

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



**FINAL REPORT**  
**A - 021/CENIPA/2015**

<b>OCCURRENCE:</b>	<b>ACCIDENT</b>
<b>AIRCRAFT:</b>	<b>PT-LOA</b>
<b>MODEL:</b>	<b>A188</b>
<b>DATE:</b>	<b>07FEB2015</b>



## NOTICE

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

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

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

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

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

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

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

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

## SYNOPSIS

This is the Final Report of the 07FEB2015 accident with the A188 aircraft, registration PT-LOA. The accident was classified as “[LALT] Low Altitude Operation”.

During the second agricultural application, the aircraft collided with a power grid wire, losing control and crashing against the ground.

The aircraft was destroyed.

The pilot perished at the site.

An Accredited Representative of the National Transportation Safety Board (NTSB) – USA, (State where the aircraft 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.....	6
1.4 Other damage.....	6
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.....	8
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.....	10
1.13.1 Medical aspects.....	10
1.13.2 Ergonomic information.....	10
1.13.3 Psychological aspects.....	10
1.14 Fire.....	10
1.15 Survival aspects.....	10
1.16 Tests and research.....	10
1.17 Organizational and management information.....	10
1.18 Operational information.....	11
1.19 Additional information.....	12
1.20 Useful or effective investigation techniques.....	13
<b>2. ANALYSIS.....</b>	<b>13</b>
<b>3. CONCLUSIONS.....</b>	<b>14</b>
3.1 Facts.....	14
3.2 Contributing factors.....	15
<b>4. SAFETY RECOMMENDATION.....</b>	<b>15</b>
<b>5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.....</b>	<b>16</b>

## GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ABNT	Technical Standards Brazilian Association
ANAC	Brazil's National Civil Aviation Agency
AVGAS	Aviation Gasoline
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CG	Center of Gravity
CHE	Company Approval Certificate
CIV	Pilot's Flight Logbook
CMA	Aeronautical Medical Certificate
CNPAA	Aeronautical Accident Prevention National Committee
DCTA	Department of Science and Aerospace Technology
GSO	Safety Manager
HBV	Brazilian Daylight Saving Time
IAE	Aeronautic and Space Institute
IAM	Annual Maintenance Inspection
INVA	Flight Instructor Rating - Airplane
METAR	Meteorological Aerodrome Report
MGSO	Safety Management Manual
MNTE	Airplane Single Engine Land Rating
PAGA	Agricultural Pilot Rating
PCM	Commercial Pilot License – Airplane
PPR	Private Pilot License – Airplane
RPQS	Responsible for Service Quality
RS	Safety Recommendation
SAE	Aircraft Registration Category of Specialized Air Service
SERIPA V	Fifth Regional Aeronautical Accident Investigation and Prevention Service
SGSO	Safety Management System
SINDAG	National Union of Agricultural Aviation Companies
SIPAER	Aeronautical Accident Investigation and Prevention System
SSAU	ICAO Locator Designator – Centeno Aerodrome – Tapes, RS
UTC	Universal Time Coordinated
VRF	Visual Flight Rules

## 1. FACTUAL INFORMATION.

<b>Aircraft</b>	<b>Model:</b> A188 <b>Registration:</b> PT-LOA <b>Manufacturer:</b> Cessna Aircraft	<b>Operator:</b> Centena Agricultural Aviation Ltd.
<b>Occurrence</b>	<b>Date/time:</b> 07FEV2015 - 1100 UTC <b>Location:</b> Rural Area <b>Lat.</b> 30°33'05"S <b>Long.</b> 051°33'37"W <b>Municipality – State:</b> Sentinela do Sul – RS	<b>Type(s):</b> [LALT] Low Altitude Operation <b>Subtype(s):</b> NIL

### 1.1 History of the flight.

The aircraft took off from the Centeno Aerodrome (SSAU), located in the municipality of Tapes - RS, at about 1050 (UTC), in order to carry out agricultural pesticide application in soybean farming, with a pilot on board.

With about ten minutes of flight, during the second application, the aircraft collided with a high-voltage power grid wire, losing control and crashing against the ground.

The aircraft was destroyed.

The pilot perished at the site.



Figure 1 - Aircraft after the accident.

### 1.2 Injuries to persons.

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

### 1.3 Damage to the aircraft.

The aircraft was destroyed.

### 1.4 Other damage.

Rupture of the steel cable (lightning arrester) of the high-voltage power grid (Figure 2).

