

**COMANDO DA AERONÁUTICA**  
**CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE**  
**ACIDENTES AERONÁUTICOS**



**FINAL REPORT**  
**A - 103/CENIPA/2015**

<b>OCCURRENCE:</b>	<b>ACCIDENT</b>
<b>AIRCRAFT:</b>	<b>PR-ITO</b>
<b>MODEL:</b>	<b>210D</b>
<b>DATE:</b>	<b>20JUL2015</b>



## NOTICE

*According to the Law n<sup>o</sup> 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<sup>o</sup> 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

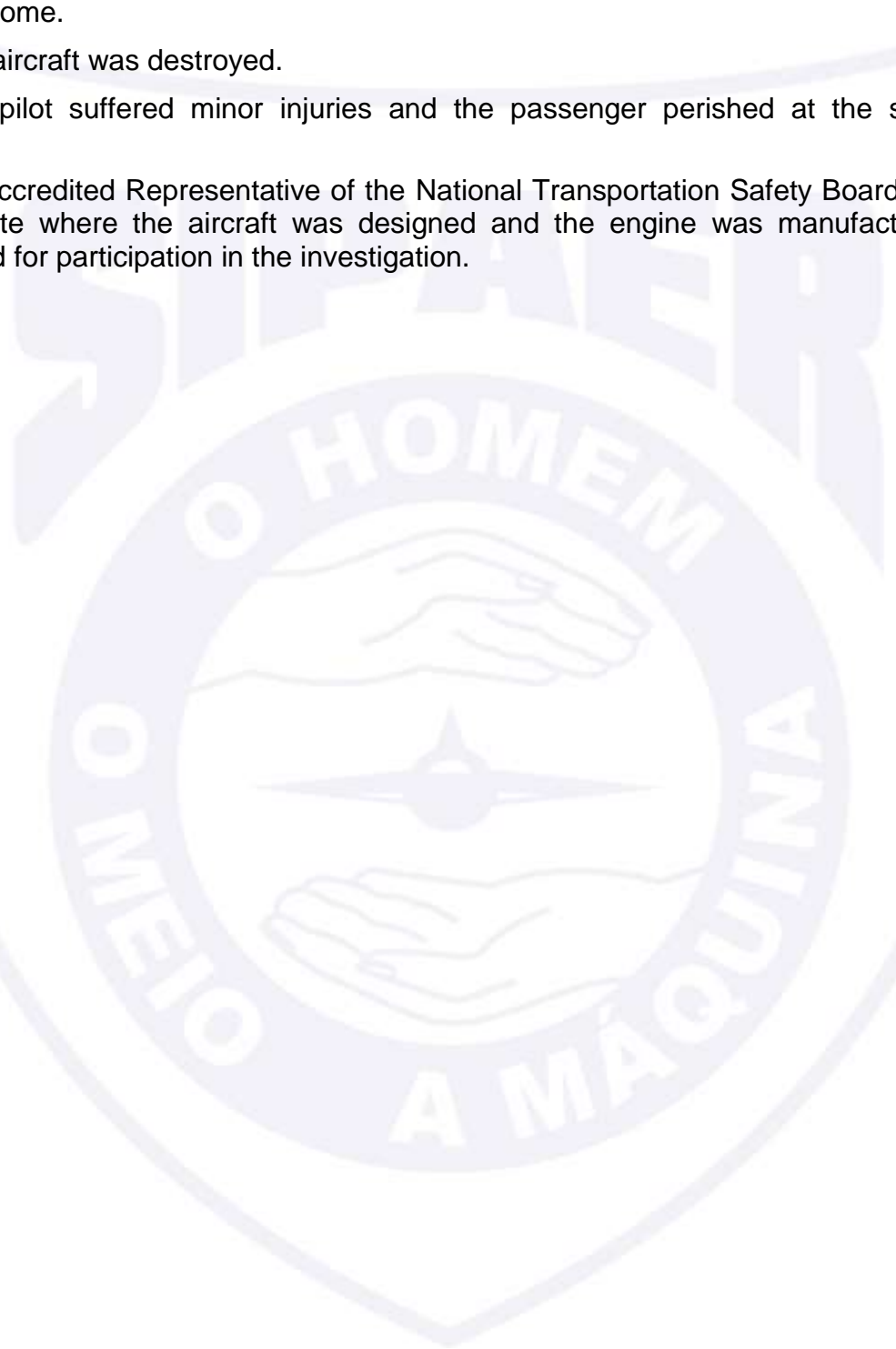
This is the Final Report of the 20JUL2015 accident with the 210D aircraft, registration PR-ITO. The accident was classified as “[LOC-I] Loss of Control in Flight”.

