# COMANDO DA AERONÁUTICA

## CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

# FINAL REPORT
# A-082/CENIPA/2022

| | |
|---|---|
| **OCCURRENCE:** | **ACCIDENT** |
| **AIRCRAFT:** | **PR-JSM** |
| **MODEL:** | **AT-502** |
| **DATE:** | **05JUL2022** |

# 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 05 July 2022 accident with the AT 502 Air Tractor aircraft, registration marks PR-JSM. The occurrence was typified as “[LALT] Low altitude operation”.

At the end of one of the turnaround maneuvers during the application of agricultural pesticides on *Fazenda Vale do Rio Verde*, in the municipality of *Tapurah*, State of *Mato Grosso*, the spray boom of the aircraft struck the crop. Subsequently the airplane collided with the ground and caught fire.

The aircraft was destroyed in the crash.

The pilot suffered serious injuries and passed away approximately 40 days after the occurrence.

Being Canada the State of Engine Design, the Canadian TSB (Transportation Safety Board) appointed an Accredited Representative for participation in the investigation of the accident.

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## GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

| | |
|---|---|
| ANAC | Brazil's National Civil Aviation Agency |
| CENIPA | Brazil's Aeronautical Accidents Investigation and Prevention Center |
| CIV | Pilot's digital logbook |
| CMA | Aeronautical Medical Certificate |
| CVA | Certificate of Airworthiness-Verification |
| GPS | Global Positioning System |
| INMET | National Institute of Meteorology |
| METAR | Routine Meteorological Aerodrome Report |
| MNTE | Single-Engine Land Airplane Rating |
| PAGA | Ag-Pilot Rating - Airplane |
| PCM | Comercial Pilot License- Airplane |
| PIC | Pilot in Command |
| RBAC | Brazilian Civil Aviation Regulation |
| SACI | Civil Aviation Integrated Information System |
| SBSO | ICAO location designator - *Adolino Bedin* Regional Aeródromo, *Sorriso*, State of *Mato Grosso* |
| SSDS | ICAO location designator - *Fazenda Vale* Aerodrome, *Tapurah*, State of *Mato Grosso* |
| SIPAER | Aeronautical Accidents Investigation and Prevention System |
| TPP | Private Air Services Aircraft Registration Category |
| TSB | Transportation Safety Board |
| UTC | Coordinated Universal Time |
| VFR | Visual Flight Rules |
| VMC | Visual Meteorological Conditions |

# 1. FACTUAL INFORMATION.

| | | |
|---|---|---|
| **Aircraft** | **Model:** AT-502<br>**Registration:** PR-JSM<br>**Manufacturer:** *Air Tractor* | **Operator:**<br>*Bom Futuro Agrícola Ltda.* |
| **Occurrence** | **Date/time**: 05JUL2022 – 13:30 (UTC)<br>**Location:** *Fazenda Vale do Rio Verde*<br>**Lat.** 12°32'15"S **Long.** 056°12'09"W<br>**Municipality – State:** *Tapurah – Mato Grosso*. | **Type(s):**<br>[LALT] Low altitude operations |

## 1.1. History of the flight.

At approximately 13:10 UTC, the aircraft took off from SSDS (*Fazenda Vale* Aerodrome, *Tapurah*, MT) on a pesticide application flight in an area of *Fazenda Vale do Rio Verde*, with 01 POB (pilot).

At the end of a turnaround maneuver, the spray boom touched the crop, causing the airplane to collide with the ground and subsequently catch fire.

Figure 1 - Final positioning of the aircraft after the occurrence.

The airplane was destroyed.

The pilot suffered serious injuries and passed away 40 days after the accident.

