

COMMAND OF AERONAUTICS
AERONAUTICAL ACCIDENT INVESTIGATION AND
PREVENTION CENTER



FINAL REPORT
A - 083/CENIPA/2013

<u>OCCURRENCE:</u>	ACCIDENT
<u>AIRCRAFT:</u>	PR-LJI
<u>MODEL:</u>	CESSNA 210L
<u>DATE:</u>	26 APRIL 2013



NOTICE

According to the Law n° 7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System – SIPAER – is responsible for the planning, guidance, coordination and execution of the activities of investigation and prevention of aeronautical accidents.

The elaboration of this Final Report was conducted 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 item 3.1, Annex 13 to the 1944 Chicago Convention, which was incorporated in the Brazilian legal system by virtue of the Decree n° 21713, dated 27 August 1946.

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

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

N.B.: This English version of the report has been written and published by the CENIPA with the intention of making it easier to be read by English speaking people. 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.

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SYNOPSIS

This is the Final Report of the 26 April 2013 accident with the Cessna 210L aircraft, registration PR-LJI. The accident was classified as inflight engine failure.

While the aircraft was on the traffic pattern for landing, a loss of engine power occurred, and the pilot made a forced landing in the vicinity of the aerodrome.

The pilot and a passenger perished, two passengers were seriously injured, while the other four passengers suffered only minor injuries.

The aircraft was substantially damaged.

An accredited representative was designated by the NTSB for taking part in the investigation.

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	(Brazil's) National Civil Aviation Agency
ATC	Air Traffic Control
ATS	Air Traffic Services
AVGAS	Aviation Gasoline
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CHT	Technical Qualification Certificate
CMA	Aeronautical Medical Certificate
IFR	Instrument Flight Rules
INFRAERO	Brazilian Airports Infrastructure Enterprise
Lat	Latitude
Long	Longitude
MLTE	Airplane, multi-engine, land
MNTE	Airplane, single-engine, land
PCM	Commercial Pilot (Airplane category)
PPH	Pound per hour
PPR	Private Pilot (Airplane category)
RBAC	Brazilian Civil Aviation Regulation
SBJC	ICAO Location designator - Brigadier Protásio de Oliveira Aerodrome
SERIPA	Regional Aeronautical Accident Investigation and Prevention Service
SIPAER	Aeronautical Accident Investigation and Prevention System
SISO	ICAO Location designator – Chaves Municipal Aerodrome
TCM	Teledyne Continental Motors
TWR-JC	SBJC Control Tower
UTC	Coordinated Universal Time
VFR	Visual Flight Rules

AIRCRAFT	Model: 210 L Registration: PR-LJI Manufacturer: Cessna Aircraft	Operator: BraboTáxi-Aéreo
OCCURRENCE	Date/time: 26 APR 2013 / 12:15 UTC Location: Júlio César Av. and Pedro Álvares Cabral Av., Belém Lat. 01°24'28"S – Long. 048°27'50"W Municipality – State: Belém - Pará	Type: Inflight Engine Failure

1 FACTUAL INFORMATION

1.1 History of the occurrence

The aircraft departed at 11:25 UTC from the Municipality of Chaves (SISO), State of Pará, destined for Brigadier Protásio de Oliveira Aerodrome (SBJC), in Belém, capital city of State of Pará. A pilot and seven passengers (two infants – one with one year and other with eight months) were onboard the aircraft.

On the approach to SBJC, when the aircraft was on the traffic circuit for landing, the pilot declared emergency and made a forced landing in a grassy area near the crossroads of the avenues Júlio César and Pedro Álvares Cabral, not far from the runway 16 threshold.

1.2 Injuries to persons

Injuries	Crew	Passengers	Third parties
Fatal	01	01	-
Serious	-	02	-
Minor	-	04	-
Uninjured	-	-	-

1.3 Damage to the aircraft

There was substantial damage to the aircraft power plant, pilot cabin, wings, and fuselage.

1.4 Other damage

There was damage to the guardrail of the roundabout.

1.5 Personnel information

1.5.1 Information on the crew

HOURS FLOWN	
	PILOT
Total	7,030:00
Total in the last 30 days	29:25
Total in the last 24 hours	00:50
In this type of aircraft	337:00
In this type in the last 30 days	15:40
In this type in the last 24 hours	00:50

NB.: Data provided by third parties.

1.5.1.1 Professional formation

The pilot did his Private Pilot Course (airplane category) in the Aeroclub of Pará in 1990.

