COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-122/CENIPA/2022

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PT-DAB**
MODEL:	**182K**
DATE:	**29OUT2022**

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 29th October 2022 accident involving the 182K Cessna aircraft of registration marks PT-DAB. The accident received the typification of "[Fuel] fuel related."

After launching skydivers, the aircraft showed variation of the engine operating parameters.

The Pilot in Command (PIC) performed an emergency landing, and the aircraft overturned, coming to rest on an upside down attitude.

The aircraft sustained substantial damage.

The pilot suffered no injuries.

The United States of America, State of manufacture of the aircraft, by means of the USA's 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

AGL	Above Ground Level
ANAC	Brazil's National Civil Aviation Agency
AvGas	Aviation Gasoline
CENIPA	Brazil's Aeronautical Accidents Investigation and Prevention Center
CMA	Aeronautical Medical Certificate
COA	Air-Operator Certificate
CVA	Airworthiness-Verification Certificate
DECEA	Department of Airspace Control
EO	Operating Specification
FAA	USA's Federal Aviation Administration
IFRA	IFR Flight Rating (Airplane)
INVA	Flight Instructor Rating (Airplane)
MCA	Command of Aeronautics' Manual
METAR	Routine Meteorological Aerodrome Report
MGSO	Safety Management Manual
MLTE	Multi-Engine Land Airplane Class Rating
MNTE	Single-Engine Land Airplane Class Rating
NSCA	Command of Aeronautics' System Norm
NTSB	USA's National Transportation Safety Board
OM	Maintenance Organization
PCM	Commercial Pilot License (Airplane)
PIC	Pilot in Command
PN	Part Number
PPR	Private Pilot License (Airplane)
RBAC	Brazilian Civil Aviation Regulation
RPM	Revolutions per minute
SAE-PQD	Specialized Public Air Services Registration Category (Parachuting)
SBRF	ICAO location designator - *Guararapes* (*Gilberto Freyre*) Airport, *Recife*, State of *Pernambuco*
SGSO	Safety Management System
SIC	Second in Command
SIFC	ICAO location designator - *Coroa do Avião* Aerodrome, *Igarassu*, State of *Pernambuco*
SN	Serial Number
UTC	Coordinated Universal Time
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	**Model:** 182K **Registration:** PT-DAB **Manufacturer:** Cessna Aircraft.	**Operator:** Jump Master *Ltda*.
Occurrence	**Date/time**: 29OUT2022 - 16:00 (UTC) **Location:** SIFC (*Coroa do Avião* Aerodrome) **Lat.** 07°50’40”S **Long.** 034°53’29”W **Municipality – State:** *Igarassu – Pernambuco*.	**Type(s):** [FUEL] Fuel related

1.1. History of the flight.

At around 15:30 UTC, the aircraft took off from SIFC (*Coroa do Avião* Aerodrome, *Igarassu*, State of *Pernambuco*), with 04 POB (a pilot and three skydivers).

After launching the skydivers, the aircraft commenced descent, but its engine operating parameters suffered variation. The pilot initiated emergency traffic at 2,000 ft. AGL for landing in SIFC. The landing was unsuccessful.

The aircraft landed at a distance of approximately 110 m to the right-hand side of the runway, close to the runway threshold 18, and came to rest in an upside down position, after traveling approximately 15 meters on the ground.

Figure 1 - View of the PT-DAB at the emergency landing site.

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 its engine, propeller assembly, auxiliary landing gear, vertical stabilizer, as well as to its right-hand wing (Figures 2 and 3).

Figure 2 - Damage to the right-hand wing.

Figure 3 - Damage to the vertical stabilizer.

1.4. Other damage.

NIL.

1.5. Personnel information.

1.5.1. Crew's flight experience.

Flight Experience	
	PIC
Total	420:00
Total in the last 30 days	30:00
Total in the last 24 hours	03:20
In this type of aircraft	25:00
In this type in the last 30 days	03:20
In this type in the last 24 hours	03:20

RMK: Data on the hours flown provided by the pilot.

1.5.2. Personnel training.

The PIC (Pilot in Command) did his PPR course (Private Pilot – Airplane) in 2021, at the *Aeroclube de Pernambuco*.

