FINAL RAPORT

On the flight safety investigation
Concerning the serious incident
Occurred near Niculești, Buzău county

CLASSIFICATION: Serious incident
Operator: C&I CORPORATION
Aircraft: EC 135 P2+
Registration: YR-CPC
Date and time: 28.11.2011 10:19 UTC
Location: N 45° 26,87' ; E 026° 44,57'
AKNOWLEDGEMENT

This REPORT presents data, analysis, conclusions and recommendations concerning the civil aviation safety, of the Civil Aviation Safety Investigation Commission appointed by the General Director of CIAS.

The flight safety investigation was conducted in accordance with the provisions of the Government Ordinance No. 51/1999 concerning the technical investigation of civil aviation accidents and incident, approved with amendments and additions by Law No. 794/2001, of the REGULATION (EU) No 996/2010 of the European Parliament and of the Council from 20 October 2010 on the investigation and prevention of accidents and incidents occurred in civil aviation and repealing Directive 94/56/EC and the provisions of Annex 13 to the Convention on International Civil Aviation signed at Chicago on 7 December 1944.

The objective of civil aviation safety investigation is preventing the occurrence of accidents and incidents, by effective determination of causes and circumstances that led to this occurrence and establishing the necessary recommendations for civil aviation safety and it HAS NOT THE PURPOSE of finding guilty, individual or collective responsibilities.

As a consequence, the use of this REPORT for other purposes than preventing the occurrence of accidents and incidents might generate misinterpretations.

In case of any divergence of interpretation of the final aircraft accident investigation report, the Romanian version shall prevail.
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SYNOPSIS

CLASSIFICATION: Serious incident
Operator: C&I CORPORATION
Aircraft: EC 135 P2+
Registration: YR-CPC
Date and time: 28.11.2011 10:19 UTC
Location: In the area of Niculesti Commune, Buzau County, geographical coordinates: N 45° 26’ 52.188” E 026° 44’ 34.1988”

The incident was notified to CIAS by phone, on 29.11.2011 and in written, being registered with the number 5307/06.01.2012. Based on the initial notification the occurrence was considered an incident. Afterwards, on 01.12.2011, based on the new information received and on the checking made to the aircraft, the occurrence was classified as serious incident and CIAS designated a civil aviation safety investigation commission for continuing the investigation and issuing the final report. CIAS has notified ICAO, EASA and BFU Germany about the occurrence.

There were appointed accredited representatives from:
BFU – Germany; BEA – France; C&I Corporation.

The representatives of Eurocopter Germany and Eurocopter Romania attended the investigation as advisors.

The flight on 28.11.2011 was carried out with three persons on board: a pilot and two passengers, on the route Oituz –Bucharest Baneasa Airport. In the area of the locality Suchea, Buzau County, the aircraft went into an extreme flight attitude and could only be recovered by the pilot after an substantial altitude loss. After the recovery the Pilot performed a successful emergency landing in the area of the locality Niculesti, Buzau County.

After the evacuation of passengers and the visual check of the aircraft, the pilot performed a flight for repositioning the aircraft from the point where it made an emergency landing to Bucharest – Baneasa Airport.

Based on the information obtained, CIAS, as a civil aviation occurrence investigation authority, issued the present final report.
1 FACTUAL INFORMATION

1.1 History of the flight

On 28.11.2011 at 09:55 UTC, the helicopter EC 135 P2+, registered YR-CPC, took-off with a passenger transport mission, from Oituz heliport (LRCC), with the final destination Bucharest – Baneasa “Aurel Vlaicu” International Airport (LRBS).

The pilot arrived at the heliport at 06.00 UTC, for preparing the flight announced since 27.11.2011. He monitored the helicopter fuel supply, carried out the pre-flight control, prepared the documents necessary to conduct the flight and he was informed on the meteorological situation for the mentioned route.

Around 09.50 UTC the two passengers arrived for boarding, the take-off was taking place at approximately 09.55 UTC.

