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Bureau d'enquête sur les accidents d'aviation BEAA
Ufficio d'inchiesta sugli infortuni aeronautici UIIA
Uffizi d'inquisiziun per accidents d'aviatica UIAA
Aircraft accident investigation bureau AAIB

Final Report No. 1882 by the Aircraft Accident Investigation Bureau

concerning the accident

to the aircraft Piper Cheyenne PA-42, D-IFSH

Cirrus scheduled flight RUS 1050

on 28 October 2003

at Zurich Airport, LSZH

Subsequent to an examination process in accordance with article 23 of the decree, dated 23 November 1994, on the investigation of aircraft accidents and serious incidents (VFU; SR 748.126.3), the Federal Aircraft Accident Board (EFUK), based on article 24, paragraph 2 VFU, has declared the investigation report, dated 24 February 2006, of the Aircraft Accident Investigation Bureau, as final report. On request of the EFUK a minor formless change has been made in chapter 2.2.5.3.

Bundeshaus Nord, CH-3003 Berne

General information on this report

This report contains the AAIB's conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Annex 13 of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

The definitive version of this report is the original in the German language.

All times in this report, unless otherwise indicated, follow the coordinated universal time (UTC) format. At the time of the accident, Central European Time (CET) applied as local time (LT) in Switzerland. The relation between LT, CET and UTC is: LT = CET = UTC + 1 hour.

For reasons of protection of privacy, the masculine form is used in this report for all natural persons, regardless of their gender.

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Final Report

Owner	FSH Luftfahrtunternehmen GmbH
Operator	FSH Luftfahrtunternehmen GmbH
Aircraft type	Piper Cheyenne PA-42
Country of manufacture	USA
Country of registration	Germany
Registration	D-IFSH
Callsign	RUS 1050 (Cirrus)
Location	Zurich-Kloten Airport
Date and time	28 October 2003, 06:42:32 UTC

General

Brief description

At 05:25 UTC on 28 October 2003, the PIPER PA-42 aircraft, registration D-IFSH, of the FSH (Luftfahrtunternehmen, Schul- und Charter GmbH) airline, took off from Leipzig (D) airport, on behalf of Cirrus Aviation as scheduled flight RUS 1050 to Zurich (CH).

At 06:36:43 UTC, after a flight which had been uneventful up to this time, flight RUS 1050 received clearance for an instrument approach on runway 14. Confirmation by RUS 1050 took place immediately.

At 06:39:54 UTC, the Zurich Arrival Sector East air traffic controller handed over the aircraft to the tower controller and informed the crew of the current RVR values of 275 m at touch-down and midpoint.

At 06:41:03 UTC, flight RUS 1050 reported on the tower frequency and at 06:41:08 UTC was instructed to continue the landing approach.

At 06:41:47 UTC, flight RUS 1050 was granted landing clearance and at the same time the following RVR values were communicated: 275 m touchdown and 325 m runway midpoint. This communication was confirmed by the crew of flight RUS 1050 at 06:41:56 UTC with “roger 1050”.

At 06:41:58 UTC, the air traffic controller asked RUS 1050 for explicit confirmation of the landing clearance. As he did not receive one, at short intervals he asked the crew of RUS 1050 another three times for their position. He received no reply to these calls.

At 06:42:32 UTC, the aircraft touched down on the grass to the right of runway 14, parallel to the RVR-Lightrow, and after a roll-out, or rather a slide, came to a standstill some 90 m from to the centreline of runway 14 and some 1200 m after the threshold[1].

The aircraft was very badly damaged. The two pilots did not suffer any physical injuries during this accident. There were no passengers in the aircraft.

Investigation

Immediately after the accident, the duty service of the Aircraft Accident Investigation Bureau was notified. In cooperation with the airport authority at Zurich Airport, the Aircraft Accident Investigation Bureau opened an investigation at approximately 08:00 UTC.

The accident is attributable to the fact that during an ILS 14 approach the crew continued the approach below the decision height without having sufficient visual references. Therefore the aircraft touched down next to the runway 14.

The following factors contributed to the genesis of the accident:

- The aircraft was neither equipped nor approved for approaches under the existing weather conditions.
- The crew was not trained for approaches under the existing weather conditions.
- The crew's work distribution during the approach was inappropriate and did not comply with procedures.
- The crew were not acquainted with the procedures.
- The operator did not adequately check the crew’s knowledge of procedures.

[1] The runway threshold is located 170 m after the end of the runway (transition from terrain to concrete)

1 Factual information

Preliminary remark: Since the aircraft involved in the accident was not equipped with any flight recording equipment, the following information about the course of events had to be obtained from the radar recordings, ground-based communication recordings and from witness statements.

1.1 Pre-flight history and history of the flight

1.1.1 Pre-flight history

On 24.10.2003, aircraft D-IFSH made a ferry flight from Siegerland to Leipzig-Halle after a technical overhaul. No technical defects were detected by the pilots during this flight.

On 27.10.2003, the day before the accident, aircraft D-IFSH took off on the first flight of a one-week aviation contract for Cirrus Aviation. This flight was from Leipzig to Zurich and back. The flight was carried out by the same crew as the flight involved in the accident. After the landing in Zurich, according to the copilot's statement, the crew had difficulty in finding the stand assigned to them. According to the copilot's statement, the autopilot switched itself off during the approach to Zurich, as it had also done on the return flight to Leipzig. The reason for this disengagement is not known to the investigation.

On the day of the accident, aircraft D-IFSH took off on the second day of its mission as part of the above-mentioned aviation contract.

1.1.2 History of the flight

1.1.2.1 Flight preparation

Before the start of the planned rotation RUS 1050/51 Leipzig-Zurich-Leipzig, the pilots received the corresponding flight documentation. It included:

- estimated loading information (passengers, baggage and freight)
- flight data and times
- weather information from the German aviation weather service (Leipzig aviation weather service)

Of the paperwork on board the aircraft, the following data are on record:

Time and fuel analysis:

Trip	1:05 h	775 lbs
5%	0:03 h	39 lbs
Alt:	0:00 h	0 lbs
Hold:	1:00 h	560 lbs
min. T/O:	2:08 h	1374 lbs
Taxi:		85 lbs
min Ramp:		1459 lbs
act. Ramp		1500 lbs
Extra:	0:04 h	41 lbs

DOW:		7554 lbs	
Total Traffic Load:	+	424 lbs	
ZFW:	=	7978 lbs	max 9350 lbs
T/O-Fuel:	+	1415 lbs	
T/O Weight:	=	9393 lbs	max 11200 lbs
Trip Fuel:	-	775 lbs	
Ldg Weight:	=	8618 lbs	max 10330 lbs

1.1.2.2 History of flight RUS 1050, Leipzig-Zurich

The commander was pilot flying (PF) and the copilot was pilot non flying (PNF) and therefore, among other things, responsible for radio communication with air traffic control throughout the entire flight. However, it must be stated that during the approach, radio communication with the air traffic control officer (ATCO) was handled by the commander.

At 06:23:18 UTC, the crew of flight RUS 1050 made contact for the first time with the air traffic controller at radar lower sector north. After a flight path instruction direction RILAX and two altitude clearances to flight level 150 then 130, flight RUS 1050 was instructed at 06:28:02 UTC to make contact with Zurich arrival sector east. This contact took place at 06:28:50 UTC and at 06:28:55 UTC the air traffic controller informed the crew of RUS 1050 that they could expect a radar-guided approach on ILS runway 14. At 06:29:11 UTC, the air traffic controller asked whether the crew had received information “BRAVO”. After no reply had been received in this connection, the air traffic controller asked again at 06:29:19 UTC. At 06:29:27 UTC the crew of flight RUS 1050 confirmed that they were in possession of information “BRAVO” and at the same time confirmed the QNH of 1020 hPa. Among other things, information “BRAVO” included a met visibility of 1200 m with a trend towards 800 m.

At 06:29:30 UTC, the air traffic controller informed the crew of RUS 1050 that meteorological visibility was now 800 m with fog banks and that the RVR value was 350 m touchdown and 300 m midpoint. At 06:29:40 UTC, the crew of RUS 1050 confirmed this information with “roger, thank you”.

On the same frequency at 06:31:31 UTC, the information about the current RVR values of 400 m touchdown and 250 m midpoint runway 14 was given to a Boeing 767 flying ahead.

There followed a stepwise descent of the aircraft to 4000 ft QNH, several speed reductions and various heading instructions before the crew received clearance at 06:36:43 UTC for an ILS approach on runway 14, after a flight which had been uneventful until then. The confirmation from RUS 1050 came immediately.

Since flight RUS 1050, a PA-42, belonged to the light category and the Boeing 767 flying ahead of it belonged to the heavy category, a minimum longitudinal separation of 6 NM was prescribed. The ATCO took care of this separation.

On the same frequency at 06:37:04 UTC, a visibility report of 800 m with fog banks, vertical visibility of 300 ft and RVR values of 275 m touchdown and 250 m midpoint was issued, this time to an aircraft flying behind.

At 06:39:54 UTC, the Zurich arrival sector east air traffic controller handed over flight RUS 1050 to Zurich aerodrome control (tower) and informed it once again of the current touchdown and midpoint RVR values of 275 m. At 06:40:04 UTC, RUS 1050 handed off from Zurich arrival sector east.

On the tower frequency, at 06:40:27 UTC, a take-off clearance was issued with reference to an RVR value of 275 m midpoint runway 16.

At 06:41:03 UTC, the crew of RUS 1050 reported on the tower frequency. They received the instruction to continue their approach. At the same time they were given a warning about possible turbulence caused by a heavy aircraft (a Boeing B-767) flying in front.

At 06:41:47 UTC, RUS 1050 received the following landing clearance: "RUS 1050 wind 200 degrees, 2 knots, RVR touchdown 275 m, midpoint 325 m, runway 14 cleared to land".

The pilot of RUS 1050 acknowledged this radio conversation with: "roger 1050", to which the air traffic controller repeated "just to confirm, cleared to land on 14 RUS 1050". The crew of flight RUS 1050 did not respond to this second landing clearance.

There was no intervention from the ATCO. He stated that the crew made a reliable impression on him, on the basis of the radio conversations. He also stated: "As the aircraft was in a critical flight phase in the short final approach and I did not wish to burden the pilots further, I did not insist on a full readback."

At 06:43:47 UTC, the crew of RUS 1050 was called by the ATCO. Since he received no answer, at 06:43:58 UTC he repeated the call relating to the question of the aircraft's position. However, since the crew still did not answer, the ATCO called RUS 1050 again at 06:44:06 UTC. Once again, there was no answer.

Because the air traffic controller could not locate the aircraft either on the Holberg radar or on ground radar, he issued an alarm at 06:46:10 UTC and initiated a search action by the airport fire-fighting service. The airport's fire-fighting service searched for the aircraft along runway 14. The search was not initially successful because of dense fog and because the aircraft was some 55 m from the edge of the runway.

The aircraft had already touched down on the grass to the west of runway 14 at 06:42:32 UTC, parallel to the RVR-Lightrow. After a roll-out of approximately 400 m, the aircraft came to a standstill some 90 m west of the centreline of runway 14 and some 1200 m after the runway threshold.

The aircraft was very badly damaged. The two pilots did not suffer any physical injuries during this accident. There were no passengers in the aircraft.

The first traces of aircraft D-IFSH's landing were found at a distance of approximately 770 m after the runway threshold and approximately 60 m west of the runway centreline parallel to the RVR-Lightrow used to check the measured RVR values.

