COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-103/CENIPA/2013

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-DJC**
MODEL:	**EC 130 B4**
DATE:	**30MAY2013**

NOTICE

According to the Law nº 7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System – SIPAER – is responsible for the planning, guidance, coordination and execution of the activities of investigation and prevention of aeronautical accidents.

The elaboration of this Final Report was conducted taking into account the contributing factors and hypotheses raised. The report is, therefore, a technical document which reflects the result obtained by SIPAER regarding the circumstances that contributed or may have contributed to triggering this occurrence.

The document does not focus on quantifying the degree of contribution of the different factors, including the individual, psychosocial or organizational variables that conditioned the human performance and interacted to create a scenario favorable to the accident.

The exclusive objective of this work is to recommend the study and the adoption of provisions of preventative nature, and the decision as to whether they should be applied belongs to the President, Director, Chief or the one corresponding to the highest level in the hierarchy of the organization to which they are being forwarded.

This Report does not resort to any proof production procedure for the determination of civil or criminal liability, and is in accordance with Appendix 2, Annex 13 to the 1944 Chicago Convention, which was incorporated in the Brazilian legal system by virtue of the Decree nº 21713, dated 27 August 1946.

Thus, it is worth highlighting the importance of protecting the persons who provide information regarding an aeronautical accident. The utilization of this report for punitive purposes maculates the principle of "non-self-incrimination" derived from the "right to remain silent" sheltered by the Federal Constitution.

Consequently, the use of this report for any purpose other than that of preventing future accidents, may induce to erroneous interpretations and conclusions.

N.B.: This English version of the report has been written and published by the CENIPA with the intention of making it easier to be read by English speaking people. Taking into account the nuances of a foreign language, no matter how accurate this translation may be, readers are advised that the original Portuguese version is the work of reference.

SYNOPSIS

This is the final report of the EC-130-B4 aircraft (registration PR-DJC) accident, occurred on 30MAY2013. The event was classified as “Ground Operations” (RAMP).

After landing at the helicopter pad of *Tibagi* Farm (SION), in *Guaramiranga, Ceará,* the pilot left the cockpit to assist passengers to disembark while the helicopter kept the rotors running.

Shortly after, the aircraft initiated a forward movement and tipped over on its left side.

The aircraft sustained substantial damage.

The pilot and four passengers were uninjured. One passenger suffered serious injuries.

An accredited representative from *Bureau d'Enquêtes et d'Analyses* - BEA, France (aircraft project State), was designated for participation in the investigation.

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	Brazil's National Civil Aviation Agency
BEA	*Bureau d'Enquêtes et d'Analyses*
CBA	Brazilian Code of Aeronautics
CENIPA	Aeronautical Accident Investigation and Prevention Center
IFR	Instrument Flight Rules
IFRH	Helicopter Flight IFR rating
IPEV	Brazil's *Instituto de Pesquisas e Ensaio em Voo* – Flight test and research Institute
NG	Gas generator rotation speed indication
NR	Rotation speed
PCH	Commercial Pilot Licence- Helicopter category
RBHA	Brazilian Aeronautical Certification Regulation
ROTAER	Brazil's Air Routes manual
SBFZ	ICAO location designator - *Pinto Martins* International Airport, *Fortaleza, Ceará*
SIPAER	Aeronautical Accident Investigation and Prevention System
SION	ICAO location designator - *Tibagi* Helipad, *Guaramiranga, Ceará*
UTC	Universal Time Coordinated
VEMD	Vehicle Engine Monitoring Display

1. FACTUAL INFORMATION.

Aircraft	**Model:** EC 130 B4 **Registration:** PR-DJC **Manufacturer:** Eurocopter France	**Operator:** DEIB OTOCH S.A.
Occurrence	**Date/time:** 30MAY2013 - 1500 UTC **Location:** *Tibagi* Farm helipad (SION) **Lat.** 04º15'05"S **Long.** 038º57'06"W **Municipality – State:** *Guaramiranga - Ceará*	**Type(s):** Ground Operations (RAMP) **Subtype(s):**

1.1 History of the flight.

The aircraft took off from a private airstrip at the metropolitan area of *Fortaleza, Ceará*, known as *Dunas*, to Tibagi Farm at Guaramiranga, Ceará, with one pilot and five passengers on board for personnel transportation flight.