## 1.2. Injuries to persons.

| Injuries | Crew | Passengers | Others |
|---|---|---|---|
| Fatal | - | - | - |
| Serious | 1 | - | - |
| Minor | - | - | - |
| 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 | |
|---|---|
| | PIC |
| Total | 9,306:42 |
| Total in the last 30 days | Unknown |
| Total in the last 24 hours | Unknown |
| In this type of aircraft | Unknown |
| In this type in the last 30 days | Unknown |
| In this type in the last 24 hours | Unknown |

**RMK:** Flight-hour information obtained through records presented by the operator's representative, as well as records from the pilot's CIV (digital Pilot-Logbook), available in the ANAC's SACI (Civil Aviation Integrated Information) System.

It was not possible to track the most recent flight hours since the post-impact fire consumed the pilot's flight records, and the fact that the aircraft logbook was not up-to-date**.**

#### 1.5.2. Personnel training.

The Pilot in Command (PIC) completed his PPR course (Private Pilot - Airplane) in 2001, at the *Aeroclube de Itápolis*, *São Paulo* State.

In 2002, the PIC earned his PCM license (Commercial Pilot - Airplane).

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

The PIC held a PCM license (Commercial Pilot - Airplane) and valid ratings for MNTE (Single-Engine Landplane) and PAGA (Agricultural Pilot - Airplane).

#### 1.5.4. Qualification and flight experience.

The information available in the CIV (digital Pilot-Logbook) indicated that the PIC had 17 hours and 54 minutes of recorded flight experience. His entries were inconsistent, with the last flight hours logged in August 2021 (2 hours) and September 2019 (2 hours).

According to the operator's representative, the PIC had been working sporadically for the company since 2009, always operating AT-502 aircraft. He had previously flown the PR-JSM airplane on other occasions.

Although the pilot's résumé, submitted when he was contracted, stated that he had over 9,300 total flight hours of experience, the aircraft logbook did not contain any flight records since June 15, 2022.

Based on the aircraft logbook's signature records, the pilot involved in the accident had not flown the PR-JSM in the last three months.

According to the operator's representative, the PIC reported for the flight on 02 July 2022, at *Fazenda Vale* Aerodrome (SSDS), in *Tapurah*, State of *Mato Grosso*, and flew on each of the three days leading up to the occurrence.

It was not possible to track the hours flown because the fire consumed the entire aircraft, including the pilot's flight records.

The control exercised by the operator was not sufficient to thoroughly verify the pilot's experience, which made it impossible to confirm the exact qualification needed for the flight, as required by section 61.21 "Recent Experience" of the RBAC-61 (Brazilian Civil Aviation Regulation n° 61), which governs Pilot Licenses, Ratings, and Certificates.

### 1.5.5. Validity of medical certificate.

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

### 1.6. Aircraft information.

The aircraft, serial number 5020184, was product manufactured by Air Tractor in 1992 and registered under the Private Air Services (TPP) category.

Its Certificate of Airworthiness (CVA) was valid. The records of the airframe, engine, and propeller logbooks were up to date.

The latest comprehensive inspection of the aircraft ("100-hour" type) was conducted on 30 May 2022, on the premises of the *AEROSIAQ* maintenance organization (COM 2010-61/ANAC), in *Cuiabá*, State of *Mato Grosso*. The aircraft flew between 40 and 50 hours after the said inspection.

No maintenance-related aspects were observed that could have contributed to the occurrence.

### 1.7. Meteorological information.

The Aerodrome of *Fazenda Vale* (SSDS), located in the municipality of *Tapurah*, *Mato Grosso*, did not have either a weather station or nearby weather stations. However, the Meteorological Aerodrome Report (METAR) from SBSO (*Sorriso* - *Adolino Bedin* - Regional Aerodrome), located approximately 30 NM from the accident site, contained the following information:

METAR SBSO 051300Z 11009KT CAVOK 25/16 Q1018=

It was verified that the conditions at SBSO were above the minimum requirements for flight operations, with visibility above 10 km and no significant clouds. The wind was 110° at 9 kt, with a temperature of 25°C, and a barometric pressure of 1,018 hPa.

According to reports, at the time of the accident, the wind had an approximate strength between 3 and 5 kt. with variable direction; the visibility exceeded 10 km, the temperature was 25°C, with sunny weather, and no significant clouds. These conditions were corroborated by the METAR from SBSO and the satellite image from the time of the event (Figure 2).

