COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 086/CENIPA/2016

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-TAC**
MODEL:	**PA 25-235**
DATE:	**17MAY2016**

NOTICE

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

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

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

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

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

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

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

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

SYNOPSIS

This is the Final Report of the 17MAY2016 accident with the PA 25-235 aircraft model, registration PR-TAC. The accident was classified as “[LOC-I] Loss of Control in Flight”.

During a pesticide application flight on a plantation, while performing a reversal turn, the pilot lost control of the aircraft, which collided against the ground.

The aircraft had substantial damage.

The pilot suffered fatal injuries.

An Accredited Representative of the National Transportation Safety Board (NTSB) - USA, (State where the aircraft/engine were designed/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
CG	Center of Gravity
CIV	Pilot's Flight Logbook
CMA	Aeronautical Medical Certificate
COMAER	Aeronautics Command
GPS	Global Positioning System
IAM	Annual Maintenance Inspection
ICA	Aeronautics' Command Instruction
METAR	Aviation Routine Weather Report
MNTE	Airplane Single Engine Land Rating
NSCA	Aeronautics Command System Standard
NTSB	National Transportation Safety Board (USA)
PAGA	Agricultural Pilot Rating
PCM	Commercial Pilot License – Airplane
PPR	Private Pilot License – Airplane
RBAC	Brazilian Civil Aviation Regulation
SIPAER	Aeronautical Accident Investigation and Prevention System
TPP	Registration Category of Private Service - Aircraft
UTC	Universal Time Coordinated
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	**Model:** PA 25-235 **Registration:** PR-TAC **Manufacturer:** Piper Aircraft	**Operator:** Serrana *Aviação Agrícola*
Occurrence	**Date/time:** 17MAY2016 - 1130 UTC **Location:** Cachoeirinha Xingu Farm **Lat.** 16°12'08"S **Long.** 046°31'17"W **Municipality – State:** Unaí – MG	**Type(s):** [LOC-I] Loss of Control in Flight **Subtype(s):** NIL

1.1 History of the flight.

The aircraft took off from an agricultural landing area of the Cachoeirinha Xingu Farm, in the municipality of Unaí - MG, in order to make a pesticide application flight on a plantation 2.6 km away, with a pilot onboard.

During the flight, in a reversal turn, to start another pass over the plantation, the pilot lost control of the aircraft, which collided against the ground.

The aircraft had substantial damage.

The pilot suffered fatal injuries.

Figure 1 - Aircraft after the occurrence.

1.2 Injuries to persons.

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

1.3 Damage to the aircraft.

Nil.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours	Pilot
Total	425:45
Total in the last 30 days	09:00
Total in the last 24 hours	01:00
In this type of aircraft	09:00
In this type in the last 30 days	09:00
In this type in the last 24 hours	01:00

N.B.: The data related to the flown hours were obtained through the Pilot's Flight Logbook (CIV) records.

1.5.2 Personnel training.

The pilot took the PPR course at the Tupi Paulista Aeroclub – SP, in 2013.

1.5.3 Category of licenses and validity of certificates.

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

1.5.4 Qualification and flight experience.

The pilot was qualified. However, he was inexperienced in the activity and was in his first crop. He had worked at *Serrana Aviação Agrícola* for two years: one year as an agricultural technician and another as a pilot.

1.5.5 Validity of medical certificate.

The pilot had valid CMA.

1.6 Aircraft information.

The aircraft, serial number 25-2847, was manufactured by Piper Aircraft, in 1964 and it was registered in the TPP category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe, engines and propellers logbooks records were updated.

The last inspection of the aircraft, the "100 hours" type, was carried out on 10MAY2016 by the Formosa Manutenção de Aeronaves Ltd. maintenance organization, in Formosa – GO, with the aircraft having flown 10 hours and 25 minutes after the inspection.

The last inspection of the aircraft, the "1000 hours" type, was carried out on 27MAY2016 by the Formosa Manutenção de Aeronaves Ltd. maintenance organization, in Formosa – GO, with the aircraft having flown 302 hours and 40 minutes after the inspection.

On 24NOV2015, according to a sales receipt, the aircraft had been sold to Serrana Aviação Agrícola Ltd., the pilot's hiring company. However, at the time of the accident, the ownership transfer had not been formalized by the ANAC yet.

