## COMANDO DA AERONÁUTICA <u>CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE</u> <u>ACIDENTES AERONÁUTICOS</u>



# FINAL REPORT A - 041/CENIPA/2019

OCCURRENCE: AIRCRAFT: MODEL: DATE: ACCIDENT PR-RVO A188B 11MAR2019



## **NOTICE**

According to the Law n° 7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System - SIPAER - is responsible for the planning, guidance, coordination and execution of the activities of investigation and prevention of aeronautical accidents.

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

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

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

This Final Report was provided to ANAC and DECEA so that the technical-scientific analyzes of this investigation can be used as a source of data and information, aiming at the identification of hazards and risk assessment, as established in the Brazilian's Program Operational Safety of Civil Aviation (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 n° 21713, dated 27 August 1946.

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

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

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

## SYNOPSIS

This is the Final Report of the 11MAR2019 accident with the A188B aircraft model, registration PR-RVO. The accident was classified as "[LALT] Low Altitude Operations".

During a fungicide application flight, the plane collided with a tree and subsequently with the ground. The aircraft was destroyed. The pilot died on the spot.

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

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## **GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS**

ANAC	Brazil's National Civil Aviation Agency		
CA	Airworthiness Certificate		
CENIPA	Aeronautical Accident Investigation and Prevention Center		
CIV	Pilot's Flight Logbook		
CMA	Aeronautical Medical Certificate		
DCTA	Department of Science and Airspace Technology		
DGPS	Differential Global Positioning System		
GSO	Safety Manager		
IGP	Santa Cruz do Sul General Institute of Expertise - RS		
MGSO	Safety Management Manual		
MNTE	Airplane Single Engine Land Rating		
NTSB	National Transportation Safety Board (USA)		
PAGA	Agricultural Pilot Rating		
PCM	Commercial Pilot License – Airplane		
PPR	Private Pilot License – Airplane		
RBAC	RBAC Brazilian Civil Aviation Regulation		
SAE-AG	Aircraft Registration Category of Specialized Air Service – Aerial Agricultural		
SERIPA V	Fifth Regional Aeronautical Accident Investigation and Prevention Service		
SGSO	Safety Management System		
SIPAER	Aeronautical Accident Investigation and Prevention System		
UTC	Universal Time Coordinated		

## **1. FACTUAL INFORMATION.**

	Model:	A188B	Operator:
Aircraft	<b>Registration:</b>	PR-RVO	Nitz Aviação Agrícola Ltd EPP
	Manufacturer:	Cessna Aircraft	
Occurrence	Date/time:	11MAR2019 – 0945 UTC	Type(s):
	Location: Rural Area		"[LALT] Low Altitude Operations"
	Lat. 30º08'31"S	Long. 052º36'12"W	Subtype(s):
	Municipality –	State: Rio Pardo – RS	Nil

## 1.1 History of the flight.

The aircraft took off from the aerial agricultural landing area of Santa Isabel Farm, Rio Pardo - RS, at 0930 (UTC), in order to carry out a fungicide application flight in a soybean field, with a pilot on board.

During an application shot, the plane collided with a tree and, subsequently, with the ground.

The aircraft was destroyed.

The pilot died on the spot.

## 1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	1		-
Serious	-		-
Minor			-
None	-	2	-

## 1.3 Damage to the aircraft.

The aircraft was destroyed.

## 1.4 Other damage.

None.

## 1.5 Personnel information.

## 1.5.1 Crew's flight experience.

Flight Hours	Pilot
Total	1.049:55
Total in the last 30 days	20:30
Total in the last 24 hours	02:15
In this type of aircraft	415:20
In this type in the last 30 days	20:30
In this type in the last 24 hours	02:15

**N.B.:** The data related to the flown hours were obtained through the operator's records. The pilot's CIV was not found.

## 1.5.2 Personnel training.

The pilot took the PPR and PAGA courses in 2015, at the Carazinho Aeroclub.

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

The pilot had the PCM course and had valid MNTE and PAGA Ratings.

