COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-116/CENIPA/2021

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-PRB**
MODEL:	**T188C**
DATE:	**24OUT2021**

NOTICE

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

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

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

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

This Final Report has been made available to the ANAC and the DECEA so that the technical-scientific analyses of this investigation can be used as a source of data and information, aiming at identifying hazards and assessing risks, as set forth in the Brazilian Program for Civil Aviation Operational Safety (PSO-BR).

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

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

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

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

SYNOPSIS

This is the Final Report of the 24 October 2021 accident with the T188C aircraft, registration marks PR-PRB. The occurrence was typified as “[FUEL] Fuel related.”

As the aircraft joined the traffic circuit for landing on runway 20 of SD9A (Caputi Aerodrome, Vilhena, State of Rondônia), the engine failed. The pilot made an emergency landing in a forested area, approximately 230 m short of the runway. There was no fire.

During the initial investigation, one found that the fuel distribution valve and the fuel tanks were empty.

The aircraft sustained substantial damage.

The pilot suffered no injuries.

For being the USA the State of design/manufacture of the aircraft, an Accredited Representative of the NTSB (National Transportation Safety Board) was appointed for participation in the investigation of the occurrence.

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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* – no clouds below 5000 ft or below the minimum height of the highest sector (whichever the higher), and horizontal visibility more than 10 km; no CBs nor significant Weather for Aviation.
CENIPA	Brazil's *Aeronautical Accidents Investigation and Prevention Center*
CMA	Aeronautical Medical Certificate
CVA	Airworthiness Verification Certificate
IAM	Annual Maintenance Inspection
METAR	Routine Meteorological Aerodrome Report
MGSO	SMM (Safety Management Manual)
MNTE	Single-Engine Land Airplane Class Rating
PAGA	Agricultural Pilot Rating (Airplane)
PCM	Commercial Pilot License (Airplane)
PIC	Pilot in Command
PN	Part Number
PPR	Private Pilot License (Airplane)
PTO	Operational Training Program
RBAC	Brazilian Civil Aviation Regulation
SD9A	ICAO location designator - *Caputi* Aerodrome, *Vilhena*, State of *Rondônia*
SDTW	ICAO location designator – Aerodrome of *Fazenda Miragem*, *Sapezal*, State of *Mato Grosso*.
SERIPA VI	6th Regional Service for the Investigation and Prevention of Aeronautical Accidents
SAE-AG	Private Specialized Air Service Registration Category (Aeroagricultural)
SN	Serial Number
UTC	Universal Time Coordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

1. FACTUAL INFORMATION.

Aircraft	**Model:** T188C **Registration:** PR-PRB **Manufacturer:** Cessna Aircraft.	**Operator:** *Master Aviação Agrícola Ltda*.
Occurrence	**Date/time**: 24OUT2021 – 18:40 (UTC) **Location:** *Caputi* Aerodrome(SD9A) **Lat.** 12º42'50"S **Long.** 060º12'10"W **Municipality – State:** *Vilhena – Rondônia*.	**Type(s):** [FUEL] Fuel related

1.1. History of the flight.

At about 17:30 UTC, the aircraft took off from SDTW (Aerodrome of *Fazenda Miragem*, municipality of *Sapezal*, State of *Mato Grosso*), bound for SD9A (*Caputi* Aerodrome, *Vilhena*, State of *Rondônia*) on a ferry flight with 01 POB (pilot).

When the aircraft joined the traffic circuit for landing on runway 20 of SD9A, its engine failed. An emergency landing was made in an area of forest approximately 230 meters short of the runway. There was no fire.

Figure 1 - Final position of the aircraft after the forced landing.

The aircraft sustained substantial damage. The pilot suffered no injuries.

1.2. Injuries to persons.

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

1.3. Damage to the aircraft.

The aircraft sustained substantial damage to the fuselage, landing gear, wings, flaps and right-hand aileron.

1.4. Other damage.

NIL.

1.5. Personnel information.

1.5.1. Crew's flight experience.

	PIC
Total	744:00
Total in the last 30 days	07:00
Total in the last 24 hours	06:30
In this type of aircraft	150:00
In this type in the last 30 days	07:00
In this type in the last 24 hours	06:30

N.B.: PIC's flight time data obtained through information provided by the very pilot.

1.5.2. Personnel training.

The PIC did his PPR course (Private Pilot – Airplane) in 2013, at the *Aeroclube de Ponta Grossa*, State of *Paraná*.

1.5.3. Category of licenses and validity of certificates.

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

1.5.4. Qualification and flight experience.

The PIC 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 T18803484T aircraft, was a product manufactured by Cessna Aircraft in 1979, and registered in the Private Registration Category of Specialized Public Air Service - Aeroagricultural (SAE-AG).