After the touch and go procedure on the ground, in the trajectory to enter the wind leg, there was loss of engine power. The aircraft crashed into the ground, about 5km from the Aerodrome.

The aircraft was destroyed.

The pilot suffered minor injuries and the passenger perished at the site of the accident.

An Accredited Representative of the National Transportation Safety Board (NTSB) – USA, (State where the aircraft was designed and the engine was manufactured) was designated for participation in the investigation.



## CONTENTS

<b>GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS .....</b>	<b>5</b>
<b>1. FACTUAL INFORMATION.....</b>	<b>6</b>
1.1 History of the flight.....	6
1.2 Injuries to persons.....	6
1.3 Damage to the aircraft.....	7
1.4 Other damage.....	7
1.5 Personnel information.....	7
1.5.1 Crew's flight experience.....	7
1.5.2 Personnel training.....	7
1.5.3 Category of licenses and validity of certificates.....	7
1.5.4 Qualification and flight experience.....	7
1.5.5 Validity of medical certificate.....	7
1.6 Aircraft information.....	7
1.7 Meteorological information.....	8
1.8 Aids to navigation.....	8
1.9 Communications.....	8
1.10 Aerodrome information.....	8
1.11 Flight recorders.....	8
1.12 Wreckage and impact information.....	8
1.13 Medical and pathological information.....	9
1.13.1 Medical aspects.....	9
1.13.2 Ergonomic information.....	9
1.13.3 Psychological aspects.....	9
1.14 Fire.....	9
1.15 Survival aspects.....	9
1.16 Tests and research.....	10
1.17 Organizational and management information.....	11
1.18 Operational information.....	11
1.19 Additional information.....	12
1.20 Useful or effective investigation techniques.....	12
<b>2. ANALYSIS.....</b>	<b>12</b>
<b>3. CONCLUSIONS.....</b>	<b>14</b>
3.1 Facts.....	14
3.2 Contributing factors.....	14
<b>4. SAFETY RECOMMENDATION.....</b>	<b>15</b>
<b>5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.....</b>	<b>15</b>

**GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS**

ANAC	Brazil's National Civil Aviation Agency
ATS	Approach Control
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CIV	Pilot's Flight Logbook
CMA	Aeronautical Medical Certificate
DCTA	Aeronautics' Science and Technology Department
GPS	Global Positioning System
IAE	Aeronautics and Space Institute
IFRA	Instrument Flight Rating - Airplane
INVA	Flight Instructor Rating - Airplane
MLTE	Airplane Multi Engine Land Rating
MNTE	Airplane Single Engine Land Rating
NM	Nautical Miles
NOTAM	Notice to Airmen
NSCA	Aeronautics Command System Standard
NTSB	National Transportation Safety Board (USA)
PCM	Commercial Pilot License – Airplane Category
PPR	Private Pilot License – Airplane Category
ROTAER	Auxiliary Air Route Manual
SBJD	ICAO Location Designator – Jundiaí Airport - SP
SWLC	ICAO Location Designator - General Leite de Castro Aerodrome, Rio Verde - GO
TPP	Terminal Control Area
UPA	Emergency Care Unit
UTC	Universal Time Coordinated
VFR	Visual Flight Rules

## 1. FACTUAL INFORMATION.

<b>Aircraft</b>	<b>Model:</b> 210D <b>Registration:</b> PR-ITO <b>Manufacturer:</b> Cessna Aircraft	<b>Operator:</b> Private
<b>Occurrence</b>	<b>Date/time:</b> 20JUL2015 – 0015 UTC <b>Location:</b> São Tomaz Abóbora Farm <b>Lat. 17°52'24"S Long. 050°56'19"W</b> <b>Municipality – State:</b> Rio Verde - GO	<b>Type(s):</b> “[LOC-I] Loss of Control in Flight”. <b>Subtype(s):</b> NIL

### 1.1 History of the flight.

The aircraft took off from the Jundiá Aerodrome (SBJD), with a pilot and a passenger on board, to the General Leite de Castro Aerodrome - GO (SWLC), located in the municipality of Rio Verde, at about 2115 (UTC), in order to carry personnel.

After performing a long landing, in the second half of the runway, the pilot decided to carry out a touch and go procedure on the ground, to make a new traffic circuit for landing.

