

# Investigation Report

## Identification

Type of Occurrence:	Accident
Date:	15 February 2006
Location:	Kiel-Holtenau
Aircraft:	Airplane
Manufacturer / Model:	Dassault Aviation / Falcon 20-C5
Injuries to Persons:	One person seriously injured, five persons slightly injured
Damage:	Aircraft severely damaged
Other Damage:	Crop damage
Information Source:	Investigation by BFU
State File Number:	BFU AX001-06

## Factual Information

A fire in the cabin occurred during cruise flight. The crew decided to conduct an emergency landing at Kiel-Holtenau Airport. During the landing roll the aircraft overshoot runway 08 and came to rest on the adjacent slope.

## History of the Flight

At about 1550 hrs the Falcon 20 had started at Moscow Domodedovo Airport, Russia, for a passenger flight to London Luton Airport, Great Britain. In addition to the two pilots and one flight attendant, three passengers were aboard.

At about 1919:38 hrs<sup>1</sup>, approximately 2.5 hours after take-off, the co-pilot established radio communications with Maastricht UAC and reported Flight Level (FL) 380.

At 1921:40 hrs the Cockpit Voice Recorder (CVR) recorded a sizzling sound which lasted for 4.19 seconds. The Pilot in Command (PIC) demanded to know what was happening. Screams could be heard coming from the cabin. At 1921:50 hrs the flight attendant asked: "Where is fire extinguisher?" The PIC repeatedly instructed her to get the fire extinguisher. Within the next three minutes the flight attendant repeatedly asked for help to find the fire extinguishers and to get the one behind the co-pilot's seat out of the mounting. At 1921:58 hrs the co-pilot said: "So, masks". One second later the PIC requested the co-pilot to hand him an oxygen mask.

At 1922:04 hrs the controller asked the crew to select transponder code 0772. The CVR recorded four seconds later the remark of the PIC: " ... we have a fire on board, request emergency descent". The co-pilot answered: "Descend" and repeated 17 seconds later: "Let's descend!" According to the Flight Data Recorder (FDR) the airplane entered descent. At 1922:34 hrs the PIC once again prompted the co-pilot: "... give the mask!" Five seconds later the co-pilot said: "I have taken control, put it on". At 1923:09 hrs the controller repeated his instruction: " ... squawk zero seven seven two".

At 1923:54 hrs, about 26 Nautical Miles (NM) north-east of Kiel, the PIC radioed: "... we have, we have a fire ... emergency descent". At 1924:01 hrs the flight attendant called: "I can't stand it anymore. Open the window". According to the FDR data at that time the airplane was approximately in FL280. At 1924:19 hrs and at 1925:47 hrs the controller asked: "... what level would you like to descend?"

At 1925:31 hrs the PIC instructed the co-pilot: "...read checklist". The flight attendant called: "Open the window, open the window". At 1925:46 hrs the co-pilot asked the PIC: "May I open?" At that time the airplane approximately passed FL240. At 1926:04 hrs the CVR recorded the remark of the flight attendant: "I didn't want".

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

At 1926:11 hrs the pilot answered the controller with: "... one five zero". At 1926:32 hrs the controller asked about the further intend of the pilot. He answered: "We will descend one five zero and request to go nearest airport." Initially the controller suggested Hamburg Airport but a short time later he said: "... there is an airport just below you, it's Kiel." After the request to repeat the radio message the controller said: "... there is an airport just below you with a short runway that is Kiel." The PIC requested a descent clearance and the flight direction to Kiel. After the controller had contacted the air traffic control unit Bremen Radar he instructed the crew to descend to FL110.

At 1928:21 hrs, the aircraft was approximately in FL180, the controller instructed the crew to change radio frequency to Bremen Radar. The co-pilot established contact with Bremen Radar and reported they were conducting an emergency descent to FL110. At 1929:13 hrs the controller said: "... roger, continue descent, altitude five thousand feet, QNH nine nine two". At that time the airplane was one NM north of Kiel Airport in FL160. The co-pilot confirmed QNH and the altitude of 5,000 ft. At 1929:43 hrs the controller asked: "...Kiel runway in use is zero eight, the length is one thousand two hundred sixty meters, is that sufficient?" The co-pilot answered: "Roger, sixty meters." According to the CVR the PIC asked the co-pilot: "What are they talking about?" The co-pilot asked the controller: "Confirm five thousand feet?" He repeated: "...I say again, runway length is one thousand two hundred sixty meters, is that sufficient?" According to the FDR the aircraft was below FL 120. The CVR recorded in this phase a high sound level aboard the airplane and the answer of the co-pilot was: "Affirmative."