The CVA (Airworthiness Verification Certificate) of the aircraft was valid.

The records of the airframe, engine, and propeller logbooks were up to date.

The last inspection of the aircraft (type "500 hours") was carried out on 27 April 2021 by *Globo Master de Manutenção de Aeronaves Ltda*., an aircraft maintenance organization located in *Goiânia*, State of Goiás. The aircraft flew 23 hours and 5 minutes after the referred inspection.

The last more comprehensive inspection of the aircraft (type "CVA"), was performed on 27 April 2021 at the premises of the maintenance organization mentioned above, in Goiânia. The aircraft flew 23 hours and 5 minutes flown after the said inspection.

The aircraft had a Special Flight-Authorization (AEV) issued by ANAC (Brazil's *National Civil Aviation Agency*) on 14 September 2021 for the use of ethanol.

1.7. Meteorological information.

The METAR (Meteorological Aerodrome Report) of SBVH (*Vilhena* Aerodrome, located 6 NM away from SD9A, had the following information:

METAR SBVH 241800Z 33007KT 9999 VCSH BKN035 FEW040TCU 31/21 Q1011

METAR SBCG 241900Z 19022KT 4000 -TSRA SCT015 BKN030 FEW035CB 24/20 Q1013

The conditions recorded at 18:00 (UTC) indicated visibility of more than 10 km.

At 19:00 UTC, visibility decreased to 4,000 m. The wind increased from 7 kt to 22 kt, and there was variation in the direction of the wind. Furthermore, the altitude of the ceiling formed by the clouds decreased from 3,500 ft to 3,000 ft.

1.8. Aids to navigation.

NIL.

1.9. Communications.

NIL.

1.10. Aerodrome information.

The aerodrome was private, and operated under Visual Flight Rules during day-time.

The runway surface was made of gravel, with thresholds 02 and 20, measuring 800 m x 18 m, at an elevation of 1,821 ft.

1.11. Flight recorders.

Neither required nor installed.

1.12. Wreckage and impact information.

The impact occurred at a distance of approximately 200 meters short of the threshold 20 of SD9A (*Caputi* Aerodrome) with signs of previous impact on bushes located 20 meters short of the spot where the aircraft stopped.

The distribution of the debris was concentrated. From the position of the aircraft, it was possible to observe that the direction of travel corresponded to the direction of the landing strip.

1.13. Medical and pathological information.

1.13.1. Medical aspects.

NIL.

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.

There was no fire.

1.15. Survival aspects.

NIL.

1.16. Tests and research.

The fuel distribution valve was opened at the time of the initial action of investigation, and one verified that there was no fuel inside (Figure 2).

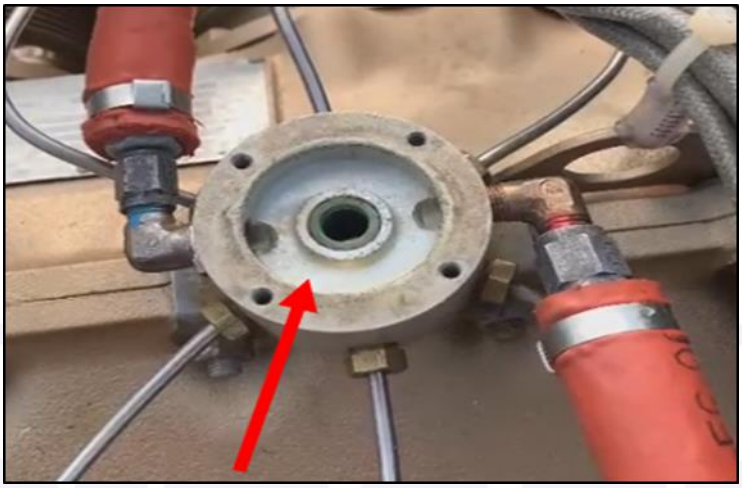

Figure 2 - Close-up photo of the fuel distribution valve. It is possible to verify the absence of fuel inside, as indicated by the red arrow.

The fuel tanks were also found empty.

1.17. Organizational and management information.

The company had a Safety Management Manual approved by its senior management.

The Operational Training Program (PTO) approved by the Accountable Manager provided only theoretical training. No records were presented with data related to the crewmember's performance.

The information gathered during the investigation indicated that the PIC complied with the prescribed rest period. Moreover, he was advised by the company that, if necessary, he could purchase more fuel in the locations of the intermediate landings. However, such procedure was not listed in the manuals of the company.

1.18. Operational information.

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

At the time of the occurrence, the aircraft was flying en route, returning to operation after the execution of maintenance services, and was operating in accordance with the requirements established in the RBAC-91.

