

Interim Report

Identification

Type of Occurrence:	Serious incident
Date:	23 September 2012
Location:	Near Memmingen
Aircraft:	Transport aircraft
Manufacturer / Model:	Boeing / B737-800
Injuries to Persons:	None
Damage:	None
Other Damage:	None
Information Source:	Investigation by BFU
State File Number:	BFU EX002-12
Published:	November 2012

Factual Information

At 1639:44 hrs¹ during the approach to runway 24 of Memmingen Airport about 4 Nautical Miles prior to the runway threshold a Boeing 737-800 (B737) passenger airplane approximated the ground. According to the radio altimeter the lowest altitude was 450 ft above ground. The Enhanced Ground Proximity Warning System (EGPWS) generated a warning and the crew conducted a missed approach procedure.

¹ All times local, unless otherwise stated.

History of the Flight

The B737 was on a flight from Manchester, United Kingdom, to Memmingen Airport with 135 passengers and 6 crew members on board. The flight was conducted in accordance with Instrument Flight Rules (IFR).

At 1621:47 hrs the crew contacted Memmingen Tower, informed the tower controller of the estimated arrival time (1645 hrs) and asked for the latest airport information: *"...our estimated landing with you at time 45 and request latest airport information."* The controller answered: *"... active runway is 06, wind 060 degrees 8 knots, visibility and clouds okay, outside temperature 19, dew point 14, QNH 1,012."* The crew replied: *"... request runway (...) ILS 24 if possible."* The controller answered: *"Okay, we inform München, from our side is approved."* At the time of this conversation the B737 was still in the upper airspace under radar control of the air traffic control unit Karlsruhe.

At 1630:23 hrs the crew contacted Munich Radar: *"(...) good day (call sign) descending flight level 90 LUPOL."* The controller answered: *"(...) expect ILS runway 24 (...) wind is presently 050, 7 knots and CAVOK, temperature 19, dewpoint 14, QNH 1,012."* The crew answered: *"1,012, expect ILS 24 (...) and confirm, can we (unintelligible.) own rate of descend."* At 1631:58 hrs the controller issued the clearance: *"(...) descend level 70 out of LUPOL, you are cleared for standard ILS approach runway 24 with the QNH 1,012."* The crew answered: *"(...) descend level 70 after LUPOL, cleared the ILS approach runway 24, QNH 1,012."*

At 1632:37 hrs the crew asked: *"(...) do we have any speed control under flight level 100?"* The controller answered: *"Ah well 250."* The crew replied: *"(...) we'll comply with standard speed."* At 1635:53 hrs the crew reported: *"(...) standing by for lower."* The controller answered: *"Please descend according the procedure you are cleared."* The crew replied: *"We weren't cleared on a procedure (...)"* The controller answered: *"You were cleared for standard ILS approach out of LUPOL."*, the crew answered: *"Ah (call sign)."*

At 1636:33 hrs the crew again requested QNH information and the controller replied: *"1,012"*. At 1636:56 hrs the crew reported: *"(...) we are now visual with the airfield."* The controller asked: *"You request visual?"* The crew answered: *"Affirm (call sign)."* At 1637:24 hrs the crew received the clearance for a visual approach to runway 24 and at 1637:35 hrs the B737 crew changed to the frequency of Memmingen Tower.

At 16:37:48 hrs the crew contacted the tower controller of Memmingen Airport: "(...) descending 4,000 feet, we're cleared for visual approach, runway 24." The controller answered: "Continue approach, report established on final for runway 24." The crew answered: "Continue approach." At the time, the airplane was in about 5,400 ft AMSL with a heading of about 117°.

Then the crew initiated a right-hand turn using the autopilot and continued the descent. An altitude of 2,096 ft AMSL had been pre-selected. Appendix 1 shows a graph of the continued approach.

At 1639:20 hrs the EGPWS generated the warning "Sink Rate". At the time the airplane was in 1,319 ft AGL with a rate of descent of about 3,240 ft/min and a bank angle to the right of about 25°.

At 1639:37 hrs the autopilot was deactivated.

