

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
A-149/CENIPA/2014

OCCURRENCE:	ACCIDENT
AIRCRAFT:	PT-DLA
MODEL:	177B
DATE:	30AUG2014



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.

SYNOPSIS

This is the final report of the 30 August 2014 accident with the 177B aircraft registered in Brazil as PT-DLA. The accident was classified as loss of control in flight.

After taking off from SBBI, the aircraft was not able to maintain the rate of climb, lost lift, and collided with a house located at a distance of 600 meters beyond the departure end of the runway.

The aircraft was destroyed in the crash.

Two passengers and the pilot were killed. The other passenger was seriously injured.

An accredited representative of the US National Transportation Safety Board was designated for participation in the investigation.



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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	Brazil's National Civil Aviation Agency
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CG	Center of Gravity
CHT	Technical Qualification Certificate
CIV	Pilot's Flight Logbook
CM	Registration Certificate
CMA	Aeronautical Medical Certificate
GPS	Global Positioning System
IAM	Annual Maintenance Inspection
INFRAERO	Brazilian Airports Infrastructure Enterprise
Lat	Latitude
Long	Longitude
METAR	Routine Aerodrome Weather Report
MNTE	Airplane, Single-Engine, Land - (ASEL)
MLTE	Airplane, Multi-Engine, Land - (AMEL)
NTSB	National Transportation Safety Board
PCM	Commercial Pilot License (airplane category)
PPR	Private Pilot License (airplane category)
RBHA	Brazilian Aeronautical Homologation Regulation
RS	Safety Recommendation
SBBI	ICAO location designator – Bacacheri Aerodrome
SBMG	ICAO location designator – Maringá Aerodrome
SSOK	ICAO location designator – Londrina Aerodrome
SERIPA V	5 th Regional Aeronautical Accident Investigation and Prevention Service
SIPAER	Aeronautical Accident Investigation and Prevention System
TPP	Private Air Services
UTC	Universal Time Coordinated
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	Model: 177B Registration: PT-DLA Manufacturer: Cessna Aircraft	Operator: Private.
Occurrence	Date/time: 30AUG2014 / 16:24 UTC Location: Curitiba Aerodrome (SBBI) Lat. 25°23'49"S Long. 049°14'48"W Municipality – State: Curitiba – Paraná.	Type(s): Loss of Control in Flight.

1.1 History of the flight.

At 13:22 UTC, the aircraft took off from SBBI, destined for SSOK, with three passengers and the pilot on board.

After taking off, the aircraft lost altitude and crashed in an urban area located beyond the departure end of the runway. There was post-impact fire.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	1	2	-
Serious	-	1	-
Minor	-	-	-
None	-	-	-

1.3 Damage to the aircraft.

The aircraft was destroyed by the impact and post-impact fire.

1.4 Other damage.

In its fall, the aircraft first hit the roof of a house, then a vehicle parked in the street, and, finally, the front part of another house.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Hours Flown		Pilot
Total		Unknown
Total in the last 30 days		Unknown
Total in the last 24 hours		Unknown
In this type of aircraft		Unknown
In this type in the last 30 days		Unknown
In this type in the last 24 hours		Unknown

N.B.: The pilot's flight logbook could not be found.

1.5.2 Professional formation.

The pilot did his Private Pilot Course (airplane category) at the Aeroclub de Londrina - State of Paraná - in 2008.

1.5.3 Category of licenses and validity of certificates.

The pilot held a Commercial Pilot license (airplane category), as well as a valid ASEL and AMEL technical qualification certificate.

His IFR rating was overdue since March 2014.

1.5.4 Qualification and flight experience.

The pilot held valid qualification certificates for ASEL and AMEL aircraft, but it was not possible for the investigation commission to verify his whole flight experience.

Since the pilot's flight logbook was missing, it was not possible to determine his flight experience as a whole. A few information items were obtained from the Pilots' Electronic Flight Logbook records on the ANAC's website, with the latest flight information being entered on 13 May 2010.

The total numbers found in the aforementioned records amounted to 240 hours. However, the pilot had been flying for at least 6 years, and had several qualification certificates in his licenses.

