

# Investigation Report

## Identification

Type of Occurrence:	Accident
Date:	2 June 2006
Location:	Hamburg
Type of Aircraft:	Fixed Wing
Manufacturer / Model:	De Havilland / DCC 2
Injuries to Persons:	Five occupants fatally injured One occupant seriously injured
Damage to Aircraft:	Aircraft destroyed
Other Damage:	Damage to railway tracks and freight cars
Source of Information:	Investigation by BFU
State File Number:	BFU 3X083-06

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.

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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## Abbreviations

ATC	Air Traffic Control	Air Traffic Control
BFU	German Federal Bureau of Aircraft Accident Investigation	Bundesstelle für Flugunfalluntersuchung
CAVOK	Clouds and Visibility okay	Wolken und Sicht in Ordnung
CPL	Commercial Pilot's Licence	Berufspilotenlizenz
CRI	Class Rating Instructor	Fluglehrer für Klassenberechtigungen
CVR	Cockpit Voice Recorder	Cockpit Voice Recorder
DWD	National Meteorological Service	Deutscher Wetterdienst
EASA	European Aviation Safety Agency	Europäische Agentur für Flugsicherheit
EASA Teil 145	EASA Maintenance Organization Approvals	EASA Anforderungen an Instandhaltungsbetriebe
EU-OPS	EU regulations specifying minimum safety and related procedures for commercial passenger and cargo fixed-wing aviation	EU Betriebsvorschriften für den gewerblichen Flugverkehr mit Flugzeugen
FBL	Post-holder Operations	Flugbetriebsleiter
FDR	Flight Data Recorder	Flugdatenschreiber
FI	Flight Instructor	Fluglehrer
JAR-FCL dt.	Flight Crew Licensing Requirements	Vorschriften für die Lizenzierung von Piloten von Flugzeugen
JAR-FCL 3	Flight Crew Medical Requirements	Vorschriften für die Medizinische Tauglichkeit von Cockpitpersonal
JAR-OPS 1	JAA regulations specifying min-	Betriebsvorschriften für den ge-

	imum safety and related procedures for commercial passenger and cargo fixed-wing aviation	werblichen Verkehr mit Flugzeugen
L-Akte	Aircraft Continuing Airworthiness Records	Lebenslaufakte
LTA	Airworthiness Directive	Lufttüchtigkeitsanweisung
LuftVG	Federal Aviation Act	Luftverkehrs-Gesetz
LuftVO	Air Traffic Order	Luftverkehrs-Verordnung
LuftVZO	Regulation on Certification and Licensing in Aviation	Luftverkehrs-Zulassungs-Ordnung
PIC	Pilot in Command	Verantwortlicher Luftfahrzeugführer
PPL(A)	Private Pilot License	Privat Piloten Lizenz
QNH	Atmospheric pressure reduced to MSL by ICAO Standard Atmosphere and altimeter subscale setting to obtain aerodrome elevation when on the ground.	Luftdruck, reduziert auf Meereshöhe mit ICAO-Standardatmosphäre und Skaleneinstellung am Höhenmesser, damit bei der Landung die Flughöhe angezeigt wird.
SB	Service Bulletin	Wartungsanweisung
TBL	Post-holder Maintenance	Technischer Betriebsleiter
TW	Engine	Triebwerk
VFR	Visual Flight Rules	Sichtflugregeln

## Synopsis

At 1038 hrs<sup>1</sup> on 2 July 2006, the German Federal Bureau of Aircraft Accident Investigation (BFU) was informed by the air traffic service provider at Hamburg Airport, that there had been a seaplane accident in the vicinity of the Port of Hamburg. On the same day, two BFU staff members attended the accident site to begin an investigation. Prior to their arrival, an external expert for field investigation attended the scene.

The seaplane was a commercially operated De Havilland DHC-2 Beaver, which had taken off under VFR conditions from the Water Aerodrome Hamburg Norderelbe for a passenger sightseeing flight over the city. The seaplane took off from the main channel of the River Elbe in an easterly direction, before commencing a right turn towards the south. Witnesses subsequently reported that, as the aircraft overflew Veddeler Damm road, there was an interruption to the engine sound. The witnesses said the aircraft then descended without any engine sound and turned towards the east.

The seaplane then made an emergency landing on the Hamburg-South Harbour freight railway yard, during which it collided with obstacles. At this time, five occupants suffered fatal injuries. One passenger was seriously injured and the aircraft destroyed.

The accident took place during initial climb after the take-off and was due to the following immediate causes:

- Prior to reaching circuit height, there was an interruption of the fuel supply between the fuel pump and carburettor, followed by the outbreak of fire and engine failure.
- During this phase of the flight, there was no suitable area for an emergency landing within reach.

The following systematic causes also led to the accident:

- The departure route laid down in the approval for the water aerodrome did not take into account the need for a suitable landing area in the event of an aircraft emergency for the aircraft used and this particular flight phase.

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

# 1. Factual Information

## 1.1 History of the Flight

The De Havilland DHC-2 Beaver seaplane was used by an operator for city sightseeing flights from the Water Aerodrome Hamburg Norderelbe. The commercial flights were conducted over the city of Hamburg under Visual Flight Rules (VFR).

On 2 July 2006 the seaplane made its first take-off for the first local sightseeing flight of the day at 0945 hrs. The aircraft returned to the pier after about half an hour and was then made ready for the next flight.

Five persons had bought tickets for the next sightseeing flight. Prior to boarding the seaplane, a company employee briefed the passengers on emergency procedures and issued life jackets. The company pier dispatcher then advised the pilot that the aircraft was ready for departure.

The pier dispatcher saw that the pilot first pulled the propeller by hand through a number of turns before boarding the aircraft and starting the engine with the electric starter. The pier dispatcher subsequently reported the engine had started without any unusual occurrence.

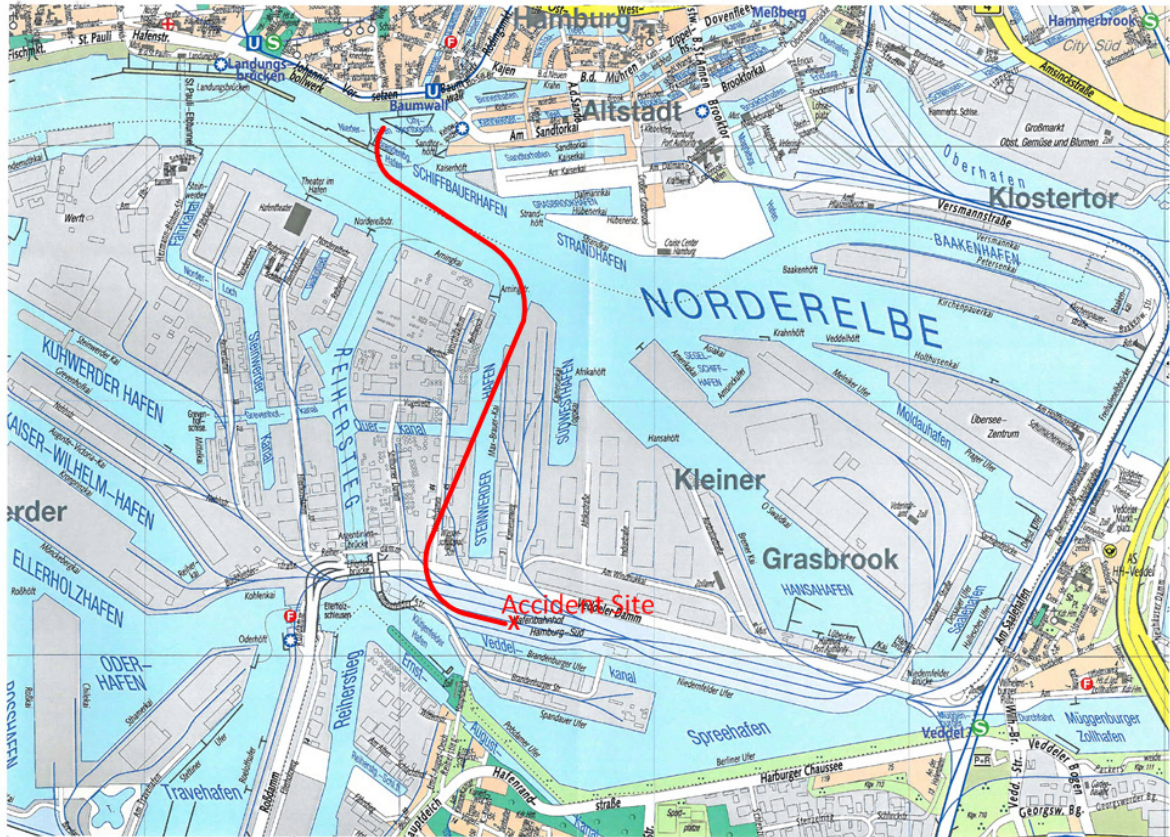
The seaplane left the pier at about 1030 hrs and proceeded towards the take-off area on the Norderelbe. After informing the radio communication ground station at the water aerodrome that he was ready for departure, at 1036 hrs the pilot changed frequency to 121.275 MHz (Hamburg Tower) and advised the air traffic service provider controller that the seaplane had lifted off.

