

# Investigation Report

## Identification

|                        |                        |
|------------------------|------------------------|
| Kind of Occurrence:    | Serious Incident       |
| Date:                  | 24 March 2010          |
| Location:              | Kassel-Calden          |
| Manufacturer / Model:  | Fixed Wing             |
| Manufacturer / Model:  | Cessna / Citation 525A |
| Injuries to Persons:   | None                   |
| Damage to Aircraft:    | None                   |
| Other Damage:          | None                   |
| Source of Information: | Investigation by BFU   |
| State File Number:     | BFU 7X002-10           |

## Factual Information

### History of the Flight

A Cessna Citation 525A (C525) was on a flight from Stuttgart (EDDS) to Kassel-Calden (EDVK). The aircraft was flown by a crew of two pilots, with one passenger on board.

After arrival near Kassel-Calden, the aircraft flew a left-hand circuit followed by a visual approach to Runway 22. The aircraft arrived from a south-westerly direction and made a turn to the right about 1.8 nm south of the airfield and positioning parallel

abeam in the downwind leg for Runway 22. The final turn to approach Runway 22 was made about 2.8 nm from the Runway threshold and at a ground speed of about 210 kt. By the time the aircraft reached a position about 0.8 NM from the threshold, speed had reduced to about 190 kt. The crew subsequently reported that the aircraft crossed the Runway 22 threshold at a speed of about 130 kt Indicated Air Speed (IAS), with the flaps set at the first position (15°). The aircraft touched down at about 16:20<sup>1</sup> approximately 572 m after the threshold.

The flight crew decelerated the aircraft using wheel brakes. The crew subsequently reported that, when it became clear the aircraft would not stop within the remaining runway, they had steered the aircraft towards the left to avoid a collision with runway lighting and the Localizer antenna.

The aircraft overran the left end of the runway lip and came to a stop about 53 m further on.

## Personnel Information

### Pilot-in-Command

The 35 year-old pilot-in-command was in possession of a Commercial Pilot's Licence (CPL) issued in accordance with JAR-FCL (German). He held a Type Rating as pilot-in-command for the C525, also an Instrument Rating and was cleared for Category 1 landings (CAT I). His total flight time was about 1 720 hours, of which about 1 050 hours were on the Type in question. His previous check flight was in September 2009.

His Class 1 Medical Certificate was valid to 18.12.2010.

On the day in question, he was rostered as the pilot-in-command. He occupied the right hand seat and was the pilot monitoring (PM).

### Second Pilot

The 56 year-old second pilot was in possession of a Commercial Pilot's Licence (CPL) issued in accordance with JAR-FCL (German). He held a Type Rating as pilot-in-command for the C525, also an Instrument Rating and was cleared for Category 1 landings (CAT I). His total flight time was about 2 300 hours, of which about

---

<sup>1</sup> All times local, unless otherwise stated

528 hours were on the Type in question. His previous check flight was in November 2009.

His Class 1 Medical Certificate was valid to 22.01.2011.

On the day in question, he occupied the left seat in the cockpit and was Pilot Flying (PF).

## Aircraft Information

The Cessna Citation 525A is a low-wing aircraft with two main landing gears and a nose gear. The aircraft has seven seats. The two engines are fitted one each side of the rear fuselage.

The aircraft is 14.05 m long, has a wing span of 14.68 m and a height of 4.26 m. It comes within ICAO Fire and Rescue Category 3.

|                               |                  |
|-------------------------------|------------------|
| Aircraft Manufacturer:        | Cessna           |
| Type:                         | Citation 525A    |
| Manufacturer's serial number: | 525A-0032        |
| Year of Construction:         | 2001             |
| Max. take off weight:         | 5 613 kg         |
| Max. landing weight:          | 5 216 kg         |
| Airframe total flight time:   | 2 005 hr         |
| Total Cycles:                 | 1 655            |
| Engine:                       | Williams FJ44-2C |

The aircraft was first registered in the Federal Republic of Germany on 30.10.2007, since when it was flown by an Air Operator.

