Bundesstelle für Flugunfalluntersuchung
German Federal Bureau of Aircraft Accident Investigation

Investigation Report

Identification

Type of Occurrence: Serious Incident
Date: 23 October 2017
Location: North Sea, near way-point JUIST
Aircraft: Helicopter
Manufacturer / Model: Sikorsky Aircraft Corporation / S-76B
Injuries to Persons: None
Damage: Aircraft not damaged
Other Damage: None
State File Number: BFU17-1441-7X
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 - FlUUG) 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.

Published by:

Bundesstelle für Flugunfalluntersuchung
Hermann-Blenk-Str. 16
38108 Braunschweig

Phone +49 531 35 48 - 0
Fax +49 531 35 48 – 246
Email: box@bfu-web.de
Internet: www.bfu-web.de
Investigation Report BFU 17-1441-7X

Content

Identification .............................................................................................................. 1
Abbreviations ............................................................................................................ 5
Synopsis .................................................................................................................... 9

1. Factual Information ............................................................................................... 11
   1.1 History of the Flight ....................................................................................... 11
   1.2 Injuries to Persons ....................................................................................... 15
   1.3 Damage to Aircraft ....................................................................................... 15
   1.4 Other damage .............................................................................................. 15
   1.5 Personnel Information .................................................................................. 15
   1.6 Aircraft Information ...................................................................................... 16
   1.7 Meteorological Information .......................................................................... 18
   1.8 Aids to Navigation ....................................................................................... 21
   1.9 Radio Communications ................................................................................ 21
   1.10 Aerodrome Information .............................................................................. 21
   1.11 Flight Recorders ......................................................................................... 23
   1.12 Findings on the Aircraft .............................................................................. 24
   1.13 Medical and Pathological Information ...................................................... 24
   1.14 Fire .............................................................................................................. 25
   1.15 Survival Aspects ......................................................................................... 25
   1.16 Tests and Research ..................................................................................... 25
   1.17 Organisational and Management Information .......................................... 25
   1.18 Additional Information ................................................................................ 29
   1.19 Useful or Effective Investigation Techniques ............................................. 33

2. Analysis ................................................................................................................. 34
   2.1 Course of the Flight ...................................................................................... 34
   2.2 Crew ............................................................................................................. 35
   2.3 Aircraft ......................................................................................................... 36
   2.4 Weather ....................................................................................................... 37
   2.5 Flight Recorders ........................................................................................... 38
   2.6 Organisations and Procedures ...................................................................... 38
   2.6.1 International Helicopter Offshore Flight Operations in the North Sea Area... 38
   2.6.2 Helicopter Offshore Flight Operations in Germany in the German EEC and
         FIR Bremen/Langen ..................................................................................... 39
2.6.3 Procedures and Stipulations of the Company Involved................................. 40

3. Conclusions........................................................................................................ 42

3.1 Findings ............................................................................................................. 42
3.1.1 Aeronautical Regulations ............................................................................. 42
3.1.2 Organisations and Procedures..................................................................... 42
3.1.3 Meteorological Conditions........................................................................... 43
3.1.4 Helicopter..................................................................................................... 44
3.1.5 Crew............................................................................................................. 44
3.1.6 Course of the Flight...................................................................................... 45
3.2 Causes.............................................................................................................. 45

4. Safety Recommendations .................................................................................. 47
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAIB</td>
<td>Air Accidents Investigation Branch</td>
</tr>
<tr>
<td>AD</td>
<td>Airworthiness Directives</td>
</tr>
<tr>
<td>AFCS</td>
<td>Automatic Flight Control System</td>
</tr>
<tr>
<td>AIC</td>
<td>Aeronautical Information Circular</td>
</tr>
<tr>
<td>AIP</td>
<td>Aeronautical Information Publication</td>
</tr>
<tr>
<td>ALT</td>
<td>Altitude</td>
</tr>
<tr>
<td>AMC</td>
<td>Acceptable Means of Compliance</td>
</tr>
<tr>
<td>AOC</td>
<td>Air Operator Certificate</td>
</tr>
<tr>
<td>AP</td>
<td>Autopilot</td>
</tr>
<tr>
<td>ARC</td>
<td>Airworthiness Review Certificate</td>
</tr>
<tr>
<td>ATPL(H)</td>
<td>Airline Transport Pilot Licence (Helicopter)</td>
</tr>
<tr>
<td>ATT</td>
<td>Attitude Mode</td>
</tr>
<tr>
<td>AVAD</td>
<td>Audio Voice Alerting Device</td>
</tr>
<tr>
<td>EEC</td>
<td>Exclusive Economic Zone</td>
</tr>
<tr>
<td>BKN</td>
<td>Broken</td>
</tr>
<tr>
<td>CAT</td>
<td>Commercial Air Transport</td>
</tr>
<tr>
<td>CFIT</td>
<td>Controlled Flight Into Terrain</td>
</tr>
<tr>
<td>CIAIAC</td>
<td>Comisión de Investigación de Accidentes e Incidentes de Aviación Civil</td>
</tr>
<tr>
<td>COP</td>
<td>Co-pilot</td>
</tr>
<tr>
<td>CPL</td>
<td>Commercial Pilot Licence</td>
</tr>
<tr>
<td>CVR</td>
<td>Cockpit Voice Recorder</td>
</tr>
<tr>
<td>DAFCS</td>
<td>Digital Automatic Flight Control System</td>
</tr>
<tr>
<td>DFS</td>
<td>Deutsche Flugsicherung GmbH (German air traffic service provider)</td>
</tr>
<tr>
<td>DH</td>
<td>Decision Height</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>DWD</td>
<td>Deutscher Wetterdienst (German Meteorological Service)</td>
</tr>
<tr>
<td>EASA</td>
<td>European Aviation Safety Agency</td>
</tr>
<tr>
<td>ENR</td>
<td>Enroute</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
</tr>
<tr>
<td>FAR</td>
<td>Federal Aviation Regulation</td>
</tr>
<tr>
<td>FCL</td>
<td>Flight Crew Licensing</td>
</tr>
<tr>
<td>FD</td>
<td>Flight Director</td>
</tr>
<tr>
<td>FDM</td>
<td>Flight Data Monitoring</td>
</tr>
<tr>
<td>FDR</td>
<td>Flight Data Recorder</td>
</tr>
<tr>
<td>FIR</td>
<td>Flight Information Region</td>
</tr>
<tr>
<td>FL</td>
<td>Flight Level</td>
</tr>
<tr>
<td>FLC</td>
<td>Flight Level Corrected</td>
</tr>
<tr>
<td>FMS</td>
<td>Flight Management System</td>
</tr>
<tr>
<td>ft</td>
<td>feet</td>
</tr>
<tr>
<td>GAFOR</td>
<td>General Aviation Forecast</td>
</tr>
<tr>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HDG</td>
<td>Heading</td>
</tr>
<tr>
<td>HFDM</td>
<td>Helicopter Flight Data Monitoring</td>
</tr>
<tr>
<td>HMR</td>
<td>Helicopter Main Routes</td>
</tr>
<tr>
<td>HOFO</td>
<td>Helicopter Offshore Operations</td>
</tr>
<tr>
<td>HPZ</td>
<td>Helicopter Protection Zone</td>
</tr>
<tr>
<td>HTZ</td>
<td>Helicopter Traffic Zone</td>
</tr>
<tr>
<td>IAF</td>
<td>Initial Approach Fix</td>
</tr>
<tr>
<td>IAS</td>
<td>Indicated Airspeed</td>
</tr>
<tr>
<td>IFR</td>
<td>Instrument Flight Rules</td>
</tr>
</tbody>
</table>
ILS  Instrument Landing System
IR   Instrument Rating
ISOL isolated
JAR  Joint Aviation Regulation
LBA  Luftpahrt-Bundesamt (German civil aviation authority)
MCC  Multi Crew Concept
METAR Meteorological Aerodrome Report
NAV  Navigation
NM   Nautical Mile
NTSB National Transport Safety Board
OM   Operation Manual
OMM  Operations Management Manual
ORO  Organisation Requirements for Air Operations
OVC  overcast
PF   Pilot Flying
PIC  Pilot in Command
PNF  Pilot Non Flying
QNH  Barometric Air Pressure
RNAV Area Navigation
RWY  Runway
SAS  Stability Augmentation System
SCT  Scattered
SMS  Safety Management System
SOP  Standard Operating Procedure
TAF  Terminal Aerodrome Forecast
UTC  Universal Time Coordinated
VFR  Visual Flight Rules
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VML</td>
<td>wear multifocal spectacles and carry a spare set of spectacles</td>
</tr>
<tr>
<td>VS</td>
<td>Vertical Speed</td>
</tr>
</tbody>
</table>
Synopsis