## 1.5.4 Qualification and flight experience.

The Digital CIV's records indicated that the pilot had operated the A188B aircraft, registered PR-RVO since January 2017. The company's records indicated that the pilot had a total of 415 hours and 20 minutes on this model of aircraft.

Information provided by the company indicates that the pilot had already operated, in previous years, in the same landing area for aerial agricultural use. However, he had not yet carried out spraying flights on that crop.

The pilot was qualified and had experience in the type of flight.

#### 1.5.5 Validity of medical certificate.

The pilot had valid CMA.

#### 1.6 Aircraft information.

The aircraft, serial number 18802177T, was manufactured by Cessna Aircraft, in 1975, and it was registered in the SAE-AG category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe, engine and propeller logbook records were updated.

The last inspection of the aircraft, the "100 hours" type was carried out on 22FEB2019 by the maintenance organization Aerovaley *Manutenção de Aeronaves* Ltd., in Novo Hamburgo – RS. It was not possible to determine the flown hours after this inspection, as they had not been entered in the logbook.

#### **1.7 Meteorological information.**

As reported by observers, the take-off took place at sunrise.

The weather conditions, at the time, were favorable for the visual flight, with calm wind, no cloudiness or any restriction to visibility, and the sun shone brightly.

#### 1.8 Aids to navigation.

Nil.

#### 1.9 Communications.

Nil.

#### 1.10 Aerodrome information.

The occurrence took place out of the Aerodrome.

#### 1.11 Flight recorders.

Neither required nor installed.

#### 1.12 Wreckage and impact information.

The first impact occurred with a heading of approximately 095° against a tree that was in a soybean plantation.

The distribution of the debris was linear (Figure 1).





Figure 1 - Trajectory and layout of the aircraft debris.

Figure 2 shows the point of the first impact and the place where the aircraft stopped.



Figure 2 - point of the first impact and the place where the aircraft stopped.

Due to the impact, parts of the tree were torn off, as seen in Figures 3 and 4.



Figure 3 - Tree branch torn off due to the impact.



Figure 4 - Upper part of the tree trunk torn off after the impact.

After the impact, the right wing separated from the aircraft and was found approximately 150 meters from the fuselage. Small fragments of the tree were observed together with the twisted metal, at the point of impact between the wing and the tree (Figure 5).



Figure 5 - Part of the wing detached when colliding with the tree.

The second impact hit the ground and separated the engine from the rest of the fuselage (Figure 6).

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Figure 6 – The aircraft after total stop. The red highlight shows the place where the engine was found.

### 1.13 Medical and pathological information.

#### 1.13.1 Medical aspects.

The last health inspection carried out by the pilot took place, on 21MAY2018, at the Maia Clinic, in Canoas - RS, and he received a favorable opinion. On that occasion, the pilot informed that he was not taking medications, that he had no previous illness and that he had not undergone surgery. He also stated that he only used alcohol occasionally and reported that he had stopped smoking in 2013.

The Expert Report issued by the Santa Cruz do Sul IGP - RS, concluded that the pilot's cause of death was traumatic brain injury.

The toxicological examination performed for organic pesticides, legal and illegal psychotropic substances and the presence of ethyl alcohol in a blood sample was negative for all these substances.

During an interview, the pilot's wife corroborated her husband's information regarding the absence of health problems and the use of medications. However, she reported that, the day before the accident, he had symptoms of allergy or cold, characterized by sneezing.

According to her report, at 2130 (local time), he used a sachet of a drug containing 400mg acetaminophen (analgesic and antipyretic), 4 mg chlorpheniramine (antiallergic) and 4mg phenylephrine (decongestant) one hour before bedtime.

As per the drug package insert, drowsiness was a common reaction, occurring in 10% or more of patients. There could also be central nervous system depression, leading to impairment of physical and mental abilities. Patients should be warned about performing tasks that require mental effort, such as operating machinery or driving vehicles. In addition, other reactions could occur, less frequently, including visual ones, such as blurred or double vision (diplopia).

The action of the chlorpheniramine lasted around 4 to 12 hours.