1.5.5 Validity of medical certificate.

The pilot had a valid Aeronautical Medical Certificate (CMA).

1.6 Aircraft information.

The SN177-01468 aircraft was manufactured by Cessna Aircraft in 1970, as was registered in the Private Air Services (TPP) category.

The airworthiness certificate (CA) was valid.

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

The last overhaul of the aircraft ("200 hours" type) was done on 31 July 2014 by *OUTRA (Oficinas Unidas de Trabalho Aeronáutico Ltda.)* workshop in Londrina, State of Paraná. After the overhaul, the aircraft flew 15 hours and 10 minutes.

The last inspection of the aircraft ("Annual Maintenance Inspection" type) was done on 31 July 2014 by *OUTRA (Oficinas Unidas de Trabalho Aeronáutico Ltda.)* workshop in Londrina, State of Paraná. After the inspection, the aircraft flew 15 hours and 10 minutes.

1.7 Meteorological information.

The prevailing meteorological conditions were VMC, according to the SBBI routine aerodrome weather reports (METAR)

METAR SBBI 301500Z 1500KT CAVOK 20/09 Q1023=

METAR SBBI 301600Z 2400KT CAVOK 22/09 Q1022=.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

SBBI was a public/military aerodrome under the administration of INFRAERO, operating VFR and IFR during day- and night-time.

It had an asphalt runway with thresholds 18/36, measuring 1,390m x 30m, at an elevation of 3,057 ft.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The accident occurred in an urban area in the district of *Bacacheri*, at a distance of 1,200 meters from the runway 18 threshold of SBBI.

The aircraft wreckage presented a concentrated distribution.

Before the frontal impact of the aircraft with a house (main impact), the aircraft hit the roof of another house and a car parked in the street.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Not investigated.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

The pilot started his aviation career in 2008, when did his private pilot course at the *Aeroclube de Londrina*. Two years later, in this same flying school, he was given the theoretical classes of the commercial pilot course. Pilot's acquaintances believe that his practical classes of the commercial pilot course were delivered aboard private airplanes.

In 2012, he worked eight months as copilot for a valuables-transport company in SBBI, being dismissed on account of a contingent company's downsizing policy. In the same year, he underwent a selective process for a position of Flight Instructor in the *Aeroclube de Londrina*, where he even did a psychological evaluation but did not get the job for not having obtained a satisfactory result.

In the time of the accident, he did not have employment bonds with any companies. Since 2013, he had been working as a freelancer, and his work routine was basically spending the day waiting for a flight in the hangar of the aircraft owner in a maintenance workshop of Londrina Airport. His work routine usually began at 6 a.m. and finished at 9 p.m.

Relatively to his career objectives, the pilot looked forward to being hired by a person who was later one of the passengers involved in the accident.

In the period of two days preceding the accident, the pilot had been engaged in flights departing from SSOK, transporting material for an aviation fair, in which he and the aircraft owner were participating.

On the day before the accident, he flew from SSOK to SBMG in another aircraft, and spent the whole day in the aviation fair. On account of preparations for the next day of the fair, he remained in Maringá for the overnight, something that he had not planned.

On the day of the accident, the aircraft owner, who was also a pilot, utilized the PT-DLA aircraft on a flight from SSOK to SBMG, with his own family on board.

After arriving in Maringá, the aircraft owner lent it to a friend who needed to pick up two passengers in SBBI and take them to Londrina. In this flight to SBBI, the pilot transported two friends of his, as well as a friend of the aircraft owner. The pilot's friends, who disembarked in SBBI, later said that the flight had been uneventful.

On the return flight from SBBI, the persons on board the aircraft were the pilot, the aircraft owner's friend mentioned in the paragraph above, and two other passengers who were being taken to Londrina.

Persons who had been with the pilot in SBBI had noticed that he was kind of reckless and disperse in the moments before takeoff. As an example, they mentioned a certain haste to refuel the aircraft, in order to takeoff in the shortest possible time.

In the leg SBMG-SBBI, the luggage belonging to the owner and his family was on board, since they would spend the day in the fair before going to a hotel.

Friends, family members, and workmates described the pilot as a humble, charismatic, and rather phlegmatic person. In relation to his professional characteristics, they said that he was not used to studying, reading manuals, or deepening his knowledge of the aircraft he flew.

