

Interim Report

Identification

Type of Occurrence:	Accident
Date:	23 June 2014
Location:	Near Olsberg-Elpe
Type of aircraft:	1.) Airplane 2.) Airplane
Manufacturer / Model:	1.) Learjet Corporation / Learjet 35 A 2.) Eurofighter GmbH / Eurofighter
Injuries to Persons:	1.) Pilot and co-pilot fatally injured 2.) None
Damage:	1.) Aircraft destroyed 2.) Aircraft severely damaged
Other Damage:	Crop damage
Information Source:	Investigation by BFU
State File Number:	BFU 1X002-14
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Factual Information

After collision with a Eurofighter, the Learjet 35 A crashed to the ground. The pilots of the Learjet suffered fatal injuries and the aircraft was destroyed. The pilot of the Eurofighter could land the severely damaged airplane at Nörvenich Air Base.

History of the Flight

At 1304 hrs¹ the Learjet 35 A (Learjet) had taken off at Hohn Airport from runway 26 with two pilots on board. The plan was to conduct a military interception and identification exercise.

The Flight Data Recorder (FDR) of the Learjet showed that after take-off the airplane had turned south and climbed to Flight Level (FL) 350. After about 15 minutes in FL350 the airplane descended and at 1356 hrs levelled off in 5,000 ft AMSL. The airplane flew three full circles and then turned north.

During the exercise the aircraft involved were in radio contact with controllers of a military control and reporting centre but used different frequencies. The work stations of the controllers were adjacent to each other.

At 1419:45 hrs the controller instructed the Learjet crew: "... climb to eight-thousand feet". The Learjet began the climb. After about one minute the controller instructed: "... start a right-hand delay turn." This was affirmed. At about 1422 hrs the aircraft reached 8,000 ft AMSL after one full circle.

At 1420 hrs the formation of two Eurofighters took off from Nörvenich Air Base. After take-off the formation established contact with the military control and reporting centre. The controller took over radar guidance of both airplanes. The initial flight direction was east. On enquiry by the controller the pilot of the Eurofighter leading the formation reported at 1426:31 hrs he had visual contact with the target aircraft ("Tally"). At that time the two airplanes were approximately 6 NM away from the Learjet in about 3,300 ft AMSL. The controller issued the clearance to climb to the altitude of the target aircraft and instructed a left-hand turn to 030°.

At 1427:00 the Learjet crew was informed that the Eurofighter pilots had reported to have visual contact with them.

¹ All times local, unless otherwise stated.

At 1427:26 hrs the pilot of the Eurofighter leading the formation acknowledged the course instruction and reported that he would conduct the approach without radar guidance by the controller ("Judy"). The controller confirmed this. The Eurofighter leading the formation approached the Learjet; the other Eurofighter followed about 2 NM behind. At 1429:14 hrs, after he had asked the controller: "... ready to copy ID?", the pilot of the Eurofighter leading the formation began to describe the characteristics of the target aircraft such as colour and registration as well as his observations. This report lasted for about two and a half minutes.

According to the Cockpit Voice Recorder (CVR) the Pilot in Command (PIC) of the Learjet said to his co-pilot at 1430:40 hrs: "Da kommt er links" (here he comes, left). The co-pilot said "speed up zwei fünfzig". The FDR recorded in this phase an increase in engine performance and indicated airspeed to approximately 250 kt. At 1434:10 the controller informed the crew: "... for your information the QRA will perform an obey-check on your left side and after three minutes you should obey". The PIC answered: "That's copied. And so far no calls heard on the guard".

At 1434:10 hrs the controller instructed the Eurofighter pilot to check if the Learjet pilot was obeying instructions (obey check) and following him toward the south-east. At 1435:04 hrs the pilot answered: "Aircraft is not obeying he is not turning". The pilot added: "... only waving at me they are not following left-hand turn", he began at 1437:25 hrs to radio the Learjet crew.

