

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
IG - 084/CENIPA/2016

OCCURRENCE:	SERIOUS INCIDENT
AIRCRAFT:	PT-YEL
MODEL:	206L-4
DATE:	13MAY2016



NOTICE

According to the Law n  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 n  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 13MAY2016 serious incident with the 206L-4 aircraft, registration PT-YEL. The serious incident was classified as “[CTOL] Collision with obstacle during takeoff and landing”.

At the final landing approach, in an open area, the aircraft collided against a single-phase energy wire of the region.

The aircraft had minor damage.

The two crewmembers and the three passengers were unharmed.



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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ADSO	Safety Audit
AIF	Aircraft Registration Category of Federal Indirect Administration
ANAC	Brazil's National Civil Aviation Agency
CA	Airworthiness Certificate
CBA	Aeronautics Brazilian Code
CIV	Pilot's Flight Logbook
CMA	Aeronautical Medical Certificate
COAer	Monitoring and Air Operations Coordination
DECEA	Air Space Control Department
FUNAI	National Indian Foundation
GSO	Safety Management
IAM	Annual Maintenance Inspection
IBAMA	Brazilian Institute of the Environment and Renewable Natural Resources.
IFR	Instrument Flight Rules
IGE	In Ground Effect
ISA	International Standard Atmosphere
METAR	Meteorological Aerodrome Report
MGO	General Operations Manual
MGSO	Safety Management Manual
MRT	Single-wire Network with Ground Return
NBR	Brazilian Regulatory Norm
NOA	Air Operations Center
OGE	Out Ground Effect
PCH	Commercial Pilot License – Helicopter
PPH	Private Pilot License – Helicopter
RBAC	Brazilian Civil Aviation Regulation
RBHA	Brazilian Aeronautical Certification Regulation
PBZPA	Aerodrome Protection Zone Basic Plan
PF	Federal Police
PRF	Federal Highway Police
SBJI	ICAO Location Designator - Ji-Paraná Aerodrome - RO
SGSO	Safety Management System
SSKW	ICAO Location Designator – Cacoal Aerodrome - RO
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	Model: 206L-4 Registration: PT-YEL Manufacturer: Bell Helicopter	Operator: IBAMA
Occurrence	Date/time: 13MAY2016 - 1919 UTC Location: Outside of the Aerodrome Lat. 11°15'52"S Long. 061°15'32"W Municipality – State: Cacoal – RO	Type(s): [CTOL] Collision with obstacle during takeoff and landing Subtype(s): NIL

1.1 History of the flight.

The aircraft took off from the site where the operations of the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) were happening, at about 1905 (UTC) to transport personnel, with two crewmembers and three passengers on board.

During the approach to landing in an open area (pasture of a farm), the helicopter collided against a power wire.

The wire was broken by the action of the aircraft's wire cutter.

The pilot was able to continue the approach, controllably, to the proposed place, making the landing in the open area.



Figure 1 - View of the landing area and the wire, already repaired by the energy provider.

The aircraft had minor damage.

The two crewmembers and the three passengers were unharmed.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Minor	-	-	-

None

2

3

-

1.3 Damage to the aircraft.

The aircraft had minor damage. The damages were restricted to two blades of the main rotor assembly, drift, right windshield, alarm panel and in the collective command.



Figure 2 - Panel, windshield and collective with the damages due to the collision against the wire.

1.4 Other damage.

According to information provided by Eletrobrás-Rondônia, the energy service provider, it was a single-phase power wire. With the collision and the wire section, in addition to cable breakage, there was the fall of the post fixed in the pasture, damage to the insulation of the pole installed along the road and damage to the fuse switch of the local system.

As informed by local residents, on the same day of the occurrence, the concessionaire repaired the wire.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Hours Flown	Pilot
Total	3.310:30
Total in the last 30 days	55:50
Total in the last 24 hours	11:35
In this type of aircraft	1.250:50
In this type in the last 30 days	55:50
In this type in the last 24 hours	11:35

N.B.: The data related to the flown hours were obtained through the Pilot's Flight Logbook records (CIV).

1.5.2 Personnel training.

The pilot took the PPH course at the SCODA *Aeronáutica* Aviation School, in Ipeúna – SP, in 1999.

1.5.3 Category of licenses and validity of certificates.

The pilot had the PCH License and had valid 206L-4 aircraft Rating.

1.5.4 Qualification and flight experience.

The pilot was qualified and had experience in the type of flight. According to research conducted, he joined the IBAMA crew in February 2011.

The crewmember had been involved in a Serious Incident on 07JUL2015 during a surveillance operation at the Gurupi Reservation, located in the city of Santa Ines - MA, aboard the PR-HMA aircraft.

At the time, one of the blades of the main rotor touched in the vegetation of the landing area, during approach to the restricted area, causing damage to the blade tip.

The RBAC 67, Requirements for the Award of Aeronautical Medical Certificates, 2011, in sub-item 67.105 (Requirements for examination after an accident or serious aviation incident), item "a", specified that:

"Following an accident or serious incident, the applicant must undergo an initial expert health examination."

Also, according to RBAC 135 (Operational Requirements: Complementary and On Demand Operations), Amendment No. 3, of 2014, Subpart H (Training), sub item 135.321 (Applicability and terms used) specified:

"(5) periodic training. It is the training required for a crewmember to remain properly trained and permanently proficient in each aircraft, on-board function and type of operation in which the crewmember works. "

Sub-item 135.293 contained the Initial and Periodic Examination Requirements for RBAC 135 pilots. Periodic training was provided in item 135.35.

The training program of the company hired by IBAMA for aircraft and pilot leasing, in accordance with what was provided by RBAC 135, contemplated the periodic training in three curricular segments: General Emergencies, Ground Curriculum and Flight Curriculum.