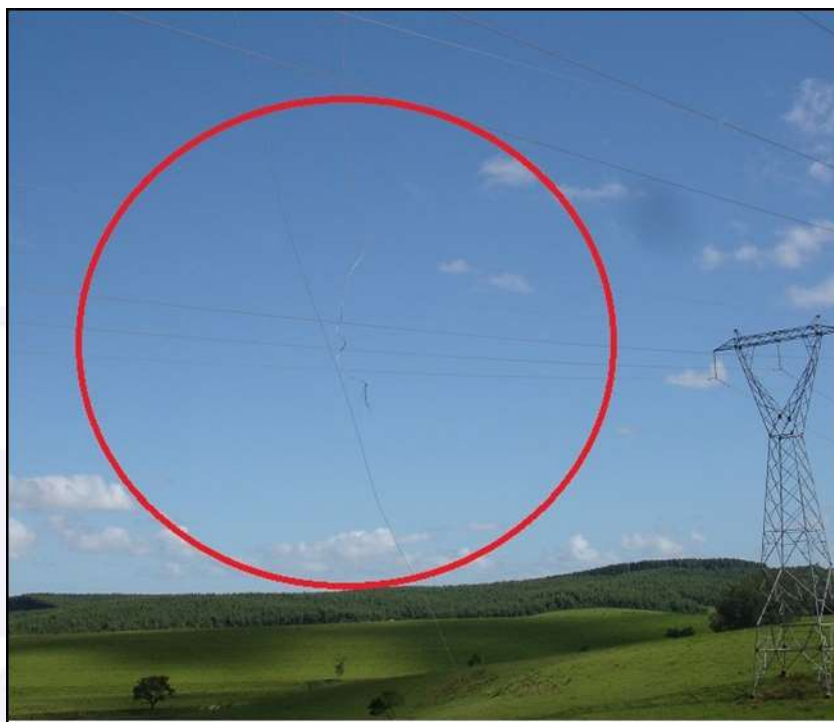


Figure 2 - Rupture of the steel cable (lightning arrester) of the power grid.

## 1.5 Personnel information.

### 1.5.1 Crew's flight experience.

Hours Flown	Pilot
Total	976:15
Total in the last 30 days	54:20
Total in the last 24 hours	00:35
In this type of aircraft	54:20
In this type in the last 30 days	54:20
In this type in the last 24 hours	00:35

**N.B.:** The data related to the flown hours were obtained through the aircraft's Logbook records, since the ones in the Pilot's Flight Logbook (CIV) were outdated.

### 1.5.2 Personnel training.

The pilot took the Private Pilot course – Airplane (PPR) at the Santo Angelo Aeroclub - RS, in 2012.

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

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

### 1.5.4 Qualification and flight experience.

The pilot was qualified and had 54 hours and 20 minutes as an agricultural pilot. It was his first crop.

### 1.5.5 Validity of medical certificate.

The pilot had valid Aeronautical Medical Certificate (CMA).

### 1.6 Aircraft information.

The aircraft, serial number 1880114, was manufactured by Cessna Aircraft, in 1968, and it was registered in the SAE-AG category.

The aircraft had valid Certificate of Airworthiness (CA).

The airframe, engine and propeller logbook records were updated.

The last inspection of the aircraft, the "50 hours" type, was carried out on 30JAN2015 by the Centena Agricultural Aviation Ltd. Shop, in Tapes – RS, having flown 35 min after the inspection.

The last overhaul of the aircraft, the "IAM" type, was carried out on 14OCT2014 by the Centena Agricultural Aviation Ltd. Shop, in Tapes – RS, having flown 52 hours and 05 minutes after the overhaul.

### 1.7 Meteorological information.

The weather conditions were favorable for the visual flight.

### 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 accident happened in the rural area of Sentinela do Sul - RS.

There were two parallel high-voltage power grids, and the network where the aircraft collided was 8m higher than the other one (Figure 3).



Figure 3 - Height difference between the parallel power distribution networks.

According to observers' statements and analysis of the wreckage, the aircraft was curving to the right and initially crashed its propeller against the transmission line's lightning arrester cable (Figure 4).





Figure 4 - Impact point of the propeller against the power grid (lightning arrester).

This cable was about 3m above the other power distribution cables. It had a gray color and diverged from the other cables, which were darker.

Shortly after the collision, the wire shifted down the aircraft, pulled out its spray pump and the right landing gear. There was a break in the wire after it had jammed into the right landing gear of the aircraft.

Finally, the aircraft collided with the approximate angle of 60° to the ground and overturned. The collision occurred 62m away from the transmission line.