1.2 Injuries to persons

	Crew	Passengers	Third parties
Fatally injured	---	---	---
Seriously injured	---	---	---
Slightly injured or uninjured	2	---	

1.3 Damage to aircraft

The aircraft was so badly damaged that a repair was not taken in account for economical reasons.

1.4 Other damage

There was minor damage to the terrain. A small quantity of kerosene seeped into the ground as a result of damage to the tank on the right wing.

Several lamps of the RVR-Lightrow to the right of runway 14 were damaged and had to be replaced.

1.5 Personnel information

1.5.1 Commander

Person	German citizen, born 1973	
Crew times	Start of duty on 27.10.03:	04:15 UTC
	End of duty on 27.10.03:	09:15 UTC
	Flight duty time on 27.10.03:	2:55 h
	Rest time:	19 h
	Start of duty on the day of the accident:	04:15 UTC
	Flight duty time at the time of the accident:	1:20 h
Licence	Commercial pilot licence, issued by the Luftfahrt-Bundesamt (LBA) Germany. CPL (A), valid until 29.08.2005	
Ratings	Voice, navigation and aeronautical radio service rating for ground or air radio in English or German for flights under visual or instrument flight rules. PA 31/42: PIC valid until 26.08.2004 IR valid until 26.08.2004 SE piston (land): PIC valid until 03.01.2005 IR valid until 03.01.2004	
Last proficiency check	27.08.2003	
Last line check	27.08.2003	
Last medical examination	Commencement of validity 20.08.2003, classes 1 and 2, valid until 04.10.2004	

1.5.1.1 Flying experience

Total flying experience	1000 h
on powered aircraft	1000 h
as commander	255 h
on the accident type	900 h
during the last 90 days	80 h
on the previous day	04:00 h
on the day of the accident	01:20 h

1.5.1.2 Training

From 1998 to 1999 the commander completed training as a PPL/BZF on aircraft types PA 38, Catana, C150, C172 and C172-RG, with a total of 74 hours.

From 1999 to 2000 he additionally completed the theoretical training for CPL-IFR and AZF/night flying. In addition, he completed flying hours in Germany and America (112 hours in total).

According to examination certificates which were available to the investigator, the following results were obtained, amongst others:

11.06.1999: the “Theoretische Prüfung Berufsflugzeugführer 2. Klasse” was failed in the subjects of air navigation law, flying performance, loading and centre of gravity.

23.03.2000: the “Praktische Prüfung zum Erwerb der Instrumentenflugberechtigung” was failed, among other things, on point 3.1 “Compliance with prescribed approach sections including prescribed missed approach procedures (ILS approach)”.

10.04.2000: the repeat examination on 23.03.2000 was again failed on point 3.1.

11.06.2000: the “Grund- und Navigationsflugprüfung für den Erwerb der Erlaubnis für Berufsflugzeugführer 2. Klasse” was failed, among other things, on points 8.9 “Tracking with radio navigation equipment” and 8.10 “Determining position using radio navigation equipment”.

13.07.2000: the “Praktische Prüfung zum Erwerb der Instrumentenflugberechtigung” was failed, among other things, on point 7.3 “NDB, VOR or LLZ approach”.

During the years 2000/2001 the pilot acquired practice in the CPL-IFR area on various single-engined aircraft types and on the simulator (total: 119 hours).

In 2001, he completed transition to the PA-42 Cheyenne aircraft. In the same year, the commander was employed by the “Skyline” company as a first officer (FO). He completed 166 flying hours as FO.

From 2002 he was in possession of a multi-engine PTL and in the process completed a total of 284 flying hours by February 2003. From 2002 he worked, likewise as FO, for the company “Cirrus Aviation Luftfahrtgesellschaft“.

On 1.9.2003 the commander was employed in a full-time position with the FSH Luftfahrtunternehmen (aviation company).

According to the operations manager's statement, the commander passed an external crew resource management (CRM) course independent from the copilot.

1.5.1.3 Upgrading to commander

According to the operations manager’s statement, the commander participated in a two-week commander’s course within the aviation company. The syllabus of this course is described in the OM D. Documentation on implementation and results are not available.

The commander completed the proficiency check on 20.10.2003 with the operations manager of the aviation company as examiner, on a ferry flight to the hangar (0:50 hours). Documentary evidence exists concerning this check, providing information about which “exercises/procedures” were carried out and that the proficiency check was passed.

According to operation manager's statement, a commercial flight of 3:15 hours duration with 3 landings took place beforehand under his supervision.

According to the syllabus, among other things a minimum number of 10 flights under supervision was required. The aviation company was not able to provide relevant documentary evidence.

It is therefore not possible to make any qualitative statements on the commander's course and the corresponding training.

1.5.2 Copilot

Person	German citizen, born 1968	
Crew times	Start of duty on 27.10.03:	04:00 UTC
	End of duty on 27.10.03:	08:00 UTC
	Flight duty time on 27.10.03:	04 h
	Rest time:	20 h
	Start of duty on the day of the accident:	04:00 UTC
	Flight duty time at the time of the accident:	01:20 h
Licence	Commercial pilot licence, issued by the Luftfahrt-Bundesamt (LBA) Germany. CPL (A), valid until 22.08.2005	
Ratings	Voice, navigation and aeronautical radio service rating for ground or air radio in English or German for flights under visual or instrument flight rules. PA 31/42: PIC valid until 12.08.2004 IR valid until 12.08.2004 SE piston (land): PIC valid until 30.10.2004 IR valid until 30.10.2003	
Last proficiency check	13.08.2003	
Last line check	13.08.2003	
Last medical examination	Commencement of validity 20.08.2003, classes 1 and 2, valid until 04.10.2004	

1.5.2.1 Flying experience

Total flying experience	500 h
on powered aircraft	500 h
as commander	420 h
on the accident type	34 h
during the last 90 days	34 h
on the previous day	02:07 h
on the day of the accident	01:20 h

1.5.2.2 Training

The copilot began his pilot training in September 1999. After acquiring the PPL and some flying experience in South Africa, the copilot began his ATPL training in Germany.

In the years 2000/01 he completed the theory for the PPL and C VFR licences.

In 2002, he obtained the South Africa radiotelephony certificate and SA PPL validation, and in addition the ATPL Theory. Additionally, the CPL/IFR check flight and the CCC.

In November 2002 the copilot was taken on for a limited period by the FSH Luftfahrtunternehmen. In March 2003 the copilot obtained an unlimited contract as a freelance pilot with the same company. The copilot was not commercially active in any other aviation company. According to examination certificates, which were available to the investigation, the following results were obtained, amongst others:

10.09.2002: the *“Navigationsflugprüfung zum Erwerb der Erlaubnis für Verkehrsflugzeugführer in der durchgehenden Ausbildung”* was failed, among other things, on points 8.5 “Orientation including map reading”, 8.7 “Observation of weather conditions including analysis of development”, 9. “Approaches”, 12. “Radiotelephony including obtaining weather reports in flight” and 13. “Use of the checklist”.

10.09.2002: the “Praktische Prüfung zum Erwerb der Instrumentenflugberechtigung” was failed, among other things, on points 7.2 “Instrument approaches”, 7.3 “NDB, VOR or LLZ approach”, 10. “Radiotelephony” and 11. “Use of the checklist”.

In May 2003, he began training on the Cheyenne III at FSH (Schul- und Charter GmbH, Leipzig-Halle Airport), which he concluded successfully on 13 August 2003. In the same period he completed the theory examination for the PPL instructor’s licence. On 2 September 2003, he made his first commercial flight on the Piper Cheyenne PA-42. At the time of the accident, the copilot had 34 hours’ flying experience on the aircraft type.

According to the operations manager's statement, the copilot passed an external crew resource management (CRM) course independent from the commander.

1.6 Aircraft information

1.6.1 Aircraft D-IFSH

Type	Piper Cheyenne PA-42
Registration	D-IFSH
Manufacturer	Piper Aircraft Corporation, Vero Beach
Serial number	42-8001101
Year of construction	1983
Owner	FSH Luftfahrtunternehmen GmbH
Operator	FSH Luftfahrtunternehmen GmbH
Registration certificate issued on	19 July 2002
Airworthiness certificate issued on	19 July 2002

Certification	Commercial IFR CAT I
Airframe flying hours	5276 h (as of 23.10.2003)
Airframe, number of cycles (landings)	4370 h (as of 23.10.2003)
Last aircraft release to service	23 October 2003
Last comprehensive inspection	09 July 2002
Last inspection of the electronic equipment	07 August 2003
Wing span	14.53 m
Length	13.23 m
Height	4.5 m
Engines, number and type	2 PT6A-41
Crew	1
Maximum take-off mass	11 200 lbs
Maximum landing mass	10 330 lbs
Maximum speed	245 KIAS
Maximum cruising altitude	33 000 ft

1.6.2 Avionics equipment

Aircraft D-IFSH was equipped with the following electronic equipment:

System:	Manufacturer:	Type designation:
ADF 1/2	KING	KDF 806
AUTOPILOT	KING	KFC 300
DME	KING	KDM 706
ELT	NARCO	ELT 10
ENC. ALTIMETER	AMERI KING	AK 350
GPS NAV/COM 1/2	GARMIN	GNS 430
MARKER	KING	KMR 675
RADAR ALTIMETER	KING	KRA 405
TRANSPONDER 1/2	KING	KXP 756
WEATHER RADAR	KING	RDR 1100

Navigation instruments on the commander's side:

- Flight command indicator (FCI), King KCI 310
- Pictorial navigation indicator (PNI), King KPI 553A
- Airspeed indicator
- Altitude indicator (servo driven)
- Vertical speed indicator
- Radar altitude indicator with DH setting
- Radio magnetic indicator (RMI)
- Standby horizon

Navigation instruments on the copilot's side:

- Attitude indicator (no flight director)
- Horizontal situation indicator (HSI)
- Airspeed indicator
- Altitude indicator (direct barometric pressure)
- Vertical speed indicator
- Radio magnetic indicator (RMI)

1.6.3 Flight control system King KFC 300

1.6.3.1 System description

For automatic guidance, aircraft D-IFSH was equipped with a flight control system, type King KFC 300. This system consisted of the following components:

- Autopilot / flight director computer
- Mode controller, King KMC 340, (aft pedestal)
- Autopilot / yaw damper / pitch trim servos
- Annunciator panel, King KAP 315, (above left instrument panel)
- Vertical navigation computer, King KVN 395, (left instrument panel)
- Flight command indicator (FCI), King KCI 310, (left instrument panel)
- Pictorial navigation indicator (PNI), King KPI 553A (left instrument panel)

The KFC 300 flight control system essentially comprises a three-axis autopilot system, which receives its control signals from the flight director computer. The flight director computer processes signals such as: pitch, roll, heading, air data, as well as signals from the Garmin GNS 430 navigation computer. The resulting calculated pitch und roll steering signals are routed to the single que flight director on the commander's FCI. When the autopilot is switched on, the pitch- and roll steering signals are routed via the autopilot computer to the corresponding servos, which in turn actuate the corresponding control surfaces.

Signals from the turn rate gyro are routed directly to the autopilot computer and processed there. When the yaw damper is switched on, the aircraft is stabilised about the vertical axis. Turn coordination is also supported. These functions, which are used to improve the aircraft's handling, are also available without the flight director or autopilot being switched on.

The flight control system also has an electric pitch trim function. When the autopilot is switched on, the aircraft is automatically stabilised about the pitch axis. This system is important when the autopilot switches itself off for some reason, or when the autopilot has to be switched off when the decision height is reached.