During a commercial air passenger transport with a S-76B helicopter above sea from the offshore convertor station DOLWIN ALPHA to Emden Airfield a CFIT(W) almost occurred. It was possible to flare the helicopter in approximately 20 ft GND and later land safely at Emden Airfield.

The serious incident, the inadvertent controlled flight towards water (CFIT(W)), was due to inadequate airmanship including loss of situational awareness.

Immediate Causes:

- The helicopter entered precipitation clouds.
- The cloud base in the precipitation was lower than the helicopter crew had anticipated, Emden Airfield observed, and the Deutscher Wetterdienst forecast.
- The descent was not stopped in 500 ft GND and an alternative flight conduct not considered.
- In very low altitude the pilots looked outside and neglected monitoring the instruments.
- The trust of the less experienced co-pilot in the actions and decisions of the significantly more experienced pilot in command prevented his intervention.
- The crew did not adhere to the task distribution and mutual monitoring of the operator and the procedures of the flight operations manual regarding the minimum flight altitude.

Contributing Causes:

- The crew did not recognise the reason for the de-coupling of the flight director.
- The helicopter, flight altitude, and airspeed had to be controlled manually.
- The crew did not want to conduct a manual instrument approach to Emden Airfield.
- The helicopter involved had been exempt from the voluntary, intra-corporate flight data monitoring.
Systemic Causes:

- In the area of the North Sea it is common that only marginal visual meteorological conditions prevail.
- In Germany IFR flights in the uncontrolled airspace G are not permitted.
- The German EEC is lying below several FIRs with different stipulations and procedures for VFR and IFR flights.
- Compared with other adjacent FIRs, the Flight Information Region Bremen/Langen did not have special helicopter procedures required by aeronautical regulations.
- Normally, in FIR Bremen/Langen flights below approximately 1,000 ft AMSL across the North Sea are not monitored by the radar of the air navigation service provider.
- During offshore flights in FIR Bremen/Langen, it was common to climb and descent through cloud layers and fly through clouds for short periods of time.
- Up until the end of 2018, flight data monitoring of all off-shore flights was not required by aeronautical regulation.
1. Factual Information

1.1 History of the Flight

On 25 October 2017 the BFU was informed by the helicopter operator that possibly a serious incident had occurred on 23 October 2017.

The operator stated that on that day commercial air passenger transport above sea from the offshore convertor station DOLWIN ALPHA to Emden Airfield (EDWE) should have been conducted. At 0759 hrs¹ a two-pilot flight crew took off from Emden Airfield with a helicopter S-76B with the destination convertor station DOLWIN ALPHA. In addition to the flight crew approximately 379 kg cargo were on board.

According to the flight plan and the FlightRadar24 recording the flight route was as follows: EDWE, JUIST, HW751, UTIRA, IVNUD and DOLWA. After take-off, the helicopter climbed to 2,500 ft AMSL. From way-point UTIRA on the flight altitude was reduced to about 700 ft AMSL. At 0832 hrs the helicopter landed at the helipad of the convertor station DOLWIN ALPHA. While the engines were still running the cargo was unloaded and the passengers embarked for the return flight.

At 0842 hrs the helicopter took off; now with four persons on board for the return flight along the same route to Emden. After take-off the helicopter climbed to 2,000 ft AMSL which remained the same up until right abeam of Borkum Island. At

---

¹ All times local, unless otherwise stated.
0854 hrs the flight crew established radio contact with the Flugleiter (A person required by German regulation at uncontrolled aerodromes to provide aerodrome information service to pilots) at Emden Airfield and requested information regarding the prevailing weather conditions. The Flugleiter answered: "Im Augenblick regnet es hier, Untergrenze few eintausend, overcast tausend-fünfhundert und Wind südwest 10 bis 15 in Böen 20 kt, QNH 1010 und Sicht hier Festmarke 2.5 bis 3 km (right now it is raining, cloud base few one thousand, overcast thousand five hundred and wind south-west 10 to 15 gusts 20 kt, QNH 1010 and visibility here visual reference point 2.5 to 3 km)." At 0857 hrs the crew informed Bremen Information of passing way-point JUIST.

Before reaching way-point JUIST the helicopter began to descend. The descent ended in low altitude with reduced speed near the coastline. Then the helicopter climbed again to about 500 ft AMSL and continued the flight to Emden. At 0901 hrs the crew again requested information regarding the prevailing weather at Emden Airfield. The answer was: "Im Augenblick ist es ein bisschen runtergegangen, few siebenhundert, broken eintausend, overcast tausend-achthundert, der Regen lässt jetzt ganz sachte nach (right now it has decreased a little bit few seven hundred, broken one thousand, overcast one thousand eight hundred, the rain is gradually slowing down)." At 0905 hrs the crew signed off with Bremen information. At 0911 hrs the helicopter landed at Emden Airfield.

![Flight path of the return flight with marked descent in the area of JUIST](https://via.placeholder.com/150)

**Fig. 1.2:** Flight path of the return flight with marked descent in the area of JUIST

Source: FlightRadar24/Google Earth/Adaption BFU
On 9 November 2017, BFU staff members interviewed the crew regarding their tasks at the day of the occurrence, the course of the flight, and the subsequent events at the company until the occurrence was reported to the BFU.

According to congruent pilots' statements during the two legs (outbound and return) the co-pilot, in the left-hand seat, acted as Pilot Flying (PF) and the Pilot in Command (PIC), in the right-hand seat, as Pilot Non Flying (PNF). After take-off from the convertor station DOLWIN ALPHA the helicopter had been operated using the Flight Director (FD) coupled in the Upper Modes ALT and NAV. Between the way-points UTIRA and HW751 the FD had decoupled without identifiable reason. The two autopilots had changed from the ATT to the SAS mode. This resulted in the PF having to actively control the helicopter manually. Subsequently, the PNF tried to find and eliminate the cause for the FD failure. But both without success. After they had enquired about the prevailing weather conditions at Emden Airfield they decided to reduce the flight altitude before reaching the coast line. During descent the helicopter had suddenly encountered heavy rain and significantly reduced visibility. At about 500 ft AMSL the co-pilot had handed over controls to the PIC. He had instructed the co-pilot to extend the landing gear because he wanted to be prepared for a possible off-field landing due to the unexpected bad weather.