1.5.3. Category of licenses and validity of certificates.

The PIC held a PCM License (Commercial Pilot - Airplane) and valid ratings for MNTE (Single-Engine Land Airplane), MLTE (Multi-Engine Land Airplane), IFRA (Instrument Flight - Airplane) and INVA (Flight Instructor - Airplane).

1.5.4. Qualification and flight experience.

For someone to perform operations as a skydivers-launching pilot, section 61.31 (h) of the Brazilian Civil Aviation Regulation nº 61 (RBAC-61) established as a requirement that a qualified instructor had to endorse the pilot's CIV (Digital Logbook), attesting to his/her capacity to perform the operation.

In the analysis of the pilot's digital CIV, accessed by means of the ANAC's Integrated Civil Aviation Information System (SACI), one identified that the pilot received the pertinent endorsement on 08 October 2022.

The pilot was qualified, but had limited experience in the type of operation.

1.5.5. Validity of medical certificate.

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

1.6. Aircraft information.

The SN 18258141 Cessna 182K, a single-engine, high-wing aircraft, was a product manufactured by Cessna Aircraft in 1967, and registered in the SAE-PQD category (Public Specialized Air Services Registration Category - Parachuting).

The aircraft had a valid CVA (Airworthiness-Verification Certificate) and was within the weight and balance limits specified by the manufacturer.

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

The aircraft's total flight time was 6,062 hours and 10 minutes.

The latest inspection of the aircraft for obtainment of the CVA took place on 28 January 2022 at the premises of the *Aeroespina Ltda*. Maintenance Organization, in *Caruaru*, State of *Pernambuco*. The airplane flew 190 hours and 45 minutes after the referred inspection.

The latest "100-hour" inspection of the aircraft came about on 07 September 2022, at the premises of *RR Manutenção de Aeronaves* OM, in *Igarassu*, State of *Pernambuco*. After the said inspection, the airplane flew 34 hours and 15 minutes.

The aircraft's Continental Aerospace Technologies O-470-R conventional engine (SN 133754-7R) had six air-cooled opposed cylinders. Its fuel was Aviation Gasoline (AvGas), and had a float type Marvel-Schebler carburetor (PN MA-4-5, SN AO-38-4744).

On the date of the accident, the engine had a total 6,125 hours and 50 minutes of operation. Its latest overhaul came about on 06 October 2021, when it had a total 5,856 hours of operation.

The engine underwent its latest "100-hour" inspection on 07 September 2022, when it had 6,091 hours and 35 minutes TSN (time since new). On the date of the accident, the engine had completed 34 hours and 15 minutes of operation after the inspection.

The propeller equipping the aircraft was a McCauley 2AJ4C-66N model (SN 767998) with variable pitch. On the date of the occurrence, it had 4,759 hours and 40 minutes of operation TSN. It underwent its latest "100-hour" inspection on 07 September 2022. On the date of the accident, the propeller assembly had flown 34 hours and 15 minutes after the said inspection.

The aircraft was equipped with two cowl flaps, responsible for helping to control the engine temperature, operated by a single control located in the cabin (Section 11 *Maintenance Manual* - page 11-2).

1.7. Meteorological information.

METARs (Routine Meteorological Aerodrome Reports) of SBRF (located at a distance of approximately 17 NM away from the accident site) had the following information:

METAR SBRF 291500Z 13010KT 090V170 9999 SCT023 29/22 Q1013=

METAR SBRF 291600Z 14010KT 090V180 9999 BKN023 29/22 Q1012=

One observed that at 15:00 UTC, the visibility in SBRF was above 10 km, and there were scattered clouds at 2,300 ft. The wind strength was 10 kt.

At 16:00 UTC, the visibility in SBRF remained above 10 km with a wind of 10 kt, and presence of broken clouds observed at 2,300 ft.

The PIC reported that, at the time of takeoff from SIFC, the wind had a direction of 150º, with a strength varying between 5 and 15 kt, with visibility above 10 km, and absence of significant clouds.

Therefore, one concluded that the meteorological conditions were above the minimums for the conduction of the proposed flight.

1.8. Aids to navigation.

NIL.

1.9. Communications.

NIL.

1.10. Aerodrome information.

The aerodrome in SIFC was private and operated under Visual Flight Rules. The runway was asphalt-paved, with thresholds 18/36, measuring 1,145 m x 30 m, at an elevation of 33 ft.

Threshold 18 was normally the one of choice for landings and takeoffs at the aerodrome.

