COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-044/CENIPA/2022

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-EFC**
MODEL:	**CABRI G2**
DATE:	**11ABR2022**

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 considering 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 distinct 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 Final Report has been made available to the ANAC and the DECEA so that the technical-scientific analyses of this investigation can be used as a source of data and information, aiming at identifying hazards and assessing risks, as set forth in the Brazilian Program for Civil Aviation Operational Safety (PSO-BR).

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. Considering 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 Final Report pertains to the April 11, 2022, accident involving the CABRI G2 helicopter of registration marks PR-EFC. The occurrence was typified as "[LOC-I] Loss of Control In-Flight."

During takeoff, there was loss of control of the aircraft, which collided with the ground and sustained substantial damage.

The pilots were seriously injured.

Being France the State of Manufacture of the aircraft, an Accredited Representative from BEA (*Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile*) was designated for participation in the investigation of the accident.

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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

AFM	Aircraft Flight Manual
AL	Student pilot
ANAC	Brazil's National Civil Aviation Agency
CENIPA	Brazil's Center for the Investigation and Prevention of Aeronautical Accidents
CIAC	Civil Aviation Training Center
CIV	Digital Pilot-Logbook
CMA	Aeronautical Medical Certificate
DCTA	Department of Aerospace Science and Technology
FCU	Fuel Control Unit
HMNC	Single-Engine Conventional Helicopter Class Rating
IN	Flight Instructor
INVH	Helicopter Flight Instructor Rating
MNTE	Single-Engine Land Airplane Class Rating
PF	Pilot Flying
PLA	Airline Transport Pilot License – Airplane
PPH	Private Pilot License - Helicopter
PPR	Private Pilot License - Airplane
SIPAER	Aeronautical Accident Investigation and Prevention System
SL	Service Letters
SN	Serial Number
SNHN	ICAO location designator - *EFAI* Helipad, *Contagem*, MG
UTC	Coordinated Universal Time
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	**Model:** CABRI G2 **Registration:** PR-EFC **Manufacturer:** *Helicopteres Guimbal.*	**Operator:** *EFAI - Escola de Aviação Civil Ltda. – EPP*.
Occurrence	**Date/time**: 11ABR2022 - 11:35 (UTC) **Location:** *Hipermercado BH*'s cargo area. **Lat.** 19°53'27"S **Long.** 044°03'28"W **Municipality – State:** *Contagem – Minas Gerais*.	**Type(s):** [LOC-I] Loss of control - inflight

1.1. History of the flight.

At approximately 11:30 UTC, the helicopter took off from SNHN (*EFAI* Helipad, Contagem, State of Minas Gerais) on a local training flight, with 02 POB [an Instructor (IN) and a Student (AL)].

Shortly after takeoff, control of the aircraft was lost, leading it to collide with a truck parked nearby.

The aircraft sustained substantial damage.

The pilots suffered serious injuries.

1.2. Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	2	-	-
Minor	-	-	-
None	-	-	-

1.3. Damage to the aircraft.

The aircraft sustained substantial damage throughout its entire structure. The skid landing gear detached from the airframe due to the impact with the ground.

Two main rotor blades separated from the rotor head, and all three blades exhibited severe damage.

Figure 1 – Side view of the helicopter after the accident.

Figure 2 – Front view of the helicopter.

1.4. Other damage.

The aircraft collided with a truck that was parked in the cargo-loading area of *Hipermercado BH*, causing damage to the vehicle's cargo compartment.

Figure 3 – On the left, the point of impact on the truck;
on the right, detail of the damage.

1.5. Personnel information.

1.5.1. Crew's flight experience.

Flight Experience		
	IN	AL
Total	3,500:00	24,000:00
Total in the last 30 days	09:35	00:05
Total in the last 24 hours	00:05	00:05
In this type of aircraft	58:25	00:05
In this type in the last 30 days	01:35	00:05
In this type in the last 24 hours	00:05	00:05

Note: Data on the hours flown by the Flight Instructor and Student-Pilot obtained from their individual CIVs (digital Pilot-logbooks).

1.5.2. Personnel training.

The Flight Instructor (IN) completed his PPH course (Private Pilot – Helicopter) in 2003, at *Nacional Escola de Pilotagem Ltda*, *Rio de Janeiro*, State of *Rio de Janeiro*.

