

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
A-074/CENIPA/2021

OCCURRENCE:	ACCIDENT
AIRCRAFT:	PR-ABN
MODEL:	PA-25-235
DATE:	18MAI2021



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 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 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. 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 Final Report of the 18 May 2021 accident with the PA-25-235 aircraft, registration marks PR-ABN. The accident was typified as “[SCF-PP] Engine failure or malfunction | Engine Failure in Flight.”

The aircraft took off from SDLL (*Yolanda Penteadó* Aerodrome, Leme, State of São Paulo, on a local crop-dusting flight, with 01 POB (pilot).

During the flight, shortly before aligning for the application, the aircraft sustained engine failure.

The pilot made an emergency landing in a sugarcane plantation area, and the aircraft ended up catching fire.

The aircraft was destroyed.

The pilot suffered no injuries.

Being the United States of America the State of manufacture of the aircraft, the USA's NTSB (National 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

AEV	Special Flight-Authorization
ANAC	Brazil's National Civil Aviation Agency
CA	Certificate of Airworthiness
CAVOK	Ceiling and Visibility OK (base of clouds above 5000 ft, horizontal visibility more than 10 km)
CENIPA	Brazil's Aeronautical Accidents Investigation and Prevention Center
CIV	Individual Pilot-Logbook
CMA	Aeronautical Medical Certificate
DCTA	Department of Science and Aerospace Technology
FAA	Federal Aviation Administration
IS	Supplementary Instruction
METAR	Routine Meteorological Aerodrome Report
MNTE	Single-Engine Land Airplane Class Rating
NTSB	USA's National Transportation Safety Board
OM	Maintenance Organization
PAGA	Aeroagricultural Pilot Rating (Airplane)
PCM	Commercial Pilot License (Airplane)
PPR	Private Pilot License (Airplane)
RBAC	Brazilian Civil Aviation Regulation
REDEMET	Command of Aeronautics' Meteorology Network
SAE-AG	Specialized Public Air Service Aircraft Registration Category (Aeroagricultural)
SBYS	ICAO location designator - <i>Campo Fontenelle</i> Aerodrome, <i>Pirassununga</i> , State of <i>São Paulo</i>
SGSO	Safety Management System
SIPAER	Brazil's Aeronautical Accidents Investigation and Prevention System
SN	Serial Number
TAF	Terminal Aerodrome Forecast
UTC	Universal Time Coordinated

1. FACTUAL INFORMATION.

Aircraft	Model: PA-25-235	Operator: <i>Ultraer Aeroagrícola Ltda. – EPP.</i>
	Registration: PR-ABN	
	Manufacturer: Piper Aircraft.	
Occurrence	Date/time: 18MAI2021 – 14:20 UTC	Type(s): [SCF-PP] Powerplant failure or malfunction
	Location: Rural area.	
	Lat. 22°12'48"S Long. 047°20'49"W	
	Municipality – State: Leme- São Paulo	

1.1. History of the flight.

At around 14:10 UTC, the aircraft took off from SDLL (*Yolanda Penteado* Aerodrome, Leme, State of *São Paulo*), on a local crop-dusting flight, with 01 POB (pilot).

During the flight, shortly before the start of the pesticide application, the aircraft sustained engine failure.

The pilot made an emergency landing in a sugar cane plantation area.

Upon landing, the aircraft caught fire and ended up destroyed.

The pilot suffered no injuries.



Figure 1 - View of the aircraft after coming to a complete stop.

1.2. Injuries to persons.

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

1.3. Damage to the aircraft.

After landing, the aircraft was destroyed by fire.

1.4. Other damage.

NIL.

1.5. Personnel information.

1.5.1. Crew's flight experience.

Flight Experience	
	PIC
Total	[1.319:43]
Total in the last 30 days	[17:35]
Total in the last 24 hours	[05:05]
In this type of aircraft	[609:55]
In this type, in the last 30 days	[17:35]
In this type, in the last 24 hours	[05:05]

N.B.: data relating to hours flown obtained through records from the pilot's CIV (Individual Digital Pilot-Logbook).

1.5.2. Personnel training.

The PIC (Pilot in Command) did his PPR course (Private Pilot – Airplane) in 2010, at the *Aeroclube de Catanduva*, State of São Paulo.