At 1930:59 hrs the PIC instructed the co-pilot twice to read the checklist. At 1931:32 hrs the controller instructed to descend to 3,000 ft AMSL and 21 seconds later he instructed to turn right to 350°. The radar data shows that the airplane had entered a right turn. At 1932:28 hrs the co-pilot announced: "Reading checklist". At 1932:46 hrs the crew received the localizer frequency of runway 08 from the controller. At 1933:05 hrs, while the aircraft was flying north, the controller issued the clearance for the ILS approach to runway 08. About two minutes later, during the final approach, the controller radioed the crew: "... you are presently five miles for touch down. Discontinue approach, maintain three thousand feet, turn right, I put you on the localizer again." A few seconds later the controller said: "... maintain three thousand feet, turn right heading two one zero." In the further course of events the

controller issued heading specifications several times and instructed the crew to descend to 2,000 ft AMSL.

At 1940:57 hrs the crew received another clearance for the ILS approach to runway 08.

At 1943:05 hrs, about 4 NM away from the threshold, the co-pilot established radio contact with Kiel Tower and reported: "... fully established, ready to land." About one minute later the tower controller informed the crew about the prevailing wind with 170° and 6 kt. At 1944:19 hrs the co-pilot reported that the runway was in sight.

At 1944:39 hrs the CVR recorded the synthetic voice "Minimums, minimums" and three times with an interval of three seconds each the warning "Too low, flaps".

The FDR recording showed that the airplane touched down at about 1944:44 hrs with an Indicated Airspeed (IAS) of about 140 kt. Vertical acceleration was about 1.2 g. Within 8 seconds the speed reduced by about 22 kt.

At 1944:58 hrs the co-pilot said to the PIC: "Brake, Brake." He answered: "Yes, a little." At 1945:15 hrs the CVR recorded curses of both pilots.

According to the FDR the speed during roll-out decreased to about 52 kt. The vertical acceleration oscillated around 1 g for about 19 seconds after touch-down. Then it reduced to 0 g for a short time and increased to about 4 g until the aircraft came to a stop about 21 seconds after touch-down.

The pilots stated that the airplane had been in FL380 when suddenly an explosive bang had occurred. They had seen flames behind them and within 2 seconds the cabin had been filled with smoke. They subsequently initiated an emergency descent. In FL120 the PIC had opened the side cockpit window to let the smoke out. During the ILS approach in about 200 m altitude they had cleared the clouds and had seen the approach lights but not the runway lighting. The cabin was still filled with smoke and the windows were covered with soot. They had been directly on the glideslope. Shortly before touch-down they had guided the airplane slightly below the glideslope. They had landed the airplane with a speed of 120 KIAS. They assumed that the runway was 2,600 m long and did therefore not activate the thrust reversers.

The flight attendant stated the airplane had been in maintenance a short time before and she had found the galley in disarray. During the flight she had served the passengers and crew their meals and was in the process of clearing the galley. The passengers had asked her to not close the curtain between cabin and galley during

her preparations. Later she was busy tidying up and wanted to cover the leftovers with plastic wrap and was searching the cupboard of the galley for it. In one of the cupboards she found a red cylindrical object. She did not notice any labelling on the object. As she tried to open the object, flames had shoot from the object and everything had been full of smoke. She had panicked and feared the airplane might crash. Two of the passengers helped her to search for a fire extinguisher and tried to extinguish the fire. The flight attendant was in the middle of the cabin when one of the passengers handed her one of the oxygen masks hanging from the ceiling. Later she had lost consciousness. Once she came to, the airplane had been on approach to land. She then tried to extinguish a burning curtain when she felt an impact and fell on her back. After the airplane had come to a stop the passengers and pilots helped the flight attendant who was lying in front of the exit to her feet and everyone left the aircraft.

The flight attendant suffered bruises on her back and burnings in her face and on one hand. The other occupants suffered minor injuries.