According to research carried out on the pilot's operational history at the contracted company, he fulfilled the planned ground training and also flew about three hours, covering a local training flight containing the basic flight exercises, and a local check flight.

As he had performed the medical examination after the event in July 2015, after being approved in the proposed periodic training, the pilot rejoined the crew, returning to operational activities.

Referring to the IBAMA documentation, General Operations Manual (MGO), Safety Management Manual (MGSO) and Manual of External Cargo, both related to the air activity performed at the Institute, no information, request or training program was found for pilots who were rejoining the crew, due to the temporary departure after an aeronautical occurrence (Accident or Serious Incident) during the operation at the institution.

1.5.5 Validity of medical certificate.

The pilot had valid CMA.

1.6 Aircraft information.

The aircraft, serial number 52198, was manufactured by Bell Helicopter, in 1997, and was registered in the AIF category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe and engine logbooks records were updated.

The last inspection of the aircraft, the "50 hours" type was performed on 12MAY2016 by the Helisul Air Taxi Ltd. maintenance organization, in Cacoal - RO, having flown 02 hours and 40 minutes after the inspection.

The last overhaul of the aircraft, the "IAM" type was performed on 16NOV2015 by the Helisul Air Taxi Ltd. in the Bacacheri Aerodrome (SBBI), in Curitiba - PR, having flown 230 hours and 40 min after the inspection.

1.7 Meteorological information.

Nil.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The occurrence took place outside the Aerodrome.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The open area chosen for landing, the pasture of a farm, was considered as an unapproved or unregistered site. It was possible to make a normal or wide-angle approach to the chosen landing site.

The terrain was flat and firm, consisting of grasses, with a dimension of around 210m x 70m, and it was perfectly possible to land the aircraft on the spot.

The aircraft's final course was approximately of 185°, and before landing at the chosen location, the helicopter collided with a power line, located in the approach sector, with an estimated height of 15m.

During the collision, there was the impact of the upper wire cutter (Figure 3) against the wire and subsequent section of the wire. The pilot landed without identifying any abnormality in the flight or vibration commands in the aircraft, making the engine shutdown.



Figure 3 - In detail, the top wire cutter that sectioned the wire after impact.

After a brief inspection, the pilot did not identify any serious malfunctions that could jeopardize a new takeoff. He decided to start and try to take off to rescue the other agents who were in an indigenous area, near the landing site.

He took off vertically, started a new takeoff run, realizing, however, an intense vibration, that would make the flight impossible. The landing was carried out, with heading 105°, facing the farmhouse.

After landing and shutting down the engine, a more comprehensive new check was made on the aircraft. It was possible to identify the damages caused as a result of the impact against the wire.

In addition to the external damages (blades, drift, pilot windshield and external thermometer), it was identified that windshield shrapnel caused damage to the alarm panel and the collective control (Figure 4).



Figure 4 - Overview. On the detail, the piece of the vertical stabilizer sectioned after the collision.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Not investigated.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

Not investigated.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

The crew coordinated the disembarkation of the three passengers after the first landing. Subsequently, after the failed attempt to take off, due to the excessive vibration, the crew landed and left the aircraft after the engine shut down and total stop of the rotors.

1.16 Tests and research.

Nil.

1.17 Organizational and management information.

The IBAMA, operator of the aircraft, was a federal organization of a special regime linked to the Environment Ministry.

The regimental structure of the IBAMA approved by Decree 6,099, of 26.2.2007, listed among its purposes the actions of exercising the power of environmental police; execute enforcement actions, monitoring and environmental control; assistance and operational support to public institutions and society in matters of environmental accidents and emergencies and of relevant environmental interest.

The Monitoring and Air Operations Coordination (COAer), located in Brasília, was responsible for the planning, coordination, execution and management of air support for the fulfillment of the institutional missions of the IBAMA.

In the COAer, an IBAMA employee, qualified as an Safety Manager (GSO), and not a member of the Institute's crew, managed the accident prevention activity.

There was also the IBAMA Coordinator, who was in the place where the mission would be carried out. The crew, upon arriving at the "base" city of the mission, received a briefing from this Coordinator, which addressed objectives to be achieved and peculiarities of the air activity.

The Flight monitoring and supervision was carried out by the pilot himself, the aircraft's commander, who was to report to COAer any discrepancies or abnormalities that might occur during flights.

Among the planned documents that guided the Institute's air activity were identified: the General Operations Manual (MGO), the Safety Management Manual (MGSO) and the Manual of External Load.

The MGO, approved on June 2016, in item 1.1, Purpose, established:

"The purpose of this MGO is to describe procedures and systems related to air operations at the IBAMA and is used as an administrative and operational tool to control and direct the activities of the Air Operations Center (NOA)."

In item 1.2 (Conformity), it established:

"This MGO was elaborated, observing the precepts established in Law n. 7.565, Brazilian Aeronautical Code (CBA), and according to the guidelines of the Brazilian Aeronautical Certification Regulations (RBHA). Its purpose is to describe the policies and standards for decision-making and procedures for conducting NOA, as an aeronautical advisory body of the Environmental Protection Directory of IBAMA for fixed and rotating wing aircraft operations and activities directly correlated."

"In addition, this manual is kept up to date with the rest of the applicable aeronautical regulations, in particular the Brazilian Aeronautical Certification Regulation - RBHA 61, Brazilian Aeronautical Certification Regulation - RBHA 91 - Subpart K, and IAC 3535, 3203, 3252, 2225, 2308 and others. This General Operations Manual (MGO) is kept permanently in the Technical Library, located at NOA's operational headquarters, available to all personnel involved in NOA operations, as well as the Aeronautical Authorities."