After landing, the pilot left the cockpit to assist passengers to disembark while the helicopter kept the rotors running. Shortly after, the aircraft initiated a forward movement and tipped over on its left side.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	1	-
Minor	-	-	-
None	1	4	-

1.3 Damage to the aircraft.

The aircraft sustained substantial damage to main rotor assembly, transmission case and rear power train. It also sustained minor damage to skids and tailboom fairing.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Hours Flown	
	Pilot
Total	3,200:00
Total in the last 30 days	12:35
Total in the last 24 hours	00:00
In this type of aircraft	12:00
In this type in the last 30 days	05:30
In this type in the last 24 hours	00:00

N.B.: Data provided by the pilot.

1.5.2 Personnel training.

The pilot took his helicopter private pilot course at *Aeroclube do Ceará* in 1999.

1.5.3 Category of licenses and validity of certificates.

The pilot held a Helicopter Commercial Pilot Licence and was helicopter flight IFR (IFRH) rated.

1.5.4 Qualification and flight experience.

The pilot was certified and had experience in the type of flight.

1.5.5 Validity of medical certificate.

The pilot had valid aeronautical medical certificate.

1.6 Aircraft information.

The serial number 3753 aircraft was manufactured by Eurocopter France in 2003, and was registered to Private Aerial Service category.

Its airworthiness certificate was valid.

The airframe, engine and rotors logbook records were up-to-date.

The aircraft last inspection (type “2,500 hours / 72 months”) was fulfilled on 05MAR2013 by *Tucson Aviação Ltda.* workshop, in *São Paulo.* At the time of the accident, the aircraft had accrued eight hours of operation since the inspection.

1.7 Meteorological information.

Visual meteorological conditions prevailed for the flight.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The accident helipad was not registered in the Air Routes manual (ROTAER). However, the pilot showed a copy of the 17APR2012 ANAC ordinance, number 726/SAI, in which the helipad was registered in the aerodromes cadaster as SION.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The accident occurred at Tibagi Farm helipad with no previous impact. The wreckage remained concentrated.

The *Tibagi* Farm workers, who used to assist passengers to embark and disembark, witnessed the accident.

While the passengers left the helicopter with rotors running, the aircraft tailboom raised, and the helicopter initiated a forward movement supported by the front part of the skids. After about three meters, the helicopter yawed to the righ and tipped over on its left side (Figures 1 and 2).

Figure 1 - Beginning of the movement.

Figure 2 - Tailboom lift, and helicopter tipping over.

The main rotor blades contacted the ground. One of them reached a passenger that had disembarked and was positioned in front of the aircraft.

The aircraft came to rest with the longitudinal axis 60° of the position it had landed (Figure 3).

Figure 3 - Post accident tipped aircraft.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Not investigated.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

The pilot used to make private flights for the accident executives group for more than three years, although it was not his main professional activity.

He used to transfer the family members of the owner of the aircraft from Fortaleza to *Tibagi* Farm twice or three times a month, usually on holidays or weekends.

The pilot did not use to give briefings to passengers. Even aware it was the first time he was transferring the passengers in that aircraft model, the pilot deemed it not necessary to give the briefing because he had already transferred those passengers aboard other helicopter model on previous flights. He deemed briefing every flight not necessary.

The pilot also stated that leaving the cockpit to assist passengers to disembark while rotors were running was a usual procedure in private operations.

The pilot had a friendly relationship with the executives, which had great confidence in pilot's job.

1.14 Fire.

No signs of post-impact fire.

1.15 Survival aspects.

One of the rotor blades amputated part of a passenger's right leg. The farm workers helped the hurt passenger and applied a tourniquet before taking him to a nearby hospital. Then another helicopter transported the injured passenger to a hospital in Fortaleza.

1.16 Tests and research.

A farm surveillance video depicted the aircraft landing and the accident moment.

The video revealed an abrupt variation of the main rotor rotation. Thus, the SIPAER accident investigators requested IPEV technical support to help clarifying the accident contributing factors.

The review of the video consisted in verifying if the main rotor rotation varied or not, and if the Twist Grip was moved.

Besides the video, the aircraft Vehicle Engine Monitoring Display (VEMD) was also sent to IPEV, allowing the analysis of the engine performance data and its limits at the accident moment.

IPEV analysis resulted a technical report, which consisted of the following results:

- Main rotor rotation

It was possible to notice two variations of the main rotor rotation in the accident video: the first one starts at video 23º second; the second one starts after one minute and thirty seconds of video. It seems that the main rotor rotation direction suddenly changes, although what is happening in fact is an optical effect named “Alias frequency”. It happens due to the difference between the rotor rotation frequency and the acquisition rate of the surveillance camera that recorded the video.

One of the main parameters of a data acquisition system (the surveillance camera in this case) is the sampling rate of the signal, in other words, the recording speed of the camera.

A higher recording speed means more frames are acquired per second, and better input signal will be depicted (Figure 4(a)).

