COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-124/CENIPA/2018

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-DMC**
MODEL:	**PA-34-220T**
DATE:	**22JUL2018**

NOTICE

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

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

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

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

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

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

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

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

SYNOPSIS

This is the Final Report of the 22JUL2018 accident with the PA-34-220T aircraft model, registration PR-DMC. The accident was classified as “[CFIT] Controlled Flight Into Terrain”.

During the approach for landing on the União da Vitória Aerodrome (SSUV) - PR, the aircraft entered a region under weather conditions of restricted visibility, which led the pilot to lose visual contact with the terrain references, causing the plane to impact against the top of trees and, later, against the ground.

The aircraft was destroyed.

The pilot and the passengers died.

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

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ACC-CW	Area Control Center - Curitiba
ANAC	Brazil's National Civil Aviation Agency
BKN	Broken - layer of clouds covering 5 to 7 octaves of the sky
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CFIT	Controlled Flight Into Terrain
CIV	Pilot's Flight Logbook
CMA	Aeronautical Medical Certificate
CPTEC	Weather Forecast and Climate Studies Center
DECEA	Airspace Control Department
DLA	Delay
E	East
EOBT	Estimated Off-Block Time
FL	Flight Level
ft	Feet
GAMET	General Aviation Meteorological Information
GOES	Geostationary Operational Environmental Satellite
IAM	Annual Maintenance Inspection
IFRA	Instrument Flight Rating - Airplane
INPE	National Institute for Space Research
Ltda.	Ltd.
METAR	Meteorological Aerodrome Report
MLTE	Airplane Multi Engine Land Rating
MNTE	Airplane Single Engine Land Rating
N/S	Serial Number
NIL	Nothing
NM	Nautical Miles
NTSB	National Transportation Safety Board (USA)
PCM	Commercial Pilot License – Airplane
PLA	Airline Pilot License – Airplane
PPH	Private Pilot License – Helicopter
PPR	Private Pilot License - Airplane
RADAR	Radio Detection and Ranging
ROTAER	Auxiliary Air Route Manual
SBBI	ICAO Location Designator – Bacacheri Aerodrome, Curitiba - PR
SBGU	ICAO Location Designator – Tancredo Thomas de Faria Aerodrome, Guarapuava - PR

SBPG	ICAO Location Designator – Comandante Antônio Amilton Beraldo Aerodrome, Ponta Grossa - PR
SERIPA V	Fifth Regional Aeronautical Accident Investigation and Prevention Service
SIGWX	Significant Weather
SIPAER	Aeronautical Accident Investigation and Prevention System
SSUV	ICAO Location Designator – União da Vitória Aerodrome, União da Vitória - PR
ST	Stratus
STSC	Stratus cumulus
SW	South-West
TPP	Registration Category of Private Service - Aircraft
UTC	Universal Time Coordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

1. FACTUAL INFORMATION.

Aircraft	**Model:** PA-34-220T **Registration:** PR-DMC **Manufacturer:** Piper Aircraft	**Operator:** *Siderquimica Indústria e Comércio de Produtos Químicos* S/A
Occurrence	**Date/time:** 22JUL2018 - 1240 UTC **Location:** Palmital do Jararaca **Lat.** 26°12'50"S **Long.** 050°44'55"W **Municipality – State:** Paula Freitas – PR	**Type(s):** "[CFIT] Controlled Flight Into Terrain" **Subtype(s):** NIL

1.1 History of the flight.

The aircraft took off from the Tancredo Thomas de Faria Aerodrome (SBGU), Guarapuava - PR, at about 1200 UTC, to the União da Vitória Aerodrome (SSUV) - PR, in order to transport personnel, with a crewmember and two passengers on board.

Approximately 17 NM away from the SSUV, the aircraft collided with the top of some trees and then impacted the ground.

The aircraft was destroyed.

The pilot and the passengers suffered fatal injuries.

1.2 Injuries to persons.

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

1.3 Damage to the aircraft.

The aircraft was destroyed due to collisions with vegetation and the ground. Several segments of the fuselage and wings were scattered and some were attached to the treetops and stems.

The engines detached from the wings. The right engine was found on the ground, among the trees, about 10m away from the fuselage and the left one was inside a stream, about 8m away from it.

The aircraft cabin and instrument panel were completely destroyed. The controls and instruments were scattered on the ground around the fuselage.

Figure 1 - Main concentration of debris after the accident.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours	Pilot
Total	1.408:20
Total in the last 30 days	01:55
Total in the last 24 hours	00:00
In this type of aircraft	364:25
In this type in the last 30 days	01:55
In this type in the last 24 hours	00:00

N.B.: The data related to the total hours of the pilot were obtained through the records of the electronic CIV. The hours in the type of aircraft were obtained from the company he worked for until February 2018.

1.5.2 Personnel training.

The pilot took the PPR course at the Parana's Aeroclub – PR, in 1999.

1.5.3 Category of licenses and validity of certificates.

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

1.5.4 Qualification and flight experience.

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

1.5.5 Validity of medical certificate.

The pilot had valid CMA.

1.6 Aircraft information.

The aircraft PR-DMC, model PA-34-220T, Seneca V, serial number 3449322, was manufactured by Piper Aircraft, in 2005, and it was registered in the TPP category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe, engine and propeller logbooks records were outdated, with the last records referring to the month of May 2018. There was, however, a paper note, with a non-posted record, reporting the partial totals for June, where 43 hours and 20 minutes were posted.

It was later verified that the 43 hours and 20 minutes corresponded to the total flown since the installation of the new engines, in March 2018, carried out at the maintenance organization GAPLAN, in Curitiba - PR.

The last inspection of the aircraft, the "IAM/100hours" type was carried out on 14JUN2018 by the maintenance organization Aeromecânica Ltd., in Curitiba - PR, with the aircraft having accumulated 1,957 hours and 10 minutes.

The aircraft's Logbook was found completely destroyed, and it was not possible to define the total hours flown after the last maintenance intervention occurred on 14JUN2018.

1.7 Meteorological information.

The synoptic analysis, carried out using the available satellite images, did not reveal the presence of frontal systems over the accident area. Likewise, no thunderstorm and/or lightning nucleus were identified in the region (Figures 2 and 3).

Figure 2 - Image of the Geostationary Operational Environmental Satellite 16 (GOES) of the visible spectrum at 1100 (UTC), on 22JUL2018, with an emphasis on the region of the accident.

Figure 3 – Image of the GOES 16 satellite of the visible spectrum at 1245 (UTC), on 22JUL2018, with emphasis on the region of the accident.

Satellite images revealed that there was a large area with low cloud cover, affecting the Eastern half of the states of Parana and Santa Catarina, including the region of the accident.

Due to SSUV does not have a METAR, it was not possible to specify the height of the base of the layer (ceiling) in the region.

The GAMET (Area or Sub-Area Forecast) for the period from 6:00 am to 2:00 pm (UTC) predicted visibility between 1,500 and 5,000m due to the humid fog East of the 052W meridian. The base of the cloud layer between 5/8 and 7/8 coverage was estimated between 200ft and 1,200ft above ground level (Figure 4).