Persons walking along the banks of the River Elbe observed the seaplane take off in an easterly direction from the River Elbe main stream. After initial climb, the seaplane commenced a right turn towards the south. Prior to crossing the Veddeler Damm road, several witnesses noted an interruption in the engine sound. Witnesses subsequently reported the aircraft had then descended without any sound from the engine and turned towards the east.

The seaplane then made an emergency landing on the Hamburg-South Harbour railway freight yard, during which it collided with obstacles. The aircraft was destroyed, and four occupants died from injuries at the scene. The pilot and one passenger escaped from the wreckage and moved towards an adjacent road.



The pilot and the surviving passenger were transported to hospital seriously injured. The pilot died from his injuries the following day. He told first-aiders on the scene that he had observed a ‘drop in pressure’.



Picture 1: Flight path

Map: Hamburg city map

## 1.2 Injuries to Persons

Injured	Crew	Passengers	Total on A/C	Other
Fatal	1	4	5	
Serious		1	1	
Minor				
None				---
Total	1	5	6	

### 1.3 Damage to Aircraft

The aircraft was destroyed.

### 1.4 Other Damage

There was damage to the freight yard railway tracks and waiting freight cars.

### 1.5 Personnel Information

The 52 year-old pilot was in possession of a valid aircraft Commercial Pilot's Licence (CPL (A)) issued in accordance with JAR-FCL (German), first issued on 21 February 1985. He was further in possession of a valid Class 1 Medical Certificate issued in accordance with JAR-FCL 3 (German).

The pilot's licence included class ratings for single piston engine-powered land- and seaplanes. The pilot was also a qualified Flying Instructor (FI PPL (A)) and a Class Rating Instructor (CRI). He further had an aerobatic rating for powered aircraft, and a banner pick-up tow pilot rating.

It was not possible to obtain precise information about the pilot's total flying experience. However, available records indicated that his total flight experience extended over several thousand hours, and more than one thousand hours on the type in question. The pilot was also the owner of the Operator.

The pilot had been conducting commercial local pleasure flights from Hamburg Harbour since 1993. In addition, he had provided banner towing services to publicise a variety of events.

He obtained his seaplane flight training and rating in Canada.

### 1.6 Aircraft Information

The seaplane was a DHC-2 MK.I (DHC-2 Beaver) manufactured by De Havilland Canada, a single-engined all-metal high-wing monoplane fitted with twin floats for water operations. The floats ('straight floats') did not contain integral retractable wheel landing gears. The aircraft bore the manufacturer's serial number 1512 and was built in 1962. It was equipped with a nine-cylinder radial Pratt & Whitney Wasp

Junior R-985-AN14B. The aircraft was first registered in the Federal Republic of Germany in 1996 and was equipped for Passenger Category 3 operations.

The seaplane was arranged and approved for single pilot operation with seven passengers.

The flight manual states that, in the event of an engine failure at 2,000 ft, the aircraft is capable of gliding a distance of about 5 km.

Since manufacture the aircraft had flown a total of 17,729 hours. Following the installation of a fully overhauled engine in April 2005, the aircraft had flown 428 hours.

The DHC-2 Beaver had three fuel tanks (2 x 135 litres, 1x 95 litres) in the fuselage and a supplementary fuel tank in each wingtip (2 x 75 litres). Prior to departure there were about 135 litres of Avgas in the fuselage tanks. The wingtip tanks were empty.

The maximum take-off weight was given as 2,291 kg. During the pre-flight preparation the take-off weight was calculated to be about 2,244 kg. The disposable load and centre of gravity were within the prescribed limits.



Picture 2 and 3: External view and Cockpit

Photos: Owner

### 1.6.1 Airframe and Engine Maintenance

The last annual aircraft inspection was completed on 23 March 2006. This inspection included preparation of a list of the completed airworthiness directives and service bulletins, together with an update of the airframe and engine operating hours. The prescribed post-inspection test flight took place on 25 April 2006. The Airworthiness

Review Certificate was issued on 01 April 2006 as Certificate No. 20/2006 by an authorised signatory of an EASA-145 approved maintenance organisation.

The aircraft continuing airworthiness records stated that new fuel supply hoses were fitted on 13 April 2005. The fuel hose service life was given as five years. The aircraft inspection report for 14 April 2005 recorded that replacement fuel hoses were fitted by the aircraft owner. The fitted hoses were checked and certified by certifying staff who countersigned the aircraft inspection report dated 14 April 2005.

The maintenance records and witness statements confirmed that the pilot who died following the accident undertook a large proportion of the aircraft maintenance.

When the engine was disassembled for examination, investigators identified fuel hoses 63 cm, 45 cm and 30 cm in length. Because of fire, markings on the identifying tags were unreadable. Supplier records for January and March 2005 state that hoses of different lengths were delivered. It was not possible to associate the lengths of the hoses supplied, with those found in the wreck. The delivery note records hoses of 66 cm, 50 cm and 32 cm in length.

## 1.7 Meteorological Information

The Hamburg bureau of the German Meteorological Service (DWD) reported that the weather conditions at the time of the accident met the CAVOK (Ceiling and Visibility are OK) requirements of VFR. The wind came from 160° at 10 knots. The temperature was 26 °C and the air pressure (QNH) was given as 1,026 hPa.

At 0820 hrs the seaplane base pre-flight preparation documentation record stated:

Wind: 130°/ 7 kt

Clouds: ok

Visibility: ok

Temperature: 21°C

QNH: 1,026 hPa

According to the weather report, high tide was to be at 0950 hrs in Hamburg Harbour and low tide at 1643 hrs on the day in question.

## 1.8 Aids to Navigation

Not relevant.

## 1.9 Communications

The aircraft had radio communication with the Hamburg-Norderelbe water aerodrome. After lifting off, the pilot gave a departure message on this frequency.

The pilot advised Hamburg Tower air traffic control at 1036 hrs that the seaplane was airborne. The last radio transmission from the seaplane was recorded about 20 seconds later, but was unintelligible.

After this last transmission the air traffic controller made a number of attempts to re-establish radio contact with the seaplane. When this failed, he contacted another pilot by radio, asking him to look out for the seaplane. This pilot spotted aircraft wreckage on the railway tracks of the freight yard and advised the air traffic controller accordingly at 1041 hrs. The air traffic controller then immediately alarmed the rescue services.

## 1.10 Aerodrome Information

The Water Aerodrome Hamburg Norderelbe was temporarily approved by the *Freie und Hansestadt Hamburg, Behörde für Wirtschaft und Arbeit, Amt Wirtschaft, Luftverkehr und Schifffahrt* (Department of Employment and Labour, Air and Maritime Transport, Free Hanseatic City of Hamburg) on 23 June 2005 for the period to 31 December 2010.

The operator was the applicant, operator and user of the water aerodrome.

The approval determined the location of the water aerodrome and its associated circuit, among other things, as follows:

- *Hamburg Norderelbe, between channel markers 620.5 and 622.0 including the water surface up to half the length of the Baakenhafens harbour, measured from the entry point to the harbour basin.*
- *Following take-off in an easterly direction, shortly after lifting off the seaplane should commence a turn towards the south and then continue a 270° turn in a clockwise direction. South of the water aerodrome and north of the Wilhelmsburg residential district, the circuit pattern should follow the railway tracks of*

*the South Harbour freight yard. While in the circuit pattern, the seaplane should not overfly the northern bank of the Veddelkanal (Niedernfelder shore).*

There were further noise restriction limitations given. The approval dated 29 August 2005 gave detailed guidance on the avoidance of environmental problems and balanced reasons for the decision.

Pages 14 to 21 of the original approval dated 20 August 2001 set out an evaluation of the effects of aircraft noise and balancing the interests of various parties.

The approval made the following observations with respect to flight safety:

[...]

#### *3.2.4 Suitability of the area and flight safety*

*The area is suitable for seaplane operation within the scope of the applicable regulation (Federal Aviation Act Section 6 Para. 2, Clause 2 LuftVG). The presented hydrological expert opinion describes the swell conditions in the water aerodrome area. The expert opinion does not identify any feature or condition that raises any fundamental obstacle to seaplane operation. Any other conclusion would be in direct contradiction with the fact that the applicant can point to several years of accident-free seaplane operations at this location.*

*A limitation contained in the approval ensures that the applicant will make a continued assessment of the water surface conditions with respect to the continuance of safe take-off and landing, and if necessary forbid take-off or landing. The requirement to make a pre-landing radio call will ensure that a pilot approaching to land can be advised if landing is refused, and can then select an alternative emergency landing area.*

*The banks of the Norderelbe have numerous obstacles that project 1:5 towards the clear manoeuvring zone. However, the applicant's pilots have detailed knowledge of the vicinity going back many years. During this period, flight operations continued without incident. The water aerodrome is subject to operational regulations that are imposed on all pilots by the applicant, ensuring that no pilot operates from the area unless and until he or she is familiar with all local requirements and limitations.*

[...]

