

# Investigation Report

## Identification

Type of Occurrence:	Accident
Date:	12 September 2010
Location:	Abbesbüttel
Aircraft:	Hot Air Balloon
Manufacturer / Model:	Lindstrand Hot Air Balloons Ltd. / LBL 330A
Injuries to Persons:	Eight people with severe and five people with minor injuries
Damage:	Aircraft severely damaged
Other Damage:	Damages to buildings, cars and fences
Information Source:	Investigation by BFU
State File Number:	BFU 3X134-10

## Factual Information

### History of the Flight

At 1806 hrs<sup>1</sup> the hot air balloon took off from a take-off site west of Braunschweig-Lehndorf for a commercial balloon flight. One pilot and 13 passengers were aboard. The company had called the passengers between 1300 hrs and 1500 hrs and

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

informed them about the meeting place, the take-off site and the time. At 1730 hrs, all passengers had arrived at the field in Lehndorf.

Prior to the flight all passengers had been briefed on the correct behaviour during the flight and the landing. One member of the ground crew conducted the briefing.

Witnesses stated there had been discussions with the ground crew member about the weather conditions that evening, in particular the thunder storms. One witness stated the ground crew member downplayed the storm hazard. While the balloon was gaining altitude one could see a dark cloud bank and lightning in the direction of Hanover. The pilot stated he had not been particularly concerned about the dark clouds; one passenger made the comment they must be still at least 40 km away. Another passenger had requested the pilot to land immediately.



Weather situation during the flight; viewing direction west-north-west

Photo: Witness

At 1834 hrs the pilot contacted Braunschweig Info and received the following weather information: *"Have a sharp look-out on the weather. [...] Hanover Tower reported heavy rain showers over there."* In addition, Braunschweig Tower also informed the

pilot about the wind conditions on the ground: "[...] *wind is calm, [...] maybe two knots from the southerly directions [...].*"



Development of the weather situation during the flight

Photo: Witness

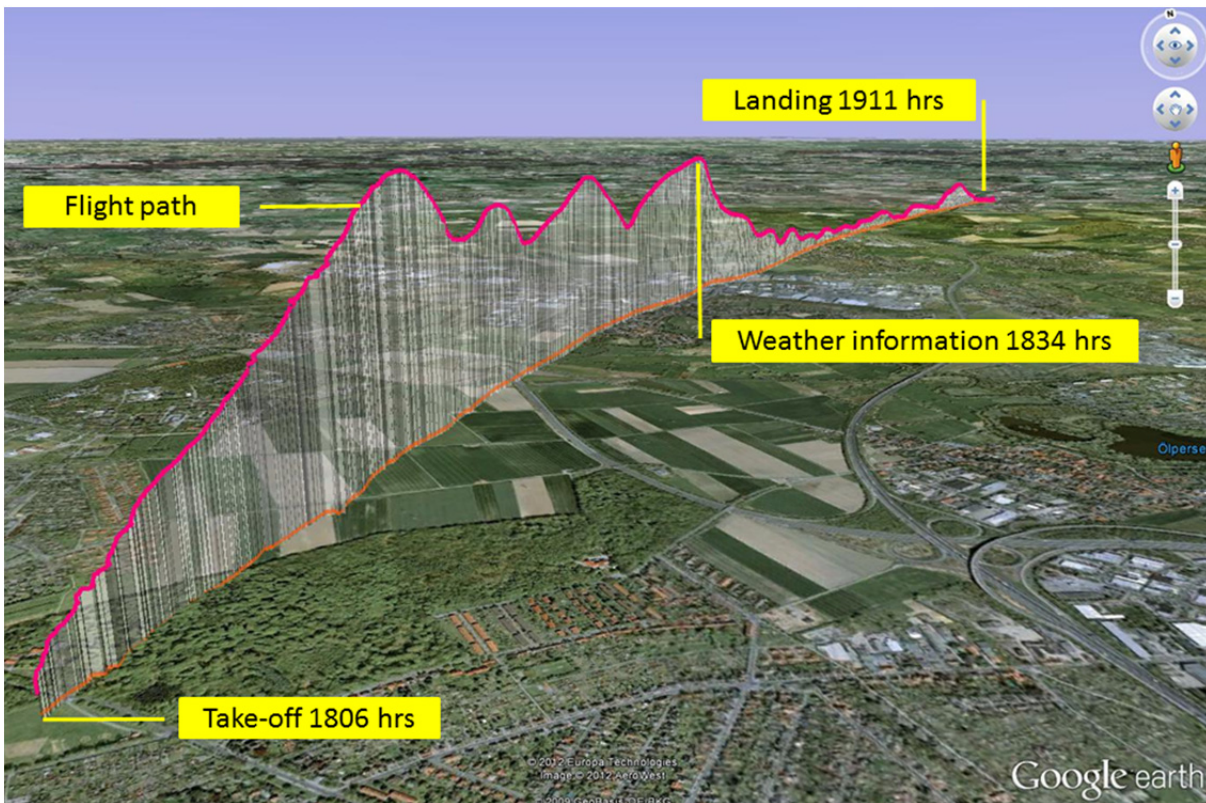
The pilot stated he decided to land after receiving this information.

The GPS data read-out shows that the balloon left the altitude of about 700 m AMSL at 1835 hrs. From 1840 hrs on it flew in about 150 m AMSL and the direction of flight varied between 035° and 040°.

The pilot stated that the balloon had had a speed of about 5 kt in 150 m AMSL and he had been on the lookout for a landing field. But ahead there had been a town, a forest and shipping canal forested on both sides.

At about 1903 hrs the balloon climbed to about 250 m AMSL. The direction of flight changed to about 045°.

At 1907 hrs the balloon began to descent and touched down on a stubble field at 1911 hrs at a wind speed of about 3 kt.



Flight path reconstruction

Source: Google Earth map service™ / Adaption BFU

The GPS data read-out showed that after touch-down the balloon stood at the landing site for about 1.0 to 1.5 minutes. During this time, the pilot had begun to vent the burner hoses and to extinguish the pilot lights while he waited for the ground crew. Suddenly, wind had arisen and the balloon had moved. He had then instructed the passengers to hold on like they did during the landing and began to open the envelope. The wind made a sail in the form a spinnaker of the larger part of the envelope and the basket was dragged along the ground.

While it was dragged along the ground in the direction of 050° the balloon collided with a number of obstacles. After about 200 m the balloon was stopped because the basket had hit the wall of a garage, the envelope draped itself over a house and ripped the chimney off the roof.

During the accident eight persons were severely injured; five persons suffered minor injuries. The balloon was seriously damaged.

## Personnel Information

The 69-year-old South-African balloon pilot held a British Commercial Pilot's License (CPL Balloon) issued on 22 September 2004 valid to 21 September 2014. He held the rating as Pilot in Command (PIC) to pilot category C balloons (more than 9,000 m<sup>3</sup>).

He also held a Flight Radio-Telephony Operator's Licence issued on 22 September 2004 valid to 21 September 2014.

He also had a British class 2 medical certificate issued on 10 August 2010 according to JAA guidelines valid to 10 August 2011 with the restriction to wear optimal corrective visual aid and to carry along a spare pair of glasses (VDL).

On 8 August 2010 he had completed a Combined Base / Line Check in Great Britain for commercial operations of category C balloons. On 3 April 2008 he had completed a First Aid course; on 18 June 2008 he had received a certificate for fire drills.

According to the German check form, on 20 August 2010 he had completed a proficiency check in accordance with the Regulation on Personnel Licensing (LuftPersV) para 49 and the Regulation on Operation of Aircraft (LuftBO) para 42 with the head of operations and flight examiner of the company for category 3 balloons (more than 6,000 m<sup>3</sup>). The check form showed that a proficiency check on 19 August 2010 was aborted after 1 hour and 10 minutes due to radio communication problems.

He had no German permission for take-offs with manned balloons outside an airport.

The pilot had not been registered with the aviation authority responsible for the operator and until the day of the accident was not listed in the company's Flight Operations Manual (FOM). The revision of the FOM dated 20 September 2010 listed the name of the pilot.

According to his pilot's logbook, his total balloon flying experience was 4,326 hours. He stated he had started flying balloons in 1976 and in 1980 acquired the pilot's license No 2 in South Africa.