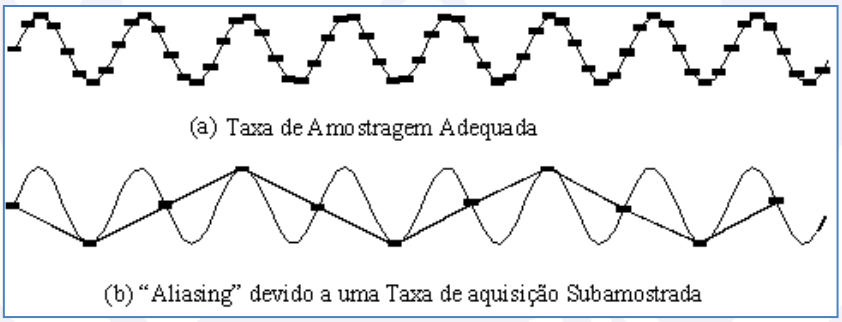

Figure 4 (a) – Appropriate acquisition rate.
Figure 4 (b) – “Aliasing” due to subsampled acquisition rate.

A very low sampling rate deforms the analog input signal (Figure 4(b)) and shows different frequency and amplitude.

Considering that the camera acquisition rate (fps - frames per second) did not change, it is possible to assert that the apparent change of direction of the main rotor rotation noticed in the recorded video is an Alias frequency. What happens in fact is not a change of direction, but the main rotor speed (NR) variation.

The main rotor rotation of the accident helicopter just varies by twisting the Twist Grip (aircraft component mounted on the collective lever).

IPEV analysis found that the NR variation (noticed by the Alias frequency) shortly before the inadvertent takeoff was a result of the turbine acceleration obtained by an action on the Twist Grip.

- Main rotor coning

A modest increase of main rotor coning shortly after the second Alias frequency (before the inadvertent takeoff) was observed in the accident video. This fact indicates that the collective lever was not in its locking position, as it should be.

Coning is the upward bending of the blades caused by the combined forces of lift and centrifugal force. Before takeoff, centrifugal force causes the blades to rotate in a plane nearly perpendicular to the rotor hub. During a vertical liftoff, the blades assume a conical path as a result of centrifugal force acting outward, and lift acting upward. The coning angle (a0) is the angle between a rotor blade and the rotary plane (Figure 5). It keeps constant, even if the rotary plane is not perpendicular to the axis. It just varies by changing the blades collective pitch. Such description is valid for stabilized rotation condition.

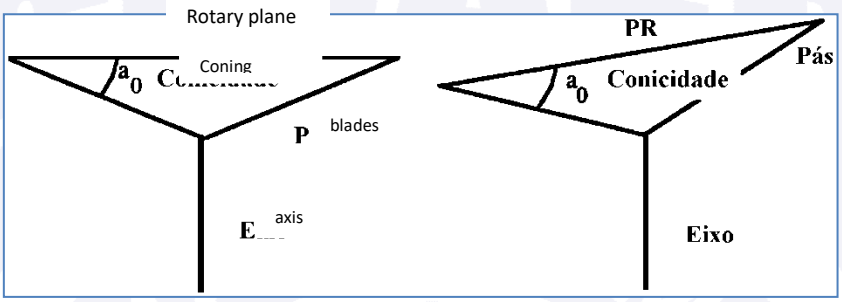

Figure 5 - Coning angle.

The acting forces on the rotor allow the analysis of coning (Figure 6).

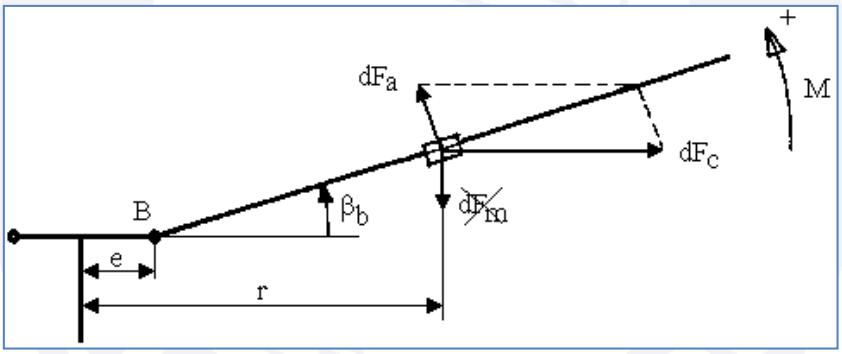

Figure 6 - Forces acting on main rotor blades.

a) dF_c is the centrifugal force obtained by $\Omega^2 rdm$;

b) dF_m is the weight obtained by gdm; and

c) dF_a is the lift force, which depends on the type of flight (hovering or forward flight).