1.6.3.2 Use of the autopilot/flight director during the approach

The crew were guided by radar on the approach to Zurich (IKL-14). The final intercept heading was 170° and the altitude required to capture the glide path was 4000 ft QNH. According to the flight crew's statements, the autopilot was switched on.

A glide slope capture can take place only following a localizer capture. This condition was met, on the basis of the radar plot.

On the basis of the manufacturer's instruction, the automatic pilot had to be switched off 200 ft above ground at the latest. This corresponded to the basis for certification. Below this height, the behaviour of the autopilot has not been examined by the aircraft manufacturer. For the flight involved in the accident, a decision height (DH) of 200 ft was preselected. On reaching the DH, the DH lamp on the FCI normally lights up.

Comment: during a test carried out after the accident, the DH lamp on the FCI did not light up.

According to the commander's statement, he switched off the autopilot after he had perceived "rattling or twitching" on the control wheel. The commander was not able to give any precise information on the altitude at which he had switched off the autopilot.

The radar plot indicates no anomalies which indicate abnormal localizer tracking by aircraft D-IFSH. (cf. Appendix 2)

1.6.4 Garmin GNS 430 navigation system

For navigation, aircraft D-IFSH was equipped with two identical Garmin GNS 430 systems. Essentially, this system consisted of the following components:

- Navigation computer No. 1, Garmin GNS 430, software version 2.25
- Pictorial navigation indicator (PNI), King KPI 553A (left instrument panel)
- Flight command indicator (FCI), King KCI 310, (left instrument panel)
- Radio magnetic indicator (RMI) (left instrument panel)
- HSI changeover switch "HSI NAV2" (left instrument panel)
- Navigation computer No. 2, Garmin GNS 430, software version 2.25
- Horizontal situation indicator (HSI) (right instrument panel)
- Radio magnetic indicator (RMI) (right instrument panel)

The Garmin GNS 430 primarily performs the functions of an RNAV computer. In addition, however, this unit also accommodates the functions of the VOR, localizer and glide slope receivers, as well as those of the VHF-Com transceiver.

A single DME system was installed in the aircraft. This could be switched to NAV1 or NAV2 via a changeover switch.

By means of another changeover switch (HSI NAV2), the navigation data from the right Garmin GNS 430 could be switched to the commander's PNI.

The waypoints of 19 flights could be stored in the Garmin GNS 430 and recalled as needed. Ten flights were stored. The route from Leipzig to Zurich was not present. According to the copilot's statement, the information was entered manually. Programmed flight plans which are not saved are erased automatically after the flight.

The Garmin GNS 430 worked with a navigation data base (NDB), which had to be updated every 28 days. The expiry date for the NDB in both units was 30 October 2003, i.e. 2 days after the flight involved in the accident.

During the approach to runway 14 in Zurich, both Garmin GNS 430 systems were working in localizer/glide slope mode, i.e. the signals from these receivers were routed both to the flight instruments and to the flight director/autopilot.

The flight command indicator (FCI) on the commander's side had a so-called expanded localizer, i.e. the localizer deviation pointer made a deflection which was twice as large as on the pictorial navigation indicator (PNI). This enabled the commander to carry out very good monitoring of the autopilot using raw data.

1.6.5 Findings after the accident

1.6.5.1 Readings after the accident

At the site of the accident, with no electrical power on the aircraft, the following values and switch positions were found and photographically recorded:

- Altimeter No. 1 QNH 1020, 1308 ft
- Altimeter No. 1 QNH 1020, 1390 ft
- Selected altitude 4000 ft
- Decision height (DH) nose 200 ft
- PNI links: Course 137°, Hdg nose 137°
- HSI right: Course 137°, Hdg nose 135°
- Avionics 1: ON
- Avionics 2: ON
- Radio altimeter: ON
- Inverter switch: INV 1
- MDA warning: OFF
- Battery master: OFF
- All external lights: OFF
- Annunciator dimming: All in BRT position
- Flaps: APPR
- Circuit Breakers: CB "STROBE LTS" tripped, all other CBs impacted.

1.6.5.2 Localizer test in the hangar

After aircraft D-IFSH had been recovered, a localizer test was carried out in a hangar in Zurich. The aim was to check the two localizer receivers for correct centring.

When the power supply was switched on, it was apparent that frequency 108.3 MHz was selected on the left GNS 430 unit.

The type NAV-402 AP-3, S/N 102007585 testset was used for the test. This was last tested in October 2003 (Cal 10/2003) by SR Technics (EQ 61345). The testset was set up in the aircraft cabin and operated via an external antenna. This antenna was erected in front of the aircraft. The test frequency was set to 108.10 MHz.

There are no indications that the localizer system on D-IFSH exhibited a fault during the flight involved in the accident.

1.6.5.3 Copilot's altimeter

On the basis of information from the copilot, he used his altimeter to call up an altitude of 1600 ft QNH, corresponding to a height of approximately 200 ft above ground and thereby to make the commander aware of reaching the decision height (DH).

Altimeter No. 2 was a standard altimeter, in which the altitude is determined directly in the instrument. It therefore functions without a power supply. Immediately after the accident, this indicated a height of 1390 ft at a QNH setting of 1020 hPa. This is in good agreement with the altitude at the airport reference point of 1384 ft.

1.6.5.4 Attitude reference on the commander's side

After the accident, both pilots indicated in their reports that the artificial horizon on the commander's side was tilted shortly before the landing. On the basis of this explanation, a detailed examination of the corresponding system was carried out after the aircraft had been recovered.

During the test on the ground, no malfunction of the artificial horizon could be found on the commander's side. On the basis of the tests carried out, the probability that the artificial horizon failed during the flight and then worked normally again on the ground is considered as low.

1.6.5.5 DH lamp on the flight command indicator

During a self-test on the Flight Command Indicator (FCI) after the accident it was found that the DH lamp on the FCI did not light up. It cannot be excluded that the filament of this lamp was destroyed in the accident. However, this appears improbable, given the relatively mild impact.

DH lamp

1.6.5.6 DH Aural Warning

By turning the DH bug in the radar altimeter indicator to 0 feet after the accident, the function of the aural warning could be verified. According to a written statement by the commander the aural warning was heard during the accident flight.

1.7 Meteorological information

1.7.1 General weather situation according to MeteoSwiss

On 28 October 2003, Switzerland was in the transition zone between a high-pressure area centred over Romania and a small low-pressure area just west of Portugal. Under the continuing predominant effect of high pressure, the sky above the north side of the Alps was practically cloudless. In the Central Plateau, extensive fog banks formed in the night and early morning. (cf. Appendix 1)

1.7.2 Weather conditions at Zurich airport

1.7.2.1 Weather development during the night and on the morning of the accident

On the evening before the accident, the sky above Zurich Airport was cloudless; ground visibility fell over the course of the evening and at midnight it was approx. 5 km. After midnight, shallow fog formed and ground visibility fell to 3500 m by 05:20 UTC. After 05:50 UTC, fog banks formed and rapidly combined to form freezing fog. The fog cleared again about midday.

1.7.2.2 Weather at the time and location of the accident

Weather/cloud:	Freezing fog Vertical visibility 300 feet
Met. visibility:	200 m
Wind:	variable, 2 knots
Temperature/dewpoint:	-03 °C / -04 °C
Atmospheric pressure:	QNH 1020 hPa

1.7.2.3 Development of ground and runway visibility between 05:50 and 06:50 UTC

	Grnd visibility	RVR RWY 14 A	RVR RWY 16 A
METAR/QAM 0550 UTC	1800 m	above 1500 m	above 1500 m
METAR/QAM 0620 UTC	1200 m	from above 1500 m falling to 325 m	above 1500 m
SPECI 0623 UTC	800 m	275 m	450 m
SPECI 0627 UTC	350 m	275 m	350 m
METAR/QAM 0650 UTC	200 m	275 m	varying 400-750 m

1.7.3 Weather conditions in the air stratum close to the ground at 06:40 UTC

Temperature / dewpoint / wind (AMETIS1 measurement chain)

Airport		- 03 °C / - 04 °C	150 degrees, 2 knots
Büelhof	300 ft AAL	- 02 °C / - 02 °C	calm
Gubrist	700 ft AAL	- 02 °C / - 03 °C	140 degrees, 1 knot
Zürichberg	1000 ft AAL	- 01 °C / - 01 °C	100 degrees, 2 knots
Lägern	1450 ft AAL	- 01 °C /	170 degrees, 3 knots
Uetliberg (tower)	2000 ft AAL	+ 04 °C / - 09 °C	190 degrees, 4 knots

1.7.4 Weather conditions at alternative airports

METAR EDDS (Stuttgart)

EDDS 280750Z 22001KT 8000 SKC M01/M03 Q1019 NOSIG
EDDS 280720Z 08002KT 8000 SKC M03/M04 Q1019 NOSIG
EDDS 280650Z 25001KT 7000 SKC M04/M05 Q1019 NOSIG
EDDS 280620Z 00000KT 7000 SKC M05/M06 Q1019 NOSIG
EDDS 280550Z 23002KT 6000 SKC M04/M05 Q1019 TEMPO 4000 BR
EDDS 280520Z 24002KT 9000 SKC M04/M05 Q1019 TEMPO 4000 BR

METAR LFSB (Basle-Mulhouse)

LFSB 280730Z 27002KT 4000 BR SKC M02/M03 Q1019 NOSIG
LFSB 280700Z 23002KT 4000 BR SKC M04/M05 Q1019 NOSIG
LFSB 280630Z 26002KT 3000 BR SKC M04/M05 Q1019 NOSIG
LFSB 280600Z 26001KT 3000 BR SKC M04/M05 Q1018 NOSIG
LFSB 280530Z 00000KT 3000 BR SKC M05/M05 Q1018 NOSIG
LFSB 280500Z 00000KT 3000 BR SKC M04/M05 Q1019 NOSIG
LFSB 280430Z 00000KT 3000 BR SKC M04/M05 Q1019 NOSIG

1.7.5 Runway visual range and ground visibility

1.7.5.1 Runway visual range

The runway visual range (RVR) is the maximum distance in the direction of the runway at which the runway lights can still just be detected. It is measured using a transmissometer (TMM). With a short-base TMM (15 m measurement distance) values in the range from 50 m to approx. 800 m can be measured, and with the long-base TMM (50 m measurement distance) RVR values between approximately 100 m and 2000 m can be determined; in the lower measurement range the measurement is somewhat less accurate. For runways with ILS approaches, short- and long-base TMMs are essential. Both types are therefore installed on runways 14 and 16 at Zurich airport, though on runway 28 only long-base TMMs are currently installed.

In the weather reports RVR values from 50 m to 1500 m are indicated. If the runway visual range is below 50 m M0050 is reported, and if it is above 1500 m this is designated as P1500. Thus in VOLMET (METAR) and ATIS (QAM) no RVR values above 1500 m are reported.

1.7.5.2 Meteorological visibility

The meteorological visibility is defined as the maximum distance at which an object of appropriate size can still be detected. Meteorological visibility is determined only in the horizontal plain. If visibility is not the same in all directions, the prevalent visibility is reported. Prevalent visibility is understood as the value which is reached or exceeded in half the circumference around the observation site; the half-circumference may comprise different separate sectors.

1.7.5.3 Relationship between meteorological visibility and runway visual range

A light source can be detected at a greater distance than an unilluminated object. The RVR value at night is therefore 3 to 4 times greater than the meteorological visibility. In daylight, the sun causes a glare effect in mist, i.e. the RVR value is only approximately twice the meteorological visibility.