According to the Cockpit Voice Recorder (CVR) data, the PIC allowed the helicopter to continue the descent because no visual contact with the coastline had been established; it was not possible in low altitude either. At about 0900 hrs the co-pilot called out 100 ft GND. A few seconds later the signal and the computer generated voice of the radio altimeter “one hundred feet” was recorded. The crew did not verbally comment on the altitude warning. The helicopter continued to descend. Both pilots looked outside searching for the coast line or a brighter place in the grey clouds ahead of them. The co-pilot recognised the low altitude 15 seconds after the acoustic warning and read the radar altimeter "20 ft GND". He advised the PF accordingly. At the same time the airspeed had decreased to approximately 40 kt. The PF stopped the descent and increased the airspeed. A short time later in low altitude the pilots had the coastline in sight. The flight was continued towards Emden under visual flight rules with reduced cruise speed in low altitude. Due to the limited visibility and low clouds it was decided to fly an approach to runway 07. When the engines were shut off the pilots noticed that the cyclic stick trim switch was not pushed in, i.e. the function was disengaged.
The PIC stated that the heavy shower and the therefore reduced visibility had occurred totally unexpectedly. He had not considered changing the flight rules from VFR to IFR and conducting an instrument approach RNAV (GPS) Y RWY25 to Emden due to the unclear situation with the FD.

The BFU asked the two passengers, who were seated opposite the flight direction, to describe their observations.

One passenger stated the helicopter had been in clouds after about 15 minutes flight time and then began to descend. Compared to previous flights the approach to Emden had been rather low.

The second passenger described the weather as not uncommon for an offshore flight. It had been windy and rainy but without strong turbulences. He stated that the first half of the flight had been uneventful. Then the helicopter had entered clouds and after some time it had made noises like during descent. After they had left the clouds the helicopter had flown much lower than usual. The passenger estimated the altitude was about 100 m AMSL. Then the helicopter had descended in stages until the main rotor generated spray. The passenger estimated the lowest altitude was 5 to 10 m. At the same time the helicopter had had a nose-up attitude. Once the coast line had been reached they had flown over land slightly above the wind turbines to Emden.

The BFU does not have any Flight Data Recorder (FDR) recordings of the flight available.
1.2 Injuries to Persons

<table>
<thead>
<tr>
<th>Injuries</th>
<th>Crew</th>
<th>Passengers</th>
<th>Third Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Serious</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Minor/None</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

1.3 Damage to Aircraft

The helicopter was not damaged.

1.4 Other damage

There was no other damage to persons or property.

1.5 Personnel Information

Pilot in Command

The 64-year-old pilot in command held an Airline Transport Helicopter Pilot's License (ATPL(H)) issued by the Luftfahrt-Bundesamt in accordance with Part FCL. The valid licence listed the rating for pilot in command on SK76 including instrument flight rules. He held a class 1 medical certificate issued in accordance with Part-MED with the restriction VML valid until 10 December 2017.

According to the operator, he had a total flying experience of 11,461 hours, of which 3,025 hours were flown on SK76. The company involved deployed him as Line Training Pilot in Command, among others.

Co-pilot

The 38-year-old co-pilot held a Commercial Helicopter Pilot's Licence (CPL(H)) issued by the LBA in accordance with Part FCL. The valid licence listed the ratings as PIC for SK76 and AW169, including instrument flight rules. The licence also listed language skills for English, ATPL Theory and MCC/IR. He held a class 1 medical
Investigation Report BFU 17-1441-7X

certificate issued in accordance with Part-MED without restrictions; valid until 7 November 2017.

According to the operator, he had a total flying experience of 910 hours. Since his acquisition of the type rating in November 2015 he had flown 359 hours on SK76.

1.6 Aircraft Information

The S-76B is a helicopter with a maximum of 14 seats produced by Sikorsky Aircraft Corporation. In 1982 the aircraft type S-76B was certified as transport helicopter in accordance with Federal Aviation Regulations (FAR) Part 29. It is equipped with a three-wheel retractable landing gear, a four-blade main rotor and a four-blade tail rotor for anti-torque. Maximum take-off mass is 5,307 kg. It is equipped with two PT6B-36 turboprop engines.

The retractable landing gear is equipped with a warning device, which is triggered visually and acoustically at an airspeed of less than 60 KIAS or an altitude of less than the selected DH, if the landing gear is in the retracted position.

The helicopter involved, year of manufacture 1992, manufacturer's serial number 760395, had a certificate of registration issued by the LBA. According to the weight & balance report of 11 December 2014, empty mass was about 3,789 kg. According to the flight plan, take-off mass at the day of the occurrence was about 4,920 kg, including crew, additional equipment, cargo, and about 1,200 lbs fuel. The last ARC was issued on 5 October 2017. At the time of the event, the helicopter had a total operating time of about 9,259 hours. For flights above sea, the helicopter had been equipped with class Sea-State 4 (up to 2.5 m significant wave height) emergency floats, among other things.

The helicopter was equipped with a Honeywell SPZ -7000 Digital Automatic Flight Control System (DAFCS). This system consists of an autopilot function for attitude stabilisation (SAS or ATT modes), and a flight director function for roll and yaw control (ALT, IAS, VS, HDG, NAV or ILS modes). During automatic flight control one or several flight director modes (upper modes) are coupled with the autopilot in ATT mode. If the cyclic stick trim function is disengaged the AP changes from ATT mode to SAS mode. It is not possible to couple the FD in SAS mode. However, the so-called command bars are still indicated when the FD is activated and the beep trim function at the cyclic stick is still active.
Prior to departure the DAFCS has to be self-tested with a two-level test (Level 1 and Level 2) with running engines. The crew stated that at the day of the occurrence the two test levels had been without fault.

The helicopter was equipped with a radar altimeter including Audio Voice Alerting Device (AVAD) which warns visually and with an acoustic signal and also with the announcement "One Hundred Feet" if descent past the selected DH occurs.
The helicopter was maintained by the operator’s maintenance organisation certified in accordance with Part 145.

1.7 Meteorological Information

The BFU asked the DWD for an official aviation weather report.

On the morning of 23 October 2017 a low pressure system was lying over the Deutsche Bucht (German Bay). During the morning it moved toward the Elbe estuary becoming weaker in the process. With the south-western to western current, relatively mild and very humid air was moved to the north-west of Germany.

The flight route from EDWE to DOLWA was part of the General Aviation Forecast (GAFOR) area 01 (East Friesland). The DWD had classified this area between 0300 and 0900 UTC as M5, ISOL RADZ. This classification means: ground visibility between 5 and 8 km and/or cloud base between 500 and 1,000 ft above the reference height of 200 ft. Forecast were sporadic drizzle and rain.
One minute after the helicopter had departed, at 0800 hrs, the Flugleiter in Emden told another helicopter taking off: "Wolken few eintausend, scattert eintausendvierhundert und overcast eintausend-achthundert (clouds few one thousand, scattered one thousand four hundred, and overcast one thousand eight hundred)".

According to the DOLWIN ALPHA helipad weather report of 0830 hrs the significant wave height was 3.1 m, wind from 250° with 30 to 34 kt, visibility about 3 NM, and cloud base at more than 180 m.
At 0722 hrs, the crew of the helicopter involved downloaded the METAR and TAF for the flight path Emden (EDWE) via Helgoland Düne (EDXH) and platform F16-A (EHFZ) to Eelde (EHGG) in a corridor of 50 NM.

The weather station Emden reported at 0700 hrs wind from 220° with 10 kt, gusts 16 kt. Ground visibility was 17 km. The cloud cover was given with scattered (SCT) at 1,500 ft, broken (BKN) at 2,800 ft, and overcast (OVC) at 3,800 ft. The temperature was 12°C, dewpoint 10°C, and QNH 1,010 hPa.

The weather station Helgoland Düne reported at 0700 hrs wind from 250° with 21 kt, gusts 25 kt. Ground visibility was 14 km in slight precipitation. The cloud cover was given with scattered (SCT) at 800 ft, and overcast (OVC) at 6,700 ft. Temperature was 13°C and the dewpoint 12°C. QNH was 1,008 hPa.
The weather station F16-A reported at 0655 hrs wind from 290° with 37 kt. Ground visibility was more than 10 km. The cloud cover was given with few (FEW) at 600 ft, broken (BKN) at 700 ft, and 900 ft. The temperature was 13°C, dewpoint 11°C, and QNH 1,010 hPa.