The investigation commission learned that he had good relationship with professionals of the aviation area with whom he had contact, and always attended social events promoted by them.

The aircraft owner became proprietor of the company in 2006. Initially, the company functioned as an flying school for ultra-light pilots, but later began to work in the area of purchase and sale of foreign aircraft, with the purpose of selling them in Brazil or reutilizing their parts. In the time of the accident, the company owner had around fifteen aircraft.

The aircraft owner met the accident pilot in 2013, when this latter came to the hangar looking for a job. The pilot began to work for the aircraft owner as a freelancer, without being formally hired by means of a work contract.

Most of the flights were not programmed in advance, and were susceptible to changes during the day. According to family members, the pilot would sometimes spend the night in other cities on account of something unexpected during the flight legs.

Due to the fact that the company worked with purchase and sale of aircraft, turnover of airplanes was high, and the pilot was always operating different types of equipment.

1.14 Fire.

Fire began immediately after impact. The combustion material was the aircraft fuel, and the ignition source was probably the strong friction of the aircraft with the ground.

Until the arrival of the firefighters, passers-by tried to extinguish the fire in the aircraft utilizing extinguishers taken from their cars.

1.15 Survival aspects.

After the impact, one of the passengers was thrown out of the aircraft. The two other passengers and the pilot were removed from the airplane by persons who witnessed the crash.

1.16 Tests and research.

The Lycoming engine (O-360-A1F6, SN L-14951-36A) equipping the accident aircraft was submitted to analysis.

The engine disassembly was performed in the presence of representatives designated by the Department of Aerospace Science and Technology (DCTA) and by the 5th Regional Aeronautical Accident Investigation and Prevention Service (SERIPA V).

The technical report issued by the DCTA informed that no evidence of malfunctioning or internal damage was found that could have resulted in engine failure, indicating that the engine was in operating conditions at the moment of the accident.

1.17 Organizational and management information.

Nil.

1.18 Operational information.

On the day of the accident, the aircraft started operations by taking off from SSOK, destined first for SBMG, and then for SBBI.

According to information collected, these two first flight legs were uneventful.

After landing in SBBI, the aircraft was refueled with 151 liters (40 US GAL) of AvGas, according to the refueling voucher. Considering that the maximum fuel capacity of the aircraft was 50 US GAL (Page 2-1 of the aircraft manual), and that the aircraft would have landed in SBBI with remaining fuel, it is possible to assume that the tanks had been filled to the maximum capacity. This fact was confirmed by the employee of the company that did the refueling.

Besides the pilot and the three passengers with their respective baggage, the aircraft was still carrying all the luggage of the first flight of the day (the one between SSOK and SBMG).

According to the passenger who survived the accident, the entire luggage had been accommodated in the baggage compartment (behind the passenger seats). The weight of the luggage according to the post-accident field investigation was 176.36 lb. (80 kg).

The calculation of the aircraft takeoff weight and center of gravity was made after identification of the positions of the passengers and cargo in the aircraft, based on the following data:

Specification	Position	Weight (Lb.)
Basic weight of aircraft	-	1,599.83
Pilot	Left front seat	220.46
Passenger 1	Right front seat	264.55
Passenger 2	Left back seat	198.41
Passenger 3	Right back seat	143.30
Baggage	Baggage compartment	176.36
Fuel	Tanks	292.00
Oil	-	15.00

The calculation of the total weight after the aircraft was loaded reached the value of 2,909.91 lb.

The maximum takeoff weight prescribed in the aircraft flight manual was 2,500 lb. The total weight of the aircraft at the moment of takeoff was, therefore, 409.91 lb. above the maximum prescribed for the aircraft in that phase of operation.

