

# Investigation Report

EX001-0/05  
April 2007

## Identification

Type of occurrence: Serious incident  
Date: 1 March 2005  
Location: Frankfurt / Main  
Aircraft: Transport aircraft  
Manufacturer / Type: Embraer / ERJ 170  
Injuries to persons: No injuries  
Damage: Slightly damaged  
Other damage: Approach lighting  
Information Source: Investigation by BFU

## Factual information

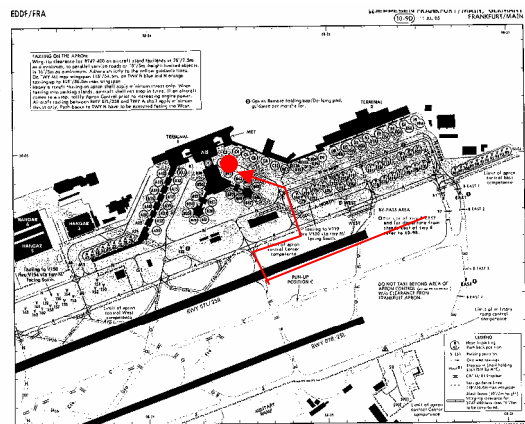
### History of the flight

On 1 March 2005 an Embraer 170 was on approach to runway 25R of Frankfurt/Main Airport. Shortly before touchdown the airplane's main landing gear tires had contact with the approach lighting. It resulted in damage to the landing gear and the approach lighting. Passengers were not injured.

The airplane started from Milan-Malpensa at 21:25 hrs<sup>1</sup> with a delay of about 30 minutes and with 24 passengers and four crew members on board. Destination was Frankfurt/Main. An instrument landing system (ILS) approach with engaged autopilot was carried out until an altitude of about 340 ft was reached. Then the co-pilot became pilot flying and controlled the airplane manually. The

pilot-in-command handled radio communications and all other necessary tasks.

The approach was flown without incident until the manual control of the airplane. Afterwards the airplane underflew the 3° ILS glide slope continuously. As a result, the airplane came in contact with the approach lighting 60 m in front of the threshold. The airplane taxied via taxiways F, A and E to gate B2.



Taxiway to Gate B2

### Personnel information

Both pilots held valid licences and ratings in order to conduct the flight.

The pilot-in-command, age 48, had a total flight experience of about 12,000 hours, 360 hours of which were on ERJ 170. Flight time of the last 90 days was 140 hours and 3 hours within the last 24 hours prior to the incident.

<sup>1</sup> Unless otherwise specified, all times are indicated in local time

The co-pilot, age 36, had a total flight experience of about 1,800 hours, 300 hours of which were on ERJ 170. Flight time of the last 90 days was 140 hours and 3 hours within the last 24 hours prior to the incident.

Both pilots had a rest period of about 16 hours prior to the flight. On this day, duty time was 8 hours and 15 minutes. There were no medical restrictions.

#### Aircraft information

The airplane was manufactured in Sao Jose dos Campos, Brasilia, by Embraer and is a twin-engine passenger jet of the newest generation. The airplane with the MSN 17000009 was delivered in April 2004. On 4 May 2004 the airplane received an Irish registration and has been flying for an Italian operator in scheduled air services ever since.

Maximum take off weight (MTOW) is 37,200 kg. Maximum landing weight (MLAW) is 32,800 kg. The actual landing weight during the incident was 26,860 kg. Centre of gravity was within limits.

#### Meteorological information

At the time of landing, visibility was more than 10 km, cloud base was above 5,000 ft and the wind was blowing from a southern direction.

#### Aids to navigation

For landing direction 25R the ILS on frequency 109.5 MHz including the respective outer marker (OM) and middle marker (MM) were available. Additionally, the NDB FR on frequency 297 kHz was available at the location of the OM. The DME FRD on frequency 115.9 MHz was in operation. All systems functioned properly.

#### Communication

Radio communications were held in English. There were no communication problems.

#### Aerodrome information

Frankfurt/Main Airport has two parallel runways (25R and 25L) with a length of 4,000 m each. The right-hand runway has a width of 60 m and the left-hand runway a width of 45 m. The terminal is located north of the runways. Gate B2 is a "nose-in" gate at terminal 1. It can be reached via taxiways A and E

#### Flight recorders

The secured flight data recorder is a combination of cockpit voice recorder and flight data recorder (DVDR) manufactured by Honeywell with the serial

number S/N 237, P/N 980-6025-001. The flight data recorder records 774 parameters. Recording time of the cockpit voice recorder is two hours. The airplane had two units of identical construction aboard. Only the one described above was evaluated by the BFU.

