

2008-226-4P

FINAL REPORT

**2008-226-4P
AVIATION ACCIDENT**

**Kiskunlacháza DK. 6km
July 31, 2008**

**Eurocopter EC 135 T2
HA-ECE**

The purpose of the professional investigation is the cause and circumstances of the aviation accident and the flight incident necessary professional measures to detect and prevent similar cases initiative and make proposals. Not in any form of professional examination its purpose is to investigate and establish fault or liability.

KBSZ

1/23

2008-226-4P

The present investigation

- Act XCVII of 1995 on Aviation. in law,
 - International Civil Aviation, Chicago, December 7, 1944
XLVI of 2007 on the promulgation of the Appendices to the Convention law
in Annex 13,
 - air, rail and waterborne accidents and other traffic incidents
CLXXXIV of 2005 on the professional examination of Act (hereinafter:
Kbvt.),
aviation accidents, incidents and aviation
123/2005 on the rules for the professional examination of disorders (XII. 29.)
Based on the provisions of the GKM decree,
 - or the Public Procurement Act. unless otherwise provided by the administrative authority procedure
and CXL of 2004 on the general rules of service. law
carried out in accordance with the provisions of the Road Safety
Organization.
- A Kbvt. and 123/2005. (XII. 29) GKM Decree together is the following EU law
to comply with the following acts:
- (a) Council Directive 94/56 / EC of 21 November 1994 on civil aviation
on the basic principles for the investigation of accidents and incidents,
 - (b) Directive 2003/42 / EC of the European Parliament and of the Council of 13 June 2003
on occurrence reporting in civil aviation.

The competence of the Transport Safety Organization is regulated by Decree 278/2006. (XII. 23.) Korm.
based on this Regulation.

According to the above rules

- The Organization for Transport Safety in the event of an accident and serious injury
you must investigate an incident.
- It may be investigated by the Road Safety Organization at its discretion
incidents or incidents which:
in their opinion, they could have led to a traffic accident in other circumstances
would be.
- The professional investigation is independent of the traffic accident or other traffic
other administrative authority, infringement or
from criminal proceedings.
- In the course of the technical examination, in addition to the legislation referred to, ICAO Doc
6920 "Aircraft Accident Investigation Manual" shall apply.
- This Final Report is not binding and is not subject to appeal
can be initiated.

There was no conflict of interest with the members of the Committee of Inquiry. The professional
persons involved in an investigation in other proceedings in that case
they may not act as experts.

The IC is obliged to keep and not make available to another authority a
during a professional investigation
the holder could have refused to disclose the data on the basis of law.

KBSZ

2/23

2008-226-4P

This Final Report

based on the observations made by the IC, adopted by the Director-General of the TSB and the comments sent to those concerned, as defined in the Regulation, for the purpose of
Draft final report served.

Simultaneously with the sending of the draft Final Report, the Director General of the TSB notified the stakeholders on the date of the final meeting and invited the parties concerned to
organizations.

The SC prepared the Final Report taking into account the comments received.

At the closing meeting on 15 September 2009, the following organizations represented:

- the pilot's family,
- a legal representative of the ambulance family,
- the operator's chief executive, chief engineer and chief pilot,
- a representative of the repair and maintenance organization,
- members of the Vb,
- Legal Adviser to the TSB,
- Head of the Aviation Department of the TSB.

After the final discussion, the TSB will send the Final Report in the legislation to specific recipients and publish it on its website.

DEFINITIONS AND ABBREVIATIONS

ADRS	Aircraft Data Recording System aircraft data recording system
AGL	Above Ground Level above ground level (height)
BEA	Bureau of Enquêtes and Analysis the French accident investigation body
BFU	Bundesstelle für Flugunfalluntersuchung the German accident investigation organization
CAD	Caution and Advisories Display display showing warnings and status indications
CARS	Cockpit Audio Recording System cabin sound recording system
CVR	Cockpit Voice Recorder cabin sound recording equipment
DECU	Digital Engine Control digital gear control unit
ECD	Eurocopter Deutschland
FADEC	Full Authority Digital Engine Control full digital drive control
FDR	Flight Data Recorder flight data recorder
FIC	Flight Information Center flight information center
GKM	Ministry of Economy and Transport
HungaroControl	Hungarian air navigation service
ICAO	International Civil Aviation Organization International Civil Aviation Organization
KBSZ	Road Safety Organization
Kbvt.	Air, rail and water accidents and more on the professional investigation of traffic accidents CLXXXIV. law
KHVM	Ministry of Transport, Communications and Water Management
LAN radar	radars connected to a local area network (LAN) radar image generated from its data

LHBP	Budapest Ferihegy Airport
MATIAS	M agyar A u T omated and I ntegrated A ir traffic control S ystem automated integrated air traffic management system
METAR	Met éorologique The aviation R égulière regular airport weather report

KBSZ

4/23

2008-226-4P

NKH LI	Aviation Directorate of the National Transport Authority
NTSB	National Transportation Safety Board the U.S. Central Accident Investigation Board
OEI	One Engine Inoperative an engine is inoperable
OMSZ LM	National Rescue Service Air Rescue Kht
QNH	atmospheric pressure- Q - at Nautical Height altitude relative to mean sea level pressure
RPM	Revolutions Per Minute speed
TMA	Terminal Manoeuvring Area airport proximity
Vb	Committee of Inquiry
VEMD	Vehicle and Engine Management Display aircraft and engine parameters display
WU	Warning Unit warning signal generating and display unit

2008-226-4P

SUMMARY OF THE CASE

Case category	aviation accident
manufacturer	Eurocopter Deutschland GmbH
type	EC 135 T2
sign of majesty and registration	HA-ECE
serial number	0359
Aircraft owner	Raiffeisen-Leasing GmbH
tenant	Helikopter Air Transport GmbH, Innsbruck, Austria
operator	OMSZ Légcueő Kht
date and time	July 31, 2008 1:43 p.m.
Case place	Kiskunlacháza DK 6 km
Case number of deaths	2
in connection with number of seriously injured	2
The extent of damage to the aircraft was	destroyed
State of registration	Republic of Hungary
Registering authority	NKH LI
Production inspection authority	Luftfahrt-Bundesamt, Germany
Competent based on the location of the case	KBSZ
investigating body	
Time used in the final report	LT

Announcement, notifications

The case was referred to the TSB on July 31, 2008 at 2:22 pm by Budapest Férihegy reported by the competent fire officer of the airport.