1.5.3. Category of licenses and validity of certificates.

The PIC held a PCM license (Commercial Pilot - Airplane), as well as valid MNTE¹ and PAGA² ratings (¹Single-Engine Land Airplane; ²Agricultural Pilot - Airplane).

1.5.4. Qualification and flight experience.

The pilot had qualification and experience for the type of flight.

1.5.5. Validity of medical certificate.

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

1.6. Aircraft information.

The SN 25-2526 aircraft was a product manufactured by Piper Aircraft in 1963, and registered in the SAE-AG (Specialized Public Air Service Aircraft Registration Category - Aeroagricultural).

The aircraft was converted for the use of ethanol, in accordance with the IS (Supplementary Instruction) 137.201-001, and in consonance with the SEGVOO 001 issued on 25 May 2020. The change was also logged in the airframe logbook.

The AEV (Special Flight-Authorization) was valid, along with its CVA (Airworthiness-Verification Certificate) valid until 08 May 2022.

It was not possible to verify whether the records of the airframe, engine, and propeller logbooks were up to date, as the copies provided to the Investigation Commission were incomplete, containing just a few records from the Part II (primary records of maintenance, inspection, overhaul, minor modifications, and minor repairs).

The last inspection of the aircraft ("100-hour" type) was performed on 20 February 2021 by the IMAER maintenance organization (*Ibitinga Manutenção de Aeronaves e Peças Ltda.*) in *Ibitinga*, State of São Paulo. On the occasion, the aircraft had 4,944 hours and 24 minutes of flight time.

The last inspection for the obtainment of the CVA (Airworthiness Verification Certificate) was carried out by IMAER (*Ibitinga Manutenção de Aeronaves e Peças Ltda.*) in *Ibitinga*, State of São Paulo, in the period between 05 May and 08 May 2021, when the aircraft had a total of 4,982 hours and 48 minutes of flight time.

It was not possible to identify the date of the last engine overhaul. One only learned that the engine had 830 hours and 6 minutes of operation after the overhaul on the date of

issuance of its most recent CVA. The previous logbooks were not presented to the Investigation Commission.

The last records of the logbook dated from 05 May 2021, and informed that the aircraft had a total of 4,981 hours and 42 minutes of flight time. By means of records logged in the pilot's CIV, in which a total of 6 hours and 6 minutes of flight with the PR-ABN was logged on 10, 17, and 18 May 2021, the Investigation Commission inferred that the aforementioned CIV was out of date, making it impossible to calculate the hours flown after the last inspections.

The Brazilian Civil Aviation Regulation nº 137 (RBAC-137) - "Certification and Operational Requirements: Aeroagricultural Operations", in its Section 137.521, letter "K", established that:

the pilot must log the data in the aircraft logbook immediately after the end of the operation.

1.7. Meteorological information.

The METARs (Routine Meteorological Aerodrome Reports) and the TAF (Terminal Aerodrome Forecast) of SBYS (*Campo Fontenelle Aerodrome, Pirassununga, State of São Paulo*) located 14 NM away from the accident site, had the following information:

METAR SBYS 181300Z VRB02KT 9999 FEW040 21/15 Q1020=

METAR SBYS 181400Z VRB03KT CAVOK 23/15 Q1019=

METAR SBYS 181500Z VRB04KT 9999 FEW045 24/14 Q1018=

TAF SBYS 180900Z 1812/1824 28015KT 9999 FEW030 TX16/1818Z TN10/1824Z
BECMG 1816/1818 26009KT CAVOK BECMG 1822/1824 29005KT RMK PEW=