The authorised approach and departure routes were recorded on a chart and appended to the approval as an appendix.

The water aerodrome operator had installed a passenger departure and arrivals pier in the recreational city yachting harbour zone *am Baumwall*.



Picture 4: City-Sportboothafen seaplane docking ponton

Photo: BFU

## 1.11 Flight Recorders

A Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) were not part of the required aircraft equipment, and were not installed.

After take-off the seaplane remained below the minimum detection altitude of air traffic control, and was not detected.

## 1.12 Wreckage and Impact Information

The accident site was on the railway tracks of the Hamburg-South Harbour freight railway yard.

The point at which the seaplane first made contact with the ground was indicated by glass fragments from the seaplane navigation lights and sheet metal shards from the right wing found on a railway track. Both seaplane floats were ripped away from the fuselage and came to rest on a goods wagon standing on a parallel railway track. The main wreckage consisted of the fuselage, motor, tailplane and both wings, and came to rest in the direction of flight on yet another parallel railway track. The main wreckage was inverted.

The seaplane control surfaces were all found and linked by cables to the control horn.

Because of the high level of airframe destruction and the effects of fire, it was not possible to determine the pre-crash positions for the wing flaps and elevator trim. The motor and aggregates found in the main wreck were damaged by impact and fire. It was not possible to determine the position of the fuel tank selector.

One blade tip on the three-blade propeller was shortened and the rest of that blade was bent slightly rearwards. The other propeller blades bore no unusual traces of deformation.





Picture 5: Accident site on the railway goods marshalling yard

Photo: BFU

The wreckage pattern indicated that the aircraft had been flying on a track of  $100^\circ$  immediately prior to impact. Witness statements and the wreckage pattern agreed that the right wingtip made first contact with the railway track; the aircraft attitude was then about  $10^\circ$  nose down and about  $45^\circ$  right wing down.



Picture 6: Impact points and wreck distribution

Photo: BFU

### 1.12.1 Examination of the Engine

In the presence of a BFU investigator, the R-985-AN14B Pratt & Whitney Wasp Junior engine was subsequently disassembled for inspection by a specialist piston engine maintenance organisation approved by the European Aviation Safety Agency (EASA).

Inspection resulted in the following findings:

- With the exception of the spark plugs in cylinder No. 1, all spark plug electrodes were light in colour and free of oil residues.
- With the exception of cylinder No. 1, all the inlet valves and piston crowns were of light colour, undamaged and with partly light red discolouration. The cylinder walls of cylinder No. 1 had distinctive oil residues.
- All outlet valves showed either a light or white condition.

- The oil and oil filter were clean and free of metal particles. The by-pass was normal.
- The oil sump magnetic drain plug was free of metal particles.
- The carburettor was damaged by the impact and fire. The carburettor blower moved freely and was without any visible defects.
- The engine valve cover could be opened and revealed no damage. The valve mechanism was normal and operated as expected when turning the propeller.
- The tappet clearance was normal on all cylinders.
- After opening to reveal the moving parts, the control horn and cam disc operation were found to be normal.
- Water originating from fire fighting was found in the oil around cylinder No. 3. A crack in the broken cylinder No. 4 was identified as the cause for the presence of the water.
- The carburettor was damaged by fire and partly missing. The carburettor float and float needle were undamaged and still in working condition.
- The engine magnetos were destroyed by fire. The two magneto drives were still recognisable and otherwise normal.
- The fuel selector was mechanically deformed, but still allowed for the passage of fuel.
- The fuel pump was partly destroyed by fire on the pressure side. During recovery of the motor, the pump drive was detached by rotation of the propeller. On disassembly of the fuel pump, the investigators found clear traces of the effects of fire. Functional components within the pump moved only with difficulty.
- The fuel hose and pipe connector elbow fittings were partly damaged by fire. All the recovered connector fittings were of aluminium.
- The screw-connector elbow fitting between the fuel hose and carburettor was not found.
- Two fuel hoses were identified: a long fuel hose acting as a link between the fuel pump and fuel tank selector; and a short fuel hose acting as a link between the fuel pump and carburettor.

## 1.13 Medical and Pathological Information

A pathologist's report said the pilot did not suffer from any medical condition that would affect his capacity to control the aeroplane.

## 1.14 Fire

Inspection of the wreck at the accident site showed that fire had broken out in the vicinity of the fuselage tank, which then spread through the passenger cabin. The cockpit with controls and almost the entire fuselage, were destroyed. The wings and empennage were damaged by the fire.

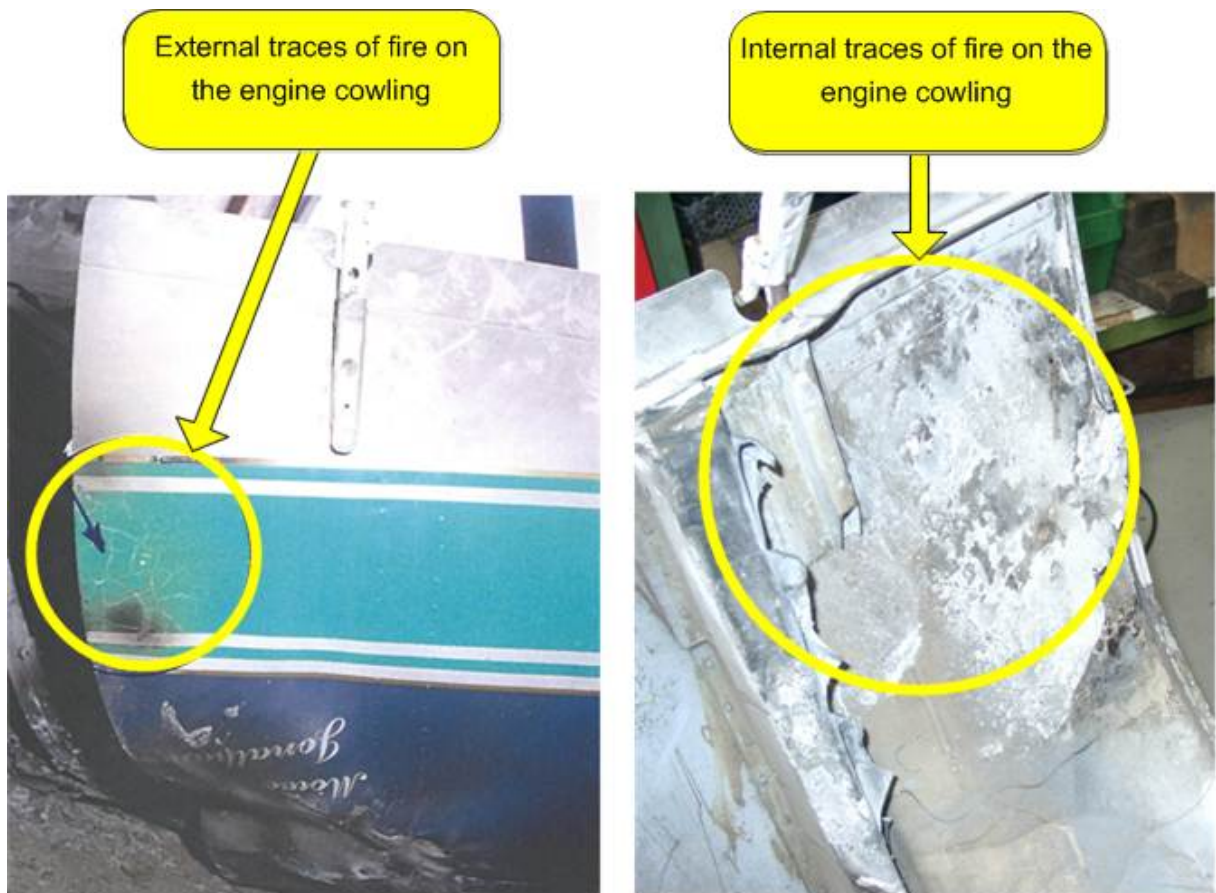
Another fire broke out around the fuel supply to the engine. Traces of fire were found on the engine cowling; these were more widespread on the cowling interior than on the external surfaces.

The left outer surface of the engine cowling showed a number of heat-induced changes, but there was no obvious link to other fire damage. The engine cowling right outer surface bore virtually no evidence of heat-induced changes.