1.7.6 Broadcast weather information

1.7.6.1 ATIS

ATIS ZURICH 28.10.2003 06:09:02
INFO ALPHA LDG RWY 14 ILS APCH, DEP RWY 28
QAM LSZH 0550Z 28.10.2003
170 DEG 2 KT
VIS 1800 M
SHALLOW FOG
FEW 200 FT
-04/-04
QNH 1020 TWO ZERO
TEMPO VIS 1500 M
SPEED LIMITATION
NOSIG
TRL 50 DAY 0535 NGT 1652 QNH TICINO 0600Z: 1022 HPA
TROPO: 39 600 FT, MS56
RUNWAY REPORT Nr. 007 0552
RWY 14 FULL LEN 30 M WIDE DEICED

The crew of RUS1050 / D-IFSH had the ATIS Information BRAVO

ATIS ZURICH 28.10.2003 06:42:55
INFO BRAVO LDG RWY 14 ILS APCH, DEP RWY 28
QAM LSZH 0620Z 28.10.2003
140 DEG 5 KT
VIS 1200 M R14/0325 R16/P1500 R28/0500
PATCHES OF FOG
VER VIS 300 FT
-04/-05
QNH 1020 TWO ZERO
QFE THR 14 969
QFE THR 16 970
QFE THR 28 969
TEMPO VIS 800 M
SPEED LIMITATION
NOSIG
TRL 50 DAY 0535 NGT 1652 QNH TICINO 0600Z: 1022 HPA
TROPO: 39 600 FT, MS56
RUNWAY REPORT Nr. 007 0552
RWY 14 FULL LEN 30 M WIDE DEICED

ATIS ZURICH 28.10.2003 06:50:30
INFO CHARLIE LDG RWY 14 ILS APCH, DEP RWY 28
QAM LSZH 0650Z 28.10.2003
VRB 3 KT
VIS 200 M R14/0275 R16/0400 R28/0325
FREEZING FOG
VER VIS 380 FT
-03/-04
QNH 1020 TWO ZERO
QFE THR 14 969
QFE THR 16 970

QFE THR 28 969
BECOMING VIS 600 M
SPEED LIMITATION
NOSIG
TRL 50 DAY 0535 NGT 1652 QNH TICINO 0600Z: 1022 HPA
TROPO: 39 600 FT, MS56
RUNWAY REPORT Nr. 007 0552
RWY 14 FULL LEN 30 M WIDE DEICED

1.8 Aids to navigation

1.8.1 General restriction

The following comment is present on the Zurich airport approach charts concerning the VHF omnidirectional radio range (VOR):

“KLO partially unreliable below 12,000 ft”

No restrictions are published on the corresponding Zurich airport approach charts concerning ILS approaches.

1.8.2 Navigation aids for ILS approach runway 14

DVOR/DME Kloten (KLO) and ILS DME 14 are used as navigation aids. The ILS DME 14 system is CAT III compatible.

DVOR KLO is an omnidirectional radio range which functions according to the Doppler principle. It is equipped with distance measuring equipment (DME).

DVOR/DME KLO

Geographical location	47° 27’ 25.73 N, 008° 32’ 44.14 E
Height above sea level	1414 ft AMSL
Designated operational coverage (DOC)	50 NM / 25,000 ft
Frequency	DVOR 114.850 MHz, DME channel 95 Y
Period of operation	H24

ILS14 - LLZ

Geographical location	47° 27’ 33.06 N, 008° 34’ 02.41 E
	PSN: 320 m FM THR 32, LLZ course 137°
Frequency	IKL 108.30 MHz
Period of operation	H24

GP14

Geographical location	47° 28’ 49.86 N, 008° 32’ 25.43 E
	PSN: 347 m FM THR 14, Angle 3°
Frequency	334.10 MHz
Period of operation	H24

DME14

Geographical location	47° 28’ 49.66 N, 008° 32’ 25.60 E
	Co-located with GP zero range THR 14
Frequency	20X
Period of operation	H24

The transmitter installations of stations DVOR/DME KLO and the ILS14 were in normal operation on 28.10.2003 from 06:15 to 06:45 UTC and were available to the operational services without restriction.

A few minutes before the aircraft involved in the accident D-IFSH, two Boeing B-767 aircraft of American Airlines, designation AAL 64 and AAL 38, landed on runway 14. No information about any irregularities concerning localizer and glide path is available from the crews of these two aircraft. The corresponding radar plots indicate fault-free operation in terms of localizer tracking.

1.8.3 Radar systems

Two new, independent radar systems were available to the air traffic controllers in the Zurich control tower.

1.8.3.1 PRN-VIGIE radar

The PRN-VIGIE radar (**P**oste de **R**adar de **N**uit à la vigie), in service since 17 June 2003, allowed two modes of operation. On the one hand, the PRN-Vigie radar could be used as a bright display to monitor air traffic on final approach (ILS – Instrument Landing System) and on the other hand, after switching over as appropriate, as an approach radar to take over a complete approach sector.

A legal recording was in existence for the PRN-Vigie radar.

1.8.3.2 SAMAX surface movement radar

SAMAX surface movement radar (Swiss Airport Movement Area Control System), operationally available since 17 September 2002, was the first step in the implementation of an Advanced Surface Movement Guidance and Control System (A-SMGCS). At the time of the accident, the SAMAX surface movement radar was being operated within the framework of a mini-system LIGHT with two radar antennas.

Normally, an aircraft appears on the surface movement radar display shortly before landing and can then be monitored by the air traffic control officer (ATCO) during roll-out on the runway and during taxiing/manoeuvring.

The ATCO reported that he never saw the aircraft on the surface movement radar. Since in addition he had never received a position report from RUS 1050, he issued an alarm at 06:46:10 UTC.

The SAMAX surface movement radar recording system was in a test phase at the time of the accident. Implementation of the legal recording was scheduled for 2004.

The investigation found that the SAMAX surface movement radar recording ended shortly before the landing of RUS 1050. It must remain open whether the aircraft was no longer being displayed on the radar display.

1.8.4 Other navigation aids

Equipment:	Type and manufacturer:	Date of commissioning:
LOC ILS 16 ZRH	S 4000 by Thales ATM	1990
GP ILS 16 ZRH	S 4000 by Thales ATM	1990
DME ILS 16 ZRH	FSD 10 by Thales ATM	1990

1.9 Communications

The transcript and an audio copy of the radio communications between the crew and the air traffic control units was available to the investigation. Comprehensibility was good and the recording was complete.

All radio conversations between the various air traffic control units and the crew of flight RUS 1050 during the approach to Zurich were conducted in English. There are no indications of any misunderstandings between the air traffic control units and the crew.

1.9.1 Air traffic control units involved

Air traffic control unit:	Abbreviation:	Frequencies:
Radar lower sector north	N RE	136.150 MHz
Approach control east	APE	120.750 MHz
Aerodrome control (tower)	ADC	118.100 MHz

1.9.2 Communications equipment

The operational recordings in the tower and the system management (SYMA) log book indicated no failures or defects in the air traffic control communications equipment. The same applies to all internal air traffic control connections (intercom, telephone).

1.10 Aerodrome information

1.10.1 General

Zurich Airport is located in north-east Switzerland. The airport reference point (ARP) has coordinates N 47° 27.5' / E 008° 32.9' and an elevation of 1384 ft.

The dimensions of Zurich airport runways are as follows:

Runway designation:	Dimensions:	Elevation of end of runway:
16/34	3700 x 60 m	1390/1386 ft AMSL
14/32	3300 x 60 m	1402/1402 ft AMSL
10/28	2500 x 60 m	1391/1416 ft AMSL

1.10.2 Runway equipment

The airport is characterised by a system of three runways, two of which (16 and 28) intersect at the airport reference point. The approach corridors of two other runways (16 and 14) intersect approximately 850 metres north-west of the threshold of runway 14. Runways 16 and 14 are equipped with a CAT III instrument landing system (ILS) and are therefore suitable for precision approaches. Runway 28 allows non precision approaches on the basis of VOR/DME KLO. The approach sectors of runways 14 and 16 are equipped with a minimum safe altitude warning (MSAW) system. This system triggers a visual and acoustic alarm in air traffic control if aircraft violate defined minimum altitudes.

1.10.3 Operational restrictions

After the issuing of the "small aircraft crash" alarm, the airport was closed to flying operations at 06:52:38 UTC.

After the aircraft involved in the accident had been located, the airport resumed operation, with the exception of runway 14.

On conclusion of the investigations on the aircraft wreck at the site of the accident and after surveying ILS runway 14 by the competent agency, with no faults being found, this runway resumed operation at 13:30 LT.

1.11 Flight recorders

The Piper Cheyenne belongs to the class of aircraft below 5700 kg, for which flight recorders (FDR and CVR) are not prescribed. Aircraft D-IFSH involved in the accident had no flight recorder installed.

1.12 Wreckage and impact information

1.12.1 The site of the accident

Zurich-Kloten Airport

Coordinates of initial contact with the ground: 683 225/258 975

Coordinates of final position of wreck: 683 500/258 675

Sheet No. 1071 "Bülach" of the national map of Switzerland, 1:25 000

1.12.2 Touchdown of the aircraft next to the runway

The aircraft touched down immediately after a lamp of the RVR-Lightrow, approximately 770m after the runway threshold. The RVR-Lightrow runs parallel to the runway and approximately 15 m from the right-hand edge and is used to monitor runway visual ranges (RVR). These lamps are equipped with a hood so that they cannot be seen by pilots, in order to avoid confusion with the runway lights. The investigation found that at the time of the accident the RVR-Lightrow was not illuminated.

View in the direction of flight, i.e. in the south-east direction:

RVR-Lightrow lamp

1.12.3 Aircraft roll-out

The aircraft initially rolled approximately parallel to the centreline of runway 14. After approx. 100 m the right wing collided with a lamp of the RVR-Lightrow; this wedged itself in the wing and the right main landing gear wheel was torn off by the concrete base of this lamp. From this point the aircraft was deflected slightly to the right, continued to slide for some 300 m and came to a standstill approx. 90 m west of the centreline of runway 14 and some 1200 m after the runway threshold.

1.12.4 Initial findings at the site of the accident

Final position of the wreck of the aircraft between taxiway G and the satellite road (cf. Appendix 3).

Initial findings at the wreck of the aircraft indicated massive damage to the fuselage and propellers.

Inside the cockpit, there appeared to be no obvious damage or indications which might have permitted spontaneous conclusions to be drawn about the accident (cf. section 1.6.5.1). The ZRH approach chart was secured to the commander's control wheel (cf. Appendix 4). No chart material was found on the copilot's control wheel. The ZRH taxiway chart was positioned on the glareshield.

Two different checklists for operation of the Piper Cheyenne PA-42 were in the back rest of the first passenger seat, which was directly behind the cockpit and facing against the direction of flight.

1.12.5 Recovery

In order to release runway 14 for flight operations as quickly as possible, it was decided not to remove the wreck of the aircraft until the following night. The airport fire-fighting services performed this task. They constructed a track using a gravel base from the runway to the wreck, in order to be able to drive vehicles with lifting gear sufficiently close to the wreck. After the wreck was recovered, it was placed in a hangar, where it was made available to the investigator.

1.13 Medical and pathological information

The commander suffered from shock and received medical attention in the airport medical centre. It was possible to speak to the copilot and he was able to provide initial information about the flight. They both flew back to Leipzig the same evening, as passengers.

The test carried out after the accident indicated an alcohol content of 0.00 per thousand for both pilots.