According to the aircraft logbook, four intermediate landings were made for refueling, with the fuel being transported in the aircraft's hopper. There were 12 containers with 20 liters of ethanol in each. The fuel consumed in the flight segments was approximately 150 liters, according to the “COMB. TOTAL” in Figure 3.

DE	PARA	PARTIDA	CORTE	HS VOO TOTAL	POUSOS TOTAL	COMB. TOTAL
ZZZZ	SWEC	06:00	07:32	01:32	1	145
SWEC	SWPY	08:10	09:40	01:30	1	143
SWPY	SWDM	10:20	11:53	01:33	1	153
SWDM	SDTW	12:45	14:16	01:31	1	144
SDTW	SDSA	14:55				

Figure 3 - Clipping from the logbook nº 03/PR-PRB/18, Part I, page 0004.

At each landing, the amount of ethanol necessary to fly the next segment was supplied, that is, a quantity of approximately 160 liters. For the final segment, in addition to the estimated 80 liters of ethanol remaining in the aircraft's fuel tank, there were two fuel containers for the refueling, which totaled 40 liters. Therefore, one inferred that the last segment was flown with a total of 120 liters of ethanol.

For planning purposes, fuel consumption corresponded to 110 liters of ethanol per each hour of flight. Therefore, with approximately 120 liters being supplied after the last landing, the aircraft would have a flying time close to one hour and five minutes.

The aircraft flew the first two segments at FL085. After the last landing for refueling, the PIC informed that it was necessary to fly the last segment at FL045 due to the degradation of the meteorological conditions.

The distance to be flown was 107 NM. The wind intensity in the region, according to the METAR, was increasing in a direction that was opposite the direction of the flight. There was also nebulosity and, according to the SBVH METAR, it varied from broken clouds at 3,500 ft (18:00 UTC) to broken clouds at 3,000 ft (19:00 UTC).

In order to fly in Visual Meteorological Conditions, it would be necessary to fly below the cloud layer, a circumstance that would increase fuel consumption.

At the interviews, the PIC reported having chosen the runway 20 of SD9A for landing, on account of the intensity of the wind. When the aircraft passed over the vertical of the runway to join the downwind leg, the engine began to fail. The procedure to turn on the electric fuel pump was performed, but the engine shut down subsequently.

As mentioned before, the aircraft was at a height of approximately 300 feet. The PIC joined the base leg, but was unable to reach the runway. Thus, he made a forced landing in an area of forest.

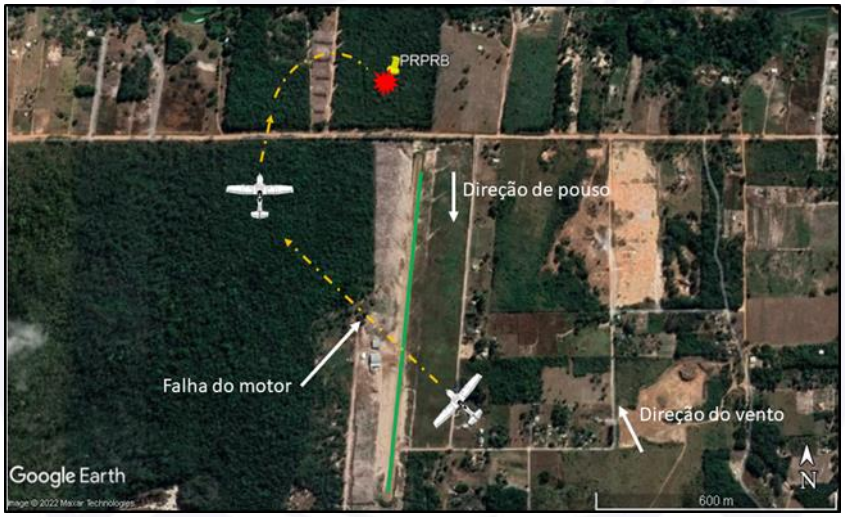

Figure 4 - Enlarged view of the croquis of the occurrence. The green color symbolizes the landing strip. In yellow, the aircraft trajectory. In red, the crash site.

The Command of Aeronautics' Instruction (ICA) 100-37/2020, issued by the Airspace Control Department (DECEA), specified the standard traffic circuit to be flown by landing traffic:

> 6.24.3 The standard traffic circuit will be flown at a height of 1,000 ft for propeller aircraft, and at a height of 1,500 feet for all jet and turboprop aircraft with a MEDIUM or HEAVY wake turbulence category, above the elevation of the aerodrome, with all turns being made on the left.

No aircraft failure or problems prior to engine shutdown were reported by the PIC. However, he did not demonstrate full knowledge of emergency procedures.