The previous Airworthiness Review Certificate was issued on 22.10.2009 by the German Civil Aviation Authority (LBA) and was valid to 30.10.2010.

The last scheduled maintenance took place on 06.01.2010 following 1 946 flight hours and 1 606 landings (Flight Cycles).

## Meteorological Information

Prior to the flight the crew had the Terminal Aerodrome Forecast (TAF) and the Meteorological Aerodrome Routine Report (METAR) for Kassel-Calden airport.

The TAF was issued at 12:00 on 24.03.10 and was valid for 13:00 to 22:00 and forecast the wind as 160° at 10 kt, CAVOK.

The METAR was issued at 15:50: Wind 130° at 10 kt, CAVOK, temperature 16 °C, dew point 2 °C, QNH 1 012 hPa.

A briefing prepared for the crew included the observation 'No SIGMETs found'.

The official German Meteorological Service (DWD) issued the following forecast for GAFOR (General Aviation Forecast) areas 24 to 28 and 37 to 64:

[...]

*Wind and Temperature:*

*at ground level: wind from SE, 5 to 10 KT, gusting 20-25 kt on the crests of the Mittelgebirge range of hills*

*1500 FT AMSL 170/05 KT, 13° C*

*2000 FT AMSL 170/05 KT, 12° C*

*3000 FT AMSL 210/10 KT, 09° C*

*5000 FT AMSL 230/15 KT, 07° C*

*FL100 220/15 KT, M01 ° C*

[...]

## Aids to Navigation

Kassel-Calden Airport has a Localizer (LOC), a Non-Directional Beacon (NDB) for Runway 22 and Distance Measuring Equipment (DME). Both were in operation on the day in question.

## Communications

Communications were conducted with the respective ground stations in the English language. Recordings of the communications were available for this investigation.

## Aerodrome Information

Kassel-Calden Airport is 908 ft above mean sea level and has a hard runway in directions 04/22. The asphalt surface is 1 500 m long and 30 m wide.

Runway direction 22 has a LOC approach and an NDB approach. At the time of the serious incident, Runway 22 with LOC and NDB was in unrestricted use.

The fire and rescue facilities at Kassel-Calden met the requirements of ICAO Category 4, and could be raised to Category 5/6 on request.

## Flight Recorders

There was no legal requirement for the aircraft to be fitted with flight data recorders, nor were any installed.

## Radar Trace

The Air Traffic Control radar trace of the Cessna's progress was available for this investigation. The trace showed the Cessna's approach to Kassel Airport, also changes in height and ground speed. While on base leg to Runway 22, the radar trace indicated a ground speed of about 210 kt at a height of 2 000 ft, subsequently reducing to about 190 kt at a height of about 1 500 ft in the short final approach to Runway 22.

Four radar stations monitored the local airspace. The DFS air traffic control service provider gives the accuracy of the ground speed in this approach sector as approx. +/- 10 kt.

## Wreckage and Impact Information

The aircraft overran the left side of the runway threshold shoulder on a heading (HDG) of approx. 201° and came to a halt on grass about 53 m after leaving the runway. The aircraft came to rest with the fuselage heading about 150°. The wheels sank about 10 cm into the ground. No other part of the aircraft made contact with the ground.

The C525 landing gear left touch-down marks on Runway 22 about 572 m after the threshold, from which point continual wheel/brake marks were left by both main landing gears.



Position of the aircraft on coming to rest

Photo: BFU



Right main landing gear

Photo: BFU



Left Main Landing Gear

Photo: BFU

## Fire

There was no fire.

## Organisational and Management Information

### Air Operator

The aircraft was flown by an Air Operator in accordance with the requirements of EU Decree No. 1008/2008. At the time in question, twelve aircraft were listed in the Air Operator Certificate (AOC), of which eight were Cessna Citation 525.

## Additional Information

### Operating Limitations

The C525A Flight Manual gives the following maximum speeds for different flap settings:

*Speed Limitations:*

[...]