He had experience with balloons of all sizes. 2010 he had conducted 17 balloon flights.

The pilot's logbook, the aircraft log books of the respective balloons, and a check form, showed the following entries for the pilot:

Date	Balloon (Manufacturer's Serial Number)	Entry pilot's logbook	Entry aircraft log book
19 August 2010	N 300 (300/11)	PIC Take-off/Landing 1845 to 1955 hrs Braunschweig - Essenrode	Other pilot was PIC Take-off/Landing 1712 to 1824 hrs Braunschweig - Essenrode
20 August 2010	N 300 (300/11)	No entry <i>* For this flight there was a check form for a proficiency check of the pilot in accordance with Regulation on Personnel Licensing para 49 / Regulation on Operation of Aircraft para 42</i>	Other pilot was PIC Take-off/Landing 1706 to 1842 hrs Hanover - Lachendorf
5 September 2010	N 300 (300/11)	PIC Take-off/Landing 1815 to 1920 hrs Braunschweig – Groß Steinum	Other pilot was PIC Take-off/Landing 1612 to 1718 hrs Braunschweig – Groß Steinum
11 September 2010	LBL 330 A (1084)	PIC Take-off/Landing 0710 to 0810 hrs Braunschweig - Wense	PIC Take-off/Landing 0512 to 0612 hrs Braunschweig - Wense
12 September 2010 (Accident)	LBL 330 A (1084)	PIC Take-off/Landing 1805 to 1855 hrs Braunschweig - Abbesbüttel	PIC Take-off/Landing 1606 to 1654 hrs Braunschweig - Abbesbüttel

He also stated he had completed 11,377 hours flight time on airplanes and helicopters until he left the South African air force in 1979.

## Aircraft Information

The hot air balloon was operated by a German operator.

Manufacturer:	Lindstrand Hot Air Balloons Ltd.
Type:	LBL-330 A
Envelope volume:	9,344 m <sup>3</sup>
Manufacturer's Serial Number (MSN) Envelope:	1084
Year of manufacture Envelope:	2006
Basket:	CB 3040, 300 TT D (MSN: BH 696, year of manufacture unknown)
Burner:	Quad. MK4-Stealth/Shadow (MSN: 166, 167, 5361, 5369, year of manufacture unknown)

The balloon was equipped with five gas cylinders Cameron CB 959. Aboard the balloon was a radio combined with a transponder and a Flytec 3040 with envelope thermometer, altimeter and variometer.

The last airworthiness inspection of the envelope was conducted on 27 April 2010. Since then 33 hours and 13 landings were conducted. The envelope had a total of 222 operating hours. Basket and burner were inspected on 16 June 2010.

<b>Balloon according to the documentation</b>	<b>Mass according to the documentation</b>	<b>Balloon components during the flight</b>	<b>Mass according to the documentation</b>
Envelope (No 1084)	292 kg	Envelope (No 1084)	292 kg
Burner + frame (No B6660, B6662, F5369, F5370)	82 kg	Burner + frame (No 166, 167, 5361, 5369)	52 kg
Basket (CB 3040, 300 TT D) with fixed structures and supports (No 769)	314 kg	Basket (CB 3040, 300 TT D) with fixed structures and supports (No 696)	306 kg
Accessory	10 kg	Accessory	10 kg
Empty mass	698 kg	Empty mass	660 kg

According to the documentation the balloon had an additional load of 2,177 kg (gas cylinders, gas, pilot and passengers) at a maximum take-off mass of 2,875 kg.

According to the load and trim sheet of the company of 10 September 2010 the take-off mass of the balloon components used (empty mass 500 kg + gas cylinder including gas 350 kg + pilot/passengers 1,107 kg) was 1957 kg. For the calculations, estimated values regarding air temperature (22 °C) and barometric air pressure (QNH 1,013 hPa) were taken into consideration.

The company stated that on 8 September 2010 balloon components had been exchanged by mistake. Originally, the entire balloon should have been exchanged due to damages on the envelope, but the employees had only replaced the envelope. Due to the identically constructed components this exchange had not been noticed until some time after the accident.

## Meteorological Information

### Pre-flight Meteorological Preparation

According to the Deutscher Wetterdienst (German meteorological service provider, DWD) the general manager of the company called the Luftfahrtberatungszentrale Hamburg at 1150 hrs and asked for the weather information for three different take-off places.

The pilot stated he had checked the weather information of three different sites on the internet: [www.XCWeather.co.uk](http://www.XCWeather.co.uk), [www.Flugwetter.de](http://www.Flugwetter.de), [www.Wetteronline.de](http://www.Wetteronline.de).

He had also gotten the Terminal Aerodrome Forecast (TAF) for Hanover Airport, Leipzig Airport and Magdeburg-Cochstedt Airport of 1300 hrs:

TAF Hannover (EDDV) 1212/1312 24004KT 9999 SCT030 BKN040 TEMPO 1213/1303 RA BKN014 PROB30 TEMPO 1213/1219 4000 TSRA BKN008CB BECMG 1214/1216 30007KT TEMPO 1303/1307 4000 BR BKN004=

TAF Leipzig (EDDP) 1212/1213 18005KT CAVOK BECMG 1300/1304 32012KT BCMG TEMPO 1300/1309 3500 -RADZ BKN008 PROB30 TEMPO 1300/1308 2000 RADZ BKN004 BCMG 1310/1312 BKN020=

TAF Cochstedt (EDBC) 1212/1221 22007KT CAVOK=

He stated he had gathered from his weather briefing that there would be slight wind and no rain. At 1445 hrs he decided to conduct the balloon flight.

Furthermore, at about 1600 hrs he got the aviation routine weather report (METAR) for Hanover Airport and Celle Special Airfield, observation time 1520 hrs:

METAR Hanover           VRB03003KT 9999 FEW031TCU BKN230 22/14 Q1018  
(EDDV)                   NOSIG=

METAR Celle             21004KT 9999 FEW030 SCT140 BKN230 23/15 Q1018  
(ETHC)                   BLU/=

According to the flight operations manual and the German Aviation Regulation para 3a subsection 2 the PIC has to make himself sufficiently familiar with flight weather reports (Met. Briefing Data, Attachment N).

Attachment N (dated 10 December 2009) stated that "prior to each take-off the pilot has to make himself sufficiently familiar with flight weather reports and forecasts" and listed sources:

- Radio, internet, newspapers, airports
- DWD (AFWA / GAFOR, mailbox, PCMET, internet, Fax, PID)
- [www.pcmet.de](http://www.pcmet.de)
- [www.flugwetter.de](http://www.flugwetter.de)
- Meteorological flight briefing by phone including telephone numbers (national, international)
- List of fax numbers
- Infomet-Service
- GAFOR North
- VOLMET Bremen
- GAFOR areas for the company's flight area
- List of offices providing the mentioned services

According to the flight operations handbook, attachment N has to be stored for six months together with the load and trim sheet.

The ground crew member stated that prior to take-off a children's balloon filled with Helium was released to determine the direction of the wind. At the take-off site the sun had been shining at wind speeds of about 2 to 3 kt.

### Forecast of the Deutscher Wetterdienst

According to the balloon weather report for Lower Saxony, Schleswig-Holstein, Bremen and Hamburg published on 12 September 2010 at 1100 hrs valid until one hour after sunset (sunset 1944 hrs), an undulating cold front with damp and partially unstable air masses reached the forecast area. In the evening the front reached the line Lübeck - Kassel - Saarbrücken. Predicted were rain showers and embedded thunder storms.

The balloon ticker reported at 1730 hrs that in front of the cold front a line of shower and thunder storms had formed which extended from the Rothaargebirge across Hanover up to Lübeck and expanded towards the north-east. The DWD was of the opinion that so-called squall lines<sup>2</sup> had to be anticipated.

At 1530 hrs a terminal aerodrome warning had been published for Braunschweig Airport (EDVE) which was valid until 2000 hrs and warned of individual thunder storms. At 1650 hrs the temperature was 23°C and the barometric air pressure (QNH) was 1,017 hPa.