1.5.1.2 Validity and category of licenses and certificates

The pilot had a Commercial Pilot license (airplane category). He had valid technical qualifications concerning ASEL and AMEL, a flight instructor (airplane) license, as well as IFR rating.

1.5.1.3 Qualification and flight experience

The pilot was qualified and had enough experience for the flight.

1.5.1.4 Validity of the medical certificate

The pilot had a valid aeronautical medical certificate (CMA).

1.6 Aircraft information

The aircraft (SN 21060724) was manufactured by the Cessna Aircraft Company in 1975.

The aircraft Airworthiness Certificate (CA) was valid.

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

The last inspection of the aircraft ("200 hours") was made on 18 February 2013 at the Taxi-Aéreo Kovacs S/A workshop in Belém, State of Pará. The aircraft had 43 hours and 15 minutes of flight after the inspection.

1.7 Meteorological information

Prevailing weather conditions were VMC.

1.8 Navigational aids

Nil.

1.9 Communications

The communications between the pilot and the ATC units had been uneventful until he joined the traffic pattern of the destination aerodrome.

At 12:15 UTC, the pilot called the SBJC control tower and reported an emergency, thirteen seconds before colliding with the ground.

1.10 Aerodrome information

Not applicable.

1.11 Flight recorders

Neither required nor installed.

1.12 Wreckage and impact information

The impact of the aircraft with the ground was at a pitch-down angle of approximately 20 degrees, with a slight banking to the right.

It was also observed that the engine separated with the cradle of the aircraft firewall, and was found in an upside down position.



Figure 1 – Situation of the aircraft after the impact.

The left wing sustained substantial damage, mainly to its leading edge.



Figure 2 – Situation of the aircraft after the impact.

Fuel leakage occurred due to the rupture of the fuel system lines.

The fuel selector valve was positioned by third parties in OFF, in order to interrupt the fuel leakage after the accident. It was not possible to confirm the previous position of the selector valve.

Before the aircraft was removed from the accident site, approximately 80 liters of aviation fuel (AVGAS) were collected from the right wing tank and was verified no water contamination.

No fuel was found in the left wing.

The start-key was in the ignition magnetos position on both, the electric auxiliary fuel pump switch was in the OFF position, the engine power lever was set forward indicating the intention of the pilot to obtain power from the engine; the flaps and the landing gear were in the retracted position.

1.13 Medical and pathological information

1.13.1 Medical aspects

According to an investigation conducted by a Human Factor – Medical Aspect accredited professional, no evidence was found that this aspect could have contributed to the occurrence.

1.13.2 Ergonomic information

Nil.

1.13.3 Psychological aspects

1.13.3.1 Individual information

Interviewees informed that the pilot was a dedicated professional, who was attentive, organized, studious, and who had excellent teaching skills. He was also very strict towards norms and regulations. He did not have a bold profile, and his piloting style was standardized.

The survivors of the accident considered him a competent person.

1.13.3.2 Psychosocial information

Nil.

1.13.3.3 Organizational information

The pilot was hired by the company in September 2011.

The company owner, a pilot and flight instructor himself, was the one who evaluated the pilot for purposes of hiring.

The pilot had, thus, been working for a year and seven months at the company, which had five pilots and four aircraft.

He was a flight instructor, and would sometimes give flight training at a private flying school.

Employees of the company at the time of the accident stated that there was no concern on the part of the management staff in relation to the maintenance of aircraft, and everything the pilots reported was verified and repaired.

In the company, the pilots would fly all the aircraft, and the owner left to the pilots' discretion which equipment they would fly.

The company owner used to perform the pre-flight procedures in all aircraft in the morning, even before the arrival of the pilots.

1.14 Fire

There was no fire.

1.15 Survival aspects

The aircraft occupants were rescued by firefighters, who responded to the emergency call.

1.16 Tests and research

During the disassembly of the engine, no abnormalities and/or discrepancies were found that could have contributed to a contingent loss of power, as well as to vibration and increase of the operating temperature.

It was observed, during the disassembly, that the internal engine parts were well lubricated, with no evidence of fractures or fatigue.

When the fuel hoses were removed, it was possible to notice the absence of fuel, indicating a probable lack of fuel in the engine feed system.

Functional tests of the following aeronautical components were carried out:

a) The *Teledyne Continental Motors* (TCM) fuel pump presented a flow of fuel which was below the limits established by the manufacturer (80 PPH); the flow-in pressure at the pump was within normal test values (34 PSI), according to the *service manual* X30593A, TCM.