THE OFFICER OF THE TSB

- On 31 July 2008, at 2.30 pm, the case was reported by the TSB on duty leader and then
- On 31 July 2008, at 2.11 pm, he informed the NKH LI duty officer.

The TSB covers aviation accidents, incidents and aviation CLXXXIV of 2005 on the rules of professional examination of disorders. pursuant to § 10 (14) and § 15 (2) of the Act: notified the German investigating body (BFU) as the representative of the State designing and manufacturing the helicopter; the French investigator (BEA) as the representative of the State producing the helicopter engines; the helicopter manufacturer (Eurocopter); the engine manufacturer (Turbomeca); the Austrian investigator organization as a representative of the state of the owner. The TSB also recorded the contact the U.S. Investigation Organization (NTSB) as the helicopter's engine controller representative of the State of manufacture of the system.

Committee of Inquiry

On 31 July 2008, the Director General of the TSB for the Investigation of Air Accidents has appointed the following Committee of Inquiry (hereinafter referred to as Vb):

leader	János Eszes	accident investigator
members of:	István Papp	accident investigator
	Zoltán Németh	accident investigator
	János Horváth	accident investigator
	Mihály Lesták	accident scene
	Dr. Máté Róbert	doctor specialist
	Sárközi Szilárd	meteorologist expert

KBSZ

6/23

2008-226-4P

Event scan overview

The World Cup began on 31 July 2008. Eurocopter and Turbomeca experts and an authorized representative of the BFU to Budapest on 1 August arrived and joined the study.

The SC took the following measures during the investigation:

- carried out an inspection of the wreckage of the aircraft and the scene of the accident,
- Took fuel samples on site from the helicopter and from Budaörs and at the Balatonfüred base from fuel tanks and filling cars, these sent for examination,
- transported the wreck to the rented hangar of the TSB for further investigation,
- arranged for the battery to be inspected by a specialist workshop,
- requested a meteorological opinion at the time of the accident of the prevailing weather in the area conditions
- asked the German Investigative Organization (BFU) for the on-board EuroNav GPS device to read your memory,
- Requested the data recorded by the on - board Tetra telephone equipment from your operator,
- Requested from HungaroControl the radio broadcasts related to the accident and telephone call logging and recorded by MATIAS radar and LAN radar radar images,
- sent the engines to the manufacturer for further examination,
- sent the DECU engine control electronic equipment to the NTSB possibly for reading recorded data and for further investigations,
- requested the French Investigative Organization (BEA) to include the memory module testing of on-board electronic equipment,
- heard the ambulance doctor as a witness, who was involved in the helicopter at the time of the accident was on board
- listened to witnesses in settlements along the route of the aircraft me,
- asked for the hospital's final reports of the injured and the autopsy of the deceased minutes.

A brief overview of the case

HA-ECE registered MEDIC-14 rescue helicopter on 31 July 2008 early in the afternoon he went from Paks to Budapest with a burn-injured patient.

The helicopter's radar signal disappeared from the radar screen at 1:43 p.m., local time. Disappearance The last marked position before Kiskunlacháza was 2.2 km in the direction 197 °. With the pilot

thereafter, neither a radio nor a cell phone connection could be established.
 Minutes later, several passenger planes signaled to HungaroControl that
 Flying in the area of Ráckeve-Kiskunlacháza, he received signs of an alarm. At the same time a
 ambulance aboard a helicopter contacted the cell phone
 OMSZ on duty, announced that their helicopter had crashed and urgent medical attention
 asked for help.
 The aircraft in distress was first found by the MEDIC-17 rescue helicopter.
 The helicopter you are looking for hit the ground and overturned, its tail holder and slides
 torn off, the cabin severely deformed. One of the 5 people on board is one

KBSZ

7/23

2008-226-4P

lost his life on the spot, one person is serious and life-threatening, two people are serious,
 and one person suffered minor injuries. (Life - threatening injury
 the person died in hospital three days later.)

1. FACTUAL INFORMATION

1.1 The course of the flight

On July 31, 2008, the MEDIC-14 rescue helicopter from the Budaörs site
 alerted a burn-injured child from Paks to Budapest in an emergency
 to transport. The helicopter landed at Paks at 1:22 p.m., picked up the injured and
 his attendant and then took off at 1:25 p.m. After the take-off in Paks, 13 hours 28
 established a radio connection on the FIC frequency. The FIC is receiving the notice
 after informing the pilot of the helicopter about a significant amount of traffic that the pilot had
 acknowledged. The helicopter varies according to the on - board GPS data (100-170 meters
 above ground level) at a speed of 240 km in a northerly direction.
 Based on the analysis of the electronic engine control unit (DECU) data a
 at 19 minutes after turning on the blocks (i.e. approximately 13 hours 42 minutes)
 the helicopter's right-hand engine stopped while the left-hand engine stopped normally
 operated. Subsequent technical examination finding
 it was found that the DECU unit of the right-hand drive was defective, which is better
 may have caused the gear unit to stop. According to the radar image, the helicopter is 13 o'clock
 At 42 minutes he rose to an altitude of 1300 feet and then lost intensely
 finally, the radar signal at 13.43 minutes from Kiskunlacháza 2.2 km
 197 disappeared in direction 0 . The on-board alarm is switched on at landing. THE
 MEDIC-17 rescue helicopter checked in at FIC at 1:57 p.m.
 and reported flying to Dömsöd in search of MEDIC-14.
 At 2:10 p.m., he reported finding the crashed MEDIC-14
 rescue helicopter and land at the scene. (Coordinates measured by Vb: N 47 ° 8 '20 "
 E 019 ° 3 '33 ".)