#### 1.13.2 Ergonomic information.

Upon analyzing the characteristics of the application area, the Investigation Team found that there were two trees (eucalyptus) of 20 and 17m high, one in the alignment of the application range, while the other was 19m to the right and 26m before (Figure 7).



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Figure 7 - Position of trees in relation to the application range.

The sunrise occurred at 0929 (UTC). At the moment of the aircraft's impact (0945 UTC), the sun was at azimuth 089° and with an elevation of 06°. In that position, the sun fell directly on the pilot's field of view, affecting visibility ahead (Figure 8).



Figure 8 - Vertical section of the angle of incidence of sunlight in relation to the aircraft and the obstacle.

When analyzing the fragments of the aircraft's windshield, it was observed that there was a significant amount of dust accumulated in the regions close to the edges. However, due to fragmentation, it was not possible to check the condition of the front part of the windshield (Figure 9).



Figure 9 - Detail of the accumulated dust on parts of the windshield.

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The pilot performed the first application pass in the opposite direction to the moment of impact (with the sun on his back). When finishing this passage, in the position where it is usual for the agricultural pilot to observe the side to which he intends to turn for the next passage, it is observed that the position of the trees in relation to the aircraft resulted in an alignment that may have induced the pilot to identify just one tree.



Figure 10 – Possible pilot's line of sight when "clearing the area".

Furthermore, a characteristic of the impacted tree, in relation to the closest one, is that it had less dense foliage and, therefore, did not completely block the incidence of sunlight (Figure 11).



Figure 11 – Detail of the foliage density of the impacted tree in relation to the others.

To minimize the effects of the sun's glare on vision, it is recommended to wear appropriate sunglasses, as well as to avoid the use of light-colored clothing, which can create a reflection on the windshield or on the instrument panel. It was not possible to specify, however, whether the pilot was wearing a visor or sunglasses at the time of the accident.

## 1.13.3 Psychological aspects.

The pilot was 31 years old and started working, in 2008, as an agricultural technician assistant at the operating company of the aircraft involved in this accident. During the harvest season, he exercised this function and, in the off-season, he trained as a pilot. In 2016, he started working as a pilot at the same company.

The pilot was described as a person with a calm and helpful profile. In the work environment, he was considered a good professional, showing good interpersonal skills. He was perceived by coworkers as a good pilot, dedicated, detail-oriented, focused on activities and of high technical standard.

According to the information gathered, the pilot was well evaluated and in high demand by the company's customers. He was one of the newest pilots at Nitz *Aviação Agrícola* and was looking forward to flying more often, since at the time of the accident he had a low number of flight hours (approximately 149 hours in the current harvest and 13 hours in March, until the date of the accident).

There were no reports that the pilot was experiencing discomfort or difficulty in his personal life. According to reports, he had commented to family members, in the week before the accident, that he had almost collided with a eucalyptus tree, in another area where he was performing a pesticide application.

#### 1.14 Fire.

There was no fire.

#### 1.15 Survival aspects.

Nil.

## 1.16 Tests and research.

The engine that equipped the aircraft, model IO-550-D, serial number 1006860, manufactured by Continental, was disassembled and inspected with the assistance of engineers from the DCTA.

The components examined and/or tested did not show signs of malfunction. All the evidence found indicated that the thruster developed power at the moment of the first impact.

Figure 12 shows the aircraft's powertrain, with deformations in the propeller blades which indicated that it was developing power at the time of the accident.



Figure 12 - Aircraft engine and propeller with typical deformations of impact with power.

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#### 1.17 Organizational and management information.

Nitz Aviação Agrícola Ltd. was founded in 1986, had its headquarters in Rio Pardo - RS, and operated North and South of BR 290, between the municipalities of Pântano Grande and Porto Alegre, Rio Grande do Sul.

It had eight aircraft, two partner pilots and four contract pilots.

The hiring of the pilot involved in this occurrence was carried out by appointment, without a selection process. At the time of the accident, he was flying his fourth crop at the company.