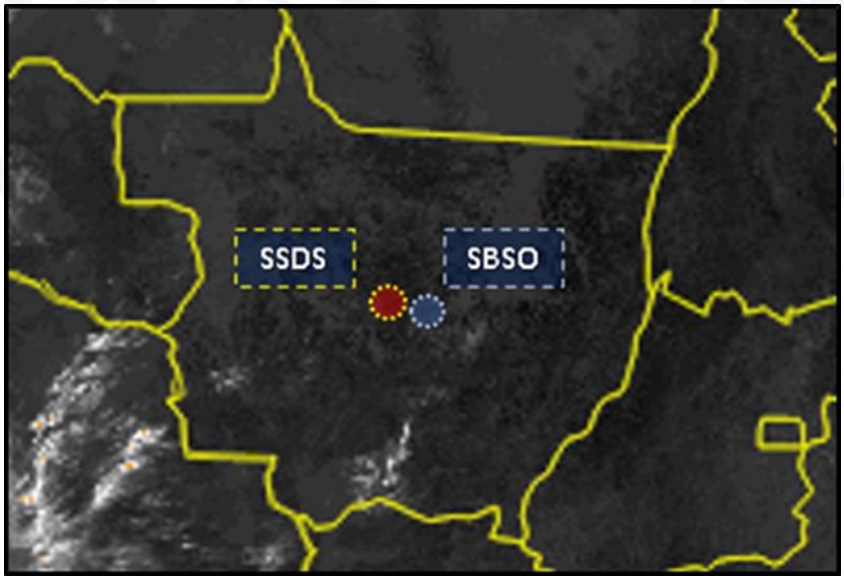


Figure 2 - Enhanced satellite image of the region at 13:10 UTC., highlighting SSDS and SBSO. Source: https://www.redemet.aer.mil.br/.

Thus, the Investigation Commission concluded that the meteorological conditions were above the minimum requirements for flight operations.

### 1.8. Aids to navigation.

NIL.

### 1.9. Communications.

NIL.

### 1.10. Aerodrome information.

Not applicable.

### 1.11. Flight recorders.

Not required and not installed.

### 1.12. Wreckage and impact information.

The Global Positioning System (GPS) installed on the aircraft could not provide data due to the fire that consumed it. However, efforts were made to reconstruct the trajectory flown by the PR-JSM airplane.

It was the fourth flight of the day, and the aircraft was executing its fifth repositioning turn for application, following a path consistent with the layout in areas 222 and 223 (highlighted in green) of *Fazenda Vale do Rio Verde*, as shown in Figure 3.


Figure 3 - Sketch of the trajectory flown by the aircraft.
Source: sunearthtools.com and adaptation from Google Earth, 2022.

The aircraft impacted the plantation with high longitudinal energy. The area of the debris extended 119 meters in length and 36 meters in width, maintaining the direction of flight, indicating the final segment of a left reversal turn, consistent with observations made during the initial action of the investigation.

Parts of the aircraft detached upon initial contact with the cotton field, including the spray bar and the tip of the left wing, which were the farthest pieces of wreckage from the aircraft's final position.

The detachment of the left wing resulted in the release of fuel, which ignited upon contact with the aircraft's hot components, initiating the fire.

The fire was concentrated at the root of the right wing, consistent with the dynamics of the impact and the aircraft's final position, as illustrated in Figure 4.