The distribution of the wreckage was dispersed. The aircraft propeller was buried about 30cm.

The wreckage visualization indicated that the aircraft developed high speed at the moment of the impact against the ground (Figure 5).



Figure 5 - Wreckage distribution.

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

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

No evidence was found that problems of physiological nature could have affected the flight crew performance.

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

Nil.

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

The pilot had approximately six months of training as an agricultural pilot and he was beginning his first crop.

Reports from close associates have pointed to a very polite, humble, helpful and confident professional.

He was a pilot who worked hard to make a perfect application, having for example; performed tailpieces in areas already completed and approved by the boss, just to guarantee the quality of the work.

Rarely did he refuse to perform any service, even when the weather conditions were not the most favorable for the flight.

Once the pilot even insisted on taking off with the wet runway, which was considered improper by his boss, claiming that "he was calm".

He ruled out the possibility of being involved in an accident and said that his main concern was not to break the aircraft.

Before taking the flight that resulted in the accident, the pilot had made the recognition of the area and had been alerted by the company about the existence of a power grid.

The pilot had a good relationship with the operator, with whom he used to constantly exchange information about the work.

According to interviewees, the pilot was satisfied with his personal and professional life.

#### **1.14 Fire.**

There was no fire.

#### **1.15 Survival aspects.**

There were no survivors.

#### **1.16 Tests and research.**

The aircraft engine, Continental brand, model IO-520-D, and serial number 159346-9-D was inspected and dismantled at a certified aircraft maintenance shop.

This work was carried out by the professionals of this shop and was accompanied by representatives from the DCTA's IAE and from the SERIPA V.

During the research work performed on the aircraft engine, it was evidenced that it was operational and presented no mechanical problems when the aircraft collided against the wire and resulted in the accident.

#### **1.17 Organizational and management information.**

The aircraft exploration company began operations in December 1998. Its last Company Approval Certificate (CHE) dated from 30AUG2011. The company also had

authorization from the National Civil Aviation Agency (ANAC) to operate a specialized public air service, in the aero agricultural modality, since 05JAN2013, valid for five years.

The company's head office was in the municipality of Tapes - RS. It was specialized in the aero agricultural application and maintenance shop.

The fleet consisted of a Cessna A188 aircraft, which was normally operating until the time of the accident. The maintenance of the aircraft was carried out in the company's own shop.

The company had only one pilot with a contract for the current crop. The payment was by applied area.

The organizational structure of the company was quite simple (Figure 6).

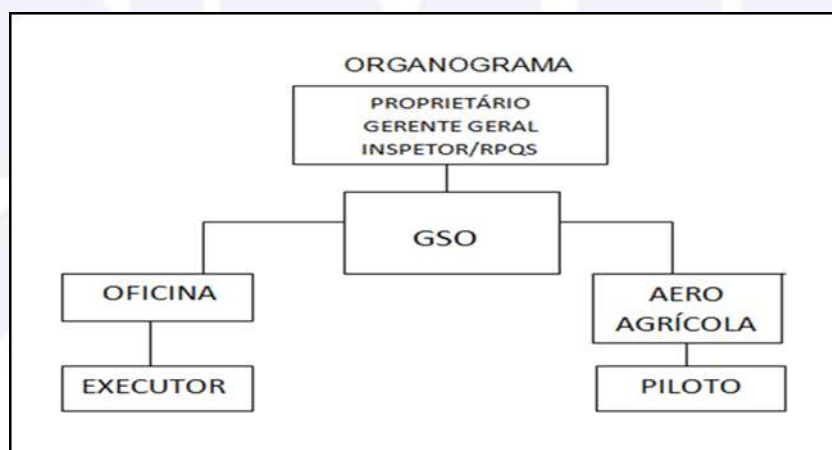


Figure 6 - Organogram of the company.

The owner, in addition to his managerial functions, acted in almost all sectors, being the inspector responsible for the maintenance services and also accumulated the Responsible for Service Quality (RPQS) function.

The Safety Manager (GSO) did not work at the company's head office in Tapes, but in the city of Camaquã - RS.

Regarding the Safety Management Manual (MGSO), it was verified that it was elaborated based on the operational activities developed by the company, addressing the procedures that defined the operational guidelines, analysis of what was missing, implementation of the SGSO, policies and objectives of the safety, risk management and the safety development.

During the interviews, the company's concern for the pilot's safety was observed and some occasions were mentioned in which the operator made warnings about the risks involved in certain operations, related to the climatic and geographical conditions.