While investigating the traces of fire in the wreck on-site, the two engine cowlings were offered up to the inverted engine on the ground. This revealed burn marks on the left side of the lower engine cowling that were clearly different from those found on the upper cowling. The burn marks on the lower cowling could be explained by escaping fuel on impact and the wind direction at that time, but the marks left on the upper cowling did not match the thermal damage of escaping fuel.

An aluminium baffle plate located between the exhaust pipe support ring and the engine cowling had melted. The carburettor and fuel pump were located behind the baffle plate. These components had areas more than 10 mm thick that had melted away. The carburettor housing had melted away. The carburettor float was exposed.

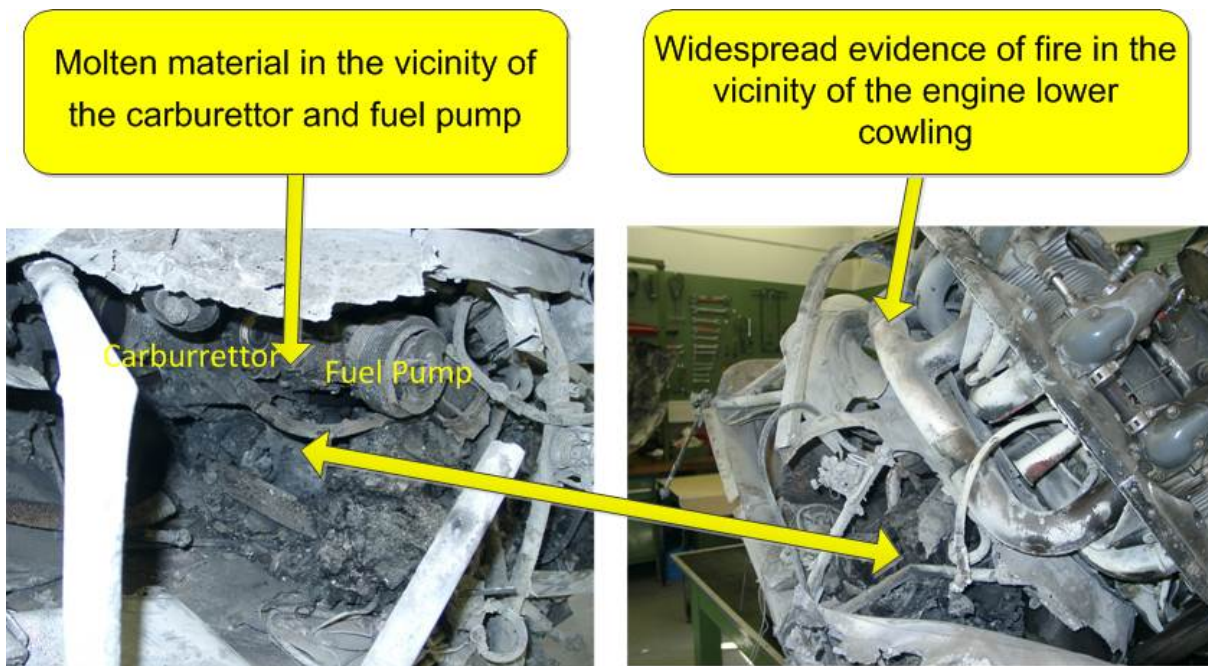
A carburettor inlet filter with stalactite-like aluminium occlusions was identified at the accident site.



Picture 7 and 8: Traces of fire on the engine cowling

Photos: BFU

On-site inspection of the fire damage to the engine cowling indicated that fire broke out in the vicinity of the carburettor and then spread via the baffle plate to the upper left side of the engine cowling.



Picture 9 and 10: Evidence of fire in the vicinity of the engine fuel pump

Photos: BFU

## 1.15 Survival Aspects

Witnesses stated that the pilot and a passenger had escaped from the wreck. Both suffered from serious burns and moved unaided over the railway tracks in an easterly direction, where they subsequently received first aid treatment from ambulance crews and rescue services.

The pilot was transported to the intensive care unit of specialist burns clinic, where he died the next day from his injuries.

The surviving badly injured passenger, who had occupied a seat on the pilot's right, was treated in a special clinic for several months. He was later discharged but with permanent long-term disabilities.

The four occupants of the centre and rearmost seating rows were unable to escape from the aircraft wreck. They died, seated in the aircraft.

## 1.16 Tests and Research

No tests or research were conducted for this investigation.

## 1.17 Organizational and Management Information

The operator provided commercial seaplane pleasure flights with take-off and landing from Hamburg Harbour. These pleasure flights over the City of Hamburg were operated using a DHC 2 Beaver for up to seven passengers per trip. The usual dock-to-dock duration of the trip was given as about 30 minutes.

### 1.17.1 Approval of the Operator

The aircraft was operated by an operator approved by the Department of Employment and Labour, Air and Maritime Transport, Free Hanseatic City of Hamburg (*Freie und Hansestadt Hamburg, Behörde für Wirtschaft und Arbeit, Amt für Wirtschaft, Luftverkehr und Schifffahrt*), in accordance with the Federal Aviation Act (*Section 20 Paras 1 Nr. 1 and 4 of the Luftverkehrsgesetz -- LuftVG*) and in conjunction with the Regulation on Certification and Licensing in Aviation (*Section 61 of the Luftverkehrszulassungsordnung -- LuftVZO*) (Appendix 3).

The approval was for the non-scheduled transport under Visual Flight Rules for hire or reward of persons and goods in aircraft with a maximum weight of 5,700 kg. This approval was due to expire on 31 May 2008.

The pilot who died in the accident had operated seaplane pleasure flights from Hamburg Harbour since 1993. Initially, he operated under a series of individual approvals. From 1994 onwards, operations continued under a series of time-limited approvals that were regularly renewed in accordance with the Federal Aviation Act (*Section 25 Para.1 LuftVG*) (Appendix 3). In 2001 the operator was accorded formal permission to operate the water aerodrome in accordance with the Federal Aviation Act (*Section 6 Para .1 LuftVG*).

An appendix to the Operator Certificate named the fatally injured pilot as 'Post-holder Operations' (FBL), 'Post-holder Maintenance' (TBL) and as pilot for the seaplane in use.

From time to time the operator used a second aircraft – a Piper PA12 – for banner towing for advertising purposes.

The two aircraft were operated under the maintenance regime of an EASA-145 maintenance organisation, with which the operator had a contract.

## 1.18 Additional Information

### 1.18.1 Check Lists in Aircraft Handbook

The aircraft manufacturer's Flight Manual has check lists and safety information. Regarding emergencies at low height after take-off the following entries are relevant:

#### ENGINE FAILURE AFTER TAKE-OFF

- a) *Lower nose immediately, to maintain airspeed at 65 mph.*
- b) *Mixture lever – IDLE CUT-Off.*
- c) *Propeller lever to DECREASE RPM position.*
- d) *Fuel an oil emergency shut –off – pull sharply CLOSED.*
- e) *Ignition – OFF.*
- f) *Battery master switch – OFF.*
- g) *Fuel selector – OFF.*
- h) *Warn passengers to brace feet against supports und protect their heads by placing an arm across forehead, gripping fuselage structure with the same hand.*
- j) *KEEP STRAIGHT AHEAD AND CHANGE DIRECTION ONLY ENOUGH TO MISS OBSTACLES. USE RUDDER ONLY.*

#### CAUTION

*Always maintain enough airspeed to assure full control of aircraft to point to touchdown. Coarse use of ailerons near the stall airspeed precipitates wing dropping.*



### CAUTION

*It is better to ride an aircraft with a dead engine safely to a crash landing straight ahead, than to turn back to the field. Attempts to turn back have, in many instances, ended with an uncontrolled roll or spin into the ground.*

### ENGINE FAILURE ABOVE 800 FT. AFTER TAKE-OFF

- a) *Depress nose to gliding attitude.*
- b) *Flaps to CRUISE.*
- c) *Propeller lever to full DECREASE RPM position.*
- d) *Maintain airspeed of 95 mph LAS (glide gradient is 11 % rate of descent 890 ft. per minute).*
- e) *Decide whether to crash land straight ahead or complete the circuit and attempt to land on the airfield.*
- f) *Proceed as described in DEAD ENGINE LANDING:*

### DEAD ENGINE LANDING

- a) *Maintain air speed of 95 mph LAS. Flaps at CRUISE for maximum glide distance.*
- b) *Propeller lever – COARSE PITCH.*
- c) *Mixture lever – IDLE CUT – OFF:*
- d) *Throttle lever – CLOSED.*
- e) *Ignition switch – OFF.*
- f) *Order occupants to brace themselves.*
- g) *Flaps to LANDING and maintain final approach speed of 65 – 68 mph.*
- h) *Touch down slightly tail first, as nearly into the wind as circumstances permit.*
- j) *Leave aircraft immediately it has stopped moving.*

### IN CASE THE AIRCRAFT NOSES OVER

- a) *Discharge fire extinguisher as soon as turn-over movement begins.*
- b) *Warn passengers to wait to be released from their safety belts.*
- c) *Leave aircraft as soon as circumstances permit.*

### 1.18.2 Operations Manual JAR-OPS 1 (German)

Chapter 7, page 21 of the Operator's Operations Manual JAR-OPS 1 (German) set out the actions to be taken in emergencies.