As the weight is negligible among the other forces, the movement equation will be:

$$I_{(B)}.\ddot{\beta}_b = M_{(B)}F_a + M_{(B)}F_c \qquad (01)$$

The blade's moment of inertia around B, $I_{(B)}$, is obtained by:

$$I_{(B)} = \int_0^L x^2 dm = \frac{m_P}{L}\int_0^L x^2 dx = m_p \frac{L^2}{3} \qquad (02)$$

where L is the blade lenght, and m_P is the blade mass (assumed constant along its length).

The moment of the centrifugal forces, $M_{(B)}F_c$, is obtained by:

$$M_{(B)}F_c \cong -\int_e^R (r-e)tg(\beta_b)dF_c \cong -\int_e^R (r-e).\beta_b.\Omega^2.r.\frac{m_p}{L}dr \qquad (03)$$

with $R \cong e + L$.

If we consider $e' = e/L$, we finally have:

$$M_{(B)}F_c \cong -\frac{m_p.L^2}{3}.\Omega^2.\beta_b.\left(1+\frac{3}{2}e'\right) \qquad (04)$$

Thus, the centrifugal force, which depends on the main rotor rotation, is an important parameter to determine the amplitude of the pitch movement.

It is also possible to notice that the centrifugal force influences the pitch βb, that is, only in the amplitude, since it multiplies the beat βb.

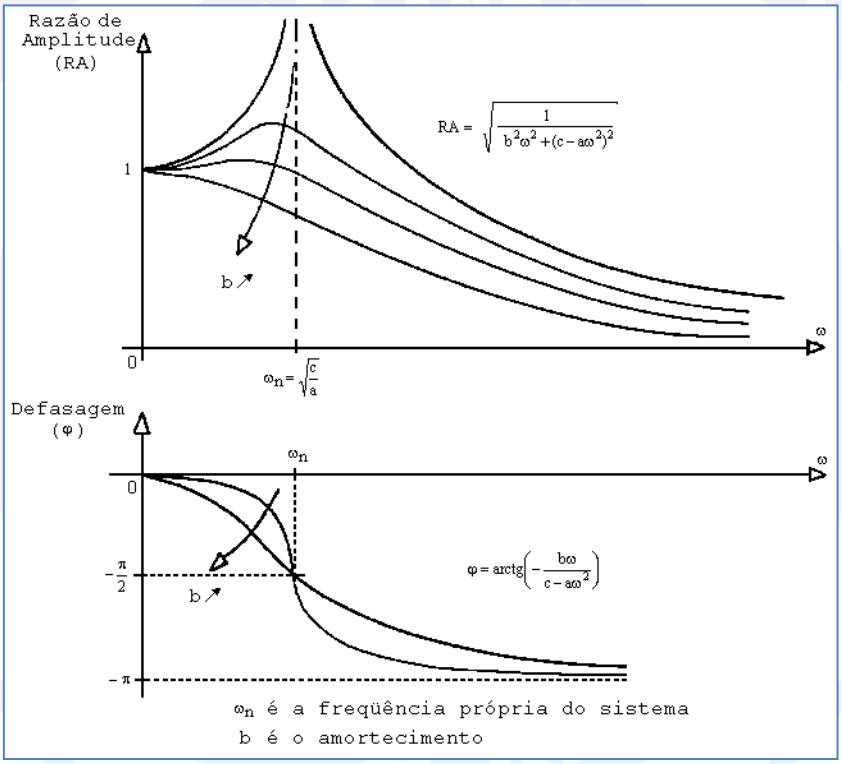

Figure 7 - Blades beat response.

By solving the βb equation and analyzing the graph (Figure 7), the following conclusion is possible:

The frequency variation (which depends on the rotor rotation) in x axis varies the amplitude of the beat movement and, consequently, the coning angle.

The first part of the equation below is the coning, directly proportional to the collective pitch.

$$\beta_b = \frac{3}{8}\frac{\rho S_p}{m_p}A.L.\alpha_0 + STLA.\Delta D\delta l.\operatorname{sen}\Omega t - STLO.\Delta D\delta m.\cos\Omega t \quad (05)$$

Figure 8 - Increase of the rotor blades coning.

Figure 9 - Increase of the rotor blades coning.

A small increase of the coning in the instants that preceded the inadvertent takeoff can be observed by the increase of the angle between the blades and the solid red line (used as reference) in figures 8 and 9. IPEV stated that it was a consequence of an increase of the aircraft collective pitch.

- Outflow lever and aircraft rotation

The aircraft has a fuel outflow control located at the collective lever. The Twist Grip (Figure 10) exerts such control.