## Personnel Information

### Pilot in Command (PIC)

The 39-year-old PIC was a Russian citizen. He held an Airline Transport Pilot's Licence (ATPL(A)) and had a rating to fly the Falcon 20 as pilot in command. His total flying experience was 2,592 hours; 949 hours of which on the Falcon 20. In the previous 90 days he had flown 74 hours. Prior to reporting for duty he had had a rest period of 24 hours.

### Co-pilot

The 47-year-old co-pilot was a Russian citizen. He held an Airline Transport Pilot's Licence (ATPL(A)) and had a rating to fly the Falcon 20 as pilot in command. In addition, he had the type rating for TU-134 and Yak-40. His total flying experience was 6,263 hours; 57 hours of which on the Falcon 20. In the previous 90 days he had flown 29 hours. Prior to reporting for duty he had had a rest period of more than 24 hours.

## Flight Attendant

The 22-year-old flight attendant was a Russian citizen. She had a total flying experience of about 36 hours; five hours of which on the type. In the previous 90 days she had flown about 3 hours.

About one year prior to the air accident she had completed a three-months training course on a Russian school for flight attendants. Then she had begun work as flight attendant at the airplane operator as flight attendant on the Falcon 20. She stated that during her training she had learned about distress signals. These had been smaller, however, as the signal flare aboard the Falcon 20. In praxis, however, she had never seen them or trained with them.

## Aircraft Information

The Dassault Mystère-Falcon 20-C5 is a self-supporting low-wing airplane in all-metal construction with two turbofan engines and a retractable landing gear. The aircraft type had a seating capacity of up to 10 passengers. According to the Airplane Flight Manual (AFM) the airplane was to be operated by at least two pilots.

Manufacturer:	Dassault
Type:	Mystère-Falcon 20-C5
Manufacturer's Serial Number (MSN):	180
Year of manufacture:	1968
MTOM:	13,200 kg
Engines:	Garrett TFE 731-5AR-2C

The aircraft was equipped with thrust reverse and also with a drag chute.

Total operating hours of the aircraft were approximately 10,413 hours. The aircraft had a French certificate of registration and was operated by a Russian business aviation company. The Russian civil aviation authority stated that at the time of the accident the aircraft had not been listed in the Air Operator Certificate (AOC).

According to the Type Certificate Data Sheet the airplane had a maximum usable fuel quantity of 8,402 lbs (3,811 kg). The OPS Flight Plan showed that at take-off at Moscow Domodedovo 8,200 lbs (3,719 kg) fuel were aboard.

The flight performance data in the AFM showed that in flap position 40° reference speed  $V_{ref}$  was 124.6 KIAS for a mass of 23,000 lbs (10,433 kg). Taking into account

the atmospheric and weather conditions the necessary landing distance would have been 2,660 ft (811 m). The factoring of 1.67 required by the manual would have resulted in a required landing distance of 4,455 ft (1,387 m).

The AFM, chapter Normal Procedures describes the Approach Checklist as follows:

**APPROACH AND LANDING**

- NO SMOKING and SEAT BELTS ..... Pushed
- Altimeters ..... Set
- Radioaltimeter ..... Checked
- . Decision height ..... Set
- Hydraulic pressures and levels ..... Checked
- LE - flaps : ..... Approach position
- LANDING LIGHTS (if installed), WRL LGT (if installed) ..... ON
- Landing gear down ..... Checked
- ANTISKID ..... Tested
- Flap position ..... Landing
- Airbrakes ..... IN
- At decision height : AP. .... Disengaged
- Upon touch-down : airbrakes ..... Extended

The paragraph Emergency Procedures in the AFM included checklists in case of smoke or fire development in the cabin and the conduct of an emergency descent. The Cabin Fire & Smoke Checklist listed the following:

**CABIN SMOKE OR FIRE**

Evacuation of smoke should be adequate with normal cabin ventilation.

If smoke cannot be evacuated :

**PHASE I**

- Crew oxygen masks ..... 100 % - Donned
- Smoke goggles, if necessary ..... Donned
- Radio transmission with masks ..... Selected and tested
- NO SMOKING ..... Pushed
- Providing there is no flame in the cabin :
  - . PASSENGER OXYGEN :
    - .. Two controls for passenger oxygen :
      - PASSENGER OXYGEN .....MAN
    - .. Single control for passenger oxygen :
      - PASSENGER OXYGEN ..... OVERRIDE
      - .. PASS. ON indicator ..... Checked
- Passenger masks ..... Donned-Checked
- WINDSHIELD DEFOGGING and FLOOR AIR ..... HOT

**PHASE II**

- If fire exists and its origin is effectively not electrical, use portable water extinguisher.
- Descend ..... Below 10,000 ft
- Cabin ..... Depressurized
- RAM AIR ..... OPEN
- If necessary, below 160 kt, sliding window ..... Open

**PHASE III**

If smoke persists land as soon as possible, initiate an emergency descent if necessary.