The weather station Eelde reported at 0655 hrs wind from 230° with 11 kt. Ground visibility was more than 10 km. The cloud cover was given with few (FEW) at 1,300 ft, broken (BKN) at 1,600 ft, and 4,500 ft. The temperature was 11°C, dewpoint 10°C, and QNH 1,011 hPa. Temporarily slight precipitation with visibility reduction to 7,000 m and cloud base decrease to BKN at 1,300 ft was observed.

Freezing level at the area of the North Sea was forecast at FL050 or higher. At the day of the occurrence, sunrise in Emden was at 0813 hrs.

1.8 Aids to Navigation

Among other things, the helicopter was equipped with a Flight Management System (FMS) Universal UNS 1K and a fixed installation Garmin GPS 500W with Moving Map indication. It also was fitted with a weather radar on which, with the respective setting, the coastline is clearly depicted in relation to the surface of the water.

1.9 Radio Communications

At 0905:45 hrs the frequency was terminated. Up until then, radio communications between the pilots and Bremen information was recorded and had been made available to the BFU as transcript.

Radio transmissions with the Flugleiter at Emden Airfield had been made available as recording. The BFU was not provided with the recording covering the time between 0907:58 hrs and 0936:32 hrs.

The radio communications were examined in regard to flight conduct and prevailing weather conditions.

1.10 Aerodrome Information

Emden Airfield (EDWE) is located about 3 NM north-east of the city centre of Emden. Aerodrome elevation is 2 ft AMSL. It has one asphalt runway with a length of 1,300 m and a width of 30 m and the direction 072°/252° (07/25). The published traffic circuit
runs north of the runway at 1,000 ft AMSL. The airfield is equipped with approach and runway lighting for night and instrument flight rules operations.

Both runway directions (07 and 25) are equipped with instrument approach and departure procedures. For helicopters approaching the airport from the north, waypoint JUIST is the Initial Approach Fix (IAF) for RNAV (GPS) Y RWY 07/25 approaches.

At the day of the occurrence between 0800 hrs and 1000 hrs, three more helicopters and one airplane departed for VFR offshore flights and one helicopter for an IFR offshore flight. One helicopter approached the airfield from the sea via the RNAV (GPS) Y RWY 25.
1.11 Flight Recorders

The helicopter was equipped with a Universal CVR30 cockpit voice recorder and a Fairchild F 1000 flight data recorder. According to the test report Electronic Equipment No: 1001-2017, on 25 August 2017 at a helicopter operating time of 9,195:24 hrs both recorders were last checked by an external specialist.

With the help of a specialised avionics company the BFU saved and examined the data of both recorders. It was determined that the FDR had recorded a total of approximately 1,361 hours of data without time stamp, of these only about 15 hours were flight data. During the rest of the time the value 0 was recorded for all parameters. The specialised avionics company determined that the FDR changed into recording mode without recording any values or generating an error message. Neither of the recorded flights met the course of the flight at the day of the occurrence.

The download of the CVR showed a recording which is characteristic for a belated deletion of the recording. On enquiry by the BFU the pilots and the technicians stated they had not deleted the CVR recording.
According to the system description of the recorder manufacturer, the delete function of the CVR is connected with the weight-on-wheel and the parking brake sensors in order to prevent deletion during the flight. On the ground with landing gear extended and parking brake set, deletion of data is quite possible. The ERASE button at the CVR control panel in the cockpit has to be kept pressed for at least two seconds. Then deletion takes about 15 seconds while several indications flash at the control panel. In the helicopter involved, the CVR control panel was located on the cabin roof above the co-pilot’s seat back.

With the aid of the CVR manufacturer in the USA, the BFU was able to reconstruct the recording, which is about 30 minutes long. The recording began at about 0858 hrs during the descent shortly before reaching 100 ft GND. It continued until the battery and the engines were switched off after the landing. In the background of the recording the conversation after the landing between the PIC and one of the passengers can be heard. The ground run of the helicopter for engine wash at the day of the occurrence was recorded. Also recorded were two other sign offs from Emden Info via radio transmissions from different aircraft crews. These could not be correlated with a time or day.

The flight path of the helicopter was recorded by radar (DFS) and ADS broadcast (FlightRadar24). The BFU was provided with the radar and the FlightRadar24 recordings. The radar contact of the DFS with the position of the helicopter ended at 0856:32 hrs in the vicinity of reporting point JUIST at FLC 010. The DFS was not able to provide the BFU with further radar data of the helicopter until it landed at Emden Airfield. FlightRadar24 on the other hand had ADS-B data from take-off until landing at Emden.

1.12 Findings on the Aircraft

On the afternoon of 23 October 2017 after the occurrence a short ground run for engine wash was conducted.

On 2 November 2017 another ground run, the first after the occurrence, including a DAFCS check was performed. Multiple tests with engaged cyclic stick trim function produced error-free Level 1 and Level 2 results.

1.13 Medical and Pathological Information

Not applicable.
1.14 Fire
There was no evidence of fire.

1.15 Survival Aspects
Not applicable.

1.16 Tests and Research
Not applicable.

1.17 Organisational and Management Information
The owner of the helicopter was an operator, certified by the Luftfahrt-Bundesamt, with their own maintenance organisation. The main focus of the company were commercial offshore flight operations. The company owned five different twin-engine helicopter types with a total of nine helicopters. Depending on the type, flight operations occurred in single or multiple pilot operations. Deployment of the S-76B was only planned until the end of 2017 or the beginning of 2018, respectively. As a result the number of crews for commercial flight operations was reduced to three (three PICs and three co-pilots). At the beginning of 2018, the helicopter involved was decommissioned.

The serious incident occurred at a time when the company was in the midst of reorganisation. It encompassed the postholder positions, the revision of the procedures, the training, and internal reporting.

The company had an Organisations Management Manual (OMM). Chapter 4 of the OMM described the Safety Management and Chapter 7 the Reporting System. According to the statement of the company, in 2016 there had been 7 reports in the reporting system. Since the postholder Accountable Manager had changed, the number increased to over 300 reports in 2017. Since then Just Culture may be described as very good. Each employee can be certain that he/she will not be punished for any occurrence report. This is known by all employees.

The Operation Manual (OM) Part A Chapter 8 Operating Procedures included, among others:
Minimum Flight Altitude (Chapter 8.1.1 ff) [...] Flights shall never be planned VFR if it is known that portions of the flight shall be flown below 500 feet to remain VFR. [...] A VFR flight shall not be flown: [...] 2. At a height less than 500 ft above ground or water, or above the highest obstacle within a radius of 150 m from the aircraft. [...] 

VFR Flight Planning (8.1.4 ff) [...] Airspace F, G: Below 3 000 ft AMSL and above 1 000 ft AGL whichever is higher, Fight Visibility 1 500 m / 800 m, Distance from clouds: clear of clouds, surface in sight [...] 

VFR / IFR Policy (8.3.1 ff) [...] If circumstances, i.e. an unforecasted deterioration in weather conditions, indicate the need for a change from VFR to IFR, this shall be requested immediately from appropriate ATS unit. Flight in VMC shall be maintained until IFR clearance is received. [...] 

Audio Voice Alerting Devices (8.3.4) [...] If an AVAD or unexplained warning occurs in VMC, the PF shall take corrective actions as necessary to achieve obstacle clearance and appropriate height separation. [...] 

Policy for Use of Autopilot (8.3.18 ff) [...] policy is to maintain a high level of manual flying skills but also the ability to make maximum use of automation equipment. In order to achieve this, when possible, one leg should be performed with auto flight system on and the following with auto flight system off. [...] 