1.2 Personal injuries

Injuries	Staff	Passengers	Other persons
Deadly	2	-	-
Serious	1	1	-
Light	-	1	-
Not damaged	-	-	-

1.3 Damage to the aircraft

The aircraft concerned was destroyed.

1.4 Other damage

The aircraft landed on an agriculturally cultivated area (stubble). When catching soil a helicopter overturned and smashed, pieces scattered. The location upon completion, the wreckage and debris were removed.

Kerosene leaked from the damaged fuel tank and seeped into the soil. THE IC has no information on the extent of the environmental damage caused.

No other damage was brought to the attention of the IC until the end of the investigation.

KBSZ

8/23

2008-226-4P

1.5 Staff details

1.5.1 The pilot of the aircraft

Age, gender	53 years old, male
Professional permission validity	12/31/2008
Professional Health	9/3/2008
Qualifications	CPL (H)
Privileges	Instructor, flying, lifting
Altogether	4699 hours, 10750 take-off
He flew time / take-offs number	13 hours 28 minutes in the previous 30 days
	In the previous 7 days 3 hours 45 minutes
	In the previous 24 hours 1 hour 57 minutes
Total on the type concerned	201 hours 58 minutes

Distribution of all hours flown: 2279 hours by helicopter, fixed wing on the plane 2420 hours.

1.6 Aircraft details

1.6.1 Validity of the certificate of airworthiness: 09.11.2008.

1.6.2 Aircraft operating time

	flew time	number of landings
Since production	1170 hours 28 minutes	31184
Since last maintenance	43 hours 40 minutes	220

1.6.3 Aircraft engine life (type: ARRIUS 2B2)

Left gear (serial number 32155)

	flew time
Since production	1170 hours 28 minutes
Since last maintenance (100 hours)	43 hours 40 minutes

Right gear (serial number 32156)

	flew time
Since production	1170 hours 28 minutes
Since last maintenance (100 hours)	43 hours 40 minutes

1.6.4 Aircraft load data

Empty crowd	1748 kg
Mass of fuel	110 kg
Mass of commercial load	330 kg
Altogether	2188 kg
Permissible total weight	2835 kg
The position of the center of gravity at the time of the incident	4132 mm
The permissible center of gravity zone	4180-4570 mm

KBSZ

9/23

2008-226-4P

Type of fuel used: JET A-1

The aircraft data had no effect on the course of the incident and is therefore additional their specification is not required.

1.7 Meteorological data

The pilot - in - command was independently informed before commencing the flight and studied the current weather report from METAR (Budapest Ferihegy) and considered it appropriate that:

Event-free summer weather in the accident area and at the time of day in question volt. Typical parameters:

- vision Over 10 km,
- the temperature +29 °C,
- air pressure 1019 hPa,
- the average height of the terrain is 94 meters,
- the clouds cloudless sky
- wind direction, speed eastern 2-3 m / s, sometimes with 7 m / s blows.

Weather conditions had no effect on the course of the event, therefore no further details are required.

1.8 Navigation equipment

The navigation equipment built into the aircraft worked properly.

The navigation equipment had no effect on the course of the event, therefore their specification is not required.

1.9 Connection

The communication equipment built into the aircraft worked properly.

The ground-based equipment worked as expected, the task were fit to supply.

The communication equipment had no effect on the course of the event, therefore, their specification is not required.

1.10 Airport information

The airport and temporary take-off and landing used by the aircraft on the day of the accident landing site parameters had no effect on the occurrence of the event, therefore

their specification is not required.

1.11 Aircraft data loggers

There is neither an on-board flight data recorder nor an on-board voice recorder on the aircraft the existence of these is the type and task of the aircraft concerned or not required by law.

The DECU blocks of the helicopter's engine control system are of the EuroNav type on-board GPS equipment, Warning Unit, VEMD block, and CAD block his memory recorded data during the flight, which were used by World Cup experts downloaded from the equipment and used in the accident investigation.

The Vb is connected to the system center by the Tetra telephone on board transmitted data was also used in the investigation.

KBSZ

10/23

1.12 Wreckage and impact data

The aircraft is in an agriculturally cultivated area with a cultivation direction of approx It hit the ground at an angle of 30 degrees to the ground. First, fenestron (completely covered tail propeller) the lower part hit hard, which is affected by the impact energy broken off, and to the right of the landing location to the right, about

It was 45 degrees, 20 meters away. After that, the tail holder was also broken. From this, the IC concluded that the helicopter had intense braking

in a position (i.e., with a raised nose). First the fenestron and then the right the rear end of the slide collided with the ground. Moments due to mass force as a result, the trunk began slightly to the right in direction of travel and to the left in tilt turn, then the left slider with its full weight breaking under the lower back of the torso one third of approx. It crumpled at a 45-degree angle. In the left rear sector a rotor blades beat into the ground. Then the torso fell forward to the left, the cabin floor due to its deformation, the pilot's seat with the strapped pilot was torn off and the first he fell out of the cabin through the windshield. Since the fuselage of the helicopter is a composite material, the stiffness of the structure due to the combined intense bending-twisting load weakened and the cabin significantly deformed. The trunk collided with the ground, it snapped, then turned to the right and to its left relative to the direction of travel he stopped leaning. The on - board battery came out of place when it crashed and it was found at a distance of about 27 meters from the wreck, in the direction of flight.