The commander's shock, noted immediately after the accident, seemed to last a long time. It was not possible to question him for weeks. Only on 29 December 2003 did the Federal Bureau of Aircraft Accidents Investigation (D) receive the written answers to a corresponding questionnaire from the Aircraft Accident Investigation Bureau (CH).

1.14 Fire

Fire did not break out at the site of the accident

1.15 Survival aspects

1.15.1 General

Generally, the chances of surviving an aircraft accident are influenced by different factors. On the one hand physical conditions such as speed, mass, attitude, configuration, topography and lie of the land, the combustion energy released and the type of disintegration of the aircraft on impact play a part.

1.15.2 The accident proceedings

Since the aircraft landed on a relatively hard grassed surface next to runway 14, and no major obstacles were in its path as it rolled out, or rather slid, deceleration of the forward movement was relatively constant and both pilots survived this accident without physical injuries. They were able to evacuate the wreck of the aircraft unaided.

1.15.3 Alarm and rescue

The ATCO had tried to identify RUS 1050 on the SAMAX surface movement radar display. He was not able to make out any aircraft on the runway. However, on the taxiways south of runway 14 and in the Dock E apron area he was able to observe various movements due to primary radar echoes.

He assumed that one of them might be RUS 1050, which had already vacated runway 14 without informing him.

However, when this assumption was not confirmed, he checked, with the support of his neighbouring colleague at the ground control position, whether the pilot, because of technical problems, might have switched back to the approach frequency or even back to area control. Finally, when a corresponding query to apron control had also proved negative, he issued an alarm at 06:46:10 UTC.

1.16 Tests and research

Apart from the activities mentioned in "Findings after the accident" (section 1.6.5), no further research was carried out.

1.17 Organizational and management information

1.17.1 Cirrus Aviation

Cirrus Aviation was a provider of charter aircraft for business travellers. It was part of the Cirrus Group, which also included Cirrus Airlines, Team Lufthansa, Cirrus Flighttraining and Cirrus Technik.

In February 1995, CIRRUS Luftfahrtgesellschaft mbH was founded as an executive company. In March 1998, Cirrus Airlines obtained an operating licence for scheduled flights. In January 2000, Skyline-Flights GmbH was taken over, its main area of business being world-wide ambulance flights.

In February 2000, Cirrus Airlines became a cooperating partner of Deutsche Lufthansa AG, as part of the "Team Lufthansa" franchise concept.

In January 2001, Cirrus Aviation was founded as a result of splitting off the VIP sector from the scheduled airline. In June 2001, Skyline Flights and Cirrus Aviation merged to become Cirrus Aviation Luftfahrtgesellschaft mbH, based in Zweibrücken.

As part of the Cirrus Aviation contract fulfilment, the company also assigned orders to other companies, within the franchising concept. This was also the case of the flight involved in the accident, which was made by the FSH Luftfahrtunternehmen using a Cirrus Aviation flight number (RUS 1050).

1.17.2 The FSH Luftfahrtunternehmen

The organisation which applied at the time of the accident, including the accountable person's obligations, is laid down in the OM A. As an operator, FSH is entitled to convey passengers, mail and or/freight on commercial transport.

At FSH, the function of the accountable manager and managing director is exercised by the same person. In addition to the quality manager and the auditor, as independent persons, the functions of the managers for maintenance, flight operations, training and ground operations are performed by a single person, by agreement with the aviation authority.

On the basis of the type of company (§ 22 LuftVG, Gelegenheitsverkehr) and pursuant to Section 4, Operation, Part 3 of the "Administrative & Guidance", FSH Luftfahrtunternehmen is classified in the "very small" group.

The responsibilities of the Postholder Flight Operations are listed in the OM A and include the following points, among others:

- supervision of company/external personnel, in compliance with the conditions and rules laid down in the flight operations manual.
- monitoring compliance with the training programmes in OM D (flight operations manual, Part D).
- responsible for implementation, compliance and application of the conditions laid down in the OM D "Betriebliche Verfahren".

1.17.3 Air traffic control

1.17.3.1 Organisation of air navigation services

Skyguide provides these services in the air traffic control unit for arrivals and departures. Approaching aircraft, depending on the volume of traffic, are routed to up to three different sectors (approach sector east, approach sector west and final sector), and departing aircraft are routed to a single sector (departure sector). In addition, a coordinator is available to support the above-mentioned sectors.

1.17.3.2 Organisation of the aerodrome air traffic control unit

In the control tower, aircraft which are taking off and landing or which have to cross runways during their taxiing manoeuvres are controlled by skyguide. For this purpose, depending on the volume of traffic, at up to four different workstations, skyguide operates the four units aerodrome control 1 (ADC 1), aerodrome control 2 (ADC 2), ground control (GRO) and clearance delivery, (CLD). A supervisor is responsible for supervising duty operations.

1.18 Additional information

1.18.1 Operational regulations of the FSH Luftfahrtunternehmen

The flight operations regulations are laid down in the company flight operations manual. They are sub-divided into the following four main sections:

- OM A (flight operations manual, Part A): General/Basics
- OM B (flight operations manual, Part B): Aircraft-related operational documentation
- OM C (flight operations manual, Part C): Route- and aerodrome-related instructions
- OM D (flight operations manual, Part D): Training.

According to the postholder flight operations' statements, OM A and OM B are components of the employment or freelance contract. Study and knowledge of the flight operations regulations by pilots are required by the aviation company.

According to the postholder flight operations' statement, one copy of the OM A and OM B respectively is on every aircraft. No corresponding manuals were found on the aircraft involved in the accident.

1.18.2 General operational regulations

The operational procedures are described in the flight operations manual OM A in section 8. Paragraph 8.1.3 contains the following, among other things, for a precision approach – flight operation according to operation stage I (CAT I):

It must be ensured that the decision height to be applied for a precision approach according to operation stage I is not less than:

- *the minimum decision height which may be specified in the aeroplane flight manual (AFM)*
- *the minimum height by which the precision approach aid can be used without the required visual references*
- *the OCH/OCL for the respective aircraft category*
- *200 ft*

The decision height (DH) was set to 200 ft on the radio altimeter of the aircraft involved in the accident.

Moreover, it is specified under "Visual References" that the pilot may continue the approach below the specified decision height only if at least one of the following visual references is clearly detectable for the runway:

- *elements of the approach lights*
- *the runway threshold*
- *the threshold marking*
- *the threshold lighting*
- *the threshold identification lights*
- *the optical glideslope indication*
- *the touchdown zone or touchdown zone markings*
- *the touchdown zone lights*
- *the runway edge lights*
- *other visual references recognised by the aviation authority*

The same section specifies the runway visual ranges in relation to the decision height. In the present case, a minimum runway visual range (RVR) of 550 m was prescribed for a decision height of 200 ft.

Section 8.1.11 states that a logbook must be kept for each of the operator's aircraft, in which the necessary technical information must be recorded and which must be on board at the start of a flight. The investigation found no such logbook on board the aircraft involved in the accident. The operator was able, on request, to provide copies from the logbook concerning the previous two flights on 24.10.2003 and 27.10.2003.

Section 8.4, "All-weather operations", contains the following in relation to the height above the threshold:

- *Within the company it is prescribed that the aircraft in landing configuration and landing attitude flies over the threshold at a safe height.*

Examination of the wreck of the aircraft revealed that the flaps were in the APPR (approach) position.

1.18.2.1 Training and education within the company

According to the flight operations manager's statement, a discussion took place with the crew members of the FSH Luftfahrtunternehmen concerning the scheduled flights operation on behalf of Cirrus Aviation. The purpose of this was to make the crew aware of the procedures in the event of bad weather flight operations, particularly in connection with scheduled flights. The following points in particular were discussed according to the "Protokoll zu Dienstversammlung am 26.10.03":

- *strictest compliance with landing minimums*
- *immediate diversion to an alternative aerodrome at the first signs of difficulties at the destination aerodrome (weather)*
- *clear, uniform procedures for cockpit duties*
- *clarification of loading of catering, newspapers, operating measures (fuel), etc.*

The two pilots involved in the accident took part in this discussion.

The meeting minutes were produced on 30.10.03, two days after the accident. According to a written statement by the copilot this discussion did not take place the way it is taken down.

1.18.3 Procedures for operation of the PA-42

The flight operations manual OM B which applies to the Piper Cheyenne PA-42 is published in English. All other flight operations manuals are in German. The following limits and procedures, among others, are described in the PA-42's OM B:

Section 1: LIMITATIONS JAR-OPS D 1.005b

Section 2: NORMAL PROCEDURES

Section 3: ABNORMAL AND EMERGENCY PROCEDURES

1.18.3.1 Section 1: LIMITATIONS

Paragraph 1.3 Approved Types of Operation states that aircraft D-IFSH is not approved for flights under CAT II/III conditions. The weather minimums at the time of the approach required CAT III compatibility of the aircraft.

Under Normal Operating Procedures (NOP), with regard to crew composition, it is stated that the PA-42 is to be operated at FSH with two qualified pilots.

1.18.3.2 Section 2: NORMAL PROCEDURES

With regard to checklist work, paragraphs 2.1 and 2.2, the following points, among others, are made with reference to reciprocal monitoring, information and support:

Response:

One crewmember, in general CM2 or PNF, reads the checklist challenge, while the other crosschecks the item and answers with the checklist response.

Checklist, Self Check:

One crewmember, in general CM2 or PNF, reads the checklist challenge, checks the item, and answers with the checklist response. All this is done in a loud and clear voice so that the other crew member is informed and the checklist is recorded on the cockpit voice recorder.

Checklist, Do List:

One crew member reads the challenge and response and simultaneously executes the checklist items: this to be done in a loud and clear voice so that the checklist is recorded on the cockpit voice recorder.

The FSH Piper Cheyenne PA-42 was not equipped with a cockpit voice recorder.

In brief, this means that one of the pilots requests the checklist points whilst the second pilot processes these and confirms complete execution of the checklist points to the first.

With regard to checklist availability, paragraph 2.1.2 Checklist Policy and 2.2.2 Normal Procedures Check List (hardcopy) state, among other things, that two identical manufacturer's checklists should be available in the cockpit. One on each pilot's side.

In the aircraft there were two different checklists, which did not originate from the manufacturer and which were not identical. Both checklists were in the seat pocket of the first seat in the cabin, which was mounted facing against the direction of flight. Both checklists contained procedures for normal operation.

With regard to the approach briefing, paragraph 2.4.7 contains the following:

The approach briefing should consist of:

- *Minimum safe altitude*
- *Altitude from which the final descent is initiated*
- *Minimum*
- *Prevailing weather including ceiling, visibility, RVR and wind (head-tailwind, crosswind, windshear)*
- *Runway length and state including wet and contaminated runway*
- *Correction to landing distance required*
- *Missed approach procedure*
- *Landing speeds*

1.18.3.3 Section 3: ABNORMAL AND EMERGENCY PROCEDURES

With regard to emergency evacuation, paragraph 3.4.5 states that no relevant manufacturer's procedures exist and reference is subsequently made to paragraph 11: "EMERGENCY EVACUATION PROCEDURES JAR-OPS D 1.285"

Paragraph 11, under General, states among other things that after the aircraft has come to a complete stop, both engines must be shut down off immediately and both fire extinguishers activated by the CM 1, and that the CM 2 must inform ATC.

Furthermore, in the event of an unprepared evacuation the crew are requested to process the vital points of the "Evacuation Checklist".

Such a checklist is not published in the OM B, nor was any such checklist found in the wreck of the aircraft.