*Maximum Flap Extended Speed – VFE*

*TAKEOFF AND APPROACH Position (15°).....200 KIAS*

*LAND Position (35°)..... 161 KIAS*

*Maximum Speed With Flaps Failed to Ground Flaps (60°)..... 140 KIAS*

*Maximum Landing Gear Extended Speed – VLE .....275 KIAS*

*Maximum Landing Gear Operating Speed – VLO (Extending).....250 KIAS*

[...]

### Extract from the Air Operator's Operation Manual B (OM-B)

OM, Part B 02, Normal Procedures:

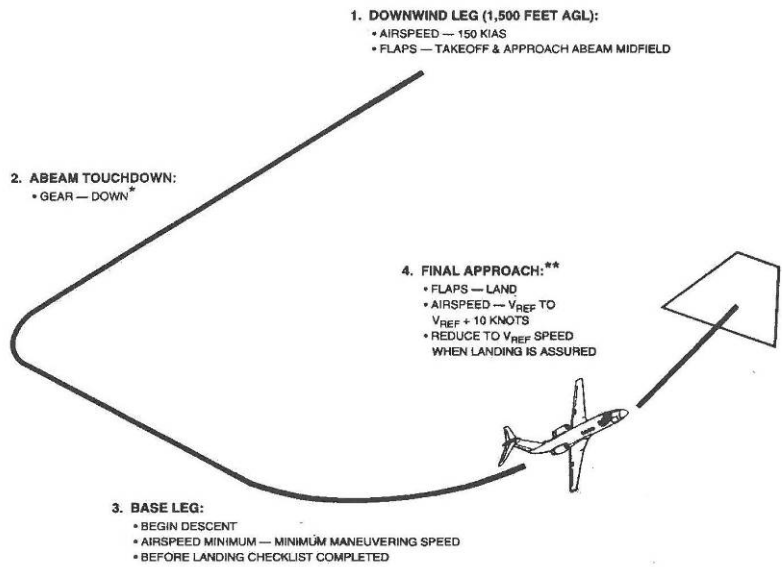
*2.7.12.5 VFR APPROACH SEQUENCE*



**OPERATION MANUAL**  
**PART B**  
**CJ SERIES**

|           |            |
|-----------|------------|
| CHAPTER   | 2          |
| PAGE:     | 34 OF 60   |
| DATE:     | 01-11-2009 |
| REVISION: | 30         |

2.7.12.5 VFR APPROACH SEQUENCE



INTENDED TO BE USED FOR THE

2.7.12.6 FINAL

[...]

|  |  |
|--|--|
| <p><b>OPERATION MANUAL</b><br/><b>PART B</b><br/><b>CJ SERIES</b></p>  | <p>CHAPTER: 2<br/>PAGE: 36 of 60<br/>DATE: 01-11-2009<br/>REVISION: 30</p> |
| <p>If landing above 12,000 feet PA, turn the OXYGEN CONTROL VALVE to CREW ONLY and turn pressurisation bleed air OFF to preclude passenger mask deployment.<br/>Engine synchronizer should be OFF to prevent excessive wear with large or frequent thrust lever movement.</p> <p style="padding-left: 40px;">On PF's command PNF positions gear lever to DOWN (speed checked less than 186 KIAS.) and checks 3 green lights are ON.</p> <p style="padding-left: 40px;">Flaps may be extended to LAND (35°) below 161 KIAS. Flaps should be in the Land position for all normal landings. Check indicator to verify position.</p> <p style="padding-left: 40px;">Yaw damper OFF to assure complete rudder authority to the pilot for landing. Utilize the AP/TRIM DISC button on either control wheel or the YD ENGAGE/DISENGAGE button on the autopilot control panel.</p> <p style="padding-left: 40px;">Extended speed brakes are prohibited for landing.</p> <p style="padding-left: 40px;">After FLAPS Land have been extended, PF requests the checklist. PNF will read the final checklist. Both pilots will respond as indicated.</p> |  |