During the flight on route, after almost 20 – 25 minutes, at an altitude of approximately 3000 ft, at about 2 min. from turning on the „ALT” and „HDG” superior modes of the autopilot (around the locality Suchea - N 45°24’ 34ˮ, E 026°35’13ˮ), at the speed of 120 Kts, in horizontal flight, the helicopter, without signalling any operation abnormality, had a sudden and violent yaw movement to the right, along with its roll (approx. 120 - 180°) and turn to the right side, nose down, descending pronouncedly in a spiral towards the ground (evolution according to the pilot’s statement).

During this movement the pilot’s headphones were pulled from his head, while his right foot was moved and placed between the rudder pedal and the right door pole, the pilot’s bust was „thrown” to the left, and the panel located under the indicators sunshade containing VNE (maximum allowable speed) data was separated from its fastening system and covered a part of the indications of board devices. During this sudden evolution the ELT device (Emergency Locater Transmitter) was switched on. The pilot noticed on the CAD signalling panel (Caution and Advisory Display) the switching on of the yellow signalling lamps: “YAW SAS” and “ACTUATION”.

He disconnected the superior modes of the autopilot (P.A.) and he managed to regain control of the aircraft, landing in the location with coordinates: N 45°26’52ˮ; E 026°44’34ˮ. From the moment the evolution started, until the aircraft re-entered in a controlled flight, the height loss was between 1500 and 2000 ft.
After landing, the pilot performed a visual check of the aircraft in order to determine the possible damages.

After this check, not finding failures that could have prevented further flight, the aircraft was moved in flight to Bucharest – Baneasa “Aurel Vlaicu” International Airport. This flight was performed without passengers on board, these being taken by another aircraft from the emergency landing place.

1.2 Injuries to persons

<table>
<thead>
<tr>
<th>Injuries</th>
<th>Crew</th>
<th>Passengers</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Serious</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Minor / None</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
1.3 Damage to aircraft

Exceeding the “Mast Moment” limits (66% for 10.4 sec and 78% for 5.4 sec);
- Hitting the main propeller’s blades to the rotor’s hub;
- Blades of the main rotor, mechanically overloaded;
- Right windscreen heavily scratched;
- Window cracking of the right sliding door;

1.4 Other damage

N/A.

1.5 Personal information

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licence</td>
<td>ATPL (H); Issued by A.A.C.R., valid until 08.04.2014 / Type rating EC 135 P2+ until 31.07.2012</td>
</tr>
<tr>
<td>Medical certificate</td>
<td>Valid until 07.04.2012</td>
</tr>
<tr>
<td>Flight experience</td>
<td>6 534 FH</td>
</tr>
<tr>
<td>Working time</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1.6 Aircraft information

<table>
<thead>
<tr>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft type and manufacturer</td>
</tr>
<tr>
<td>Serial number and manufacturing year</td>
</tr>
<tr>
<td>State and registration mark</td>
</tr>
<tr>
<td>Property of / Operator</td>
</tr>
<tr>
<td>Navigability certificate</td>
</tr>
<tr>
<td>Total flight hours</td>
</tr>
</tbody>
</table>
### Engines

<table>
<thead>
<tr>
<th>Engine type and series</th>
<th>TURBOPROPULSOR</th>
<th>TURBOPROPULSOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total flight hours</td>
<td>1378:45 FH</td>
<td>1378:45 FH</td>
</tr>
</tbody>
</table>

### 1.7 Meteorological information

In the area where the helicopter flew, depending on the available meteorological stations the situation was as presented in the tables below (reproduced in facsimile).
According to the analysis received from the National Administration of Meteorology, the airflow was from northwest sector and then from western sector. The high pressure gradients from middle levels certificated the existence of an intense wind in the mountain area. The satellite images first indicated the presence of a compact mass of clouds over the Meridional and Curvature Carpathians, but which decreased in the next hours.