[...]

#### 7. Emergency Procedures

1. *In the event of an emergency, the PIC must follow the instructions given in the DHC-2 Emergency-Checklist.*
2. *After transmitting a Mayday call to ATC, the company should be advised of the nature of the emergency on the company frequency of 130.65, and action to be agreed.*
3. *In the event of a total engine failure, the seaplane is to land on the most convenient clear expanse of water within the area of the harbour.*

#### 8. Contingency Procedure

1. *Should the water aerodrome be closed for an extended period or be temporarily unsuitable for landing (e.g. recovery of sunken vessel, unforeseen dredging operations due to harbour operating reasons the seaplane is to land in the area of Entenwerder.*
2. *In such an eventuality, the company operations manager is to be advised on the company frequency and arrangements made as necessary.*

[...]

### 1.19 Useful or Effective Investigation Techniques

No use was made of special investigation techniques.

## 2. Analysis

This non-scheduled local sightseeing flight over Hamburg Harbour and the City of Hamburg was a commercial operation conducted by an operator in accordance with JAR-OPS 1 (German) regulations (now, EU-OPS). The regulations defined the safety standard that was required for the conduct of a flight with passengers.

At the focal point of the investigation was the question as to whether and why the pilot had to initiate an emergency landing in a single-engined seaplane a few moments after take-off. In this context, an assessment was made of the suitability of the departure route from the water aerodrome in the event of reduced engine power or a total engine failure. The conclusions from this evaluation took into account the pilot's decisions and the safety procedures envisaged.

During the course of this investigation it became clear that the emergency sequence was highly dynamic.

### 2.1 History of the Flight

#### 2.1.1 Operational Aspects

The first pleasure flight of the day commenced at 0945 hrs and lasted about 30 minutes; it was a routine flight and without any problem. Likewise, preparations for the second flight and undocking from the seaplane pier bore no indication of any problems or unusual factors. In the view of the BFU, the witness observation that the pilot had pulled the propeller through by hand prior to starting the engine is no indication that there was any technical problem with the engine. The start-up procedure using the electric starter motor was completely normal.

The pilot's choice of take-off direction on the Norderelbe was commensurate with the wind direction and the operating approval issued for the water aerodrome. The take-off and initial climb subsequently described by witnesses and photos taken at the time were completely routine.

The first indication of a problem with the engine occurred after the initial climb and initiation of a right turn, when several witnesses noted an interruption in the engine sound. Based on witness statements and the seaplane performance figures, the BFU holds the view that at this time the seaplane altitude was no more than 400 ft. The

immediate commencement of a left turn and transition to glide descent was a result of pilot action. Evidently, the pilot had recognised that at this phase of the flight his only option was an immediate emergency landing.

Given that at this moment there was a drop in fuel inlet manifold pressure, followed by a fire in the motor compartment and engine failure, his decision to descend for an immediate landing was logical.

When the engine stopped overhead the Veddeler Damm road, the seaplane was at a height and in a phase of flight from which the pilot could not reach any suitable emergency landing area. In the view of the BFU, the pilot could not have effected an emergency landing on the Veddeler Damm road, because it could only have been reached by initiating an immediate steep turn to the left. Such a manoeuvre would have risked stalling the aircraft. The Veddelkanal waterway was obstructed by bridges and therefore unsuitable for an emergency landing, and the Spreehafen waterway was too far away.

In the view of the BFU, the pilot had no alternative than to attempt a landing on the railway tracks of the freight yard, even though it was most unsuited to the purpose. In spite of the fact that the pilot had huge flying experience and was intimately familiar with the seaplane's performance, it was not possible for him to effect a safe landing without engine power.

Even though in this situation, the pilot had no alternative than to attempt a landing on the tracks of the freight yard, it was virtually impossible to effect a safe landing without encountering surface obstructions.

### 2.1.2 Technical Aspects

The results of the technical examination of the propeller, engine and individual engine components, confirmed witness statements that they had detected an interruption of engine operation.

### 2.1.2.1 Propeller

The propeller was deformed on impact with the ground. The propeller blade deformation patterns indicated that at this moment the propeller had either stopped or was turning very slowly.

The tip of one propeller blade broke off on contact with a rail track; the damage pattern on this blade indicated that the break was almost entirely due to forward motion. The propeller blade bore no trace of rotary motion. Deformation found on a second propeller blade only bore indication of aircraft forward motion. Since the third propeller blade bore no trace of rotary motion, the inference can be drawn that, at the moment of impact, the engine was delivering either no power at all or only very little power.

**Finding:**

Propeller blade bent rearwards; propeller tip broken off; little deformation due to rotary motion.

**Evaluation:**

None or little rotary propeller motion on impact.

Detached propeller tip found embedded in track bed



**Finding:**

Propeller blade slightly bent; no deformation arising from rotary motion

**Evaluation:**

None or little rotary propeller blade motion on impact

**Finding:**

Propeller blade slightly bent, no deformation arising from rotary motion

**Evaluation:**

None or little rotary propeller blade motion on impact

Picture 11: Evaluation of damage to propeller blades

Photo: BFU

### 2.1.2.2 Engine

Given the extent of damage arising from fire and impact, after the accident it was not possible to establish whether the nine-cylinder radial Pratt & Whitney Wasp Junior R-985-AN14B had been capable of delivering full power.

Post-crash investigation did not reveal any mechanical reason why the engine should have failed to deliver full power in flight. Given the extent of damage from fire and impact, as far as could be ascertained the motor had been well maintained and was in good general condition. This was indicated in particular by the condition of the oil, spark plugs, combustion chambers, piston rings and valve mechanisms.

The inference that the motor ceased to operate in flight as a result of an interruption in fuel flow was supported by the presence of light-coloured to white surfaces in the engine combustion chambers.

The pilot's post-crash statement to first-aiders that he had observed a 'loss in pressure' is interpreted by the BFU as a loss of pressure in the fuel system (Appendix 2) and hence fuel inlet manifold pressure.

### 2.1.2.3 Fire Traces

When examining the causes of fire on-site, investigators identified two points at which fire had broken out due to different causes.

In the vicinity of the fuselage and the adjacent cockpit, the fire was caused by impact with the railway track. The seaplane tanks in this area were full of fuel and burst upon impact. A spark ignited a fire on impact, which then spread with emerging fuel and the effects of wind.

The other fire originated in the fuel supply to the engine and was not associated with the impact fire. The burn marks in the vicinity of the fuel pump and carburettor indicated that the fire spread first under the engine cowling, then outside via the baffle plate. The burn marks can be explained by the fact that there was a mass escape of fuel in the vicinity of the fuel supply that continued to feed the fire under the engine cowling. As seen by the BFU, the fact that aluminium components – which have a melting point of 652°C – broke up, and that parts of the carburettor housing which in part is more than 10 mm thick, were destroyed by fire, is explained by the presence of a major fuel leak in the vicinity of the fuel supply. The burn marks point to an area

between the fuel pump and carburettor. It is suspected that the pump continued to expel fuel through the leak for some time while still in flight.

The burn marks found on the engine lower cowling can be ascribed to the fuel that escaped on impact.

The BFU view is that fire broke out while in flight in a location between the fuel pump and carburettor.

The verifiable reason for the massive leak in the fuels system could not be determined due to the damage caused by the fire. The BFU holds the view that there are two possible scenarios.

