

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



**FINAL REPORT**  
**IG-065/CENIPA/2022**

<b>OCCURRENCE:</b>	<b>SERIOUS INCIDENT</b>
<b>AIRCRAFT:</b>	<b>PS-CTN</b>
<b>MODEL:</b>	<b>AT-502B</b>
<b>DATE:</b>	<b>19MAI2022</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 considering the contributing factors and hypotheses raised. The report is, therefore, a technical document which reflects the result obtained by SIPAER regarding the circumstances that contributed or may have contributed to triggering this occurrence.*

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

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

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

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

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

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

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

## SYNOPSIS

This is the Final Report of the 19 May 2022 serious incident involving the AT-502B aircraft, registration PS-CTN. The occurrence was typified as “[LALT] Operation at Low Altitude”.

While performing a reversal turn during the application of agricultural pesticides, the aircraft collided with low-voltage electric-power transmission lines.

The aircraft sustained minor damage.

The pilot escaped uninjured.

For being Canada the State of engine manufacture, the Canadian *Transportation Safety Board (TSB)* appointed an Accredited Representative for participation in the investigation of the occurrence.



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## GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ABNT	Brazilian National Standards Organization
ANAC	Brazil's National Civil Aviation Agency
CA	Airworthiness Certificate
CMA	Aeronautical Medical Certificate
LT	Electric-Power Transmission Lines
MNTE	Single-Engine Land Airplane Class Rating
OM	Maintenance Organization
PAGA	Agricultural Pilot License (Airplane)
PIC	Pilot in Command
PCM	Commercial Pilot License (Airplane)
PPR	Private Pilot License (Airplane)
RBAC	Brazilian Civil Aviation Regulation
SERIPA V	5th Regional Service for Investigation and Prevention of Aeronautical Accidents
SN	Serial Number
SWEV	ICAO location designator - <i>Fazenda Cambará I Aerodrome, Correntina, State of Bahia</i>
TPP	Private Registration Category – Private Air Services
TSB	Transportation Safety Board - Canada
UTC	Universal Time Coordinated

## 1. FACTUAL INFORMATION.

<b>Aircraft</b>	<b>Model:</b> AT-502B <b>Registration:</b> PS-CTN <b>Manufacturer:</b> Air Tractor.	<b>Operator:</b> Private.
<b>Occurrence</b>	<b>Date/time:</b> 19MAI2022 - 09:40 (UTC) <b>Location:</b> <i>Fazenda Cambará I.</i> <b>Lat.</b> 13°36'49"S <b>Long.</b> 046°05'16"W <b>Municipality – State:</b> <i>Correntina - Bahia</i>	<b>Type(s):</b> [LALT] Low altitude operations

### 1.1. History of the flight.

At about 0910 UTC, the aircraft took off from SWEV (*Fazenda Cambará I* aerodrome, municipality of *Correntina*, State of *Bahia*, on a local crop-dusting flight, with 01 POB (pilot).

After performing a reversal turn, the aircraft collided with low-voltage electric-power transmission lines. The pilot returned to the runway from which he had taken off, and landed safely.

The aircraft sustained minor damage. The pilot escaped uninjured.

### 1.2. Injuries to persons.

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

### 1.3. Damage to the aircraft.

The aircraft sustained slight damage to the propeller assembly, left-hand engine exhaust, left-hand wing, left-hand aileron, and to the spray system.

### 1.4. Other damage.

There was damage to the cables of the low-voltage electric-power transmission network of *Fazenda Cambará I* (Figure 1).



Figure 1 – Low-voltage network, repaired after the occurrence.

## 1.5. Personnel information.

### 1.5.1. Crew's flight experience.

	PIC
Total	4,401:40
Total in the last 30 days	72:30
Total in the last 24 hours	07:20
In this type of aircraft	243:50
In this type in the last 30 days	72:30
In this type in the last 24 hours	07:20

**NB.:** Data on the hours flown was reported by the pilot in an interview.

### 1.5.2. Personnel training.

The Pilot in Command (PIC) did his PPR course (Private Pilot – Airplane) in 2009, at *Aeroclube de Eldorado do Sul*, State of *Rio Grande do Sul*.

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

The PIC held a PCM license (Commercial Pilot - Airplane), and valid ratings for MNTTE (Single-Engine Land Aircraft Class) and PAGA (Agricultural Pilot - Airplane).

### 1.5.4. Qualification and flight experience.

The pilot had qualified and experienced in the type of flight.