The Student Pilot (AL) completed his PPR course (Private Pilot – Airplane) in 1984, at *Aeroclube do Estado de Minas Gerais*, *Belo Horizonte*, State of Minas Gerais. On the occasion of the accident, he was doing the first flight of the PPH course.

1.5.3. Category of licenses and validity of certificates.

The IN held a PCH license (Commercial Pilot – Helicopter) and had valid ratings for HMNC (Single-Engine Conventional Helicopter) and INVH (Flight Instructor – Helicopter).

The AL held a PLA license (Airline Transport Pilot – Airplane) and a valid MNTE rating (Single-Engine Land Airplane).

1.5.4. Qualification and flight experience.

Flight Instructor (IN):

The IN's personal CIV (digital pilot-logbook) indicated extensive experience, totaling over 3,500 flight hours accumulated over 19 years, most of which involving instructional flights.

A significant portion of his operational history was developed while working for the operator, where he primarily flew the *Schweizer* 269C-1 helicopter, accumulating approximately 2,000 flight hours on that aircraft.

However, he had only 58 flight hours on the *Cabri G2*, the accident aircraft.

While the IN was qualified and experienced in this type of mission, his experience with this specific helicopter model was limited.

Student Pilot (AL):

The AL's personal CIV indicated experience with fixed-wing aircraft. He had been flying since 1984 and worked as an Airline Transport Pilot (PLA) for various airlines, accumulating approximately 24,000 flight hours across multiple aircraft models, such as DC-10, B737, B747, B767, and B777.

However, the AL had no prior experience with rotary-wing aircraft, and the flight in question was his first one of the PPH course (Private Pilot – Helicopter).

The theoretical part of the course concerning that aircraft was completed only a few days before the accident flight.

1.5.5. Validity of medical certificate.

The pilots held valid CMAs (Aeronautical Medical Certificates).

1.6. Aircraft information.

The SN 1120 helicopter was manufactured by *Hélicoptères Guimbal* in 2015 and registered under the Private Category – Instruction.

The aircraft's CVA (Certificate of Airworthiness) was valid.

The latest maintenance inspection ("500-hour" check) was performed on April 7, 2022, on the premises of *EFAI - Escola de Aviação Civil Ltda* maintenance organization in *Contagem*, State of Minas Gerais. At the time of the accident, the aircraft completed 7 hours and 36 minutes of flight time after the referred inspection.

The activities of maintenance on the helicopter would be carried out at the CIAC (Civil Aviation Training Center) facilities. The Investigation Committee confirmed that all records

indicated the aircraft was up to date with its maintenance, and the records of both the airframe and engine logbooks were up to date.

The aircraft was a model Cabri G2 single-engine conventional helicopter with capacity for two persons. The main rotor rotated clockwise (as viewed from above the aircraft), and the tail rotor was of the Fenestron[1] type. The helicopter was powered by a Lycoming O-360-J2A engine, and its maximum takeoff weight was 700 kg.

The helicopter's dimensions were listed in the Aircraft Flight Manual (AFM), Section 1, page 1-2, revision 11, as shown in Figure 4.