Additionally, the weight values were transferred to the diagram of the page 4-7 of the manual, so that the moments of load for each section of the airplane could be obtained, as seen in Figure 1:

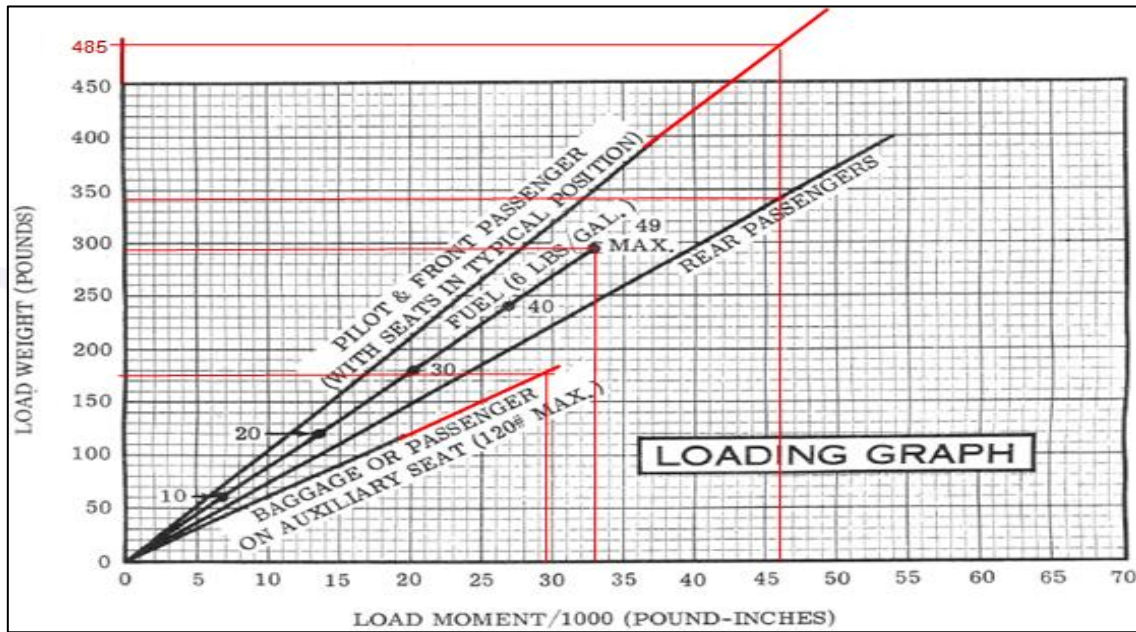


Figure 1 – Diagram for obtainment of the load moment.

The weight limits relative to the front seats and cargo compartment (max. 120 lb.) were exceeded. In the diagram, such values were inserted merely for illustration (in red).

The values obtained for each section were inserted in the table of page 4-6 for calculation of the total numbers of the load weight and moment:

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (lb. -ins. /1000)	Weight (lbs.)	Moment (lb. -ins. /1000)
1. Licensed Empty Weight (Sample Airplane)	1465	151.1	1.599,83	164,2
2. Oil (8 Qts. - Full oil may be assumed for all flights)	15	0.7	15	0.7
3. Fuel (49 Gal. at 6 Lbs./Gallon)	294	32.9	292	33
4. Pilot and Front Passenger	340	31.6	485,01	46
5. Rear Passenger	340	45.9	341,71	46
6. Baggage (or Passenger on Auxiliary Seat)	46	7.5	176,36	29,6
7. TOTAL WEIGHT AND MOMENT	2500	269.7	2.909,91	319,5
8. Locate this point (2500 at 269.7) on the center of gravity moment envelope, and since this point falls within the envelope, the loading is acceptable.				

Figure 2 – Table for obtainment of total loading.

After the total values were obtained, they were inserted in the aircraft center-of-gravity diagram, as seen in the Figure 3 below:

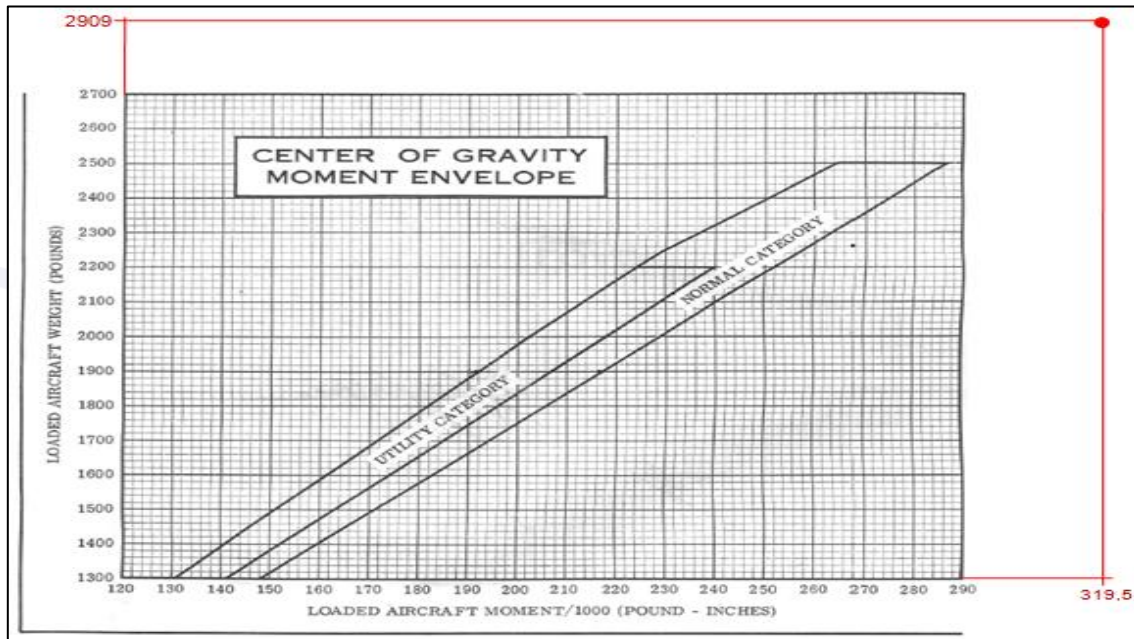


Figure 3 – Diagram of the Aircraft Center of Gravity.

Thus, in a mere illustrative fashion, one verifies that the limits of the aircraft center of gravity and maximum takeoff weight were considerably outside of the envelope certified for the aircraft.

1.19 Additional information.

CG location X Flight balance

The position of the CG influences the flight characteristics of the aircraft. The CG, when pronouncedly displaced forward, makes it difficult to 'rotate' the airplane at takeoffs and landings. It is difficult for the aircraft nose to go up, even if strength is applied to the elevators.

Conversely, if the CG is moved well backwards, the aircraft may take off before the necessary minimum speed is reached. During the climb, the aircraft tends to assume a pitch-up attitude, and it may enter unanticipated stalls or even spins.

Images

Videos of the takeoff were made by INFRAERO security cameras, making it possible to observe that the aircraft had frozen in a pitch-up attitude, that is, it was flying level despite a high angle of attack.

GPS data

The aircraft was equipped with a GARMIM-GPSMAP 696 GPS.

Data retrieved from the GPS showed that the aircraft started the takeoff at a ground speed of 60 mph. Upon getting airborne, the aircraft climbed 70 ft, reached a maximum speed of 68 mph, and then began a pronounced descent.