Upon completion of the test, the correct flow was set (150 PPH), and the pump met the parameters, something which indicates that, after the flow adjustment, the pump worked correctly. It was not possible to determine when and where the adjustment was changed;

b) The dosage/control valve was tested as prescribed in the *Service Manual* X30593A, TCM, and presented normal functioning.

c) The fuel distributing unit and the injection nozzles were tested, and the fuel flow was normal for the different rotations simulated during the test;

d) The magnets were tested, as prescribed in the *Service Manual* TCM X42002-1, presenting uniform good intensity sparking, an indication of normal functioning at high and low rotation;

e) The ignition spark-plugs were bench-tested, and all of them showed good sparking characteristics; and

f) The electric fuel pump was bench-tested, and its functioning was considered perfect.

1.17 Organizational and management information

The company started its activities in Belém, State of Pará, in December 1996, operating as an air-taxi enterprise. Its main office was located at Brigadeiro Protásio de Oliveira Airport (SBJC).

The flight in question was part of a line for transporting passengers on Mondays, Wednesdays and Fridays, and was hired from the air-taxi company by the municipal government of Chaves, State of Pará.

The coordination of the flights was made via telephone, and the pilot would only be summoned after confirmation of the flight.

The aircraft were refueled by apron agents, who made use of a refueling gauge for checking the quantity of fuel in the tanks. The gauge consisted of a wooden rod, not certified, with marks identifying the quantity of fuel: 30, 60, 90, 120 and 150 liters, respectively, when placed in an upright position in the wing fuel filler door.

When more than one aircraft was refueled with AVGAS, the total quantity was recorded in just one refueling card. Thus, it was not possible to determine how many liters each aircraft received.

At the time of the occurrence, the company had a fleet of four aircraft (three Cessna 206L's and a Cessna U206F).

The company was hired for transporting passengers from SISO to SBJC.

According to instructions of the air-taxi company, just four passengers were allowed to come aboard in this segment, but the company left to the pilot's discretion the decision to receive more passengers up to the maximum authorized number, depending on the passengers' weight and runway condition.

The entire procedure of monitoring and controlling the passengers' boarding was conducted by the pilot.

Until the date of the accident, the company did not have a training program for the crews.

The pilot was considered a good crewmember by his peers, but according to information obtained during the investigation, he had the custom of using the fuel from only one of the tanks until it reached its limit.

The owner of the air-taxi company had already warned the pilot of the need to use the fuel from the two tanks, and that in the round trip SBJC-SISO-SBJC one tank was to be used on the go-leg and the other on the return-leg.

1.18 Operational aspects

The flight consisted of positioning the aircraft in SISO and transporting seven passengers from SISO to SBJC.

The pilot flew along the same route on 21 April 2013, and it took him 53 minutes to fly the first segment and 51 minutes for the return leg, according to the records written in the aircraft logbook.

The last known refueling of the aircraft was on 24 April 2013. Since the refueling voucher had been utilized for the refueling of two aircraft (PT-JPW and PR-LJI), it was not possible to determine the exact quantity of fuel each one received.

According to a testimony given by the apron agent who was monitoring the refueling, the PR-LJI aircraft had 130 liters of fuel in each wing.

According to the logbook, the aircraft did not fly on 25 April 2013.

According to information provided by the owner of the company, the pilot did the preflight and visually verified the existing fuel, using a gauge standardized by the company.

The cargo manifesto was not presented. With the data collected, was not possible the conclusion that the aircraft was within the weight and center of gravity limits specified by the manufacturer.

The data relative to the flight from SBJC to SISO on 26 April 2013 were not entered by the pilot in the aircraft logbook.

For the return flight to Belém, the aircraft departed from SISO, in the municipality of Chaves (*Ambrósio Farm*), State of Pará, at 11:25 UTC on a VFR flight plan for SBJC, in the city of Belém, with the pilot and seven passengers (two infants) on board.

At 12:12 UTC, the PR-LJI aircraft made the first call on the SBJC control tower frequency, and requested a left base for landing on runway 34.

The requested procedure was not authorized, since there was an aircraft lined up for departure on runway 16 and two other aircraft at the holding point. The pilot was asked to enter a visual traffic pattern for landing on runway 16.

At 12:14 UTC, the pilot informed an estimate of 30 seconds to cross over the aerodrome, and was told to join the downwind leg for runway 16 and report on base leg.