The wind direction indicator was in a visible location, between the aircraft apron and threshold 36.

At the time of the accident, the aerodrome was open to air traffic and the runway was unobstructed and dry.

1.11. Flight recorders.

Neither required nor fitted.

1.12. Wreckage and impact information.

After performing a 360º-approach, starting at 2,000 ft. overhead the runway threshold 18 of SIFC, the pilot made a forced landing outside the runway in an area located to the right of the runway alignment (Figure 4).

Figure 4 – Croquis of the accident.

After traveling approximately 15 m on the terrain, the aircraft came to a complete stop in an area located approximately 110 m away from the right-hand side of the runway, after overturning in the process. With the impact, the auxiliary landing gear separated from the aircraft, but the rest of the debris remained concentrated (Figure 5).

Figure 5 - Auxiliary landing gear separated from the aircraft.

At the scene of the accident, the Carburettor Heat lever was in the off position (Figure 6).

Figure 6 - Detail of the Carburettor Heat lever in the off position.

1.13. Medical and pathological information.

1.13.1. Medical aspects.

NIL.

1.13.2. Ergonomic information.

NIL.

1.13.3. Psychological aspects.

NIL.

1.14. Fire.

There was no fire.

1.15. Survival aspects.

NIL.

1.16. Tests and research.

Fuel analysis:

The characteristics of specific mass at 20ºC, initial boiling point, temperature of the evaporated 10%, temperature of the 40%, temperature of the 90%, final boiling point, distillation residue, and total sulfur were within specifications.

Examination of the engine accessories:

Tests of the spark-plug wires did not indicate failure of continuity. The spark plugs showed normal sparking. The magnetos presented adequate functionality.

Examination of the Carburetor:

Tests of the aircraft's carburetor in a workshop certified by the ANAC revealed that it was in proper operating condition.

1.17. Organizational and management information.

The operator of the accident aircraft was a limited liability company, certified for the provision of non-regular passenger air-transport services, including scenic flight services. The company also worked in the area of aircraft maintenance and repair services.

The company operated in accordance with the requirements established in the Brazilian Civil Aviation Regulation nº 91 (RBAC-91) - "General Operation Requirements for Civil Aircraft".

On the date of the accident, the corresponding COA (Air Operator Certificate) number 2022-01-00KE-02-00, issued on 15 February 2022, was valid.

According to the Operational Specification (EO), Revision 0, of 01 February 2022, the company had authorization to carry out skydiver-launching services.

The company had two aircraft, and counted with an implemented Safety Management System (SGSO) and a Safety Management Manual (MGSO) accepted by the ANAC, with the latest update as of 12 March 2021.

The PIC involved in the occurrence was a professional pilot hired by the operator.

1.18. Operational information.

For the flight that resulted in the accident, the aircraft took off with approximately 80 liters of fuel in the tanks, having consumed around 40 liters until the forced landing.

The purpose of the flight was to launch three skydivers.

It was the fourth flight of the day, with duration of approximately 30 minutes like the preceding flights. There were no records of discrepancies affecting the operation of the engine on those previous flights.

The Maximum Takeoff Weight (PMD) was 1,270 kg and, according to calculations, the aircraft took off with an approximate weight of 1,180 kg, weighing 832 kg at the time of the accident, as shown in the table below (Figure 7).

PESO BÁSICO DA AERONAVE	730 kgf (1609 lb)
COMBUSTÍVEL (40 LITROS)	32 kgf (70 lb)
PILOTO	70 kgf (154 lb)
PESO TOTAL NO MOMENTO DO ACIDENTE	832 kgf (1.833 lb)

Figure 7 - Calculation of the aircraft weight at the time of the accident.

According to the pilot, the descent began after the launching of the skydivers at an altitude of 10,000 feet overhead SIFC.

When the failure occurred, the engine was running at 2,300 RPM, with the power lever set to 18 inches and the fuel mixture set for a climb to 10,000 ft. (rich mixture).

The cowl flap was in the closed position and the fuel selector indicated "BOTH".

The failure occurred when the descent began, still close to the altitude of 10,000 ft. overhead SIFC, with the engine beginning to present variations between 2,300 and 2,000 RPM.