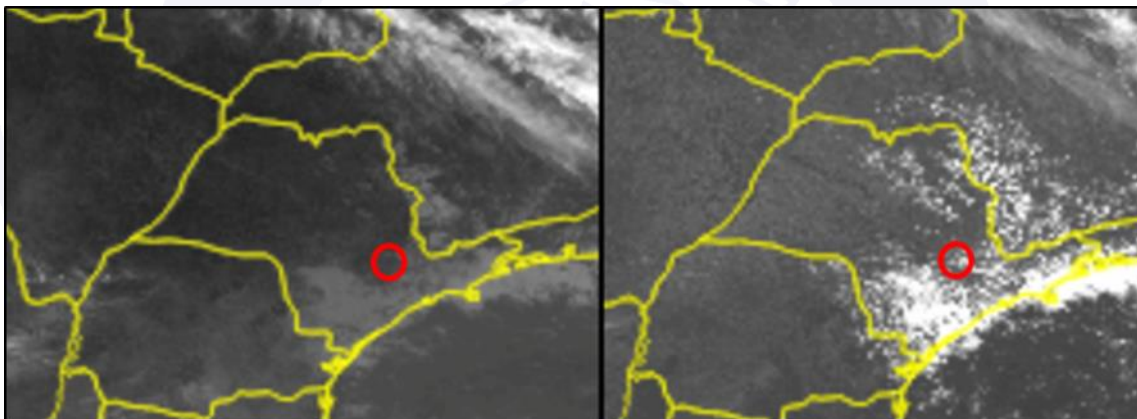


Figure 2 - Infrared and visible satellite images at 13:40 UTC and 14:30 UTC, respectively.
Source: Command of Aeronautics' Meteorology Network (REDEMET).

One found that the weather conditions in the region where the flight evolved were consistent with VMC, with visibility of more than 10 km, and few clouds at 4,000 ft. The wind was predominantly calm, with speed varying between 2 and 4 kt. There were no reports of significant meteorological formations for the area of the flight.

1.8. Aids to navigation.

NIL.

1.9. Communications.

NIL.

1.10. Aerodrome information.

The occurrence took place outside an aerodrome area.

1.11. Flight recorders.

Neither required nor installed.

1.12. Wreckage and impact information.

The impact occurred outside SDLL (*Yolanda Penteado Aerodrome*), approximately 1.75 NM from the threshold 27, in a sugarcane plantation area.

The direction of the emergency landing was towards a slightly positive slope, with the first impact occurring with wings level, and at low speed.

Due to the impact against the ground, the lower part of the aircraft and one of the propeller blades got bent before the fire engulfed the aircraft. The other blade had no marks or twists, showing that it had not made contact with the ground, and that the engine was not developing power at the time of the impact (Figure 3).



Figure 3 - Propeller of the PR-ABN

The aircraft touched the ground with a magnetic heading of 188° , and traveled a few meters before coming to a complete stop. The wreckage was concentrated at the geographical coordinates $22^{\circ}12'48''S$ $047^{\circ}20'49''W$.

After the collision, the fire started in the front of the aircraft, and spread quickly. The flaps were in the down position (Figure 4), and the rudder deflected to the right (Figure 5); however, due to the destruction caused by the fire, it was not possible to verify the positions of the other control surfaces the aircraft.

The fixed-type main landing gear was broken near the connection with the aircraft (Figure 4), whereas the nose wheel showed no damage resulting from the impact (Figure 5).



Figure 4 - Flap lowered, with the left- and right- main gear attached to the aircraft.



Figure 5 - Rudder deflected to the right, and tail-wheel of the aircraft.

The level of destruction and charring of the aircraft made it difficult to verify the aircraft's pieces of equipment, accessories, and flight instruments (Figure 6).



Figure 6 - Charred cabin and instrument panel.

1.13. Medical and pathological information.

1.13.1. Medical aspects.

There was no evidence that issues of physiological nature or incapacitation might have affected affected the crewmember's performance.

1.13.2. Ergonomic information.

NIL.

1.13.3. Psychological aspects.

There was no evidence that issues of psychological nature or incapacitation might have affected the crewmember's performance.

1.14. Fire.

After the collision, the aircraft initially caught fire in its frontal area and, due to the fuel stored in the tanks, the fire quickly spread, causing serious damage to the entire structure.

1.15. Survival aspects.

After the aircraft came to a complete stop, the pilot, who was wearing his seat belt, helmet, and flight suit, managed to get out in time, before the fire completely consumed the airplane.

1.16. Tests and research.

During the initial action, one collected a sample of fuel (ethanol) from the fuel truck that had refueled the aircraft, and a technical-qualitative analysis of the material was performed. The analysis revealed that fuel was in accordance with the respective physical-chemical specifications, and showed no signs of contamination.

It was not possible to collect samples of the aircraft's engine oil for testing, due to the degree of carbonization of the engine.

The model O-540-B2C5, SN L-4730-40 engine of the aircraft was a product manufactured by Lycoming Engines.



Figure 7 - View of the engine during the technical analysis.

The technical analysis of the engine showed severe damage caused by fire after the impact. The carbonized condition of the engine accessories and components prevented a comprehensive analysis of the engine system.