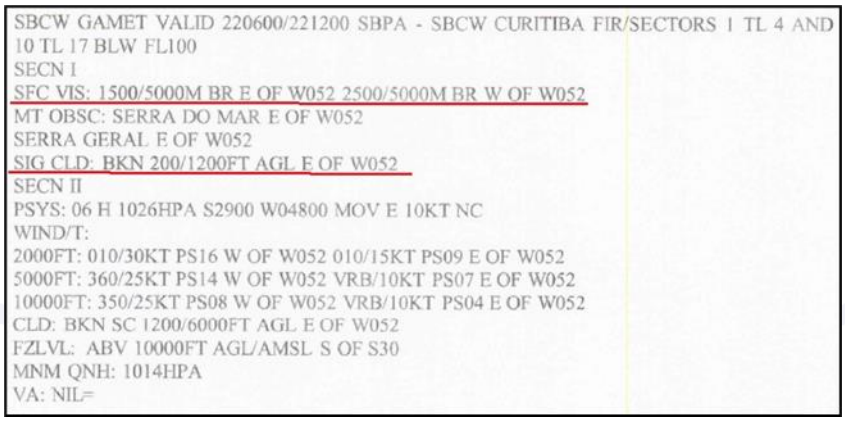
SBCW GAMET VALID 220600/221200 SBPA - SBCW CURITIBA FIR/SECTORS 1 TL 4 AND
10 TL 17 BLW FL100
SECN I
SFC VIS: 1500/5000M BR E OF W052 2500/5000M BR W OF W052
MT OBSC: SERRA DO MAR E OF W052
SERRA GERAL E OF W052
SIG CLD: BKN 200/1200FT AGL E OF W052
SECN II
PSYS: 06 H 1026HPA S2900 W04800 MOV E 10KT NC
WIND/T:
2000FT: 010/30KT PS16 W OF W052 010/15KT PS09 E OF W052
5000FT: 360/25KT PS14 W OF W052 VRB/10KT PS07 E OF W052
10000FT: 350/25KT PS08 W OF W052 VRB/10KT PS04 E OF W052
CLD: BKN SC 1200/6000FT AGL E OF W052
FZLVL: ABV 10000FT AGL/AMSL S OF S30
MNM QNH: 1014HPA
VA: NIL=

Figure 4 - GAMET of 22JUL2018, valid from 6:00 am to 12:00 pm (UTC).

A new GAMET message, for the period from 1200 to 1800 (UTC), predicted visibility between 3,000 and 5,000m due to humid fog East of the 052W meridian, in the interval between 1200 and 1400 (UTC). The base of the cloud layer between 5/8 and 7/8 of coverage was estimated to be between 800 and 2,000 ft above ground level in the same region and at the same time interval (Figure 5).

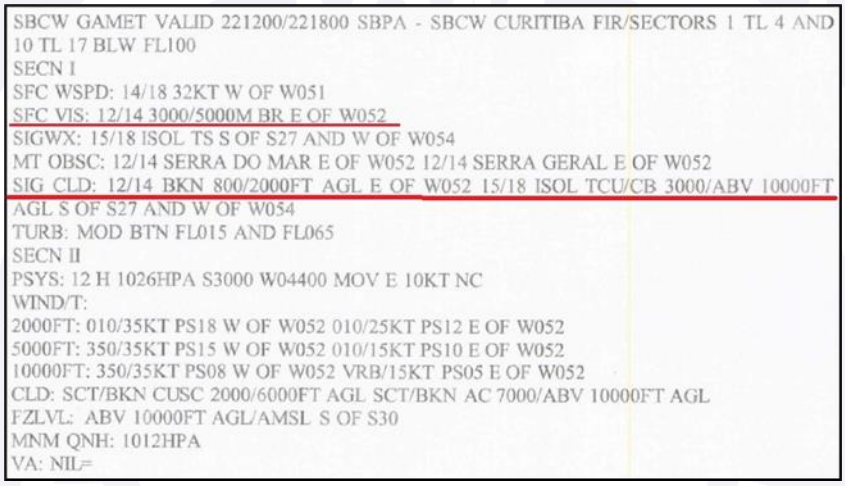
SBCW GAMET VALID 221200/221800 SBPA - SBCW CURITIBA FIR/SECTORS 1 TL 4 AND
10 TL 17 BLW FL100
SECN I
SFC WSPD: 14/18 32KT W OF W051
SFC VIS: 12/14 3000/5000M BR E OF W052
SIGWX: 15/18 ISOL TS S OF S27 AND W OF W054
MT OBSC: 12/14 SERRA DO MAR E OF W052 12/14 SERRA GERAL E OF W052
SIG CLD: 12/14 BKN 800/2000FT AGL E OF W052 15/18 ISOL TCU/CB 3000/ABV 10000FT
AGL S OF S27 AND W OF W054
TURB: MOD BTN FL015 AND FL065
SECN II
PSYS: 12 H 1026HPA S3000 W04400 MOV E 10KT NC
WIND/T:
2000FT: 010/35KT PS18 W OF W052 010/25KT PS12 E OF W052
5000FT: 350/35KT PS15 W OF W052 010/15KT PS10 E OF W052
10000FT: 350/35KT PS08 W OF W052 VRB/15KT PS05 E OF W052
CLD: SCT/BKN CUSC 2000/6000FT AGL SCT/BKN AC 7000/ABV 10000FT AGL
FZLVL: ABV 10000FT AGL/AMSL S OF S30
MNM QNH: 1012HPA
VA: NIL=

Figure 5 - GAMET of 22JUL2018, valid from 1200 to 1800 (UTC).

According to SIGWX from 1200 (UTC), valid from 9:00 am to 3:00 pm (UTC) for the region that included the accident site, fog was expected to occur in a large area, weather cloudy (BKN - 5 to 7 octaves coverage), Stratus (ST) and Stratus Cumulus (SC) clouds, with base at 800ft and top at 3,000ft (Figure 6).