In item 1.3, Commitment, the documentation established:

"NOA, through its Coordination, NOA-filled servers, consultants and employees, and people related to the NOA who are responsible for making decisions, undertake to disclose, comply with and enforce the guidelines of this General Operations Manual, when approved by the Brazilian Aeronautical Authority. They also undertake to seek the highest levels of safety quality in their air and ground operations, to encourage and support good aeronautical practices and to consider all suggestions and recommendations issued by any of its professionals, partners and suppliers and by authorities, in order to be permanently improving the conduct of aeronautical activities. "

"This manual is mandatory for all flight, ground, and NOA maintenance personnel and people related to air operations, and the Coordinator and Chief Operations Officer shall determine the levels of knowledge necessary for good performance in relation to the content of this manual, according to the tasks and positions occupied by the various professionals involved, as well as their areas of activity."

"At the administrative and operational headquarters, there is a copy of this manual, together with the Body of applicable legislation, which is the responsibility of all the Heads of the NOA sections. Also, in each aircraft, there is a copy of this MGO for consultation and for the faithful fulfillment by the crew."

"Each holder of this manual is responsible for complying with and enforcing the standards and procedures set forth therein. Holders are also responsible for their preservation and updating, and must return it to NOA in case of definitive removal."

The aircraft crew was unaware of the contents and existence of such Manual, despite the fact that the documentation previsions the need for full knowledge of the guidelines and standards issued by the IBAMA. In addition, the MGO was not available on the aircraft for consultation during the mission.

In the 3rd paragraph, sub-item 6.3.5 (Aerodrome requirements), it stated:

"Landings and take-offs of helicopters at non-approved or registered locations are authorized under certain conditions as set forth in RBHA 91 Subpart K, and it is the Commander's responsibility to judge the suitability and service of the chosen location at the safety minima required in terms of obstacles and the possibility of getting around an emergency, in particular the failure of an engine."

Regarding the MGSO, approved on August 2015, it detailed in item 2.5:

"This MGSO is regulated by the ANAC as one of the requirements of Resolution 106 of 30JUN2009, whose implementation allows the adoption of preventative and predictive approaches to safety."

The MGSO described the characteristics of the Safety Management System (SGSO) as a set of integrated measures, procedures and practices and tasks of the personnel involved in the SGSO.

The purpose of the MGSO was to consolidate and integrate information and documentation regarding the policy, objectives, strategies, goals, indicators, programs, procedures and responsibilities pertaining to the IBAMA's SGSO, as well as the structure, organization, planning and programming of its implementation.

Regarding the specific safety programs foreseen in the MGSO, it is highlighted item 11 (safety audits program), which included:

"This program is intended to establish the procedures necessary for planning and conducting safety audits (ADSO). The purpose of ADSO is to provide the IBAMA management with information on the existing risk conditions in the air operation, but that are not easily detected at the management level during routine operations. "

"The ADSO will be carried out through observation, documentary analysis and interviews with people involved in the activity. In addition to the ADSOs provided in

the calendar of this manual, an ADSO will be held on an exceptional basis whenever one of the following circumstances occurs:

"- Accident with an aircraft operated by the IBAMA."

"- Repetition of incident or ground incident."

In its item 11.2, Report of ADSO and Follow-up, it established:

"Immediately after the completion of each ADSO, the Safety Manager will prepare a report containing the description of the observed risk conditions, their analysis of the severity and likelihood of contributing to the occurrence of an accident and the proposition of one or more corrective actions for the elimination of each risk involved."

"This report will be presented to the Director of Environmental Protection and then to the President of IBAMA so that, within a maximum of fifteen days, corrective actions are approved for compliance."

"The Safety Manager shall supervise the execution of each corrective action and shall establish the need for a new ADSO to be carried out to evaluate the effectiveness of the procedures adopted for its compliance."

"The Safety Manager shall monitor compliance with all corrective actions, informing the Director of Environmental Protection of the situation in each IBAMA sector or of the need to adopt other measures."

According to consultation held with COAer, there were two operation bases of the IBAMA in the country. After the occurrence with PT-YEL, in spite of not being classified as "accident", but being the second occurrence in operation in the year, two ADSOs were carried out, one at the base in the city of Sinop - MT and another at the Novo Progresso's Base - PA, that is, one in each base of operation.

According to COAer, the audits occurred in these localities due to the peculiarities of the operations and the involvement of the IBAMA teams with other institutions (PRF, PF, FUNAI, etc.).

The results of the audits were not implemented, due to the departure of the Institute's Safety Manager. In addition, it was also verified that there was no ADSO in COAer.

The External Cargo Manual, approved on August 2015, prepared in accordance with RBAC 133-47, contained information on IBAMA's special external load operations.

There was a leveling course that the crewmember was supposed to perform to start operating on the Body. This course covered the theoretical and practical part of the Institute's operations.

The practical part was programmed only for the pilots and mechanics of the contracted company. The crewmembers, called "crew chiefs" and the copilots, only performed the theoretical course.

With regard to training, there was provision for recycling in the techniques applicable to the type of operation only for pilots and mechanics who had already undergone training. The Manual did not include theoretical recycling for copilots and crew (crew chiefs).

Regarding daily air activity, sub-item 4.27.1, Characteristics of Operations of External Cargo Manual operations prevised:

"The firefighting operation using aircrafts often occurs in narrow, deep valleys, or mountains, under restricted visibility conditions by smoke. In these conditions, the risk of collision in flight with other aircraft, cables or even with the ground is considerable. "

"While maximum journey time is set by legislation, all pilots must carefully weigh their limits, looking for fatigue symptoms, as well as all other aspects of their physical well-being. Do not hesitate to interrupt a flight if you feel tired or sick. "

The IBAMA air operation was classified as "federal indirect administration" and had as main characteristic the accomplishment of typical missions of the public security aviation.