#### Scenario 1:

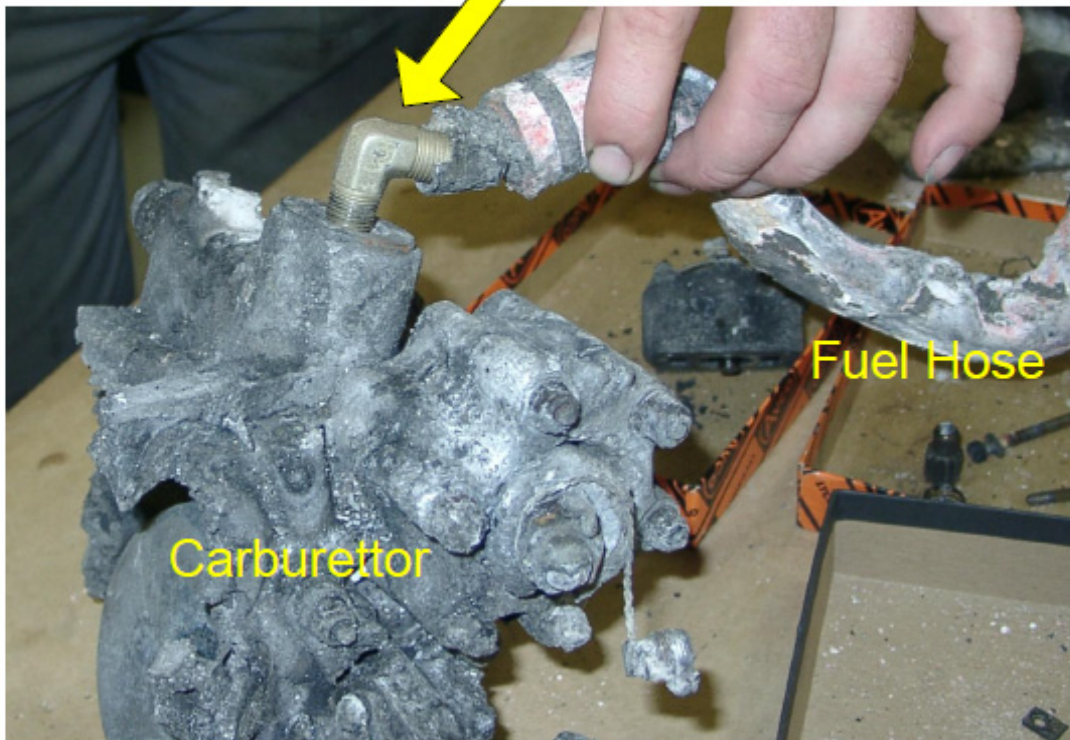
The fuel supply hose became detached from the elbow link fitting to the carburettor, because the hose was too short. In support of this proposition, the fuel hose found in the wreck was a few centimetres shorter than that specified by the aircraft manufacturer. However, this cannot be proved beyond reasonable doubt because the hose was damaged and it was not possible to ascertain the actual length with certainty.

#### Scenario 2:

The fuel leak originated at or in the elbow link fitting between the fuel hose and carburettor. This might have been due to a material failure or the application of excessive torque during installation. In the opinion of an approved engine maintenance organisation, both possibilities are plausible. It was not possible to prove this proposition one way or the other, because the elbow link fitting was not found in the wreck. It was made of aluminium and probably melted in the fire.



Elbow link fitting between fuel hose and carburettor;  
connector in the photograph is a spare part



Picture 12: Reconstruction arrangement of the fuel hose to carburettor

Source: BFU

## 2.2 Specific Conditions

### 2.2.1 Crew

The pilot was licensed for the flight and properly qualified. Although it was not possible to determine the pilot's total flying experience, the BFU holds the view that he had a flying experience of several thousand hours, including more than 1,000 hours in the DHC-2 Beaver, and was therefore very highly qualified in terms of flight experience.

He was so familiar with the DHC-2 Beaver, that he was able to deal competently with the most challenging flight handling problem.

In the view of the BFU, in the emergency situation in which he found himself, it was not possible for the pilot to effect a safe landing.

### 2.2.2 Human Performance

For the pilot, the planned local area pleasure flight was completely routine. There was no time pressure; the passengers had checked in on time and the seaplane dispatch procedure was concluded by the dock personnel with no unusual occurrences.

Not only was the pilot highly experienced in terms of flying hours, he was also a highly enthusiastic proponent of seaplane operations and aerial banner towing. In addition to his role as pilot, he was also the business manager for the operator and made great efforts to ensure that customers and passengers had an enjoyable experience that would contribute towards the company's success.

He showed enthusiasm for and commitment to the seaplane. Based on his previous experience with the DHC-2 Beaver in Canada, he was convinced that this seaplane type was ideal in every respect for pleasure flights over Hamburg.

The investigation identified nothing which suggested that, on the day of the accident, the pilot might have been affected by any unusual problems.

The BFU view is that on the day of the accident the pilot was well prepared and believed that everything was in order for a successful pleasure flight. Prior to the flight, he was convinced that the seaplane was fully airworthy.

The pilot undertook a large part of the seaplane maintenance himself, and the possibility cannot be excluded that he partly over-estimated his own skills in this respect.

### 2.2.3 Special Features of the Seaplane and of Harbour Operations

With twin floats fitted, there were significant differences in flight performance between seaplanes and landplanes of the same type. This was primarily due to the high drag from the floats, which affected both the rate of climb after take-off and the sink rate on approach. These performance differences were well known to the pilot.

In addition, there were special aspects relating to the operation of seaplanes in Hamburg Harbour. The harbour area is associated with the River Elbe and in principal has plenty of areas suitable for seaplane operation, but many of these areas have bridges limiting seaplane operation or obstacles preventing access and use. Other factors to be considered were the presence of shipping and the tidal rise and fall of the river. The pilot had many years' experience of seaplane operations on the River Elbe, and the BFU holds the view that these limitations and unusual features did not present him with particular difficulties.

#### 2.2.4 Weather

The weather had no influence upon the accident. It was ideal, both from the point of view of flying conditions and to maximise the pleasure derived by passengers.

### 2.3 Safety Mechanisms

Safety mechanisms are measures employed to protect a system from the consequences of technical and/or human error. In this system, the human does not operate by himself but is an element in a complex socio-technical system.

In analysing this seaplane accident, the investigation also encompassed and evaluated the formal Approval given for the water aerodrome and the operator approval, with regard to the essential safety-relevant mechanisms.

#### 2.3.1 Approval and Operation of the Water Aerodrome

The legally required approval for the water aerodrome issued under the Federal Aviation Act included a number of legal requirements designed to ensure safe operation. These legal requirements were designed to create safety mechanisms that would prevent accidents. In addition, there were a number of aeronautical legal limitations designed to maintain order and safety, plus national and European environmental protection regulations.

With the partly abstract general descriptions of the Federal Aviation Act (*Luftverkehrsgesetz -- LuftVG*) and the Regulation on Certification and Licensing in Aviation (*Luftverkehrszulassungsordnung -- LuftVZO*) tangible individual safety procedures for the operation of the water aerodrome were to be generated.

The BFU is of the opinion that there were a number of factors of particular relevance for the water aerodrome:

The Hamburg Water Aerodrome had a number of features that diverged from those usually found on conventional airfields and other water aerodromes. Although in principle the take-off area on the River Elbe was suitable for seaplane operations, it was surrounded, however, by a densely built up city, industrial sites and harbour installations. In addition, there was considerable shipping traffic on the River Elbe.

The approval required the pilot to adhere to a predetermined departure route. In case of a take-off towards the east, he was required to commence a right turn shortly after take-off and follow a traffic pattern to the south and fly a 270° turn in a clockwise direction. This requirement was imposed as a noise abatement procedure.

In the context of flight safety, the particularities of seaplane operations, e.g. rate of climb and glide characteristics with floats, are of special importance.

From the technical point of view, the risk of engine failure was slight, but could not be excluded. The construction regulations define procedures, speeds and aircraft configuration for a glide descent following an engine failure, which must also be demonstrated.

In this specific situation, the requirements covered the possibility that the seaplane might suffer an engine failure after take-off from the Norderelbe followed by an emergency landing without power. Particularly in critical phases of the flight such as initial climb (little height, small speed reserve) the availability of an emergency landing zone in the immediate vicinity of the take-off area was important. In the case of a seaplane, the availability of water for an emergency landing should have been a priority. In addition, the floats in this particular seaplane did not have integral retractable gear for airfield use.

The Federal Aviation Act (Section 6 *Paras. 2, 3 LuftVG*) requires that the area used must both be suitable for manoeuvring aircraft without endangering public safety or order. The approval for the Hamburg Norderelbe Water Aerodrome dated 20 August 2001, as modified on 29 August 2005, took into account numerous factors relating to seaplane noise and shipping on the River Elbe, but not the question of flight safety in the event of an engine failure after take-off before reaching a minimum safety height. In particular, the approach and departure routes to and from the water aerodrome should have included provision of suitable areas for possible emergency landings and off-base landings.

If the departure route had been straight ahead after take-off, the seaplane would have been able to make an emergency landing. The only reason this departure route was not specified was the aircraft noise nuisance to residents.

### 2.3.2 Approval and Operation of the Operator

In addition to the flight safety requirements with respect to the position and layout of the water aerodrome, the operator was subject to a number of additional safety requirements.

The legal requirements for the operation of aircraft for commercial air transportation by an operator were set out in JAR-OPS 1 (German) (now EU-OPS). JAR-OPS 1 (German) 1.240 (a) (6) requires an operator of single-engined aircraft to ensure that suitable emergency landing areas are available. Investigation into this accident has shown that no safe emergency water landing area was available for the De Havilland DHC-2 Beaver seaplane on the prescribed departure route.