Pre-Landing Checklist

Version 1: Document in the Aircraft

| <b>BEFORE LANDING</b>             |                                     |
|-----------------------------------|-------------------------------------|
| 1 Ignition .....                  | <b>ON</b>                           |
| 2.. Landing Gear.....             | <b>DOWN AND LOCKED</b>              |
| 3. Flaps .....                    | <b>LAND</b>                         |
| 4. Pressurization .....           | <b>CHECK ZERO DIFFERENTIAL</b>      |
| 5. Autopilot and Yaw Damper ..... | <b>OFF</b>                          |
| 6. Airspeed.....                  | <b>V<sub>REF</sub></b>              |
| 7. Speed Brakes.....              | <b>RETRACT PRIOR TO 50 FEET AGL</b> |

**Version 2: Document in OM-B and in Aircraft**

| FINAL               |               |      |     |
|---------------------|---------------|------|-----|
| Engine synchronizer |               | OFF  | PNF |
| LDG gear            | DOWN, 3 GREEN |      | B   |
| Ignition            |               | ON   | PF  |
| Flaps               |               | LAND | B   |
| A/P                 |               | OFF  | PF  |
| Yaw damper          |               | OFF  | PF  |

## Analysis

The weather had no decisive influence upon events. The visual approach flown was unhindered by visibility or clouds.

All those involved were properly qualified and experienced for the correct discharge of their duties.

Both pilots had already flown to Kassel-Calden several times and were familiar with the local conditions.

On the day in question, there were no restrictions or limitations on the use of Kassel-Calden Airport. The ground aids to navigation were fully available for use by airborne receivers. During the investigation, it was not possible to determine with total certainty whether the crew had made use of the NDB and DME.

The aircraft was properly registered and airworthy. There was no technical limitation on normal operation of the aircraft.

The aircraft made a visual approach to Runway 22, which on the day in question was essentially an adequate procedure.

However the entire approach procedure was flown at an excessive speed and not in conformity with the instructions contained in OM-B. Below FL100 the aircraft ground speed was about 300 kt, later reducing to about 290 kt. Based on the available meteorological data and the reported wind (5 kt at 1 500 ft), this resulted in a maximum IAS of about 295 kt, ground speed 285 kt. When making the turn onto base leg – airfield wind 130° / 10 kt – the ground speed was recorded as about 210 kt (about 200 kt IAS), while on final approach the ground speed was about 190 kt (about 190 kt

IAS). Throughout, the speed was too high for a stable and well-controlled approach, even under visual flight conditions.

The aircraft commenced its turn onto base leg and final approach about 2.6 NM from the threshold to Runway 22, which was insufficient separation at the higher IAS and ground speed.

Assuming that the aircraft threshold speed was approx. 130 kt IAS, the actual IAS was commensurate with an excess speed of approx. 27 kt at a calculated  $V_{ref}$  of 103 kt. This is equivalent to approx. 26% excess speed.

The landing distance required would increase from approx. 805 m to approx. 1 115 m at the speed flown with a flaps setting of 35°.

Witnesses subsequently reported that, when the aircraft crossed the threshold, the flaps had been set in Position 1 (15°). Commensurate with other statements, the inference is that the speed did not decay in the usual manner during the landing run and roll-out.

However, it was not possible to determine the flap position selected at this point with total certainty.

Working on the assumption that the flaps had not been set (35°) for landing, with the flaps set at 15° the landing distance would increase by 25% (or by 45% with no flap selected) because the approach speed would have to be faster. In this case, calculations based upon the AFM values would result in the following landing distances:

Flaps 15° ( $V_{ref} + 8$  kt) -> ca. 1 006 m

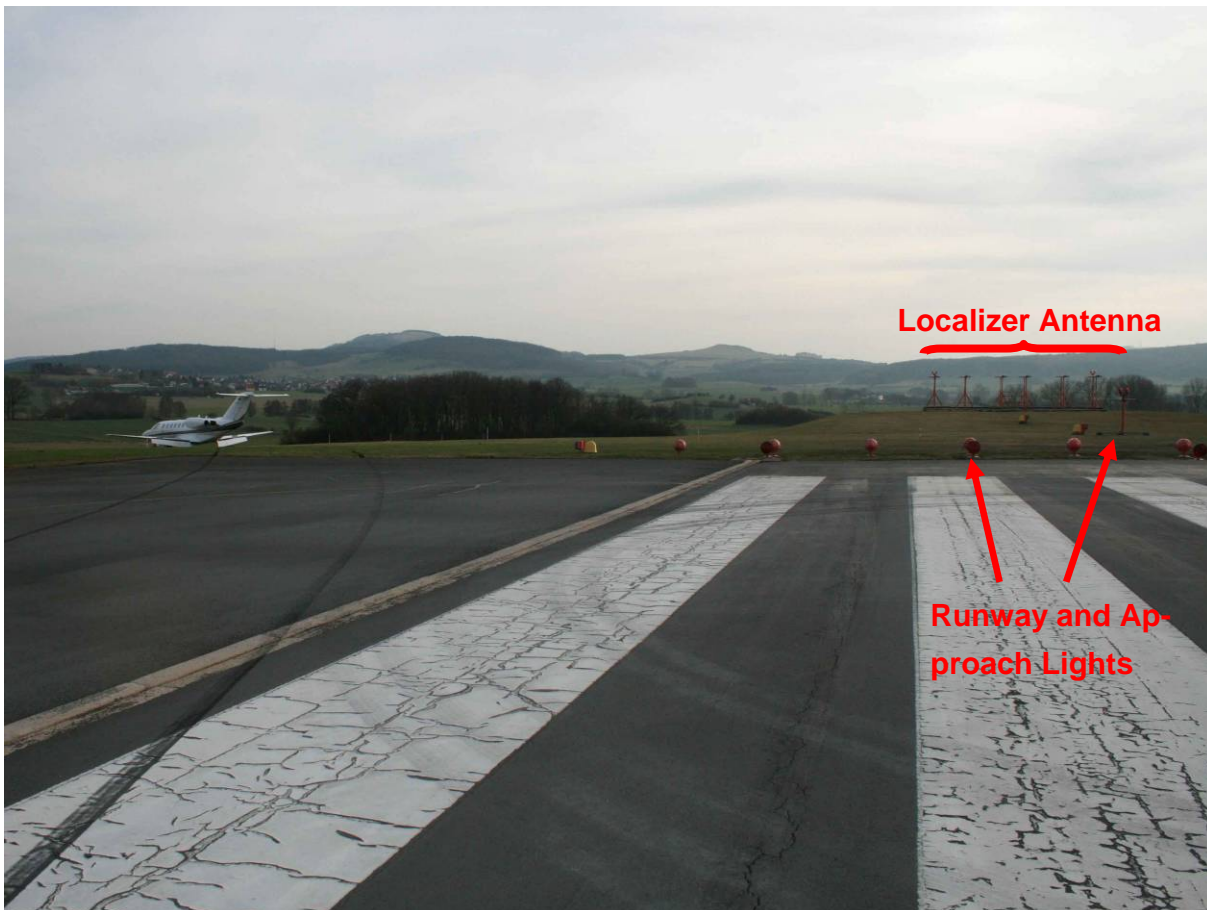
(Flaps 0° ( $V_{ref} + 18$  kt) -> ca. 1 167 m)

Prior to crossing the threshold, the Final- or Before Landing Checklists should have been read-out and completed. The Check Lists include the item *Flaps - Land*, which must be confirmed by both pilots in accordance with the requirements of the OM-B. It was not possible to determine whether the Check List had been read.

There are two versions of the Final Check List. On the day in question, both were fully up to date, had been published and were valid. There are a number of differences between the two. However, irrespective of these differences, both Check Lists require both pilots to check that the Flaps have been correctly selected and set. The sole difference with respect to the landing configuration was the item *speed brakes*.

