COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 079/CENIPA/2017

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PT-WPD**
MODEL:	**PA-34-220T**
DATE:	**28MAY2017**

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 28MAY2017 accident with the PA-34-220T aircraft, registration PT-WPD. The accident was classified as “[UNK] Unknown”.

During the displacement, the aircraft collided against two trees in a pasture area.

The aircraft was destroyed.

The pilot and the passenger died at the site of the accident.

An Accredited Representative of the National Transportation Safety Board (NTSB) – USA, (State where the aircraft and the engine were designed) was designated for participation in the investigation.

CONTENTS

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
CTR	Control Zone
IAM	Annual Maintenance Inspection
IFRA	Instrument Flight Rating - Airplane
MLTE	Airplane Multi Engine Land Rating
NTSB	National Transportation Safety Board (USA)
PCM	Commercial Pilot License – Airplane
PPR	Private Pilot License – Airplane
SBAU	ICAO Locator Designator – Araçatuba Aerodrome - SP
SNUD	ICAO Locator Designator – Arruda Ramos Farm Aerodrome, Porto Esperidião - MT
SWKC	ICAO Locator Designator – Cáceres Aerodrome - MT
SIPAER	Aeronautical Accident Investigation and Prevention System
SN	Serial Number
UTC	Universal Time Coordinated

1. FACTUAL INFORMATION.

Aircraft	**Model:** PA-34-220T **Registration:** PT-WPD **Manufacturer:** Piper Aircraft	**Operator:** Private
Occurrence	**Date/time:** 28MAY2017 - 1540 UTC **Location:** Seriema Farm **Lat.** 18°22'24"S **Long.** 054°53'17"W **Municipality – State:** Coxim – MS	**Type(s):** [UNK] Unknown **Subtype(s):** NIL

1.1 History of the flight.

The aircraft took off from the Arruda Ramos Farm Aerodrome (SNUD), located in the municipality of Porto Esperidião - MT, to the Araçatuba Aerodrome (SBAU) - SP, at about 1300 (UTC), in order to transport personnel, with a pilot and one passenger on board.

With about 2 hours and 40 minutes of flight, the aircraft collided with two trees in a pasture area in the municipality of Coxim - MS. There was fire after the impact.

The aircraft was destroyed.

The pilot and passenger suffered fatal injuries.

1.2 Injuries to persons.

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

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.

Hours Flown	Pilot
Total	600:00
Total in the last 30 days	10:40
Total in the last 24 hours	00:00
In this type of aircraft	139:00
In this type in the last 30 days	10:40
In this type in the last 24 hours	00:00

N.B.: The data related to the flown hours were obtained through the Pilot's Flight Logbook and recent flight records found in the pilot's clipboard at the crash site.

1.5.2 Personnel training.

The pilot took the PPR course, in 2009.

1.5.3 Category of licenses and validity of certificates.

The pilot had the PCM License and had valid MLTE and IFRA Ratings.

1.5.4 Qualification and flight experience.

The pilot was qualified and had experience in that kind of flight.

1.5.5 Validity of medical certificate.

The pilot had valid CMA.

1.6 Aircraft information.

The aircraft, serial number 3449015, was manufactured by Piper Aircraft, in 1997, and was registered in the TPP category.

The aircraft had valid Certificate of Airworthiness (CA). It was not possible to verify if the airframe, engines and propellers logbook records were updated, because they were consumed by fire.

By analyzing the last maintenance record obtained from the shop, it was possible to determine that the aircraft had 3.068 hours and 42 total minutes of flight during the inspection. It is estimated that it would have 3.087 hours and 30 minutes of flight on the date of the accident.

The last inspection of the aircraft, the "IAM/100 hours" type, was performed on 30MAR2017 by the *Marília de Aviação* shop, in Marília - SP, having flown 18 hours and 50 minutes after the review.

1.7 Meteorological information.

The accident site had no meteorological information service, only information on the route.