In addition, 1.240 (a) (2) of JAR-OPS 1 requires that the aircraft in use must be capable of maintaining the required minimum height.

In addition to other requirements, the Air Traffic Order (Section § 6 LuftVO) defines a minimum safe altitude to prevent unnecessary danger to persons and property in the event of an emergency landing. The Air Traffic Order says that above cities and densely populated areas, industrial zones, crowds, and areas where there has been an accident or catastrophe, the minimum safe altitude is 1,000 ft above the highest obstacle in a 600-metre circle.

When considering the minimum safe altitude in connection with an engine failure after take-off, the aircraft glide characteristics were of key importance. Following an engine failure at 1,000 ft the seaplane would have been able to glide a distance of about 2.6 km.

The climb performance following take-off is also of great importance. JAR-OPS 1 (German) required that the aircraft was capable of adhering to the circuit pattern or departure route set out in the Approval for the water aerodrome.

Within this investigation the BFU came to the conclusion that a seaplane equipped with 'straight' floats (floats with no integral retractable wheel landing gear) would only be able to make a safe emergency or precautionary landing on a suitable expanse of

water. An emergency landing in the built up city area or on harbour side terrain would result in an accident with possibly very serious consequences.

The emergency procedures described in Chapter 7 page 21 of the Operations Manual JAR-OPS 1 were plausible in principle and appropriate for the emergencies described therein. However, under the accident conditions described, these procedures were inadequate to deal with an engine failure after take-off. A landing at the closest available expanse of water was impossible.

Likewise, the emergency check lists in the aircraft handbook:

- *ENGINE FAILURE AFTER TAKE-OFF*
- *ENGINE FAILURE ABOVE 800 FT AFTER TAKE-OFF*
- *DEAD ENGINE LANDING*
- *IN CASE THE AIRCRAFT NOSES OVER*

did not cover the eventuality of an engine failure after take-off at low-level. Given the unavailability of an emergency landing area, the procedures were not, or only of limited applicability.

Using the Aircraft Continuing Airworthiness Records, the BFU was able to make formal confirmation that the aircraft was airworthy. The required test certificates were available for inspection; the maintenance regime was conducted in accordance with JAR-OPS 1 (German) within a commensurate maintenance programme under contract with a JAR 145 maintenance organisation.

It was not always possible to identify exactly who had completed each individual maintenance task. For example, it was not possible to determine with absolute certainty who had fitted the fuel hoses to the engine, or who might have made changes or repairs after the change in March 2005.

## 2.4 Organisational Aspects

The operator had two aircraft used for pleasure flights and banner towing, and was required to meet the requirements of JAR-OPS 1 (German). Within the context of JAR-OPS 1, a single person carried out all the responsible management and operational functions. The pilot who died from his injuries was the operations manager,

flight operations manager, post-holder maintenance, and quality system manager. There was no second or independent check or monitoring of adherence to flight standard operational procedures. In reality, there was no practical separation between nominally independent functions such as quality assurance.

Nevertheless, on the face of it, the operator met all the organisational requirements set out in JAR-OPS 1, with all the responsibilities set out in detail as described in JAR-OPS 1. Only the maintenance was conducted under a contract with a JAR 145 maintenance organisation, and thus separated from other functions within the operator.

During the investigation, the BFU gained the impression that although the JAR-OPS 1 operations manual existed on paper, it was in fact a paper cover without any tangible relevance to safe, everyday flight operations.

The BFU drew the conclusion that the requirements of JAR-OPS 1 (German) (now EU-OPS) are not sufficiently practical for implementation by small commercial operators. It was understandable that small companies are unable to implement or adhere to the requirements. Nor is the problem solved by the fact that the authorities issuing the relevant approvals, accept the fact that one and the same person carries out a number of different responsibilities and functions.

## 3. Conclusions

### 3.1 Findings

- The aircraft was correctly certificated for operations.
- The pilot was very experienced. He had a valid licence, and was properly qualified to conduct the local pleasure flight.
- There was no indication that the pilot suffered from any health problem or health limitation.
- The flight was a commercial operation conducted in accordance with the requirements of JAR-OPS 1 (German).

- Prior to engine start-up for the planned local area pleasure flight, there was no indication of any abnormality or faulty operation.
- After the seaplane took off and commenced the initial climb, there was a fire in the engine compartment and an engine failure at a height not exceeding 400 ft.
- The pilot made an emergency landing without power on the railway tracks of the nearby freight yard.
- During the emergency landing, the seaplane made contact with the rail tracks and waiting railway freight wagons.
- A fire broke out on impact.
- The pilot had no alternative than to attempt a landing on the railway tracks.
- The engine failure was confirmed by the post-crash condition of the propeller and examination of the engine.
- The engine failure and fire in the engine compartment were due to a fuel leak between the supply from the fuel pump and carburettor.
- Due to crash damage, it was not possible to determine the reason why the fuel supply was interrupted.
- The water aerodrome was approved for use by this seaplane. The approval specified a required departure route.
- The approval did not define a suitable emergency landing area in the event of an engine failure after take-off.
- The requirements of JAR-OPS 1 (German) require that when operating a single-engined aircraft, the operator must ensure there exist an area for an emergency landing within gliding distance.
- The operator's operations manual and the aircraft flight manual give check lists for use in the event of an engine failure and emergencies below 800 ft, but these were of only limited value because there was no surface area suitable for an emergency landing.



## 3.2 Causes

The accident took place during initial climb after the take-off and was due to the following immediate causes:

- Prior to reaching circuit height, there was an interruption of the fuel supply between the fuel pump and carburettor, followed by the outbreak of fire and engine failure.
- During this phase of the flight, there was no suitable area for an emergency landing within reach.

The following systematic causes also led to the accident:

- The departure route laid down in the approval for the water aerodrome did not take into account the need for a suitable landing area in the event of an aircraft emergency for the aircraft used and this particular flight phase.

## 4. Safety Recommendations

On 04 May 2007 the BFU issued the following Safety Recommendations:

Recommendation No.: 05/2007

Within the licensing procedure, the airfield licensing authority with responsibility for the water aerodrome on the Norderelbe section of the River Elbe should give due consideration to the possibility of an engine failure during the operation of single-engined aircraft. In this context, the licensing authority should ensure that a suitable area exists for a possible emergency landing.

Recommendation No.: 06/2007

The licensing authority with responsibility for the water aerodrome on the Norderelbe section of the River Elbe, should ensure that the only aircraft used in commercial operations are those whose performance enables adherence to the flight path defined in the water aerodrome approval. The licensing authority should further ensure and monitor implementation of the requirements of JAR-OPS 1(German), 1.240 (a) (2) and (6).

Braunschweig, Juli 2011

Bundesstelle für Flugunfalluntersuchung  
(Federal Bureau of Aircraft Accident Investigation)

Johann Reuss  
(Investigator in charge)