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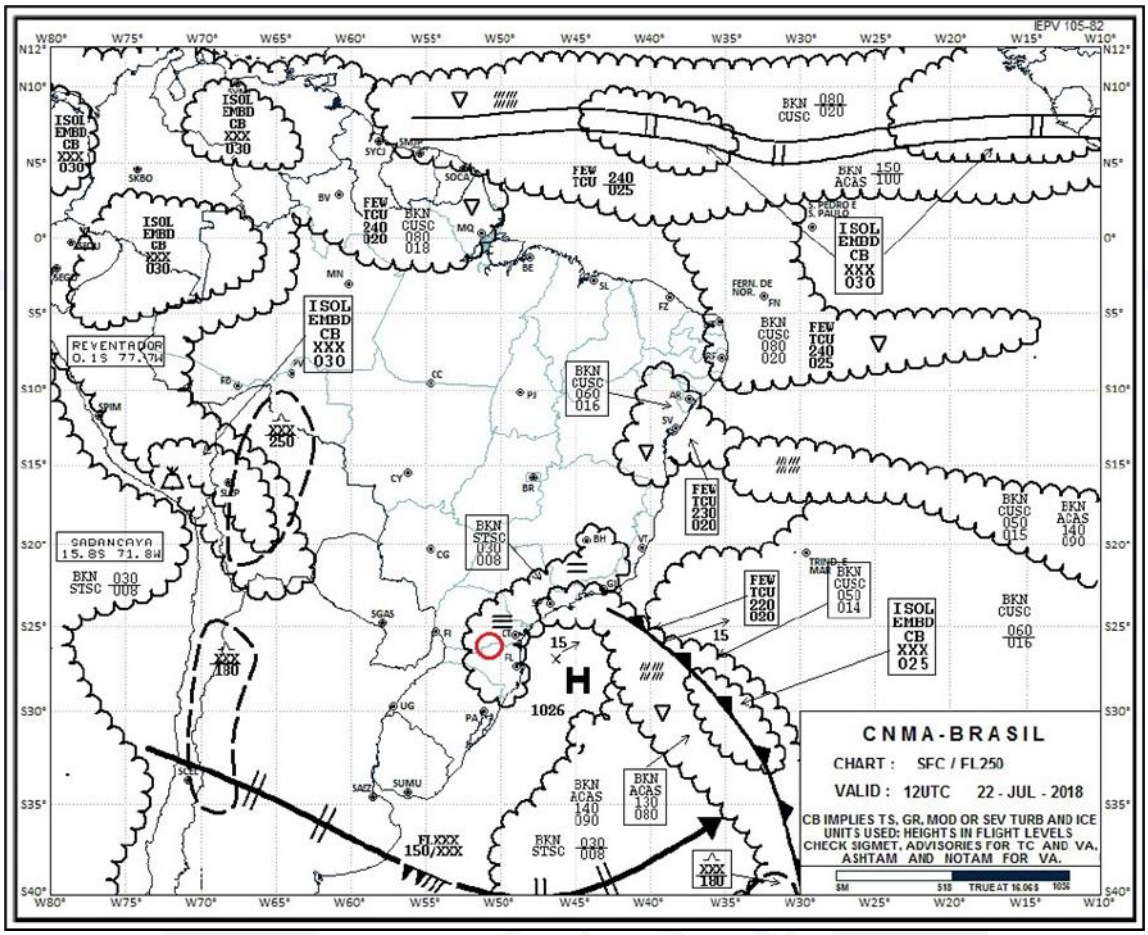

Figure 6 - SIGWX chart dated 22JUL2018, from 1200 UTC, highlighting the region of the accident.

The GOES 16 satellite image, generated by the INPE and the CPTEC, indicated the occurrence of fog in the region that included the accident site (Figure 7).

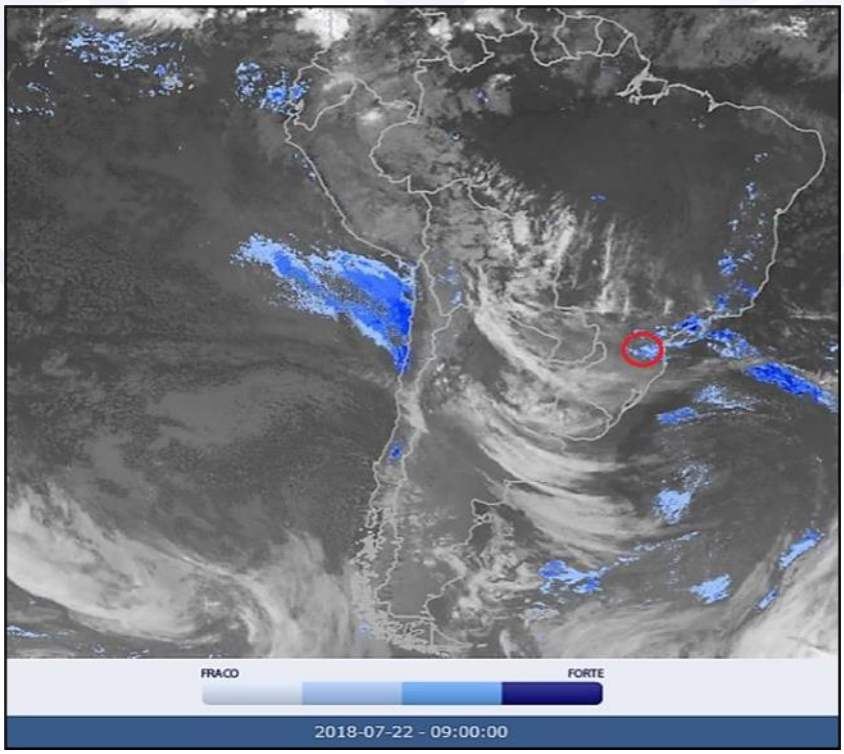

Figure 7 - GOES 16 satellite image indicating the presence of fog at 9:00 am (local), available on the CPTEC/INPE website, highlighting the region of the accident.

Also, according to information from military and civil police officers who attended the incident, and from residents of the city, there was fog typical of the União da Vitória region at the time of the accident.

1.8 Aids to navigation.

Nil.

1.9 Communications.

There was no technical abnormality in the communication equipment during the flight and the information was clearly transmitted between the aircraft and the air traffic control agencies. The last contact took place at 1156 UTC, when the aircraft reported its estimated time of landing, 1215 UTC, to the Curitiba Area Control Center (ACC-CW).

1.10 Aerodrome information.

The SSUV Aerodrome was public, administered by the Municipality of União da Vitória - PR, and operated under VFR during daytime.

The runway was made of asphalt, with 16/34 thresholds, dimensions of 1,000 x 30 m, with an elevation of 2,467ft.

It had, as obstacles:

- a hill (Morro do Cristo) 3,490m away from threshold 16 in the North sector (N), with an elevation of 3,126ft;
- an antenna with an elevation of 3,147 ft, 1,800 m away in the Southwest (SW) sector of the aerodrome;
- a hill with an elevation of 2,822ft, distant 2,300m in the East sector (E) of the Aerodrome; and
- a telephone tower with an elevation of 3,126ft, 1,800m away in the SW sector of the Aerodrome.

The traffic circuit should be carried out at 1,500m of height (3,960ft of altitude) and the minimum height for the realization of the circuit was 1,300ft, according to information from the ROTAER.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The wreckage was located 17 NM from SSUV.

According to physical evidence from the impact site, the aircraft was flying on a 190° course when it collided with eucalyptus trees, in the rural area of the municipality of Paula Freitas - PR, in a region of difficult access.

The site comprised a stream with an approximate width of 1.5m and a depth of about 2m, bordering the eucalyptus plantation to the Southeast. The relief of the place was predominantly irregular, with a negative slope in the direction of the aircraft's displacement.

The highest point on the ground, which contained affected trees, was about 750m (2,460 ft) of altitude and the highest trees affected had an average height of 15m (49 ft), measured from the ground to the top, totaling about of 2,509ft of altitude.