At 1639:40 hrs the EGPWS generated the warning "Caution Terrain". At the time the airplane was in 480 ft AGL with a rate of descent of about 500 ft/min and a bank angle to the left of about 35°.

At 1639:41 hrs the B737 reached the lowest flight altitude of about 450 ft AGL.

At 1639:42 hrs the EGPWS generated the warning "Terrain, Terrain, Pull up, Pull up". At the time the airplane was in 460 ft AGL with a **rate of climb*** of about 600 ft/min and a bank angle to the left of 7°.

The crew conducted a missed approach procedure and then landed at Memmingen Airport on runway 24.

The Pilot in Command (PIC) stated take-off in Manchester had been delayed by about 25 - 30 minutes. During the flight the crew decided to land on runway 24 at Memmingen Airport. The PIC stated the reason was the short taxiways to the apron after landing on runway 24. Were the landing to take place on runway 06 the airplane would have to taxi to the end of the runway and then turn back. The aim was to make good on some of the time lost in Manchester. The crew had conducted a briefing regarding the ILS approach to runway 24. They had even talked about a possible visual approach in case something would not go according to plan. The responsible controller (Lech Sector) had cleared them for the "Procedure Approach". He was not prepared for this. The documentation of the operator noted, however, that radar vectoring could be expected. So far, he had always received radar vectors on his flights to Memmingen. After the airport had come into view the crew decided to conduct a vis-

* translation error, corrected 7th Dec 2012, 15:30 UTC

ual approach, requested the respective clearance and received it from the controller. The subsequent descent to 4,000 ft was flown with a high rate of descent and a speed of about 250 kt. The PIC reduced the speed to 220 kt while on the downwind leg (right). On the base leg (right), which was very short, a tail wind component of about 20 to 30 kt had prevailed. The aircraft had crossed the extended centre line. At that time the crew had realised that something was not quite right. The PIC had tried to turn the airplane back towards the extended centre line and to stabilise the approach. A high rate of descent in combination with tailwind had still prevailed. The landing gear had been extended, the air brakes had been set and the flaps were in position 5. Then the crew decided to go around. The crew realised the EGPWS warning "Sink Rate", then "Pull Up" and then the crew noticed the approximation with the ground. Once the PIC heard the warning "Terrain, Pull Up" he had conducted the "Terrain Avoidance Manoeuvre" as stipulated by the operator. All this happened within seconds.

The responsible tower controller of Memmingen Airport stated that the crew had contacted him as the aircraft had been about 4 to 5 NM north-east of the airport. He instructed the pilot to report when the airplane was on final approach. He could no longer remember whether he had had the airplane in sight at that time. At the same time a vehicle had crossed the runway from south to north. He had observed the vehicle so that he would know when it would leave the landing area so he could give the landing clearance to the B737. Once he looked to the left again he saw the airplane south of the extended centre line. He further noticed that the airplane was significantly below the regular approach height with a heading of about 270° to 290°. The airplane had been in a slight climb and had crossed the extended centre line. A missed approach procedure had been initiated. He estimated that the airplane flew over the northern part of the airport in 3,000 to 3,500 ft. After coordination with the Lech Sector the B737 was handed back over to Munich.

Personnel Information

B737 Crew

Pilot in Command (PIC)

The 30-year-old PIC held an Airline Transport Pilot's License (ATPL(A)) issued by the Irish Aviation Authority in accordance with ICAO and JAR-FCL valid until 19 September 2015. His flying experience was 5,018 hours on the type in question.

Co-pilot

The 29-year-old co-pilot held a Commercial Pilot's License (CPL(A)) issued by the Irish Aviation Authority in accordance with ICAO and JAR-FCL valid until 8 September 2015. His flying experience was 1,499 hours on the type in question.

Air Traffic Control

The 29-year-old radar controller held an Air Traffic Control Licence, valid until 30 January 2013.

The 38-year-old tower controller held an Air Traffic Control Licence, valid until 21 January 2013.

Aircraft Information

The aircraft type is a twin-engine, low-wing airplane. It is mainly used for passenger transport on short and medium range flights.