In the trajectory to enter the wind leg, there was loss of engine power. The aircraft crashed into the ground about 5km from the Aerodrome.

The aircraft was destroyed.

The pilot suffered minor injuries and the passenger perished at the site of the accident.



Figure 1 - Side view of the aircraft after collision against the ground.

### 1.2 Injuries to persons.

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



### 1.3 Damage to the aircraft.

The aircraft was destroyed.

### 1.4 Other damage.

Nil.

### 1.5 Personnel information.

#### 1.5.1 Crew's flight experience.

Hours Flown	Pilot
Total	262:22
Total in the last 30 days	20:00
Total in the last 24 hours	02:00
In this type of aircraft	162:43
In this type in the last 30 days	20:00
In this type in the last 24 hours	02:00

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

#### 1.5.2 Personnel training.

The pilot took the Private Pilot Course – Airplane, at the Bauru Aeroclub – SP, in 2010.

#### 1.5.3 Category of licenses and validity of certificates.

The pilot had the PCM License and had valid MLTE, MNTE, INVA and IFRA Ratings.

#### 1.5.4 Qualification and flight experience.

The pilot was qualified and had experience in that kind of flight.

#### 1.5.5 Validity of medical certificate.

The pilot had valid Aeronautical Medical Certificate (CMA).

### 1.6 Aircraft information.

The aircraft, serial number 21058422, was manufactured by Cessna Aircraft, in 1964 and was registered in the TPP Category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe, engines and propellers Logbook records were outdated.

The license holder of the aeronautical maintenance mechanic's license, authorized by ANAC, who performed the "50 hours" inspection on the propeller of the aircraft, had valid technical qualifications of Powertrain and Airframe.

The last inspection of the aircraft, the "50 hours" type, was carried out on 16MAY2015, by a mechanic who holds a license for aeronautical maintenance authorized by ANAC, and the aircraft had flown 4,816 hours and 54 minutes total since it was new.

It was not possible to determine the number of hours flown after the review, as there were no records kept in the logbook.

The last inspection of the aircraft, the "100 hours" type, was carried out on 03DEC2014 by the TBA shop - *Tecnologia Brasileira de Aeronáutica S/A*, in Pará de Minas - MG.

It was not possible to determine the number of hours flown after the revision, as there were no updated records in the logbook.

### 1.7 Meteorological information.

The conditions were favorable for the visual flight.

The destination Aerodrome did not have Air Traffic Services (ATS) nor Aerodrome Meteorological Service.

### 1.8 Aids to navigation.

The aerodrome did not have navigational aids.

### 1.9 Communications.

The aerodrome did not have an ATS body.

There was only one coordinating frequency of the Aerodrome management, in an administrative period that was not operating at the time of the aircraft's arrival.

### 1.10 Aerodrome information.

The Aerodrome was public, administered by the Municipal Government of Rio Verde and operated only under the Visual Flight Rules (VFR), during daytime and nighttime periods.

The runway was made of asphalt, with thresholds 03/21, dimensions of 1,500m x 30m, with elevation of 2,464ft.

In order to activate the runway lights, it was necessary to contact the Aerodrome management, at least 30 minutes in advance.

### 1.11 Flight recorders.

Neither required nor installed.

### 1.12 Wreckage and impact information.

The impact occurred, about 5km away from the Aerodrome, on the trajectory to the wind leg entrance.

The impact marks of the aircraft revealed that it collided against the ground laterally and in a downward attitude, as evidenced in Figure 2.





Figure 2 - (I) impact on the lower front part of the fuselage. (II) marks of the terrain on the left side of the engine fairing. (III) deformations on the propeller assembly and impact on the spinner. (IV) marks of the terrain on the left side of the front fairing of the engine.

### **1.13 Medical and pathological information.**

#### **1.13.1 Medical aspects.**

The flight was entirely performed at nighttime. In this situation, studies indicate that there are probabilities of visual illusions, because the visual acuity and the depth vision are reduced.

Pilots are especially susceptible to poor perception of the horizon (illusion of the false horizon) when flying at night. Isolated lights on the ground may appear to them as stars, leading them to the illusion that the aircraft is nose-up (Figure 3).



Figure 3 - Photo taken at night, from the highway located next to the SWLC runway.

In a scenario where there is no visibility of the stars and the moon, without illumination, there may be an illusion that the terrain is part of the sky.

The visual system is the most important of the systems that promote the maintenance of spatial orientation and most cases of disorientation are associated with few visual references, such as night flights and instrument meteorological conditions.