Although the Institute is not classified as a public security operator (because it is a federal indirect administration), it was required to carry out missions with characteristics of public security, including exposure to armed confrontation and operation in restricted areas.

As IBAMA was not classified as a public security operator, the air operation developed by the Institute, in fact, was accomplished with exceptional conditions, since it did not make use of the prerogatives of Subpart K of RBHA 91, however It was necessary to the fulfilment of its institutional mission.

In addition, the Institute had pilots hired from an airline, therefore, operating under Law 7,183 (regulating the exercise of the aeronautical profession) and in accordance with the labor agreement, and were therefore restricted to environmental, social conditions defined for airlines.

This fact caused restrictions to the Body's own operation, since it did not provide a system of selection and accompaniment for the inclusion of personnel in its crew.

In 2016, through a lease agreement with an air taxi company, the IBAMA operated six helicopters, one being an AS350 Squirrel and five Bell Long Ranger 206L-4. The rental company was responsible for the maintenance of the aircraft and for the provision of a mechanic for accompanying each helicopter during its operations.

In that year the institute flew a total of 1,557 hours until the occurrence, all relating to flights of inspection, transfer, policing, support, monitoring and transport of cargo and of fire fighter.

The helicopter crew consisted of 28 pilots from various organizations, such as military police, military fire brigade and pilots of aircraft rental companies. In the year 2016, an IBAMA's pilot was added to the existing group.

1.18 Operational information.

The definition of the helicopter crews was made jointly by the IBAMA (Operator) and by the hired company, being the copilots defined by the IBAMA and the pilots (commanders) by the hired company.

On the day of its occurrence, the crew consisted of only one pilot (commander) and one non-pilot crewmember, called "crew chief".

Each crew, which performed a mission by the IBAMA, alternated every fifteen days. At the time, the pilot and the "crew chief" were in their first mission period. The "crew chief" had joined the IBAMA Crew Board in 2012, having only performed an operational mission in 2013.

The arrival of the crew took place on 11MAY2016, in Porto Velho - RO, where the aircraft was. The next day, 12MAY2016, there was a transfer to the city of Ji-Paraná (SBJI), where the meeting with the local Coordinator of the IBAMA would take place, which would detail the operation to be carried out.

At SBJI, the local Coordinator informed where the operation would take place and what it was about. Although an eventual landing in an unprepared area was prevised, there was no warning about the characteristics of the area of the activity, such as slope of the terrain, types of vegetation, obstacles (energy transmission towers, etc.), roads / support to possible emergency landings, among other things deemed necessary for the safety of the operation.

According to the pilot, it was routine for the IBAMA's operation, to receive the details about the mission moments before its beginning and without any in-depth study on the characteristics of the mission. In this case, it would be performed in a mining located in an indigenous area on the outskirts of the city of Cacoal - RO, with involvement of another federal agency – the Federal Police - PF.

The PF agents, who would be transferred to the areas defined by the Coordinator, were, however, already in the area of operation in Cacoal, making an initial IBAMA briefing impossible with all those involved.

Thus, both the briefing of the operation and the briefing of how to proceed inside the aircraft, also following what was provided in sub-item 6.9.3 of the Institute's MGO, was segmented, occurring at different times.

Also on 12MAY2016, reconnaissance flights were performed in the city of Cacoal, with the return and crew overnight in Ji-Paraná. On that day, 7 hours and 25 minutes of air activity were carried out, as observed in the flight logbook's diary.

According to the commander, he would be in charge of the hours flown control, not being restricted by the IBAMA, provided that the hours established in the legislation in force were fulfilled.

According to Law No. 7,183, dated 05MAY1984, regulating the exercise of the profession of aeronaut, article 29, item "d", the daily flight limit would be of 8 hours. In Article 30 (d), the monthly limit of flight hours for helicopters could not exceed 90 hours.

On the day of the occurrence, 13MAY2016, the pilot and the "crew chief" had adequate rest. The commander performed the pre-flight inspection and nothing abnormal was found, as well as there were no technical discrepancies recorded in the flight logbook.

The weight and balance calculation considered the transfer to the next aerodrome with a passenger. Fuel consumption and the first trips to the operating areas with their respective passengers were also recorded.

The aircraft took off from SBJI at 1140 (UTC), to SSKW, arriving at 1250 (UTC). At the Aerodrome, the area of the mining to be inspected on the day was delineated. In addition to the two crewmembers (commander and "crew chief"), an IBAMA prosecutor, a police officer and two PF agents.

Since it had already consumed fuel in the transfer, even with six people on board there were landing conditions in an area considered restricted. Since the mining point was 20 minutes from SSKW, the aircraft had endurance to make a total of three transfers to the mining and return to landing and refueling in Cacoal.

At about 1440 (UTC), the aircraft took off for the mining. When flying over the area, no movement of machines or people, which characterized "area with activity", was identified. It was decided to make an on-site landing with the engine shut down, for further investigation, which occurred in the sequence.

With one hour on the site, the IBAMA team and the PF agents returned to the aircraft, informing that there was no mining activity in that area and a new takeoff was carried out. It was decided to fly over the region.

Soon after the takeoff, an area with deforestation was identified and personnel opening a clearing. As there was a landing area nearby, an on-site landing was made and the four passengers on board were disembarked.

The pilot made another takeoff towards SSKW. At the Aerodrome, two more agents boarded and the pilot proceeded to the new area of operation, around 20 minutes flight

from the Cacoal runway. After landing the two passengers on the spot, the aircraft returned to SSKW.

At 1830 UTC, the aircraft took off from SSKW towards the point where the operation was taking place. Three agents were boarded at the scene. At that moment, the local coordinator of the IBAMA requested that the agreed to take the agents to the runway of Cacoal and return would no longer be fulfilled, as this would require a lot of time.