1.8 Aids to navigation
N/A.

1.9 Communications
N/A.

1.10 Aerodrome information

The aircraft took-off from PA & CO heliport, ICAO indicative - LRCC, from the locality Oituz, Bacau County. The heliport is authorized by AACR, according to the Romanian civil aviation regulation RACR-AD-AADC, since 2008.

The scheduled destination airport was Bucharest – Baneasa “Aurel Vlaicu” International Airport, indicative ICAO – LRBS.

According to the message received by ROMATSA from COSPAS-SARSAT, which was generated by the reception of the signal light ELT (message retransmitted to the operator according to the procedures), and also in compliance with the ASR report transmitted to CIAS, according to RACR-REAC procedures, the aircraft landed in point of geographical coordinates N 45° 26.87'; E 026° 44.57', which means 45° 26' 52.188" northern latitude and 026° 44' 34.1988" eastern longitude.

1.11 Flight recorders

The aircraft wasn’t equipped with FDR and CVR flight recorders.
As a reference it was used data from the memory of FADEC (Full Authority Digital Engine Control).
1.12 Wreckage and impact information

N/A.

1.13 Medical and pathological information

The passengers suffered a psychological shock, requiring specialized assistance.

1.14 Fire

N/A.

1.15 Survival aspects

N/A.

1.16 Tests and research

The following technical check activities were performed by the aircraft manufacturer and by the manufacturers of some components:

- There have been decoded the data recordings from FADEC (Full Authority Digital Engine Control).
- Checking the flexible cable from the kinematic chain of the tail rotor control (Minute of EUROCOPTER ROMANIA CS 1817 / 25.01.2012).
- Checking the SEMA electromechanical actuators from the chain of rotation controls (Report issued by Safran – Sagem, QSC-2012-052-FV on 10.04.2012).
- Checking the hydraulic actuator from the chain of rotation controls (BFU Report from 01.03.2012).
- Checking and testing the tail rotor assembly of the type FENESTRON (Eurocopter Romania Report No. 2PP04-0166-12 from 28.02.2012).
- Checking the engines at their manufacturer (the right engine - Pratt and Whitney Canada Report, Customer Service Centre Europe GmbH DSR 0036-12 from 22.01.2012, the left engine – Engine Test Certificate MTU Maintenance 0076-13 from 17.09.2013).
- Checking and testing the main rotor blades at the manufacturer (The Reports issued by Eurocopter with the numbers 1294529/07.03.2012; 1294530/07.03.2012; 1294531/07.03.2012; 1294532/07.03.2012.
- Checking the data registered in EURONAV system (message from EUROCOPTER GERMANY from 11.07.2012 and message from C&I Corporation 211/17.05.2012)
- Checking the friction system of collective pitch lever control (EUROCOPTER ROMANIA Report CS 2746 / 25.11.2013).
- Reproducing the flight dynamics in the flight simulator for this type of helicopter, at the manufacturer’s headquarters (The minute of the visit from 21.05.2012 at EUROCOPTER GERMANY).
- These checks have been performed in the investigators’ presence, who have participated in conformity with the applicable regulations and international standards.