#### **1.13.2 Ergonomic information.**

Nil.

#### **1.13.3 Psychological aspects.**

Not investigated.

During the period in which the pilot was hospitalized, he was interviewed by the Investigator in Charge (IIC), however, after being discharged from the Municipal Hospital of Rio Verde - GO, it was not possible to locate him for the psychological interview.

### **1.14 Fire.**

There was no fire.

### **1.15 Survival aspects.**

The passenger perished at the site of the accident.

The pilot was found standing outside the aircraft and was initially assisted by a Military Police team until a rescue unit from the Fire Department took him to an Emergency Care Unit (UPA).

### 1.16 Tests and research.

According to the pilot, the engine of the aircraft showed loss of power in the ascent after the touch and go procedure.

The aircraft was equipped with a Continental engine; model IO520-A, serial number 112973-R.

As described in the Logbook, the engine oil was replaced with 12 liters of Aero shell W100 Plus oil, when the "50 hours" inspection was performed on 16MAY2015.

In order to identify possible factors that may have contributed to a power failure or loss of power in the engine, tests and analyzes were performed on the components of the powertrain.

The engine research report showed that both magnetos failed.

On the left magneto, it was observed in the bench test that there was spark leakage at the base of one of the spark plugs outlet terminals (Figure 4).

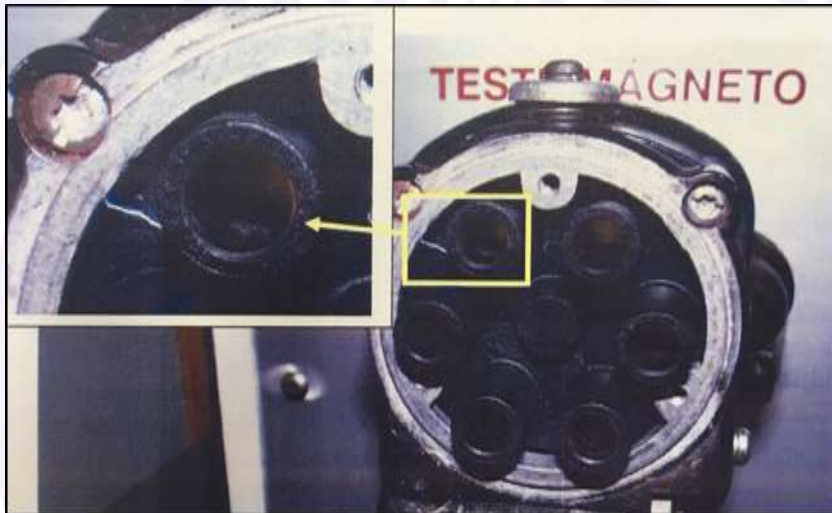


Figure 4 - View of the spark leak observed during the magneto test.

On the right magneto, oxidation was observed at the outlet end of the spark cable (Figure 5).



Figure 5 - View of the terminal of the oxidized magneto.

These faults can cause the cylinder to malfunction, if there is no spark in one of the spark plugs, as fuel burns out.

### 1.17 Organizational and management information.

Nil.

### 1.18 Operational information.

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

According to the pilot, the operator of the aircraft had hired him temporarily to carry out the leg between Jundiaí (SBJD) and Rio Verde (SWLC), in order to transport a passenger.

In SBJD, the aircraft was fuelled with the full capacity of the tanks and there was residual fuel at the crash site.

The take-off took place at 2115 (UTC). The sunset at the geographic coordinate of Jundiaí, on 19JUL2015, occurred at 2105 (UTC), so the route was executed entirely at night.

Prior to takeoff, a telephone contact was made by the pilot for the administration of the destination Aerodrome, for information on estimated arrival of the traffic and for turning on the runway lights, as foreseen in the ROTAER.

About 30 minutes before the aircraft was scheduled to land, an Aerodrome employee lit the runway lights.

According to data obtained from the Global Positioning System (GPS) on board the aircraft, the route was executed on FL085, as provided in the flight plan.

Next to the arrival at the Aerodrome, it was observed that the aircraft performed the entry on the wind leg of runway 21 and rotated base for approach (Figure 5).