According to the nearest meteorological information services, meteorological radars and observer reports, the visibility was over 10km. There was moderate cloudiness, and it was not possible to accurately state the base of the layer (Figure 1).

Figure 1 - Weather conditions on the day of the accident.

There was no evidence that the weather contributed to the accident.

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.

It was observed that, initially, the aircraft collided against the stem of a tree, approximately 1m high (Figures 2 and 3). The first point of impact on the aircraft was on the wing and right engine, with their separation from the rest of the aircraft and the presence of fire on the impact, evidenced by the burning of the tree parts and portions of the right wing.

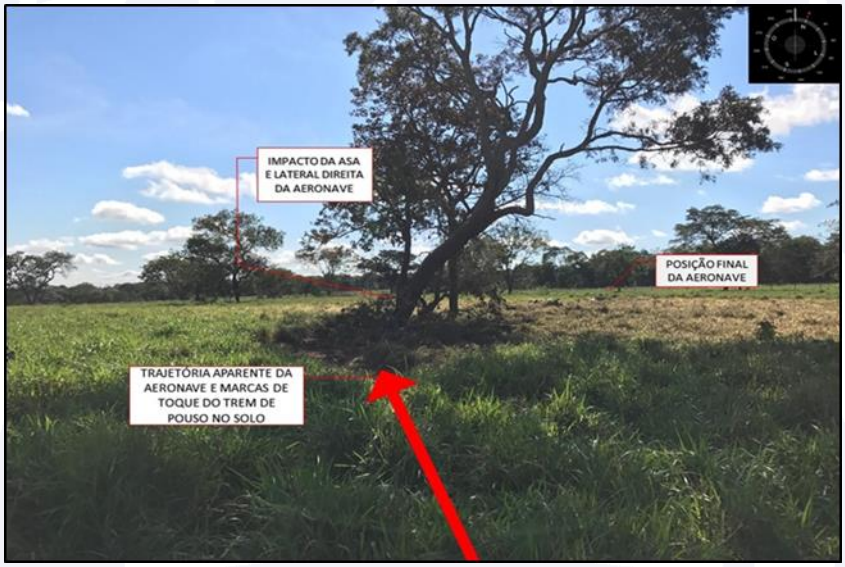

Figure 2 - Aircraft trajectory and impact.

Figure 3 - First impact point.

The right engine was found 15m ahead of the first impact point. The right wing was found about 10m ahead, slightly to the right, near the tail of the aircraft.

After the first impact and consequent right turn, the aircraft collided with another tree about 5m ahead, where there was the separation of the outer section of the left wing. There was also evidence of fire on the impact.

The fuselage, tail cone, engine (separated from the mounting but connected to the aircraft by cables) and the inner section of the left wing, followed by approximately 30m where they stopped, upside down (Figure 4).

Figure 4 - Final position of the aircraft.

The fire consumed the cabin and caused fatal injuries to its occupants. The tail cone and the inner section of the left wing were not damaged by fire.

The three landing gears were found broken and separated from the aircraft. The fractures found in the landing gear and flaps indicated that the aircraft was configured for landing.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Not investigated.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

According to the information obtained, the pilot was considered a helpful and well-connected person, being very loved by the people of his conviviality.

His first job contract as a pilot was to fly with a farmer, but he resigned because he did not feel safe with his employer. In 2013, he started flying as a freelancer, having flown in the mining for three months.

In January 2014, he started flying to the owner of the crashed aircraft, not only to transport him, but also to perform charter flights.

According to reports from people close to the pilot, he demonstrated knowledge of the aircraft and safety in the operation. He worried about the maintenance, being responsible to accompany it. It was he who took, accompanied, and received the plane after maintenance. He even carried out, by the employer's request, a local flight to check the conditions of the aircraft.

According to the information collected, from 2015 onwards, the owner started questioning the pilot's decisions about the flight according to the weather, asking him to call the destination farms, in order to confirm the weather conditions.