In spite of the fact that there was no apparent animosity from the Indians and the people in the place, the Coordinator advised that an area nearby was searched (outside the indigenous area), so that the three agents would be disembarked and, as soon as possible, return to rescue the other three agents.

The aircraft took off from the area and with ten minutes of flight, the crew identified a pasture outside the indigenous area, near a power grid, a house, probably a farmhouse, and a dirt road.

Estimating a calm wind (observation of the local vegetation - whose branches did not vary in any direction), the commander defined the heading of approximation, around 185° . He made a pass in the profile that would be made the landing approach (Figure 5).

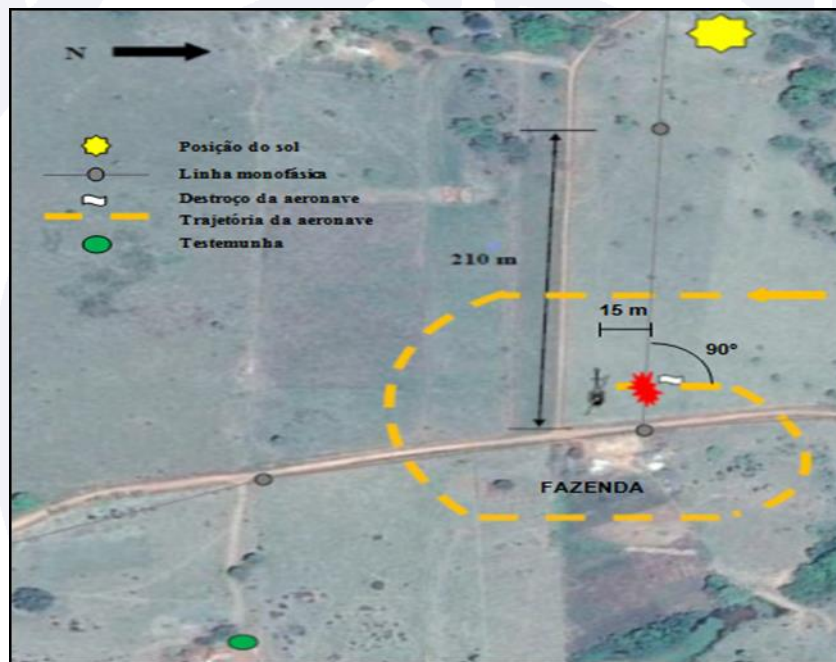


Figure 5 - Sketch of the occurrence.

As he passed the fence that bordered the pasture, he curved to the left, authorized the opening of the door by the "crew chief" (left door), to identify obstacles in the landing area.

At that moment, they talked about the power grid, which the commander said, had been identified and that the network was parallel to the road that is, it would not interfere in the approach to the open area (pasture).

After identifying the obstacles and peculiarities of the place, the "crew chief" closed the door. The sun would be to the right of the aircraft in the final approach, also not interfering with the view of the landing area by the pilot.

The idea of approaching that area, the one closest to the farmhouse, would be to provide a possible support, if necessary, for the agents landed on the first leg.

The procedures and speeds predicted for the base and final leg were as recommended.

At the final approach, with 60kt, the crewmember opened the left door, beginning the final phraseology for landing with the pilot.

Near the landing site, about 15m away and 15m high, a momentary "braking" of the aircraft was noticed followed by a boom. The pilot proceeded closely to the completion of the approach without identifying any abnormalities in the flight commands.

It was made a landing at the heading of the approach and the cut off the engine. It was identified that a collision occurred with a wire of a single-phase line.

According to the pilot and the "crew chief", they identified the line that accompanied the parallel road, but the connection of this line with another line perpendicular to it and that took energy to the farm, was not visualized, due to the distance between the poles being very large and, as the wire was single-phased, its visualization was imperceptible during the obstacle recognition run performed.

With the rotor stopped, the crewmember disembarked the three passengers.

The pilot and the "crew chief" examined the aircraft in general, in order to identify damages due to the collision with the wire. Damage was identified in the right windshield, in the collective, and a cut in the vertical stabilizer.

As the aircraft apparently did not have its flight condition affected, it was decided to re-start to rescue the other three agents in the gold prospecting area.

The landed agents proceeded to the farmhouse to request support to proceed to the town.

The crew performed the start and vertical takeoff procedures without identifying any abnormalities.

When starting the normal takeoff, the pilot identified abnormal vibration in the aircraft that, with the increase of speed (reached up to 20kt of indicated speed), increased progressively.

The pilot decided to abort the takeoff run and returned controllably to the landing at the same location, stopping with the nose of the aircraft facing the farmhouse. The landing, engine failure, and abandonment occurred without any abnormality.

Possibly, with the new start, additional efforts were made on blades and surfaces called "TAB", which reduce vertical vibration of the aircraft, causing the blades to rotate at the same heights during the flight.

The pilot and the "crew chief" did not identify any damage to these surfaces after impact, as they should be small and difficult to detect, visually speaking. With the rotational movement of the blades, the aircraft presented excessive and exponential vibration as the speed increased.

Meteorological conditions were favorable to the visual flight, with no cloudiness or strong winds that could have prejudiced the pilot's judgment regarding the choice of the best approach sector for the landing. The sun stayed to the right of the aircraft during the final approach, not obfuscating the visualization of obstacles on the ground.

Regarding the operation of the aircraft, it was approved for a maximum takeoff weight of 3,730 lbs, under International Standard Atmosphere (ISA) conditions - sea level, 15°C and 1,013.2hPA.