The pilot reported having performed the descent check, and confirmed the following settings: fuel selector set to "BOTH", cowl-flap selector closed, and fuel-lever set for a climb to 10,000 ft. (rich mixture); throttle-pitch lever of the propeller in the forward position, and power-lever set to 18 inches; carburetor heating positioned at "OPEN", magnetos indicating "BOTH", and master switch selected to "ON".

The aircraft was descending through an altitude of approximately 8,500 feet, when the engine speed varied between 2,600 and 2,300 RPM, while producing a characteristic sound.

When the aircraft was passing through an altitude of approximately 5,500 feet, the engine speed began to oscillate between 2,200 and 2,000 RPM, evidencing that the aircraft was losing power during the descent.

The pilot then began a 360º-approach at an altitude of 2,000 ft. AGL overhead the runway threshold 18, and turning to the left.

The engine rotation continued varying between 2,200 and 2,000 RPM until the end of the procedure, when the rotation suddenly dropped to 800 RPM (*idle speed*).

At the end of the spiral descent, in the turn to align with the final leg for landing on the runway 18, the aircraft maintained a speed of approximately 80 MPH, aiming at the best glide rate.

As reported by the PIC, out of fear of increasing the aircraft's angle of bank for alignment with the runway 18 (on account of the stall speed), he leveled the wings, and made the emergency landing in an area located to the right of the runway.

At the accident site, the aircraft's flaps were in a 20°-configuration.

The PIC had performed training of 360°-approaches during his PPR course in 2021.

The Aircraft Owner's Manual of the Cessna 182, included a table showing the stall speeds with Power Off, for different flap configurations and angles of bank (Figure 8), considering an aircraft gross weight of 2,800 lb.

STALL SPEED, POWER OFF			
Gross Weight 2800 LBS.	ANGLE OF BANK		
CONFIGURATION	0°	30°	60°
FLAPS UP	64	69	91
FLAPS 20°	57	61	81
FLAPS 40°	55	59	78
SPEEDS ARE MPH, CAS			

Figure 8 - *Stall Speed, Power Off* Table.
Source: Section V, page 5.2, Cessna 182 Owner's Manual.

The Aircraft Owner's Manual, Section I, Operation Check List, Normal Procedures, contained the following procedures for descent:

<u>Let Down</u>

Mixture -- Rich.

Power -- As desired.

Carburetor Heat -- Apply (if icing conditions exist).

<u>Before Landing</u>

Fuel Selector Valve -- "BOTH".

Mixture -- Rich.

Propeller -- High RPM.

Cowl Flaps -- Closed.

Carburettor Heat --Apply before closing throttle.

Airspeed -- 80 to 90 MPH (flaps retracted).

Wing flaps -- 0º to 40º (below 110 MPH).

Air Speed -- 70 to 80 MPH (flaps extended).

Elevator and Rudder trim --Adjust.

The Quick Reference Emergency Checklist contained the following emergency procedures:

<u>Engine Failure During Flight.</u>

1. Airspeed......................80 MPH

2. Landing Site......................Select

3. Fuel Selector...Check Both, Lt/Rt

4. Mixture.................................Rich

5. Carburettor Heat...........Check On

6. Mags...........Check Lt/Rt or Both

NOTE: Most engine failures occur due to loss of Fuel Flow, Improper Ignition, or Carburetor Icing

If Engine Doesn't Restart

7. Communicate...........Advise ATC

8. Transponder...........Squawk 7700

9. Passengers..........................Brief

<u>Emergency Descent</u>

1. Carburettor Heat.............Full Hot

2. Throttle.................................Idle

3. Propeller..................Full Increase

4. Pitch......................For 198 MPH

1.19. Additional information.

<u>Carburetor-icing conditions</u>

With respect to the phenomenon of icing, the Command of Aeronautics' Manual (MCA) 3-6, SIPAER's Investigation Manual, dated 2017, read:

> Such phenomenon occurs more frequently in small conventional engines in comparison to larger conventional ones, which generally have an injector system that diminishes the likelihood of ice crust formation in the intake system. Carburetor Icing is generally characterized by a gradual power decrease, RPM variation, rough and intermittent engine operation, and black smoke in the exhaust (with a rich mixture). In some engines, carburetor icing will occur when the relative humidity is rather high (above 60%) in good, sunny, and, many times, even in hot weather conditions (15º/20ºC – 60º/70ºF) [...]