1.7 Meteorological information.

The weather conditions were favorable for the visual flight.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The occurrence took place outside the Aerodrome.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

There were no signs of horizontal displacement of the wreckage in the vegetation, as can be observed in figures 2, 3 and 4.

Figure 2 – View of the wreckage at the crash site, with indication of the most affected areas.

Figure 3 – Front view of the aircraft, with indication of the most severe damaged areas.

Figure 4 – Rear view of the aircraft, showing absence of signs of horizontal displacement of the wreckage on the ground.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Not investigated.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

The pilot worked for the company that bought the aircraft for two years and it was his first crop. According to information gathered from the company employees, he was motivated to perform application flights, as he had achieved his goal of being hired as an agricultural pilot.

Still according to these reports, the pilot was considered a very correct person, rigorous with the details of the operation and knew the routine of this type of service, since he had worked for a year as an agricultural technician for the same company. However, the agricultural technician who worked with the pilot reported his bolder behavior in flight throughout the season.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

Nil.

1.16 Tests and research.

The data collected during the investigation, such as the examination of the aircraft wreckage, its systems and components, control surfaces and flaps, did not identify evidence of defects or malfunctions.

The aircraft maintenance records indicated that planned inspections and reviews were performed and were updated.

The engine was collected, disassembled and tested on a bench, and no evidence of failure was found. The exams identified evidence that the engine was operating normally, with power development at the moment of collision with the ground.

Damage observed on the propeller blades were compatible with a power development condition at impact. This condition was evidenced by the twisting and the slight forward bending of one of the propeller blades, as can be seen in Figure 5.

Figure 5 - View of one of the propeller blades, indicating the twisting and folding of the end of the blade forward.

1.17 Organizational and management information.

On 24NOV2015, according to the purchase and sale receipt, registered in the PR-TAC Full Content Certificate, the aircraft had been sold to Serrana *Aviação Agrícola* Ltd., that was the pilot's employer and the plane's operator. However, at the date of the accident, the transfer of ownership had not yet been formalized by the ANAC. The formalization of this process only occurred on 30SEPT2016.

1.18 Operational information.

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

On the day of the occurrence, no abnormalities were observed in the flight preparation actions. Visual inspections, aircraft refueling, pesticide loading and other equipment checks were carried out in accordance with planned routines.

It was learned from the buying company that the pilot had been flying in that crop for five months, during which time he had flown about 150 hours. These flight hours were not recorded in the pilot's CIV.

According to the company, the work at that crop was already near the end.

The agricultural technician, responsible for managing that crop reported that, as the flights progressed, the pilot showed increasing boldness in making the "balloons" (reversal turns to start a new pass on the crop), shortening the turn radius and increasing the bank angle of the wings during the performance of these "balloons".

This fact made him worried, the reason why he had warned the pilot about the issue the week before the accident, exposing his concern and suggesting the pilot to pay attention to the risk involved.

Following the events, the agricultural technician would have seen the maneuver that culminated in the collision of the aircraft against the ground, reporting to other colleagues of the company about the occurrence, stating, according to his perception that the pilot had "stalled in the reversal turn".

1.19 Additional information.

Statistical data show that most agricultural aviation accidents occur near the end of the season.

In this case, specifically, the pilot was in this condition, that is, at the end of the season. As of the date of the event, he had already made several passes over the plantation and was preparing to end the working day and return to the farm.

It was found that it was the pilot himself who established and inserted in the aircraft GPS the application flight pattern, that is, the order (sequence) of the plantation strips that should be covered with the agricultural product.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a pesticide application flight.

The pilot had worked for the company for two years and this was his first crop, seeming to be motivated to make the flights, mainly because he had achieved his goal of being hired by an agricultural aviation company.

In that season, the pilot had been operating for five months, during which time he had flown about 150 hours. From this, it can be inferred that, at that moment, he was already comfortable to complete the journey uneventfully.

After the first months of work, the evidence indicated that the flights were normal. However, the agricultural technician responsible for the crop management reported that, in his opinion, as the flight progressed, the pilot showed increasing “boldness” in performing reversal turns, shortening the turn radius and increasing the bank angle during that.