The airplane was equipped with an Enhanced Ground Proximity Warning System (EGPWS). The system is designed to avoid unintended ground approximations.

The aircraft had a valid Irish certificate of registration and was operated by an Irish operator.

Meteorological Information

The aviation routine weather report (METAR) of Memmingen Airport of 1620 hrs gives the following weather information:

Wind 050° with a speed of 7 kt, temperature: 19°C, dewpoint: 14° CAVOK (visibility of more than 10 km, no thunder clouds and no clouds below 5,000 ft or Minimum Sector Altitude, respectively, whereas the higher value is applicable, no significant weather phenomena in the vicinity of the airport), QNH 1,012 hPa.

Communication

The air traffic service provider in question recorded radio communications and made them available as transcripts for investigation purposes. In addition, the Tower Memmingen also sent a sound file.

Flight Recorders

The radar recordings of the air traffic service provider were available for the investigation.

The Quick Access Recorder (QAR) data was available for read-out.

The Cockpit Voice Recorder (CVR) recordings were not available for the investigation.

Aerodrome information

Memmingen Airport has a single 2,401 m long and 30 m wide asphalt runway in the directions 06/24. Runway 24 is equipped with an Instrument Landing System (ILS). The glideslope from the final approach fix (OGROB) to the threshold of runway 24 is 3° for an original altitude of 4,000 ft AMSL. Aerodrome elevation is 2,078 ft. The airport is surrounded by airspace classification D from the ground up until 4,500 ft AMSL.

Additional Information

The vertical distances determined by the radar altimeter were verified by a second approach. For this purpose, the terrain height (the elevation of the terrain) was determined using Shuttle Radar Topography Mission (SRTM) data (see below). These were subtracted from the QNH-corrected flight altitude; the result was the vertical distance between the airplane and the terrain lying below the flight path.

The difference between radar altimeter and SRTM data is about 50 ft along the flight path with less than 1,000 ft between aircraft and ground; in the area of the closest approximation with the ground - transition of descent into climb or missed approach, respectively - the difference is about 20 ft.

NASA and DLR collected the SRTM data by radar distance measurement from space. For depiction and storage of the SRTM data, the surface of the earth was divided into connected square areas to which the collected terrain elevation values were assigned. Each of these "tiles" measures 90 m in north - south direction and along the equator also in west - east direction. Toward the poles the "tiles" become smaller in the west - east direction.

If a geographical position is known, the respective "tile height" can be determined. Since the height within a "tile" is assumed to be constant, there are discrepancies of the punctual measurements if the terrain is mountainous.

Due to the design of the SRTM measurements vegetation and development of the earth surface are also recorded. This may cause additional discrepancies of the real terrain elevation and the SRTM values.