In case of an emergency descent the Emergency Descent Checklist was to be used:

### EMERGENCY DESCENT

- AP ..... Disengaged
- Throttles ..... Idle
- Airbrake handle ..... EXT. position
- SEAT BELTS / NO SMOKING pushbuttons ..... Pushed
- Descent airspeed : MMO / VMO, smooth air conditions.
- ATC transponder ..... Mayday code

## Meteorological Information

At the time of the accident it was night and Instrument Meteorological Conditions (IMC) prevailed. At Kiel Airport the following weather conditions prevailed at 1945 hrs:

Wind: 160° / 8 kt  
Clouds: 5-7 oktas in 600 ft AAL  
Visibility: 3,200 m  
Precipitation: light drizzle and rain, mist  
Temperature: 3 C  
Dewpoint: 1 C  
Barometric air pressure (QNH): 991 hPa

## Aids to Navigation

Kiel-Holtenau Airport is equipped with an Instrument Landing System (ILS) for runway 08. After the accident the functionality of the ILS was checked by a maintenance technician who stated that it functioned properly.

## Communication

Radio communications were held in English. The recordings of the air traffic control units involved were made available to the BFU.

## Aerodrome Information

Aerodrome elevation of Kiel-Holtenau Airport is 101 ft AMSL. The airport has one asphalt runway which is 1,260 m long and 30 m wide. The runway is oriented 082°/262° (08/26).

The threshold is shifted to runway 08 and therefore the Landing Distance Available (LDA) is 1,100 m. The threshold of runway 08 is at an elevation of 99 ft AMSL.

Both landing directions of the runway have approach lights, threshold lights and runway edge lights. In addition, the runway was equipped with a visual approach slope indication system (VASIS) 3°.

## Flight Recorder

The aircraft was equipped with a Flight Data Recorder (FDR) and a Cockpit Voice Recorder (CVR). Both recorders were removed and available for evaluation.

### Cockpit Voice Recorder

The Cockpit Voice Recorder (CVR) was read out at the BFU. The Russian accident investigation authority (Interstate Aviation Committee, IAC) conducted the transcript of the recorded Russian conversation and the translation into English.

### Flight Data Recorder

The FDR Fairchild F 1000 was read out at the BFU. The device had recorded 17 parameters.

## Wreckage and Impact Information

The airplane had overshoot the end of runway 08. In the process it had destroyed a concrete lamp post in the adjacent sloping ground, had burst through the airport fence and had come to rest about 30 m behind the asphalt area, about 140 m behind the threshold of runway 26 in extension of the centre line and about 5 m below the airport level. The distance between the threshold of runway 08 and the final resting point of the airplane was about 1,174 m.



Final position of the airplane

Photo: BFU

The left main landing gear had been torn off; the left wing was severely damaged. On the left wing the outer flap was extended, the inner flap was lying on the left main landing gear and was bent upward. The slat had been torn off and was found about 8 m from the aircraft. On the right wing outer and inner flaps were extended. The slat was extended.

The airbrakes on both wings were in the extended position.



Locked emergency exits

Photo: BFU

The fuselage was torn open and deformed in the area of the fuselage nose. The entire extent of the fuselage in front of and behind the wings showed folds. The main door hinged at the bottom and located on the aft left fuselage side was open by about a third. The door could be opened without much force. The two overwing emergency exits were closed.

The thrust reversers on both engines were in the retracted position.

In the cockpit the flap control lever was in position 25°; the indication showed 0°. The drag chute lever had not been activated. The speed bug of the airspeed indicator on the left instrument panel showed 130 kt; the one on the right showed 140 kt.

In the cabin the oxygen masks hung from the ceiling. The oxygen mask in the lavatory had not been activated.

The entire interior of the cabin showed a layer of soot.