According to family reports, on the eve of flights, the employer used to overwhelm the pilot with messages questioning about meteorology, sent in the evening and early in the morning. Despite this, he was struggling to maintain his performance on the flight.

However, there were also reports that the pilot had difficulties in being assertive and not giving in to the pressures, which made him professionally uncomfortable.

1.14 Fire.

Most of the aircraft's structure and cabin were consumed by fire. There was therefore no possibility to analyse the flight instruments.

All records of aircraft hours posted in the logbooks were destroyed by fire at the time of the occurrence. Among the wreckage were found notes of the pilot, from where were collected information of hours flown after the inspection of the aircraft.

1.15 Survival aspects.

Nil.

1.16 Tests and research.

It was observed that the Continental engine TSIO-360-RB1B, Serial Number (SN) 1001404, which equipped the aircraft, presented severe damages, due to the collision against the ground.

In the ignition system, the spark plugs showed evidence of normal mixing operation. The magnetos, when submitted to functional test of spark, showed to be operational.

With respect to the fuel supply system, it was observed that the injector nozzles were unobstructed, with the exception of nozzle #4, which was contaminated. This contaminant was loose inside the nozzle, an indication that it may have entered during the process of disassembling the engine.

The engine servo injector was subjected to functional bench test, being verified that it operated with a too rich mixture. Thus, considering the values obtained, the fuel flow in the bench had to be reduced in half, in the mixing lever, to reach the predicted values. This fact indicated that the engine had possibly irregular functioning at the moment of the occurrence.

The presence of black soot inside the cylinders was indicative of this type of operation. On the right engine, this finding could be considered more precise, because it was out of the fire line that happened to the fall of the aircraft.

As for the propeller of this engine, it was observed that only one of the blades had considerable backward deflection and localized damage to its leading edge. These observations pointed to the lack of power of this engine.

Analysis was performed on the oil removed from the right engine filter. It was not possible to determine if there was a lubrication failure that could have contributed to its malfunction.

As for the left engine Continental TSIO-360-RB1B, SN 1001235, which equipped the aircraft, it was observed that it presented severe damages, due to the fire action after the accident.

In the ignition system, the spark plugs presented evidence of operation with normal mixing considering the state of the porcelain of the central electrode. However, the

presence of black soot deposited on the spark plugs was observed. The magnetos, due to the damages suffered, were not analyzed in the workbench.

Regarding the lubrication system, components such as primary and main oil filters were not found for analysis, due to engine damage. The oil sump, due to the action of the fire and the impact, was broken and with signs of melting.

The cylinders and pistons were inspected and found to be operational. Bronzines presented normal operation.

The servo-injector of this engine was not bench tested, due to the damages suffered in the impact and fire action. Therefore, its control parameters could not be verified. If it were regulated in a similar way to the right engine servo-injector, this would in part justify the presence of black soot that was observed in the combustion chambers of that engine.

On the left engine, it was not possible to determine if the black soot originated from the operation with rich mixture or if it was due to the fire that happened after the aircraft's fall. The smoke may have penetrated the combustion chambers through the intake and exhaust valves of the engine.

With respect to the propeller and its governor, the same characteristics of the right engine were found.

1.17 Organizational and management information.

Nil.

1.18 Operational information.

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

There was no registered flight plan. Annotations found on the pilot's clipboard account for flights previously made and a scheduled flight to 28MAY2017, departing from SNUD to Cáceres - MS (SWKC).

However, after interviews, there were indications that the route actually executed was from SNUD, to SBAU, with intermediate landing for supply in Coxim - MS (SSCI).

The aircraft was found at the Seriema Farm, located in the municipality of Coxim - MS, in a location compatible with the route to Araçatuba - SP (SBAU), where it was based.

1.19 Additional information.

Item 7.7 ENGINE CONTROLS, from Section 7 of the flight manual, recommended that all power train operations should be performed smoothly, without sudden or rapid movements, to avoid loss or damage to the engines, to allow sufficient time for turbo-compressor to stabilize.