Vb is the aircraft's operating instructions scattered around the wreckage of the aircraft found (the metal clips on the plastic folder were open) while the rest on board document was in the storage between the first meetings.

A photo of the wreckage of the aircraft can be found in No. 14. can be found in Annex.

In examining the wreckage, the IC found that:

When testing engines:

- the right engine was intact within the limits of visibility, the opinion of the IC most likely did not work at the time of landing,
- a small amount of soil and crop residues in the intake manifold of the left gear unit was visible, the nozzle was deformed due to the fall. A Vb In its view, the engine was not operational at the time of the landing, and residues due to the suction effect generated by the exhaust compressor may have entered the intake manifold,
- there was fuel in the engine fuel system filters.

When testing the fuel system:

- detached from the installation site of the two-compartment consumption tank at the time of landing,

- there was fuel in the tanks and in the system.

On the spot, the IC checked the filters in the fuel system, fuel sample taken from the wreck, as well as a sample of all the charging options at the site water. The filters were judged clean by the IC. The fuel samples are laboratory examination result Based on the fuel water- and solid its impurity content was below the permissible limit.

When testing the electrical system:

- the condition of the on-board battery during the bench test is electrical was considered good in terms of parameters. Battery cover a it was indented on impact with the ground, but the cells were not damaged. Other electric investigation due to severe damage to the helicopter, the IC had no way finish,

KBSZ

11/23

2008-226-4P

- no external damage was visible on the alternators of the AC system. A Vb a Subsequent investigations found no evidence of onboard electrical network failure.

When inspecting rotor blades and rotor blade hubs:

- two of the rotor blades facing each other remained together but geometrically deformed, twisted; the other two shovel broken in the middle,
- the nature of the damage found on the rotor blades as a consequence identifiable cannot be the cause of the accident. Nature of injuries extremely low impeller refers to kinetic energy.

When inspecting the helicopter cabin:

- the bottom of the cabin is broken, the top is broken upwards, the entrance doors are missing,
- position of instruments:
 - variometer upwards 3 ft / sec,
 - 300 ft according to the altimeter QNH 1015 hPa,
 - bearing system at 350 °,
 - the time is 16 hours 29 minutes,
 - the radio altimeter is 30-40 feet,
 - impeller tachometer below 0%,
- position of controls:
 - the collective arm was in the upper position,
 - the differential control handles of the gears were in the neutral position,
 - a three-position switch on both gears on the control panel of the gear units
In the "IDLE" position, both FADEC switches were in the "OFF" position.

1.13 Medical examination data

- 1.13.1. Injuries to the ambulance located in the rear of the cabin: a his left arm, chest and head were injured in a plane crash. Left wrist fracture plate-screwed, surgically fixed.
- 1.13.2. Injuries to a female passenger in the rear of the cabin: Spine, ankle, head injured. X-ray and CT scan of a vertebral upper rupture of the occipital disc and nasal bone fracture were found. Ankle landscape

his jerk was placed in a plaster rail. During his stay, his complication did not developed, spinal fracture did not require surgical care.

1.13.3. The 2-and-a-half-year-old boy was more easily injured in the plane crash.

1.13.4. The pilot of the aircraft and the ambulance sitting next to him during the accident they lost their lives as a result of their injuries.

The pre-flight and in-flight psychophysical condition of the pilot is not regulated by the IC information.

Forensic medical examination

1.13.5. The chest, hips, legs and head of the pilot of the aircraft during the accident damaged. He lost consciousness. It took place on July 31, 2008 at 3 p.m. hospital admission. He died at the hospital on August 3, 2008.

KBSZ

12/23

2008-226-4P

Also taking into account the medical history, according to the autopsy report, death occurred violently, polytraumatization, multiple severe internal bleeding due to injuries due to traumatic shock. THE injuries, organ damage were so severe that it was intense treatment could not save the victim's life either.

According to the information of the Police Authority, the blood alcohol test was performed the result was negative.

1.13.6. The ambulance traveling in the left front seat is like that as a result of the accident he suffered serious injuries that lost his life at the scene. The based on historical data and autopsy, it can be determined that the person death by force, with rupture of the thoracic section of the main artery, a with spinal cord injury, multiple rib fractures, liver injury and multiple open fractures of the lower extremities associated with traumatic shock.

The main thoracic artery injury suffered was of such a serious nature that that death occurred inescapably.

By laboratory test (gas chromatographic method) from the blood An ethyl alcohol concentration of 1.047 mmol / l was detected. From urine testing could not be performed due to sampling vessel delivery meanwhile broken.

1.14 Fire

There was no fire in the incident.

1.15 The possibility of survival

The personnel were provided with protective equipment in accordance with the regulations. A Vb a during an on-site inspection, it was found that the staff members were in compliance used a seat belt and helmet.

The deformation dampers on the helicopter seats worked properly.

The connection nodes of the helicopter's slipper landing gear are large were torn off when landing at an angle.

When he crashed, he crashed along with the pilot's seat due to the deformation of the cabin floor from the cabin. The pilot's head is on the left side from behind by the helicopter cabin part a powerful blow hit him, which dented the helmet. He suffered a serious injury the pilot was taken to a hospital where he died three days later.

An ambulance traveling in the left front seat leaned to the left of the helicopter wrecked, his life could no longer be saved by the arriving ambulances.

The child transported on the stretcher was held in place by the lashing straps, who is like that way only more easily injured in the accident.