The touchdown point approx. 572 m after the threshold was clearly too late. In addition, investigation showed that the aircraft touchdown speed of 120 kt IAS was too fast. The distance remaining to come to a full stop was about 928 m. Assuming the flaps were set at 15° and an excess speed of only 8 kt, the distance remaining was still insufficient to come to a full stop on the runway.

The decision to steer the aircraft towards the left on approaching the end of the runway, prevented a collision with the Runway 04 approach lights and possibly also the Localizer antenna, which are all mounted on concrete plinths. The decision to guide the aircraft towards open space avoided serious damage to the aircraft.



View End of Runway 22

Photo: Kassel-Calden Airport

The crew did not initiate a *go-around*. The PF subsequently stated that he could not recall whether the PM had called for a go-around during the approach. A go-around was not considered until after the aircraft had touched down by which time, given the

position on the runway and the runway length remaining, this was no longer possible and therefore rejected.

## Conclusions

### Findings

The crew was properly licensed and qualified to undertake the flight.

The aircraft was properly registered and airworthy.

The approach speeds flown did not match the requirements laid down in the Airplane Flight Manual (AFM).

The approach speeds flown did not match the requirements laid down in the OM-B.

There was no initiation of a go-around manoeuvre.

The aircraft was not in the correct landing configuration.

The aircraft touch down point was too far after the runway threshold.

### Causes

The aircraft was not established in a stable approach; the aircraft did not cross the runway threshold in the landing configuration; and no go-around manoeuvre was initiated.

The aircraft touched down on the runway too late and at a speed that was too high to bring the aircraft to a full stop on the remaining runway.

## Safety Recommendations

Recommendation No. 19/2010:

The Air Operator should standardise the Check Lists contained in OM-B and the aircraft documentation, because differences were found, not only in the Final Check List. The OM-B should specify which checklists are to be used.

**Recommendation No. 20/2010:**

The Air Operator should specify the visual approach sequence in greater detail, including duration of the downwind leg, and separation from the airfield on initiation of the turn to base leg and final approach. At the latest, the aircraft should be in its final landing configuration and the check lists should have been read out and completed before descending through 500 ft AGL in a properly stabilised condition.