At the time of occurrence, the temperature was approximately 31° C, the altitude of the terrain was 700ft, density altitude (calculated) was 2,640ft, atmospheric pressure was around 1,017hPA and the aircraft weight was 3,618lb. By consulting the chart, the aircraft was within the limits of weight and balance.

Regarding the performance of the aircraft, inserting these data into the graphs in ground effect (IGE) and out of ground effect (OGE), it was concluded that the aircraft was within the limits of operation.

1.19 Additional information.

As for the characteristics of electric power transmission wires, the transmission lines are basically made up of metal conductive wires, suspended in towers by means of insulators made of ceramic or other highly insulating materials.

According to information provided by Eletrobrás - RO, the circuit involved was a medium voltage distribution network, type Single-wire Network with Ground Return (MRT). The "zinc" steel conductive cable had a thickness of 3.09mm and a breaking load equal to 1,800kgf.

The energy provider was questioned about the obligation of signaling the network. The distributor's medium voltage technical standards did not provide signaling for network wires in the region.

The Brazilian Regulatory Standards (NBR) 7276 and 6535, of 2005, established the warning signaling requirements for air electric power transmission wires, as well as establish procedures for the safety of air inspection, by placing signaling beads on the electric power transmission cables.

Ordinance No. 957 / GC3, of 09JUL2015, of the Aeronautics Command, provided for restrictions on objects projected in the airspace that could adversely affect the safety or regularity of the air operations, referring to the Aerodrome Protection Zone Basic Plan (PBZPA), Basic Helicopter Protection Zone Plan, Aerodrome Protection Zone Specific Plan, Special Aircraft and Helicopter Routes Zone Protection Plan, and Air Navigation Aid Protection Zone Plan.

According to the aforementioned Ordinance, Aerodromes should have a PBZPA, which would establish that the area around the runway would have restrictions, according to distance and forecasted height and technical specificities, restricting the construction of buildings at heights that would put at risk or affect the safety of each flight.

Still in the Ordinance, Chapter V dealt with the Signaling and Illumination of Objects. Article 68 provided that a new object or existing object should be signaled and illuminated, as planned, in the following cases.

"I - in the case of towers, masts, poles, elevated electrical lines, suspended cables or other objects whose configuration is barely visible at a distance which are located within the lateral limits of the transition surface or within 3,000 m of the inner edge of the surfaces approach or take-off, even if they do not exceed the vertical limits of those areas;"

"II - in the case of air power lines, suspended cables or other objects of similar configuration crossing rivers, waterways, valleys or roads;"

"III - in the case of articles that rise to 150 m or more in height;"

"IV - in the case of an obstacle;" or

"V - upon request, at the discretion of the Regional Authority of DECEA."

Finally, the Ordinance defined in Table 3-4 (Dimensions of Obstacle Limiting Surfaces - PBZPA / PEZPA) the internal and external radius that, according to height, distance and location in relation to approach and takeoff (runway axis) could be an obstacle to the operation.

The restrictions varied according to the type of Aerodrome operation, being: visual, non-precision IFR and Precision IFR.

For the off-runway axis surfaces, such as the location of the wire involved in the collision, the Horizontal Internal Limit whose Aerodrome operated visual, would be height of 45m and radius of 2,000m. There would be no limitation to the Horizontal External Limit.

For the off-runway axis surfaces, the Horizontal Internal Limit, whose Aerodrome operated non-precision IFR and precision IFR would be height of 45m and radius of 3,500m. For the Horizontal External Limit, we would have height of 150m and radius of 20,000m.

The transmission line was located 33km from the Aerodrome, at a height of about 15m, at an off-axis position. According to the Ordinance, it would not therefore be an obstacle to air navigation, not needing to be signaled, corroborating with the Concessionaire's response on the subject of network signaling.

In consultation with the Administrator of Cacoal Airport, until the date of the occurrence, the runway did not yet have PBZPA. The Plan had been sent to the DECEA, and its approval was awaited. This PBZPA draft reinforces that the point in question was off-axis and did not present any obstacle to the air operation.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

The crew had a mission from the IBAMA. This was an interdiction on deforestation in an indigenous area on the outskirts of the city of Cacoal - RO, 33 km away from this locality.

During the approach to landing, in an open area of a farm near the area of the operation, aiming to leave three agents from the PF, the crew noticed a bump, followed by a boom, coming from the collision against a power line. The commander proceeded normally in the final, landing and cutting off the engine.

After landing, cutting off the engine and stopping the rotor, he disembarked the three agents, made a new engine start and attempted to take-off. As in the take-off procedure the vibration from the rotary assembly increased progressively, the commander interrupted the takeoff and returned to the starting point, controlled, landing with the heading facing the farmhouse.

According to the data obtained during the investigation, the commander had been working on the IBAMA missions since February 2011 and had adequate training and experience to carry out the mission. On the flight that caused the occurrence, he operated under the rules of Subpart K of RBHA 91.

The pilot was therefore accustomed to operating even in high risk situations, such as landings and departures made in not approved or registered places, as well as in emergency response.

It was also determined that the commander had been involved in a serious incident during a mission by the IBAMA in the 2015. As provided by RBAC 67, RBAC 135 and Training Program of the aircraft rental company and the pilot, the commander followed the steps of the training recommended for reintegration into air activity.

In the consultations performed in the Institute manuals (MGO, MGSO, External Cargo Manual), no information was found regarding the return of the crewmember to the air activity, after the temporary removal, due to the involvement in aeronautical occurrence during operation.

Despite compliance with the provisions of the ANAC and leasing company documentation, the activity developed by the IBAMA has stressors that differentiate it, which may increase the risk of air activity.

When considering such specificities, it is possible that the adequate reinsertion of the professional in the air activities demand the accomplishment of a specific recycling directed to the crewmembers separated from the air activity.