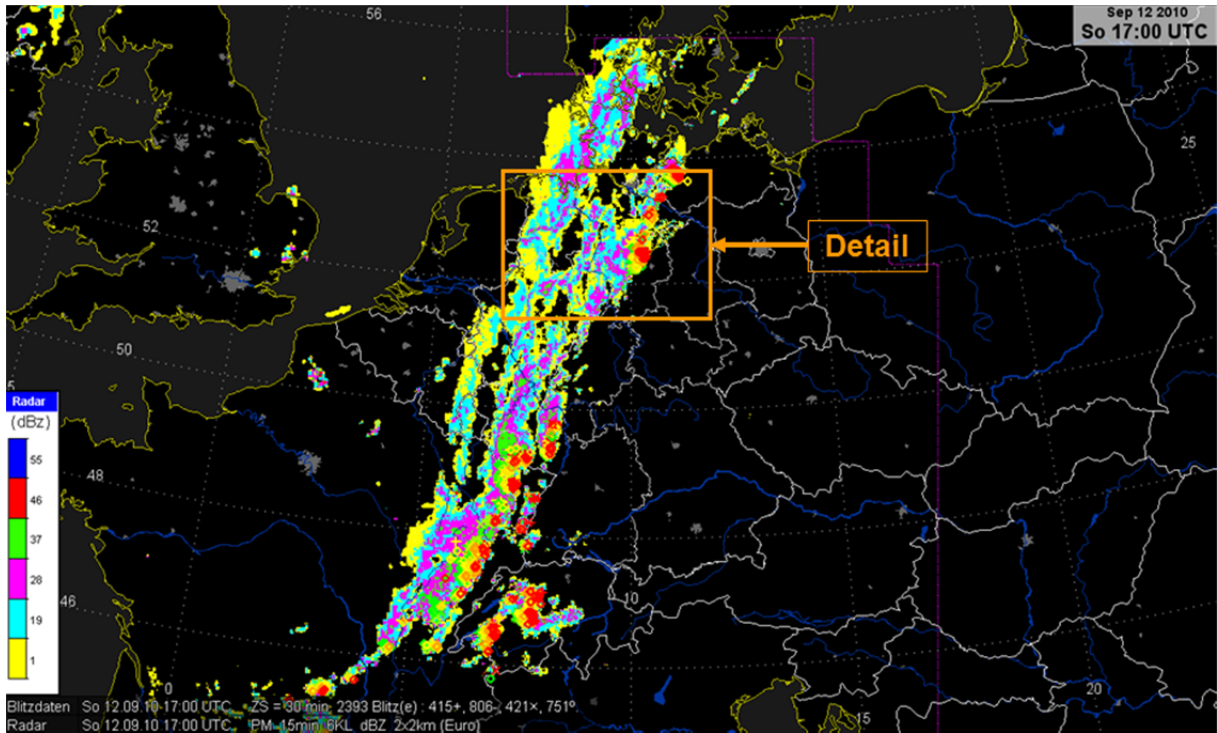
### Weather at the Time of the Accident

According to the DWD expert opinion and the data of the Wetterwarte Braunschweig (weather station) the wind increased between 1850 hrs and 1900 hrs on average by about 8 kt with gusts of 22 kt. Up until 1920 hrs the wind increased further to an average of 15 kt with gusts of 25 kt. At the time of take-off heavy thunderstorms occurred in Hanover. Until the time of the landing, the so-called squall lines shifted further east up to the landing area.

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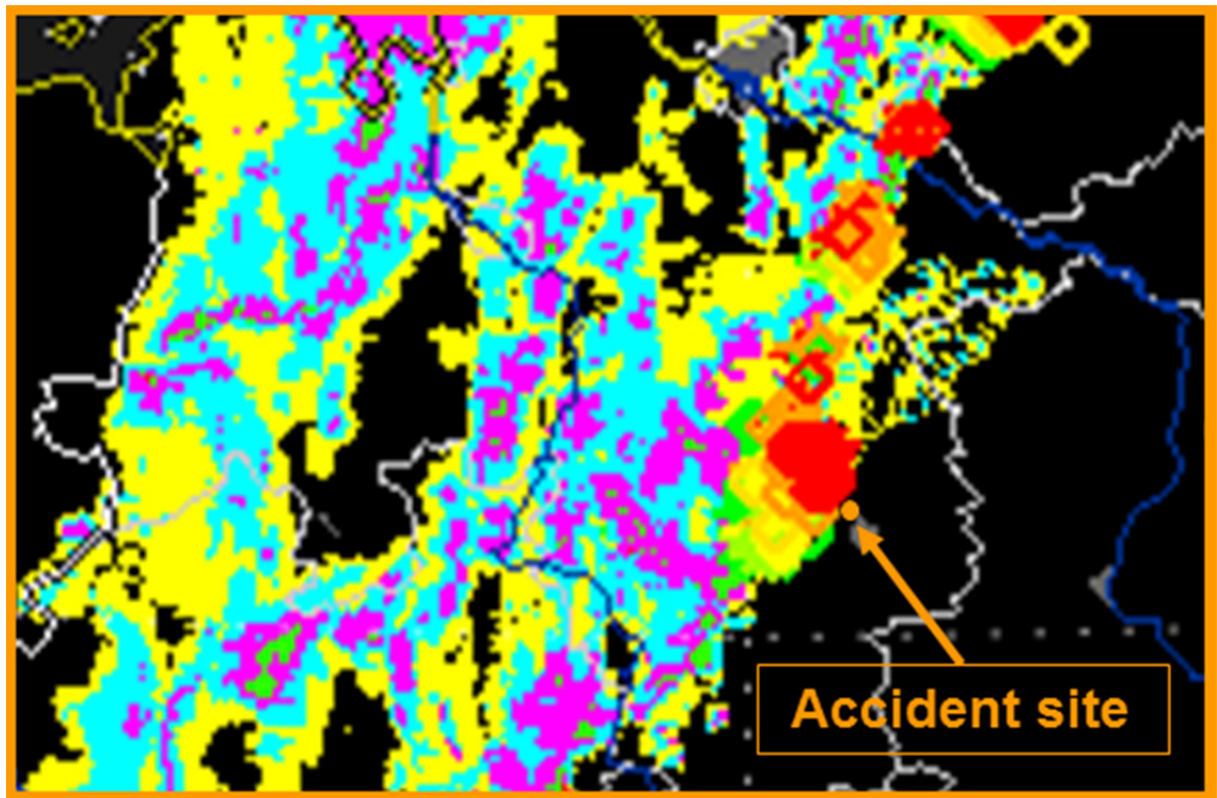
A squall line is a storm front which can form long before a cold front. One basic condition is that the wind in higher altitudes is significantly stronger than the wind closer to the ground. The effect is that in higher altitudes the cold air moves more quickly than the cold front closer to the ground. This constellation makes the warm air in front of the cold front very unstable especially when there is cold air in higher altitudes and still warm air on the ground. Often the weather phenomena at a squall line are significantly stronger than in the succeeding cold front because here the instability is stronger than in the subsequent ground cold front. The forecast of a squall line is much more difficult than that of a weather front.

Source: DWD expert opinion.



Rain radar and lightning (red) at 1900 hrs.

Source: DWD



Detail: Progress of the front at 1900 hrs in regard to the accident site

Source: DWD

## Communication

Radio communications between the pilot and Braunschweig Info at Braunschweig Airport were recorded and made available to the BFU as transcript.

## Take-off Site

The take-off site "Festplatz Lehdorf" (fairground) in Braunschweig was a take-off site in accordance with para 25 of the Federal Aviation Act (Luftverkehrsgesetz) approved for take-off during the day of hot air balloons of the company. The approval was issued on 24 March 2010 and valid until 31 March 2011.

In the west and north, the take-off site is bordered by forests.