At 12:15 UTC, the pilot informed that he was proceeding direct for landing, and was cleared to do so by TWR-JC.

Immediately after receiving the clearance from the tower, the pilot declared emergency, and this was his last transmission.

According to witnesses in the apron, the engine of the aircraft had stopped and the plane was on a descending trajectory.

The final trajectory of the aircraft was recorded by a security camera of the airport. It was possible to see the wing banking to the right, shortly before the collision with the ground.

1.19 Additional information

The aircraft airworthiness certificate prescribed a maximum number of five passengers and one crewmember. The number of seats installed was according to the aircraft airworthiness certificate.

According to the Operating Specifications, the company had authorization for operating with five passengers and one crewmember.

The RBAC 135, section 135.128 had the following operational requirement:

“Each person onboard an aircraft operated in accordance with this regulation shall occupy an approved seat or berth, with an individual safety belt adjusted to his/her body, during movements on the surface, takeoffs and landings. (...) the seat belt provided for use by the occupant of a seat shall not be used by more than one person. Notwithstanding the preceding requirements, a child is allowed:

(1) to be held by an adult occupying an approved seat or berth, provided the child is less than two years of age, and is neither occupying nor using any securing device.”

1.20 Utilization of other investigation techniques

Nil.

2 ANALYSIS

It was a normal operation for the aircraft, departing from SISO, destined for SBJC, with the purpose of transporting passengers.

The pilot was experienced in and had flown along that route five days before the accident.

According to an analysis of the wreckage and to the evidence found in the crash site, the aircraft engine was not developing power at the moment of impact with the ground.

The tests of the aircraft power plant indicated that the aircraft engine did not present any abnormalities and/or discrepancies that could have contributed to a contingent loss of power. It was possible to rotate the engine crankshaft by hand.

During the disassembly of the engine, it was possible to observe that its internal components had good lubrication and showed no evidence of fractures and fatigue.

During the analysis of the engine fuel feed system, no fuel was found in the hoses, and this was the reason for the inflight engine failure.

Although it was not possible to confirm the exact quantity of fuel existing in the aircraft on the day of the accident flight, the PR-LJI aircraft, had been refueled and had 130 liters in each wing.

Due to the fact that the company made use of a rod for measuring the fuel, with marks corresponding to 30, 60, 90, 120 and 150 liters, the quantity of 130 liters is considered approximate.

Besides, the aforementioned measuring rod was not homologated by the manufacturer, being just an auxiliary piece of equipment used by the operator.

Each leg of the flight would take approximately 50 minutes. Considering a fuel consumption of 65 liters per hour, the aircraft would have an endurance of 4 hours, using the fuel from both tanks, a quantity which would be more than enough for the two planned legs.

According to the owner of the company, the procedure informally recommended for the selection of the tanks was to use the fuel from one tank in the go-leg and switch to the other tank for the return-leg.

Witnesses reported that the pilot had the custom of using the fuel from just one of the wing tanks up to its limit.

Since there was not a program for the training and operational monitoring of the pilots, in addition to the fact that there was only one pilot on board the aircraft, it was not possible to confirm whether the reported procedure was part of the routine or an occasional deviation on the part of the pilot.

No fuel was found in the left tank of the aircraft, while at least 80 liters of fuel were extracted from the right tank, without considering the amount that leaked after the impact. Thus, it is possible to conclude that there was no shift between tanks during the flight, with the two legs (SBJC – SISO / SISO – SBJC) being flown with the fuel select switch set to the left tank, which was the only source of the fuel consumed by the aircraft.

Even considering that the fuel utilized came from just one tank, the exhaustion of the fuel from this tank would only have occurred if the consumption was higher than the average utilized by the company for planning the flight.

It is worth highlighting that an average consumption of 65 liters per hour was expected during the cruise phase, according to the manual. Since there was not a control of the aircraft refueling on an individual basis, it was not possible to determine the actual average consumption of the accident aircraft.

It is possible that the aircraft received less than 130 liters of fuel per tank, due to the imprecision of the measuring device utilized, or even on account of the position of the aircraft at the moment the fuel was measured.

Anyway, for exhausting all the fuel of the tank, it is certain that there was not a shift of tanks during the flight, on account of either forgetfulness or deviation from procedures on the part of the pilot.

When the aircraft was on the traffic pattern for landing in SBJC, a loss of engine power occurred due to shortage of fuel.