### 1.5.5. Validity of medical certificate.

The pilot held a valid CMA (Aeronautical Medical Certificate).

## 1.6. Aircraft information.

The aircraft, model AT-502B (Serial Number 502B-3261) was manufactured by Air Tractor Inc. in 2020, and registered in the Private Registration Category - Private Air Services (TPP).

Its Airworthiness Certificate (CA) was valid.

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

The last inspection of the aircraft ("100 hours" type) was carried out on 02 May 2022 by the *Serrana Manutenção de Aeronaves Ltda.* maintenance organization (OM), located in the municipality of *São Desidério, Bahia*. The aircraft flew 26 hours and 05 minutes after the referred inspection.

## 1.7. Meteorological information.

The meteorological conditions were consistent with the rules for the proposed type of flight.

## 1.8. Aids to navigation.

NIL.

## 1.9. Communications.

NIL.

## 1.10. Aerodrome information.

The event occurred outside of aerodrome area.

## 1.11. Flight recorders.

Neither required nor installed.



## 1.12. Wreckage and impact information.

After performing a reversal turn to the left, while aligning with the lane to be sprayed, the aircraft collided with low-voltage electric-power transmission lines, at a height of about 10 meters.

## 1.13. Medical and pathological information.

### 1.13.1. Medical aspects.

NIL.

### 1.13.2. Ergonomic information.

NIL.

### 1.13.3. Psychological aspects.

The PIC had employment bonds with the *Fazenda Cambará I*'s owner, who was also the operator of the aircraft. They had good interpersonal relationship.

At the time of the serious incident in question, the pilot was adequately rested, and did not feel under conditions associated with excessive workload.

The region where the collision occurred had a uniformity of landscapes, characterized by the cotton plantation.

## 1.14. Fire.

There was no fire.

## 1.15. Survival aspects.

NIL.

## 1.16. Tests and research.

NIL.

## 1.17. Organizational and management information.

NIL.

## 1.18. Operational information.

The operation was being carried out under the rules of the RBAC-137 (Brazilian Civil Aviation Regulation no. 137 - Certification and Operational Requirements: Aero Agricultural Operations).

*Fazenda Cambará I* was crossed by low-voltage electric-power lines at the lots 6 and 7, and by a high-voltage electric-power transmission network, known as Aerial Electric-Power Transmission-Line (LT).

Since the area belonged to the operator of the aircraft, the PIC was familiar both with the location and layout of the electric-power lines. The section 137.205 of the RBAC-137 established the following provisions in relation to private operators:

137.205 Restrictions for private aero agricultural operators

(a) the private operator of an agricultural aircraft may not conduct agricultural operations:

(1) remunerated, or for the benefit of third parties;

(2) over any property unless he is the owner or tenant; or

(3) in disagreement with the provisions of this Regulation.

The airplane had 520 liters of fuel in the tanks, and 1,350 liters of agricultural pesticides in the hopper. It was within the weight and balance limits specified by the manufacturer.



The aircraft took off at sunrise, from the airstrip located at the headquarters of *Fazenda Cambará I*. After the takeoff, the PIC headed for the lots 6 and 7, located at a distance of approximately 6 NM from the runway, to carry out the spraying of agricultural pesticides on a cotton plantation.

Five minutes after takeoff, at 0915 UTC, he began spraying the pesticide, in a northeast/southwest direction, parallel to the high-voltage power lines (TL), with the sun at his six-o'clock position, and passing over the low-voltage power lines.

At around 0935 UTC, the pilot, which had already released about 1,250 liters of chemical product, selected another lane to be sprayed in a southwest/northeast direction.

According to the PIC, the spraying of the agricultural pesticides in a southwest/northeast direction and back, with the aircraft flying parallel to the TL, aimed therefore at avoiding convergence with that high-voltage electric-power transmission network.

The aircraft was flown to the selected lane and, after a left-side reversal-turn (aka "balloon"), the PIC came across the low-voltage power lines, when the plane was on a descending trajectory with a magnetic heading of 030°, being repositioned for a new pass over the plantation.

Regarding the circumstances, the PIC reported that he was focused on stabilizing the aircraft along the correct axis, something which distracted him from the power lines further ahead. He added that, on top of that, his vision was glared by the position of the rising sun.

Thus, the collision with the power lines occurred seconds after the pilot prepared the aircraft equipment for a new pass, with the sun ahead, diagonally to the right-hand side in relation to the flight path (Figure 2).