At 1435:30 hrs the Learjet crew reported to the controller: "We received a first wing-rock, we're waiting three minutes and then obey". The controller acknowledged this information.

At 1438:00 the controller issued the following instruction to the Eurofighter pilot: "Try again if the aircraft is obeying your orders and again heading is south-west I authenticate at minute three eight...".

At 1438:10 hrs the controller radioed the Learjet crew: "... for your information, you overwhelmed the hijacker and now you will obey the orders of the QRA and call them on the guard".

According to the FDR at 1438:10 hrs the Eurofighter began to alternately roll about its longitudinal axis and at 1438:16 hrs it initiated a left-hand turn. About two seconds later the bank angle reached approximately 20° and within two seconds increased to approximately 27°.

According to the FDR of the Learjet, the autopilot was disengaged at 1438:13 hrs and one second later the aircraft had a bank angle to the right of approximately 5°. After about one second the bank angle decreased to approximately 3° and until 1438:16 hrs increased again to approximately 5° right. The airplane made a left-hand turn and at 1438:18 hrs it had a left bank angle of 4° when the co-pilot said: "Kannst du mal nehmen, ich kann den nicht mehr sehen" (can you take over, I can no longer see it). One second later, at 1438:19 hrs, N1 of both engines was increased from approximately 73% to about 88%. At this time, the left bank angle had reached 13° and increased still further.

At 1438:22 hrs the Eurofighter pilot said: "Now the aircraft is responding and following in a left-hand turn". During the next six seconds until the collision, altitude, indicated airspeed, and bank angle of the Eurofighter remained almost constant.

At 1438:23 hrs the PIC of the Learjet had answered the radio transmission of the controller with: "Roger". At 1438:26 hrs he said: "Nimm mal den Computer" (take the computer). At this point the bank angle to the left was 52°. At 1438:28 hrs the CVR recorded dull sounds before the recording stopped after one second.

At the time of the collision the FDR of the Learjet recorded a heading of 358° and a left bank angle of 46°. The FDR of the Eurofighter recorded a heading of 001° and a left bank angle of 26°.

Ten seconds after the collision, at 1438:48 hrs, the radio transmission of the Eurofighter pilot was recorded: "Mayday, mayday, mayday".

The Learjet crashed to the ground in the area of Olsberg-Elpe. The two pilots suffered fatal injuries and the aircraft was destroyed.

At 1439:09 hrs the pilot of the Eurofighter leading the formation informed the controller: "... crashed with Learjet probably [...] left-hand turn direct inbound Nörvenich declaring emergency." The controller instructed the pilot to set the emergency transponder. This was affirmed.

At 1442:45 hrs the pilot of the second Eurofighter radioed the controller and transmitted the coordinates of the accident site of the Learjet. At 1443:25 hrs the pilot of the second Eurofighter requested the controller to issue a clearance for a direct approach to Nörvenich Air Base. The controller asked the pilot of the Eurofighter leading the formation if he still needed the support of the second airplane.

He asked the pilot of the second Eurofighter if he could fly to the accident site. The pilot answered: "... Currently doing a structural damage check [...] severely damaged on the right-hand side he needs my assistance right now." The he added: "Able to come back to downed aircraft position once he is save down in Nörvenich."

At 1445:56 hrs the controller instructed the Eurofighters to change frequencies.

The pilot of the Eurofighter leading the formation stated that after take-off the two fighter planes flew with Mach 0.3 and in accordance with the controller's instructions accelerated to 450 KIAS. The two airplanes had approached the Learjet from the lower left. By flying turns and using the air brake the pilot reduced the speed of the Eurofighter. He had flown left of the Learjet and conducted an identification. Subsequently, he had conducted the obey check. Initially the Learjet crew had not responded. He tried to contact the Learjet using the Guard Frequency, but the crew had not responded. Then the Learjet responded to the obey check. Subsequently, he had initiated a left-hand turn with a bank angle of 15 - 25°. He had been looking into the cockpit then the jolt occurred. The other airplane had disappeared. In the mirror he saw black smoke. Subsequently, he made the distress call and discontinued the exercise. He stated that the right engine thrust controller had been jammed at 75 - 85% NH and he therefore shut down the engine right before the landing.