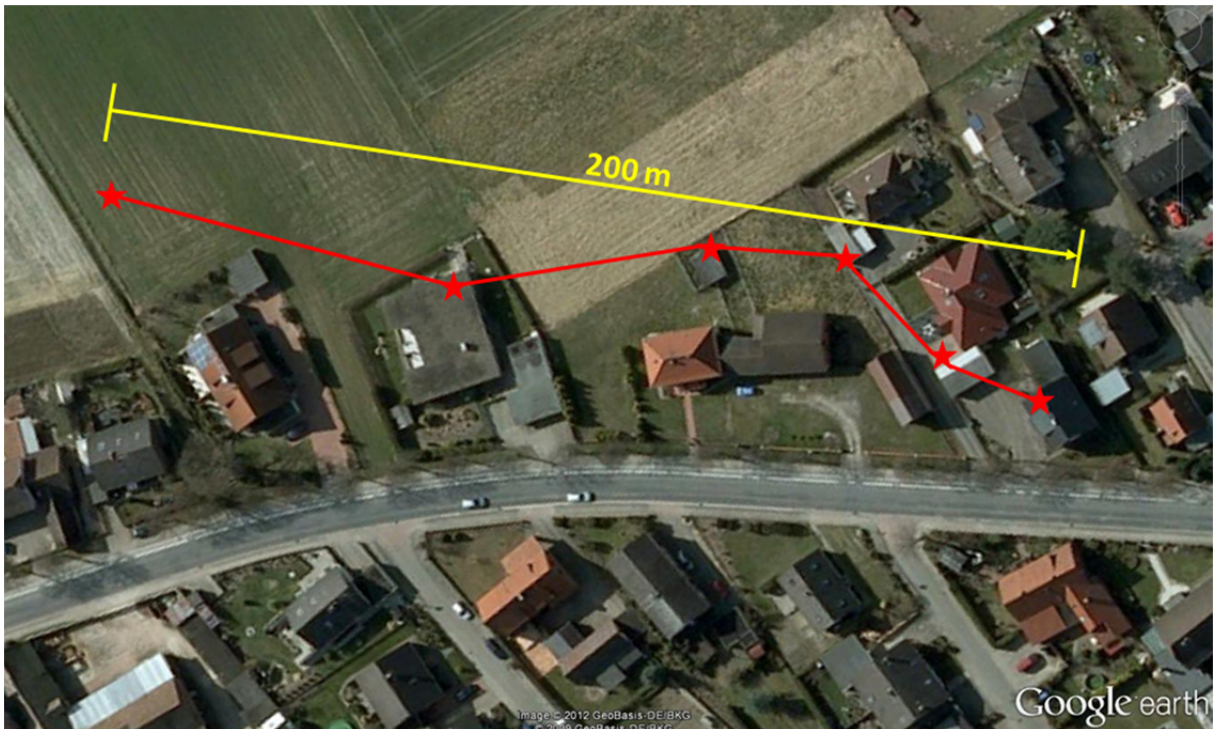
## Flight Recorder

A GPS recorded the entire flight path. The data was available to the BFU for analysis.

## Wreckage and Impact Information

### Accident site

The accident site was located at the north-western part of the town Abbesbüttel on several private properties.



Accident site

Source: Google Earth map service™ / Adaption BFU

The touch-down occurred on an even meadow. For about one to one and a half minutes the balloon came to a stop. A sudden wind set the balloon in motion again and after about 65 m the basket collided with an approximately two-meter-high hedge and subsequently crashed into the wall of a house with a platform roof. The entire balloon was pulled over the house. After about 130 m the basket penetrated a wire mesh fence and collided with a solid shed. Subsequently the basket was pulled through a second wire mesh fence, crossed a garden, collided with a solid metal fence after about 180 m and came to rest at a garage. After about 200 m the envelope came to rest on top of the roof of a house.



Final position of the balloon

Photo: Witness

## Findings on the Aircraft

After the accident the balloon and the equipment were seized. On 25 October 2010 an examiner for aerial sports equipment class 3, hot air balloons, conducted a technical examination and survey.

The survey report stated:

### **Envelope**

Several panels of the envelope were torn. The tensile strength of the fabric was about 20 - 25 kg.

### **Burner and Burner Hoses**

The frame of the quad burner was deformed.

At the time of the investigation the burner system was soiled and rust-streaked.

The burner hoses showed ruptures and abrasions on the outer shroud and in the kinks of the burner mountings. It was not possible to determine time and cause of these damages.

## Gas Cylinders

The five propane gas bottles, Cameron CB 959, MSN 0698/4522, 0698/4524, 0698/4525, 8494/4143 and 0407/4278 were not damaged. They were all listed in the so-called bottle list required for the airworthiness certificate and had a valid review.

## Basket

The metal tube frame was deformed in the area of the basket railing.



Deformation of the metal railing on one of the compartments

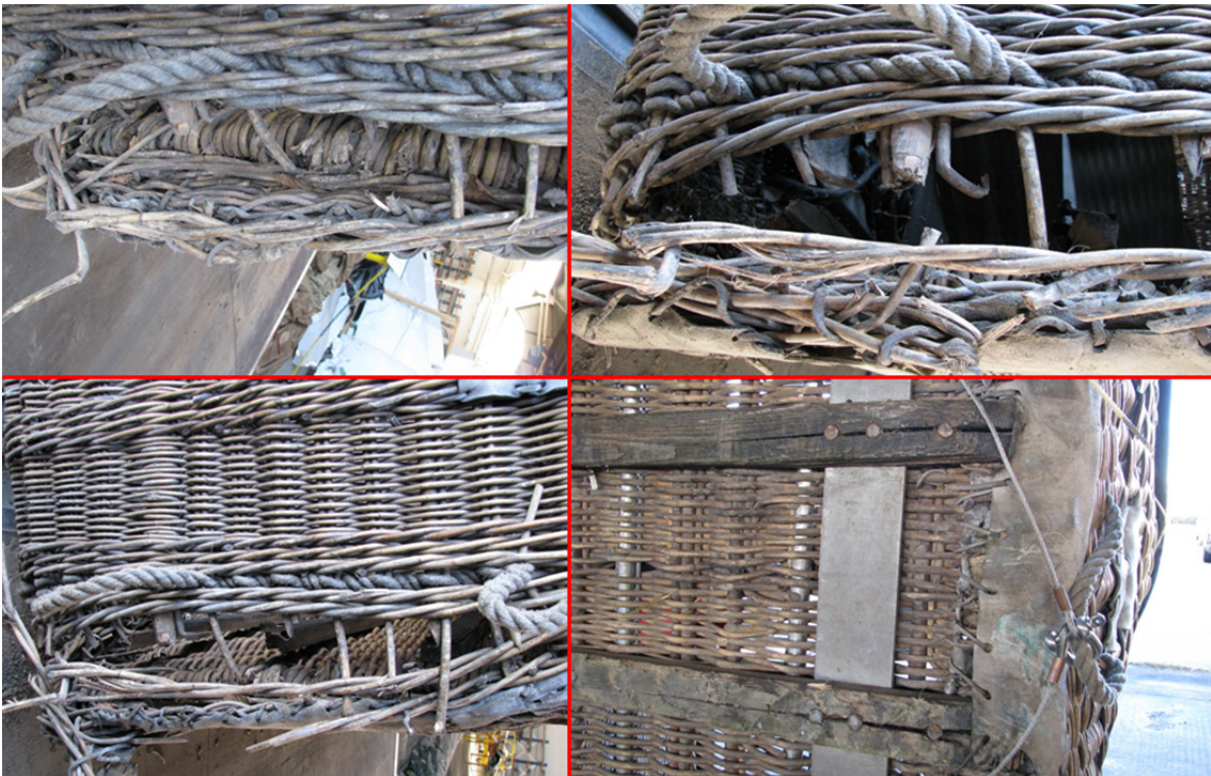
Photo: BFU

The basketwork on the lower edge of the basket was fractured but also partly decayed. The sliding runners on the right basket bottom were split.



Visibly fractured basketwork on the bottom (prior to take-off / rigging process)

Photo: Passenger / Witness



State of the basket in the area of the lower basketwork - after removal of the rawhide - and on the basket floor

Photos: BFU

## Other Equipment

There was a radio, Becker AR 4201, combined with a transponder Bendix/King aboard. There was a check record dated 27 April 2009 for the radio. The transponder was not in use during the flight; check protocols were not available.

## Documents

A road map, a passenger list and the load and trim sheet were aboard.

The documentation of the aircraft, personal documents and aeronautical charts were neither found aboard the aircraft nor in the car of the ground crew.