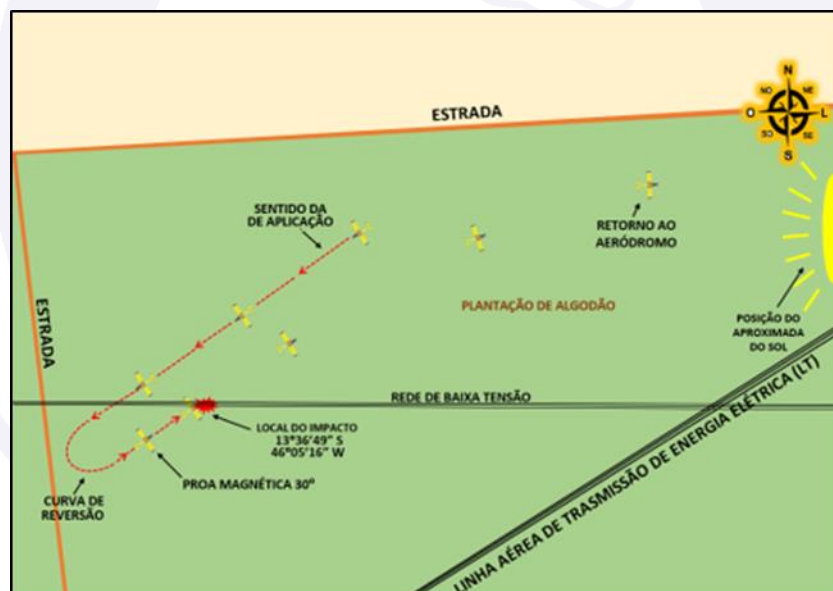


Figure 2 - Sketch of the occurrence.

After the collision with the power lines, one of the wires got stuck on the right-hand side of the aircraft's crop-dusting device.

Initially, the PIC believed it to be safer to land in the cotton plantation, for fearing that the aircraft remained connected to the electric-power transmission network by means of the stuck wire. Upon making a turn to the right, he found that there were about 200 meters of wire stuck to the aircraft, and part of it was dragging along the ground. He then decided to return to the headquarters of *Fazenda Cambará I* and land on the airstrip from which he had taken off

For the return, the aircraft had to climb, and the wire stuck to the aircraft ended up hitting the Transmission Line, and broke into two pieces, one of which remained hooked to the referred TL.

When approaching the airstrip, the rest of the electric wire, which had remained stuck to the PS-CTN, became entangled in the aerodrome fence, detaching itself from the aircraft, falling into the low-voltage electric-power transmission network of *Fazenda Cambará I*, causing a short circuit and power outage.

As for the conduction of that flight, the PIC reported that he did not have a map of the region, showing the obstacles that could pose a risk to aero agricultural operations.

### 1.19. Additional information.

“*Balloon*” is the name of a maneuver commonly performed in aero agricultural operations, which consists of a reversal turn with a pronounced banking of the wings and with a high angle of attack, associated with an increase of the load factor (G force). The purpose of the “balloon” maneuver is repositioning the airplane for a new pass over the plantation, in a direction that is opposite to the previous pass.

The NBR 7276 Norm of the ABNT (Brazilian National Standards Organization), of 29 August 2005, dealing with *Warning Signage of Overhead Electric-Power Transmission Lines*, among other aspects, established the following:

#### 3 - Definitions

[...]

3.2 Signaling sphere: Spherical signaling devices with a diameter of 600mm, in orange and red, according to the color patterns in table A.1. They are installed in overhead cables with a maximum spacing of 30m between each other.

[...]

#### 4.7 - Special cases

[...]

4.7.5 In addition to the cases provided for in this Norm, the transmission line is signaled in a similar way to those previously described, whenever it is demonstrated by the interested parties that there is a risk to the safety of third parties or to the safety of the transmission line itself, even if safety requirements of other norms are met.

There was no signage on the low-voltage electric-power transmission network and on the TL crossing *Fazenda Cambará I*.

In turn, the Good Practices Manual - Agricultural Aviation, issued in 2016 by the SERIPA V (5<sup>th</sup> Regional Service for the Investigation and Prevention of Aeronautical Accidents) warned of the fact that the sun had great influence on in-flight collisions with obstacles.

Regarding the subject, the item 4.3 - Collision with Obstacles in Flight, highlighted that:

[...]

There are many records of collisions at sunrise and sunset. Low passes for application with the sun head-on (or close to it) generate dangerous momentary glare to the pilot's vision. Reconnaissance of the terrain before the start of the aero agricultural operations greatly helps the awareness regarding the position of the obstacles.