The IC found that the persons in the first row of seats were ground catchers mode and subsequent inertia movements (trunk advance) as a result of which they received a much higher load than in the rear of the cabin, the persons closer to the center of gravity.

KBSZ

13/23

2008-226-4P

Search and save

The on-board alarm was activated at the time of the crash and the signals transmitted. Two passenger aircraft also reported their purchase to HungaroControl.

After the helicopter crash, the ambulance doctor on board - himself severely injured - he called the OMSZ on call and for urgent help asked while pulling out of the wreckage the transported burn injured child and severely injured attendant and stabilized the severely injured pilot. The OMSZ alerted two rescue helicopters, but the exact location of the accident was then it was not yet known.

The MEDIC-17 rescue helicopter informed the FIC at 1:57 p.m. to fly to the Dömsöd area to search for MEDIC-14 at 2:10 p.m. reported finding a grounded MEDIC-14 rescue helicopter and lands on the spot. The second alerted helicopter, MEDIC-12, at 2 p.m. arrived at the scene at.

Military Operations of the Hungarian Armed Forces Joint Forces Command His headquarters at 13:58 minutes reported to the National Disaster Management A DG is on duty that an ambulance helicopter crashed in the Apaj area. THE helicopter on duty at the Szolnok Air Search and Rescue Service at 2:22 p.m. took off and arrived at the scene at 2:46 p.m., but had nothing to do, whereas two OMSZ rescue helicopters have meanwhile supplied and transported the injured. The SC found that the rescue was delayed by the fact that, although the The MEDIC-14 radar signal disappeared from the radar screen at 13:43, only 15 minutes after which the source of the alarm was identified.

1.16 Tests and experiments

On October 20, 2008, the World Cup is detailed at the BSZörs base of the OMSZ LM conducted a cabin test on the same type of rescue helicopter, stationary and operational next to the engine. During the study, the Vb observed and interpreted the gears operation of the instrumentation signals, examined the cabin ergonomics and received information from the pilot participating in the test activities to be carried out in emergency procedures.

Between 1-2 December 2008, at the request of the World Cup, BFU investigators will be Eurocopter At Donauwörth, a live flight and autorotation test was With 135 types of helicopters. The purpose of the test was to determine whether the standing the effect of disengaging the gearbox FADEC switch on the impeller

speed and observing how the helicopter is behaves during autorotation.

1.17 Description of the organizations involved

The characteristics of the organizations concerned did not affect the occurrence of the case, therefore, it is not necessary to detail them.

1.18 Additional information

In addition to the above factual data, the IC draws conclusions and safety recommendations considers that no other circumstance is relevant for the purpose of does not intend to disclose data.

Useful or effective methods of investigation

There were no non-standard methods used in the investigation need.

KBSZ

14/23

2. ANALYSIS

During the site, the IC found that the helicopter's rotor was low collided with the ground in a state of rotational energy, i.e., the rotation of the rotor it was low. This circumstance led to the conclusion that the helicopter was one his engine did not operate the rotor either, and the execution of autorotation did not succeeded.

This assumption was confirmed by the ambulance doctor's testimony that the pilot mentioned an engine shutdown on the on-board communication equipment in less than a minute before the helicopter landing at high speed.

The accident received great publicity in professional circles as well as at home and abroad in the press, not only because of its grave outcome, but also because it was the first case where the type of helicopter is likely to be dual engine shutdown occurred. The EC 135 helicopter is used in large numbers as a rescue helicopter in Europe and the United States. The World Cup is one of the most urgent its task, therefore, was to determine whether they had contributed any factors in the accident which suggest a structural defect, and may justify the partial or total restriction of flights of that type.

At the request of the IC, the BFU performed a readout of the on-board GPS memory and this reconstructed the helicopter's flight path as well as some of its features parameter (Annex 1).

The operator of the Tetra telephone system provided the helicopter to the IC reconstructed flight path based on data transmitted by the device on board and other parameters (Annex 2).

HungaroControl provided the IC with information on the accident radio traffic and telephone call logging; and MATIAS radar and LAN radar images recorded by radar (Annexes 3 and 4).

By comparing GPS, Tetra and radar data, the IC found the helicopter feature flight altitude and speed. According to them, the helicopter was pre-crash Variable in 5 minutes at altitudes between 100-170 meters and 240 km / h moving north in speed.

Testing of on - board electronic equipment

Because the helicopter has neither an on-board data recorder nor an on-board recorder with sound recording equipment, the IC decided to examine it on board

other, with memory and related to various operations electronic equipment capable of recording data in the hope that such data obtained in this way help to find out what may have caused the left gear performance degradation.

On 19 August 2008, the SC carried out the VEMD at the BEA site in France, Reading chips from CAD and WU equipment can be found there to extract information. The raw data is decoded by BEA and ECD performed by professionals. However, the data were not included for the study useful information (Annex 5).

The main directions of the study

In the opinion of the SC, one or a combination of the following reasons could have resulted in engine downtime:

1. failure of the fuel system,
2. fuel consumption,

KBSZ

15/23

2008-226-4P

3. mechanical failure of the gear unit,
4. failure of the electronic control of the gear unit,
5. operation of the engine emergency stop system,
6. accidental engine shutdown.

Examination of the fuel system

Vb during site detection and further investigation of the wreck in the fuel system found neither mechanical nor organic impurities nor mechanical or electrical fault.

At an early stage in the investigation, the SC considered it possible to that the shutdown of the engines was caused by fuel consumption. The helicopter its consumption tanks are capable of holding enough fuel for about 20 minutes.