At 1458 hrs the Eurofighter landed on runway 07 at Nörvenich Air Base.

The pilot of the second Eurofighter stated that he flew 1.5 - 2 NM behind the other two aircraft as intended. The pilot of the Eurofighter leading the formation had steered the airplane left of the Learjet and conducted a cockpit check. From his position he could not see if the airplanes had rocked their wings. After checking his instruments he noticed a "small explosion". The video recordings of the head up display showed reflections of fire lasting about two seconds and then black smoke. A short while later he heard the distress call of the Eurofighter leading the formation. After he had escorted the damaged Eurofighter to Nörvenich Air Base, the pilot flew to Köln-Bonn Airport and landed there at 1505 hrs.

Personnel Information

Learjet 35 A Crew

Pilot in Command

The 50-year-old PIC held an Air Transport Pilot's License (ATPL(A)) of the European Union issued in accordance with Part-FCL. It was first issued on 11 December 2013 and valid until 16 February 2015. The type rating for the Learjet 20/30 and the Instrument Rating (IR) were also valid until 16 February 2015.

His medical class 1 certificate was issued on 25 September 2013 and valid until 15 October 2014.

His total flying experience was about 7,505 hours; approximately 3,554 hours of which were on the type. About 3,935 hours of his total flying experience he acquired on military aircraft.

The pilot had been employed by the company since 1 January 2004.

Co-pilot

The 43-year-old co-pilot held an Air Transport Pilot's License (ATPL(A)) of the European Union issued in accordance with to Part-FCL. It was first issued by the Luftfahrt-Bundesamt (German civil aviation authority, LBA) on 22 January 2014 and valid until 30 June 2015. He had the rating as co-pilot on Learjet 20/30, and the IR and they too were valid until 30 June 2015.

His medical class 1 certificate was issued on 5 May 2014 and valid until 19 November 2014.

The pilot had a total flying experience of about 3,560 hours; approximately 745 hours of which were on the type. He had acquired 2,814 flying hours on military aircraft.

The co-pilot had been employed by the company since 1 July 2012.

Eurofighter Pilot

The 33-year-old pilot held a Military Pilot's License. It was initially issued on 2 July 2004 and was valid until 17 December 2014. He had Eurofighter and instrument ratings.

His total flying experience was about 1,465 hours, approximately 406 hours of which were on the type. Within the last 60 days he had flown 12 hours on the type; in the last 90 days 17 hours. In 2013 the pilot had acquired approximately 167 flying hours and 34 hours in the simulator.

In 2014 he had flown eleven, in the previous year twenty-six identification and interception missions.

Aircraft Information

Learjet 35 A

The Learjet is a twin-engine business jet in all-metal construction. It is a low-wing airplane with T-tail configuration. The aircraft had a valid German certificate of registration.

Manufacturer:	Learjet Corporation
Type:	Learjet 35 A
Manufacturer's Serial Number (MSN):	35A-612
Year of manufacture:	1986
Total operating time:	about 8,259 hours
MTOM:	8,890 kg
Fuselage length:	14.84 m
Wing Span:	12.07 m
Engines:	Honeywell TFE731-2-2B

The latest Airworthiness Review Certificate (ARC) was issued on 19 February 2014 and valid until 27 January 2015.

A tablet computer was used as additional navigation equipment during flights.

Operator

The Learjet was operated by a German operator. The operator held an Air Operator Certificate (AOC) valid until 30 June 2015 issued by the Luftfahrt-Bundesamt. The AOC carried the entry commercial transport of passengers and freight.