Crew Concept and Procedures (8.9.1 ff) [...] Each individual, within the crew, must be aware of the status of the helicopter and of the intentions and actions of the other crew members. This allows all crew members to continually compare targets and inputs with actual performance and enhances the situational awareness. Crew members shall apply the principle of challenge and response and have to exchange relevant information. The result of any action carried out or commanded must be checked and verified. [...] Workload should be carefully distributed between crew members, considering the duties of the Pilot Flying (PF), the Pilot Non Flying (PNF) and crew members. [...] All crew members should work together as a team with each individual assigned to their duties in order to fulfil the common targets and reach the operational goal. The crew should support each other at all times in fulfilling these duties and responsibilities. The leadership of the pilot in command shall be focused on what is right and not who is right. [...] By supporting each other and forwarding information to other crew members, the situational awareness of each crew member is maintained at the highest possible level. This allows the pilot in command to find the best possible solution for each individual situation. Following this strategy of
decision making and informing all crew members about the decision creates and ensures a closed loop. […]

The company also had the Standard Operating Procedure (SOP) "Conduct of Multi Crew Operation MCC". Chapter 4.2 describes crew duties, tasks of the PF and the PNF and mutual monitoring. […] In IMC conditions the PF focuses entirely on the flight attitude / NAV instruments. The PNF is responsible for the external references. This is regulated by the instruction of the PF to the PNF “Have a look out for visual contact.” The PF only stops observing the instruments once the PNF has given clear information of positive “Visual Contact” (e.g. Approach Lights at 12 a clock in sight, no clouds between). […] The PNF is responsible for monitoring the PF, he also reads and completes the checklists (normal/emergency). The PNF shall assist the PF in all flying matters in order to relieve him. He informs the PF of altitude and heading deviations and checks his countermeasures. […]

The OM Part A Chapter 1.4 Authority, Duties and Responsibilities of the Pilot-in-Command/Commander describes among other things: […] ensures that flight recorders (if installed): are not disabled or switched off during flight, in the event of an accident or an incident that is subject to mandatory reporting: are not intentionally erased, are deactivated immediately after the flight is completed, are reactivated only with the agreement of the investigating authority […]

In anticipation of the aeronautical requirement to implement and apply a FDM system the company already applied a FDM with part of their helicopter fleet. The company stated that a descent with infringement of the minimum altitude would have been noticed by the so-called Gatekeeper who would have addressed it. Due to missing technical conditions, the helicopter involved was not part of the FDM.

Since July 2018, the company deploys only helicopters which are part of the FDM.

Oversight of the Operator

The BFU asked the LBA, department Flight Operations, for information regarding the company involved.

According to which, on 19 October 2016 the company filed an application of approval of the safety principles and procedures, which were described in Chapter 1 of the Organisations Management Manual. On 14 July 2017 the LBA determined that requirements of AMC1 ORO.GEN200(a)(2) were not taken into account in the Safety Policy of the company. The following should be added: Safety reporting principles
and not to blame someone for reporting something which would not have been otherwise detected.

On 28 September 2017 the LBA performed the last flight operations audit. Among other things, deficits in regard to trainings of the safety and compliance monitoring managers were detected. In addition, deficits regarding the internal audit as part of the management system were determined.

On 15 December 2017, EASA audited the company involved. Deficits in the compliance monitoring of the internal audits conducted in 2016 and in the planning for 2017 were determined.

Aeronautical Regulations

Commercial helicopter offshore operation generally has to be conducted in accordance with Regulation (EC) 965/2012 and after 1 July 2018 considering the amendments with Regulation (EC) 1199/2016. Part K - Helicopter Offshore Flight Operations (HOFO) - stipulates, among other things:

SPA.HOFO.110 Operating Procedures:

(a) The operator shall, as part of its safety management process, mitigate and minimise risks and hazards specific to helicopter offshore operations. […]

(b) The operator shall ensure that: […] (4) where established, the offshore route structure provided by the appropriate ATS is followed; (5) pilots make optimum use of the automatic flight control systems (AFCS) throughout the flight; (6) specific offshore approach profiles are established, including stable approach parameters and the corrective action to be taken if an approach becomes unstable; (7) for multi-pilot operations, procedures are in place for a member of the flight crew to monitor the flight instruments during an offshore flight, especially during approach or departure, to ensure that a safe flight path is maintained; (8) the flight crew takes immediate and appropriate action when a height alert is activated; (9) procedures are in place to require the emergency flotation systems to be armed, when safe to do so, for all overwater arrivals and departures; and (10) operations are conducted in accordance with any restriction on the routes or the areas of operation specified by the competent authority or the appropriate authority responsible for the airspace.

SPA.HOFO.145 Flight data monitoring (FDM) system:

(a) When conducting CAT operations with a helicopter equipped with a flight data recorder, the operator shall establish and maintain a FDM system, as part of its
integrated management system,
by 1 January 2019.

(b) The FDM system shall be non-punitive and contain adequate safeguards to protect the source(s) of the data.

SPA.HOFO.150 Aircraft tracking system:

An operator shall establish and maintain a monitored aircraft tracking system for offshore operations in a hostile environment from the time the helicopter departs until it arrives at its final destination.

1.18 Additional Information

Helicopter Offshore Operations in Germany

Since 2010 with the construction and operation of offshore wind energy convertors a new field of activity has developed for helicopter operators in Germany. Helicopters were increasingly used to supply medical emergency aid for offshore workers and transport of personnel and material. In the beginning there were just a few flights, by 2016 the number had increased to about 14,000 per year in the German EEC.
Due to the aeronautical regulations and the airspace and procedure specifications, these flights have, so far, essentially been conducted in accordance with VFR. In the European neighbouring states the offshore flights in connection with oil and gas production are essentially conducted in accordance with IFR due to the unpredictable weather or often marginal visual meteorological conditions.

**Route System North Sea in the German Area of Responsibility**

For helicopter offshore operations in the FIR Bremen, since April 2019 FIR Langen, and the German area of responsibility of the North Sea, respectively, a way-point and route system including stipulated vertical separation and communications procedures were compiled on the initiative of several operators and in agreement with the DFS. Since September 2014 a majority of the offshore companies are committed to adhere to this way-point grid and the procedures.
In October 2017 the AIP AIC VFR 03/17 Reporting point network and special alerting service for helicopters in the North Sea of the Bremen Flight Information was published as information and recommendation. At the end of March 2019, the DFS stopped the special alerting system and the AIC VFR 03/17 was repealed.

The operators still voluntarily adhere to the way-point and route system, which connects with the route system of the neighbouring states Denmark (FIR Copenhagen), Netherlands (FIR Amsterdam), and Scotland (Scottish FIR). Contrary to Germany, the aeronautical charts (AIP NL ENR 6.3-1, AIP DK ENR 6.5-1, and AIP UK ENR 6-1-15-3/5) of these states specify Helicopter Main Routes (HMR), Helicopter Traffic Zones (HTZ), and Helicopter Protection Zones (HPZ). The respective AIPs describe helicopter VFR, VFR-Night, and IFR flights above sea or the general IFR and VFR procedures were amended accordingly. The way-point grid of Denmark connects with the one of Norway (AIP NOR ENR 6.4-1). Norway issued extensive procedures in their AIP Supplement (AIP AIRAC SUP 10/17, PROCEDURES FOR HELICOPTER OPERATIONS ON THE NORWEGIAN CONTINENTAL SHELF).

Since January 2018, a group of experts, including representatives of the BMVI, BAF, BSH and DFS, has been meeting to discuss potential and possibly necessary airspace actions and the approval of IFR procedures in airspace G above sea.