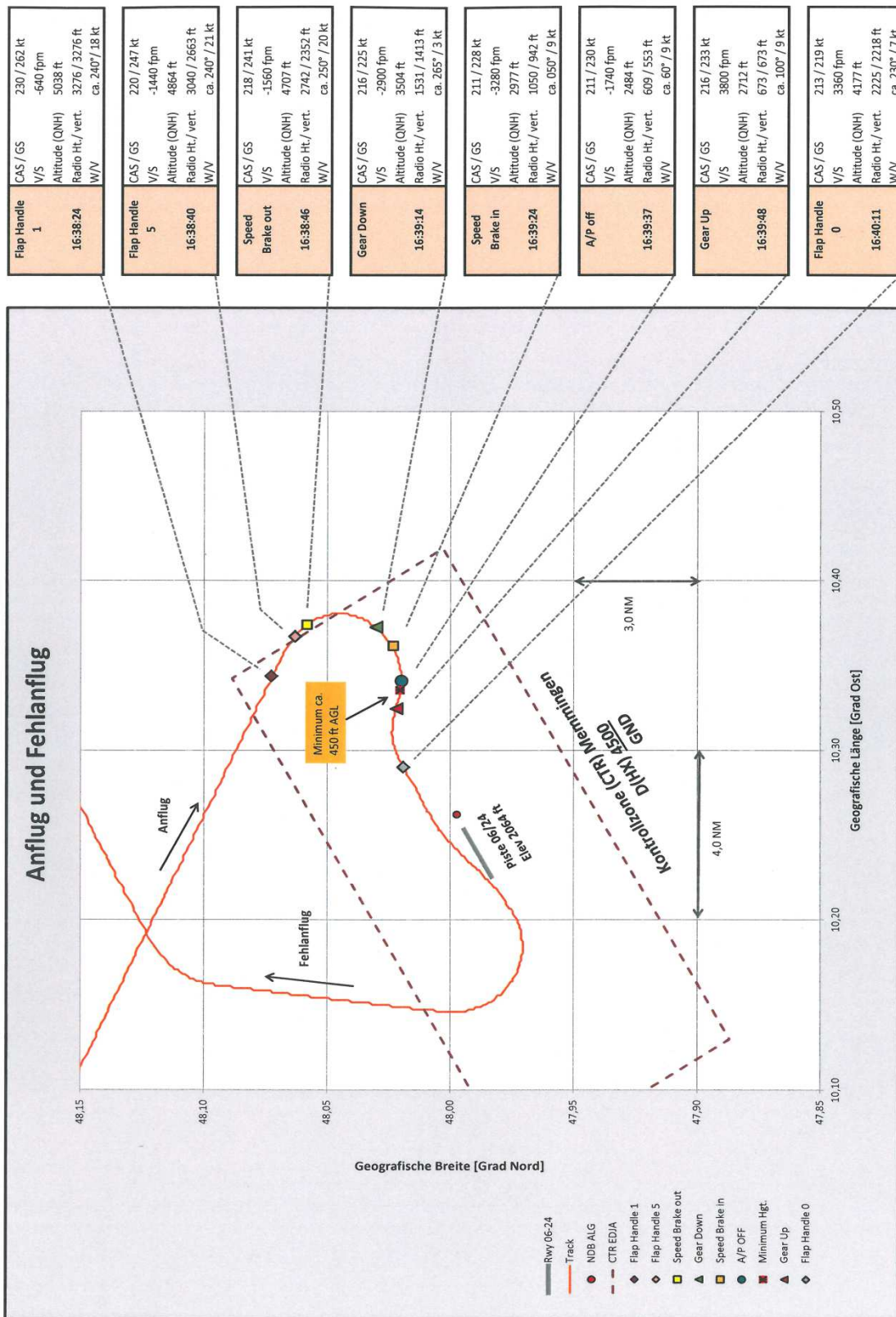
Investigator in charge: Blanke

Appendices

1 Approach and missed approach

2 Instrument Approach Chart – ICAO, Memmingen ILS or LOC RWY 24

Appendix 1:



Explanation

Data in the beige coloured part of the squares (data source: Quick Access Recorder (QAR):

Example:

