loss was approximately 900 ft.

Wreckage and Impact Information

The accident site was located in the area of the last radar recording in the town of Muehlenberg.

The wreckage parts were strewn across a drawn-out semi-circular arch of 500 m in diameter. Parts of the lower surface of the right wing were found at a hillside west of the state road B 497 in the town Muehlenberg. Part of the upper surface of the right wing (about 2 m x 1 m) was found on the state road. The right flap and the right winglet were found in town. Spar pieces of the right wing were found at the north-west outskirts of town. The right fuel tank and parts of the left wing were found at a hillside west of town. The fuselage was located in 240 m mean sea level approximately 500 m west at the beginning of the wreckage field.
The front fuselage stuck about 1 m deep in the ground. The airplane was found in an inverted position. The fuselage had been destroyed up to the aft row of seats.

**Wreckage Examination**

The wreckage was transported to the BFU for further investigation.

Both spar’s main fracture had occurred about 100 cm from the wing root. The fracture of the outer spar had occurred on both sides about 360 cm from the wing root.

The left spar fracture had occurred from the lower surface to the upper. This was indicated by the fracture of the upper spar cap, which was not fully severed, and a crack, which had severed the lower spar cap. The wing strut had torn out the upper lug on the wing. During the accident, the wing including spar and strut remained attached to the fuselage via the control cable and were found at the main impact site.

The right wing spar was severed at one place (main fracture area). The wing strut had been torn out of the lug on the fuselage. The clevis, at the upper end of the strut, was fractured.

The sequence of the fracture shows that the fracture of the wing occurred almost symmetrically and that the wing was bent upward. Wing ruptures indicate abnormal high stress and exhibit static rupture characteristics. There was no sign of flutter.
Deviations from the Instructions of the Kit Manufacturer

During the investigation deviations from the instructions of the Kit manufacturer were determined:

- Missing trim tabs
- Repair of the left fuel tank not according to manufacturer instructions
- Use of a non-designated fuel pipe to the header tank
- Use of a control cable in the fuselage tail not certified by the manufacturer
- No corrosion protection on the wing struts

After the repair of the left fuel tank the fuel pipes were replaced with fuel hoses according to SAE J30 R7. The owner reported that he only used control cables which were delivered with the Kit. In his opinion the trim tabs and corrosion protection were not mandatory.

Fire

There was no fire.

Additional Information

Home-built

The Kit manufacturer stated that the aerodynamic trim tabs at the elevator of the Jaribu are intended as safety measures. The trim tabs serve as attenuator mechanism preventing overspeed. The trim system of the Jabiru is designed for a maximum trimable cruise flight speed of 120 - 130 kt. In order to significantly exceed this speed considerable power on the control column has to be applied. The higher the air speed the more power is necessary to overcome the restoring power of the trim tab. In addition to the pitching-up effect damping of the phugoid motion is achieved.
The Jabiru J430 Constructor’s Manual Chapter Pre-Paint Fuselage Empennage Fit Elevator describes the fitting of the elevator to the stabiliser.

Objectives of this task:

To fit the elevator to the horizontal stabiliser, to fit the trim tabs to the elevator and the end caps to the elevator and the horizontal stabiliser. 

Fit the trim tabs

Mark the trim tab locations on the elevator from the dimensions given on the drawing on the previous page. Note that the trim tabs fit onto the top of the elevator and face downwards. 

The trim tabs of the elevator were missing on the aircraft. The French examiner stated that he had not noticed the missing trim tabs.
Weather Related Decision Making

In General Aviation entering Instrument Meteorological Conditions (IMC) often results in accidents. In 2016 Walmsley und Gilbey published the study Cognitive Biases in Visual Pilots' Weather-Related Decision Making. In the study case examples describe how private pilots interpreted given weather information and flew the flight routes. The weather information was interpreted differently and resulted in experienced pilots entering IMC more readily. The experienced pilots felt more ready to continue the flight due to previous experiences.
Analysis

General

Both occupants held valid licences and ratings to conduct the flight. The pilot of the Extra 300 conducted the return flight to Oehna. His experience on the type was limited to 28 hours, which had been conducted under visual flight rules during the day. He did not have an instrument rating. The qualification of the 36-year-old pilot had to be considered as insufficient given the instrument meteorological conditions.

The occupant in the right-hand seat had a total flying experience of 705 hours and held an instructor rating. He did not have an instrument rating.

The aircraft was operated in Germany with a French experimental certification. It was neither certified nor equipped for instrument meteorological conditions. Operation in Germany partially occurred beyond the certification restrictions in charter operation. The Kit Manufacturer’s specification that only AVGAS was permitted was not adhered to, because sometimes Mogas was used. During construction and subsequent checks, the French examiner did not notice the missing trim tabs.

Technical Examination

The fracture of the wing was a result of overstressing the structure. Exceedance of $V_{NE}$ and simultaneous flare resulted in the fracture of the structure. This caused an increase in the lift coefficient ($C_L$) to approximately $C_L = 1.6$ and an acceleration of 8 g.

Initially the respective lugs fractured which meant the connection with the fuselage was lost and the wings could be bent upward until they fractured, which subsequently led to the fracture of the spars. It is highly likely that the fracture of the clevis occurred after the lugs had been torn from the fuselage. The fractures were a result of the large upward force which overstressed the structure.