#### FDR evaluation (see Appendix 1)

- The autopilot was disengaged 29 seconds prior to touchdown in an altitude of about 340 ft. The co-pilot controlled the airplane manually after that.
- Indicated airspeed (IAS) was constant 120 kt.
- 27 seconds prior to touchdown the airplane was moved below the 3° glide slope through control inputs from the right-hand control column. Pitch moved from +1° to an average of about 0°.
- For 25 seconds the airplane travelled below the ILS glide slope.
- Five seconds prior to touchdown the flare out began. Speed decreased and pitch increased to +4.3°.
- During the entire approach until touchdown autothrust was engaged.

The cockpit voice recorder did not provide any evidence concerning flight status and approach briefing because the recorder remained engaged for another two hours after the landing. The recordings start at the point where the airplane left the runway via taxiway F and the taxiing instruction of Frankfurt Ground.

#### Wreckage and impact information

The airplane suffered significant damage on the main landing gear, the fuselage underside and the right-hand flap (see photos).



Right-hand main landing gear



Right-hand fuselage underside

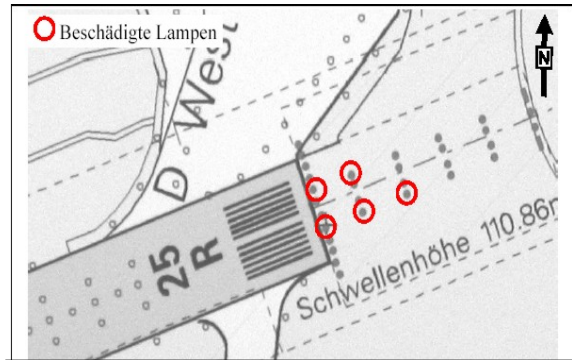


Right-hand flap trailing edge

The airplane's initial contact with the ground occurred about 60 m prior to the threshold of runway 25R. The airplane was precisely on the runway's extended centre line.

Five lights of the approach lighting were either destroyed or damaged (see photos).

The crew did not claim any technical malfunction as cause for the incident.



Destroyed or damaged approach lighting



Touchdown marks and two missing approach lights (right and left)

## Analysis

The investigation revealed that the crew kept the airplane below the 3° ILS glide slope due to the 30-minute delay so that they would be able to leave the runway and reach Gate B2 at Terminal 1 as soon as possible. The airplane taxied via taxiway F which intersects runway 25R at a right angle 742 m from the threshold. The airplane was decelerated on an extremely short landing length. This requires that the airplane must have touched down immediately at the beginning of the runway. This in turn requires that the airplane was kept below the ILS glide slope.

The approach was planned as an ILS precision approach and was flown accordingly until the autopilot was switched off. Adherence to all criteria for a precision approach such as course and glide slope, crossing the threshold in 50 ft with  $V_{Ref}$  is a prerequisite for a safe landing. At night altitude estimation is much more difficult and adherence to the mentioned criteria is even more important.

Flying below the ILS glide slope will increase the risk of colliding with obstacles the closer one gets to the runway. Even time pressure, e.g. through delay,

does not justified the underflying of the glide slope. Both pilots were rather inexperienced given their respective flight experience of 360 and 300 hours on the aircraft type. The risk of touching down too early should have been recognized.

## Conclusions

### Findings

- Both pilots held the necessary licenses and ratings required for the conduct of the flight.
- Both pilots were rather inexperienced on the accident type.
- The airplane was properly certificated and maintained in accordance with existing regulations and approved procedures. There was no technical cause for the collision with obstacles.
- According to the information contained in load sheet and trim sheet the landing mass and the centre of gravity were within limits.
- The flight from Milan to Frankfurt was about 30 minutes delayed. This may have influenced the decision to attempt a short landing.
- Taxiing to Gate B2 was to be as short as possible. Therefore, the glide slope was underflown.
- Due to flying below the glide slope the airplane touched down between the approach lights about 60 m prior to the threshold.
- The danger of touching down too early was not recognized.

### Cause

The airplane flew below the glide slope in order to attempt a short landing and, therefore, collided with obstacles. Contributory factors were the pressure for time and the relative inexperience of the two pilots on the aircraft type.

Investigator in charge      L. Müller

## Appendices

### Appendix 1 Flight recorder read-out