The Manual had a diagram with the probability of carburetor icing, as shown in Fig. 9.

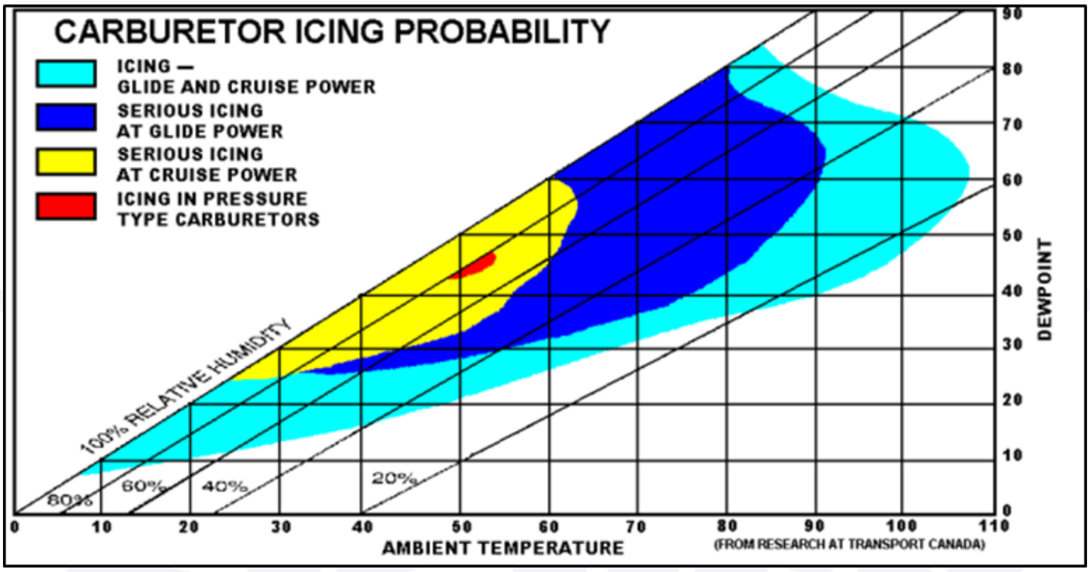

Figure 9 - Carburetor icing probability, with temperature and dew point in Degrees Fahrenheit. Source: MCA 3-6.

In-flight engine failure associated with carburetor icing

The Report published by the ANAC in July 2022, entitled "Qualitative Analysis of the Final Reports of Occurrences with Brazilian-Registered Aircraft in the Last 10 Years (2010-2019), classified as Engine Failure in Flight (SCF-PP)", established the following analysis of the contribution of carburetor icing to in-flight engine failures:

> The lack of knowledge regarding the problem of carburetor icing may be associated with the lack of approach to this topic in practice pilot training, based on the mistaken culture that the phenomenon is unusual given the Brazilian climatic conditions. Many aviators believe that the carburetor icing only occurs in atmospheric conditions with temperatures close to 0°C, when in fact the problem may occur even at 35°C, being quite likely at temperatures below 17°C with medium/high humidity, which is a frequent condition in Brazil. In such context, it is important that the pilot, from his early training, be indoctrinated as to the relevance of this phenomenon, identifying its likelihood prior to the flight, taking preventative measures during the flight in accordance with the diagnosed probability, and being able to identify problems associated with the phenomenon. One, thus, suggests the promotion of actions by the ANAC on the theme of carburetor icing, with publication of booklets (e.g. the *Piston Engine Icing* study published in 2013 by EGAST), and that the Carburettor-icing probability chart have its use incorporated during the practice instructions to be consulted and discussed in the briefings prior to each flight.

Aviation accidents x carburetor icing

Accidents related to the carburetor icing of aircraft equipped with conventional engines have been recurrent, as can be seen in the CENIPA-issued final reports of the occurrences involving aircraft of registration marks PT-IBL and PT-DYG, both of which Cessna 182 models.

Approaches and landings

An overhead 360°-approach is a maneuver utilized mainly in the case of an emergency landing, when the plane is flying exactly overhead the landing spot.