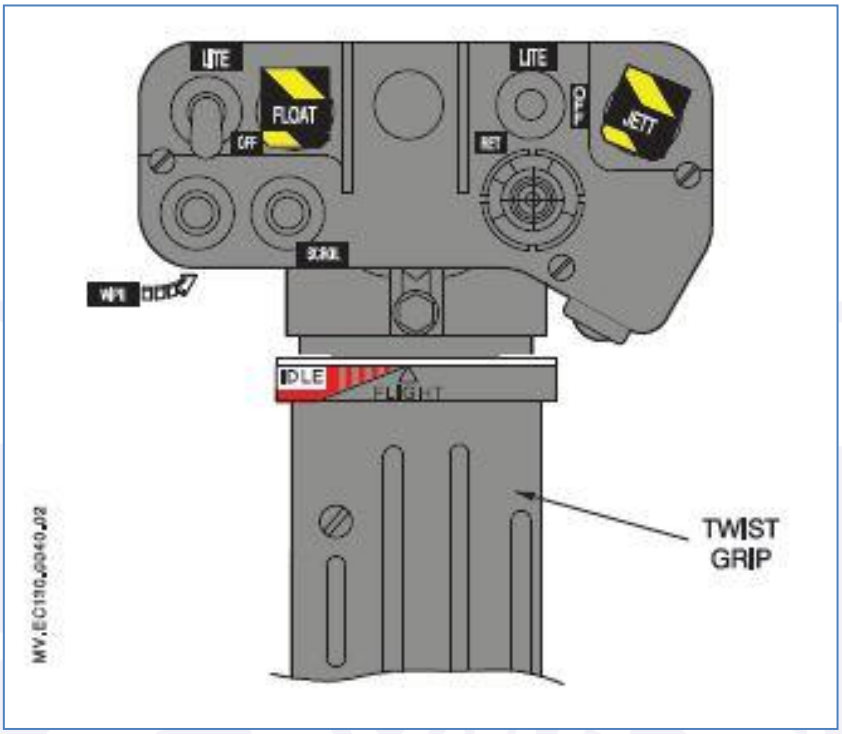

Figure 10 - Twist Grip.

By turning the Twist Grip in a counter clockwise direction, the engine functions at ground-idle, and NG at approximately 68%. (Credit: EC-130 *Flight Manual Supplement page* 6-2)

The figure 11 (obtained from the aircraft VEMD) depicts NG at 89.9% (above ground-idle range) at the impact moment. Such information means that the Twist Grip was turned in a clockwise direction before the aircraft inadvertent takeoff.

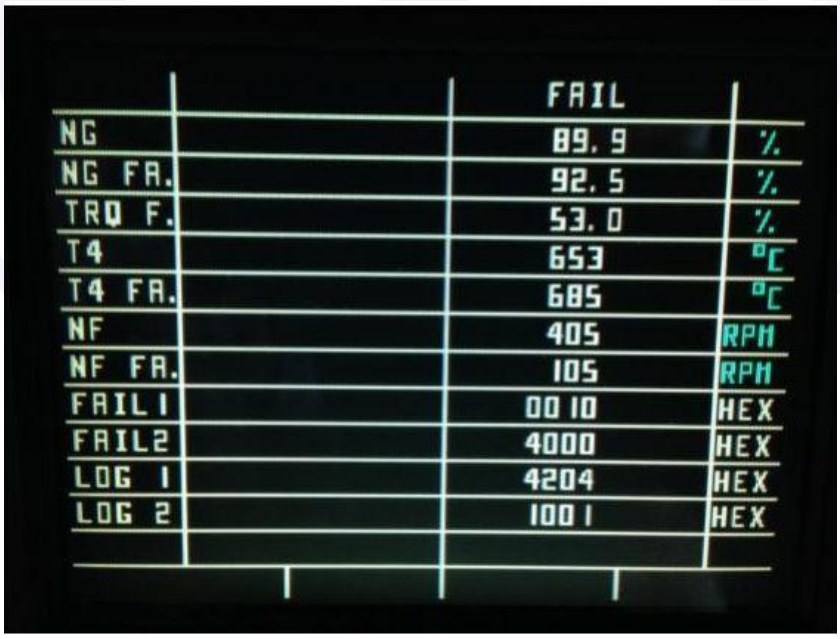

Figure 11 - VEMD data at the impact moment.