## Medical Information

During the accident eight people were severely injured; five people suffered minor injuries. One person remained uninjured. The following injuries were documented:

- 1 Passenger: Fracture of the spinal column, serial rib fractures, patella fracture
- 2 Passengers: Fracture of the spinal column, rib fracture
- 2 Passengers: Second degree burns, bruises
- 6 Passengers: Bruises, abrasions
- 1 Passenger: Torn ligament in the shoulder blade, serial rib fracture
- 1 Passenger: Collarbone fracture, serial rib fracture

## Fire

According to the statements of the pilot and one passenger, one of the burners was activated for a short time during the drag along the ground because the pilot hit the burner valve with his head. Two passengers suffered burns to their heads and hands.

## Organisations and their Procedures

### Regulations of the Operator

According to the FOM, prior to the flight the PIC is obliged to check whether the aircraft is airworthy. This includes checking whether the required consumables are aboard and the aircraft's load is within operating limits. Furthermore, the required documentation has to be aboard. The pilot has to familiarise himself with all

documentation and information which are necessary for a safe conduct of the balloon flight; he especially has to obtain current flight weather information. Prior to each take-off he has to familiarise the passengers with the safety instructions. Furthermore, he has to keep an aircraft log book and a pilot's log book and immediately document determined deficiencies. According to the checklist "check of the aircraft" key aspects of the basket check were: Damages to the basket robes, mountings for the gas cylinders, damages to and stability of the basketwork, cracks in the floor plate.

The general manager of the operator was head of flight operations and head of maintenance. He was also a balloon pilot and flight examiner.

The FOM stipulates that the tasks of the head of operations include the following: Orientation of pilots on new balloon types and keeping of pilot's files, supervision of the pilots, issuing flight orders (normally written orders).

According to the presented documentation, the pilot received the written flight order via e-mail on 10 September 2010 at 1421 hrs from the head of operations. It contained the passenger list and the trim and load sheet.

The FOM and the Technical Operations Manual (TOM) stipulate that the head of operations is responsible that the aircraft are only operated in accordance with the issued approval. He supervises the airworthiness of the balloons used in flight operations.

The federal and state governments passed common principles for application, approval and supervision procedures of German operators in accordance with the Federal Aviation Act (LuftVG) para 20. According to the questionnaire "Pilots", Appendix 1.3 to the aforementioned principles passed in February 2002, the operator has to attach the following documents and certificates to the application for the approval of a pilot:

- Employment contract
- Aviation experience and proof of the necessary flight experience
- Valid pilot's license
- Proof of the conducted proficiency check in accordance with para 15 subsection 1 of the 4. Durchführungsverordnung (DVO) LuftBO (executive order of Regulation on Operation of Aircraft).

- Proof of the conduct of introduction in the use of hand fire extinguishers and participation in a First Aid class, both in accordance with para 15 subsection 2 of the 4. Durchführungsverordnung (DVO) LuftBO (executive order of Regulation on Operation of Aircraft).
- Changes and additions to the FOM and TOM

## Supervision of the Operator

In accordance with the above-mentioned principles of the federal and state governments and the Regulation on Certification and Licensing in Aviation (LuftVZO) para 65, not only the continuous supervision of the operator but also the continuous flight operational, technical and economic conditions of the operator should be determined - if possible annually.

Employees stated that in accordance with an internal regulation of the Niedersächsischen Landesbehörde für Straßenbau und Verkehr, Geschäftsbereiche Oldenburg und Wolfenbüttel (State authority for road construction and transport in Lower Saxony, divisions Oldenburg and Wolfenbüttel) operators shall be inspected annually and training organisations every two years.

In the responsible state authority in Wolfenbüttel two employees supervise 18 operators; an additional employee checks the operators' economic performance. The employees are also responsible for: supervision of 30 training organisations, conduct of exams and skill tests, flight operational and legal supervision and inspection of the airports within their area of responsibility, supervision of flight operations outside of airports, supervision of aviation events, support in the processing of irregularities and administrative tasks.

On 18 April 2000 the state authority in Oldenburg issued the approval as operator for the first time. On 27 April 2009 the approval was extended until 30 April 2012. At the beginning of 2010 the state authority in Wolfenbüttel had taken over the supervision of the operator from Oldenburg. Up until then, there was no documentation regarding any operator audit. A witness stated one employee of the state authority in Oldenburg had conducted operator audits but kept no records.

On 22 July 2010, the responsible state authority Wolfenbüttel conducted the first operator audit. On the same day the general manager handed in documents and additions to the FOM and the TOM to the state authority: Registration of a new balloon, deletions and additions of pilots and flight examiners.

The attachment to the audit report of 4 August 2010 listed the following deficiencies, among others:

- Use of several company names misleading the customers;
- The FOM is not updated and disorganised, the pilots did not sign reading the FOM;
- The TOM was not updated;
- Flight duty and rest time were not documented.

The state authority also requested:

- Hand in the employment, duty and fee contracts of the operations personnel;
- Hand in current and signed maintenance contracts;
- The keeping of daily aircraft log books by the PIC.

It was noted in particular that the personnel changes requested on 22 July 2010 can only be granted once the requested documentation has been handed in. The state authority did not set a deadline for the operator to submit the requested documentation and remedy the deficiencies.

The responsible employee of the state authority stated that another audit was scheduled for 30 September 2010.

## Additional Information

### Exercise the Rights of a License

The Regulation on Personnel Licensing (LuftPersV) para 127 stipulates that the person in possession of a German pilot's license (Balloons) cannot be employed in commercial air transport once he has passed his 65th year.

### Conduct of Proficiency Checks

The Regulation on Personnel Licensing (LuftPerV) para 128 makes all provisions for the checks and check procedures for balloon pilots. Proficiency checks shall be done with examiners approved by the responsible authority. The approved examiners for the proficiency check have to have an instructor rating for the training of the license or rating in question and a special professional experience. The responsible authority can allow exceptions to the requirement of the instructor rating.

On 2 May 2005 the examiner had received his approval which was renewed on 17 November 2008 and then valid until 17 November 2011. His duty as examiner was linked to his instructor rating, which had expired on 26 April 2007.

The responsible aviation authority states that since 27 April 2007, the flight examiner in question no longer met the requirements to work as flight examiner. The pilot stated between May 2007 and September 2010 he had conducted 13 examinations. On 21 March 2011 the responsible aviation authority had revoked the approval as examiner.

## Maintenance Regulations

The LBA stated that in accordance with Commission Regulation (EC) 2042/2003 Part M issuance of the Airworthiness Review Certificate (ARC) can occur with a certain configuration. The envelope of a balloon is the component which defines the aircraft. It is not stipulated that all possible configurations of envelope and baskets, burners and gas cylinders, which according to the flight manual, constitute possible combinations have to be part of the check and are included in the ARC.

The TOM assigns burner and basket types and sizes to the envelopes. The respective airworthiness certificate lists the respective balloon component with type and MSN and on this basis the masses were determined and documented in the respective mass report.

## Analysis

### Pre-flight Preparation

Two days prior to the flight, the pilot had already received the load and trim sheet. The masses of basket and burner used for the calculations did not correspond with the aircraft documentation found and belonged to another balloon. It was later determined that the balloon components were identically constructed. Temperature and barometric air pressure probably originated from a forecast and differed slightly from the prevailing conditions. After the BFU had received all technical inspection documentation it could be determined that the results of the load and trim sheet were within the prescribed limits.

On the day of the accident, at 1150 hrs, the general manager had obtained weather information from the DWD for three take-off sites. The DWD evaluated this as

general enquiry and not as a valid consultation in accordance with the Federal Aviation Act (LuftVO) para 3.

The PIC had familiarised himself with the weather situation on the internet and had obtained the TAFs<sup>3</sup> for Hanover Airport, Leipzig Airport and Magdeburg-Cochstedt Airport at about 1300 hrs.

The TAF for Hanover of 1300 hrs [...] TEMPO 1213/1219 4000 TSRA BKN008CB [...], contained the possibility of thunderstorms between 1500 hrs and 2100 hrs. The TAF for Hanover of 1520 hrs the pilot obtained at 1600 hrs also contained the possibility of so-called towering cumulus (TCU) clouds.