On the subject, among other aspects, the Federal Aviation Administration (FAA), by means of the Airplane Flying Handbook (FAA-H-8083-3C) Chapter 9: Approaches and Landings, established the following:

- on dual command training flights, the instructor should give simulated emergency landings, in which the utilization of engine power should be avoided;

- the objective of these simulated-emergency landings is to develop the pilot's accuracy, judgment, planning, execution of procedures, and confidence when there is little, or no power at all, available;
- a simulated-emergency landing can be performed with the plane in any configuration, and the pilot has to define the best glide-rate speed established for his/her aircraft;
- the pilot should ensure that the flaps and landing gear are in the appropriate configuration for the existing situation;
- a constant glide-speed should be maintained, since variations in the glide-speed may compromise the judgment of the gliding distance and of the landing spot;
- variables, such as altitude, obstacles, wind direction, landing direction, descent gradient, and landing distance requirements, determine the approach pattern and approach procedures to be adopted;
- the pilot may utilize any combination of maneuvers, aiming for the best glide, from the banking of the wings to spiral descents (Figure 11), in order to reach the key position at normal traffic altitude for landing in the intended area;

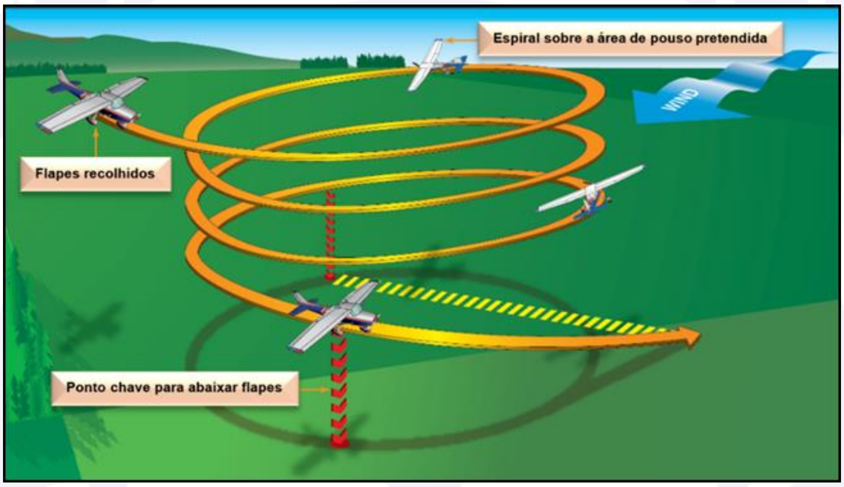

Figure 11 - Spiral descent performed over the intended landing area.

- with the better choice of landing fields afforded by higher altitudes, the inexperienced pilot may be inclined to delay making a decision, and with considerable maneuvering altitude, errors in the maneuvers and in the estimation of glide distance may develop;
- pilots should learn to determine the wind direction and to estimate the wind speed from the windsock at the airport, brush fires, factory smoke, or dust on the ground, as well as from wind farms;
- once a field has been selected, the pilot should indicate the proposed landing area to the instructor;
- instructors should stress on the slipping of the plane, using flaps, varying the position of the base leg and varying the turn onto the final approach as ways of correcting for misjudgment of altitude and glide angle (ramp);
- eagerness to descend is one of the most common faults of inexperienced pilots during simulated-emergency landings. They forget about speed and arrive at the edge of the field at speeds above the ones recommended for a safe landing;
- the habit of performing these procedures must be developed to such an extent that, if an engine failure actually occurs, a pilot checks the critical items that might get the engine operating again while selecting a field and planning an approach;

- combining the two operations - accomplishing emergency procedures and planning and flying the approach - is difficult during the early training in emergency landings; and
- there are steps and procedures that pilots should follow in a simulated-emergency landing. Although they may differ somewhat from the procedures used in an actual emergency, they should be learned thoroughly, and each step called out to the instructor. The use of a checklist is strongly recommended. Most airplane manufacturers provide a checklist of the appropriate items.

The *Airplane Flying Handbook* (FAA-H-8083-3C) *Chapter 9: Approaches and Landings* also defined:

Spiral Descent - common mistakes:

- failure to adequately clear the area;
- excessive change in pitch (aircraft attitude) during entry or recovery;
- attempts to start recovery prematurely;
- failure to define precise directions at the end of turns;
- excessive rudder amplitudes during recovery, resulting in skidding;
- inadequate energy management and speed control;
-trying to perform the maneuver using instrument reference instead of visual reference;
- poor coordination, resulting in skidding and/or sinking;
- inadequate wind correction;
- inadequate application of flight controls, resulting in an increase or decrease of the aircraft's speed when it is close to touching down on the runway;
- failure to search for other traffic; and
- failure to maintain orientation.