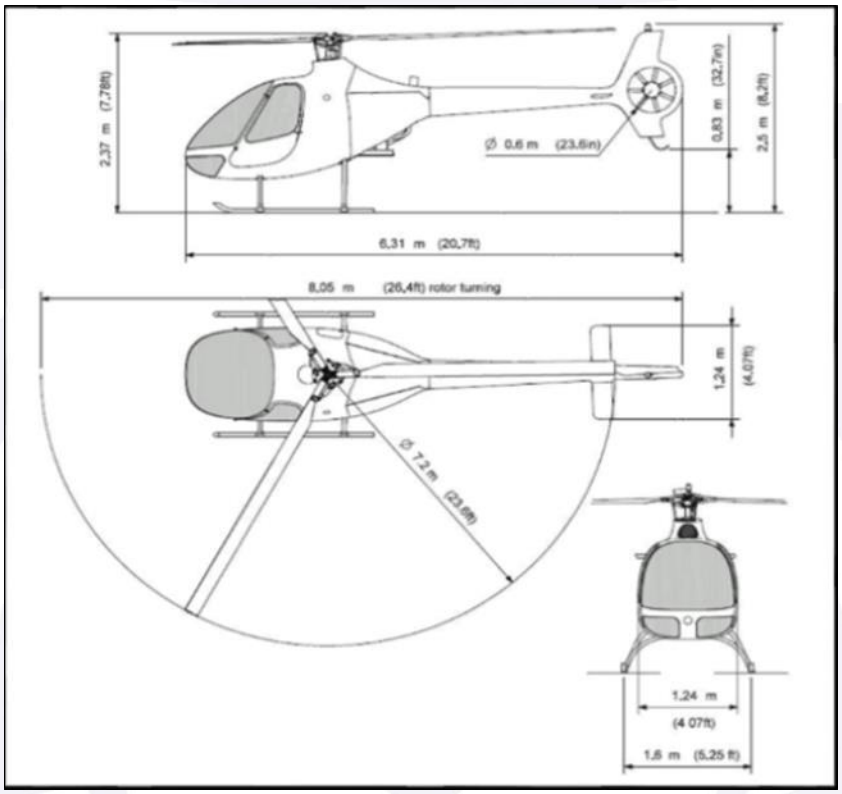

Figure 4 – Aircraft dimensions. Source: AFM.

The normal operating RPM range for the main rotor was between 515 and 540 RPM. This value was monitored by means of a digital instrument and was also indicated by a green light on the instrument panel. If rotor RPM dropped to a value below 466, a low-RPM warning buzzer was triggered (Figure 5).

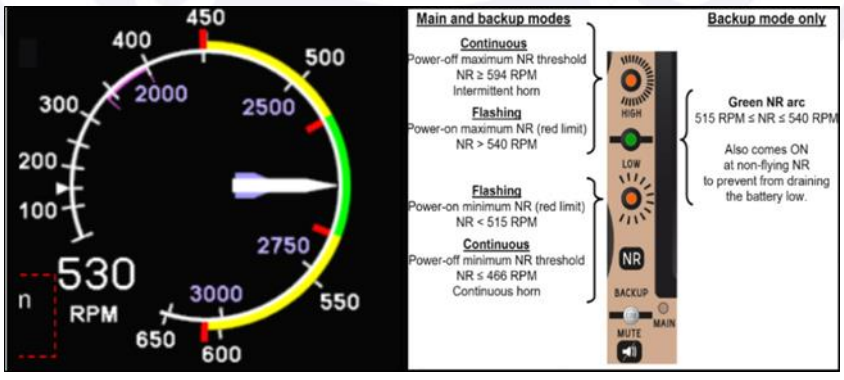

Figure 5 – RPM Display. Source: AFM.

1 "*Fenestron*" is a trade mark from Eurocopter.

1.7. Meteorological information.

The Routine Meteorological Aerodrome Reports (METAR) from SBBH (*Pampulha – Carlos Drummond de Andrade* – Airport, located 5.4 NM from the accident site) provided the following information:

METAR SBBH 111100Z 10010KT CAVOK 23/17 Q1017=

METAR SBBH 111200Z 10009KT 9999 SCT025 23/17 Q1017=

METAR SBBH 111300Z 12010KT 9999 SCT025 25/17 Q1017=

It was determined that the weather conditions were above the minima required for the flight, with visibility exceeding 10 km, scattered clouds at 2,500 ft., and winds at 9 kt.

1.8. Aids to navigation.

NIL.

1.9. Communications.

NIL.

1.10. Aerodrome information.

The helipad of departure was a private property under management of the CIAC. It operated VFR (Visual Flight Rules) during both day- and night-time.

The area surrounding the helipad contained multiple terrain elevations, prompting the CIAC to standardize the 320° axis as the sole departure direction. However, along this axis, a high-voltage power line was positioned transversely, as illustrated in Figure 6.

Figure 6 – Departure axis and high-voltage power line.
Source: Adapted from Google Maps.

1.11. Flight recorders.

Not required and not installed.

1.12. Wreckage and impact information.

The wreckage was concentrated in the cargo-loading area of *Hipermercado BH*, at a distance of approximately 0.16 NM from the helipad of departure.

Security camera footage from the site captured the final moments before impact. It was observed that the aircraft sustained damage after colliding sequentially with a truck and the ground. Before the impact, the tail boom, main rotor blades, and the *Fenestron* were intact.

Figure 7 – Image of the aircraft moments before impact.
Source: *Hipermercado BH's s*ecurity camera footage.

1.13. Medical and pathological information.

1.13.1. Medical aspects.

There was no evidence that physiological issues or incapacitation had affected the crew's performance.

1.13.2. Ergonomic information.

NIL.