<table>
<thead>
<tr>
<th>Check</th>
<th>Location</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>The flexible cable from the kinematic chain of flight controls - FENESTRON</td>
<td>Romania</td>
<td>The cable fit into normal parameters.</td>
</tr>
<tr>
<td>SEMA electromechanical actuators</td>
<td>France</td>
<td>The actuators were completely functional.</td>
</tr>
<tr>
<td>FENESTRON hydraulic actuator, from the chain of rotation controls</td>
<td>Germany</td>
<td>No anomalies were found. A micron sized piece of shaving found in the oil collector of the bench doesn’t come from the actuator components and it couldn’t have influenced its functioning.</td>
</tr>
<tr>
<td>Tail rotor assembly of the type FENESTRON</td>
<td>Romania</td>
<td>The assembly worked normally and there were only minor signs of usage, common during operation.</td>
</tr>
<tr>
<td>Blades of the main rotor</td>
<td>Germany</td>
<td>The blades need to be replaced due to overloading.</td>
</tr>
<tr>
<td>Engines checking</td>
<td>Germany</td>
<td>Engine s/n BJ0457: over speed 117% time of 2.42 Sec; Engine s/n BJ0458: over speed 116% time of 2.83 Sec, The engines were checked and they only needed normal work for returning into service.</td>
</tr>
<tr>
<td>Data from the EUR-NAV system</td>
<td>Germany</td>
<td>The system was not used and there weren’t found any kind of recordings.</td>
</tr>
<tr>
<td>Friction system of the collective pitch lever control.</td>
<td>Romania</td>
<td>No functional anomalies were found.</td>
</tr>
<tr>
<td>The check of the aircraft in flight by a manufacturer's test pilot in order to return it into service</td>
<td>Romania</td>
<td>The aircraft worked normally.</td>
</tr>
</tbody>
</table>

Table with the findings resulted after the tests and checks that have been performed
Reproducing the flight dynamics in the flight simulator:

- The activity in the simulator was made with the direct participation of the pilot involved in the occurrence.
- In order to reproduce the evolution of the aircraft, there were established the following flight parameters which are considered to be parameters from the initial moment of entering in uncontrolled evolution:
  - Initial flight level 3000 ft;
  - Switched to the autopilot with the additional functions “Heading” and “Altitude”
  - Indicated speed 100-120 Kts.

- These sequences are the starting point for the tests performed into the simulator, in two phases:
  - The first test without the movement of the simulator;
  - The final tests with the movement of the simulator.

- Within the tests there were introduced the following situations:
  - Flight with defective rotation servo-control;
  - Pressing the rudder pedal at maximum to the right at the mentioned parameters;
  - Total loss of tail transmission;
  - Sudden lowering of collective pitch lever control.

1.17 Organizational and management information

N/A.

1.18 Additional information

After the occurrence of the accident, the aircraft involved in the incident, the helicopter type EC 135 P2+, registered YR-CPC, was moved in flight, by the same pilot in command, at Bucharest – Baneasa Airport. The passengers on board of the helicopter YR-CPC were taken by another aircraft of the same operator from the emergency landing place and transported to destination.

1.19 Useful or effective investigation techniques

N/A.
2 ANALYSIS

From the results analysis of all the tests performed for this aircraft no technical failure was revealed.

Analysing the evolution from the simulator combined with the pilot’s statements and the ones of the passengers, a possible scenario can be created, being based on the objective, limited information provided by FADEC. Thus at a speed of 120 Kts and at the altitude of 3000 ft, the aircraft had a sudden yaw movement to the right, the cause of which couldn’t have been highlighted. In the moment of that sudden movement onset, the body of the pilot was laterally thrown in the left side (according to his statement) due to the fact that he didn’t have his hands on the controls and that he didn’t wear the whole safety belt system (the shoulder belts). Simultaneously, the pilot lost the radio headset from his head, conditions in which he wasn’t able to hear neither the audio warnings, nor to communicate with the passengers. In this displacement of the pilot’s body, the collective pitch lever was involuntarily, abruptly left on minimum position, the aircraft entering in a spiral descending evolution, to the right side. The amplification rate of the spiral descent was determined by this sudden movement of the collective pitch lever control (at the speed of 120 Kts) and by the reaction of the autopilot with the connected elevation channel. It is possible, that when the pilot involuntarily actioned the collective pitch, to might have touched also the windshield wiper contact, either the one located on the collective pitch lever, or the one located on the control stick, this explaining the position in which the windshield wiper stopped.

Finally, the pilot managed to regain the balance and the control over the controls, redressing the aircraft from this evolution, after a loss of altitude of almost 1500 – 2000 ft.