Influence of the wind

As the 360°-approach from the vertical of the aerodrome is considered a precision maneuver, the pilot, in its final stage, must begin the landing approach by defining a glide path, so that the touchdown takes place at the end of the first one-third of the runway.

Wind is an important factor, therefore, the direction and strength of the wind must be taken into account on all points of the approach, especially when making turns.

1.20. Useful or effective investigation techniques.

NIL.

2. ANALYSIS.

The aircraft took off from SIFC (*Coroa do Avião* Aerodrome) on a skydiver-launch mission.

The pilot reported that after release of the skydivers at an altitude of 10,000 feet overhead SIFC, an aircraft's engine-failure occurred at the beginning of the descent.

At that moment, the engine was running at 2,300 RPM, the power lever setting was 18 inches, and the fuel mixture lever had been set for a climb to 10,000 ft.

The engine failure consisted of variations in the RPM indication, initially between 2,300 and 2,000 RPM.

As the aircraft passed through the altitude of approximately 8,500 ft., the engine speed was varying between 2,600 and 2,300 RPM, and at around 5,500 ft., the variation had values between 2,200 and 2,000 RPM, indicating that the aircraft's engine performance was getting worse during the descent.

The pilot began a 360º-approach at 2,000 ft. AGL overhead the runway threshold 18, making a left turn with a radius of approximately 300 m.

The RPM of the engine remained varying between 2,200 and 2,000 RPM until the end of the descent. Then, as the aircraft was aligning for the final leg, the engine's rotation dropped to 800 RPM (*idle speed*), remaining in this situation until the landing.

For fearing to increase the aircraft's bank-angle to align with runway 18 because of the stall speed, the pilot leveled the wings and made the emergency landing in an area to the right of the runway.

Considering that, at the time of the accident, the aircraft was at a weight of 1,833 pounds and that its flaps had a 20° configuration, based on the Table in Figure 8 (*Table of Stall Speeds for an aircraft weight of 2,800 lb.*), it is possible to deduce that, concerning the stall-speed, there was a favorable margin for performing the maneuver that would lead to a correct alignment of the aircraft with the runway 18 of SIFC.

On the other hand, all the evidence suggests that, during the spiral descent, common errors related to dual training flights may have occurred, notably due to inadequate wind correction and glide distance judgment. Such errors are discussed in the *Airplane Flying Handbook* (FAA-H-8083-3C), *Chapter 9: Approaches and Landings*.

Pilots operating aircraft registered in the SAE-PQD category may experience similar situations as they generally operate overhead/close to the aerodromes used as a base for their air activities.

Thus, it is possible that the limited experience in that model of aircraft and in the circumstances of the operation, particularly in relation to the spiral descent, contributed to the inadequate alignment for landing on the runway 18.

The pilot reported having complied with the checklist during the descent. That being said, it was not possible to ensure that he activated the carburetor heat in strict compliance with the prescriptions contained in the Cessna 182 Aircraft Owner's Manual (*Section I, Operation CheckList, Normal Procedures, Let Down and Before Landing* phases), since the occurrence of the carburetor icing phenomenon is related to lack of activation of the carburetor heat.

During the investigation procedures at the accident site, one found that the wing tanks contained sufficient fuel (approximately 40 liters) to complete the flight.

Subsequent tests and research carried out on the spark plugs, spark plug cables, magnetos, and carburetor did not reveal any discrepancies that could be associated with the engine failure.

One collected samples of fuel and sent them for analysis. The results indicated that the characteristics of the fuel were within the product specifications.

Then, one conducted further research regarding the possibility of carburetor icing.

On this subject, information was gathered that many flights take place in the so-called "danger zone", in which, on a regular basis, a phenomenon known as *carburetor icing* may occur in a wide range of external air temperatures and relative humidity.

Therefore, carburetor icing may occur with outside temperatures as high as 100 degrees Fahrenheit (38°C) at 50% relative humidity.

Focusing on this scenario, one sought to identify the meteorological parameters that, at the time of the accident, could influence the operation of the engine.

Hence, from the parameters of the meteorological station closest to the accident, one identified that the temperature on the ground in SBRF (at a distance of approximately 17 NM from SIFC) was 29°C (84°F) and the dew point was 22°C (71.6°F).