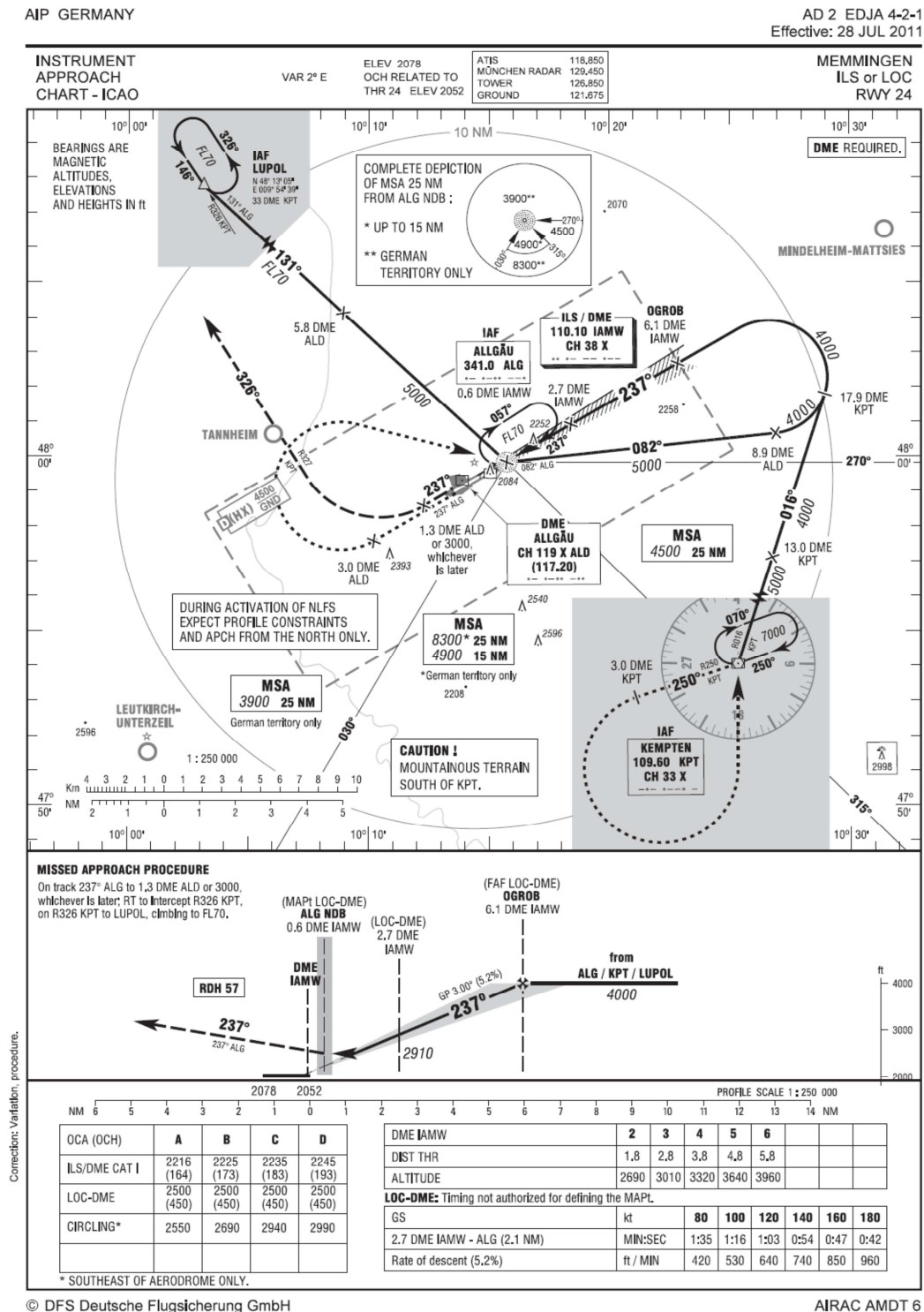
„Flap Handle 1“ ← Action (in the cockpit)

1638:24 hrs ← Time of the action in CEST (Central European Summer Time).

Data in the white coloured part of the squares (data source: QAR):

Abbreviations	Parameter [Scale]	Meaning
<u>CAS</u> / GS	Computed Air-speed [kt / knot]	The Air Data System speed value in relation to the air
CAS / <u>GS</u>	Ground Speed [kt / knot]	The IRS speed value in relation to the ground
V/S	Vertical Speed [fmp, feet per minute]	Change of flight altitude per time unit, calculated from the differences of flight altitudes in relation to consecutive points in time
Altitude (QNH)	Altitude [ft / feet]	Transmitted by the transponder and put into relation to 1,013 QNH (standard), corrected by the pressure discrepancy between standard atmosphere and QNH
Radio Ht./ vert.	Radio altitude or vertical distance to the terrain, respectively [ft / feet]	The distance to the terrain determined by the radio altimeter in the direction of normal axis or the calculated vertical distance to the terrain taking into account the wing down attitude of the airplane, respectively.
W/V	Wind direction and intensity [degrees / knot]	See left-hand side

Appendix 2:

Instrument Approach Chart – ICAO,
Memmingen ILS or LOC RWY 24

Source: Aeronautical Information
Publication (AIP), Germany

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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