1.18.4 Approach procedure

1.18.4.1 The precision approach procedure according to FSH

Among other things, paragraph 2.3.2 Manoeuvres of the OM B states the following for the Precision CAT I Instrument Approach:

Duty PF	Duty PNF
Request landing checklist Respond as required	Read landing checklist and call outstanding items, e.g. “Full flaps remaining” Respond as required
When passing OM call: “Outer marker” Reduce speed to 150	Check OM altitude and call: “Altitude checked” or “X feet high/low”
When at any time beyond this point the TDZ environment is in sight: • The PNF should call this effect • The PF should make his landing/go-around decision at that time, and • The approach may be continued visually (items marked * maybe omitted)	
Request full flaps	Check speed 153 or less Call: “Speed is checked”, select flaps full down and observe flap position Call: “Flaps full”
	Verify landing checklist completed and call: “Checklist completed”
	At 200 ft above DH look for visual reference. Call: “Approaching minimum”
*If visual reference established call: “Continue” *If no visual reference established call: “Go around” and apply go-around thrust	*At DH call: “Minimum” *Monitor altitude and speed, vertical speed

The copilot stated that he had called out the minimum altitude “1600 ft”, without receiving verbal confirmation from the commander. Otherwise, he said no verbal communication took place in the cockpit.

Comment: 1600 ft QNH corresponds to 200 ft AGL.

1.18.4.2 The precision approach procedure according to the aircraft manufacturer

In the "Pilot's Operating Handbook and FAA Approved Airplane Flight Manual" of the manufacturer, Piper Aircraft Corporation, dated March 1980, for the aircraft type CHEYENNE III PA-42, the ILS approach procedure is described in section 9 supplement 1 as follows, among other things:

- *Do not override autopilot to change pitch attitude*
- *Autopilot and yaw damper must be disengaged during take off and landing*
- *The minimum altitude for autopilot operation is 200 feet AGL during an approach and 800 feet AGL during cruise, climb and descent*
- *At decision height, DH light will illuminate on FCI*
- *Disengage autopilot prior to landing by depressing the autopilot disconnect and trim interrupt switch on pilot's control wheel or by manually moving AP and YD switch on mode controller to off.*

Furthermore, section 4, under normal procedures, states:

- *Prior to reaching 50 feet above landing surface verify (landing checklist): gear, flaps, airspeed and power*

1.18.4.3 ILS minimums according to Jeppesen Route Manual

In the Jeppesen Route Manual approach chart, which was used by FSH (11-1, 29 NOV 02, cf. Appendix 4), the ILS minimums for the various aircraft categories (A/B/C/D) are prescribed as follows:

RA 187 ft, DA 1602 ft (200 ft), RVR 550

1.18.5 Pilots' training and qualification

Among other things, flight operations manual OM A states for the Piper Cheyenne that the minimum crew must consist of one pilot and that in this case the latter must have at least 50 flying hours on the aircraft type, of which 10 flying hours must be as commander.

The minimum flying experience for a commander is defined as follows:

For flights according to IFR, total flying experience of at least 700 hours

- *of which at least 400 hours as pilot in command*
- *of which at least 100 hours on this type*
- *of which at least 100 hours according to instrument flight rules, including 40 hours on multi-engined aircraft as pilot in command*
- *flying hours as pilot in command may be replaced by twice as many flying hours as copilot.*

At the time of the accident, the commander demonstrably had total flying experience of 1000 hours, of which 255 hours as commander and 900 hours on the aircraft type involved in the accident.

Moreover, the OM A states under paragraph 4.2 that when he is nominated as commander, the latter has completed the corresponding course, including training in crew resource management (CRM). In this context, it is noted that the operator did not imperatively carry out this CRM training itself, but also accepted it when this took place externally.

The OM A, section 1, paragraph 1.4 states among other things the following obligation of the commander:

- *shall ensure compliance with all operating procedures and checklists in conformity with the operations manual, by processing all checklists and behaviour algorithms as described in this operations manual.*

According to the copilot's statements, on the accident flight RUS 1050 the work was performed without checklists.

1.19 Useful or effective investigation techniques

Not involved.

2 Analysis

The origin of aircraft accidents is often explicable by the complex interaction of human, technical, operational and environmental factors. For the analysis, therefore, a systematic approach has been chosen, which not only designates the obvious deficiencies but also analyses the basic situation and the deeper causes of a primary failure.

2.1 Technical aspects

The technical investigation found no indications of a technical failure of the aircraft.

2.2 Human and operational aspects

2.2.1 Commander

2.2.1.1 Behaviour during the flight involved in the accident

Up to the time of the approach to LSZH, there are no indications that any irregularities of any kind had occurred. According to the concurring statements of the two pilots, the commander was PF and the copilot PNF.

According to the copilot’s statement, the commander took over radio communication during the approach to LSZH.

Throughout the entire approach and up to the accident, the RVR values communicated to the crew were lower than the values prescribed for CAT I. The RVR value was communicated directly to the crew of flight RUS 1050 three times. The RVR value was communicated two further times to other aircraft on the same frequency selected by RUS 1050. According to the copilot’s statement – the commander could not recall – the communicated RVR values were never addressed in the cockpit and the commander continued the approach without comment.

In addition, on the first transmission of the RVR values at 06:29:30 UTC, a visibility of 800 m was passed on to the crew of flight RUS 1050 and confirmed by RUS 1050 with “roger, thank you”. A weather transmission with slightly different RVR values, but also with 800 m visibility, took place on the same frequency at 06:37:04 UTC to another aircraft. It must be assumed that as a result the crew were focused on this 800 m and were not consciously aware of the RVR values.

A procedural regulation states that in the event of “CAT II or CAT III in progress” the approach must be aborted immediately. It must remain open whether the crew were aware that they continued an approach with visibility values below CAT I.

At 06:41:47 UTC, the tower cleared the crew of flight RUS 1050 to land. This was confirmed only with “roger”. There was no explicit readback of the landing clearance. The repetition of the landing clearance by the air traffic control officer “just to confirm cleared to land on one four RUS 1050” was not answered by RUS 1050. It must be assumed that this failure to read back the landing clearance was a consequence of the excessive strain on the commander, as he had taken over radio communications in addition to flying the aircraft.

2.2.2 Copilot

2.2.2.1 Behaviour during the flight involved in the accident

In his function as PNF, the copilot handled radio communications with the various ground stations and supported the PF with “administrative” tasks such as updating the flight plan and listening to and noting weather reports.

According to the copilot’s statement, the commander took over radio communications during the approach to LSZH. From this point on, according to his statements, the copilot felt that he was no longer directly involved in the flight procedures, leading him to adopt a somewhat passive behaviour. Subsequently, the copilot dedicated himself intensively to studying the taxiway chart of Zurich Airport. This, because the previous day they had had difficulties in orientation whilst taxiing to the stand and the commander had insisted on a study of the pertinent charts.

This circumstance was confirmed by the fact that after the accident a taxiway chart for Zurich Airport was found on the copilot’s glareshield. However, no approach chart was found on the copilot’s side.

According to the FSH Luftfahrtunternehmen's procedures, the PNF must make the PF aware of the minimum, 200 ft above the minimum, by means of the call-out: “approaching minimum” and then call out “minimum” when this is reached.

According to his own statement, the copilot restricted himself to the call: “1600 feet – minimum”. Since the commander had called out “field in sight” just before, the copilot expected no response, nor did he look outside. According to his statement, he did not perceive the DH warning from the radio altimeter (200 ft).

No radio altimeter was installed on the copilot’s instrument panel. Consequently, the copilot must have reverted to his altimeter for the decision height call-out. The altitude of 1600 ft corresponds approximately to a height of 200 ft above the threshold of the runway.

After the call-out: “1600 feet – minimum” the copilot, according to his statement, carried out the “final check” in silence and unsolicited and continued to monitor the instruments. He was relying unconditionally on the commander’s “field in sight” call-out and hence on the latter’s assessment of the visibility conditions.

2.2.3 Interaction between commander and co-pilot

2.2.3.1 General

In principle, the PA-42 aircraft may be flown in one-man or two-man operation. According to the FSH Luftfahrtunternehmen (aviation company), the accident flight was defined as a flight with a two-man crew. The OM B for the PA-42 describes the procedures to be applied in two-man operation. The following analysis is based on this foundation.

The copilot’s statement that no regulations from the aviation company existed regarding standard duty assignments in the individual flight phases or with regard to the approach briefing permit the conclusion that the conditions for optimal two-man operation were not met for him. According to his understanding, he only had to bother with the radio and the NAV setting, while the commander was acting as PF.

Once the commander as PF had also taken over radio communications, the copilot felt forced into a passive role. His statement that after his call out: "1600 feet – minimum" he had carried out the final check on his own reinforces this impression.

The assumption of radio communications by the commander as PF in a phase of increased workload must be seen as inappropriate and contradicts the work distribution principals for two-man operation. It can also be assumed that two-man operation collapsed entirely at this point at the latest.

As the training documentation showed, both pilots had trouble with instrument flying at times or had not passed the relevant examinations. It must remain open how much these deficits contributed to the accident.

2.2.3.2 Crew resource management

According to the postholder operations, both pilots took an external crew resource management (CRM) course independently of each other.

As the above analysis shows, the behaviour of both pilots in two-man operation was not appropriate, nor did it correspond to the procedures published by the operator. In this context is it questionable how appropriate it is for crews to take CRM courses in an external company. At least in such a case company-specific requirements should be part of the training.

2.2.4 Interaction between flight crew and the aircraft

2.2.4.1 General

In considering the interaction between the crew and the aircraft, the man-machine relationship was in the foreground. In the process, consideration was given not only to the aircraft in itself, but also to its equipment, especially in relation to two-man operation.

2.2.4.2 Equipment of the aircraft in relation to two-man operation

On the Piper PA-42 involved in the accident, the instrument panel equipment on the commander's side differed from that on the copilot's side. For example, the copilot's side had neither a flight director nor a radio altimeter indicator. Likewise, a status display for the autopilot/flight director and a display for system warnings were present only on the left side.

On the one hand, this limited the function of the copilot as pilot flying and on the other hand it also greatly restricted the monitoring function of the copilot during a precision approach.

2.2.4.3 Equipment of the aircraft in relation to all-weather operation

The Piper PA-42 involved in the accident was equipped for precision approaches in weather category 1 (CAT I). In view of the cockpit equipment, such an approach had to be made by the commander as PF.

The aircraft involved in the accident was equipped with an autopilot/flight director system. According to information from the aircraft manufacturer, the autopilot must not be engaged below 200 ft.

2.2.4.4 Use of the flight management and navigation equipment

For the landing approach, the crew had set the runway 14 ILS frequency on both Garmin 430 navigation systems. According to the pilot's statement, the localizer and glide slope signals were connected to the autopilot (coupled approach).

The DH bug on the radio altimeter indicator was set to 200 ft. The commander reported that he had heard the corresponding acoustic warning at the decision height. The copilot cannot recall such a warning.

It must be assumed that the visual DH warning on the flight command indicator (FCI), which was no longer functioning after the accident, was already out of operation during the approach. However, this did not have any operational consequences.

The correct QNH setting had been set on both altimeters.

After the accident, the preselected altitude was still set to 4000 ft. For a precision approach, it would have been expected that this should have been set to the go-around altitude of 5000 ft.

Analysis of the radar plot indicated normal tracking, with a slight oscillation along the localizer. This oscillation was within the tolerance for a CAT I certified aircraft.

According to the commander's statement, the autopilot was switched on when the aircraft passed the decision height. He further mentioned that the aircraft suddenly made unusual movements, upon which he switched off the autopilot. At this time he had sufficient visual references available. The copilot, according to his statements, did not notice any unusual aircraft movements.