Even though TAF is not a decision making aid for a balloon flight, the pilot should have reasoned to have another timely consultation, e.g. by phone, due to the possibility of thunder storms.

The TAFs of the airports located further to the East did also not allow drawing any conclusion as to the conduct of the balloon flight.

The DWD could not determine whether or not the self-briefing system pc\_met was used. The balloon weather report including the balloon ticker of 1730 hrs decisive for the balloon flight was not retrieved. Only here would the pilot have been informed and had learned that a squall line had formed in front of the cold front and stretched from the Rothaargebirge across Hanover to Lübeck and was moving further to the north-east.

Between 1300 hrs and 1500 hrs the operator had informed the passengers they should be at the take-off site at 1730 hrs. At 1445 hrs, the pilot made the decision to conduct the flight.

In addition, at about 1600 hrs, he got the aviation routine weather report (METAR) for Hanover Airport and Celle Airport. Getting the METARs (last publication time 1520 hrs) did not constitute a weather consultation as defined in the Air Traffic Order (LuftVO) para 3 for a balloon flight with take-off at 1806 hrs.

The pilot did not keep a record of the pre-flight meteorological preparation in accordance with the FOM Attachment N or documentation of the weather forecast.

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<sup>3</sup> The Terminal Aerodrome Forecast (TAF) is not a product for pre-flight preparation for a balloon flight. This forecast serves primarily as a decision making tool for air transport. For example, occurring gusts of below 25 kt are no criterion to change the TAF.

Source: DWD expert opinion.

At 1600 hrs the balloon crew drove to the take-off site, where they arrived at about 1700 hrs.

The pilot was responsible for the safety instruction of the passengers but since he did not speak German, the driver of the ground crew vehicle conducted it.

Prior to the flight or during rigging of the balloon, the pilot did not assure himself to the full extent of the technical condition of the basket on the basis of the checklist. At the latest while rigging the balloon as the basket was laying on its side the pilot could have noticed for example some cracks in the basketwork.

Shortly before take-off at 1806 hrs, the wind situation was once again checked by dispatching a children's balloon filled with helium. Since the sun was shining the pilot was of the opinion nothing prevented take-off. The ground crew member played down the concerns of the passengers regarding the weather situation in particular the expected thunderstorms.

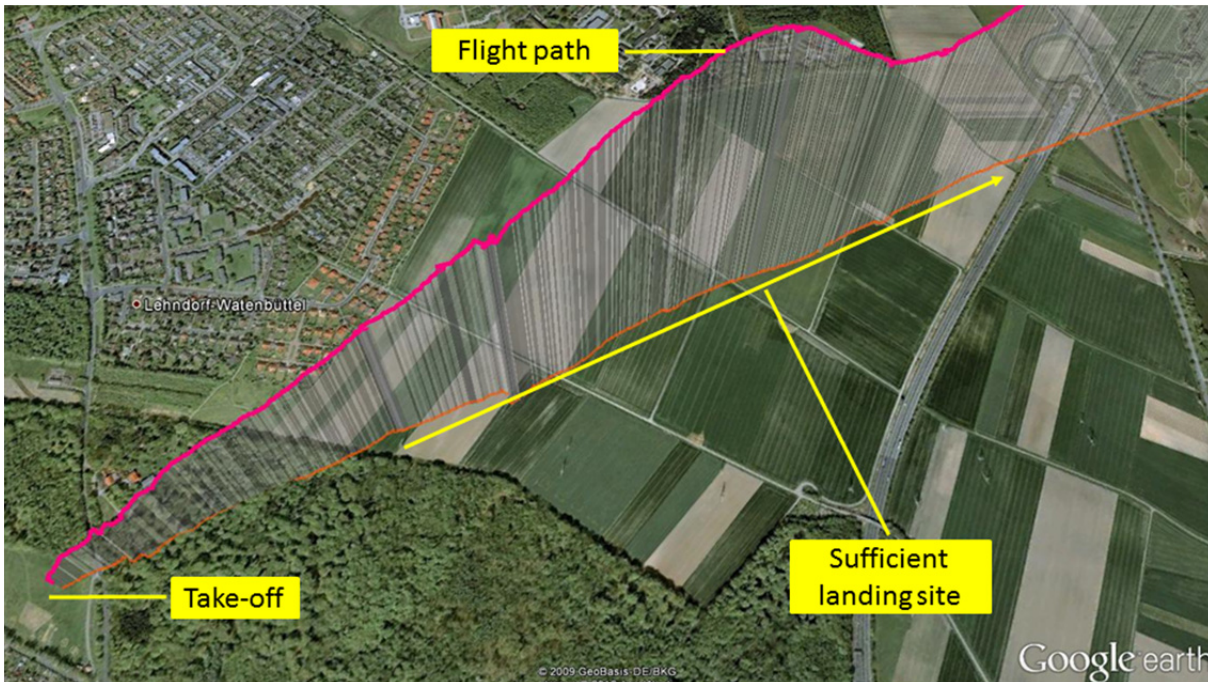
Aeronautical charts for the flight region were not carried along.

The pre-flight preparation did not meet the requirements of the FOM.

### Course of the Flight

There was a thunderstorm warning for Braunschweig Airport valid to 2000 hrs. Already after take-off and during the flight, the following cloud formation was visible in the west: Cumulus fractus which indicated gusts of the down bursts as well as Cumulonimbus and lightning.

According to his own statements, the pilot was not overly concerned about the weather. Several passengers saw the dark cloud formation and lightning and one passenger even requested him to land. At that time, he would have had sufficient landing areas available after traversing a wooded area. The pilot, however, decided to continue the flight.

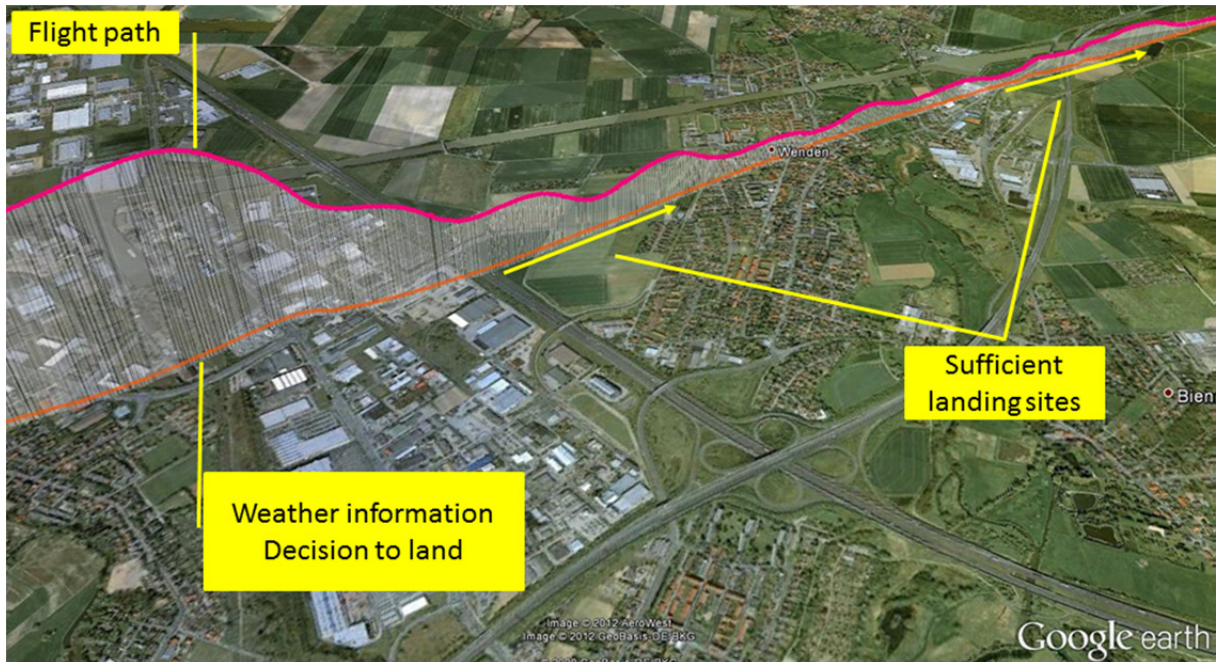


Available landing sites immediately after take-off

Source: Google Earth map service™ / Adaption BFU

After 28 minutes of flight, Braunschweig Info informed him of the weather situation: *"Have a sharp look-out on the weather. Hannover Tower reported heavy rain showers over there."* This information is an explicit indication of the expectable critical weather conditions.