During the exams, one noticed that the engine's cylinders, pistons, conrod bushings, connecting rods, and bearings, did not have a color typical of lack of lubrication, making it evident that the engine's lubrication system had been functioning properly.

Inside the engine, there was no residue of lubricating oil due to the long exposure to the fire heat, which caused the fluid to evaporate. For this reason, the bushing of both the support bearings and connecting rods had no signs of oil on them. Also, it became evident that such evaporation did not occur during the flight, otherwise, the components already mentioned, together with the main bearing journals and connecting rods journals of the crankshaft, would have either melted or deformed, and would be presenting abnormal color.

Doubts subsisted regarding the operability of the engine's ignition and fuel supply systems. The fire consumed or, at least, damaged the components of the abovementioned systems. Such condition prevented any type of analysis aimed at identifying whether or not the affected components contributed to the failure of the PR-ABN aircraft's engine.

The color of the spark plugs was compatible with normal operation. There were no signs of overheating or residues of partial combustion.

It was not possible to make a proper assessment of the carburetor, exhaust system, muffler and fuel shut-off valve as they had been severely damaged by the fire, as seen in figures 6 and 7.



Figure 8 - View of the damaged engine magnetos.



Figure 9 - Charred oil filter.

1.17. Organizational and management information.

The company operating the aircraft, *Ultraer Aeroagrícola Ltda.* (COA no. 2013-11-41HF-04-00), had a Safety Management System (SMS) based on the “*Piloto Aero*” digital platform, through which all its crew members had access to the manuals, as well as to the company’s training program, Emergency Response Plan, Area Bulletin, among other pieces of information.

1.18. Operational information.

The flight in question had the purpose of spraying agricultural pesticides on a sugarcane plantation, being conducted under the requirements established in the RBAC-137.

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

The PIC reported that he had already made six takeoffs that day, and, after refueling the airplane with 100 liters of ethanol, he took off for the seventh time.

He performed the climb with two 360°-turns, whilst getting ready for the pesticide application. Subsequently, while proceeding to the final alignment for the spraying, at a height of about 100 feet, he sensed the aircraft's performance degrade to the point that the engine was no longer generating power. The PIC reported that he observed the propeller come to a complete stop.

Given the situation, the pilot chose to make a forced landing on the plantation, and just lowered the flap to 30°, as he considered that there would not be enough time to try to restart the engine in flight on account of the low altitude AGL.

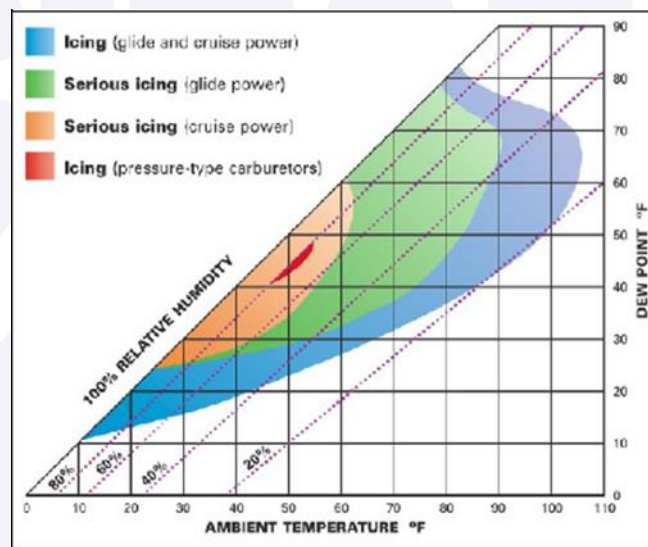
The PIC reported that, during the climbing turn procedure and when aligning with the final for the application, he was using almost full power and had not reduced it at any time until the collision. He also reported that he did not use the carburetor heater, so that there would be no loss of power during the take-off.

The aircraft touched the ground in the plantation area at low speed. Shortly after the impact, the start of fire was noticeable. The pilot managed to abandon the aircraft before the fire reached the cabin.