The RBAC-91 (regulation in force at the time of the accident) defined the following requisite:

> 91.151 Fuel and oil requirements for VFR flights

(a) an airplane will only be permitted to start a VFR flight if, after consideration of the known conditions of wind and weather, there is enough fuel and oil to fly to the first planned landing location and, at a normal cruising speed;

(1) during day-time, to fly for at least 30 minutes further, except for aerobatic flights at a maximum distance of 50 km (27 NM) from an aerodrome; or

(2) During night-time, to fly for at least 45 minutes further.

In the item 3.8.1, letter “a”, of the SMS, the company described the importance of conducting operations in compliance with all the safety requirements. The manual described the correct fuel planning required for the conduction of a cruise or ferry flight.

1.19. Additional information.

NIL.

1.20. Useful or effective investigation techniques.

NIL.

2. ANALYSIS.

It was a ferry flight between SDTW (*Sapezal*, State of *Mato Grosso*) and SD9A, (*Vilhena*, State of *Rondônia*), with four intermediate landings along the route for refueling.

The aircraft had a Special Flight-Authorization issued by ANAC (Brazil’s *National Civil Aviation Agency*) for the use of ethanol.

The crewmember had qualification and experience for the type of flight. He also held a valid CMA.

According to reports (confirmed through the SBVH METAR), there were strong winds in a direction opposite to the aircraft's route and, on account of clouds, it was necessary to fly the last segment of the route at a lower flight level so that it was possible to maintain the flight in VMC. Under such circumstances, the fuel consumption increased, that is, a greater amount of fuel was needed to fly the same segment. Therefore, one inferred that the aircraft was not supplied with the minimum amount of fuel prescribed.

Based on the information gathered, there was no adequate planning for the conduction of the flight, in discordance with the provisions of the RBAC-91, section 91.151, which determined fuel endurance for an extra 30 minutes, in addition to the amount of fuel necessary for the segment when flying under VFR.

Moreover, such an inadequate planning contributed to increased risk for the flight, in disagreement with the item 3.8.1, letter “a” of the SMS, which had provisions for the conduct of safe operations.

In relation to the landing traffic, the height of 300 ft. at which the aircraft was at the time of the engine failure, was too low for attempting an airstart or an emergency procedure other than the forced landing.

It should be noted that the traffic being flown by the PIC was in disagreement with the provisions of the ICA 100-37/2020. The height being used was lower, and the turn was made to the opposite side.

The company sought to carry out its operations in accordance with regulations. However, the records of theoretical training from the PIC Operational Training Program were not presented to the investigation commission.

Thus, the lack of an adequate planning in relation to the refueling of the aircraft and the meteorological information utilized, besides the informalities observed and the use of procedures in discompliance with the established standards, amplified the risks of the operation.

3. CONCLUSIONS.

3.1. Findings.

a) the PIC held a valid CMA (Aeronautical Medical Certificate);

b) the PIC held valid MNTE and PAGA ratings;

c) the PIC had qualification and experience for the type of flight;

d) the aircraft had a valid CVA (Airworthiness Verification Certificate);

e) the aircraft had a Special Flight-Authorization issued by the ANAC (Brazil's *National Civil Aviation Agency*) for the use of ethanol;

f) the aircraft was within the specified weight and balance limits;

g) the airframe, engine, and propeller logbooks were up to date;

h) the company had an SMS and a PTO approved by its senior management;

i) there was strong upwind along the route flown by the aircraft in the last segment of the flight;

j) the fuel to be used throughout the route was transported in the aircraft's hopper;

k) the last segment of the flight was flown at FL045;

l) there was no control over the procedure for refueling the aircraft;

m) the fuel tanks were empty, and there was no residual fuel in the fuel distribution valve of the engine;

n) while flying the traffic pattern for landing at the destination, the aircraft sustained engine failure;

o) an emergency landing was made in an area of forest;

p) the aircraft sustained substantial damage; and

q) the PIC suffered no injuries.

3.2. Contributing factors.

- **Adverse meteorological conditions – a contributor.**

Degrading weather conditions forced the PIC to lower the flight level in order to maintain VMC, resulting in greater fuel consumption.

- **Organizational culture – a contributor.**

Informal practices were evidenced in the company. The informality of the procedures contributed to the lack of perception of latent failures, and increased the demands on the PIC. Therefore, the lack of adequate planning and the resulting risks could have been minimized by formal application of procedures and control.

- **Flight planning – a contributor.**

The flight planning procedures were inappropriate, as they allowed the aircraft to be supplied with less fuel than the prescribed amount, that is, without fuel to fly for another 30 minutes beyond the planned flight segment.

4. SAFETY RECOMMENDATIONS

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

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

[None.**]**

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On December 29th, 2023.