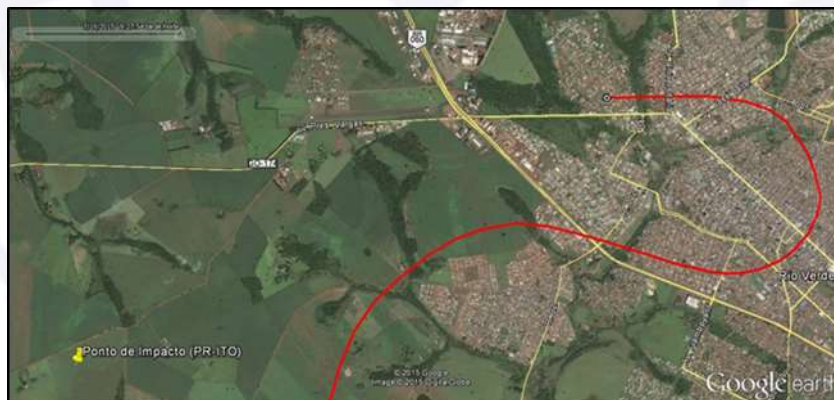


Figure 5 - Reconstitution of the traffic circuit of the aircraft recorded in the on-board GPS.

According to reports of the pilot, in the final approach, he judged that the approach slope higher than usual. However, he decided to continue.

The GPS trajectory data was recorded up to 1.3 NM from the SWLC threshold 21. It was not possible to get information after this point.

According to a report from an Aerodrome official, shortly after touching the runway, the aircraft started a new touch and go procedure.



It was observed that the plane approached on a slope higher than usual and that the touch on the ground occurred after the second half of the runway. It should be noted that this observer was in the Aerodrome's parking lot.

Due to the long landing, already in the second half of the runway, the pilot decided to perform a touch and go procedure.

During the climb, after the touch and go procedure, the pilot reported that the engine did not develop sufficient power for the aircraft to gain altitude, colliding against São Tomaz Abóbora farm's land, located about 5km from the Aerodrome.

It was reported that the landing gear and flaps were retracted as planned.

The Aerodrome was located 6km west of the city's urban area.

The southeast sector of the runway, where the São Tomaz Abóbora farm was located and where the accident occurred, was a very sparsely populated region with little light on the ground.

### **1.19 Additional information.**

Spatial disorientation, in general, is divided into three groups, based on whether or not the pilot recognizes the occurrence of the phenomenon, or even becomes incapacitated: unrecognized (Type I), recognized (Type II), and incapacitating (Type III).

In unrecognized disorientation (Type I), the pilot is not aware of what is happening and, therefore, does not perceive any manifestation of disorientation. That is, he does not identify any disparity with respect to the sense of orientation; he does not suspect of any of the instruments malfunction and does not feel that the aircraft may be in an abnormal attitude.

In this type, the pilot, obviously disoriented, flies and commands the aircraft according to a false perception regarding the orientation.

Flight illusion is a false perception of position or movement relative to the surface of the Earth. There is a type of illusion occasioned by the difficulty of establishing visual references in function of restricted visibility at night, called "black hole".

Such a situation can occur in the night flight over the water or even on the ground, without lighting near the runway, without definition of the horizon line. In this case, only the lights on the runway are visible.

As there is no peripheral vision aid, given the absence of references in the environment surrounding the Aerodrome, the pilot "tends to perceive" that the aircraft is stabilized and that the runway is moving, thus becoming poorly positioned for approach, which leads him to make several corrections and, usually, induces a short landing (Gillingham, Preval, 1996: 360)<sup>1</sup>.

Studies have shown that there is a trend towards higher angles in the final approach path for night landing after a long-duration flight in this period. This tendency refers to the characteristics of the human eye in the perception of depth under these nocturnal flight conditions.

### **1.20 Useful or effective investigation techniques.**

Nil.<sup>1</sup>

## **2. ANALYSIS.**

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<sup>1</sup> GILLINGHAM, K.K.; PREVIC, F.H. Spatial Orientation in Flight. In: DeHart, R.L. Fundamentals of Aerospace Medicine. 2nd. ed. Baltimore: William & Willins, 1996. p.309-97

The leg between Jundiá and Rio Verde lasted approximately three hours. The entire route was completed at night.

The pilot stated that the aircraft had been filled with the full tanks at the original Aerodrome. There was no evidence of lack of fuel in the occurrence because there was residual fuel at the accident site.

At the final approach, the pilot judged the landing ramp to be higher than usual. However, the decision to hit a new traffic circuit was only made after the touch on the runway.

In spite of the delay in the decision-making, the touch and go procedure on the ground can be considered as an appropriate one, since the pilot was not sure that he would be able to stop the aircraft within the limits of the runway.