1.13.3. Psychological aspects.

The Student Pilot (AL) was 59 years old and had extensive experience in fixed-wing aviation, having flown for several airlines, including some based outside Brazil, accumulating more than 24,000 flight hours on various aircraft types.

As an aviation enthusiast, after retirement, he expressed an interest in flying helicopters, pursuing the PPH course (Private Pilot – Helicopter) purely for the pleasure of flying.

The Flight Instructor (IN) was 57 years old and was considered one of the most experienced at the Flight School. According to the investigation team's findings, he was aware of the AL's extensive experience and was enthusiastic about participating in this particular training flight.

1.14. Fire.

There was no fire.

1.15. Survival aspects.

Witnesses who observed the aircraft's impact immediately contacted the local Fire Department, which rescued the victims and provided first aid before their transportation to the hospital.

1.16. Tests and research.

Two fuel samples from the aircraft's main tank and one oil sample from the engine drain were collected. These materials were analyzed for physical and chemical properties and were within specifications, showing no signs of contamination.

Additionally, the aircraft's engine was examined by the Investigation Committee to determine whether it had contributed to the chain of events under analysis. The Cabri G2

was a single-engine helicopter, powered by a Lycoming O-360-J2A engine, Serial Number L-42676-36E, with four cylinders and running on aviation gasoline.

An initial visual inspection of the engine confirmed that its components and accessories were structurally intact, and impact-related damage was minor. The engine was manually rotated, confirming that it was not seized. Subsequently, the ignition timing and cylinder compression were evaluated, and it was determined that the engine could be turned while still mounted on the aircraft.

The engine was then test-run in the aircraft, following the parameters outlined in the Operator's Manual – Lycoming O-360, dated October 2005, 8th edition. During testing, the engine performed normally across different power settings, with no malfunctions or operational anomalies.

Figure 8 – Image of the instrument panel during engine run-up.

Furthermore, the Investigation Committee identified that fractures in the main rotor blades, as well as a torsional failure in the tail rotor drive shaft (Figure 9), indicated that the engine was operating normally at the time of the accident.

Figure 9 – Tail rotor drive shaft with torsional failure.

1.17. Organizational and management information.

NIL.

1.18. Operational information.

It was the first instructional flight for the PPH course (Private Pilot – Helicopter).

The aircraft was operating within the weight and balance limits specified by the manufacturer.

According to the pilots' accounts, the IN was acting as Pilot Flying (PF) and allowed the AL to interact with the flight controls. During takeoff, the aircraft failed to reach the necessary altitude to clear a high-voltage power line located along the takeoff path.

Both pilots realized they would not clear the obstacle and simultaneously increased collective pitch to gain altitude. Shortly after, the aircraft yawed to the left and began an uncontrolled spin around its vertical axis (counterclockwise from an overhead observer's perspective). In response, the IN reduced collective pitch in an attempt to stop the spin, but the aircraft lost altitude and impacted the ground while still rotating.

Additionally, the pilots reported hearing the low rotor RPM warning alarm during the spin.

A review of previous flight logs and pilot reports indicated no prior mechanical issues that could have contributed to the accident sequence.

The CIAC Instruction Program, dated November 19, 2020, revision 00, in Annex 5, specified that the first flight of the PPH course was classified at Level "M" for all exercises (Figure 10).

	Exercícios	Nível	Objetivo a serem atingido
1	Cálculo de P&B / Desempenho	M	- Determinar a margem de desempenho com base nas condições ambiente e no P&B da aeronave.
2	Inspeções / Partida / Engrazam. / Cheques	M	- Executar os itens previstos, determinando a real condição da aeronave para o voo. - Executar com segurança o acionamento do motor e o engrazamento do rotor.
3	Decolagem Vertical	M	- Manter o controle da aeronave ao sair do solo. - Limites de variação: - N_R..... Dentro da faixa normal de operação; - Proa ..... ± 20°; - Altura ... ± 1 ft; e - Posição ± 1 m (sem deslocamento para trás)
4	Taxi	M	- Limites de variação: - N_R..... Dentro da faixa normal de operação; - Eixo ..... ± 1 m; - Proa ..... ± 10°; e - Altura ... ± 1 ft.
5	Decolagem Normal	M	- Cumprir o perfil de decolagem dentro dos seguintes limites de variação: - Proa ..... ± 10°; e - V_i..... ± 5 ft (veloc. de subida).
6	Subida / Descida	M	- V_i..... ± 10 Kt; e - Proa ..... ± 10°.