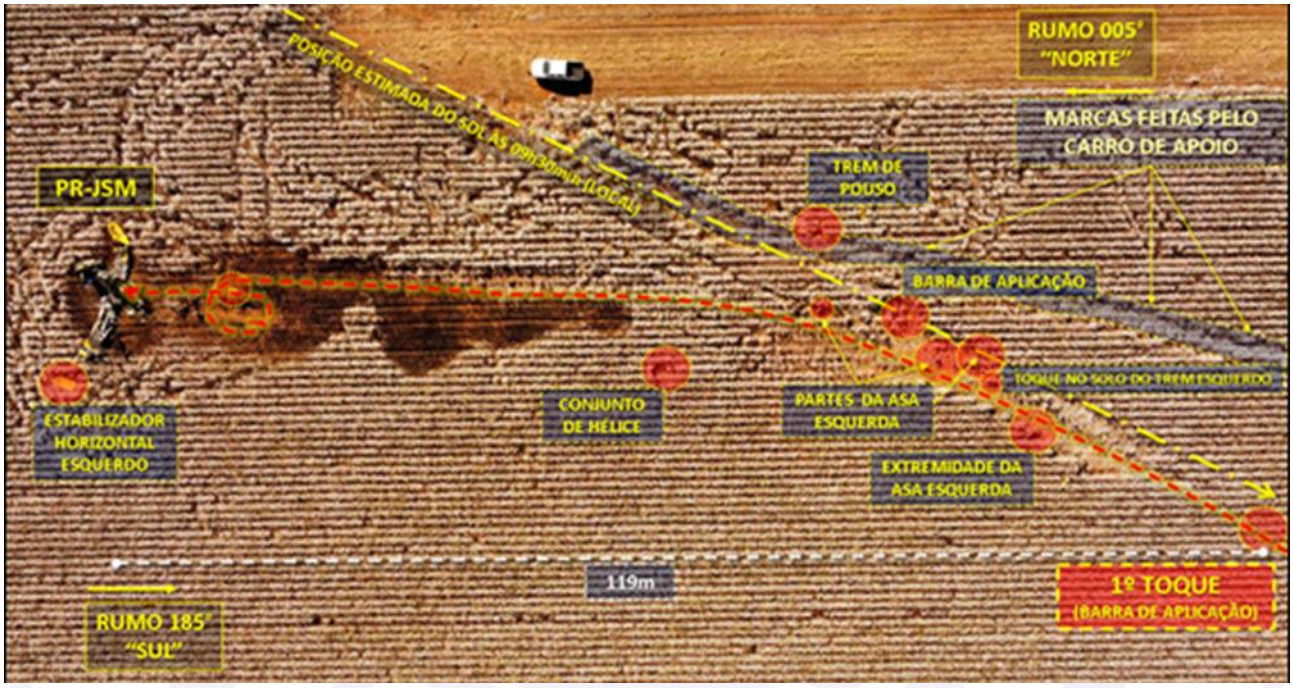


Figure 4 - Dynamics of the occurrence and debris dispersion.
Source: Adapted from Google Earth, 2022.

## 1.13. Medical and pathological information.

### 1.13.1. Medical aspects.

NIL.

### 1.13.2. Ergonomic information.

The sun was positioned to the left of the trajectory during the final segment of the reversal turn. According to information from sunearthtools.com, at the time of impact (13:30 UTC), the sun was at an azimuth of 54.36° and an elevation of 29.76°.

In this position, its brightness was directly within the pilot's line of sight, potentially impairing forward visibility.

### 1.13.3. Psychological aspects.

No abnormalities in the pilot's routine were observed by the ground support team on *Fazenda Vale*.

According to reports, the pilot appeared to be in good spirits, as he always did when reporting for duty.

There was no evidence suggesting that emotional factors might have affected the pilot's performance.

## 1.14. Fire.

The fire ignited immediately after the left wing impacted the ground.

The combustible material was the aircraft's fuel, and the ignition source likely originated from contact with the engine's hot components.

The fire spread throughout the aircraft within seconds after it came to a complete stop.

## 1.15. Survival aspects.

Seconds after the aircraft came to a complete stop, it was engulfed in flames.

The pilot reported managing to free himself from the seatbelt and exit the aircraft on his own through the right side. He moved with difficulty due to burns and a minor cut on his foot but was quickly assisted by a support vehicle from *Fazenda Vale*, which had been monitoring the application from a road bordering the area, approximately 300 meters from the crash site.