According to the manufacturer, at reaching maximum speed, the trim tabs would have created a stabilising and righting moment. It is possible that the loss of control may not have occurred in the reconstructed chronological order.

The BFU is of the opinion that overstressing was a result of pulling during high-speed flare.

Flight Weather

The two pilots flew to Dinslaken on different flight routes. While the Extra 300 pilot chose an almost direct flight, the second pilot flew farther north.
Prior to the return flight, the pilot had used a smartphone to collect weather information. The return flight to Oehna was started under moderate weather conditions. The direct flight path would have been 230 NM long which could have been flown in about 1:50 hours of flight time. Until sunset in Oehna 2:20 hours remained. The deviation via Bielefeld and Porta Westfalica shortened the flight time until sunset. Further deviation to the north would have resulted in landing at Oehna after sunset. After Porta Westfalica, the pilot decided to follow the river Weser upriver. He encountered worsening weather conditions. It is possible that the change of altitude was an attempt to avoid the clouds. In the further course of the flight the airplane flew into approaching thunderstorms and extreme rain. The radar data of this area shows heading and altitude changes. It is possible that the turn initiated in the area of the accident site was an attempt to avoid the clouds. Initially the turn had been controlled but developed into one with an ever decreasing radius. Rate of descent and speed increased severely. It is highly likely that the aircraft encountered instrument meteorological conditions which resulted in loss of control and overstress of the structure.

The expert opinion of the DWD summaries as follows:

*With a sufficient meteorological pre-flight preparation it should have been evident that even more severe showers occurred along the route. [...] Which meteorological pre-flight preparation the pilot had done cannot be said.*

**Actions of the Pilot**

The BFU is of the opinion that it is highly likely that the pilot was under high mental pressure to conduct the flight. The transfer of the Extra 300 had been postponed several times. At the day of the accident, the weather conditions only permitted a transfer in Dinslaken. The accompanying pilot in the right-hand seat had an appointment the next day which he could not postpone. Assuming that the transfer of the Extra 300 would happen at 17:00 hrs, the window for the round-trip would have been sufficient to plan for alternative routes. The delayed landing of the Extra 300 at 1747 hrs and of the Jabiru at 1833 hrs resulted in a significantly smaller window for the return flight. With take-off at 1912 hrs in Dinslaken the pilots had 2:20 hours until sunset for the return flight. The distance to Oehna on direct heading was 230 NM and could have been flown in 1:50 hours. At the time they reached Porta Westfalica, it was no longer realistic to reach Oehna prior to sunset.

The remaining time until the destination airport Oehna and the interpretation of the flight weather influenced the choice of flight path. A flight path, which would have led
around the approaching storm front, would not have been possible in the remaining
time until sunset. The BFU is of the opinion that the experience from the outbound
flight, that the weather was controllable and no conservative flight planning (flying
farther north) necessary, resulted in the choice of flight path between take-off and
Bielefeld. The worsening weather conditions were interpreted wrongly and resulted in
the continuing flight in instrument weather conditions. The decision, at about Porta
Westfalicia, to fly along the river Weser upstream may have been influenced by the
remaining time until sunset. Another deviation downriver would have resulted in
landing way after sunset.

The option for a diversion to airports along the flight path was not recognised. There
were no radio transmissions with Bielefeld Airport, Porta Westfalica Airport, and
Hoxter-Holzminden Airport or the Flight Information Service (FIS). The pilot did not
use the chance to obtain weather information to plan the continuing flight.

The BFU is of the opinion that the continuing flight and entering instrument
meteorological weather conditions (from VMC to IMC) unintentionally resulted in
increased psychological stress. The pilot lost control of the aircraft due to loss of
visual reference. Consequently, the speed quickly increased. The absence of the
counterforce of the not-installed trim tabs allowed the speed to increase faster. As
wing ruptures are static in upward overstress without signs of flutter, it is highly
probable that a firm flare of the aircraft was made by one or both pilots to stop the
steep dive, resulting in the rupture. The absence of the trim tabs allowed a greater
deflection of the elevator which then resulted in higher load factors. It is highly likely
that flaring the aircraft out of the steep dive was done too abruptly. This resulted in
the overstress of the structure.

Conclusions

The accident was caused by the pilot flying into instrument meteorological conditions
which resulted in an uncontrolled flight attitude, which in turn resulted in structural
failure due to overstress.

Contributory factors were the lack of qualification of the pilot to control an aircraft in
IMC and the aircraft equipment geared to visual flight rules. In addition, both
occupants were under mental pressure to reach the aerodrome of destination on
direct course.

Since the trim tabs were not installed on the elevator, it was possible to perform a
flare with higher load factors due to a greater deflection of the elevator.
This investigation was conducted in accordance with the regulation (EU) No. 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and the Federal German Law relating to the investigation of accidents and incidents associated with the operation of civil aircraft (Flugunfall-Untersuchungs-Gesetz - FlUUG) of 26 August 1998.

The sole objective of the investigation is to prevent future accidents and incidents. The investigation does not seek to ascertain blame or apportion legal liability for any claims that may arise.

This document is a translation of the German Investigation Report. Although every effort was made for the translation to be accurate, in the event of any discrepancies the original German document is the authentic version.