Figure 10 – Training Program with Learning Levels.

In the aforementioned program, Table 16 defined Level "M" as "Memorization", meaning that the AL would receive information about the exercises and memorize procedures before starting dual-control training (Figure 11).

QUADRO 16 - NÍVEIS DE APRENDIZAGEM		
NÍVEIS DE APRENDIZAGEM	**CÓDIGOS**	**DESCRIÇÃO**
Memorização	M	O aluno tem informação suficiente sobre o exercício e memoriza os procedimentos para iniciar o treinamento duplo comando.
Compreensão	C	O aluno demonstra perfeita compreensão do exercício e pratica-o com o auxílio do instrutor.
Aplicação	A	O aluno demonstra compreender o exercício, mas comete erros normais durante a prática. Dependendo da fase da prática de voo, poderá treinar solo.
Execução	E	O aluno executa os exercícios segundo padrões aceitáveis, levando-se em conta a maior ou menor dificuldade oferecida pelo equipamento utilizado.

Figure 11 – Learning Level Descriptions.

Thus, the IN was expected to demonstrate all flight procedures, including normal takeoff. Typically, the AL would be allowed to follow the cyclic and collective movements with their hands, but with limited active control.

However, in the accident flight, the IN allowed the AL greater participation in the controls due to his prior aviation experience. The AL performed the procedures with verbal and manual assistance from the IN.

From an operational standpoint, a key factor at SNHN was the proximity of a high-voltage power line located directly along the takeoff trajectory.

The power line was in a position higher than the helipad; however, a properly executed takeoff would normally allow the aircraft to clear such obstacle.

The analysis of the instructions provided to the AL before the flight indicated that general aspects of the aircraft operation were covered. Nevertheless, there was no specific instruction for takeoff from SNHN that considered the characteristics of the location, such as the proximity of the high-voltage power lines. Furthermore, the pre-flight briefing was conducted hastily, with the IN and the AL walking toward the aircraft, without properly discussing the specific aspects of the takeoff.

Previous Loss of Control Occurrence – PR-EFC (2016)

In 2016, the PR-EFC helicopter was involved in an accident at the same helipad during an instructional flight. On the occasion, at takeoff, the aircraft lost altitude immediately after crossing the high-voltage power line, entered a left spin (nose left, tail right), and triggered the low rotor-RPM alarm before losing altitude and impacting the ground.

The SIPAER investigation team determined that there were no mechanical failures. During takeoff, upon realizing the aircraft would not clear the power line, the IN took over the controls and increased collective pitch to gain altitude.

The maneuver proved effective, as the aircraft managed to clear the obstacle, but controllability was lost shortly thereafter.

Based on information gathered from witnesses, the aircraft experienced rotor-RPM decrease, left yaw (nose left, tail right), and low-RPM alarm activation, followed by a loss of altitude. The investigation concluded that the accident resulted from improper control inputs and poor pilot judgment.

Additionally, the IN had only 19 hours on the aircraft model, and the AL had approximately 6 hours, indicating limited experience with the Cabri G2 helicopter, which may have contributed to the occurrence.

1.19. Additional information.

A series of related incidents involving the same aircraft model were identified, presenting characteristics similar to the ones of the case under analysis.

In one such incident, involving Cabri G2 F-HGRE on February 18, 2022, the BEA Safety Investigation Report, under item 2.10 – *Accidents linked to loss of yaw control*, stated the following:

> *Between 2015 and 2022, the BEA recorded eight other occurrences (seven accidents and one incident) in France involving the Cabri G2, six of which were linked to loss of yaw control. Of these:*
>
> *Two were the direct result of insufficient input on the right rudder pedal, one during an approach in instruction (2019), and the other during hover taxiing (2022).*
>
> *Three were linked to a drop in rotor speed, resulting in a loss of tail rotor effectiveness during an engine failure or Fuel Control Unit (FCU) failure training exercise, in instruction.*
>
> *Guimbal estimates that, since the entry into service of the Cabri G2, more than 50% of Cabri G2 accidents worldwide are associated with losses of yaw control. It states that half of these accidents were due to insufficient right pedal input, sometimes followed by collective pitch application, while the other half resulted from rotor speed losses, mainly occurring during instructional maneuvers.*
>
> *In 2022, of the 13 Cabri G2 accidents worldwide, nine were due to a loss of yaw control.*

Two other accidents with the same helicopter model occurred in Germany and Switzerland in 2020, the summaries of which are presented below:

- Cabri G2 Accident – *Speyer* Airfield, Germany (2020)

This incident involved a navigation circuit with only the student (AL) on board (solo flight), as part of the PPH training program. During takeoff, the aircraft lost control. Airfield cameras captured the helicopter spinning to the left (nose left, tail right) before impacting the ground.