The last occurrence involving the company's aircraft was an accident, on 01FEB2017, with the PR-NVC. In the accident history, available in the Final Report No. A-017/CENIPA/2017, it appears that, during the take-off, the aircraft covered the entire length of the runway, climbed a few meters, but was unable to takeoff, returning to the ground and colliding against an irrigation canal.

In this report, the following Safety Recommendation was issued:

To the National Civil Aviation Agency (ANAC), it is recommended:

A-017/CENIPA/2017 - 01 Issued on: 04/08/2019

Work with Nitz Aviação Agrícola Ltd., in order to verify the planning, supervision and compliance with the planning and supervision procedures of aerial agricultural operations, as well as verifying the effective performance of the Company's GSO.

In response to the Recommendation, the ANAC informed that it was considered fulfilled, "given that an inspection was performed at the operator Nitz *Aviação Agrícola* in 2017 after the accident of the Report in question". The Agency also informed that the inspection had as objective: "verify the operational procedures, including the procedures related to the SGSO of the aforementioned company".

#### 1.18 Operational information.

It was a fungicide application flight on a soybean plantation, conducted under the RBAC No. 137.

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

The operation briefing was held the day before, when the situation of obstacles (trees) present in the area where the accident occurred was discussed.

According to reports, while the aircraft was being prepared for the first take-off of the day, the pilot confirmed the areas that would be sprayed and scheduled the application for seven flights. The accident occurred during the first flight that day.

Data taken from the DGPS of the aircraft showed that the pilot started the application from an area free of obstacles.

According to reports, his intention was to reduce the weight and then, with lighter plane, proceed to the second area, where there were the trees mentioned.

Figure 13 shows an image based on data extracted from the aircraft's DGPS. It shows the plane's trajectory from the take-off, flight in the first area, and abandonment to the second application area.



Figure 13 - First application area (before the accident).

Figure 14 shows the aircraft entering the second operating area (accident area), an application pass (in yellow), a reversal curve and the end of the DGPS recording.



Figure 14 - First pass in the application area where the accident occurred.

After completing the DGPS recording, the aircraft traveled 589m to the first impact point. In this trajectory, it was estimated that the plane flew with the heading 095° (Figure 15).



Figure 15 - Estimated trajectory between the end of the DGPS recording and the first impact on the tree.

#### 1.19 Additional information.

Research in the CENIPA database on occurrences involving agricultural flight demonstrates that high and low voltage networks, trees, fences and signs are among the objects most frequently hit in flight by aircraft of this category.

According to the Manual of Good Agricultural Aviation Practices prepared by the SERIPA V, in situations where the pilot knows the obstacle in advance, the sun has a great influence on occurrences such as those mentioned above. There are several records of collisions at sunrise and sunset.

Application passages with the sun at the heading, or close to it, generate glare to the pilot's vision. When overshadowed, the pilot's reaction time is compromised.

Once the details of the area are known, the flight planning must also consider the influence of natural factors.

The publication suggests that good planning should assess, among other issues, the fact that the position of the sun and its luminosity will be critical factors in choosing the application times and axes for the "shots" in a given area, more or less congested by obstacles.

Direct sunlight on the pilot's eyes can cause temporary blindness, ranging from seconds to minutes, depending on the conditions encountered.

A study (Natural Sunlight and Its Association to Aviation Accidents: Frequency and Prevention), which gathered accidents related to the glare of sunlight, for 10 years (1988-1998), showed that 74% of the cases characterized as in-flight, involved collision with terrain or obstacles. Of these, 62% involved the application of agricultural products.

The visual difficulty generated by the glare of the sunshine can be exacerbated if the aircraft's windshield is covered with agricultural residues, insects, dirty or damaged.

Still, it is necessary to emphasize that some medications can be photosensitizing, but this description is not easily found in drug package inserts or in the literature. Therefore, pilots should be discouraged from using medications without specialized medical advice. Alcohol, even in small amounts and for several hours after ingestion, can also increase the time needed to regain visual acuity after exposure to sunlight.

## 1.20 Useful or effective investigation techniques.

Nil.

#### 2. ANALYSIS.

It was an agricultural fungicide application flight on a soybean plantation.