Comparable Occurrences

The US American Federal Aviation Administration (FAA) defines Controlled Flight Into Terrain, Loss of Control, and Situational Awareness as follows:

a. Controlled Flight into Terrain: CFIT occurs when an airworthy aircraft is flown, under the control of a qualified pilot, into terrain (water or obstacles) with inadequate awareness on the part of the pilot of the impending collision.

b. Loss of Control: The term, loss of control, refers to emergency situations from which a pilot may have been able to recover but did not, such as problems with situation awareness, recovery from windshear, mishandling of an approach, and recovery from a stall.

c. Situational Awareness: Situational awareness means the pilot is aware of what is happening around the pilot's aircraft at all times in both the vertical and horizontal plane. This includes the ability to project the near term status and position of the aircraft in relation to other aircraft, terrain, and other potential hazards.
ICAO and EASA describe airmanship as follows:

*The consistent use of good judgment and well-developed knowledge, skills and attitudes to accomplish flight objectives. Together with an integration of discipline, skill, proficiency, yourself [pilot], aircraft, team, and environment, to understand, assess, and manage risks, by use of not only piloting skills but also common sense, academic knowledge, awareness, experience, correct reaction to emergencies, etc.*

The Flight Standards Directorate of Pakistan describes in AIR SAFETY CIRCULAR ASC-010 STANDARD OPERATING PROCEDURES: Several studies of crew performance, incidents and accidents have identified inadequate flight crew monitoring and cross-checking as a problem for aviation safety. Therefore, to ensure the highest levels of safety each flight crewmember must carefully monitor the aircraft’s flight path and systems and actively cross-check the actions of other crew members. Effective monitoring and cross-checking can be the last barrier or line of defense against accidents because detecting an error or unsafe situation may break the chain of events leading to an accident. Conversely, when this layer of defense is absent, errors and unsafe situations may go undetected, leading to adverse safety consequences. […] Crew monitoring performance can be significantly improved by developing and implementing effective SOPs to support monitoring and cross-checking functions, by training crews on monitoring strategies, and by pilots following those SOPs and strategies. […]

Occurrences and accidents comparable with this serious incident occurred in many cases in the past during marginal visual meteorological conditions or at night.

A short list of similar accidents:

NTSB/AAR-06/02: 23 March 2004, S-76A++, Controlled Flight Into Terrain (W) during Night

AAIB Report 7/2008: 27 December 2006, SA365N, […] when preparing to land on the North Morecambe platform, in the dark, the helicopter flew past the platform and struck the surface of the sea.

CIAIAC Report A-002/2010: 21 January 2010, AW139, […] crashed in a controlled flight into water, inadvertently by the crew […]

AAIB Report 1/2011: 18 February 2009, EC225 LP, […] the flight crew made a visual approach to the platform during which the helicopter descended and impacted the surface of the sea […]
BFU 3X006-14: 28 February 2014, BK117 C-1, crashed into water at night

1.19 Useful or Effective Investigation Techniques

Not applicable.
2. Analysis

2.1 Course of the Flight

At the day of the incident, the flight assignment of the helicopter was typical for offshore operations during the construction and operation of Renewable Energy at sea. The flight from Emden, located within Bremen/Langen FIR, to the convertor station DOLWIN ALPHA, within Amsterdam FIR, was uneventful and corresponded with regular procedure.

The BFU finds it remarkable that right after take-off the helicopter climbed to 2,500 ft AMSL. When taking into account the information from the weather station at Emden Airfield, the precipitation radar image, the minimum visibilities, and the distance to clouds, it is highly unlikely this was possible as VFR flight. According to FlightRadar24 data, with the exception of one helicopter flying in accordance with IFR, all other helicopters and one airplane taking off at Emden Airfield between 0800 and 1000 hrs were flying between 500 ft and 900 ft AMSL.

Up until the FD decoupled, the flight back to Emden Airfield was uneventful. The decoupling resulted in manual control. However, the so-called command bars of the FD and the beep-trim function of the stick could still be used as support of the PF. The BFU does not understand why the crew, in cruise flight, a phase without increased workload or stress, did not realise that the stick trim switch was deactivated. The interaction of AP mode (ATT or SAS), the FD, and the trim switches is typical for helicopters of all types. The BFU is of the opinion that the mode of operation of a digital automatic flight control system is part of the basic knowledge of a pilot. In addition, the trim switches are located next to the DAFCS panel and were therefore in the line of vision of the pilot during the trouble shooting process.

Then the helicopter once again drew near the precipitation area close to the East Frisian Islands within Bremen FIR and entered clouds. The early question regarding the weather conditions at Emden Airfield before reaching reporting point JUIST and the statement of the passengers, serve as indication for the BFU that at the time, in airspace G, the helicopter had been in clouds at about 2,000 ft AMSL. The weather conditions transmitted from Emden during the return flight, before reaching reporting point JUIST, and the weather report during pre-flight preparation must have given the crew a sense of safety and the expectation of early ground visibility during descent through the clouds. Therefore, it is likely that the pilots either discarded the option to
follow the instrument approach procedure from the reporting point JUIST to Emden using the GPS-RNAV-Approach very early on or did not consider it at all.

Probably entirely unexpectedly and also unprepared, the crew did not obtain sight of the coastline. The BFU does not understand that the descent was continued and the helicopter went below 500 ft GND. Then the landing gear was extended and the helicopter descended below the landing gear warning altitude. Even though the co-pilot called out the altitude, the radar altimeter warning indication flashed, and the AVAD announcement sounded the helicopter continued the descent below 100 ft GND. According to the CVR data, both pilots tried to obtain sight of the coastline. They did not recognise that speed and the already low altitude decreased.

After flaring the helicopter, stopping the descent, and having the coastline in sight, the crew flew to Emden at low altitude. Here, the CVR data showed cooperative crew resource management, use of the navigation equipment, and concentration on the conduct of the flight in very marginal visual meteorological conditions.

2.2 Crew

Both pilots held the required and valid licences and ratings. Corresponding with their ratings and flying experiences they were scheduled as pilot in command and co-pilot.

The PIC has to be viewed as very experienced due to his long-standing flying experience, high total flying hours, and flight time in the helicopter type involved. This is also documented by his intra-corporation rating as line training captain.

The co-pilot had sufficient total flying and type experience which should qualify him to act as fully-fledged crew member. However, he lacked routine and experience regarding flying without outside view and manual instrument control of the helicopter.

The BFU was provided with the records of the line and operator proficiency checks of both pilots. The BFU is of the opinion that it is not understandable why, in spite of the training and regular flying checks of the pilots, neither checked the stick trim switch or recognised the deactivation of the trim function as cause for the decoupling of the FD.

According to the CVR data and the impression the BFU gained from the interview, the pilots communicated friendly and at eye level with each other.

However, there existed an enormous flying experience gradient between the two pilots. This surely resulted in the co-pilot trusting the decisions and actions of the
PIC. That he did not intervene against the infringement of 500 ft GND, the extension of the landing gear during descent before reaching the coastline, and further descent below 100 ft GND in spite of him calling out the altitude, and the indication and sounding of the RA/AVAD warnings could proof this.

The BFU is of the opinion that both pilots had insufficient airmanship. They consciously disregarded specified minima and put themselves in danger of a CFIT(W). This and the course of the flight until the helicopter was flared in very low altitude proof loss of situational awareness of both pilots during the attempt to establish visual contact with the coastline. The conscious infringement of the minimum altitude differentiates this occurrence from other incidents during offshore flight operations, where in the past CFIT(W) accidents occurred after unintentional descent.

The BFU does not understand why the crew did not report the occurrence, the massive infringement of the minimum descent altitude, and the near approach to water with passengers on board, immediately after their return or compiled an internal flight safety report according to the specifications of the internal reporting procedures.

2.3 Aircraft

The helicopter was certified for commercial helicopter offshore operations in the scope of the company’s Air Operator Certificate (AOC). In accordance with aviation regulation the helicopter had a certificate of registration and was kept airworthy by the maintenance organisation of the operator. The centre of gravity and the flight mass were within prescribed limits.

The helicopter was equipped and approved for IFR flights. The PF was assisted by the digital Automatic Flight Control System with two autopilots in ATT or SAS modes. Only in the ATT mode was it possible to couple FD and autopilots and fly “hands off”. The deactivation of the stick trim function is a wanted procedure and an option of the DAFCS and therefore not part of any checklist as an emergency procedure or system failure.