Eurofighter

The Eurofighter is a single-seat, twin-engine, multi-role fighter in composite construction. It has a canard foreplane / delta wing configuration.

The aircraft had a German military certificate of registration.

Manufacturer: Eurofighter GmbH
Type: Eurofighter
Manufacturer's
Serial Number (MSN): GS0070
Year of manufacture: 2012
MTOM: more than 23,500 kg
Fuselage length: 15.96 m
Wing Span: 10.95 m
Engines: Eurojet EJ200

Total operating time of the aircraft was approximately 329 hours.

The airplane was equipped with two external fuel tanks (tank capacity 1,000 litres each) fitted below the wings at the centre wing station. Below the left wing the outboard wing pylon carried an air/air training rocket fitted to a rail launcher. Below the right wing a multi-function rail launcher was fitted to the outboard wing pylon.

Meteorological Information

Visual Meteorological Conditions (VMC) prevailed at the time of the accident. According to the statement of the Deutscher Wetterdienst (German meteorological service provider, DWD) the following weather conditions prevailed:

Clouds: 3-4 oktas Cumulus in 4,500 ft AMSL
5-7 oktas Cirrus in FL180
Visibility: More than 10 km
Barometric air pressure (QNH): 1,018 hPa

Communication

Radio communications and the phone calls of the controllers were recorded and made available to the BFU for evaluation.

Flight Recorder

The Learjet and the two Eurofighters were equipped with cockpit voice recorders and flight data recorders. These and the video recordings of the head up displays of the two fighters were read out and available for the investigation.

In addition, the system failure messages recorded in the Portable Maintenance Data Storage (PMDS) of the Eurofighter were analysed. At 1438:35 hrs the messages that one wing pylon was no longer electronically registered in the system and the loss of one outboard tank were recorded. At 1438:59 hrs the system recorded a failure message regarding the failure of the right engine's accessory gearbox and the failure of the right alternating current generator. At 1454:45 hrs a failure message concerning the right engine control (problems with the mass flow) was recorded.

The flight paths of the three aircraft were recorded by military and civilian air traffic service providers and made available for the investigation.

Wreckage and Impact Information

Accident Site Learjet 35 A

The Learjet impacted a slope, which declines to the west, in an inverted attitude with large nose-down pitch angle. The distance between several buildings and the place of impact was approximately 100 m.

At the impact site the left wingtip tank stuck in the ground. In the area surrounding the impact site the elevator and the vertical tail of the airplane were found. The FDR was found about 20 m and the CVR about 30 m to the north.

The right engine had fractured between compressor and turbine and was found about 75 m downslope from the impact site. In this area the right wingtip tank was found.



Dimension of the accident site of the Learjet 35 A

Photo: Police

The left engine was found about 1.3 km south of the main wreckage. Parts of the cowling of the right engine were found about 2.7 km south of the main wreckage.



Left engine (left) and the cowling of the right engine (right)

Photos: BFU

A 2.5 m long piece of the interior cabin panelling of the Learjet was found about 2.9 km away from the main wreckage.

The right fuselage emergency exit door of the Learjet was found 2.7 km south of the main wreckage. The inside of the door showed traces of fire.

Findings on the Eurofighter

The Eurofighter was examined at Nörvenich Air Base. It was determined that the rail launcher at the outboard wing pylon below the right wing was fractured in the front third and bent towards the fuselage. In the rail a white part of the Learjet fuselage was found. At the aft part of the rail launcher, parts of the insulating material from the Learjet fuselage were found.

The lower surface of the inner elevon and parts of the nozzle of the right engine showed blue paint transfer.

The entire right engine was deformed towards the longitudinal axis of the airplane.



Damages on the tail of the Eurofighter

Photo: BFU

The outboard tank of the fighter had been torn off and separated into two pieces. One of the pieces still carried the jettison. One piece was found 2.1 km and the other 2.3 km south of the main wreckage of the Learjet.