It was not possible to determine the runway length used in the touch and go procedure, however, it could be stated that the length was enough for takeoff, since the aircraft flew approximately 5km until the collision against the ground, in a low visibility area.

During the climb, after the go-around procedure, in which more engine's power and torque were required, the pilot reported that there was loss of power and consequent engine failure, which could have contributed to the collision of the aircraft against the ground.

The research report of the powertrain components pointed out that both magnetos failed. Electrical leakage or lack of spark has been identified during the operation.

Thus, it could be inferred that the lack of power reported by the pilot had as a contributing factor the malfunction of the magnetos, which possibly caused irregular cylinder operation and consequent loss of engine power.

Considering that the cell, engine and propeller logbooks were outdated, it was not possible to identify the latest maintenance actions on the failed components.

Recording of the GPS trajectory was interrupted at 1.3 NM before landing on runway 21 (SWLC). It was not possible to obtain the data from the beginning of the go-around procedure till the point of impact.

However, according to the pilot's report, it is estimated that the aircraft covered a left turn path for re-entry into the wind leg (Figure 6).



Figure 6 - Reconstruction of the aircraft traffic circuit recorded in the on-board GPS (in red) and the probable trajectory of the aircraft after the go-around procedure (in yellow).



According to the evidence found in the wreckage, it was possible to identify marks on the ground and significant deformations in the aircraft, which suggest that the impact occurred in a downward attitude and with a lateral slope to the left.

The southeast section of the runway, where the aircraft crashed into the ground, was a very sparsely populated rural region, devoid of more intense lighting, making it difficult to maintain visual references to the terrain.

The absence of light on the ground and the lack of references on the horizon line may have interfered with the processes of vision, assimilation and interpretation of the elements external to the aircraft, favoring an ineffective perception of the lateral, frontal obstacles and the position of the aircraft itself to the ground.

The difficulty in maintaining visual references to the terrain during an approach to night landing is common.

The absence of contrast due to the visibility restriction in the night period may have caused the type of illusion called "black hole".

Thus, the lack of references in the external environment may have favored a false perception regarding the sense of orientation, thus suggesting the presence of spatial disorientation as a contributing factor, making it difficult to manage the possible engine failure and the execution of a forced landing.

### **3. CONCLUSIONS.**

#### **3.1 Facts.**

- a) the pilot had valid Aeronautical Medical Certificate (CMA);
- b) the pilot had valid MLTE and IFRA Ratings;
- 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 weight and balance specified by the manufacturer;
- f) the airframe, engines and propellers logbook records were outdated;
- g) the weather conditions were favorable for the visual flight;
- h) the airplane approached for landing on a slope that was higher than usual;
- i) the pilot performed a touch and go procedure after the touch occurred on the second half of the runway length;
- j) according to the pilot's report, the aircraft presented power loss during the climb, after the touch and go procedure;
- k) the aircraft hit the ground, about 5km away from the Aerodrome, while it was on a trajectory to the wind leg entrance;
- l) the engine research report pointed out that both magnetos had failed;
- m) the aircraft was destroyed; and
- n) the pilot suffered minor injuries and the passenger perished at the site of the accident.

#### **3.2 Contributing factors.**

- **Disorientation – undetermined.**

The absence of references in the external environment after the touch and go procedure may have contributed to a false perception regarding the sense of orientation, thus suggesting the presence of spatial disorientation as a contributing factor.

**- Illusions – undetermined.**

The difficulty in maintaining visual references to the terrain during an approach to night landing is common. The absence of contrast due to the visibility restriction during the night period may have caused the type of illusion called "black hole".

This situation can occur in the night flight on the water or even on the ground without lighting near the track, where there is no definition of the horizon line.

These elements may have contributed to the accident in question.

**- Aircraft maintenance – undetermined.**

According to the analysis of the powertrain, it was observed that there was an electric current leakage or lack of spark during the operation of the two magnetos.

Possibly some maintenance actions or the absence of them contributed to the failure of the components, as the lack of data and records in the logbooks suggest that the inspections were not fulfilled as planned.

#### **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):**

**A-103/CENIPA/2015 - 01**

**Issued on 01/29/2019**

Act in conjunction with the TBA shop - *Tecnologia Brasileira de Aeronáutica S/A*, in order for the maintainer to demonstrate that it possesses and applies all the necessary resources for the adequate rendering of maintenance services, in accordance with the legislation in force, the respective technical manuals and the Company Capabilities List, which accompanies the Maintenance Organization Certificate.

#### **5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.**

None.

On January 29<sup>th</sup>, 2019.