The examinations and tests carried out on the powerplant that equipped the aircraft showed that its components did not show signs of malfunction and that the type of deformation found in the propeller blades indicated that the propeller was developing power at the moment of impact.

Thus, the possibility that an engine failure contributed to this accident was ruled out.

The data extracted from the DGPS showed that the aircraft made several turns with variations in height and speed consistent with the expected flight profile. Thus, there was no evidence of failure conditions or malfunctioning of systems and/or components that could have affected the aircraft's in-flight performance or control.

The pilot was qualified and had experience to perform the flight. He was considered a good professional, related well in the work environment and was well regarded by both colleagues and clients of the company.

It was found that the pilot was going through a period of normality in his work routine and in his personal life, so that there were no individual or psychosocial issues that could have affected his performance in flight.

Regarding the use of medication to combat allergy or cold symptoms the day before the occurrence, it was concluded that, as the accident occurred 10 hours after use, the probability that the medication still had a significant effect on the pilot's performance was considered low.

The pilot had been instructed on the characteristics of the spraying area, having participated in the operation briefing the day before, when operational issues were addressed, including obstacles (isolated trees) present in the area.

On the day of the accident, the flight started as planned. The weather was favorable and the sun was shining brightly after sunrise.

Following his planning, the pilot applied part of the hopper's load in an area free of obstacles and proceeded with the lighter aircraft to the area where the accident occurred, where, admittedly, there were obstacles and more attention would be needed in carrying the application.

He made a first pass in the opposite direction to the one in which the collision occurred (with the sun on his back). When aligning on the axis of the next application "shot", the pilot took heading 095°, with the morning sun in front of him (089° azimuth and 06° elevation).

Thus, considering that sunlight fell directly on the pilot's eyes during this passage, it was concluded that he had his perception impaired by the glare generated by the position of the sun at that moment and that he was not able to identify the obstacle against which the plane crashed in time to avoid impact.

The fact that the tree had less dense foliage than the two in the application range may have made it difficult to see.

In this scenario, it was concluded that the preparation for the flight, including risk management, did not adequately explore the influence of natural factors, such as the position of the sun and the complexity of the application area.

It is possible that this inadequacy was related to weaknesses in the safety culture and an inefficient supervision of planning and execution activities at the operational level, which apparently remained even after the inspection carried out by the ANAC.

#### 3. CONCLUSIONS.

#### 3.1 Facts.

- a) the pilot had valid CMA;
- b) the pilot had valid MNTE and PAGA Ratings;
- c) the pilot was qualified and had experience in the kind of flight;
- d) the aircraft had valid CA;
- e) the aircraft was within the weight and balance limits;
- f) the airframe, engine and propeller logbook records were updated;
- g) no evidence was found that problems of physiological nature or incapacitation could have affected the flight crew performance in flight;
- h) no evidence of failure or malfunctioning of systems and/or components of the aircraft that could have affected its performance or its control in flight;
- i) the weather conditions were favorable for the flight;

- j) the sun compromised visibility in front of the aircraft;
- k) during the execution of the "shot" of application, the airplane collided with a tree and, subsequently, with the ground;
- I) the impacted tree had less dense foliage among the two present in the application range;
- m) the aircraft was destroyed; and
- n) the pilot suffered fatal injuries.

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

#### - Flight planning – a contributor.

Despite identifying the obstacles and adopting measures so that the operation in that area was carried out in better operational conditions for the aircraft, the planning did not consider the possibility of restriction of visibility in the time of the intended flight and contributed to the operation taking place in inadequate conditions of visibility ahead.

#### Managerial oversight – undetermined.

It is possible that the inadequacies observed in relation to flight preparation and operation risk management were related to inefficient supervision, by the organization's management, of planning and completion of activities in the operational scope.

## 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-041/CENIPA/2019 - 01

## Issued on 02/09/2022

Reinforce the work with Nitz Aviação Agrícola Ltd., in order to reassess the adequacy of the MGSO adopted by that operator, verifying whether the instructions contained in this document are being complied with by the company's crew, notably regarding the items that concern risk management.

## 5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On February 09<sup>th</sup>, 2022.