In fact, based on the graph on potential carburetor icing with reduced power (*glide power*), one observed that the aircraft was operating in the danger zone, precisely, in the so-called *Serious Icing* (*glide power*) (Figure 12).

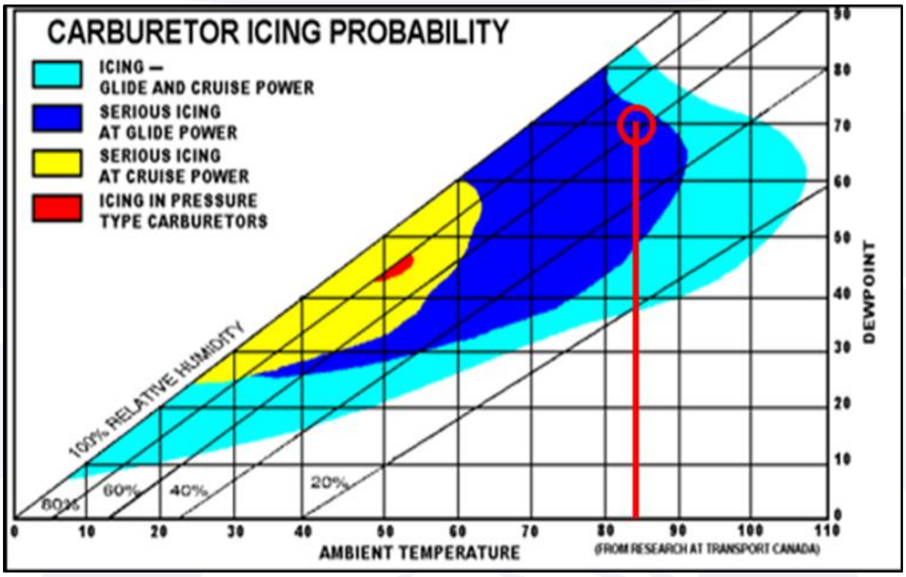

Figure 12 - Probability of occurrence of icing in the carburetor,
taking as reference the temperature and relative humidity in SBRF.

Taking into account the meteorological variables then present (temperature and relative humidity), which are compatible with the formation of severe ice in the carburetor, the engine with reduced power, the failure to activate the carburetor-heating lever, and with no discrepancies found in the engine and its accessories, the Investigation Committee inferred that the engine failure may have been related to a restriction in fuel supply due to ice formation in the carburetor.

3. CONCLUSIONS.

3.1. Findings.

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

b) the pilot held a PCM License (Commercial Pilot - Airplane) and a valid MNTE rating (Single-Engine Land Airplane Class);

c) the pilot was qualified but had limited experience in the aircraft model;

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

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

f) the records of the airframe, engine, and propeller logbooks were up to date;

g) the purpose of the flight was to launch skydivers;

h) the meteorological conditions were above the minimums for VFR flights;

i) the aircraft's engine presented RPM variations at the beginning of the descent;

j) the pilot performed a 360º-approach, starting at 2,000 ft. AGL overhead the runway 18 threshold of SIFC;

k) the aircraft landed at a distance of approximately 110 m to the right of the runway;

l) the aircraft traveled approximately 15 m on the ground, and came to a complete stop after overturning;

m) the aircraft sustained substantial damage; and

n) the pilot suffered no injuries.

3.2. Contributing factors.

Training – undetermined.

It is possible that during the basic training process, the pilot was not given full knowledge relative to the meteorological conditions capable of contributing to the formation of ice in the carburetor.

Piloting judgment – undetermined.

The unsuccessful execution of the emergency traffic procedure may have resulted from inadequate assessment regarding both the influence of the wind on the aircraft and the glide distance.

Insufficient pilot's experience – undetermined.

The pilot's limited experience in the aircraft model and in the circumstances endured in the operation, particularly with respect to the spiral descent, may have contributed to the inadequate alignment of the aircraft for landing on the runway 18.

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".

To Brazil's National Civil Aviation Agency (ANAC):

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Disseminate the lessons learned from this investigation to the Civil Aviation Instruction Centers (CIAC), with the aim of alerting student pilots on the risks arising from the formation of ice in the carburetors equipping conventional aeronautical engines.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On June 3rd, 2024.