If for some reason the main fuel tank is taking off in Paks transfer pumps would not have been turned on, so would the consumption tanks continuous recharging does not occur and so may be consuming tanks run out of fuel and the engine stops. However, during the study, Vb subsequently ruled out this possibility for the following reasons:

- the switches for the transfer pumps Vb in the "ON" position at the site which corresponds to the normal in-flight situation,
- the different volumes of the consumption tanks virtually exclude the two engines the possibility of simultaneous shutdown due to fuel shortages,
- visual and audible warnings to the pilot to deplete the fuel, and the IC considers it unlikely that the pilot will heed these signals would have left out
- Vb during the on-site more than 11 liters from the consumption tank fuels extracted.

Vb for laboratory testing of collected data as well as fuel samples based on *the results of fuel system failure and fuel excluded its consumption from the possible causes of the accident.*

Mechanical testing of gears

The World Cup was carried out on site and in the days following the accident by the gears externally screening. There was a sufficient amount of lubricating oil in the oil system of the engines, a

no metal chips were found on the chip marker plugs.

The Vb found the intake manifold of the right - hand drive in a clean, undamaged condition, and based on this, he assumed that the right engine did not work at the time of landing.

Vb is a small amount of plant parts and found ground, suggesting that the engine was still rotating when it collided with the ground occurred. The Vb was not found by foreign objects (such as birds) by the engine traces of intake.

The ribbed surface of the drive shaft from the left gear to the main gear his injuries also suggested that the rotor of the left gear it was in rotation at the moment of the collision.

The World Cup will be held on 20-21 August 2008 at the site of the engine manufacturer, Turbomeca (Tarnos, France) carried out an inspection of the engines in the presence of BEA representatives and bench inspection (Annex 6).

The gears were placed on a test bench by the factory technicians and removed for testing covers not required or impeding access to the engine, and

KBSZ

16/23

2008-226-4P

attachments and then examined with a boroscope the compressor, the gas generator turbine and the free turbine housing and rotor.

Mechanical damage to the right gear indicates that the gear is already stationary, when a collision with the ground occurred.

Internal damage to the left gear confirmed the Vb's view that the left the engine rotor was still rotating at the moment of landing.

During the bench checks, both engines started and their operating parameters complied with the regulations.

The left transmission torque transmitter on the test bench indicated a fault. As the gears DECU blocks record in-service failures of torque transmitters, the Turbomeca suspended further testing of the gears by testing the DECU blocks until the arrival of the result.

Examination of the engine control

The IC requested the NTSB to inspect the DECU gear controller electronic equipment up. Examination of DECU blocks in the presence of the head of the IC under the supervision of the NTSB at the electronics manufacturer Goodrich (Hartford, Connecticut, USA) in 2008. happened on September 9-10.

A report on the analysis of the data extracted from the memory of the DECU blocks is shown in Figure 7 is included in Annex.

There was an unfortunate error entering credentials when starting the scan, therefore, the engine serial numbers in the header have been reversed. The left gear the serial number is correct 32155 and the one on the right is 32156. In the Goodrich report these serial numbers are incorrect, interchangeable.

The DECU block on the right-hand drive did not communicate with the test equipment, so the Goodrich experts performed component-level fault detection on the block.

The fault was found to be built into a power supply for the overspeed limiter caused by capacitor failure. Due to a faulty capacitor, one resistor and one transistor also defective.

After replacing the panel containing the faulty parts, the DECU block was successful connected to the test equipment and the memory has been read. THE according to the read data from the time the DECU block on the right was energized

In 1099 seconds, the overspeed limiter is due to a faulty capacitor probably activated (Appendix 7, page 75, Power On Time). A DECU block The drive controller is energized immediately before starting the gear unit by turning on the DECU switch on the panel, so the Vb believes that the phenomenon occurred around the 19th minute after the DECU blocks were turned on. THE the mode switch on the right-hand drive was in the FLIGHT position (Annex 7, item 76). page, Discrete inputs, Bit 04). The current parameters of the right-hand drive are not justified the activation of the overspeed limiter.

Based on the evaluation of the data, the IC found that *the right gear was its DECU block due to overrun limitation module failure probably stopped.*

The memory of the left gear DECU block was managed without any problems to read. Based on the data, the left DECU was calculated from the time it was energized. It was detected in 1100 seconds due to overspeed issued by the right DECU engine shutdown, switched to single engine mode (OEI) and left gear to 2 operated in the forced mode for about 2.5 seconds (Fig. 7). Appendix, page 31, Duration of OEI Event and Type of OEI Event).

KBSZ

17/23

2008-226-4P

The mode switch on the left-hand drive was in the FLIGHT position (Annex 7, item 31). page, Discrete inputs, Bit 04).

The DECU data did not provide an answer to the question of what happened to the operating left with the gear unit after the right-hand gear unit has stopped.

In the days following the evaluation, Turbomeca informed the IC that in 2004 similar DECU failures occurred in two and 3 cases in 2006 and subsequent engine downtime (no accident). The Turbomeca in these cases subsequently issued a service bulletin in November 2006 and called a number of DECU blocks back to make the necessary changes. The crashed helicopter left the DECU block of the engine was included in the recall list, as required changes have been made. However, the DECU block of the right gear was not included in the callback list. The SC, considering these circumstances, on 2 October 2008 considered decided to issue a preventive security measure calling on the person concerned operators are aware of the risk of unexpected engine downtime (see **Safety Chapter 4) recommendations**).

There was no data in the DECU blocks memory that the torque transmitters were operating would have referred to his failure in the meantime. On 28 January 2009, at the request of the World Cup, Turbomeca under the supervision of the BEA, as a follow-up to the suspended engine test. the auxiliary equipment housing was dismantled and the torque transmitter was inspected drive shaft. It was found that the shaft at the time of the helicopter crash deformed (Annex 8).