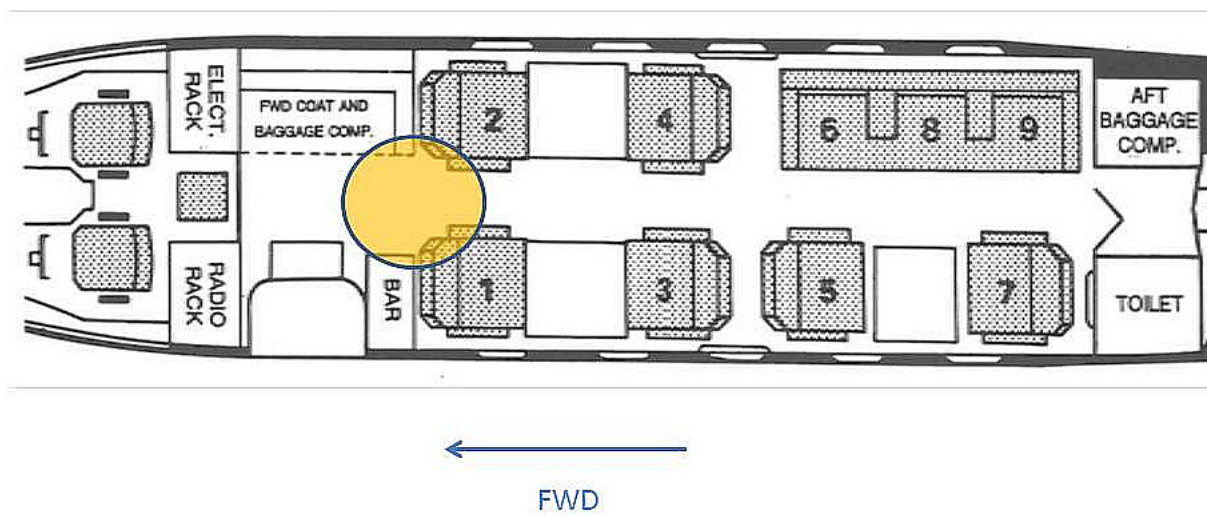
Traces in the cabin; line of vision is flight direction

Photos: BFU



Fire damage on the cabin floor opposite the galley

Photo: BFU



Cabin layout and fire damage

Source: Dassault/BFU

## 1.13 Medical and Pathological Information

The flight attendant suffered burns on her face and on one hand.

### Fire

The signal flare had caused a fire in the aft part of the cabin. Especially the interior between cockpit and first seating area showed traces of fire.

### Additional Information

The pyrotechnical device was a *Handheld Flare*. Powered by a solid fuel rocket it was meant to reach about 300 m and let a red flare sink to the ground on a parachute for at least 40 seconds. The device was meant to be used outdoors for the purpose of signalling an emergency. The manufacturer stated that the activated pyrotechnical device could be extinguished by water. According to the manufacturer the device has to be treated in accordance with the regulations for Dangerous Goods and it is not permitted to transport it in passenger aircraft.

The flight attendant stated that on board the airplane the life raft and the distress signals were normally stored in the aft part of the cabin beneath the sofa. The two pilots, however, stated the distress signals were stored in a compartment opposite the door.

### Aviation Regulations

In JAA member states certification of survival equipment and pyrotechnical signals was not required. JAR OPS 1 stipulated that as part of survival kits pyrotechnical signals had to be on board which were suited to make the pyrotechnical distress signals described in ICAO Annex 2.

The training of flight and cabin crew in accordance with JAR OPS also included the handling of pyrotechnical signals. Subsequently, an operator had to ensure that pilots and flight attendants are trained in *Actual fire-fighting using equipment representative of that carried in the aeroplane on an actual or simulated fire except that, with Halon extinguishers, an alternative method acceptable to the Authority may be used. ... Actual handling of pyrotechnics, real or simulated, where fitted ....*

The Russian Federation was not a member of the JAA. The BFU did not have the Russian aviation regulations valid at the time of the accident available for analysis.