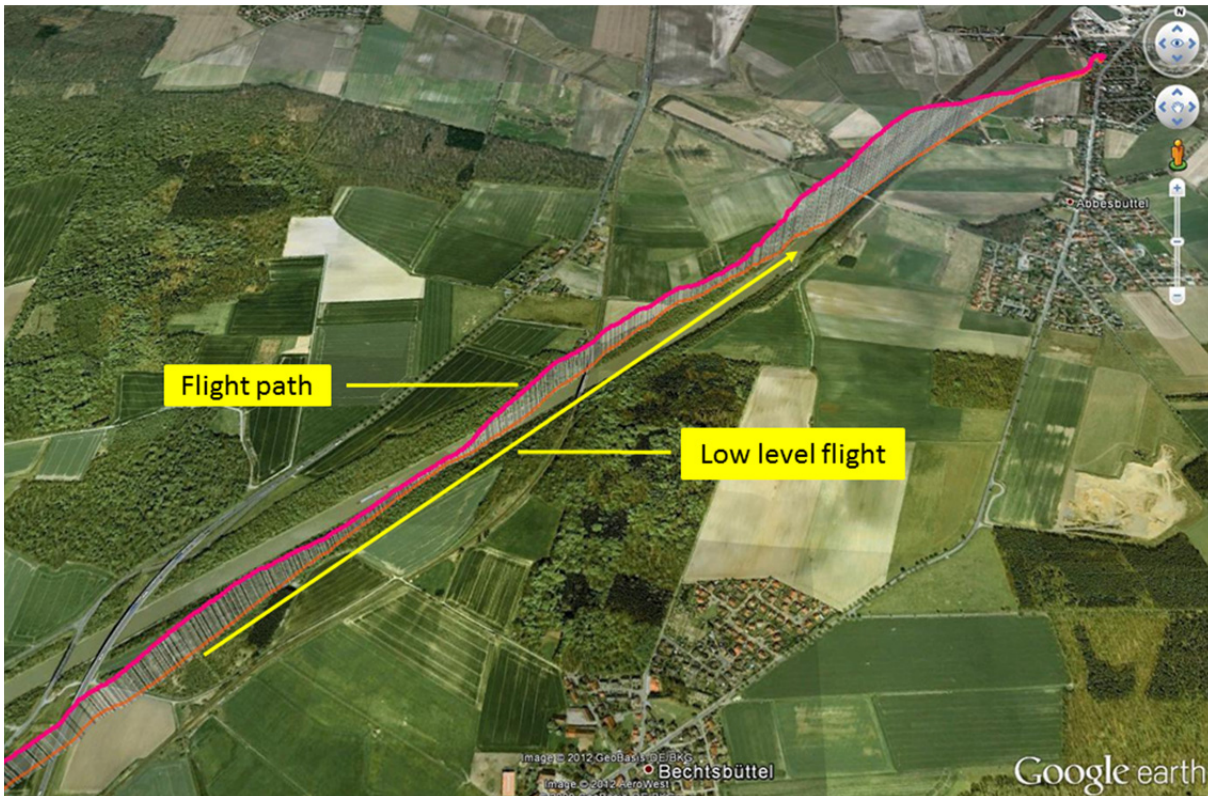
The balloon pilot stated, he contemplated a landing and let the balloon descent to about 200 m - 150 m AMSL but continued the flight. The BFU is of the opinion that - contrary to the opinion of the pilot - sufficient landing areas were still available.



Available landing areas in the further course of the flight      Source: Google Earth map service™ / Adaption BFU

During the subsequent flight in about 10 to 100 m GND the pilot reached further well-suited landing sites after he had traversed some fields and a town; once again he did not use them to land.

Until reaching the shipping canal, wooded on both sides, he had traversed three well-suited landing sites and here he should have, at the latest, gained altitude in order to maintain the minimum safety height of 150 m above ground.

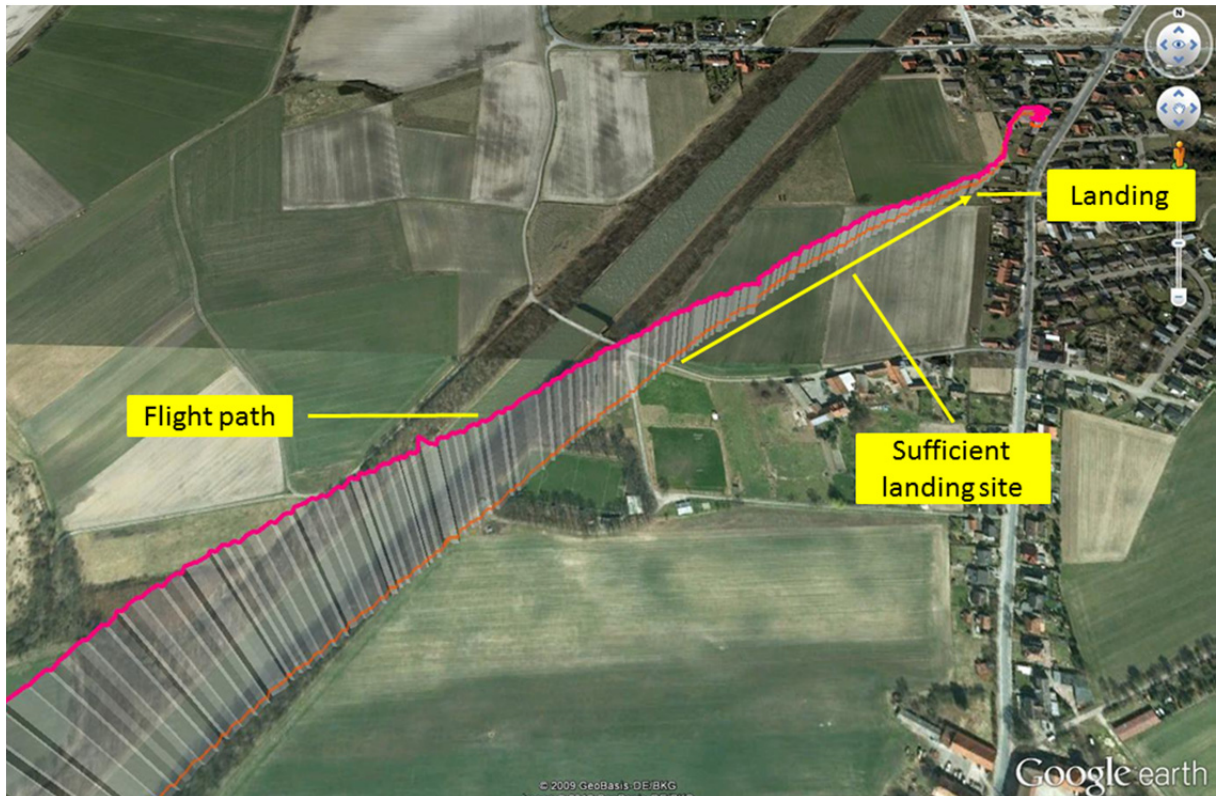


Flight above the shipping canal

Source: Google Earth map service™ / Adaption BFU

Since the heading did not change very much during the further course of the flight, the pilot should have been aware that if the low altitude flight was continued there would be no suitable landing site available for a considerable length of time due to the low surface wind of about 2 kt and the upcoming shipping canal including wooded strips.

During the continued flight below the minimum safety altitude in the area of the canal the balloon moved toward an unsuitable direction which did not provide any landing sites. The BFU is of the opinion that in this phase this does not attest to the pilot trying to find a landing site.



Flight profile after climb and corresponding change of direction

Source: Google Earth map service™ / Adaption BFU

The pilot ended the flight above the canal or in its immediate vicinity only after about 12 minutes by climbing to about 250 m where the heading changed due to the changed wind direction.

The landing occurred with an upright balloon and very little wind. At that time, the pilot still had the chance to empty the envelope as quickly as possible and put it down.