Signals of the aircraft crashing into vegetation and ground extended for about 60m from the site of the first impact against the eucalyptus trees to the complete stop of the main fuselage assembly. The degree of tree destruction suggests that the aircraft was at a high horizontal speed at the time of impact (Figure 8).

Figure 8 - View of damage caused to vegetation, from the opposite direction to the displacement of the aircraft.

The engines detached from the wings. The right one was found on the ground among the trees, about 10m away from the fuselage. The left one was inside the stream, about 8m away from it (Figure 9).

Figure 9 - Final disposition of the wreckage.

The degree of destruction of the aircraft and the difficulty in removing the components made it impossible to check equipment and instruments.

For the same reasons, it was not possible to perform a more detailed check of the command cables, however, from what could be observed, the cables broke due to overload because of the impacts of the aircraft.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

The pilot, at his last health inspection, had appeared able, without restrictions. He had no medical history that could lead to sudden illness. He had a family history of myocardial infarction and, as a result, kept his cardiac exams up to date. These exams indicated normality and there were no symptoms or clinical signs prior to the accident.

There were no technical conditions for the collection of material for psychotropic examinations.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

The pilot was 44 years old and was described as passionate about aviation, dedicated and demanding about flight safety. He got his first license when he was 18 and, around 33, started flying professionally. He worked in aerial survey aviation, air taxi and later in executive aviation.

He had been flying for the owner of the crashed aircraft since January 2018. According to the reports obtained, he had a good relationship with the owner of the company and was satisfied with his autonomy at work, salary and benefits.

At the time of the accident, the owner had lent the aircraft to transport a friend who needed to fulfill his political campaign schedule.

This friend was described by interviewees as a pleasant and polite person. He arrived at 1100 (UTC) in Guarapuava, informed that he would not proceed to Ponta Grossa - PR, and he asked that, after União da Vitória - PR, the flight would continue straight to Curitiba - PR.

At 1130 (UTC), the pilot contacted employees at the União da Vitória airport by telephone to obtain information on operating conditions. At the time, officials informed that the weather was unfavorable for VFR flights.

The takeoff from Guarapuava - PR, to União da Vitória - PR, was scheduled for 1130 (UTC), but it only took place around 1200 (UTC).

After the leg to the city of União da Vitória, the aircraft would continue to Curitiba - PR, as the passenger would return home and the pilot would attend the birthday of a family member, on the same day.

There was also another passenger on board the aircraft. According to the data obtained, he was a colleague of the pilot, who had a MNTE license, however, expired. In addition, he did not have the MLTE license, required to perform a function on board the PR-DMC aircraft.

According to interviewees, the presence of this colleague was due to the commander's intention to promote experience to this crewmember. This was a common practice to provide the accumulation of hours for beginners and less experienced pilots.

From the information collected, the pilot was used to helping new pilots. However, it was unusual for the pilot to allow a second crewmember to make decisions or to actually pilot the aircraft in such cases.

After the accident, unofficial approach procedures by instruments were found on the aircraft. According to information, it was common for pilots in the region to use that procedure on days when weather conditions were unfavorable for the VFR flight.

1.14 Fire.

It was reported by the police team, who carried out the first assistance for the incident, that there was a characteristic odor of fuel in the area.

In the bodies of two victims, signs of carbonization were observed, indicating that combustion occurred during the accident.

It was also found that there were signs of scorching and burning of vegetation in the area close to the fuselage, indicating that there was fire after the impact against the trees, in the last 20m of the aircraft's displacement.

1.15 Survival aspects.

There were no survivors.

The occupants died from multiple trauma, as a result of the strong impact against the vegetation and ground.

1.16 Tests and research.

The Continental engines, TSIO-360-RB model, serial number (S/N) 1034900 and LTSIO-360-RB, S/N 1034901, that equipped the aircraft were disassembled and analyzed.

As a result of the impact against the trees and the ground, the left engine had severe damage. During the external inspection, the lack of a magnet, damage to the cylinder feed ducts, large amount of mud, damage to the turbocharger, damage to the exhaust duct and absence of other components were observed (Figure 10).

Figure 10 - Right side view of the left engine.

In the bench test, one of the magnets and the spark plugs, which could be analyzed, showed normal operation.

The lubrication system was showing evidence of good functioning and no signs of contamination or obstructions were found. The turbocharger was manually turned and was not stuck, even with the presence of earth inside the turbine.

In the fuel supply system, it was possible to examine only two injection nozzles and they were not clogged. The others had a rupture on the face with the cylinder and it was not possible to remove them. The fuel distributor had a normal diaphragm, despite the impacts resulting from the accident. The fuel pump had several fractures and this made its functional testing and analysis impossible.

The engine cylinders were analyzed and revealed no damage that could have caused the engine to malfunction. In the crankshaft flange, it was observed that part of it broke and became attached to the propeller flange. This was due to the strong impact that the propeller suffered at the time of the accident.

The propeller assembly had fractures and deformations in the three blades, which evidenced the normal functioning of the engine with power development. There were characteristic impact deformations against soft ground or tree, with characteristics of an operating engine with power (Figure 11).

Figure 11 - Detail of fractures and deformations in the three propeller blades of the left engine.

As a result of the series of impacts, the right engine was also severely damaged. It was observed the lack of a magnet, damage to the cylinder feed ducts, large amount of clay, damage to the turbocharger, exhaust duct and lack of other components (Figure 12).

Figure 12 - Front view of the right engine.

Therefore, the disassembly for internal evaluation of its components was performed.

In the ignition system, a magnet was observed and tested, which showed normal functioning. The spark plugs were free of contamination, showing normal functioning.

The lubrication system was showing evidence of good functioning and no signs of contamination or obstructions were found. The turbocharger was manually turned and was not stuck, even with the presence of earth inside the compressor turbine.

In the fuel supply system, it was possible to examine four injection nozzles, which were not clogged. The others had a rupture on the face with the cylinder and it was not possible to remove them. The fuel distributor was with a normal diaphragm and the presence of fuel was observed when disassembled.

The fuel pump was not fractured, however, its pressure adjustment screw had deformation by impact, which made its functional test impossible. It was verified that its drive shaft was intact and not stuck. The servo injection fuel inlet filter was removed to be inspected when it was found to be clean and had fuel in its housing.

The cylinders were analyzed and no damage that could have caused the engine to malfunction was found. The crankshaft flange was deformed due to the impact of the propeller at the time of the accident, but without rupture.

Similar to the left engine, the right engine propeller set had fractures and deformations that were found in the three blades, showing the normal functioning of the engine with power development. The blades also exhibited characteristic deformations from impact against soft ground or trees, and the forward-facing bending, characteristic of an operating engine with power development (Figure 13).

Figure 13 - View of the right propeller blades with forward-facing folds.

Thus, from what could be observed, the evidence indicated that the engines were in operation and that they developed high power at the moment of impact.