During the investigation, the IC found no evidence that the left gear would indicate a technical defect leading to a failure.

The IC continued the investigation to find out what might have caused the left gear loss of power.

Emergency stop of the gear unit

In the event of an engine fire or other unforeseen event, the engines shall be inspected by the Warning Unit (9). Emergency stop under the red safety cover on the front of Annex can also be stopped with pushbuttons. Intelligent control only operates the fire extinguishing system if required. The SC found that no emergency shutdown occurred because there was no data in the unit's memory to issue such a command.

Accidental engine shutdown

According to the condition recorded at the site, *both are on the gear unit control panel gearbox three-position switch in the "IDLE" position and both FADECs switch was in the "OFF" position* (Appendix 10). This setting is for the gears keeps it at idle, which does not allow it to perform a flight. THE collective arm was in the upper position (Appendix 11), the gears were differential control and its grips were in a neutral position (Annex 12).

The first people to come to the rescue said they did not reach for the dashboard therefore, the Vb treated it as a fact that the position of the switches corresponded to the situation set in the moments immediately preceding the fall.

The operating mode switches of the gear units are three-position switches and are designed so that can only be switched from any position by pulling out the switch body (except for "IDLE" switch from position to "FLIGHT" position). In the picture taken during the scene it is clear that the end of the right-hand drive mode switch is dirty with earth, it may have collided with the ground when the cabin was destroyed. The Vb is Lufthansa Technik with the involvement of its experts in operation and repair, examined that whether it is possible to switch the switch from the "FLIGHT" position without pulling it out (which corresponds to normal flight mode) to "IDLE" (which corresponds to the location recorded that is, it is possible that the switch was tilted by the force of the collision.

KBSZ

18/23

2008-226-4P

During the experiment, the IC found that the switch without pulling out only the could be switched at the cost of permanent deformation (breakage) of the coupling body and housing. Other however, experience of accidents has shown that the force of a large-scale collision you can toggle the drive mode switches without the switch body would be deformed.

The Vb outlined two possible situations, which are the left gear and ultimately a helicopter ground collision they could drive.

Chapter 3 of the helicopter air operations manual describes emergency procedures if one of the engines stops, its emergency stop must be performed. However, the emergency stop operation clearly stipulates that the engine in question mode switch must be set to "OFF".

1. Switch the left gear to "IDLE" mode

If for any reason the switch changes from "FLIGHT" to "IDLE" would be in flight, the power of that particular engine will decrease, the power It is sufficient to maintain a ground impeller speed of 70%. The switch within a few seconds of reconnecting, the engine will return to its previous state performance level. In the opinion of the World Cup, the pilot is certainly would have turned the switch back to the "FLIGHT" position. But man reacts differently in a normal situation and differently in a stressful situation. Very it is possible that the effects following the changeover (sudden elevation and loss of speed, decrease in impeller speed) is so surprising and it was unexpected that the pilot was not even aware: all he had to do was switch back to "FLIGHT".

2. Switch the left gear to "OFF" mode

If, for any reason, the left-hand drive is stopped, so it was not possible to restart it until the gear was N1 speed did not fall below 17%. Due to the low flight altitude, the there would have been no time to restart, and the World Cup is unlikely to be an attempt occurred to restart the left drive.

None of the situations outlined are explained by the engine control panel

the position of its switches. However, since the investigation did not find proven left gear failure, Vb is intentional and missed considers engine shutdown to be the most likely cause of left engine shutdown.

On October 20, 2008, the World Cup is detailed at the BSZörs base of the OMSZ LM conducted a cabin test on the same type of rescue helicopter, stationary and operational next to the engine. During the study, the Vb observed and interpreted the gears operation of the instrumentation signals, examined the cabin ergonomics and received information from the pilot participating in the test activities to be carried out in emergency procedures. During the inspection the Vb is convinced that the switches on the center panel of the instrument panel are both available from the meeting. According to current instructions, there is only one switch a dashboard, which the aircraft driver instructs the left front seat space occupying an ambulance can operate: this rotor speed is ascending mode button for 3% increments (called Category The button). The IC also made sure that in the back of the cabin, the a person occupying a seat facing in the direction of flight between the front seats of the cabin due to the built-in storage element and the cover of the control rod panel located there he could not see the activities of the persons sitting in the first meetings.

KBSZ

19/23

2008-226-4P

Perform autorotation

Between 1-2 December 2008, at the request of the IC, BFU investigators visited the Eurocopter based on a sharp flight and autorotation test of an EC-135 type by helicopter. The purpose of the test was to determine whether the stationary gear was FADEC the effect of switching off the switch on the rotor speed, and observing how the helicopter behaves during autorotation.

Switching off the FADEC switch at 100% impeller speed a resulted in a 2% decrease in impeller speed when on the same side gear did not work. When the gear unit is running, the FADEC switch has no effect for the operation of the DECU as it is powered by an alternator driven by the engine performs. The FADEC switch is used when starting the gear unit and switches on the DECU to the on-board battery. Low vane speed warning beep is not on.

The helicopter proved to be well-flying in autorotation, but with lightweight construction due to the mode, the drive is a rotor with a low moment of inertia slows down within a short time when the pilot reacts late. In such a situation a collective lever with the least possible delay (this is about 1.5-2 seconds) must be reset and the angle of heel with the joystick must be must be properly adjusted to stabilize the impeller speed. The a summary report can be found in Annex 13.