In this context, it was incumbent upon the IBAMA to formalize requirements for crewmembers in general, pilots and non-pilots, in order to ensure the adequate accompaniment of the crew and the management of the air activity.

In the organizational part, the IBAMA regimental structure, approved by Decree 6,099, of 26APR2007, listed among its purposes the following actions:

"Exercise the power of environmental police; execute enforcement actions, monitoring and environmental control; assistance and operational support to public institutions and society in matters of environmental accidents and emergencies and of relevant environmental interest."

Thus, in spite of the actions undertaken by the Institute to identify themselves with those of public security and civil defense, because they did not belong to the direct public administration, the IBAMA could not operate under the rules of Subpart K of RBHA 91.

Thus, the IBAMA was not required to establish minimum training standards for its missions, as the Civil Aviation Authority requires from the public organizations.

Despite the absence of minimum standards, the IBAMA has implemented specific, theoretical training for all its crewmembers and practical, only for the aircraft rental company's pilots.

As it did not contemplate all the crew, this situation could generate lack of standardization in the execution of its missions, creating an atmosphere conducive to divergences of procedures between the crew.

The training program of a company guides the training of the crew and the maintenance of their operational functions, serving as the basis for the implementation and strengthening of standardization in the activities performed in an organization, promoting greater quality in the members' interaction.

As for the aircraft, the documentation was up-to-date, with no evidence of discrepancies that might have impaired its operation and contributed to the occurrence. It was found that, at the time of occurrence, the aircraft was capable of power and performance for operation both inside and outside the ground effect.

There was no ceiling or visibility restriction in the area, according to crew reports. At the time of the occurrence, it was estimated that the wind was calm.

The area chosen for landing had characteristics appropriate to the operation, taking into account length and width. It was an open pasture area, with flat, firm ground with grass cover, with no obstacles in the ground.

In addition, there was enough room for approach and landing safely at the chosen location. However, the crew did not consider the presence of electric wires in that locality and, therefore, did not act in the sense of avoiding the collision.

As observed on the field investigation and in the crew report, the approach axis for the landing, heading 185°, left the Sun positioned to the right of the final, not overshadowing the vision of the crew, pilot and "crew chief", not having contributed for not visualizing the power wire.

However, the fact that the distance between the power poles was very large, around 210m, and that there was no signaling on the wire, could have contributed to the crew not being able to see the network, in the only pass made over the selected area to the landing.

In relation to the overflight procedure of the place chosen for the landing, it was possible to infer that a single pass on this one was insufficient for the identification of all the obstacles on the ground.

In such circumstances, it is possible that a new pass over the area would allow the crew better conditions of evaluation of the locality.

In this way, if a second overflight was carried out in the area using a different axis of pass, probably that branch of the network, at 90° of the line that followed parallel to the road, would be sighted by the pilot or by the "crew chief".

According to sub-item 6.3.5 (Aerodrome Requirements), the IBAMA's MGO, landings and departures at non-homologated or registered sites, as was the case at the chosen location, were entirely the pilot's responsibility and judgment.

There were no specificities of procedures (number and overflight axes) to be performed to identify possible obstacles on the ground, among other potential hazards for approach and landing.

With regard to the general briefing of the operation, which the IBAMA Coordinator gave on 12MAY2015, and the verbal instructions of the crew to the passengers (sub-item 6.9.3 of the MGO), a meeting was first held with the crew in Ji-Paraná. Subsequently, it was performed with the PF agents.

The verbal instructions to the passengers (PF agents) were given in the area of operation, not counting long enough, usually used by the crew.

The reduction of the time available for the operational briefing may have impacted on the quality of team interaction and favored a lowering in the level of situational awareness of the crew.

It was also identified that, the MGO was intended to describe the policies and standards for decision-making and the procedures for conducting NOA, as an aeronautical advisory body of the IBAMA with regard to operations of fixed and rotating wing aircraft and directly related activities.

It also provided that the manual would be mandatory for all flight, ground and NOA personnel, as well as persons related to air operations. It was prevised the existence of a copy of the MGO on board the aircraft for consultation and faithful compliance.

Regardless of what was provided in the Manual, this documentation was not available on the aircraft and those who participated in the air activity did not know its content, evidencing a latent factor for aeronautical occurrences, since the various prescriptions issued by the IBAMA were not known by those interested and involved in the air activity.

The current MGSO provided for the Safety Audit Program (ADSO) that should be performed annually, or, in case of accident, recurrence of an incident, among other circumstances.

The occurrence with the PT-YEL aircraft was the second one in 2016 involving COAer. The first, of the serious incident type, occurred in March 2016 with the registration helicopter PR-HCT.

The COAer carried out two ADSOs, one at the Institute's base in the city of Sinop - MT, and another at the base located in the city of Novo Progresso - PA.

The results of these audits were not implemented, according to the Monitoring and Air Operations Coordinator, as the Safety Manager had left the IBAMA.

Accordingly, sub-item 11.2 (ADSO and Monitoring Report) was not followed, according to which, immediately after the completion of each ADSO, it was incumbent upon the Safety Manager to prepare a report containing a description of the observed risk conditions, its analysis of the severity and likelihood of contributing to the occurrence of an accident, and the proposition of one or more corrective actions to eliminate each risk involved.

Had it been prepared as planned, this report would be submitted to the Director of Environmental Protection and, later, to the President of the IBAMA, so that, within a maximum of 15 days, corrective actions could be approved for compliance.

It should be noted that, in this scenario, there was an interruption in the ADSO process, making it impossible to close the prevention cycle.

These circumstances may have contributed to the occurrence in question as they favored the continuation of conditions that could weaken the safety of air activities conducted within the Institute.