Handheld flare with imprinted operating instructions and warnings

Photo: BFU



Pyrotechnical device with classification and description

Photo: BFU

## ICAO Regulations

ICAO, Annex 2, Rules of the Air stipulated which emergency distress signals can be used in civil aviation. The stipulations included:

### **1. DISTRESS AND URGENCY SIGNALS**

#### **1.1 Distress signals**

*The following signals used either together or separately, mean that grave and imminent danger threatens, and immediate assistance is requested:*

- a) a signal made by radiotelegraphy or by any other signalling method consisting of the group SOS (. . . — . . . in the Morse Code);
- b) a radiotelephony distress signal consisting of the spoken word MAYDAY;

- c) a distress message sent via data link which transmits the intent of the word MAYDAY;*
- d) rockets or shells throwing red lights, fired one at a time at short intervals;*
- e) a parachute flare showing a red light.*

## Analysis

### General

Once the pyrotechnical device was triggered the rocket was activated. The CVR recordings showed a time span of 4.19 seconds during which the sizzling sound was recorded. The manufacturer stated the burning time of the flare was at least 40 seconds. The distinct traces of heat and soot of about 2 m<sup>2</sup> found in the area of the galley and the left front passenger seat on the cabin ceiling showed clearly that the pyrotechnical device burned out in this area.

The BFU is of the opinion that the traces showed the fire did not set the whole interior on fire. The main reason is the short burning life of the pyrotechnical signal of not more than one minute (rocket and flare). The entire cabin and the cockpit showed clear traces of soot. This means the entire fuselage must have been filled with smoke. The statement of the flight attendant indicates that during the approach to land at least the fire of the curtain was not fully extinguished.

The flight data shows that the airplane had touched down with a speed of 140 KIAS and has rolled a distance of 1,080 m until standstill. Consequently, the airplane has touched down about 100 m beyond the threshold of runway 08.

As the airplane was over-shooting the end of the runway it still had a speed of about 55 kt; when it left the asphalt strip it still had a speed of about 50 kt. The decrease of the vertical acceleration to 0 g shows that above the sloping ground the aircraft followed a ballistic trajectory before it crashed to the ground with about 4 g.

### Operational Aspects

#### **Flight Attendant**

The statement of the flight attendant indicates that while she was in the galley looking for a roll of plastic wrap she found the pyrotechnical device, unscrewed it, and inadvertently activated it.

In the process of activating the pyrotechnical device and the attempt to extinguish the fire the flight attendant suffered some injuries. It is likely that the flight attendant's capacity to act was already impaired at the beginning of the emergency situation because of the burns she had suffered. The CVR recordings show that she had great difficulties to find a fire extinguisher. In the process she panicked more and more. Again and again the flight attendant called out to the pilots to open the windows. The recording of the flight attendant's remark "I didn't want", 04:24 minutes after the distress signal had been activated shows that at that time she still was not wearing an oxygen mask.

She stated that then the passengers had handed her one hanging from the cabin ceiling. It is to be assumed that she lost consciousness shortly afterwards. It could not be determined with sufficient certainty for how long she had been unconscious and therefore been unable to act. The present statements show that during the descent she was temporarily unconscious. According to her own statements she had regained consciousness during the approach to land and fell due to a severe jolt while she tried to extinguish the fire of the curtain. It is likely that she did not fall during the relatively soft touch-down which occurred with 1.2 g but during the crash on the slope which reached 4 g.

### **Flight Crew**

The PIC initiated an emergency descent about 40 seconds after the distress signal had been activated. The co-pilot had donned his oxygen mask within 18 seconds after the distress signal's activation and the PIC had donned his within 59 seconds.

The fact that the PIC's remark: ".. we have a fire on board, request emergency descent" was recorded by the CVR at 1922:08 hrs but not by the air traffic service provider was due to the pilot not having pushed the radio transmission button. One minute and 46 seconds later he repeated this information and this time it reached the controller.

In this phase the co-pilot was busy supporting the flight attendant in her search for the fire extinguishers. The PIC was highly stressed steering the airplane. The CVR recordings show that he had to ask the co-pilot repeatedly to hand him an oxygen mask.

At 1925:31 hrs the PIC instructed the co-pilot to read the checklist. The co-pilot was distracted by the flight attendant who was suffering from shortness of breath due to the smoke development asking him to open the cockpit window. Subsequently, the

co-pilot asked the PIC whether the cockpit window could be opened and the checklist was never read. Neither the CVR recording nor the presented statements indicate whether the pilots realised that the flight attendant had lost consciousness shortly afterwards.