7.7 ENGINE CONTROLS

Engine controls consist of a throttle, a propeller control and a mixture control lever for each engine. These controls are located on the control quadrant on the lower center of the instrnment panel where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

The throttle levers are used to adjust the manifold pressure. Some aircraft incorporate gear up warning horn micro-switches which are activated by either or both throttles contacting the switches during the lower portion of throttle lever travel (approximately 14 in. Hg. MAP and below). If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a safety feature to warn the pilot of an inadvertent gear up landing.

All throttle operations should be made with a smooth, not too rapid movement to prevent unnecessary engine wear or damage to the engines, and to allow time for the turbocharger speed to stabilize.

The propeller control levers are used to adjust the propeller speed from high RPM (low pitch) to feather (high pitch).

The mixture control levers are used to adjust the air to fuel ratio. An engine is shut down by the placing of the mixture control lever in the full lean (idle cut-off) position.

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7-6 REVISED: FEBRUARY 5, 2003

Figure 5 - Recommendations of item 7.7 of the flight manual.

In item 7.15 FUEL SYSTEM of Section 7, p. 7-21, there were guidelines for the operation of fuel management controls. This section describes the location of the power control levers for each engine and the ON (open), OFF (closed) and X FEED (cross feed) positions of the tank selector valve.

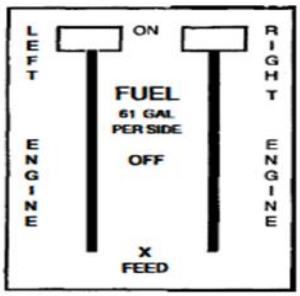
7.15 FUEL SYSTEM (Cont)

FUEL CONTROLS

Fuel management controls are located on the console between the front seats. There is a control lever for each of the engines, and each is placarded ON - OFF - X FEED. During normal operation, the levers are in the ON position, and each engine draws fuel from the tanks on the same side as the engine. The two fuel systems are interconnected by crossfeed lines. When the X FEED position is selected, the engine will draw fuel from the tanks on the opposite side in order to extend range and keep fuel weight balanced during single-engine operation. During the crossfeed operation, a crossfeed annunciator will illuminate to inform the pilot that crossfeed is selected. The OFF position shuts off the fuel flow to that engine.

NOTE

When one engine is inoperative and the fuel selector for the operating engine is on X FEED, the selector for the inoperative engine must be in the OFF position. Do not operate with both selectors on X FEED. Do not take off with a selector on X FEED.



FUEL CONTROLS
Figure 7-15

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7-21

Figure 6 - Description of fuel management controls.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a personal transport flight.

It was observed, in bench tests, that the right engine servo-injector was with fuel flow out of the manufacturer's limits. He had an over-rich mixing operation. This was evidenced by the presence of black soot inside the cylinders. This fact implied a probable irregular operation of the engine, if the lever was in the maximum flow position.

This condition could be related to an inadequate servo- injector setting. However, due to lack of subsidies (maintenance records destroyed by fire), it was not possible to verify if the quality of maintenance work influenced the above-mentioned condition.

Section 7.7 ENGINE CONTROLS, of Section 7 of the flight manual, recommended that all power train operations should be performed smoothly, without sudden or rapid movements to avoid loss or damage to the engines, to allow sufficient time for turbocharger to stabilize.

In item 7.15 FUEL SYSTEM of Section 7, p. 7-21, there were guidelines for the operation of fuel management controls. This section describes the location of the power control levers for each engine and the ON (open), OFF (closed) and X FEED (cross feed) positions of the selector valve.

In normal or open position, both levers should be in the ON position, indicating that each engine would receive fuel from the tank of the respective wing. He further described that the engine feed systems were interconnected by a cross feeder (X FEED).