1.17 Organizational and management information.

The operator of the PR-DMC aircraft was *Siderquimica Indústria e Comércio de Produtos Químicos* S/A. This company did not have other aircraft and did not provide civil aviation services.

According to the information obtained, the aircraft was used privately (according to its category) to transport company executives, for the owner's personal use or for leisure for his family, and, occasionally, it was lent to friends.

Thus, the pilot did not have a previously established work routine and did not comply with a fixed schedule of daily flights. According to the data collected, flights were carried out sporadically.

The pilot had been hired in January 2018. As there were no other pilots working at the company, he had autonomy in the decision-making process of his activities. The management of the aircraft was delegated to him, including maintenance, but these services required operator approval to be performed.

1.18 Operational information.

According to the initial planning, the aircraft would take off from the Bacacheri Aerodrome (SBBI), Curitiba - PR to SBGU, with the purpose of boarding a passenger. Afterwards, it would go to SSUV; Ponta Grossa - PR (SBPG); and would return to SBBI, according to flight plans (Table 1).

Identificação da aeronave	Aeródromo de decolagem	Aeródromo de destino	Hora estimada de calços fora	Data de início	Estado do plano	Tipo de voo
PR-DMC	SBBI	SBGU	10:00	21/07/2018	Terminado	G
PR-DMC	SBGU	SSUV	11:45	21/07/2018	Terminado	G
PR-DMC	SSUV	SBPG	16:00	21/07/2018	Terminado	G
PR-DMC	SBPG	SBBI	17:00	21/07/2018	Anulado	G

Table 1 - Record of flight plans sent by the PR-DMC.

The flight plan for the SBGU-SSUV leg was issued the day before and provided for EOBT for 1100 (UTC), under VFR rules, at flight level 055 (FL055), with direct heading to destination (173). The estimated time en route was twenty minutes (Figure 14).

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(FPL-PRDMC-VG
-1PA34/L-SCDFGR/C
-SBGU1100
-N0170F055 DCT
-SSUV0020 SBBI
-PBN/B2C2D2O2S1 DOF/180722 OPR/SIDERQUIMICA ORGN/SBCTYOYX PER/B
RMK/FROM SBBI)
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Figure 14 - Flight plan information issued for leg SBGU - SSUV.

At 1139 (UTC) on 22JUL2018, a delay message (DLA) with EOBT was transmitted to 1145 (UTC).

Upon arriving in Guarapuava - PR, the passenger informed the pilot that he would not proceed to Ponta Grossa - PR and would return to Curitiba - PR, from União da Vitória - PR (SSUV).

In SBGU, the pilot contacted SSUV Aerodrome officials to find out about the meteorological conditions and they would have said that the region was in intense fog, with no visual flight conditions (VMC) to make the landing in that location.

The pilot would then have stated that, if he encountered fog en route, he would fly through the Três Barras location until he found visual conditions and then follow the Iguaçu River to the SSUV (Figure 15).

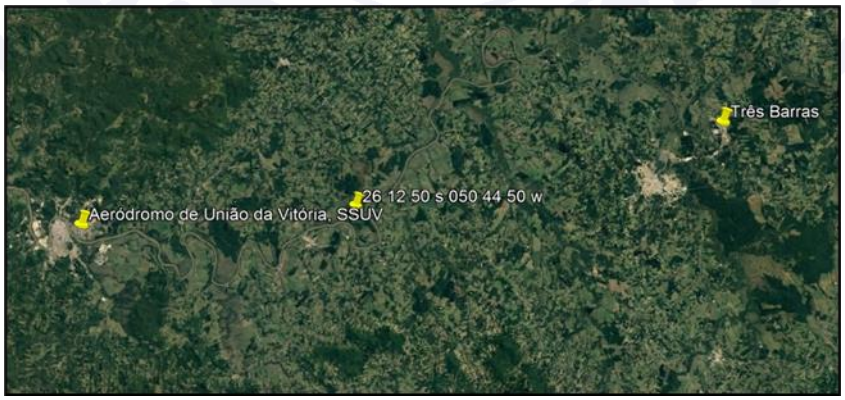

Figure 15 - Planning mentioned by the pilot for the case of fog conditions en route.

The aircraft took off from Guarapuava at about 1150 (UTC).

According to the transcripts of the communication audios between the PR-DMC and the ACC-CW, it was found that the pilot made contact with that Center after taking off from

SBGU to SSUV, informing that he would keep FL055, which estimated the landing at SSUV at 1215 UTC and would report to descent. The last contact with the ACC-CW took place at 1156 UTC.

The aircraft continued the flight without informing for its descent and the last RADAR contact occurred at 1209 UTC, according to the following sequence (Figures 16, 17, 18 and 19):

Figure 16 - RADAR track of PR-DMC aircraft after SSUV takeoff (11h56min47s UTC).

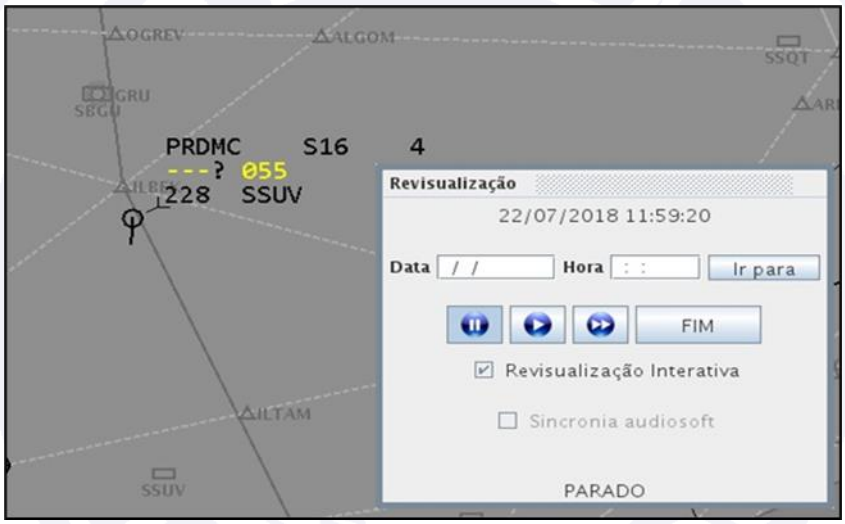

Figure 17 - RADAR track of PR-DMC aircraft generated at 11h59min20s UTC.