Approximately 6.5 minutes after the distress signal had been activated the crew changed the frequency to Bremen Radar. The radar controller issued descent instructions and passed on information about Kiel Airport. With the question "... Kiel runway in use is zero eight, the length is one thousand two hundred sixty meters, is that sufficient?" the controller wanted to inform the crew about the runway length and a confirmation that it would be long enough for the airplane. The co-pilot answered: "Roger, sixty meters." And the PIC asked: "What are they talking about?" This shows that neither of the two had understood the information. The subsequent question the co-pilot asked the radar controller is also proof of it: "Confirm five thousand feet?" The controller repeated the information: "...I say again, runway length is one thousand two hundred sixty meters, is that sufficient?" But it did not reach the pilots. This was due to the high level of noise on board the airplane due to the open side window. From the co-pilot's answer: "Affirmative" the controller deduced that the pilots had estimated the runway length to be sufficient.

At 1930:59 hrs the PIC instructed the co-pilot to read the checklist; at 1932:28 hrs the co-pilot announced he was going to read it. Both times the pilots were interrupted by the controller's radio calls. During the entire time of the approach to land there never was any approach briefing.

Since the airplane was significantly north of the extended centre line the controller instructed the crew to abort the approach and gave them vectors for the second approach.

According to the statements of the pilots they had seen the approach lighting during the ILS approach after passing about 200 m. The statements of the pilots indicate that at that time the cabin was still filled with smoke and visibility through the cockpit windows was impaired due to soot.

The touch-down speed of 140 KIAS was significantly higher than stated by the pilots and was also above the speed selected on the PIC's airspeed indicator.

Because the pilot's acted on the assumption the runway was 2,600 m long they did not use the thrust reversers nor did they apply the wheel brakes with maximum power.

## Specific Conditions

The BFU is of the opinion that the statement of the flight attendant the distress signal was laying unsecured in the galley area is plausible. The unsecured storage made the improper use of the pyrotechnical device possible in the first place. The BFU is also of the opinion that the fact that it was dark when the event happened has contributed to the fact that the flight attendant had mistaken the pyrotechnical device for a roll of plastic wrap.

The pyrotechnical device met the criteria in ICAO Annex 2 for emergency equipment in airplanes. The operational procedures (JAR OPS) stipulated regarding the medical emergency equipment to store them "*... protected from dust, humidity and unauthorised access ... and, if possible, in the cockpit ...*". There were no such stipulations regarding pyrotechnical signals as part of the survival kit.

The differing statements of the pilots and the flight attendant indicate that the storage of distress signals was not unambiguously regulated within the operator. These statements also indicate insufficient training regarding storage and handling of pyrotechnical distress signals within the operator.

On board of the airplane, for the occupants the situation abruptly seemed to be like the airplane was on fire after the pyrotechnical device had been triggered due to the massive smoke development, the flames and the red glow. Neither the pilots, nor the passengers or the flight attendant could fully and clearly understand the situation at that time. Within seconds the cabin was filled with smoke, visibility and breathing were severely impaired.

From the BFU's perspective, the pitch of the pilots' voices and the rate of speech recorded on the CVR, the missing completion of checklists and touch-down with too high a speed can be explained by a high stress level of the pilots.

The PIC was experienced where is total flying experience and his experience on the type is concerned. The co-pilot was 11 years his senior. His total flying experience was even higher but he had only very few flight hours on the type.

The flight attendant's experience in general and on the aircraft type has to be evaluated as low.

The fact that it was dark and that the airplane was already in 600 ft (200 m) when it was free of clouds complicated the approach as well. In addition, the pilots were not familiar with Kiel Airport and did not have the respective approach charts available.

According to the data in the AFM the airplane would have needed a landing distance of 811 m. Therefore, the LDA of 1,100 m was theoretically sufficient; it was, however, below a runway length of 1,387 m which would have included reserves.

## Conclusions

The causes of the flight accident were:

### Immediate causes

- Inadvertently ignition of a pyrotechnical distress signal in the cabin
- Emergency situation due to fire and smoke development
- Misunderstandings in the communication
- Disuse of the thrust reversers or of the brake parachute and insufficient use of the wheel brakes

### Systemic Causes

- Incorrect storage of the pyrotechnical signal on board
- Inadequate training of the crew members within the operator

Investigator in charge: Jens Friedemann

Assistance: Dieter Ritschel

Field Investigation: Karsten Severin, Andreas Wilke

Braunschweig: 15 January 2013

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 - 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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