However, the dynamic of the flight (checking of the quantity of the chemical product, alignment of the light-bar, speed of the aircraft, among other tasks) divides the pilot's attention. Without glare, the airman can easily see (and avoid) collision with obstacles. However, once temporarily blinded, precious seconds of reaction time are compromised, and the accident becomes inevitable.

Secondly, there is the issue of the low contrast of thin wires with the environment. Especially for those who insist on passing under the power lines, here is an important warning: the increase in temperature throughout the day causes thermal expansion and a consequent increase in the curvature of the wires. That is, it passed once... it may not pass on the second attempt. Don't risk it!

Still, keeping oneself attentive in flight is critical. As with classes and lectures, it's hard to stay focused on the instruction for more than 20 minutes. The professor/speaker has to be didactically captivating, as well as the subject interesting enough to keep the audience's motivation high. On prolonged and repetitive flights, monotony tends to reduce the agricultural-pilot's desirable levels of attention. This one knows where the obstacles are, but the frequent proximity with electric energy lines, for example, generates a dangerous "intimacy".

Finally, reconnaissance of the crop-dusting area while in flight is completely inadvisable, since the height at which such flight is performed may compromise the timely identification of details of the obstacles or, in more extreme cases, may result in inadvertent collisions. More details on what can be done to eliminate or mitigate this type of accident are discussed later in this manual. (Emphasis added)

Regarding the reconnaissance of the area, the item 6.4.1 - Recognition of the Area, highlights that:

Reconnaissance of the crop-dusting area is not just important for the pilot.

It is a matter of survival. There are, for example, several reports of collisions with wires, fences, and antennas, the position of which was not previously known by the pilot. Why?

Because the pilot did not carry out a previous reconnaissance on the ground, that is, he did not visit the place on foot or by car, before the start of the flight. What many do is a brief flyover before crop-dusting pass. In this way, details such as telephone cables and low-voltage lines close to vegetation become practically invisible when observed from above. Even worse if the luminosity further compromises the contrast of this type of obstacle.

The combined use of area maps and ground visits enables a level of preparation and planning that, in addition to protecting the pilot against in-flight collisions, protects them from problems arising from the dispersion of phytosanitary products over schools, springs and the like.

Once the details of the area are known, the planning must also consider the influence of natural factors (biorhythms, sun, wind, and complexity of the application area).

Therefore, it is suggested that good planning evaluates the following questions:

[...]

3. The position of the sun and its luminosity will be critical factors in choosing the application hours for a given area (more or less congested by obstacles).

Therefore, as a safety recommendation, the most complex areas should be sprayed, combining the pilot's best performance with the time of the day at which brightness or glare from the sun does not distract the crew's attention. (Emphasis added).

## 1.20. Useful or effective investigation techniques.

NIL.

## 2. ANALYSIS.

It was an aero agricultural operation, taking place under the rules of the RBAC-137, in which the aircraft (registration PS-CTN) was being utilized for the spraying of agricultural pesticides on a cotton plantation.

SWEV was the base for take-off and landing operations. The aerodrome was located at the headquarters of *Fazenda Cambará I*, at a distance of approximately 6 NM from the crop-dusting area.

The aircraft had up-to-date logbooks and inspections, and was within the prescribed weight and balance limits. The mentioned parameters had no influence on the occurrence.

At the time of the serious incident, the weather conditions were consistent with the conduction of the proposed flight.

The PIC's qualifications and experience in that type of operation were adequate for the conduction of the flight. He was familiar with the region, being aware of the existence of electric-power lines crossing the area of *Fazenda Cambará I*.

He started the application of the agricultural pesticides in a northeast/southwest direction, parallel to the TL, with the sun at the rear, and passed over the low-voltage electric-power lines.

The collision of the aircraft with the aforementioned low-voltage electric-power lines occurred after a reversal turn to the left, when the airplane was on a descending trajectory, during its repositioning over the lane to be sprayed, in a southwest/northeast direction (magnetic heading 030°).

The pilot reported that his attention was focused on stabilizing the plane on the correct axis for the pass. That was the reason why he did not notice how close to the power lines the aircraft was.

The choice of the spot to perform the *balloon*, so close to the low-voltage power lines, to the point of interfering with the aircraft's descent trajectory, denoted that the pilot failed to adequately assess the existing risks. The identification of the location of the obstacle in question, on the occasion of the transition for the first pass, should have led him to be more conservative in performing the *balloon*, notably, in relation to the height to be reached by the aircraft at the end of that maneuver.