Helicopter involved in the accident with a valid certificate of airworthiness had. According to the manufacturer, the certificate of airworthiness condition that the aircraft be capable of performing all the to perform flight mode, including autorotation. The 800 flew after hours part of a recurrent check is a check flight in which the high rotor speed warning signal must be checked operation. This operation must be performed in the air during autorotation, thus, this control is also an indirect control of the helicopter's autorotatory capabilities considered. The 800-hour inspection was carried out on the helicopter in November 2006. ***The the technical conditions of autorotation were met.***

When the engines were lost, the aircraft was outside the relevant type, a

in the danger zone determined on the basis of speed and flight altitude values. *The physical conditions of autorotation were met.*

The pilot-in-command was an experienced helicopter pilot who needed to be aware of the activities required during emergency procedures and at the skill level

he had to know. However, the World Cup does not rule out the possibility of a better one already increased due to the unexpected and unjustified loss of the side gear

the stressed pilot may have been disturbed by the shutdown of the second engine and the situation while evaluating the autorotation a few seconds later than necessary

he started. If autorotation is started with a delay, the speed of the rotor

it can fall back to a low value from which it is very difficult to recover it

speed required for autorotation. In the absence of sufficient impeller speed

the descent of the helicopter cannot be damped to the extent necessary by the ground clearance before.

The helicopter was about 170 meters above the ground in the moments before the accident flew at an altitude above. Based on GPS and Tetra data, the helicopter is 240 km / h

within 30 seconds of a reduction in cruising speed. The landing

the nature of and the fact that three persons survived the fall prove that *the pilot attempted autorotation.*

KBSZ

20/23

3. CONCLUSIONS

3.1 It can be directly related to the occurrence of the incident factual findings

The investigation revealed that the right-hand drive was most likely to shut down caused by a technical error.

Based on the results of the technical tests performed, the IC considers that the left there was no technical reason for the engine to stop. The Vb is therefore most likely to say that keeps the possibility that the left gear is in error - the already stopped right gear instead of being turned off.

3.2 Indirectly related to the occurrence of the incident factual findings that can be made

In the opinion of the World Cup, the experienced pilot of the aircraft is current altitude and terrain conditions with that type of aircraft is successful should have performed autorotation. The significant rate of descent and hard gripping of the ground suggest that the timely start of autorotation - for an unknown reason - some error has slipped.

3.3 It cannot be linked to the occurrence of the incident, risk factors

The SC did not find a risk factor.

4. SAFETY RECOMMENDATIONS

BA 2008-226-4_1: The IC recommends that aviation safety authorities:

bring unexpected engine downtime to the attention of organizations operating that type with particular regard to the fact that not in the recall affected drive control units may also fail. Aviation safety authorities they may take other measures within their competence.

BA 2008-226-4_2: The IC recommends to the helicopter manufacturer Eurocopter that the to promote flight safety, consider a maximum of 3180 kg installation of two-engine helicopters under take-off mass system (ADRS) and voice recording system (CARS).

BA 2008-226-4_3: The IC recommends to EASA that aviation safety To promote this, consider Category A for type A tasks in the case of twin - engined helicopters, an aircraft data recording system (ADRS); and sound recording system (CARS). installation.

BA 2008-226-4_4: Vb recommends fabrication and programming of the gear unit control unit supervisor Turbomeca company to consider the engines FADEC system review of its logic and the reliability of the overspeed limiting system increase.

BA 2008-226-4_5: The IC recommends to the operator that pilot retraining and pay special attention to emergency procedures during periodic inspections practical training, in particular on the implementation of autorotation.

KBSZ

21/23

2008-226-4P

BA 2008-226-4_6: The IC recommends to the manufacturer and operator that a emergency procedures detailed in Chapter 3 of the Air Operations Manual change the method of switching off the gear unit that has stopped for any reason.

The current specification is to turn the transmission control switch to the "OFF" position requires. Vb recommends that the mode be switched off before switching off the gear unit switching the switch to the "IDLE" position and checking the gearbox parameters, in order to avoid a possible incorrect gear selection and stop it immediately.

Responses to security recommendations and implementation informations

Response to BA 2008-226-4_1 recommendation

Turbomeca, which oversees the production and programming of engine control units KBSZ was informed that plans to issue the first half of 2009 [319 73 2128](#) No. a revised version of the Service Bulletin in which the original bulletin The range of DECU blocks to be recalled is extended by all DECUs block.

Official Journal of the European Aviation Safety Agency (EASA) dated 6 April 2009 in its reply, informed the IC that it had calculated for the aircraft type in question, a in - flight engine shutdown rate due to engine control failure can be said to be low and fully in line with current standards. The EASA also welcomed the Turbomeca DECU modernization measure plan. The SC safety recommendation was accepted by EASA with partial agreement.

Response to BA 2008-226-4_4 recommendation

Turbomeca plans to release No. [319 73 2130](#) (TU 130) in September 2009 Service Bulletin, applicable from 1 November 2009. A TU Amendment 130 disables the traction control in modes where it is not justified its use (for N2 speeds between 30% and 107%). The amendment

it is recommended to perform it on DECU blocks that have already undergone the TU 128 modification.

Response to BA 2008-226-4_6 recommendation

The operator modified the emergency procedures following the accident Memory List document in accordance with the Recommendation. THE compliance with the modified sequence of operations by the machine personnel every six months during the airworthiness review to be performed.

5. ANNEXES

- No. 1 Annex I: Helicopter flight path based on on-board GPS data
- No. 2 Annex I: The helicopter route is the Tetra satellite telephone system based on your data
- No. 3 Annex I: MATIAS radar image of the last minutes of a helicopter flight
- No. 4 Annex: Mosaic composed of LAN radar images
- No. 5 Annex I: Analysis of data stored in on - board display memory
- No. 6 Annex I: Result of bench test of engines
- No. 7 Annex 1: Result of reading DECU blocks
- No. 8 Annex 2: Left gear torque transmitter test report

KBSZ

22/23