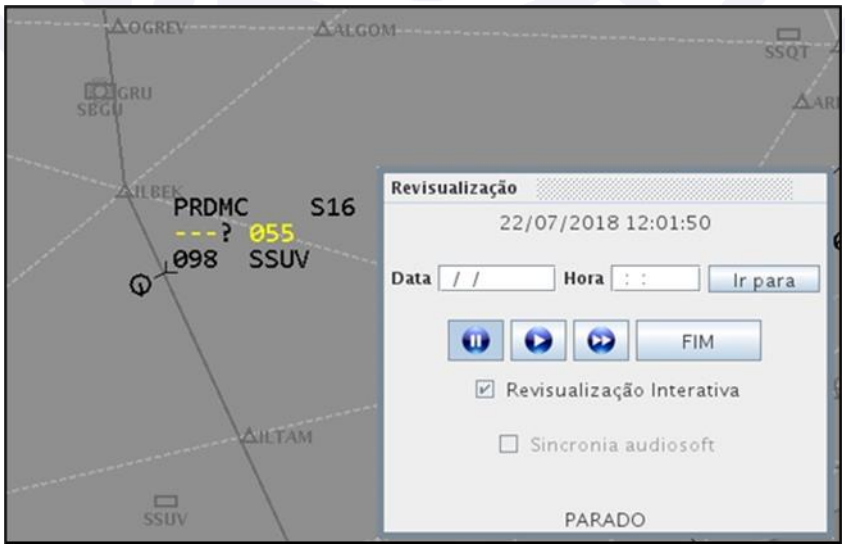

Figure 18 - RADAR track of PR-DMC aircraft generated at 12h01min50s UTC.

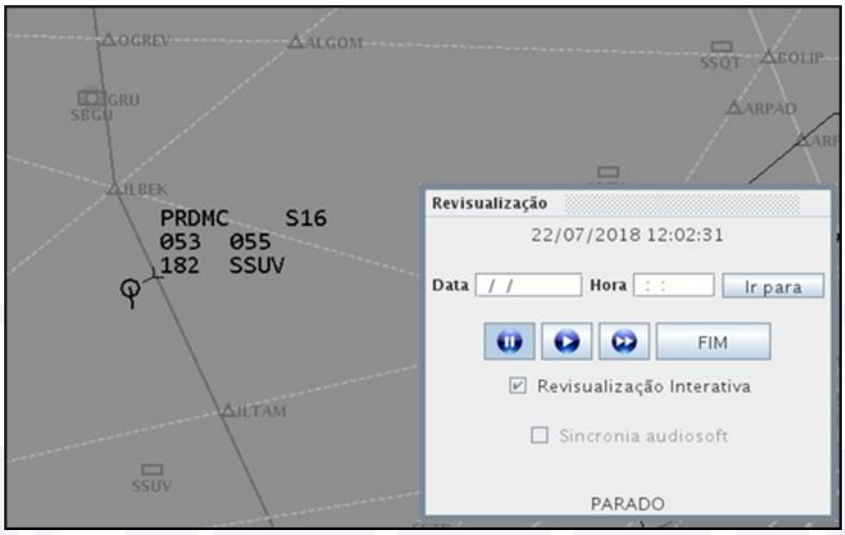

Figure 19 - RADAR track of PR-DMC aircraft generated at 12h02min31s UTC.

By analyzing the sequence of the RADAR images, it is observed that, from 1204 UTC, there was a change of course of the aircraft, which initially flew with the heading of SSUV and then took a heading more to the left of the initial route (Figures 20, 21, 22 and 23).

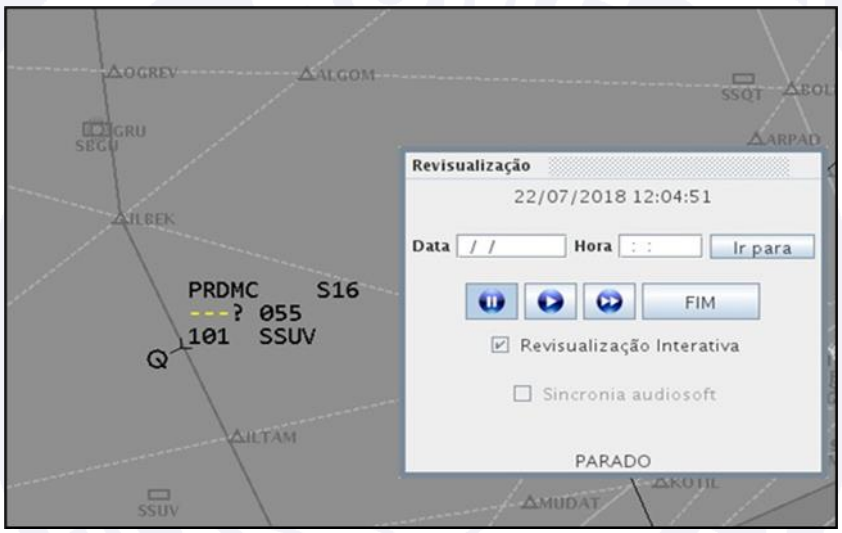

Figure 20 - RADAR track of PR-DMC aircraft generated at 12h04min51s UTC.

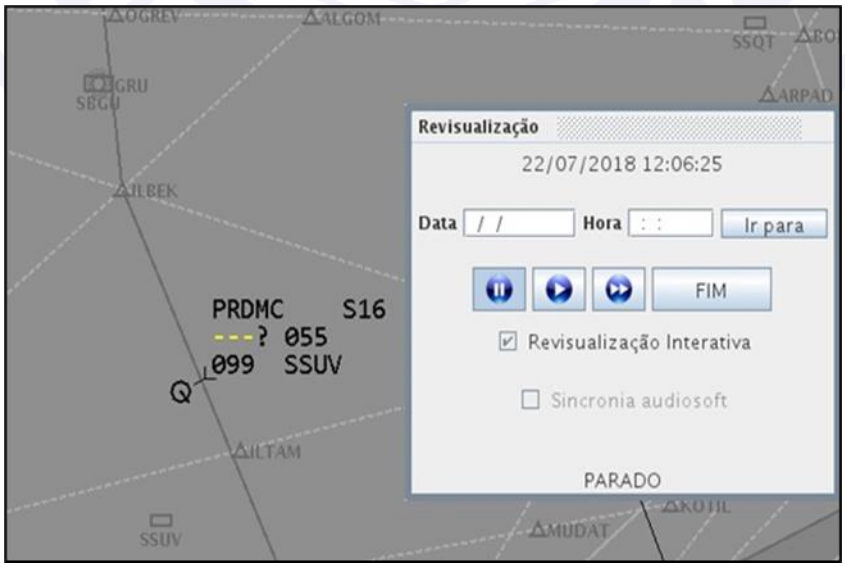

Figure 21 - RADAR track of PR-DMC aircraft generated at 12h06min25s UTC.