- IPEV examination results

The accident video and the images from the aircraft VEMD were analyzed, resulting in the following:

a - By the review of the video and Alias frequency (occurred due to the difference between the rotor rotation frequency and the acquisition rate of the surveillance camera), it was possible to verify the main rotor rotation acceleration shortly before the aircraft inadvertent takeoff. Such variation only was possible by turning the Twist Grip, located at the collective lever;

b - By the analysis of the main rotor blades coning, it was noticed that the action on the collective lever occurred shortly before the aircraft inadvertent takeoff;

c - By the analysis of the aircraft VEMD images, it was possible to verify that NG exceeded 89% shortly before the blades' collision with the ground. Such NG indication just can be reached if the Twist Grip is out of the ground-idle position (turned in a clockwise direction).

1.17 Organizational and management information.

Although there was no employment relationship between the pilot and the executives, the accident captain used to take part in issues concerning the aircraft maintenance and operation.

1.18 Operational information.

The aircraft was within the manufacturer prescribed weight and balance limits.

The pilot took off from *Fortaleza, CE* Airport (SBFZ) with no passengers and landed in a private airstrip at the metropolitan area of *Fortaleza,* known as *Dunas.* Then, he departed to *Tibagi* Farm (approximately 100 Km from *Fortaleza, CE*) with five passengers on board.

The pilot had experience in flying to *Tibagi* Farm. The previous flights to this locality were on AS-350 helicopter model.

In the operations to *Tibagi* Farm, the pilot used to leave the cockpit to assist passengers to disembark.

It was the first time the pilot transferred passengers in the EC-130 B4 helicopter model.

The pilot did not give the passengers any briefing on the aircraft embarkation/disembarkation or emergency procedures.

On that flight, one of the passengers occupied the right front seat, and the others occupied the four aircraft's rear seats.

The video showed that after landing in *Tibagi* Farm the captain left the cockpit by the aircraft left side in order to assist passengers to disembark by the helicopter right side. The aircraft rotors kept running.

At that moment, one of the rear passengers disembarked by the left front door, as the left rear door was closed.

One of the accident helicopter characteristics was that captain's seat was the left front seat (Figure 12).

The aircraft was equipped with two collective levers (one at captain's seat left side, and the other between the captain's seat and the central seat) (Figure 13).

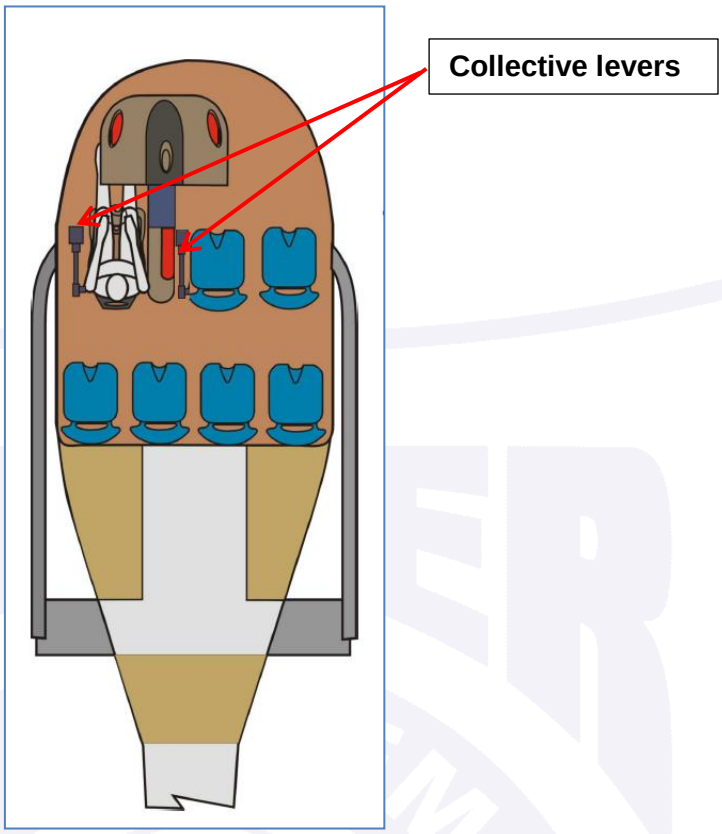

Figure 12 - Helicopter interior configuration.

The passenger who left the aircraft by the left front door used one of the collective levers as support during the exit, and inadvertently changed the Twist Grip position from “ground idle” to “flight idle”.

Figure 13 - Aircraft collective levers.

The aircraft was equipped with two front doors and two rear doors. The rear ones were sliding doors (Figure 14).

Figure 14 - Aircraft doors (left side).

1.19 Additional information.

The captain stated he decided to disembark the passengers while rotors kept running (as done on previous operations) for fear of insufficient battery charge for a new engine start up after landing in Tibagi Farm.