### 1.18 Operational information.

The pilot had started the operation at 0900 (UTC) on the day of the accident.

He applied a load of agricultural pesticide on the crop, landed, fueled the aircraft with chemical, and took off for further application.

At the time of the accident, the aircraft had 70 liters (47kg) of aviation gasoline (AVGAS) and 30 liters of product (21kg). In addition to the basic weight of the aircraft (922kg) and of the pilot (90kg), the value of 1,080kg was obtained as total weight.

The maximum takeoff weight of the aircraft was 1,497 kg.

The aircraft was within the limits of weight and center of gravity (CG) specified by the manufacturer.

As reported, two parallel high-voltage power grids separated the crops.

According to observers, the aircraft crashed into the cable (lightning arrester) of one of the nets when it was turning from the right, then hit the ground and overturned.

The first network had been surpassed, but the collision occurred on the second one, which was 8m higher.

The pilot was performing his first crop as an agricultural pilot.

It was observed that the position of the sun did not affect the pilot's vision at the time of the accident (Figure 7).



Figure 7 - Sketch of the accident.

### 1.19 Additional information.

Part of the power transmission line, where the accident occurred, did not have any type of signaling.

The ABNT, through NBR 7276: 2005 - Warning Signaling on Power Transmission Lines - established the minimum criteria for warning signs on power transmission lines, related to their physical and operational safety, as well as that of third parties.

The standard did not identify the risk of collision of agricultural aircraft with transmission lines, and did not provide for the signaling of these lines in arable areas, subject to the agro agricultural operation.

The following text was contained in item 4.7.5 of NBR 7276: 2005, regarding special cases:

"In addition to the cases provided in this Standard, the transmission line is signaled in a similar way to those described above, where it is demonstrated by the interested parties that there is a risk to the safety of third parties or to the transmission line itself, even if the requirements of other standards are met."

It was not possible to identify the mechanisms that allowed interested parties to demonstrate the existence of a risk to the safety of third parties or the transmission line itself. Likewise, it was not possible to identify to which body or institution should be demonstrated the existence of this risk.

A survey performed with the Final Reports published by the CENIPA on the Internet, identified that, until 30NOV2015, 73 reports of collision-type occurrences with obstacle had been released. Of these, eleven involved the collision of agricultural aircraft with power transmission lines (high-voltage), and five reported the collision of this type of aircraft with power grid distribution networks (low voltage).

Among the eleven accidents of agricultural aircraft with power transmission lines, four were fatal, two generated serious injuries and the other five produced minor injuries.

Regarding the five accidents of agricultural aircraft with power distribution networks, four produced slight injuries and one did not generate injuries.

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

Nil.

## **2. ANALYSIS.**

On the day of the accident, the pilot started the operation at 0900 (UTC).

On the first flight, he had applied a load of pesticides on the crop. After having refueled the aircraft with pesticides, he took off for a new application. During this application, the accident occurred.

The weather conditions were favorable for the visual flight at the time of the accident.

The aircraft operated within the weight and balance limits stipulated by the manufacturer.

During the investigation work carried out on the aircraft engine, it was evidenced that the engine was operational and presented no mechanical problems when the aircraft collided against the wire and resulted in the accident.

It was observed that the pilot had approximately six months of training in agricultural aviation and was beginning his first crop. Attitudes adopted during this time in agricultural aviation, such as takeoff on runway with inappropriate conditions and disbelief in the possibility of engaging in an accident, pointed to a high level of self-confidence.

The overconfidence may in this case, have contributed to the lowering of critical ability in assessing the risks involved in agricultural aviation, leading to opting for riskier choices from the flight safety point of view.

Regarding information on impact, wreckage and the operational aspect, it was verified that there were two parallel high-voltage power grids, being that the network where the aircraft collided was 8m higher than the other one.

It could also be verified that the aircraft was curving to the right and initially impacted the propeller against the lightning arrester cable of the transmission line. This cable was about 3m above the other power distribution cables. It had a gray color and diverged from the other cables, which were darker.

Shortly after the collision, the wire shifted down the aircraft, pulled out its spray pump and the right landing gear. There was a break in the wire after it had jammed into the right landing gear of the aircraft.

Finally, the aircraft collided with an approximate angle of 60° to the ground and overturned. The collision against the ground occurred 62m away from the transmission line.

In face of the information gathered by the investigation and described in this report, the main hypothesis for the occurrence is that the pilot did not see the lightning arrest

cable of the transmission line, probably because there is a difference between the height of the two transmission lines, which were parallel.