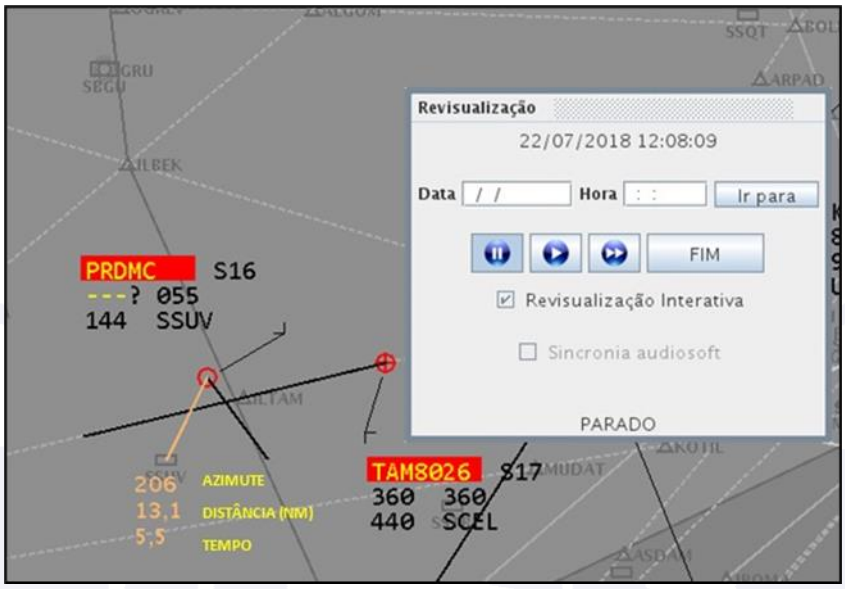

Figure 22 - RADAR track of PR-DMC aircraft generated at 12h08min09s UTC.

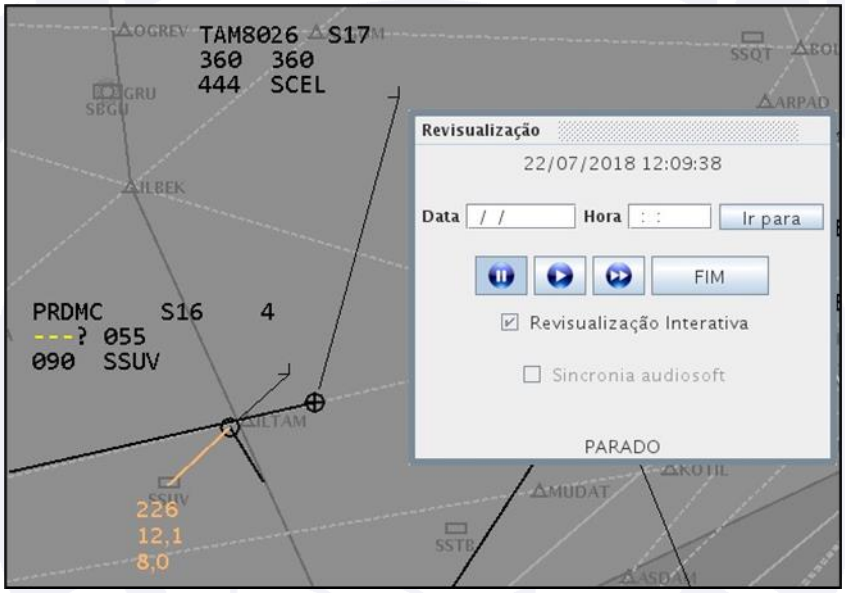

Figure 23 - Last RADAR contact of the PR-DMC aircraft generated at 12h09min38s (UTC).

1.19 Additional information.

Unofficial instrument approach procedure.

An instrument approach procedure consists of a series of predetermined maneuvers, with specific protection against obstacles, up to a position in which the criteria of a waiting circuit or obstacle-free margin en route apply, and must be prepared by experts, according to internationally established safety requirements.

However, a number of unofficial procedures for SBGU and SBPG locations were found on board the aircraft, along with an unofficial procedure for descent into SSUV.

According to reports, the use of these procedures was common among pilots operating in that region, especially on days when weather conditions were restricted.

The accident site was 0.86 NM away from the first point of the unofficial procedure for descent into SSUV (Figure 24).

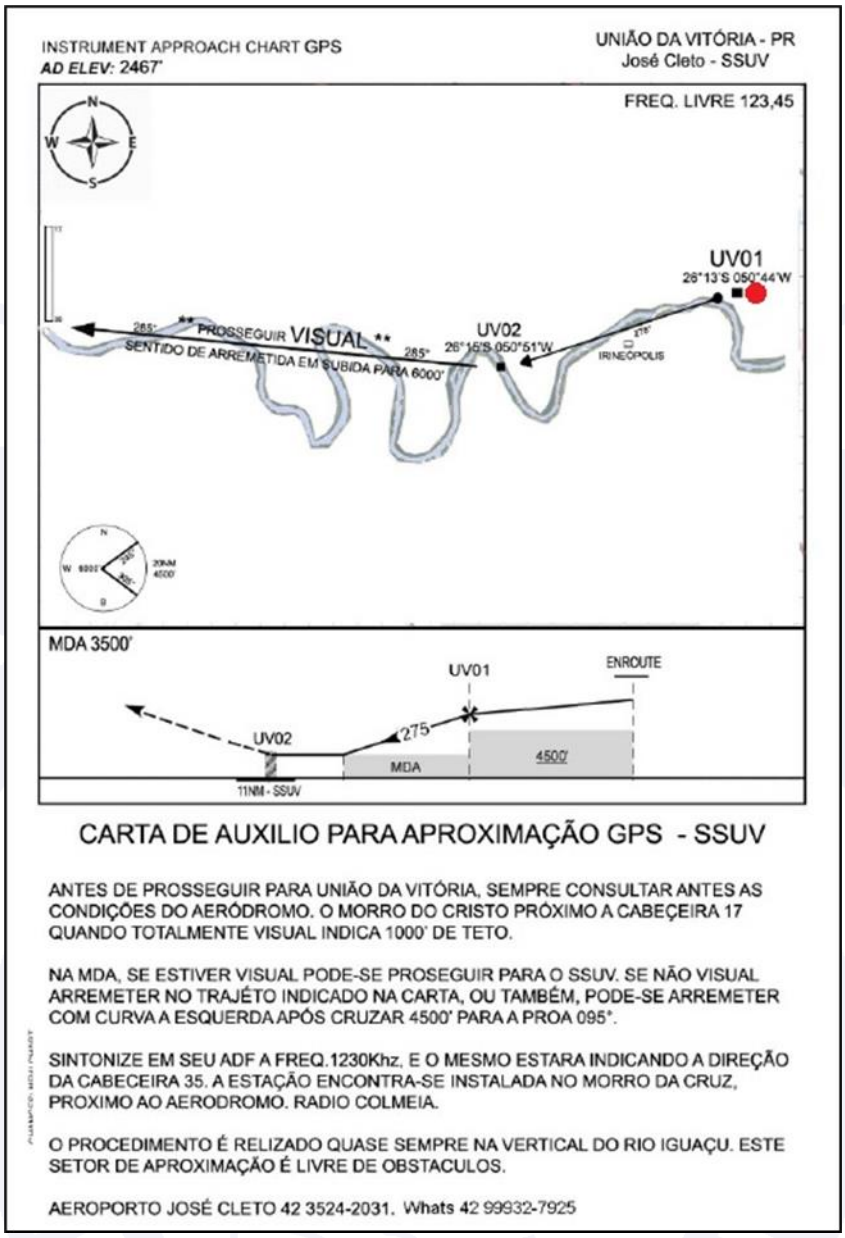

Figure 24 - Unofficial procedure for União da Vitória (the red dot indicates the location of the aircraft crash).