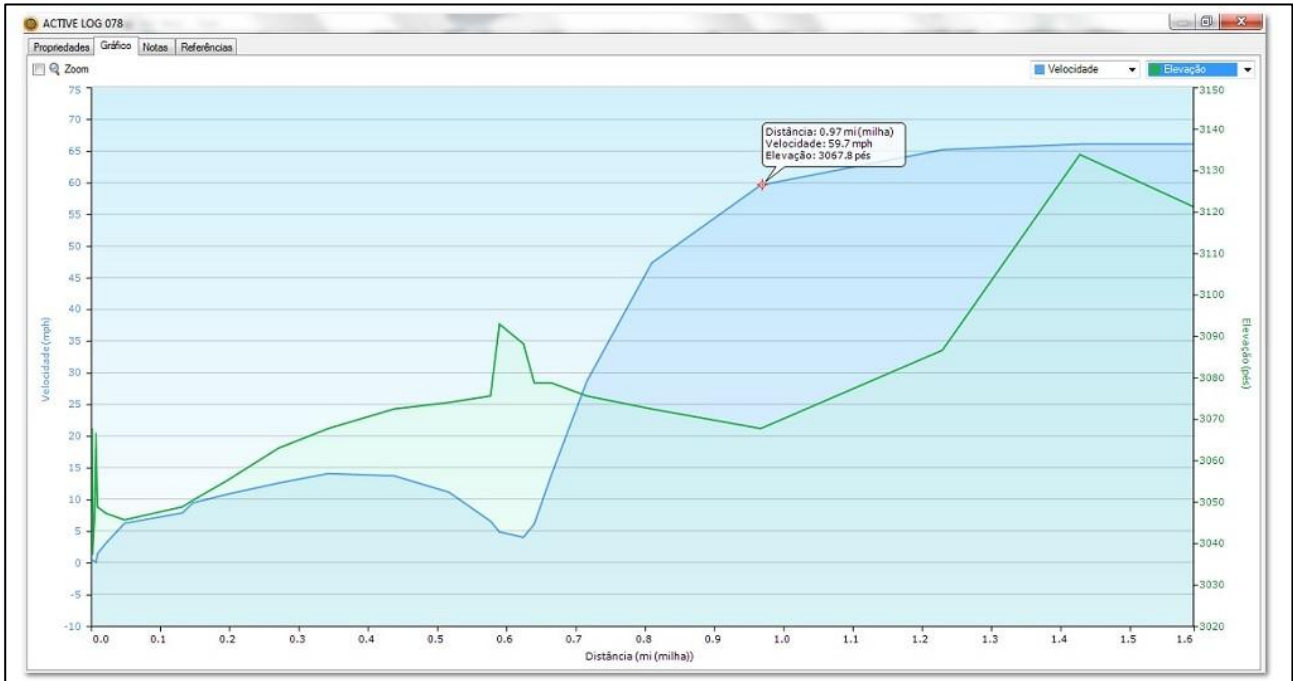


Figure 4 – Speed and elevation diagram.

In Figure 5 below, it is possible to observe (line 22) that the aircraft reached a maximum speed of 68 mph.

ACTIVE LOG 078

Propriedades Gráfico Notas Referências

ACTIVE LOG 078

Resumo: Pontos: 25, Distância: 1.6 mi (milha), Área: 0.1 milhas quadradas

Horário: Duração: 0:17:13, Tempo em movimento: 0:05:04, Tempo de parada: 0:12:09

Velocidade: Média: 5.6 mph, Movimento médio: 18.9 mph, Mínimo: 0.0 mph, Máximo: 68 mph

Elevação: Mínimo: 3039 pés, Subida: 108 pés, Máximo: 3134 pés, Descida: 50 pés, Grau: 0.6 %