Assistance: Uwe Berndt

## 5. Appendices

Anlage 1: Aircraft dimensions

Anlage 2: Fuel tank system

Anlage 3: Extract from German National Aviation Regulations

Appendix 1

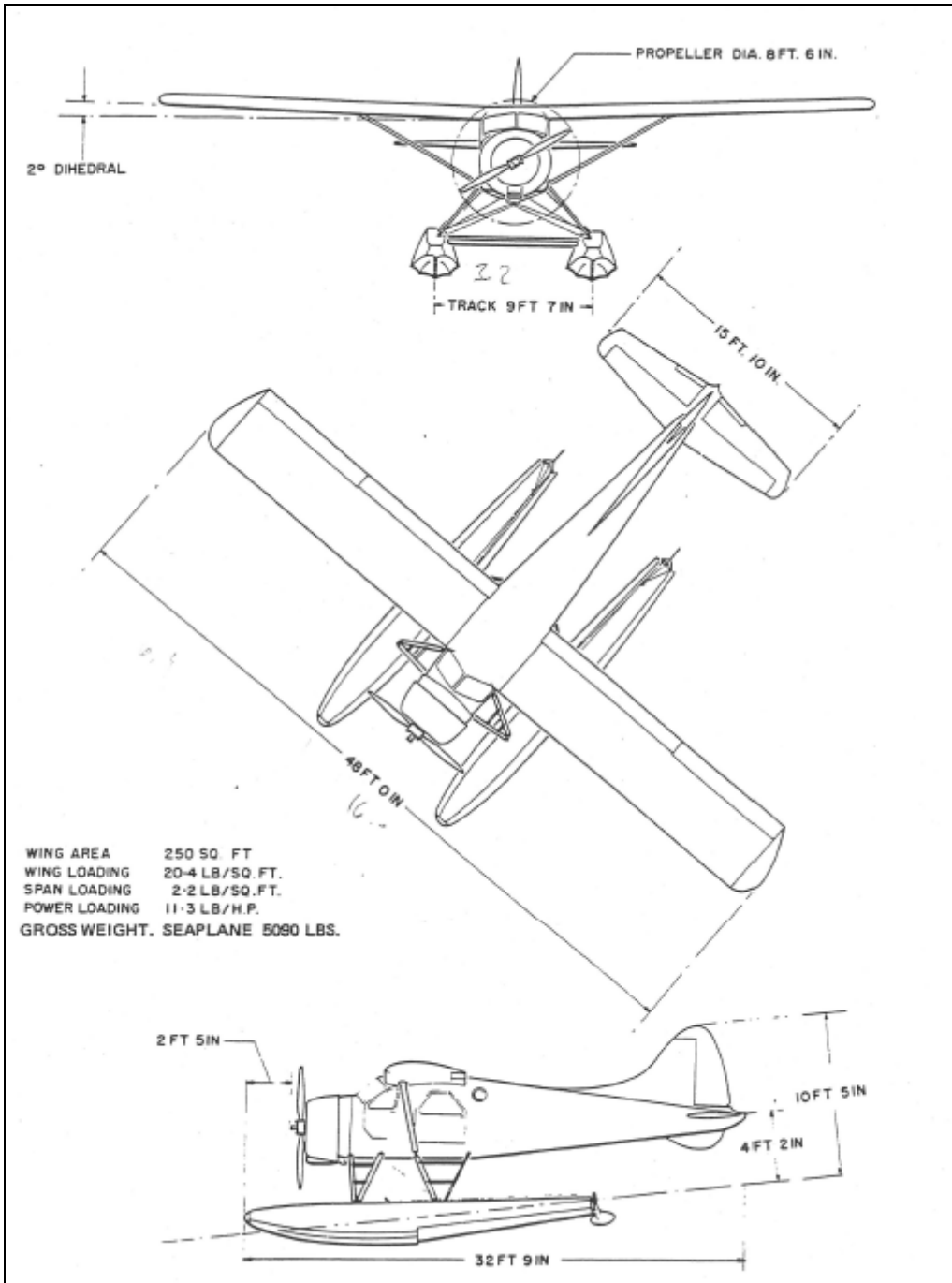


Diagram 1: Aircraft Dimensions

Source: Flight Manual

## Appendix 2

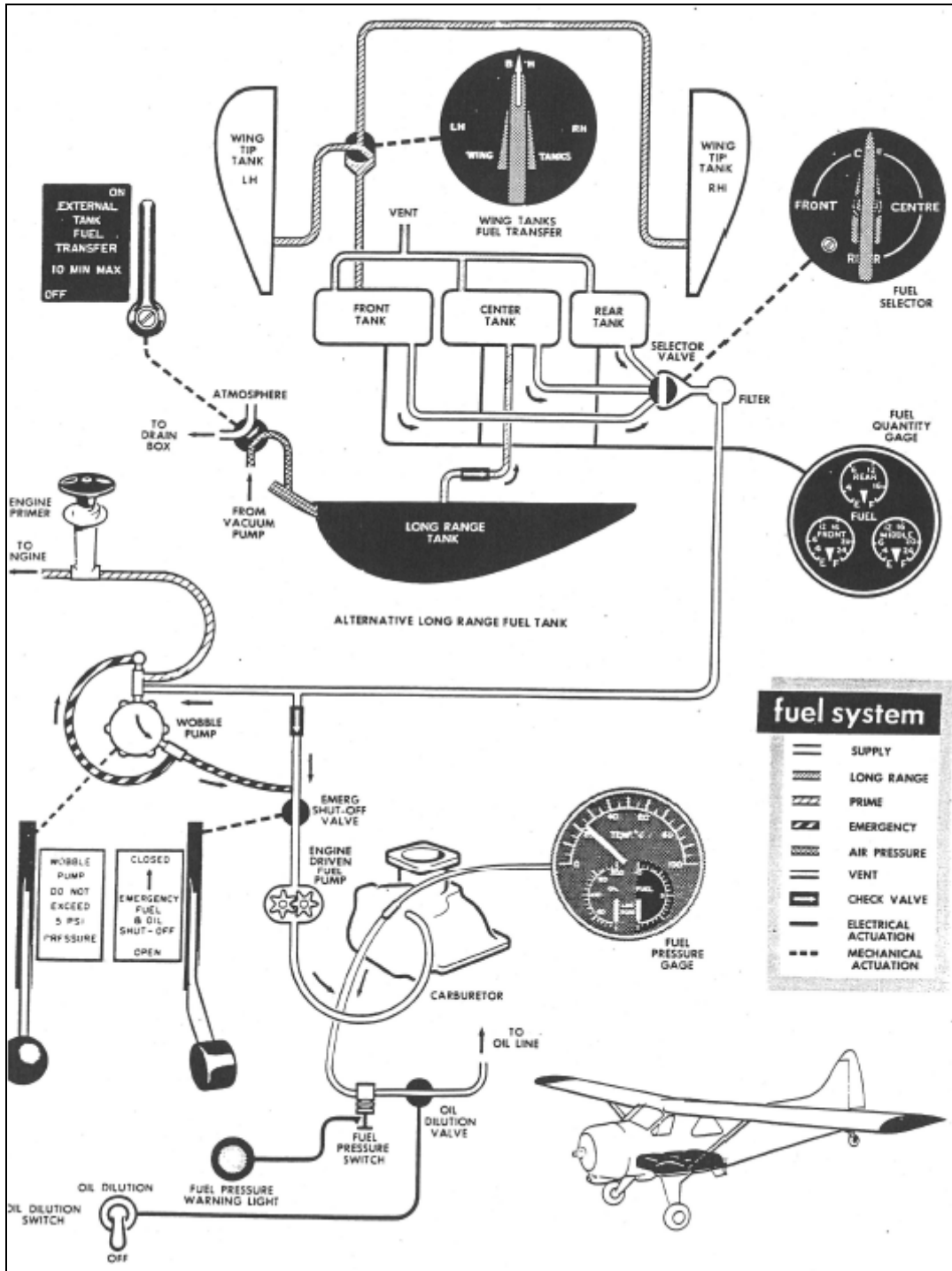


Diagram 2: Fuel system

Source: Flight Manual

## Appendix 3

### Extract from German National Aviation Regulations

The investigation report makes reference to the following German National Regulations:

#### **1. Federal Aviation Act *Luftverkehrsgesetz (LuftVG)***

##### **Section 6**

*(1) Airfields (airports, landing sites and sailplane launch sites) require approval prior to construction and operation. The approval process for landing sites, which are subject to planning approval, also requires assessment of the environmental acceptability. Section 15 subsection 1 sentence 2 of the Law on Evaluation of Environmental Acceptability stands unaffected. The approval can be subject to restrictions and may be time-limited.*

*(2) Prior to issue of an approval, special consideration must be given as to whether the measures proposed comply with the land use planning requirements; also whether the prerequisites for protection of fauna and flora, countryside conservation, urban development and protection from aircraft noise have been satisfied. Sections 4 and 5 of the Development Plan Law stand unaffected. If the proposed site is unsuitable or if there are other circumstances to justify the conclusion that the proposed site would be detrimental to public safety or order, the application for approval is to be refused. Should such facts subsequently come to light, the approval can be withdrawn.*

[...]

##### **Section 20 subsection 1 No.1**

*(1) A legal entity, a person or a trading company, require for*

*1. commercial local area flights in aircraft not operating a scheduled service between two different points,*

[...]

##### **Section 20 subsection 4**

*(4) Air Operators subject to European Community air law and who provide a commercial service for the transport of passengers, post or freight, require an Air Operator Certificate issued in accordance with Article 3 Para. 1 of Regulation (EC) No 1008/2008 of the European Parliament and of the Council of 24 September 2008 on common rules for the operation of air services in the Community (ABl. L 293 of 31 October 2008, page. 3). Paras 2 and 3 still apply, provided that they are not in*

*contradiction with the requirements of sentence 1 of the European Community regulation.*

### **Section 25 subsection 1**

*(1) Aircraft may only take off and land from sites outside an approved airfield if the landowner or the responsible official has agreed and the local Aviation Authority has granted permission. In the case of take-off and landing by unmotorised sport flying machine), authority to grant permission may be delegated to an individual authorised under the requirements of Section 31c; if the site is less than five kilometres from an airfield, the delegated individual must obtain authority to grant permission from the local Aviation Authority. In addition, aircraft on airfields may only take off or land:*

- 1. outside the runway denoted in the airfield approval*
- 2. outside the official airfield operating hours*
- 3. within the official airfield operating hours that are subject to other limitations, if the airfield operator has given permission and the local Aviation Authority has also given approval. Approvals issued under sentence 1, 2 or 3 can be granted on a general basis or for a single movement. Approvals may be issued with limitations including period of validity.*

*[...]*