When the X FEED position was selected, the engine would receive fuel from the tank on the opposite side, in order to increase the range and maintain the weight of the fuel balanced, especially during single-engine operation.

During the cross-feed operation, a crossfeed alert would light up on the panel to inform the pilot that cross-flow would be selected. The OFF position would shut off the fuel flow to that engine.

In order to the right, bench-tested engine to operate normally, there was a need to decrease the stroke of the fuel lever. There is, therefore, the possibility that the pilot could have actuated on one or both of the power or fuel levers to correct the fault.

If this correction occurred abruptly, there is the possibility of significant loss of power or, even, the cutting of the engines.

As much of the aircraft's structure was consumed by fire, it was not possible to determine the position of the power, propeller and fuel levers, preventing a precise response to the questioning.

Regarding the left engine, in all the items that could be analyzed, it was verified its operability. As for the presence of black soot, its origin could not be determined by the fact that the engine was exposed to the action of the fire.

Both engines showed evidence that they did not develop power at the moment of the collision against the ground. It should also be considered that the pilot may have cut off the engines at the imminence of the emergency landing.

On the other hand, if the pilot operated the right engine with the fuel lever in the all-rich condition, it could have been a malfunctioning, due to the excess of fuel. This may have induced the pilot to misinterpret the fault.

This fact would indicate, therefore, that there might have been faults in the understanding of the abnormal condition presented by the aircraft engine, leading the pilot to take an inappropriate action for the circumstance itself.

Thus, there was possibly an attempted emergency landing, due to the probable failure of the right engine.

3. CONCLUSIONS.

3.1 Facts.

a) the pilot had valid Aeronautical Medical Certificate (CMA);

b) the pilot had valid MLTE and IFRA Ratings;

c) the pilot was qualified and had experience in that kind of flight;

d) the aircraft had valid Airworthiness Certificate (CA);

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

f) it was not possible to verify whether airframe, engines and propellers logbooks were updated;

g) there were no indications that the weather conditions contributed to the accident;

h) it was found, in bench tests, that the right engine servo injector was operating with rich mixture;

i) the left engine had severe damages, due to the fire action after the accident;

j) the aircraft was configured for landing, due to the fractures presented in the landing gear and flaps;

k) the aircraft crashed into two trees;

l) after the collision there was fire;

m) the aircraft was destroyed; and

n) the pilot and the passenger suffered fatal injuries.

3.2 Contributing factors.

- **Control skills – undetermined.**

There is a possibility that the pilot has operated on one or both of the power or fuel levers to correct the right engine failure. If this happened abruptly and / or inadvertently, it could cause the power reduction or even the engine cut off.

- **Piloting judgment – undetermined.**

There may have been an inadequate evaluation by the pilot of certain parameters related to the operation of the aircraft in relation to the rich mixture of the right engine.

- **Aircraft maintenance – undetermined.**

It was observed, in bench tests, that the right engine servo-injector had a fuel flow out of the limits prescribed by the manufacturer, showing too rich fuel operation. This was evidenced by the presence of black soot inside the cylinders. This would imply a probable malfunction of the engine, if the lever was in the maximum flow position.

Thus, it is possible that an inadequate servo-injector setting was related to this condition. However, considering that maintenance records were destroyed by fire, it was not possible to verify if the quality of the maintenance work influenced in the above-mentioned condition.

- **Decision-making process – undetermined.**

The condition observed on the right servo-injector would imply an irregular operation of the engine. In this way, it is possible that there has been difficulty in understanding the

failure that the aircraft presented, which may have impaired the pilot's ability to perceive, analyze and choose among the alternatives available to manage the adverse situation experienced.

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-079/CENIPA/2017 - 01 **Issued on 04/08/2019**

Disseminate the lessons learned in the present Investigation, in order to alert the Brazilian civil aviation pilots and operators to the importance of correct management of emergencies, especially regarding the assertive identification of failures and compliance with the recommendations presented in the aircraft flight manuals.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On April 08th, 2019.