The pilot was 63 years old and had extensive experience on commercial aviation with over 23,000 flight hours in various aircraft models. However, he had only 46 hours in helicopters.

The German Investigation Authority found no indications of mechanical failures that might have contributed to the accident.

It was determined that loss of control resulted from improper coordination between engine power demand and pedal control inputs used for torque compensation around the vertical axis.

- Cabri G2 Accident – *Thun* Airfield (LSZW), Switzerland (2020).

The pilot was conducting his first flight after obtainment if the PPH license, with only 75 total flight hours.

During takeoff, the low rotor-RPM warning sounded, and the aircraft lost altitude, impacting the ground.

No mechanical failures were identified that could have contributed to the accident.

The Swiss Investigation Authority determined that the pilot was not adequately monitoring the aircraft parameters and that the RPM may have been reduced by control inputs made by the very pilot.

The Cabri G2 *Service Letter 12-001A – Yaw Control in Approach*.

The introduction of the Service Letter (SL) 12-001A – *Yaw Control in Approach* explained that following two incidents involving loss of yaw control, both with inexperienced pilots flying helicopters equipped with *Fenestron* tail rotors, such as the Cabri G2, led Guimbal to issue the service letter to highlight specific characteristics of these tail rotors.

One of the key notes in the letter stated:

> *Extensive flight testing of the Cabri G2 and of other helicopters equipped with a Fenestron have shown that such tail rotor, combining a large shroud and a relatively high disk loading, is immune to stall and to vortex-ring state commonly referred to as LTE (Loss of Tail Rotor Efficiency).*

The letter also emphasized that pilots must use greater pedal input for a given tail rotor thrust than would be required in helicopters with conventional tail rotors, and that they must react immediately to an uncommanded yaw.

The Service Letter warned that a typical situation was:

> *When getting closer to the ground, if the pilot does not control sideslip, the reduction of airspeed causes the tail fin to increase its angle of attack to maintain the torque/antitorque balance: the helicopter nose moves to the left progressively as the airspeed is reduced.*

The Service Letter 12-001A concluded with the following recommendations

> *Advice 1:*
>
> *The main lesson drawn from the above analysis is**: Never wait to correct a sideslip** - and particularly to the left - when approaching for a standard landing (30-60 kt approach).*
>
> *Use adequate pedal input without any hesitation.*
>
> *If there is a known cross wind, and particularly from the right hand, pay even more attention to keep the helicopter centerline aligned with the path and be prepared to large pedals input.*
>
> *Advice 2:*
>
> ***Never hesitate to apply full right pedal** to correct a yawing to the left before it gets faster.*
>
> *Keep the pedal to its stop, until the rotation stops completely.*
>
> *Advice 3:*
>
> *When practicing spot-turns at low height above the ground, **always do it "on the power pedal"** - to the right in the Cabri G2 case.*
>
> *Then raising the collective in case of problem will stop the spin.*
>
> *Advice 4:*
>
> *When aiming at a landing site close to helicopter IGE hover ceiling above the power transition (3800 ft. ISA), pay specific attention to smooth piloting to prevent reaching 100% FLO and thus possible rotor speed decay.*
>
> *Note that the recovery process consists in lowering slightly the collective, thus increasing sink rate before recovering the rotor speed.*

1.19. Useful or effective investigation techniques.

NIL.

2. ANALYSIS.

No evidence of mechanical failures was found that could have contributed to the accident in question. All analyses confirmed that the aircraft was in normal operating condition.

For this reason, the investigation focused on operational and human factors related to the flight.

The IN was accustomed to flying with students who had little or no prior aviation experience. Given the AL' extensive experience with fixed-wing aviation, it is possible that the IN felt comfortable and allowed greater participation of the student pilot in the controls during takeoff, although it was the first instructional flight—which, according to training protocols, should have been at the "Memorization" learning level, where the AL would receive information about the exercises, and the IN would demonstrate all flight procedures.