**Recommendation No. 21/2010:**

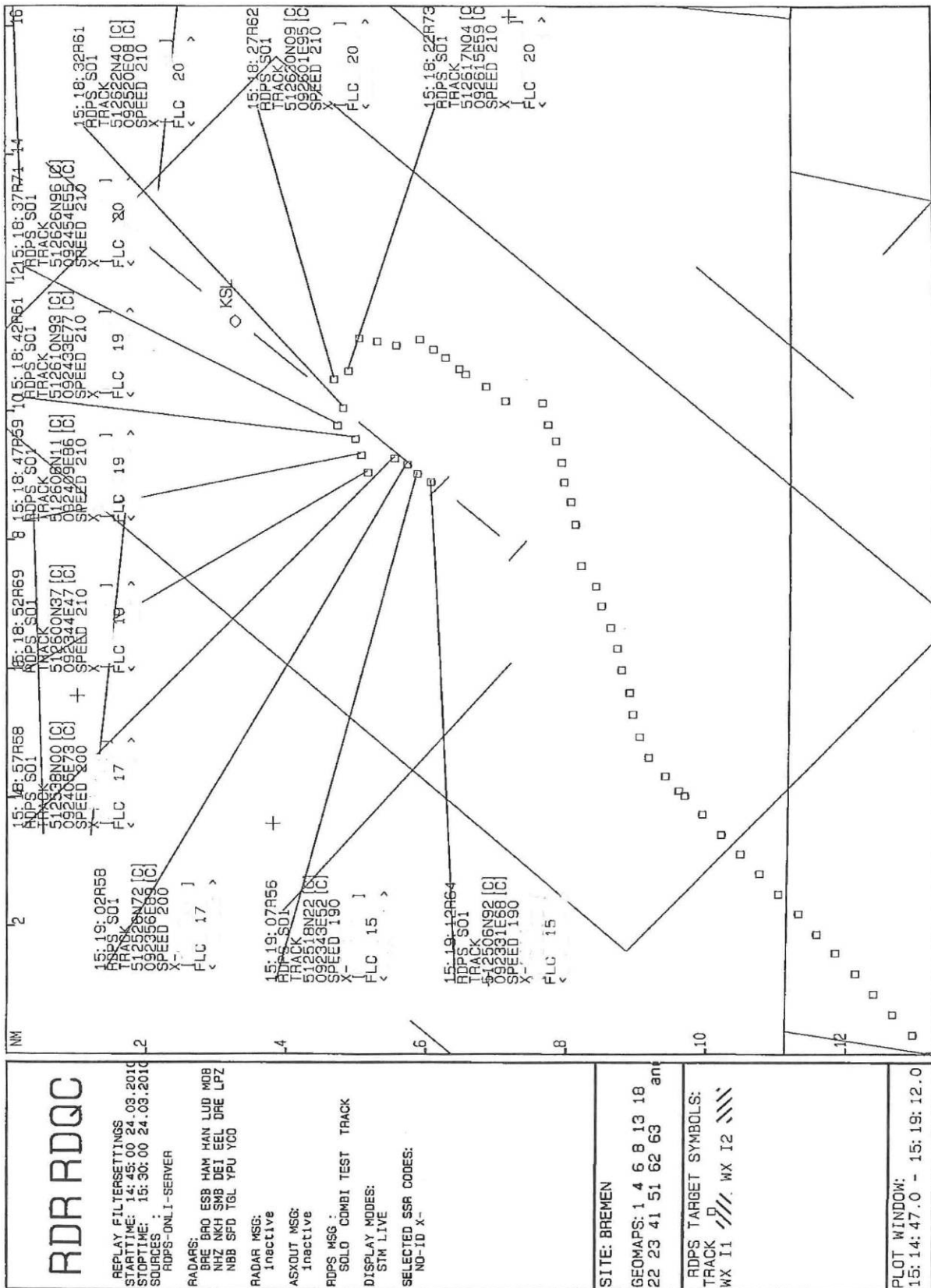
During simulator training and check flights, the Air Operator should emphasise the importance of following the standard approach procedures and requirements set down in OM-B. In addition, crew performance should be monitored by training personnel at regular intervals e.g. at six-month intervals during regular flight operations.

Lead Investigator:            Andreas Bresky  
Aided by:                        Uwe Berndt  
On-site investigation:        Bresky, Berndt  
Braunschweig:                01.02.2011

## 5. Appendices

DFS Radar Trace

Radar Data



**RDR RDQC**

REPLAY FILTERSETTINGS  
 STARTTIME: 14: 45: 00 24.03.2010  
 STOPTIME: 15: 30: 00 24.03.2010  
 SOURCES: 1  
 RDPS-ONLI-SERVER

RADARS:  
 BRE BRO ESB HAM HAN LUD MOB  
 NHZ NKH SMB DEI EEL DRE LPZ  
 NBB SFD TGL YPU YCD

RADAR MSG:  
 Inactive  
 ASXOUT MSG:  
 Inactive

RDPS MSG:  
 SOLO COMBI TEST TRACK

DISPLAY MODES:  
 STM LIVE

SELECTED SSR CODES:  
 ND-10 X-

SITE: BREMEN  
 GEOMAPS: 1 4 6 8 13 18  
 22 23 41 51 62 63 ant

RDPS TARGET SYMBOLS:  
 TRACK □  
 WX 11 // WX 12 ///

PLOT WINDOW:  
 15: 14: 47.0 - 15: 19: 12.0

This investigation was conducted in accordance with the Federal German Law on 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 to achieve complete accuracy, discrepancies may occur. In this case, the German is the authentic version.

## Published by

Bundesstelle für  
Flugunfalluntersuchung  
Hermann-Blenk-Str. 16

38108 Braunschweig

Telefon 0 531 35 48 - 0  
Telefax 0 531 35 48 - 246

Mail [box@bfu-web.de](mailto:box@bfu-web.de)  
Internet [www.bfu-web.de](http://www.bfu-web.de)