Parts of the outboard tank of the Eurofighter



Photos: BFU

Approximately 2.4 km south of the Learjet's main wreckage the following parts of the Eurofighter were found: pieces of the nozzle of the right engine, carbon composite pieces of the aft fuselage and the cowling of the inner elevon track and carriage of the right wing.



Parts of the nozzle (left); carbon composite structure of the Eurofighter

Photos: BFU

The braking parachute of the Eurofighter was found in a tree approximately 4.5 km south of the main wreckage of the Learjet.

Fire

The recordings of the head up display of the second Eurofighter and the traces on wreckage parts of the Learjet show that the collision resulted in fire.

Additional Information

Planned Training Procedure

According to the schedule dated 13 June 2014 prepared by the Zentrum Luftoperationen der Luftwaffe, the intent was to conduct a military exercise in which the Learjet would pose as unidentified airplane without radio contact. The Learjet was to fly north and the Eurofighter formation had to identify and accompany it to Wunstorf Air Base. The exercise should have ended with an overflight of Wunstorf Air Base. The exercise was to be conducted under Visual Flight Rules (VFR).

Aviation Regulation

The Aeronautical Information Publication (AIP) Chapter ENR 1.12 Interception of Civil Aircraft states:

1. Signals initiated by the intercepting aircraft and action to be taken accordingly by the intercepted aircraft:

Signals from the intercepting military or police aircraft

1. (a)

– **Day:**

Rocking wings alternately from a position slightly above and ahead of and, normally, to the left of the intercepted aircraft. After acknowledgement of the signal, a slow level turn, normally to the left, onto the desired heading.

Meaning:

Follow me.

[...]

Action to be taken by the intercepted aircraft

Aeroplanes

– **Day:**

Rock wings alternately and follow

Meaning:

Understood, will comply

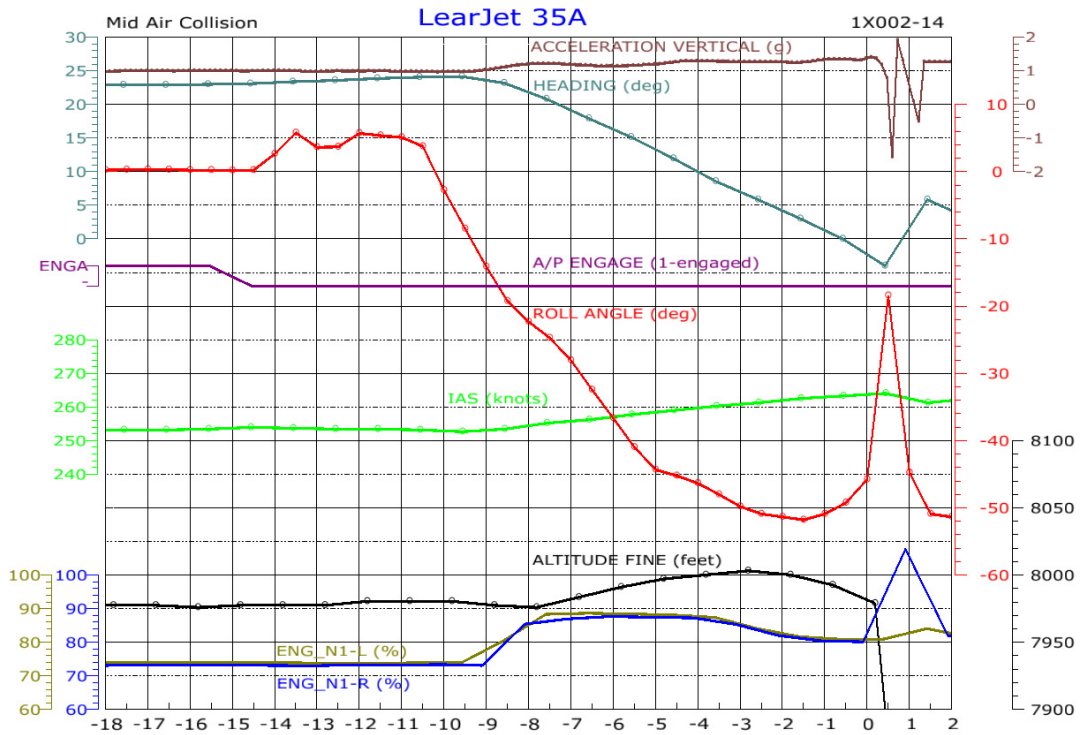
[...]