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

The aircraft model PA-34-220T, Seneca V (PR-DMC) was registered in the TPP category and was operated by *Siderquimica Indústria e Comércio de Produtos Químicos* S/A.

The maintenance management was delegated to the pilot and services were performed in certified companies, after approval by the operator.

The airframe, engine and propeller logbooks were outdated, with the latest maintenance records for the month of May 2018.

Despite these records failures, it was found that the inspections/reviews were updated and were considered adequate, given the recent inspection that had been carried out on 14JUN2018. The CA was valid.

In the wreckage area, there were signs of scorching vegetation near the fuselage, indicating that there was combustion during the aircraft crash. Additionally, the police team that carried out the first assistance to the incident reported the presence of fuel odor in the area, a fact that points to the existence of fuel in the tanks.

Analysis of the wreckage and vegetation at the crash site revealed that the aircraft impacted the trees with high horizontal speed. The evidence identified during the analysis of the engines and propeller assemblies indicated that both were in operation and that they developed high power at the moment of impact. As for the flight controls, from what could be observed, it was found that the cables broke due to overload because of the impacts of the aircraft.

Thus, no failure or malfunction conditions of systems and/or components of the aircraft were evidenced that could have affected its performance or its control in flight.

The pilot had been flying professionally for eleven years and, according to information gathered by the investigation, accumulated at least 364 hours in the PA-34-220T model. He had valid CMA, valid required Ratings, and had no medical restrictions for the flight.

The passenger occupying the seat on the right did not have the MLTE Rating required to exercise a function on board that type of aircraft.

According to the information obtained, the presence of this passenger was intended to accompany the flight in order to acquire experience. However, it is noteworthy that the aircraft model did not require a multiple crew for its operation and that, according to reports, it was unusual for the pilot to allow a second crewmember to manage the flight in those circumstances.

This flight was intended to transport a passenger from Guarapuava - PR (SBGU), to União da Vitória - PR (SSUV).

The flight plan prevised EOBT for 1100 (UTC) and should take place under VFR rules at FL055 with a direct heading to the destination (173º), with an estimated time in a route of twenty minutes. A few minutes before the takeoff, a DLA message with EOBT was broadcast for 1145 UTC.

The GAMET for the period predicted visibility between 1,500 and 5,000m due to wet fog in the SSUV region, based on cloud cover between 5 and 7/8 of coverage and an estimated ceiling between 200 and 1,200ft above ground level. Additionally, the 1200 UTC SIGWX chart predicted the occurrence of fog over a wide area, cloudy weather, Stratus (ST) and Stratus Cumulus (SC) clouds, based at 800 and top at 3,000ft.

Before the take-off, the pilot contacted SSUV Aerodrome officials to find out about the weather conditions and they would have informed him that the region was in intense fog and without VMC conditions to make the landing in the locality.

All information gathered indicated that weather conditions were not favorable for VFR flight in the region of the accident.

Thus, it was evident that there was an inadequate assessment of that operational context in view of the reduced capacity of the pilot to properly identify the risks involved.

According to the analysis of the RADAR images, the flight took place without abnormalities until, at 12h04min51s UTC, it was verified that the aircraft took a heading to the left of the ideal route to the destination. At 12h09min38s (UTC), with the heading still diverging from the route, the PR-DMC RADAR track was lost.

The wreckage was located 17 NM from SSUV. According to physical evidence from the impact site, the aircraft was flying on a 190° course when it collided with eucalyptus trees in the rural area of the municipality of Paula Freitas - PR.

Amidst the wreckage, several procedures for approaching by unofficial instruments were found. Among them, there was a descent procedure for SSUV, which previsted a starting point at a geographic position of 0.86 NM distant from the place where the aircraft impacted the ground. This fact indicated that the aircraft could be fitting the profile of this procedure at the time of the crash.

Thus, it is possible that the pilot made use of such a procedure, which may have contributed to the accident, as this would lead to an operation below the minimum safety requirements.

It is noteworthy that the use of an unofficial procedure to perform the landing in a location that operated only under VFR consisted of non-compliance with the rules in force at the time of the occurrence.

The existence of such unofficial procedures and the acceptance of their use among pilots operating in the region denoted a culture informally shared by these professionals, which may have influenced the pilot's decision to continue the flight, even without the required meteorological conditions.

Thus, considering the fragmentation pattern of the wreckage, which did not show any failure that could have compromised the performance and/or controllability of the aircraft; evidence of impact with high horizontal speed; and the low visibility conditions associated with the use of unofficial instrument descent procedures; it is concluded that there was a lowering of the pilot's level of situational awareness, causing the aircraft to crash into the terrain.

3. CONCLUSIONS.

3.1 Facts.

a) the pilot had valid CMA;

b) the pilot had the PLA License and had valid MLTE and IFRA Ratings;

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

d) the inspections/reviews were considered adequate;

e) the aircraft had valid CA;

f) the aircraft took off with one pilot and two passengers;

g) there were several unofficial procedures for approaching by instruments on board the aircraft, including to the location of SSUV;

h) no failure conditions or malfunctions of systems and/or components of the aircraft were evidenced;

i) the weather conditions were not conducive to carrying out the flight in VMC;

j) approximately 17 NM from the destination Aerodrome, the aircraft collided with the treetops and impacted the ground;

k) the aircraft was destroyed; and

l) the pilot and passengers suffered fatal injuries.

3.2 Contributing factors.

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

Since the SSUV Aerodrome only allowed operations under VFR rules, the weather conditions proved to be an impediment to the operation within the minimum safety requirements in that location.

- **Work-group culture – undetermined.**

There was an informal practice of pilots using unofficial instrument approach procedures. It is possible that this informally shared culture favored the pilot's mistaken decision to continue the flight, without the conditions required for the operation at that Aerodrome having been met.

- **Perception – a contributor.**

Degraded meteorological conditions compromised the pilot's perception of the environment outside the aircraft, which favored the loss of visual references and contributed to the occurrence of the accident.

- **Flight planning – a contributor.**

There was an inadequacy in the preparation work for the flight, including the lack of a careful assessment of the meteorological conditions of the route and the destination.

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

The inadequate assessment of the context compromised the identification and management of the risks involved in the air operation, to the point where the flight continued in unfavorable weather conditions.

- **Other (lack of adherence to rules or regulations established by the Brazilian civil aviation authority) – a contributor.**

The use of unofficial approach procedures by instruments in conducting flights in unfavorable meteorological conditions for flying in VMC represented a lack of adherence to the standards that established the minimum requirements for operation in Aerodromes restricted to operation under VFR, a fact that led to an operation below the minimum acceptable levels of safety.

4. SAFETY RECOMMENDATION.

A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident. In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies.

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

Recommendations issued at the publication of this report:

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

A-124/CENIPA/2018 - 01 **Issued on 10/04/2021**

Disseminate the lessons learned in this investigation, in order to alert the Brazilian civil aviation pilots and operators about the importance of careful assessment of meteorological conditions for conducting flights under VFR.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On October 04th, 2021.