By interviewing several helicopter pilots who flew over *região Nordeste*, it was verified that, when the operations were not in headquarters, captains usually left cockpit to assist passengers to embark/disembark while engine kept running. Such procedure was generally intended to meet the requirements of the aircraft owners/operators.

Not all the interviewed pilots were aware of the Brazilian Aeronautical Certification Regulation (RBHA 91) restriction on leaving the helicopter cockpit to assist passengers to embark/disembark while rotors keep running.

RBHA 91 does not enforce the pilots to give passengers briefings on helicopter embarkation/disembarkation procedures.

Section 91.102 (e), (2) and (3) of RBHA 91 regarding passengers embarkation/disembarkation stablished that:

> (e) No pilot-in-command can allow passengers to embark/disembark while engine keeps running, unless:
>
> (2) for helicopters (in addition to the requirements prescribed in paragraph (f)(1) of this section) - it is possible to stop the main rotor(s) or, if not possible, the throttle is reduced to idle, and the height of the lowest main rotor rotary plane allows passengers to walk around safely; and
>
> (3) the pilot-in-command is totally responsible for **providing all necessary to assure the safety of the operation***.
>
> (f) No pilot-in-command can allow the aircraft refueling while engine(s) keep(s) running (except APU), unless the pilot-in-command conducts the operation as prescribed in the aircraft flight manual or other DAC approved procedure. In addition,
>
> (1) there can be no passenger onboard.
>
> *** bolded emphasis added**

The Brazilian Code of Aeronautics (CBA - law nº 7.565 of December 19, 1986), in its chapter III (Infringements), stablishes that leaving the aircraft with no crewmember while engine keeps running is an infringement attributable to aircraft operators.

Research revealed recurrent accidents similar to this one, such as the PT-YGB aircraft accident on 15JAN2008.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

The accident video and the aircraft VEMD data showed the acceleration of the main rotor rotation shortly before the aircraft inadvertent takeoff.

The main rotor rotation just varies by twisting the Twist Grip (aircraft component mounted on the collective lever).

It was also verified that the collective lever was moved shortly before the aircraft inadvertent takeoff (what indicates that the collective lever was not locked) and the gas producer turbine achieved NG parameters that just can be reached by turning the Twist Grip to the “flight idle” position (clockwise direction).

Thus, the passengers that occupied the rear seats should disembark by the right rear door. However, one of them rear decided to disembark by the left front door because the left rear door was closed. Such procedure is possible only if the passenger passes from the rear section to the front section of the aircraft.

While leaving the aircraft, the passenger used one of the aircraft’s collective levers as support, and inadvertently turned the Twist Grip from “ground idle” to “flight idle” position. Such action moved the collective lever from the low pitch position, and the helicopter started the movement that resulted in the accident.

A detailed briefing on disembarkation procedures at *Tibagi* Farm could have prevented the accident, as it would have avoided the passenger’s decision of leaving the aircraft through the left front door. The lack of briefing to passengers is an evidence of fail in pilot’s planning, as it is an important safety procedure that was neglected.

It was observed that captain’s behavior was influenced by helicopter pilots culture, which usually adopted disembarkation procedures similar to the occurred in the accident.

As the pilot had been flying the same route for the same executive for three years, and had flown with the accident passengers in previous flights (in which he did not give briefings either), his increased confidence hindered the recognition of the risks involved in the operation.

Thus, The pilot failed to maintain the situational awareness, as he did not assess the safety risks associated with the operation.

In addition, the pilot and the executive (the owner of the helicopter) had a friendly relationship developed over the years. Such relationship prompted the executive not to supervise any pilot’s action.

Although some pilots reported that RBHA 91 was not very clear whether the pilot was prohibited to leave the cockpit to assist passengers to disembark while rotors keep running, it certainly did not allow such procedure. Moreover, CBA was quite clear and prohibited such practice in conditions similar to the occurrence.

Furthermore, RBHA 91 determines that such procedure is prohibited unless it is possible to stop the main rotor or, if not possible, the throttle is reduced to idle, and the height of the lowest main rotor rotary plane allows passengers to walk around safely.

It also prescribes that the pilot-in-command is totally responsible for providing all necessary to assure the safety of the operation. It does not mean that pilot must leave the cockpit to assist passengers to disembark, but that if the pilot deems passengers disembarkation is risky, he must stop the engine before conducting the procedure.

However, as different pilots give different interpretations to the regulation, it is presumable that such unclarity contributed to pilot's decision to leave the cockpit to assist passengers to disembark.

Although the farm workers who assisted passengers to embark/disembark had no influence on the occurrence, it is important to ensure greater coordination between such workers and pilots during these procedures.