It is possible that during the spiral descent evolution with high speed and the collective pitch lever on minimum position, to might have reached the moment of overcoming the maximum admitted rotations at engines and rotor. The moment of performing the manoeuvre of existing from this evolution is the moment in which “mast moment” was registered at the main rotor, and the panel from the devices sunshade detached from the fastening system. Subsequently, the pilot controlling the aircraft looked for a landing place and performed an emergency landing in complete safety.

The passengers were affected in this evolution because they weren’t wearing the safety belt.

After performing this landing and stopping the engines, the passengers descended from the aircraft, being subsequently taken by another aircraft and transported to destination. The pilot made a visual check of the aircraft and being in telephone contact with Eurocopter Romania, he performed two more starts of the engines on ground for verification. After that, assuming the responsibility and without waiting for the operator’s technical team which was on its way, team that might have made a detailed control of the
aircraft, he moved the aircraft in a technical flight, from the emergency landing place to Bucharest – Baneasa Airport.

The engines and the main rotor critical parameters records were confirmed after the checks and the tests performed by the manufacturers. As a result, for restoring the aircraft in airworthy condition it was necessary to replace the set of main blades and to make repairs to the engines.

### 3 CONCLUSIONS

#### 3.1 Findings

1. The original cause for the onset of this occurrence couldn’t be determined.

2. After testing it results the necessity of replacing the blades of the main rotor and of repairing the two engines, as a consequence of the mechanical overload during the evolution/incident.

3. According to the registered data, in the initial phase of the occurrence, it was noticed a minimum value of the collective pitch lever. It should be mentioned that the collective pitch control can only be mechanically actioned by the pilot.

4. The following have been revealed during the simulator tests:
   - This helicopter type, at the movement speed of 100-120 Kts in horizontal flight, does not yaw with more than 10° even in the situation of voluntary pressing, through a sudden movement, of the rudder pedal at maximum value.
   - The displacement of the panel from underneath the devices sunshade, that contains data about VNE, could have only taken place in the final evolution phase of redressing the helicopter.
   - The evolution recognized as being the closest to the real situation was the one with the collective pitch control on minimum threshold and cyclic pitch control on right-rear position.
   - According to the recordings in the simulator, during the spiral evolution of the aircraft, there were reached overloads that normally allowed the activation of ELT signal light (Emergency Locater Transmitter).
   - The evolution in the simulator is limited by the fact that the simulator is not designed for acrobatic flight tests and for evolutions at the aircraft performances limit.

5. When the accident took place there were activated the “ALT” and “HDG” superior modes of the autopilot and there weren’t activated the “APP”, “NAV”, “GS”, “VS”, “IAS” modes.

6. From the recordings on board of the helicopter (FADEC) it resulted that there were exceeded the maximum admitted values for free turbine speed of both engines and also the “Mast Moment” recording indicates mechanical overloads at the level of the main rotor hub.
(7) After landing and stopping, within the performed checks, the pilot made two starts on ground to highlight possible faults, occasion with which he noticed that, after switching “FADEC” on, it was displayed “ENG EXCEDEED” at both engines and when trying to switch on the autopilot’ “TEST” button, it doesn’t respond to the control, even if the “ON/OF” and “A.TRIM” buttons could have been involved. At a second attempt he managed to switch the autopilot “TEST” button on and the test was successfully performed.

(8) The civil aviation safety investigation commission didn’t find any functional abnormality after performing the test at the friction system of the collective pitch control.

3.2 Causes of the occurrence

Human error occurred on the background of inadequate use of the safety belts, as a consequence of an initial cause that couldn’t have been established.

3.3 Safety recommendations

RCAA will take measures so that this final report will be publicized to all the operators of EC 135 P2+ helicopters, drawing the attention, especially on the causes of this occurrence.

Note: The documents and analysis objects used for the development of this flight Safety Investigation Report are confidential and are stored by the Civil Aviation Safety Investigation and Analysis Centre, according to legal provisions.