Initial assistance was provided by *Fazenda Vale*, including receiving the pilot's account of the incident and transporting him to the nearest hospital in *Lucas do Rio Verde*, *Mato Grosso,* approximately 80 km away.

The pilot remained conscious until he arrived at the hospital.

Due to the inhalation of high-temperature gases, the medical team performed an intubation procedure, which prevented initial contact with the Investigation Committee.

**1.16. Tests and research.**

It was not possible to determine the position of the flaps.

From the recovered parts, it was verified that the engine was producing power at the time of impact.

The degree of destruction and charring of the aircraft made it difficult to inspect various pieces of equipment and instruments.

**1.17. Organizational and management information.**

The company, *Bom Futuro Agrícola Ltda.,* was a private entity that adhered to the requirements established in Section 137.205 of RBAC 137, Amendment 04, and, as such, did not hold an Air Operator Certificate (COA).

> 137.205 Limitations for private agricultural operators
>
> (a) A private operator of an agricultural aircraft may not conduct aerial agricultural operations:
>
> 1. for compensation or the benefit of third parties;
>
> 2. over any property unless they are the owner or lessee; or
>
> 3. in violation of the provisions of this Regulation.

Despite the fact that *Bom Futuro Agrícola Ltda.* was a private company, Subpart F established documentation requirements applicable to all agricultural operators. During the investigation of the accident, it was noted that the control exercised by the operator regarding the allocation of human resources for operational activities was not effective, which hindered the search of information regarding the pilot's experience.

**1.18. Operational information.**

The aircraft was within the prescribed weight and balance limits.

According to reports, the pilot had previously operated on *Fazenda Vale* and had flown the aircraft in question, being familiar with the operational area, landmarks, and obstacles.

However, due to the lack of available information, it was not possible to determine the PIC's recent experience, qualification, or specific experience with this aircraft model.

The accident happened during the last of four planned flights that morning. The aircraft was in the process of executing its fifth repositioning turn for application.

An observer reported, and this was later confirmed by the pilot about a month after the event when he was again able to communicate, that while attempting to align the aircraft's trajectory after the reversal turn, the left end of the spray bar struck the cotton crop.

This reportedly destabilized the aircraft's control, leading to the left wingtip contacting the ground, followed by the propeller blades, left landing gear, and right wingtip. The aircraft then rotated counterclockwise, decelerated over the plantation, and eventually caught fire.

### 1.19. Additional information.

NIL.

### 1.20. Useful or effective investigation techniques.

NIL.

## 2. ANALYSIS.

The flight involved the application of agricultural pesticides over an area of Fazenda Vale do Rio Verde, with one pilot on board. The flight in question was the fourth of the day, and was performing its fifth repositioning turn for the application when the aircraft collided with the crop and the ground, subsequently catching fire.

It was not possible to ascertain the pilot's qualifications and experience with the specific aircraft model, despite his résumé stating that he had over 9,000 total flight hours. Therefore, it could not be determined whether the pilot was indeed experienced with this type of aircraft or the specific operational circumstances.

The aircraft's logbook was not up to date, there were no records of the pilot's flights in the past three months, and entries in the PIC's digital CIV were inconsistent.

The operator's inadequate control at the management level, particularly regarding the allocation and monitoring of human resources for operational activities, hindered the ability to thoroughly verify the pilot's experience.

The aircraft's Certificate of Airworthiness (CVA) was valid, and the maintenance logbooks were up to date. The aircraft was operating within weight and balance limits.

According to reports and confirmed by meteorological analysis of the region, weather conditions were suitable for the proposed flight. It was noted that the sun was positioned in such a way that its brightness directly affected the pilot's line of sight during a left turn on the given heading, which may have impaired forward visibility.

Given that this was the last flight scheduled for the morning, it is possible that the pilot experienced a reduction in attentiveness. Repeated execution of agricultural pesticide application procedures may have subjected the pilot to lapses associated with automatic processes, which occur when tasks become familiar and routine, potentially leading to actions performed without the necessary conscious attention.