Another important factor to consider is the difference in coloration between the wires. Although there was no direct influence of the sun's position on the pilot's view, the light from the sun at 1100 UTC could have impaired the viewing of the cable.

Regarding ABNT's NBR 7276: 2005, it was verified that it did not include signaling procedures in the power grid in areas subject to aero agricultural operations.

Also about the standard, it was verified that, when a third party or the transmission line safety risk is exposed by the interested parties, a specific signaling request could be made. The procedure for such a request was not described by the standard.

In order to emphasize the need for a specific standardization on the subject, more than 70 crash event reports of collision in-flight with obstacles were available for consultation on the CENIPA website. Of these, eleven involved the collision of agricultural aircraft with power transmission lines (high-voltage), and five reported the collision of this type of aircraft with power distribution networks (low-voltage).

In addition to this issue of lack of signaling, it is common practice for pilots of agricultural aviation to fly close to the power grid, in order to optimize the application.

Given this, it is also possible to consider that this work group culture has reflected in this occurrence, favoring the collision with the wire. As the pilot was beginning his career in the agricultural aviation and was newly hired by the company, in order to enhance his professional image, he may have opted to optimize his application, flying close to the wires, as other agricultural aviation pilots performed.

According to data collected by the investigation, the pilot was highly motivated to work, to the point of carrying out operations under conditions considered improper by his employer.

Although the owner of the company expressed concern about the safety of the pilot and warned him about the risks involved in the operation, these actions were not enough to contain unsafe behavior.

This could indicate inefficient management of people and processes by lack or failure to monitor, supervise and evaluate performance or even designing important organizational procedures for maintaining safety.

### **3. CONCLUSIONS.**

#### **3.1 Facts.**

- a) the pilot had valid Aeronautical Medical Certificate (CMA);
- b) the pilot had valid MNTE, INVA and PAGA Ratings;
- c) the pilot was qualified and had his first aero agricultural crop;
- d) the aircraft had valid Airworthiness Certificate (CA);
- e) the aircraft was within the weight and balance parameters specified by the manufacturer;
- f) the airframe, engine and propeller logbook records were updated;
- g) the weather conditions were favorable for the visual flight;
- h) the aircraft took off in order to perform the application of agricultural pesticide;
- i) during the second application, the aircraft collided against a high-voltage power grid;

- j) the high-voltage power grid had no signaling;
- k) the ABNT's NBR 7276: 2005 did not include signaling procedures in power grids in areas subject to aero agricultural operations;
- l) the ABNT's NBR 7276: 2005 did not establish procedure for requesting signaling in areas subject to air operations;
- m) after the collision against the wire, the aircraft lost control and hit the ground;
- n) the aircraft was destroyed; and
- o) the pilot perished at the site.

### 3.2 Contributing factors.

- **Attitude – undetermined.**

Overconfidence, demonstrated through the pilot's actions, may have lowered his ability to assess the risks involved in the agricultural aviation, leading him to less conservative choices during the operation.

- **Work-group culture – undetermined.**

The culture shared by the agricultural aviation pilots of flying very close to the power grid, to guarantee the quality in the application, could have influenced the behavior of the pilot, who, in the attempt to optimize the application, possibly chose to fly close to the wires, despite the risks.

- **Motivation – undetermined.**

The high motivation shown by the pilot to perform the air activity, combined with the confidence he had in himself and the low operational experience, probably compromised the analysis of the inherent risks of the operation in areas with the presence of transmission lines.

- **Insufficient pilot's experience – undetermined.**

It is possible that the little experience of the pilot (first crop) has contributed, as far as the specific circumstances of the aero agricultural operation is concerned.

- **Organizational processes – undetermined.**

The adoption of conducts that compromised the safety of the operation and which were known to the company could reflect the absence of an effective systematic guidance and follow-up of the pilot, in order to hold the recurrence of such behaviors.

## 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-021/CENIPA/2015 - 01**

**Issued on 01/29/2019**

Act with the ABNT, in order for the NBR 7276:2005 to be updated, in order to clarify the process by which the interested parties must demonstrate the existence of risk to the safety of third parties or the transmission line and to which entity this statement should be presented.

**A-021/CENIPA/2015 - 02**

**Issued on 01/29/2019**

Disseminate the lessons learned in the present investigation, in order to alert Brazilian agricultural aviation pilots and operators about the risks of collision with transmission lines.

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

The CNPAA established a Working Group under the coordination of the SINDAG, with the objective of seeking solutions to avoid recurrence of events related to the collision of aero agricultural aircraft against transmission and distribution networks.

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