The navigation equipment consisting of GPS including moving map indication and the FMS in combination with the weather radar would have been capable to generate a comprehensive navigational overview of the situation and with correct use could have maintained the situational awareness of the crew.
The investigation revealed that the FDR was defective. It is likely that this defect already existed at the last avionics check which occurred about 65 operating hours prior to the occurrence. However, the maintenance personnel or the flight crew could not detect this defect without reading out the data first.

There was no continuous flight data monitoring of the helicopter involved.

2.4 Weather

The crew had obtained online METARs and TAFs at 0722 hrs for the flight route Emden - Eelde via Helgoland and the oil platform EHFZ. These showed that at departure time of the helicopter the following was to be expected: visibility of more than 10 km, few clouds at least at about 800 ft AMSL, broken and overcast clouds at 1,000 ft AMSL and higher, mostly with slight precipitation. These forecasts and observations with sufficient visibility and low clouds are common conditions and typical for offshore flight operations above the North Sea.

During the outbound and inbound flights of the helicopter, a shower area was located between Borkum Island and the coastline. The helicopter had to pass through it during both flights. Since the freezing level was above FL50, the precipitation clouds restricted a VFR flight but not an IFR flight in clouds.

Contrary to the observations at Emden Airfield and the estimation of the crew, during the return flight the clouds in the shower area south of Borkum Island reached further down. Above sea this usually results in a very low and diffuse contrast between cloud base and water, or it blurs entirely. In addition, the surface of the sea south of the East Frisian Islands, between islands and coast, is usually calmer and whitecaps are rarer or less distinct. This uniform, dark surface in turn reduces the contrast to the low hanging clouds. Precipitation also results in reduction of visibility and to line-of-sight obstruction of the windshield of the helicopter.

All in all, the weather conditions were not unusual for offshore flight operations above the North Sea. The other flights at Emden Airfield on the morning of the day of the occurrence proof this.

The reported swell in the area of the convertor station DOLWIN ALPHA would not have permitted the flight due to safety considerations and limits in regard to rescue equipment and recommendations of EASA AD No.: 2014-0244. The observed significant wave height of 3.1 m was above the certification of the helicopter’s emergency floats with Sea State 4, which means a maximum wave height of 2.5 m.
2.5 Flight Recorders

The BFU had available the statements of the crew and the passengers, but no FDR data, because the FDR was defective. The internal test logic of the FDR did not recognise this defect and was therefore not indicated in the cockpit. The BFU did not further investigate this defect, because it is a rare malfunction of a recorder which has been used in aviation for years and the BFU is not aware of any comparable defects.

During read-out, the CVR showed a typical deletion signal of the recording. Due to the erase logic of the CVR it can be ruled out with significant probability that the CVR was inadvertently deleted. The BFU could not determine, who deleted the recording and when. The recording of the ground run of the helicopter and the recorded landing reports of other aircraft show that the deletion of the data did not occur immediately after the occurrence flight. The company’s operations manual explicitly prohibits deletion of the recordings.

BFU and recorder manufacturer recovered the voice recording with great effort. It began shortly before the descent through 100 ft GND and was complete up until the landing.

The flight path was recorded by radar and ADS broadcast. This showed that the radar contact of the air navigation service provider ended at less than 1,000 ft AMSL. The air navigation service provider could not recognise the serious incident and had a CFIT(W) occurred search might have been difficult. The ADS-B contact of FlightRadar24 was complete. Due to the requirements of Regulation (EU) 965/2012 SPA.HOFO.150 ADS-B is a prerequisite for offshore flight monitoring in neighbouring states and corresponding equipment in aircraft mandatory. The BFU is of the opinion that the responsible air navigation service provider should ensure the contact with aircraft in offshore flight operations from take-off to landing in Germany and the German FIR, respectively.

2.6 Organisations and Procedures

2.6.1 International Helicopter Offshore Flight Operations in the North Sea Area

The lower airspace above the North Sea is divided into several FIRs (FIR Norway, FIR Copenhagen, Scottish FIR, Amsterdam FIR, Reykjavik FIR, London FIR,
Brussels FIR, and Bremen/Langen FIR). Helicopter offshore flight operations above the North Sea are conducted from the different neighbouring states. Due to oil, gas, and renewable energy production, for each FIR national airspace actions, and operational air navigation service and monitoring procedures were developed which should enable offshore flight operations even under difficult meteorological conditions. Essentially, IFR flights along Helicopter Main Routes and instrument approach procedures or so-called Cloud Breaks within Helicopter Protection Zones were permitted. In addition, complete flight coverage, e.g. ADS-B, and radio communication in low altitudes were ensured.

2.6.2 Helicopter Offshore Flight Operations in Germany in the German EEC and FIR Bremen/Langen

The German EEC in the North Sea is below the airspace of the FIRs Bremen/Langen, Amsterdam, Copenhagen, and Scotland. Thus within the EEC different airspace actions and aeronautical procedures for the conduct of offshore flights exist.

At the time of the occurrence, FIR Bremen/Langen, for which Germany is responsible, was compared to neighbouring states an exception, because within the FIR there were no HMR, HPZ, or HTZ, and the German AIP did not stipulate any helicopter offshore flight operations procedures. Up until now only AIP AIC VFR 03/17 published information regarding the route system of some companies. In 2019 even the AIC was cancelled.

At the time of the occurrence, in Germany all flights had to be conducted in accordance with visual flight rules in the uncontrolled airspace G. This was also true for FIR Bremen/Langen for all offshore flights in airspace G below 2,500 ft AMSL. Minimum distances to clouds and ground visibility had to be adhered to. IFR flights in clouds and instrument approach procedures in the uncontrolled airspace G above sea were prohibited.

Some years ago, several German operators conducting offshore flight operations implemented a route system, and altitude separation to sea and back. This served as standardisation of the flights, collision avoidance, and flight monitoring. The flight route structure and the procedures of this system show similarities to the procedures of neighbouring states. At short-term weather deterioration, the route system tempted the pilots against valid aeronautical stipulations in airspace G within FIR
Bremen/Langen, to enter clouds, and continue the flight using instruments and autopilots.

At the time of the occurrence, there was no complete radar coverage including low altitudes below 1,000 ft AMSL on the part of the responsible air navigation service provider. Due to aeronautical requirements and the technical infrastructure of the customers of helicopter offshore missions and the operators involved, complete flight coverage by ADS-B would already be possible.

In summary, the BFU is of the opinion that the different general frameworks, airspace actions, and aeronautical stipulations for day, night, VFR, IFR, flights complicate the compliant flight conduct through all FIRs within the EEC. Regarding flight safety, adaptation and coordination of the procedures (VFR, IFR, day, and night), airspace actions (HMR, HPZ, and HTZ) with the adjacent FIRs (Amsterdam, and Copenhagen) and establishment of an aeronautically mandatory route system within the FIR Bremen are past due.

2.6.3 Procedures and Stipulations of the Company Involved

The company involved had been conducting helicopter offshore flight operations for years. The company was LBA approved and had corresponding procedures and manuals. The serious incident showed, however, that in this case flight conduct procedures were not adhered to, that the training regarding system knowledge, crew coordination, and task distribution was insufficient, that internal reporting did not occur in time, and that there were obviously constraints in the company, which prompted someone to delete the CVR.

The BFU is of the opinion that the procedures described in OM Part A and the SOP “Conduct of Multi Crew Operation MCC” corresponded with the aeronautical stipulations and were similar to the common procedures and requirements of comparable operators. These procedures should suffice to ensure safe flight operations.