Recurrent accidents similar to this one show the difficulty in changing private helicopter pilots conduction of passengers embarkation/disembarkation. They usually conduct it after leaving the cockpit while engine keeps running.

3. CONCLUSIONS.

3.1 Facts.

a) The pilot had valid aeronautical medical certificate;

b) The pilot had valid technical qualification certificate;

c) The pilot had considerable experience in the type of flight;

d) The aircraft had a valid airworthiness certificate;

e) The aircraft was within the weight and balance limits;

f) The airframe, engine and rotors logbooks records were up-to-date;

g) After landing in *Tibagi* Farm, the captain left the aircraft cockpit to assist passengers to disembark by the right side of the helicopter;

h) The aircraft rotors kept running;

i) One of the rear seats passengers disembarked through the left front door;

j) During the exit, the referred passenger used one of the aircraft's collective levers as support, and inadvertently unlocked the collective lever and changed the Twist Grip from "ground idle" to "flight idle" position;

k) The unlocking of the collective lever and the increased main rotor rotation started an inadvertent takeoff;

l) After moving three meters forward, the helicopter tipped over on its left side;

m) The aircraft sustained substantial damage; and

n) The pilot and four passengers were not injured. One passenger suffered serious injuries.

3.2 Contributing factors.

- **Attitude - a contributor.**

It was identified pilot's increased confidence, as he had been flying the same route for years, and had already flown with the accident passengers in previous flights. Thus, he

did not observe the prescribed procedures to the type of flight, nor the risks that could hinder the operation safety.

- **Communication - a contributor.**

The lack of briefing to passengers contributed to passenger's decision of leaving the aircraft through the left front door.

- **Work-group culture - a contributor.**

The procedure adopted by the pilot reflects the helicopter pilots culture of conducting passengers' disembarkation with no pilot in the cockpit, and while rotors keep running.

- **Flight indiscipline - a contributor.**

The pilot failed to comply with the regulation that forbids him to leave the aircraft with no crewmember aboard while engine keeps running.

- **Piloting judgement - a contributor.**

The captain did not assess the potential risks in assisting passengers to disembark with no crewmember in the cockpit while rotors kept running.

- **Flight planning - a contributor.**

Pilot's decision to assist passengers to disembark at *Tibagi* Farm while rotors kept running, and with no crewmember aboard, demonstrates an improper flight planning.

The lack of briefing on disembarkation procedures to passengers reinforces the contribution of this factor.

- **Support systems - undetermined.**

Despite the regulation in force did not allow the pilot to leave the cockpit to assist passengers to disembark (in the accident conditions), helicopter pilots who were interviewed stated that the regulation was not very clear about this procedure. The lack of objective directions about this procedure in the regulation can have contributed to the occurrence.

4. SAFETY RECOMMENDATION.

A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident. In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies.

In consonance with the Law n°7565/1986, recommendations are made solely for the benefit of the air activity operational safety, and shall be treated as established in the NSCA 3-13 "Protocols for the Investigation of Civil Aviation Aeronautical Occurrences conducted by the Brazilian State".

Recommendations issued at the publication of this report:

To the Brazil's National Civil Aviation Agency (ANAC):

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Include, among established criteria within RBHA 91, section 91.102, the enforcement (if engine is running) of pilot's permanence inside the cockpit during passengers embarkation/disembarkation.

A-103/CENIPA/2013 - 02 **Issued on 09/24/2018**

Include, within RBHA 91, the enforcement (to helicopter pilots) of giving briefing on embarkation/disembarkation safety procedures to passengers.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

The DIVOP nº 004/2013 was issued warning helicopter operators, pilots and mechanics about the potential risks in ground operations in which rotors are running with no crewmember aboard.

On September 24th, 2018.

ANNEX A

COMMENTS BY THE BEA REGARDING THE FINAL REPORT

Below, there is a list of all the comments forwarded by the *Bureau d'Enquête et d'Analyses pour la Sécurité de L'Aviation Civile*, which were not included in this Final Report wording.

- **COMMENT 4**

Regarding the following portion of the section "2. Analysis"

"While leaving the aircraft, the passenger used one of the aircraft's collective levers as support, and inadvertently turned the Twist Grip from "ground idle" to "flight idle" position. Such action moved the collective lever from the low pitch position, and the helicopter started the movement that resulted in the accident".

Text proposed by BEA

While leaving the aircraft, the passenger main probably used right side collective lever as support, and inadvertently turned the Twist Grip from "ground idle" to "flight idle" position. Such action moved the collective lever from the low pitch position, and the helicopter started the movement that resulted in the accident.

BEA´s comment

Nil.

CENIPA´s comment

During the investigation, it was not possible to identify which one of the aircraft's collective levers had been moved.