There are several possible explanations for the occurrence of the unusual movements mentioned: an atmospheric disturbance, a disturbance of the ground based ILS signals due to taxiing movements or a disturbance to aircraft systems. A B-767 had landed a relatively short time before flight RUS 1050. There were also taxiing movements on the ground; however, in the event of CAT III weather conditions the relevant critical zones are protected. On the aircraft, sensors such as the localizer receiver and the attitude reference system were inspected after the accident without any defects being found.

2.2.4.5 Fuel reserves

According to the statements of the flight crew and the postholder operations, the crew were not under any pressure to land in Zurich. The crew had had enough fuel to initiated a go-around and to land the aircraft at the alternate aerodrome in Basle.

2.2.5 Flight crew implementation of procedures

2.2.5.1 General

According to the postholder flight operations' statements, OM A and OM B were components of the employment or freelance contract. Study and knowledge of the flight operations regulations by pilots were required by the operator.

The copilot stated that though he was in possession of the OM B, he had never familiarised himself with an OM A. Statements by the commander on this point are not available to the investigator.

From the above contradiction, it must be assumed that the operator did not adequately check whether the required knowledge was actually to hand.

Regardless of this, the procedures published by the operator served as a basis for the following analysis.

2.2.5.2 Approach briefing

According to the statements of both pilots, an approach briefing was carried out by the PF.

According to the copilot's statement, there were no procedures for such an approach briefing. The relevant statement from the commander leads to the conclusion that he was basing himself in principle on the regulations published in the OM B for the PA-42, paragraph 2.4.7, with the aid of the Jeppesen approach chart.

The copilot stated that the RVR value was not addressed in the approach briefing. The commander could not remember. However, this point was a component of the approach briefing according to the OM B.

2.2.5.3 Procedures and work distribution during the approach

The work distribution between the PF and PNF was described in detail in the OM B for the PA-42, paragraph 2.3.2 *Manoeuvres*, sub-paragraph (J) *Precision CAT I Instrument Approach*. According to both pilots' statements, it is to be assumed that these procedural regulations were not complied with, at least in the following points:

The procedures prescribed that the PF must request the landing checklist and that this must be read out by the PNF (in this case the copilot).

However, according to the copilot's statement, no checklists were read out during the flight. The corresponding items were processed from memory.

The fact that the available checklists were found not in the cockpit but in the back of the first passenger seat supports this statement. In addition it leads to the assumption that the crew were essentially working without checklists.

The procedural regulations further prescribed that at the decision height (DH), the PNF must call out "minimum" and the PF must then make known his intentions. This means that if the visual references are adequate, the PF calls out "continue", or if they are not, "go-around". The commander was unable to remember this flight phase and the copilot reported that he had only heard "field in sight" just before reaching the DH.

The above-mentioned visual references were defined in the OM A. The remark mentioned in JAR-OPS 1.405, to the effect that the approach may actually be initiated if the reported runway visual range/visibility is lower than the minimum visibility to be applied, but must not be continued over the outer marker, was published in the OM A Chapter 8.1.4 *"Darstellung und Anwendung von Betriebsmindestbedingungen für Flugplätze und für den Reiseflug"*.

2.2.5.4 Configuration during a Category I precision approach

As described under 1.18.4.1, the procedural regulations of the FSH Luftfahrtunternehmen require the setting of full flaps for the final approach and landing. This also corresponds to the manufacturer's procedures, as laid down in the Pilot's Operation Handbook in Section 4, normal procedures, pages 4-18.

Examination of the wreck of the aircraft revealed that the flaps lever was in the APPR (approach) position. The relevant statement by the commander, that if the landing strip were long enough it would also be possible to land with this flap position, is mentioned explicitly neither by the operator nor by the manufacturer.

2.2.6 Flight crew – environment interface

2.2.6.1 General

In the consideration of the flight crew – environment interface, the main factors were the aircraft flying in front, the weather situation, the operator and air traffic control.

2.2.6.2 Aircraft flying ahead of flight RUS 1050

Shortly before flight RUS 1050 reached the decision height of 200 ft, an American Airlines B-767 had landed on runway 14. According to the radar plot, the separation between the two aircraft in the final approach was about six miles. When the crew of flight RUS 1050 reported to the tower at 06:41:03 UTC, they were made aware by the air traffic control officer at 06:41:08 UTC of the preceding traffic as follows: “RUS 1050 Zurich Tower, guten Tag, continue approach, caution wake turbulence, you’re following a heavy arrival".

At this time, AAL 38 was already on the ground. The time since AAL 38 had passed the 200 ft point was approximately two minutes. It is questionable whether wake turbulence which might have affected flight RUS 1050 was present at this time (cf. section 2.2.4.4).

2.2.6.3 Weather situation and weather minimums

The weather situation at the time of the accident permitted approaches only by aircraft which were equipped for approaches under weather Category 3 (CAT III) conditions with appropriately trained crews.

After being asked twice, the crew confirmed to the air traffic controller that they had received information “BRAVO”. Among other things, information BRAVO specified a met visibility of 1200 m together with a trend message of a worsening to 800 m. The preceding information ALPHA had contained a met visibility of 1800 m. The flight crew’s statements permit the conclusion that the crew did not realise this continuing worsening of visibility.

According to the copilot’s statement, the RVR value was not mentioned during the approach briefing. Likewise, he apparently did not catch any of the transmitted RVR values throughout the entire flight. The commander could not remember anything about RVR values.

2.2.6.4 The operator

The regulations issued by the operator were in principle appropriate and strict compliance with might have prevented the accident.

According to the postholder flight operations’ statement, the pilots possessed flight operations manuals OM A and OM B. The operator required crews to be aware of the procedures in these manuals. The copilot’s statement that he had never seen an OM A is in contradiction with the postholder flight operators’ statement.

From this contradiction, it must be assumed that the operator did not adequately check whether the required knowledge was actually to hand.

The postholder flight operations had a special discussion with crews two days before the flight involved in the accident, in the preparation for scheduled operations for Cirrus Aviation.

The particular point mentioned in this discussion, that it was absolutely essential to go around in the event of inadequate visual references, allows one to conclude that this point had generally not been dealed with consistently. A pertinent statement by the copilot reinforces this impression. The fact that this point was addressed in particular is amazing, as it is a logical consequence when carrying out IFR approaches.

Two days after the accident, minutes of this discussion were drawn up by the FSH postholder flight operations. In these minutes, he provides a summary of his own analysis of the accident and in the process blames the two pilots for the accident.

2.2.6.5 Air traffic control – traffic handling

During the period when RUS 1050 was in contact with the Zurich arrival sector east (APE) ATC unit, the flight continued without any recognisable problems.

The ATCO had lined up RUS 1050 6 NM behind a Boeing 767 for an approach on ILS 14. Since flight RUS 1050, a PA-42, belonged to the light category and the Boeing 767 flying ahead of it belonged to the heavy category, the ATCO was obliged to apply a minimum longitudinal separation of 6 NM between the two aircraft.

During the period when RUS 1050 was in contact with the control tower, the flight continued without any recognisable problems until the point at which the landing clearance was issued.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects

- There is no indication that a technical defect on the aircraft caused this accident.
- The ground navigation aids used for the approach were functioning normally.

3.1.2 Weather conditions

- The ATIS information BRAVO was known to the crew.
- The RVR values were communicated by ATC to flight RUS 1050
- CAT III weather conditions prevailed at the time of the accident.
- As far as the weather was concerned, alternative airports such as Basle and Stuttgart would have allowed a landing at any time.

3.1.3 Crew

- According to the available documentation the crew were in possession of the necessary licences.
- There are no indications of any crew health problems.
- The training to become a commander was inadequately documented and did not comply with operating procedures.
- The commander was pilot flying (PF) and the copilot was pilot non flying (PNF).
- The crew did not comply with the operator's procedures.
- The crew did not show an adequate MCC/CRM behaviour.

3.1.4 History

- The crew passed below the minimum height for the approach (decision height – DH) of standard ILS approach 14 and continued the approach.
- No attempt was made to prevent continuation of the flight below the decision height.
- The PF also took over radio communications in the final phase of the approach.
- The flight ended at 06:42 UTC next to runway 14 whereupon the aircraft was heavily damaged.
- It was only by chance that the accident was survivable.

3.1.5 General conditions

- The operator did not adequately check the required knowledge of procedures.
- The approach procedure according to JAR OPS 1.405 was not present in the OM A, section 8.4: All-weather Operation.
- A B-767 landed shortly before the landing of RUS1050. ATC referred to possible turbulence.

3.2 Cause

The accident is attributable to the fact that during an ILS 14 approach the crew continued the approach below the decision height without having sufficient visual references. Therefore the aircraft touched down next to the runway 14.

The following factors contributed to the genesis of the accident:

- The aircraft was neither equipped nor approved for approaches under the existing weather conditions.
- The crew was not trained for approaches under the existing weather conditions.
- The crew's work distribution during the approach was inappropriate and did not comply with procedures.
- The crew were not acquainted with the procedures.
- The operator did not adequately check the crew’s knowledge of procedures.

4 Safety Recommendations

4.1 Equipment of aircraft

4.1.1 Safety deficit

Many aircraft accident investigations have shown that it is difficult and sometimes almost impossible to get the required data for an investigation if neither FDR nor CVR are available. The statements of surviving crews are not neutral because they are part of the occurrence and there perception is often subjective and incomplete. Technical recordings (FDR/CVR) could be realised today also for small airplanes. Modern GPS, air data computers, FADEC with data bus, as installed in small single engine aircraft and favourable memory solutions make it possible to report flight data in aircraft built nowadays.

4.1.2 Safety recommendation No. 374

We recommend that the FOCA, in cooperation with the international authorities, do ensure FDR- and CVR data availability for aircraft built today and in the future, independent of weight class and kind of mission.

Berne, 24 February 2006 Aircraft Accident Investigation Bureau

This report contains the AAIB's conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Annex 13 of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

Glossary

A

AAL	above aerodrome level
ADC	aerodrome control (tower)
ADF	automatic direction finding equipment
AAIB / BFU	Aircraft Accident Investigation Bureau
ALT	altitude
AP	autopilot
APE	approach control east
APPR	approach
ATC	air traffic control
ATCO	air traffic control officer
ATIS	automatic terminal information service
ATPL	air transport pilot licence
AZF	general flight radiotelephone operator's certificate

B

BFU / AAIB	Aircraft Accident Investigation Bureau
BZF	restricted flight radiotelephone operator's certificate

C

CB	circuit breaker
CCC	crew coordination concept
CM	crew member
COM	communication
COPI	copilot
CPL	commercial pilot licence
CRM	crew resource management
CRS	course
CVR	cockpit voice recorder

D

DA	decision altitude
DEP	departure control
DH	decision height
DME	distance measuring equipment
DVOR	doppler VOR

E

ELEV	elevation
ELT	emergency locator transmitter

F

FAA	Federal Aviation Authority
FCI	flight command indicator
FD	flight director
FDR	flight data recorder
FL	flight level
F/O	first officer
FOM	flight operations manual
ft	feet

G

G/A	go around
GNS	global navigation system
GP	glide path
GPS	global positioning system
GRO	ground control
G/S	glide slope

H

HDG	heading
hPa	hecto pascal
HSI	horizon xx indicator

I

IAS	indicated airspeed
ICAO	International Civil Aviation Organization
IFR	instrument flight rules
ILS	instrument landing system
IMC	instrument meteorological conditions
IR	instrument rating
JAR	Joint Aviation Regulation