Thus, it is possible that the sunlight in the pilot's line of sight, combined with task familiarity due to repetition, caused distraction and contributed to a lapse in attention.

The observer in the support vehicle, who provided the initial assistance, reported that the pilot mentioned the left wing's spray bar striking the crop following the reversal turn.

Based on the facts presented, it was inferred that the safety margin during the reversal turn may have been exceeded, leaving little or no time for the pilot to make any necessary trajectory corrections after completing the left turn.

This condition highlighted an inadequate assessment of parameters related to the aircraft's operation, coupled with a possible impairment of the pilot's vision due to the sun's position at the time of the occurrence. The sun was relatively low on the horizon, with no significant clouds or vegetation to block the brightness, directly aligned with the left reversal turn, leading to the spray bar striking the crop, followed by the wingtip contacting the ground and subsequently causing the fire.

A reduction in situational awareness or delayed perception was observed, along with a possible inadequacy in the use of flight controls by the PIC, as the aircraft approached the ground without maintaining wings-level flight.

## 3. CONCLUSIONS.

### 3.1. Findings.

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

b) the pilot's MNTE and PAGA ratings were valid.

c) it was not possible to verify whether the PIC was qualified or experienced with the specific aircraft model.

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

e) the aircraft was within weight and balance limits.

f) the airframe, engine, and propeller logbooks were up to date.

g) meteorological conditions were above the minimum required for the flight.

h) during the flight, after the left reversal turn, the spray bar struck the crop.

i) the aircraft crashed into the cotton plantation.

j) the sun was near the horizon and aligned with the aircraft's trajectory during the final segment of the left reversal turn.

k) a fire occurred after the aircraft's crash.

l) the aircraft was destroyed.

m) the pilot sustained serious injuries, having passed away 40 days later.

### 3.2. Contributing factors.

- **Attention – undetermined.**

As it was the last flight scheduled for that morning, the pilot may have experienced a reduction in his attention level. Repeated execution of agricultural pesticide application tasks may have subjected the pilot to lapses associated with automatic processes.

Additionally, sunlight interference in the pilot's line of sight may have caused distraction, diverting focus from flight-related stimuli and leading to a lapse in attention.

- **Physical work-conditions – undetermined.**

The sun's position may have degraded the visibility of the flight path, contributing to the occurrence.

- **Handling of aircraft flight controls – undetermined.**

A possible inadequacy in the use of flight controls was observed as the aircraft approached the ground without maintaining wings-level flight, which may have contributed to the accident.

- **Piloting judgment – a contributor.**

By not maintaining a safe margin during the reversal turn, leaving little or no time for corrections to trajectory imperfections at the end of the left turn, an inadequate assessment of parameters related to the aircraft's operation became evident.

- **Perception – a contributor.**

Impairments in recognizing the operational environment were observed as the aircraft approached the ground without maintaining wings-level flight, indicating a reduction in situational awareness or delayed perception.

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

It could not be determined whether the pilot was experienced with this type of aircraft or the specific operational circumstances, which may have contributed to the accident.

- **Organizational processes – undetermined.**

Failures in personnel management, reflected in the operator's lack of control over the allocation and monitoring of human resources involved in operational activities, prevented verification of the PIC's experience, which may have influenced the context of the occurrence.

## 4. SAFETY RECOMMENDATIONS

***A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident.***

***In consonance with the Law n°7565/1986, recommendations are made solely for the benefit of safety, and shall be treated as established in the NSCA 3-13 "Protocols for the Investigation of Civil Aviation Aeronautical Occurrences conducted by the Brazilian State".***

**To Brazil's National Civil Aviation Agency (ANAC):**

**A-082/CENIPA/2022 - 01** **Issued on 04/15/2025**

Disseminate the lessons learned from this investigation to *Bom Futuro Agrícola Ltda*., to ensure compliance on the part of the company with the requirements established in Subpart F of the RBAC-137, Amendment n° 05, with the aim of addressing any organizational management shortcomings that may lead to a reduced level of operational safety management.

## 5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On April 15th, 2025.