Investigator in charge: Jens Friedemann
Field investigation: Lutz Jäkel, Lothar Müller, Jens Friedemann
Assistance: Lutz Jäkel, Christian Blanke, Dieter Ritschel,
Philipp Lampert, Hans W. Hempelmann

Appendices

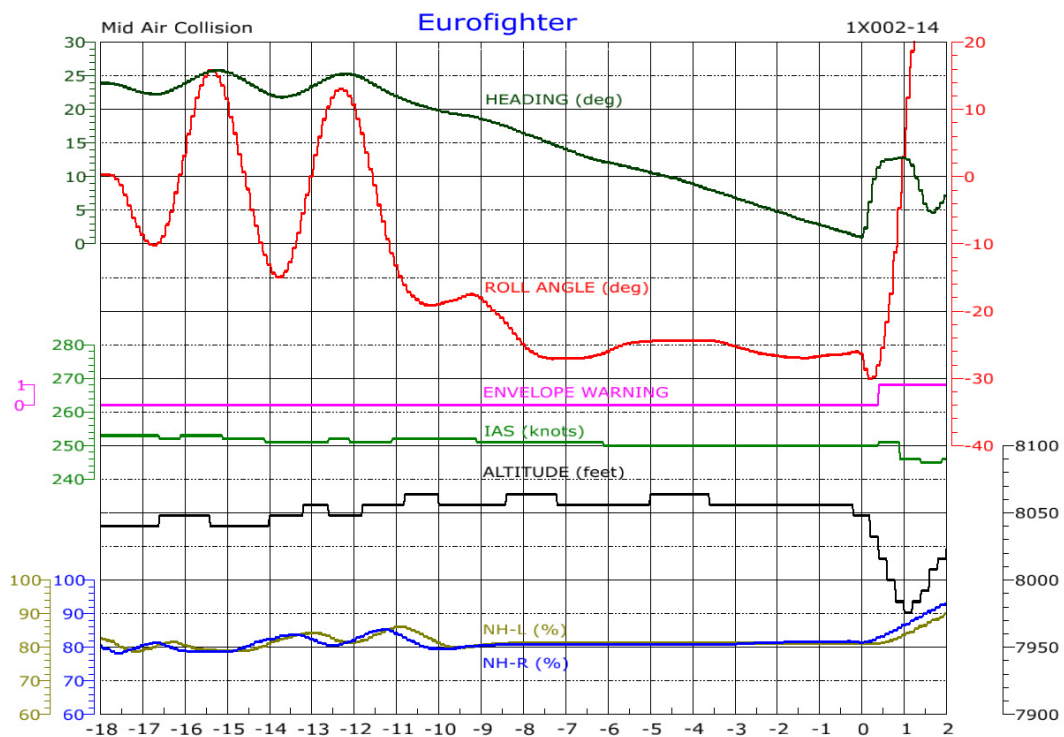
Excerpt flight data recorder Learjet 35 A

Excerpt flight data recorder Eurofighter



Preliminary Data, file: acc_LearJet35A Seconds related to first touch
 Created: July 30, 2014
 Revised: July 31, 2014

BFU Germany
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Preliminary Data, file: acc_Eurofighter Seconds related to first touch
 Created: August 21, 2014
 Revised: August 21, 2014

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This investigation is 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 - FIUUG*) 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.

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