K

KIAS	knots indicated airspeed
kt	knots

L

lb	pound
LLZ	localizer

M

MDA	minimum descent altitude
METAR	aviation routine weather report
MHz	megahertz

N

NAV	navigation
NDB	non directional beacon
NM	nautical mile

O

OM	operations manual
OM	outer marker

P

PF	pilot flying
PIC	pilot in command
PNF	pilot non flying
PNI	pictorial navigation indicator

R

RA	radio altimeter
RA	radar altitude
RMI	radio magnetic indicator
RNAV	area navigation
RVR	runway visual range
RWY	runway

S

SEL	select
SIGMET	information concerning en-route weather phenomena which may affect the safety of aircraft operations
S/N	serial number

T

TMM	transmissometer
TWR	tower

U

UTC	universal time coordinated

V

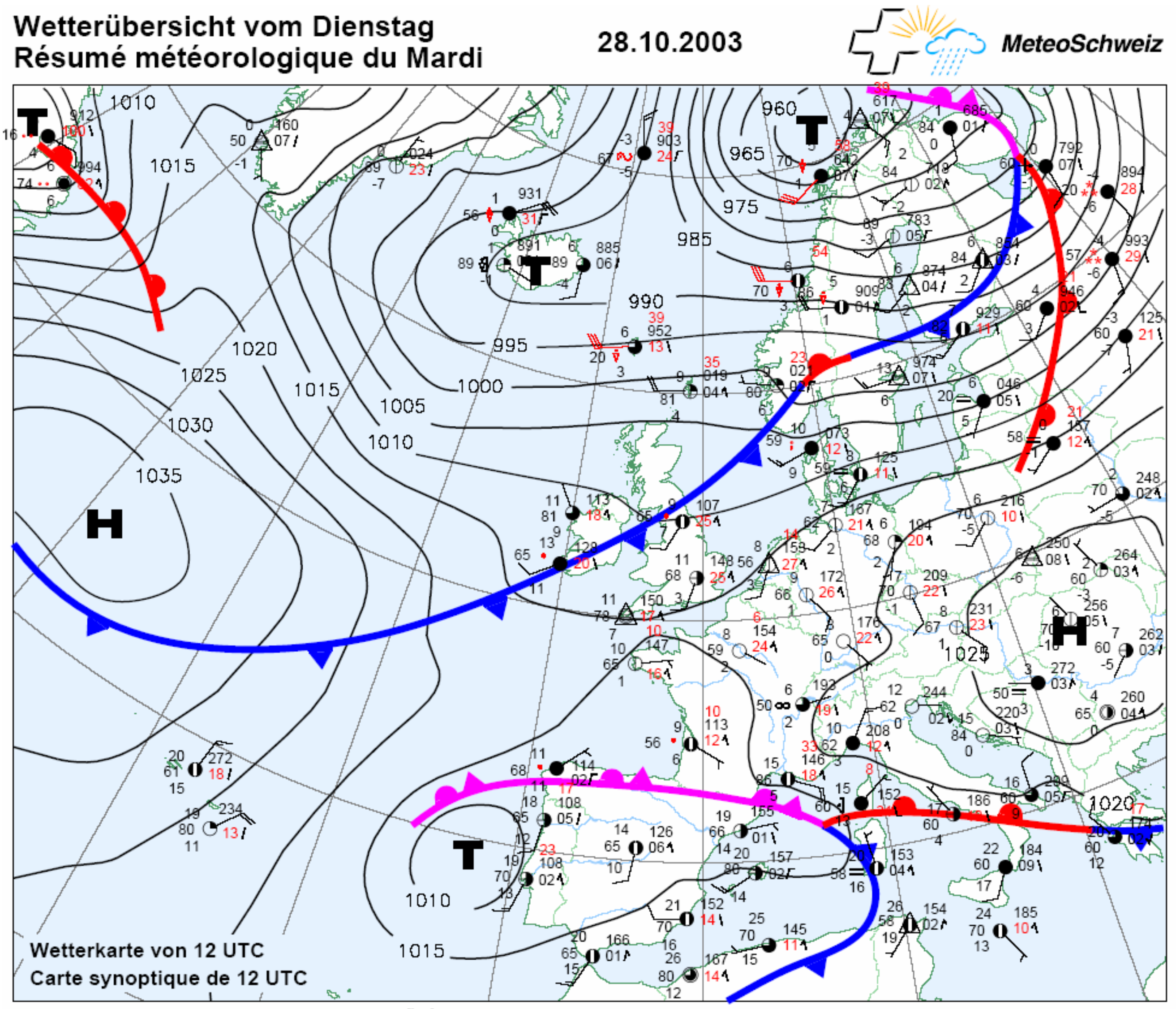
VFR	visual flight rules
VHF	very high frequency
VMC	visual meteorological conditions
VOR	VHF omnidirectional radio range

Y

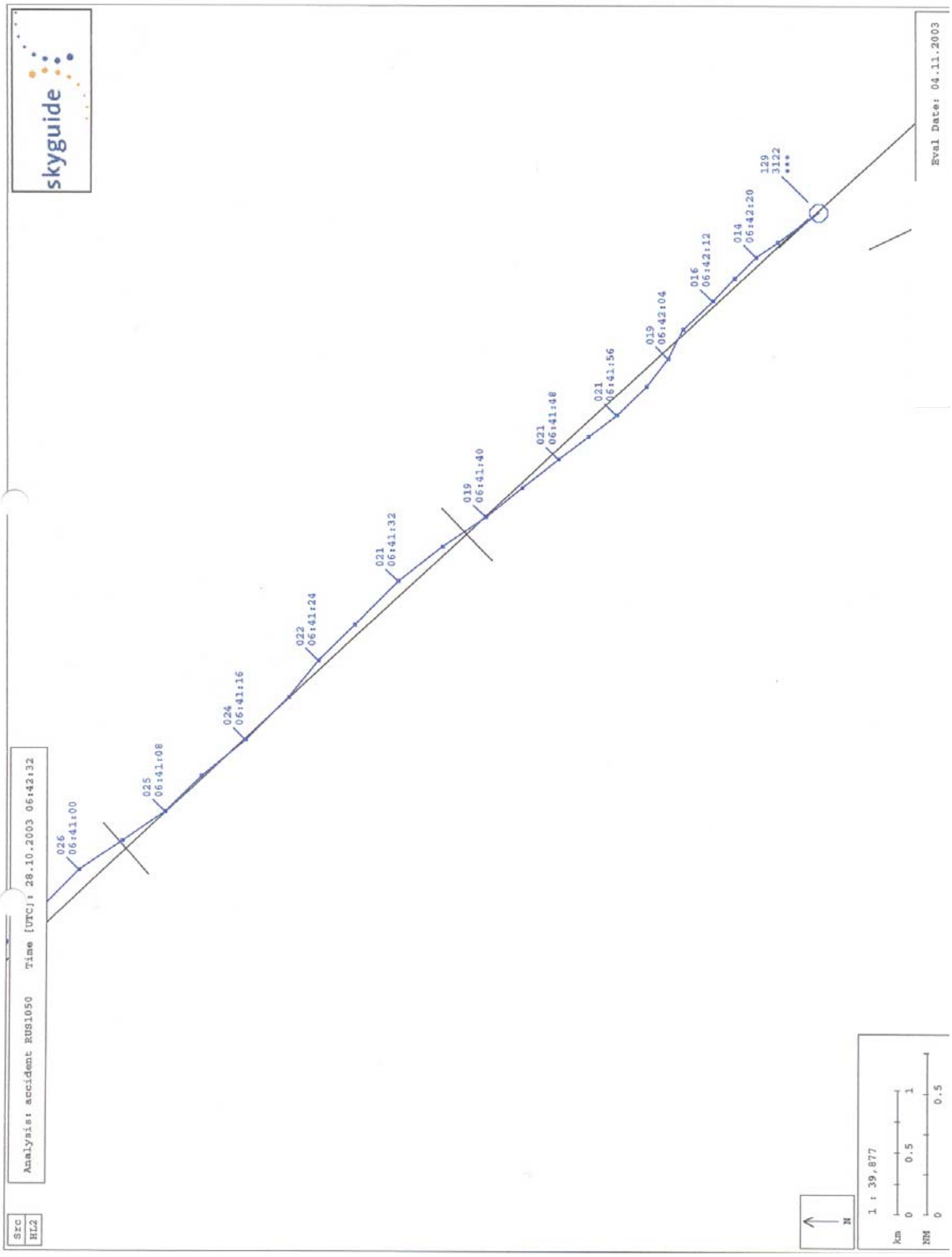
YD	yaw damper

Appendices

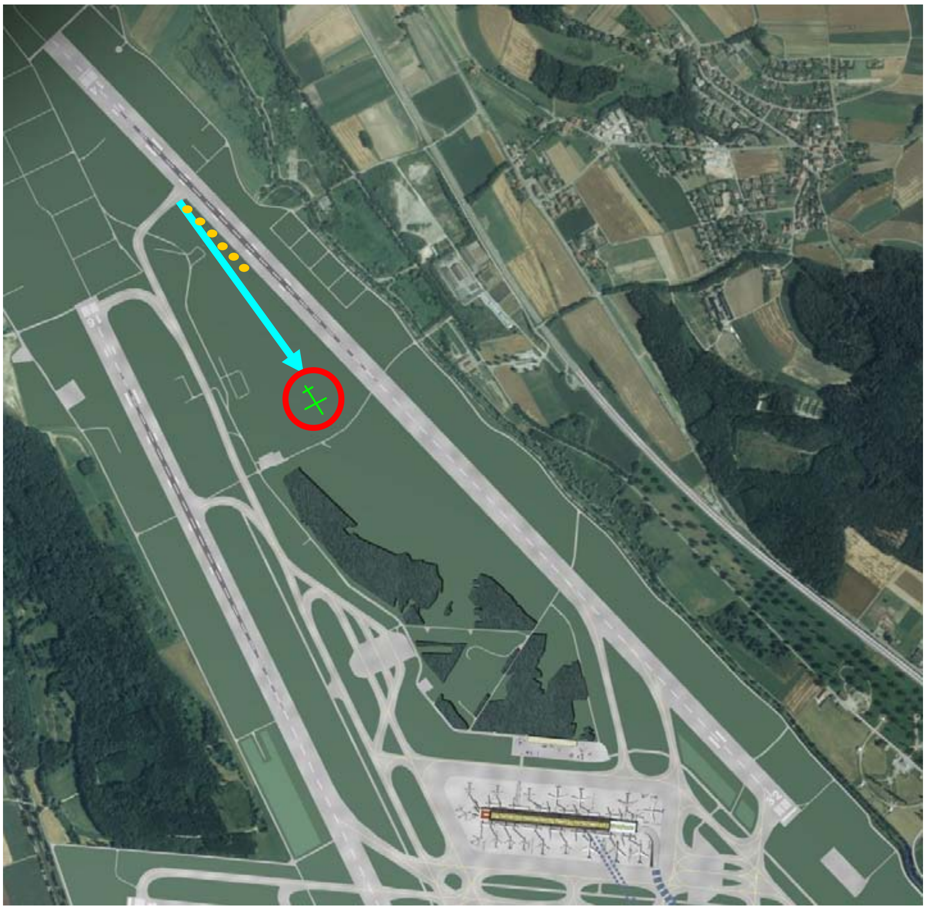
Appendix 1: General weather situation



Appendix 2: Radarplot – Flight RUS 1050



Appendix 3: General overview of the accident site



RVR-Lightrow

Approximate ground track and final wreck position

Appendix 4: Approach chart LSZH, Runway 14