This may have resulted in complacency and overconfidence on the IN's part regarding the AL's ability, leading to a takeoff roll that did not develop as expected. Consequently, the high-voltage power line, which would normally be cleared by a gradual altitude gain during takeoff, remained in close proximity to the aircraft's flight path.

The need for a large collective input to clear the wires, while still at low forward speed and consequently with limited effectiveness of the vertical fin in contributing to anti-torque, resulted in the same effect described in Service Letter 12-001A. That is, a left yaw requiring an immediate and appropriately sized application of the right pedal.

The left yaw of the aircraft in the final moments may have been related to the lack of anticipation in pedal application to compensate for the increased torque caused by collective input. This finding aligns with the aerodynamic conditions described in SL 12-001A.

Although SL 12-001A specifically addresses yaw control during approach, the tendency for left yaw and the need for active pedal inputs apply to any low-speed condition.

Furthermore, the AL was neither given specific instructions about the presence of this obstacle nor the procedures to manage proximity to it, highlighting deficiencies in the systematic processes aimed at improving knowledge, skills, and decision-making. Additionally, the pre-flight briefing was not properly conducted, meaning that an opportunity was missed to discuss this crucial factor.

As a result, the first time the AL became aware of this obstacle was during the takeoff roll itself. Meanwhile, the IN allowed the AL to make an error during a critical phase of flight—takeoff—which prevented the expected gain of altitude.

Since no mechanical failures or malfunctions were identified, it can be inferred that improper control inputs led to the loss of aircraft control.

It is worth noting that, in 2016, PR-EFC was involved in another accident while taking off from the same helipad, and the contributing factors in both incidents were similar.

3. CONCLUSIONS.

3.1. Findings.

a) the pilots held valid CMAs (Aeronautical Medical Certificates);

b) the IN held valid ratings for HMNC (Single-Engine Conventional Helicopter) and INVH (Flight Instructor – Helicopter);

c) the IN was qualified and had experience in the type of flight;

d) the AL had experience in fixed-wing aviation but was performing his first training flight in helicopters;

e) the aircraft had a valid CVA (Certificate of Airworthiness);

f) the aircraft was within weight and balance limits;

g) the records of the airframe and engine logbooks were up to date;

h) the weather conditions were above the minima required for flight;

i) no evidence of mechanical failure was found in the aircraft;

j) during takeoff, while crossing a high-voltage power line, the aircraft yawed to the left;

k) the aircraft lost altitude while spinning and hit a parked truck before colliding with the ground;

l) the aircraft sustained substantial damage; and

m) the pilots suffered serious injuries.

3.2. Contributing factors.

- **Attitude – undetermined.**

The IN may have felt a greater level of confidence flying with an AL so experienced in fixed-wing aviation, which could have contributed to complacency and overconfidence in the AL's ability. This allowed the takeoff roll to develop differently than expected.

- **Training – a contributor.**

The AL did neither receive specific instructions relative to the presence of the obstacle (high-voltage power lines) nor the procedures to follow when operating in proximity to it. This is an indication of inefficiencies in the structured training process designed to enhance knowledge, skills, and decision-making. Additionally, the pre-flight briefing was not conducted properly, representing a missed opportunity to address this critical factor.

- **Handling of aircraft flight controls – a contributor.**

The helicopter's flight controls were not applied correctly during takeoff, preventing the aircraft from reaching the necessary altitude to clear the high-voltage power line. Additionally, when the collective was increased to clear the obstacle, the right pedal was not applied with sufficient amplitude, allowing the helicopter to enter a left yaw and subsequently lose control.

- **Limited pilot's experience – a contributor.**

Although highly experienced in fixed-wing aviation, the AL had no prior experience with rotary-wing aircraft, a state of affairs that led him to execute the takeoff inappropriately.

4. SAFETY RECOMMENDATIONS

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 consonance with the Law n°7565/1986, recommendations are made solely for the benefit of 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".

To Brazil's National Civil Aviation Agency (ANAC), it is recommended:

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Disseminate the lessons learned from this investigation to *EFAI - Escola de Aviação Civil LTDA. - EPP*, so that the referred CIAC can enhance its monitoring and supervision mechanisms for the practical part of flight training, particularly in standardizing flight instructors regarding the takeoff characteristics at the *EFAI* helipad.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On May 22th, 2025.