Índi...	Elevaç...	Distância da fase	Duração do trecho	Velocidade do trecho	Percurso do trecho	Horário	Posição
1	3068 pés	6 pés	0:00:09	0.5 mph	278.2° verdadeiro	30/08/2014 13:07:17	S25° 24.198' W49° 13.816'
2	3039 pés	14 pés	0:02:29	0.1 mph	66.2° verdadeiro	30/08/2014 13:07:26	S25° 24.198' W49° 13.818'
3	3047 pés	9 pés	0:04:25	0.0 mph	117.0° verdadeiro	30/08/2014 13:09:55	S25° 24.197' W49° 13.815'
4	3064 pés	11 pés	0:03:39	0.0 mph	278.1° verdadeiro	30/08/2014 13:14:20	S25° 24.197' W49° 13.814'
5	3049 pés	65 pés	0:00:11	4.0 mph	156.2° verdadeiro	30/08/2014 13:17:59	S25° 24.197' W49° 13.816'
6	3047 pés	141 pés	0:00:19	5 mph	221.7° verdadeiro	30/08/2014 13:18:10	S25° 24.207' W49° 13.811'
7	3046 pés	442 pés	0:00:32	9 mph	247.1° verdadeiro	30/08/2014 13:18:29	S25° 24.224' W49° 13.828'
8	3049 pés	79 pés	0:00:06	9 mph	242.2° verdadeiro	30/08/2014 13:19:01	S25° 24.253' W49° 13.902'
9	3050 pés	260 pés	0:00:18	10 mph	155.2° verdadeiro	30/08/2014 13:19:07	S25° 24.259' W49° 13.915'
10	3055 pés	395 pés	0:00:20	13 mph	155.4° verdadeiro	30/08/2014 13:19:25	S25° 24.297' W49° 13.895'
11	3063 pés	378 pés	0:00:18	14 mph	156.6° verdadeiro	30/08/2014 13:19:45	S25° 24.356' W49° 13.865'
12	3068 pés	504 pés	0:00:24	14 mph	156.8° verdadeiro	30/08/2014 13:20:03	S25° 24.413' W49° 13.838'
13	3072 pés	419 pés	0:00:23	12 mph	157.4° verdadeiro	30/08/2014 13:20:27	S25° 24.489' W49° 13.802'
14	3074 pés	318 pés	0:00:33	7 mph	157.9° verdadeiro	30/08/2014 13:20:50	S25° 24.553' W49° 13.773'
15	3076 pés	68 pés	0:01:27	0.5 mph	160.0° verdadeiro	30/08/2014 13:21:23	S25° 24.601' W49° 13.751'
16	3093 pés	183 pés	0:00:17	7 mph	186.4° verdadeiro	30/08/2014 13:22:50	S25° 24.612' W49° 13.747'
17	3088 pés	83 pés	0:00:14	4.0 mph	244.2° verdadeiro	30/08/2014 13:23:07	S25° 24.642' W49° 13.750'
18	3079 pés	131 pés	0:00:13	7 mph	334.0° verdadeiro	30/08/2014 13:23:21	S25° 24.648' W49° 13.764'
19	3079 pés	270 pés	0:00:06	31 mph	337.3° verdadeiro	30/08/2014 13:23:34	S25° 24.628' W49° 13.774'
20	3076 pés	496 pés	0:00:07	48 mph	338.0° verdadeiro	30/08/2014 13:23:40	S25° 24.587' W49° 13.793'
21	3072 pés	0.2 mi (milha)	0:00:09	63 mph	338.0° verdadeiro	30/08/2014 13:23:47	S25° 24.512' W49° 13.827'
22	3068 pés	0.3 mi (milha)	0:00:14	68 mph	338.5° verdadeiro	30/08/2014 13:23:56	S25° 24.385' W49° 13.884'
23	3087 pés	0.2 mi (milha)	0:00:11	65 mph	336.9° verdadeiro	30/08/2014 13:24:10	S25° 24.173' W49° 13.976'
24	3134 pés	0.2 mi (milha)	0:00:09	66 mph	337.1° verdadeiro	30/08/2014 13:24:21	S25° 24.014' W49° 14.051'
25	3121 pés					30/08/2014 13:24:30	S25° 23.883' W49° 14.112'

Centralizar mapa

Filtro... Inverter Criar rota... Criar aventura... Imprimir...

Figure 5 – GPS information.

Check List

The procedures for a Normal Takeoff prescribed in the checklist were the ones listed below:

- 1- *Wing Flaps - 0° to 10° (10° preferred).*
- 2- *Carburetor Heat – Cold.*
- 3- *Power – Full throttle (applied smoothly), and 2700 RPM.*
- 4- *Airplane Attitude – Lift nose wheel at 60 mph.*
- 5- *Climb Speed – 75 to 85 mph.*
- 6- *Retract flaps (if extended).*

In the post-accident field investigation, the aircraft flaps were found in the “up” position (retracted).

Regulation on the weight of aircraft

The Brazilian Aeronautical Homologation Regulation (RBHA) 91, in force at the time of the accident, read:

91.605 – WEIGHT LIMITATIONS OF TRANSPORT-CATEGORY CIVIL AIRPLANES

(a) No person is allowed to take off with any transport-category airplane (with the exception of airplanes equipped with turbine engines of the type homologated in the country of origin after 30 September 1958), unless:

(1) The takeoff weight does not exceed the maximum takeoff weight allowed for the departure aerodrome altitude.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

Before the accident flight, the aircraft had flown twice on that day.

The first flight was from SSOK to SBMG, transporting the aircraft owner and his family.

Upon arriving in SBMG, the aircraft owner lent the aircraft (with the pilot) to a friend of his who wanted to fly to SBBI with the objective of picking up two passengers.

The flight between SBMG and SBBI was uneventful.