Upon realizing that, due to the loss of engine power, he would not make it to the runway, the pilot prepared the aircraft for a forced landing in an area near the aerodrome, and retracted the landing gear shortly before impact, after reporting the emergency situation to TWR-JC.

3 CONCLUSIONS

3.1 Facts

- a) the pilot had a valid aeronautical medical certificate (CMA);
- b) the pilot had a valid technical qualification certificate (CHT);
- c) the pilot was qualified and had enough experience for the flight;
- d) the aircraft had a valid airworthiness certificate;
- e) the aircraft was within the weight and balance limits;
- f) the aircraft departed from SISO at 11:25 UTC, destined for SBJC, with a pilot and seven passengers (two infants) on board.
- g) on the traffic pattern for landing, the pilot declared emergency and made a forced landing in a grassy area in the vicinity of the aerodrome;
- h) the aircraft had been last refueled on 24 April 2013. Since the refueling voucher had been utilized for both the PT-JPW and PR-LJI aircraft, it was not possible to determine the exact quantity of fuel provided for each one;
- i) according to a report from the apron agent, who was monitoring the refueling, the aircraft had 130 liters of aviation fuel (AVGAS) in each wing;
- j) the aircraft sustained substantial damage; and
- k) the pilot and a passenger perished, two passengers were seriously injured, and the other four passengers suffered minor injuries;

3.2 Contributing factors

3.2.1 Human Factor

3.2.1.1 Medical Aspect

Not a contributor.

3.2.1.2 Psychological Aspect

3.2.1.2.1 Individual information

a) Memory – undetermined

Considering that the pilot was described in interviews as a disciplined person concerned with flight safety, it is possible that a forgetfulness event could have contributed to his maintaining the same fuel tank for the whole flight, perhaps on account of an acquired habit of shifting the fuel selector valve only after a tank became empty.

3.2.1.2.2 Psychosocial information

Not a contributor.

3.2.1.2.3 Organizational information

a) Training – undetermined

If the company had adopted a recurrent training program, the pilot would probably have performed a correct fuel control procedure.

3.2.2 Operational Factor

3.2.2.1 Concerning the operation of the aircraft

a) Pilot's forgetfulness – undetermined

It is possible that the pilot forgot the procedure informally recommended for the selection of tanks, namely, using the fuel from a tank on the go-leg, and selecting the other tank for the return-leg.

b) Training – a contributor

The company had an informal procedure recommended for the selection of tanks, and there was neither recurrent training nor operational monitoring of the pilots.

c) Piloting Judgment – undetermined

It is possible that the pilot exercised inadequate judgment, if one considers the hypothesis of his intentional maintaining of the same tank on both legs of the flight.

3.2.2.2 Concerning ATS units

Not a contributor.

3.2.3 Material Factor

3.2.3.1 Concerning the aircraft

Not a contributor.

3.2.3.2 Concerning ATS technology systems and equipment

Not a contributor.

4 SAFETY RECOMMENDATION

A measure of preventative/corrective nature issued by a SIPAER Investigation Authority or by a SIPAER-Link within respective area of jurisdiction, aimed at eliminating or mitigating the risk brought about by either a latent condition or an active failure. It results from the investigation of an aeronautical occurrence or from a preventative action, and shall never be used for purposes of blame presumption or apportion of civil liability.

In accordance with the Law n°12970/2014, recommendations are made solely for the benefit of the air activity operational safety.

Compliance with a Safety Recommendation is the responsibility of the holder of the highest executive position in the organization to which the recommendation is being made. An addressee who judges to be unable to comply with a Safety Recommendation must inform the CENIPA on the reason(s) for the non-compliance.

Safety Recommendations made by the CENIPA:**To the National Civil Aviation Agency (ANAC):****A-083/CENIPA/2013 – 001****Issued on 27/10/2014**

Publicize the content of this report at seminars, lectures and similar activities held for owners, operators, and explorers of aircraft regulated by the RBAC 135.

A-083/CENIPA/2013 – 002**Issued on 27/10/2014**

Due to the latent conditions listed in this report, intensify actions aiming at inspecting the operator of the accident aircraft.

5 CORRECTIVE/PREVENTATIVE ACTION ALREADY TAKEN

Nil.

6 DISSEMINATION

- (Brazil's) National Civil Aviation Agency – ANAC
- Brabo Táxi-Aéreo*
- SERIPA I
- National Transportation Safety Board (NTSB)

7 APPENDICES

Nil.

On 27 / 10 / 2014.