At the time of the serious incident, the company was in a phase of change, on the part of the management, the responsible postholder, the revision of the manuals and procedures and the regular training. The findings the LBA and EASA audits for the time period 2016/2017 determined mirrored the problems of the company management, the company structure, and the management system (ORO GEN.200).
The BFU is of the opinion that the reorganised company should ensure, with actions such as comprehensive flight data monitoring system, and active extensive compliance monitoring, that all requirements and procedures are adhered to. In the scope of the safety management system and the reporting, the company should ensure with internal actions that every employee reports occurrences without delay and communicates openly. The crew training should ensure that the pilots have sufficient system knowledge and apply MCC procedures.
3. Conclusions

During a commercial passenger flight of a transport category helicopter over sea a serious incident occurred as the crew attempted to establish visual contact with the coast line. In spite of a two-pilot crew, use of a transport category helicopter, and flight operations in the scope of an approved air operator, a CFIT(W) almost occurred.

The analysis of the facts determined that the serious incident was the result of the aeronautical general framework within the German Exclusive Economic Zone in the North Sea and the FIR Bremen/Langen, flight operational stipulations in Germany, and conscious deviation of the crew from company internal stipulations and procedures.

3.1 Findings

3.1.1 Aeronautical Regulations

- Different airspace actions and national aeronautical regulations existed in the EEZ in the North Sea.
- In Germany IFR flights in airspace G were not permitted.
- Instrument approach procedures and so-called Cloud Breaks over sea were not permitted in the FIR Bremen.
- The route system in the FIR Bremen/Langen was only a voluntary agreement between German companies. It had not been published in the German AIP, with coordinates and procedures, etc. It did not have the status of a route system (including Helicopter Main Routes) as did adjacent FIRs.
- A flight data monitoring system was not mandatory until 2019.

3.1.2 Organisations and Procedures

Helicopter Offshore Operations in Germany

- Due to the instrument flight capacity of the helicopters used and the skills and ratings of the pilots, flying in marginal visual meteorological conditions above sea was common and, if necessary, IFR was relied on as back up option..
• During offshore flights in FIR Bremen/Langen, it was common to climb and descent through cloud layers and fly through clouds for short periods of time.
• Competition among the German offshore air operators is high and therefore flights are rarely cancelled due to marginal visual meteorological conditions.

Company Involved
• The company focus was on offshore flight operations.
• At the time of the serious incident it was in the process of extensive change.
• The company had established a safety management and reporting system.
• The last LBA and EASA audits revealed partial faults with the safety management and the compliance management.
• The company had not established a FDM system for the entire fleet.
• The procedures and stipulations of the flight operations manual met the common standards of similar operators.
• As a general rule, the pilots of the company held instrument ratings and were deployed as two-pilot crews.

3.1.3 Meteorological Conditions
• The weather was quite common for the region and the operation area above the North Sea.
• A rain and shower area was located between the western East Frisian Islands and the coast.
• Outside the shower area sufficient visual meteorological conditions prevailed.
• In the precipitation area cloud bases and visibilities decreased.
• The weather observations prior to the flight were better than the prevailing weather conditions during the flight.
• The weather conditions the Flugleiter at Emden had transmitted were better than the prevailing weather conditions during the descent to the coastline.
• Freezing level was high and therefore did not restrict instrument flight in clouds and precipitation.
3.1.4 Helicopter

- The helicopter was equipped and approved for offshore flights.
- The helicopter was not monitored by a FDM.
- According to the CVR recording there were no technical defects which would have distracted the pilots from aircraft control and crew cooperation.
- The helicopter was equipped with a moving map indication and weather radar, among other things, on which the coastline would have been clearly visible.
- The deactivation of the stick trim function, a standard function of the DAFCS, resulted in the decoupling of the FD.
- After the decoupling, the helicopter was still stabilised in the SAS mode by the DAFCS and the so-called command bars were still available to the crew and could have been used for support.
- Due to the extension of the landing gear, the landing gear warning was suppressed.
- Radio altimeter and AVAD were functioning.
- It is likely that the FDR had been defect quite some time prior to the occurrence.
- It is highly likely that the CVR recording was deleted intentionally.

3.1.5 Crew

- Both pilots held the required licences and ratings.
- The PIC had an extensive total flying and type experience; he had a long-standing offshore experience.
- Compared to the PIC, the co-pilot had little experience in regard to IFR conditions and a low total flying experience.
- Prolonged manual control of the helicopter without outer references was difficult for the co-pilot.
- Both pilots had insufficient system knowledge of the DAFCS.
- Communications between them showed deficiencies concerning mutual support and monitoring which normally characterises the flight-safety improving actions of multi-pilot operation.
• The pilots consciously infringed the low altitude of 100 ft GND in spite of the call-out of the co-pilot and the warning of the AVAD.

• Both pilots simultaneously attempted to establish visual contact with the coastline and disregarded the monitoring of flight parameters.

• After the landing, both pilots neglected to file an immediate internal report.

• Both pilots stated they had not deleted the CVR.

3.1.6 Course of the Flight

• The course of the flight was typical for passenger transport flights during construction and operation of Renewable Energy in the North Sea.

• The flight followed the route systems in the agreed altitudes (2,500 ft AMSL outbound/2,000 ft AMSL inbound).

• The attempt to establish ground in sight prior to reaching the coast and the high obstacles located there sporadically was understandable after the helicopter had entered the precipitation area.

• Contrary to the OM, the descent was not aborted after reaching 500 ft GND.

• An instrument approach to Emden using RNAV (GPS) Y RWY 25 from JUIST would have been possible; the pilots did not take this into consideration, however.

3.2 Causes

The serious incident, the inadvertent controlled flight towards water (CFIT(W)), was due to inadequate airmanship including loss of situational awareness.

Immediate Causes:

• The helicopter entered precipitation clouds.

• The cloud base in the precipitation was lower than the helicopter crew had anticipated, Emden Airfield observed, and the Deutscher Wetterdienst forecast.

• The descent was not stopped in 500 ft GND and an alternative flight conduct not considered.
• In very low altitude the pilots looked outside and neglected monitoring the instruments.

• The trust of the less experienced co-pilot in the actions and decisions of the significantly more experienced pilot in command prevented his intervention.

• The crew did not adhere to the task distribution and mutual monitoring of the operator and the procedures of the flight operations manual regarding the minimum flight altitude.

Contributing Causes:

• The crew did not recognise the reason for the de-coupling of the flight director.

• The helicopter, flight altitude, and airspeed had to be controlled manually.

• The crew did not want to conduct a manual instrument approach to Emden Airfield.

• The helicopter involved had been exempt from the voluntary, intra-corporate flight data monitoring.

Systemic Causes:

• In the area of the North Sea it is common that only marginal visual meteorological conditions prevail.

• In Germany IFR flights in the uncontrolled airspace G are not permitted.

• The German EEC is lying below several FIRs with different stipulations and procedures for VFR and IFR flights.

• Compared with other adjacent FIRs, the Flight Information Region Bremen/Langen did not have special helicopter procedures required by aeronautical regulations.

• Normally, in FIR Bremen/Langen flights below approximately 1,000 ft AMSL across the North Sea are not monitored by the radar of the air navigation service provider.

• During offshore flights in FIR Bremen/Langen, it was common to climb and descent through cloud layers and fly through clouds for short periods of time.

• Up until the end of 2018, flight data monitoring of all off-shore flights was not required by aeronautical regulation.
4. Safety Recommendations

01/2019

Bundesministerium für Verkehr und digitale Infrastruktur (BMVI) (Federal Ministry for Transport and Digital Infrastructure) should, for helicopter flight operations over sea in the area of the Flight Information Region Langen in agreement with the adjacent Flight Information Regions, develop procedures and airspace actions which allow safe flight operations even in marginal weather conditions by day and night.

Investigator in charge: Axel Rokohl
Field investigation: Thomas Kostrzewa, Axel Rokohl
Assistance: George Blau, Philipp Lampert

Braunschweig, 29.08.2019