This fact made him worried and, as a result, he talked to the pilot, warning him about the risks involved.

The aforementioned employee stated that he witnessed the maneuver that culminated in the crash of the aircraft against the ground, and reported the accident to his colleagues, reporting that the aircraft had “stalled during the reversal turn”.

These facts, by themselves, provide sufficient evidence that the profile of the flight that was being performed at that time could be deviating from the normal patterns of agricultural flights.

The investigation has shown that statistical data demonstrate that most agricultural aviation accidents occur near the end of the season. In this case, specifically, the pilot was in this condition. He had made several passes over the plantation and was preparing to end the working day and return to the farm.

The data collected indicated that it was the pilot himself who defined the flight pattern to be performed by entering the data in the aircraft GPS.

Thus, it is reasonable to state that certain patterns could favor shorter radius reversal turns, inducing the pilot to increase the bank angle and the load factor during the execution of the “balloons”.

In this sense, it can be ensured that the risk management of this operation could have been more effective if this attribution were the responsibility of the operating company, especially for pilots carrying out their first crop.

Based on the data collected and the analyzes performed, it is plausible to infer that the pilot failed to evaluate some aircraft performance parameters and was not effective in the actuation of the commands at the moment of the reversal turn.

This misapplication of commands led to the extrapolation of the flight envelope limits of the aircraft in relation to the turn radius and bank angle, supposedly causing a stall, initiating a condition of loss of control of the aircraft.

Then the aircraft would have descended with a left wing turn, culminating in a collision with the ground.

The pilot, in his colleagues' opinion, was very dedicated to work, studious and attentive to the details of the operation. However, he was inexperienced in the agricultural aviation and in the aircraft, and was only in his first crop. Therefore, by that time, he was just beginning to experience that kind of flight.

It is reasonable to suppose that as he was gaining self-confidence during the months of the operation, his perception of the risks inherent in the operating environment, especially in the reversal turns, decreased significantly, degrading their situational awareness and, consequently, his piloting judgment.

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, but had little experience in the aircraft and in the type of flight;

d) the aircraft had valid CA;

e) the aircraft was within the limits of weight and balance;

f) the airframe, engine and propeller logbooks records were updated;

g) the weather conditions were favorable for the visual flight;

h) the aircraft did not show any abnormality during the flight preparation actions;

i) the aircraft engine and its components have been examined on a bench, and no evidence of failure has been identified;

j) the engine analysis result has identified signs of normal operation with power development at the moment of impact;

k) the aircraft hit the ground at a location compatible with the area intended for the reversal turn to begin a new pass over the plantation;

l) the aircraft had substantial damage; and

m) the pilot suffered fatal injuries.

3.2 Contributing factors.

- **Control skills – a contributor.**

The circumstances under which this occurrence happened indicate that at a certain point in the execution of the low-altitude reversal turn, the pilot did not act effectively on the aircraft flight controls, thus allowing the limits of its flight envelope to be extrapolated, in relation to the load factor and speed, resulting in the loss of lift during the turn and collision with the ground.

- **Attitude – undetermined.**

The pilot's increasing bold posture during the season may reflect an overestimation of his own ability to control the operation, leading him to adopt parameters outside the flight limits, which put him into an irreversible condition.

- **Piloting judgment – undetermined.**

Sufficient evidence was found to infer that the pilot did not adequately assess certain safety parameters related to the aircraft flight envelope, progressively exceeding the load factor and speed limits in the execution of reversal curves, favoring the occurrence of loss of lift during one of those maneuvers.

- **Perception – undetermined.**

It is possible that, due to the pilot's level of confidence in his operational capacity, situational awareness has been lowered, so that the imminent risk of running a low-altitude reversal curve has not been considered.

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

The pilot's little experience in the aircraft, in the type of flight and in the presented operating circumstances, may have contributed to the inadequate perception and evaluation of the flight circumstances and parameters, leading to a deficient application of the commands.

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-086/CENIPA/2016 - 01 **Issued on 10/29/2020**

Disseminate the lessons learned in this investigation to alert agricultural aviation pilots and operators about the importance of supervising the activities undertaken and the use of voluntary hazard reporting tools, so that the responsible managers administer the risks.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On October 29th, 2020.