Furthermore, the PIC reported that his eyes became temporarily blinded by the rising sun. Thus, it is possible that such glare impaired the sighting of the electric-power lines, to the point of hindering a successful evasive maneuver.

Thus, one verified the inadequacy of the work for the planning of the flight, including in this aspect the time of the day chosen for application of the agricultural pesticides, in which the position of the sun and its luminosity were considered unfavorable in relation to the selected aircraft trajectory.

In the same way, the pilot's attitude, characterized by failure to use a map identifying the obstacles posing some risk to that type of operation, may have been influenced by an excessive degree of self-confidence, given his familiarity with the region.

Despite the fact that the PIC was familiar with the region, a previous reconnaissance of the crop-dusting area would be recommendable. The reconnaissance of the terrain prior to the beginning of the aero agricultural operations would be helpful, to a great extent, in consolidating the position of the obstacles in the area to be sprayed.

In terms of psychological variables, one observed that, at a critical moment of the flight, the pilot's attention was subject to distraction, resulting in a compromised condition in terms of a quick and accurate response to the unanticipated presence of the wires, which could otherwise be translated into a timely evasive maneuver capable of preventing the collision of the aircraft against the low-voltage electric-power transmission network.

That said, the crop-dusting operation in the areas with the greatest number of obstacles should have been conducted in a way that combined the best performance of the pilot and the best time at which the brightness or glare from the sun would not be a source of distraction for the pilot.

One also considered that in the scenario of the collision, there was a uniformity of landscapes, characterized by the cotton plantation. Such aspect may have hindered the



ability of the PIC to recognize and project the sensations arising from external stimuli, thus concurring to the establishment of a delayed perception in relation to the operational environment in which the flight was being conducted.

According to reports given by interviewees, no signs of pilot fatigue or of excessive workload were identified that could have had an influence on the occurrence.

### 3. CONCLUSIONS.

#### 3.1. Findings.

- a) the pilot held a valid Aeronautical Medical Certificate (CMA);
- b) the pilot had valid ratings for MNTE (Single-Engine Land Airplane) and PAGA (Agricultural Pilot – Airplane);
- c) the pilot was qualified and experienced in the type of flight;
- d) the aircraft had a valid Airworthiness Certificate;
- e) the aircraft was within the prescribed weight and balance limits;
- f) the records of the airframe, engine, and propeller logbooks were up to date;
- g) the meteorological conditions were suitable for the flight;
- h) after performing a reversal turn, the aircraft collided with low-voltage electric-power lines;
- i) the collision with the power lines occurred seconds after the pilot prepared the aircraft equipment for a new pass, with the sun head on, diagonally to the right-hand side in relation to the flight path;
- j) the aircraft sustained slight damage; and
- k) the pilot escaped uninjured.

#### 3.2. Contributing factors.

- **Attention – a contributor.**

According to reports from the pilot, at the time of the collision, his attention was focused on adjusting to the flight axis, a fact that made it impossible for him to perceive imminent collision.

- **Attitude – undetermined.**

The pilot's attitude, characterized by not using a map to identify the obstacles that posed a risk to that type of operation, may have been influenced by his excessive self-confidence, given his familiarity with the region.

- **Flight planning – a contributor.**

There was inadequacy of the work related to the planning of the flight, including in this aspect the time of the day for the spraying of the pesticides, in which the sun and its luminosity were in a position considered unfavorable for the selected trajectory of the aircraft.

- **Support systems – undetermined.**

It is possible that the lack of an up-to-date map of the area over which the aircraft would fly during the crop-dusting operation contributed to the collision of the aircraft with the electric-power lines.

### 4. SAFETY RECOMMENDATIONS

None.

## 5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

The owner of *Fazenda Cambará I*, simultaneously the operator of the aircraft involved in the occurrence, was instructed to provide signage for the electric-power lines crossing his farm, in accordance with the provisions of the Norm NBR 7276 (Warning Signage of Overhead Electric-Power Transmission-Lines) issued by the ABNT (Brazilian National Standards Organization).

The pilot was advised to condition the execution of aero agricultural operations to the following requirements: visual on-the-ground reconnaissance of the areas to be overflown; planning of the flight, establishing risk management, involving aspects, such as, the currency of the information concerning the existing obstacles on his maps/charts; and the circumstances which may lead to the occurrence of glare resulting from the sunlight.

On August 15<sup>th</sup>, de 2023.