As reported by ELETROBRÁS-RONDÔNIA, the region's energy supplier, corroborated by the provisions of Ordinance No. 957 / GC3, the location and height of the power line did not present obstacles to air navigation or to landing and take-off procedures in the Cacoal runway axis region (SSKW).

The lack of more detailed knowledge of the area to be operated contributed to the ignorance of obstacles in the field. This could have been avoided by prior planning of the operation, done by the IBAMA's local Coordinator.

It is added to this fact, the lack of a definition of the minimum number of passes to be performed before a landing in a possible area that, in the case of the occurrence in question, contributed to the collision of the aircraft against the wire in the final landing approach.

3. CONCLUSIONS.

3.1 Facts.

- a) the pilot had valid Aeronautical Medical Certificate (CMA);
- b) the pilot had valid 206L-4 aircraft Rating;
- c) the pilot was qualified and had experience in that kind of flight;
- d) the aircraft had valid Airworthiness Certificate (CA);
- e) the aircraft was within the limits of weight and balance;
- f) the airframe and engine logbooks records were updated;
- g) the weather conditions were not favorable for the flight;
- h) the pilot was part of the IBAMA's crew since February 2011;
- i) in 2015, the pilot was removed from the air activity, after an aeronautical occurrence during an IBAMA operation;
- j) the aircraft was taking part of an interdiction mission to deforestation in an indigenous area on the outskirts of the city of Cacoal - RO;
- k) the MGO was not available on the aircraft;
- l) the crew was unaware of the content of IBAMA's MGO;

- m) during the approach to an open area, the aircraft collided with a power line;
- n) the wire cutter of the aircraft has sectioned the wire;
- o) the pilot was able to continue the approach, with the controlled aircraft, to make the landing, to cut off the engine and to disembark the passengers;
- p) after restart and attempted take-off, due to excessive vibration, the pilot returned to the landing point, cutting off the engine and abandoning the aircraft after the rotors stopped;
- q) the aircraft suffered minor damage; and
- r) all occupants left unharmed.

3.2 Contributing factors.

- **Piloting judgment – a contributor.**

There was an inadequate evaluation of the inherent aspects of the approach, with a single overflight of the place where the landing would be carried out and the definition of only one sector of the area to visualize the obstacles in the terrain.

This attitude contributed to the non-identification of the energy wire in the final approach and the consequent chain of events that culminated in the occurrence.

- **Perception – a contributor.**

During the approach to the landing, the wire of the existing electrical network in the locality was not perceived by the crew, which led to the collision of the aircraft against this obstacle.

- **Flight planning – a contributor.**

During the flight planning, the pilot did not consider aspects related to the area of the operation, with the possibility of an eventual landing, such as slope of the terrain, types of vegetation, obstacles (electric power transmission towers), supporting roads to a possible emergency landing, or even the definition of possible landing sites for emergency support.

- **Decision-making process – a contributor.**

Although the selected area presented propitious conditions for landing, there was an inaccurate evaluation of the elements present in that context that could increase the risk of the operation area, which contributed to the collision of the aircraft against the power line.

- **Organizational processes – undetermined.**

The absence of a program for crew follow-up, after involvement in aeronautical events; the failures related to the planning and supervision of the mission; as well as those related to the identification and mitigation of latent conditions through audits (ADSO), denoted vulnerabilities in processes established in the organizational context.

These weaknesses may have contributed to the maintenance of conditions unfavorable to flight safety, affecting the preparation and performance of the crew.

- **Managerial oversight – a contributor.**

From the management level to the operational level, there was no adequate supervision regarding the dissemination of the guidelines prescribed in the MGO and the initial coordination of the mission, in the sense of the IBAMA Local Coordinator bringing

together all involved in the operation and instructing them on the peculiarities of the mission, potential hazards, most suitable landing areas for emergencies, relief features and obstacles on the ground, among other information essential for the safety of the operation.

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):

IG-084/CENIPA/2016 - 01

Issued on 03/11/2019

Act together with the IBAMA, in order that the General Operations Manual of that operator be disclosed and made available to all crewmembers working with the aircraft operated by that Institute.

IG-084/CENIPA/2016 - 02

Issued on 03/11/2019

Act with the IBAMA, in order to the operator to establish minimum and periodic practical training for all crewmembers operating the Institute's aircraft, in order to consolidate doctrinal, standardization and safety aspects.

IG-084/CENIPA/2016 - 03

Issued on 03/11/2019

Act with the IBAMA, in order to make that operator to insert in its MGO, or in another pertinent document, prescriptions regarding the return of the crewmember, pilot or not, to the air activity after having been involved in aeronautical occurrence.

IG-084/CENIPA/2016 - 04

Issued on 03/11/2019

Act together with the IBAMA, in order to make that operator to establish a minimum standard of necessary overflight to survey the ground characteristics that will be used as landing site, occasion that it will be considered the type of terrain, the presence of obstacles, the relief and any other aspects relevant to the safety.

IG-084/CENIPA/2016 - 05

Issued on 03/11/2019

Act with the IBAMA, in order to make that operator to complete the processes of the already initiated Safety Audits (ADSO) and to perform, as provided in the current MGSO, new ADSOs in its bases, seeking to identify, manage and mitigate the risk involved in the operations of the Institute.

IG-084/CENIPA/2016 - 06

Issued on 03/11/2019

Act with the IBAMA, in order to make the operator to establish, in a document that it deems pertinent, requirements for the general briefing of the mission, to be carried out, in advance and by a designated coordinator, for all those involved in the air operation of the Institute.

IG-084/CENIPA/2016 - 07

Issued on 03/11/2019

Act together with the IBAMA, in order to reassess the adequacy of the Safety Management Manual (MGSO) adopted by that operator, especially in relation to the mechanisms of flight planning, management planning, organizational processes and managerial supervision.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On March 11th, 2019.