1.19. Additional information.

The Federal Aviation Administration's (FAA) Special Airworthiness Information Bulletin on carburetor icing prevention contained the following information:

Pilots should be aware that carburetor icing doesn't just occur in freezing conditions, it can occur at temperatures well above freezing temperatures when there is visible moisture or high humidity. Icing can occur in the carburetor at temperatures above freezing because vaporization of fuel, combined with the expansion of air as it flows through the carburetor, (Venturi Effect) causes sudden cooling, sometimes by a significant amount within a fraction of a second. Carburetor ice can be detected by a drop in rpm in fixed pitch propeller airplanes and a drop in manifold pressure in constant speed propeller airplanes. In both types, usually there will be a roughness in engine operation. The graph below shows the probability of carburetor icing for various temperature and relative humidity conditions:



Using the temperature of 23° C (73.4° F) and the dew point of 15° C (59° F) reported in the SBYS METAR in the graphic above, a situation of high probability of ice occurrence would be found at glide power.

1.20. Useful or effective investigation techniques.

NIL.

2. ANALYSIS.

It was a flight for the spraying of agricultural pesticides. After taking off and proceeding to the area, the PIC performed two 360°-holds in order to prepare the aircraft for the crop dusting. Shortly before aligning for the start of the operation, at a height of approximately 100 feet, he noticed the aircraft engine failing and the propeller stopping.

Due to the low height of the flight, the PIC only lowered the flaps and landed ahead on the sugarcane plantation, as he considered that there would not be enough time to try to restart the engine in flight.

It was not possible for the investigation commission to verify whether all the maintenance inspections were correct and up to date as per the manufacturer's requirements, since only a few pages of the aircraft's maintenance logbooks were presented.

Upon analyzing the aircraft logbook, one observed that the last records were logged on 05 May 2022 and, through the pilot's digital CIV, one verified that the aircraft had made at least three flights after that day. However, the pertinent records were missing in the aforementioned logbook, contrary to the provisions of the RBAC-137, Section 137.521, letter

“K”, which read that the data should be logged by the pilot in the logbook immediately after completion of the operation.

According to reports from the PIC and the characteristics evidenced in the wreckage during the initial action of the investigation, it was possible to conclude that the propeller was not functioning at the time of the impact, a condition that led to further examinations related to the propulsion of the aircraft.

The results of the fuel sample examination showed that it was in accordance with the respective physical-chemical specifications and had no signs of contamination.

The analysis of the engine revealed no abnormalities or discrepancies in the lubrication system that could have caused it to fail.

However, doubts subsisted in relation to the operability of the ignition and fuel supply systems, since the components of the referred systems suffered the effects of the fire (either by being consumed, or damaged). Such condition prevented further exams capable of determining whether they were contributors to the aircraft's engine failure.

The carburetor icing hypothesis was ruled out, because using the air temperature and dew point reported on the SBYS METAR, 14 NM from the accident site, on the graphic presented in the FAA Bulletin, one would arrive at a situation of high probability of icing occurring (serious icing), in a glide power situation, however, it was reported by the PIC that he was not using reduced power in the reported event.

Therefore, although the investigation ruled out several hypotheses associated with engine malfunction, it was not possible to determine the cause of the engine failure experienced by the aircraft.

3. CONCLUSIONS.

3.1. Findings.

- a) the PIC held a valid Aeronautical Medical Certificate (CMA);
- b) the PIC held valid MNTE (Single Engine Land Airplane) and PAGA (Agricultural Pilot - Airplane) ratings;
- c) the PIC had qualification and experience for the type of flight;
- d) the aircraft was converted for the use of ethanol, as per the IS 137.201-001;
- e) the aircraft had a valid AEV (Special Flight-Authorization);
- f) the aircraft was within its prescribed weight and balance limits;
- g) the airframe, engine, and propeller logbooks were only partially presented;
- h) the meteorological conditions were consistent with the type of flight;
- i) the aircraft took off from SDLL for a local crop-dusting flight;
- j) shortly before aligning for the pesticide application, the aircraft sustained engine failure;
- k) the PIC made an emergency landing in a sugarcane plantation area;
- l) after the emergency landing, the aircraft caught fire;
- m) the fuel sample (ethanol) collected from the fuel-truck was in accordance with the physical-chemical specifications;
- n) due to the destruction of the aircraft by fire, it was not possible to determine the reasons for the reported loss of power;
- o) the aircraft was destroyed; and

p) the PIC suffered no injuries.

3.2. Contributing factors.

- **Other – undetermined.**

It was not possible to determine the factors that may have contributed to the accident, due to the degree of destruction of the aircraft components and the difficulty faced in tracking the maintenance services.

4. SAFETY RECOMMENDATIONS

None.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On June 25th, 2024.