Despite the approaching line of dark thunderclouds which had been visible for some time, the pilot left the balloon standing, waited for the ground crew, vented the fuel hoses and extinguished the pilot lights. The pilot stated during the occurrence two passengers suffered burns because a burner had been inadvertently activated. Therefore, the BFU doubts the pilot had really carried out the above-mentioned activities. There is thus reason to presume that the pilot left the balloon rigged to indicate to the ground crew where to find it.

It is probable that once strong wind took hold of the balloon, the pilot began to empty the envelope.

Once large parts of the envelope had taken on the shape of a sail and the balloon was dragged across the ground, the pilot did not have any influence on the course of events.

The balloon came to rest after about 200 m once the basket had collided with a garage wall and the envelope had draped itself across the roof of a house.

### Flying Experience and Licensing

For more than 30 years varied activities of the pilot centred on ballooning. With a total of 4,326 hours of flying experience in all balloon categories he was very experienced.

The pilot held a valid British commercial pilot's licence for balloon pilots. He did not meet the criteria, however, to work as pilot in command for a German operator (Appendix 1). The operator did not apply for it either.

### Technical State of the Balloon

On 25 October 2010 the balloon was subject to a technical inspection.

During the accident the envelope was severely damaged. The tensile strength of the fabric was about 20 - 25 kg and, therefore, in the allowable range; the porosity was estimated as good.

The damaged quad burner was in bad repair which became especially apparent by rust and dirt. There were no limitations as far as functionality was concerned.

The gas cylinders had been checked but it was hard to read the certification stamps.

The basket was severely damaged. After the basket mats and the leather lining had been removed partially decayed and broken basketwork became visible. The sliding runners on the underside of the right basket bottom were split. A connection between the sliding runners and the basket did no longer exist. The condition of the fractures - differentiation between light, new and dark, old fracture surfaces - allowed the conclusion that some damage on the basket and the basketwork occurred before the accident. On 16 June 2010 the last technical inspection of the basket took place, i.e. 12 weeks prior to the accident. This inspection did not result in any findings. Thus the damages must have occurred in this space of time. The fractured sliding runners on the underside of the basket and the fractures in the basketwork could have been noticed by each pilot rigging the balloon prior to a flight. Prior to the accident flight the

pilot could have noticed during a thorough pre-flight check and due to his experience that because of the damages the balloon was no longer airworthy.

The BFU did not inspect or technically assess the functionality of the combination units.

## Regulations

Even though the envelope is the balloon component which defines the aircraft and it is therefore not stipulated that all combinations of balloon components have to be part of the ARC, it must be pointed out that the technical handbook of the operator lists and approves the combination of components for each balloon. The BFU draws the conclusion that an exchange of balloon components is not readily possible, because the load and trim calculations for the envelope also depend on the combination of components which may be different depending on the manufacturer.

## Organisational Conditions within the Operator

Within the operator the tasks and responsibilities of the general manager, head of operations and head of maintenance were assigned to one person. He was also balloon pilot and flight examiner.

The general manager was once again comprehensively informed as to the requirements pilots need to meet if they want to work for a German operator when he received the attachment to the check report of 22 July 2010 at the beginning of August 2010. He also knew that a pilot can only be deployed if his qualification had been checked and he was entered into the FOM. Even the proficiency check the general manager, in his role as flight examiner, had conducted with the pilot and documented on 20 August 2010 was invalid. He held an approval for examiners valid until 17 November 2011 but he knew that the instructor rating had expired on 27 April 2007 and therefore one of the criteria to be an examiner was not met. It could be that for him uncertainty had developed which he never resolved because his examiner approval was last extended on 17 November 2008, i. e. more than a year and a half after his instructor rating had expired. On the other hand the authority issuing the approval did not check the validity of the instructor rating.

Nevertheless the pilot was verifiably deployed on 11 September 2010 and on 12 September 2010. It was not possible to sufficiently clarify the differences between the entries in the pilot's log book and the aircraft log book for 19 and 20 August 2010 and 5 September 2010.

Two days prior to the flight on 12 September 2010 the pilot received the flight order. The BFU came to the conclusion that the general manager had fully integrated the pilot to conduct commercial passenger transportation for the company. This finding is supported by the subsequent effort of the general manager who added the pilot to the list of pilots working for the company in the revision of the FOM dated 20 September 2010, i.e. eight days after the accident.

The general manager in his role as head of maintenance was also responsible for the deployment of the aircraft. The operator stated the exchange of balloon components had occurred by mistake four days prior to the accident. This has to be doubted because several persons were involved and type labels and markings should have given the necessary information. At the latest the pilot should have recognised during pre-flight preparation which balloon components were in use in order to for example have the correct values for the load and trim calculations. The presented load and trim sheet corresponded with another balloon. That the components were identically constructed and had almost the same masses and did not result in exceedance of any operating limitations was not determined until after the accident.

Except for the envelope, the investigation revealed the deficient maintenance condition of the burner. The technical investigation of the basket on 25 October 2010 revealed that it was not airworthy.

The company management insufficiently fulfilled the obligation to enforce flight operations in accordance with legal requirements. Especially the concentration of all functions and responsibilities within the company on one person is problematic because this type of management does not include any control and monitoring in regard to quality assurance.

### Supervision of the Operator

The Niedersächsische Landesbehörde für Straßenbau und Verkehr verifiably audited the operator for the first time in its 10-year history.

This control and supervision mechanism does not do justice to Regulation on Certification and Licensing in Aviation para 65 (LuftVZO). It is contradictory to the common principles for application, approval and supervision procedures of German operators the federal and state governments passed and their own internal regulations and it shows that the task diversity and the subsequent time and effort are disproportionate to the low number of responsible employees.

## Conclusions

The accident is due to the fact that the strong wind of a forecast weather front took hold of the balloon after the landing and dragged it across the ground. It was dragged towards the town of Abbesbüttel and collided with obstacles.

Contributory factors:

- Insufficient pre-flight preparation in regard to weather information which was unsuitable for the planning of a balloon flight
- Flawed interpretation of the weather conditions during the balloon flight
- Misjudgement of the weather situation after the landing

## Immediate Actions

The responsible aviation authority revoked the Air Operator Certificate (AOC).

Investigator in charge: Jens Eisenreich

Field investigation: Frank Stahlkopf, Uwe Berndt

Flight Data Analysis: Philipp Lampert

Braunschweig, 12 December 2013

## Appendices

### Appendix 1:

Listing and analysis of the requirements to work for a German operator as balloon pilot

<b>Proof</b>	<b>Requirement according to German aviation regulation</b>	<b>Qualification of the pilot</b>	<b>Analysis</b>
Regulation on Personnel Licensing, para 127	Maximum age 65 years	69 years	Age limit exceeded
License in accordance with Regulation on Personnel Licensing, para 48	Commercial Pilot's License (Balloon)	Commercial Pilot's License (Balloon)	Was not changed or approved
Medical certificate	Class 1	Class 2	Class insufficient
Proficiency check in accordance with the executive order of the German Regulation on Operation of Aircraft (LuftBO), para 15 (2) 4.	Proficiency check	Combined Base/Line Check Proficiency check conducted in accordance with the Regulation on Operation of Aircraft, para 42	No approval Invalid check since the check was conducted by a flight examiner without approval
Proof of First Aid training in accordance with the executive order of the German Regulation on Operation of Aircraft (LuftBO), para 15 (2) 4.	Certificate valid for 24 months	British certificate of 3 April 2008, valid for three years	Certificate had expired
Training in the use of the hand fire extinguisher in accordance with the executive order of the German Regulation on Operation of Aircraft (LuftBO), para 15 (2) 4.	Certificate valid for 24 months	British certificate of 18 June 2008 without validity restrictions	Certificate had expired
Proof of flying experience	Proof of flying experience	Aviation experience	Information available but without proof
Employment contract	Employment contract	No contract	Pilot worked without a contract

<b>Proof</b>	<b>Requirement according to German aviation regulation</b>	<b>Qualification of the pilot</b>	<b>Analysis</b>
Entry in the flight operations handbook and the technical operations handbook	Changes and additions have to be submitted to the responsible authority	No entries	Was not submitted

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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