In SBBI, the aircraft was refueled to its maximum fuel capacity, and the two passengers were picked up.

At the moment of the accident, in addition to the pilot and the three passengers with their respective luggage, the aircraft was carrying all the baggage of the aircraft owner and his family. This baggage had not been removed from the aircraft after the first flight of the day.

Considering that the maximum takeoff weight prescribed was 2,500 lb., the actual aircraft weight was in excess of 409.91 lb.

Another issue was the weight distribution in the aircraft. The baggage items in the baggage compartment weighed 176.36 lb., while the maximum certified weight was 120 lb.

In SBBI, The pilot seemed to be in a hurry to refuel the aircraft with the intent of taking off the soonest possible, something which may have led him to perform an inadequate evaluation of the weight parameters for a safe flight. Since the pilot would have to fly one more leg to SBMG, it is possible that he wanted to shorten the time to be spent

on the ground, in order to fly as soon as possible to the final destination, where the aviation fair was being held (he had attended the fair the days before).

Considering, also, that the pilot was working as a freelancer, and that he was carrying a prospective employer, he may have failed to take a stand in relation to the excess weight, accepting to run the risk of flying in those conditions.

The cargo manifesto with the weight and balance calculation was not found, reinforcing the hypothesis that it may not have been prepared at all.

The possibility of engine failure was ruled out, since the technical report issued by the DCTA stated that no problems had been identified that could have contributed to, the accident.

The investigation commission considers the hypothesis that lack of compliance with of the maximum takeoff weight prescriptions, associated with the excess weight in the cargo compartment, may have altered the aircraft controllability and performance conditions, leading it to not reaching the proper parameters for the climb.

The images of the INFRAERO security cameras showed that the aircraft was flying at a high angle of attack but was not gaining altitude, suggesting that the CG of the aircraft had been displaced backwards.

Information from the GPS showed that the aircraft got airborne at a speed of 60 mph, reaching a maximum altitude of 70 ft AGL at a maximum speed of 68 mph, and then started a pronounced descent. The climb speed prescribed in the flight manual was 75 mph.

The lack of study of aircraft manuals on the part of the pilot may have contributed to his possible lack of knowledge of the aircraft certified weight limits.

Considering, also, that according to witness, the pilot did not have the habit of studying the manuals of the aircraft flown by him, it is reasonable to infer that, with the purpose of increasing the aircraft speed, he may have commanded the retraction of the flaps, something that, associated with the high angle of attack, may have resulted in reduction of lift, which, in turn, led the aircraft to enter a stall condition.

3. CONCLUSIONS.

3.1 Facts.

- a) The pilot held a valid aeronautical medical certificate (CMA);
- b) The pilot held a valid technical qualification certificate (CHT);
- c) The aircraft had a valid airworthiness certificate (CA);
- d) The aircraft was not within the weight and balance limits;
- e) The airframe, engine, and propeller logbook records were updated;
- f) After the takeoff, the aircraft entered a stall condition, lost altitude, and collided with the ground;
- g) The aircraft engine had an operative condition before the accident;
- h) The aircraft was destroyed;
- i) A passenger was seriously injured; and
- j) The pilot and two passengers perished in the crash site.

3.2 Contributing factors.

- **Attitude – a contributor.**

The aircraft excess weight reflects inobservance of the aircraft prescribed procedures on the part of the pilot, an attitude that was reinforced by his lack of habit in reading the aircraft manual.

- **External influences – undetermined.**

The apparent haste shown by the pilot in SBBI may have resulted from his interest in returning more quickly to *Maringá* in order to participate in the aviation fair, which he had attended the days before. Time pressure, even if self-imposed, may produce changes in the cognitive states, compromising one's judgment and decision-making processes.

- **Flight planning – a contributor.**

There was not adequate planning, capable of preventing takeoff outside of the weight and balance envelope.

- **Decision-making process – a contributor.**

The aircraft excess weight reflects a compromised examination of the pieces of information available and necessary for compliance with the limits. This may have resulted from the pilot's lack of adaptation to the aircraft, as well as from other variables, such as his eagerness to take off.

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, criminal, or administrative liability.

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".

Nil.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On October 18th, 2016.

