COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 001/CENIPA/2016

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PP-LMM**
MODEL:	**C90GTI**
DATE:	**03JAN2016**

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 03JAN2016 accident with the C90GTI aircraft, registration PP-LMM. The accident was classified as “Controlled Flight Into Terrain (CFIT)”.

The aircraft collided into elevations in the vicinity of the Aerodrome during a go-around procedure, after an attempt of landing at Paraty Aerodrome, RJ (SDTK), under adverse weather conditions.

The aircraft was destroyed.

The pilots suffered fatal injuries.

An Accredited Representative of the NTSB (National Transportation Safety Board), from the United States of America (State where the aircraft was manufactured); and an Accredited Representative of the TSB (Transportation Safety Board), from Canada (State where the engine was manufactured) were designated for participation in the investigation.

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	(Brazil's) National Civil Aviation Agency
APP-SP	*São Paulo* Approach Control
ATS	Air Traffic Services
ATZ	Aerodrome Traffic Zone
CENIPA	Aeronautical Accident Investigation and Prevention Center
CFIT	Controlled Flight Into Terrain
CIV	Pilot's Flight Logbook
CMA	Aeronautical Medical Certificate
CTAC	Civil Aviation Training Center
CVR	Cockpit Voice Recorder
EGPWS	Enhanced Ground Proximity Warning System
FSTD	Flight Simulation Training Devices
IAM	Annual Maintenance Inspection
ICA	Command of Aeronautics' Instruction
IFR	Instrument Flight Rules
IFRA	Instrument Flight Rating - Airplane
LABDATA	Flight Data Recorders Read-out and Analysis Laboratory
MLTE	Airplane Multi Engine Land Rating
NTSB	National Transportation Safety Board
PCM	Commercial Pilot License - Airplane Category
PLA	Airline Pilot License- Airplane
PPR	Private Pilot License - Airplane Category
RBAC	Brazilian Civil Aviation Regulation
SACI	Integrated Civil Aviation Information System
SBMT	ICAO location designator - Campo de Marte Aerodrome
SC	Stratocumulus
SDTK	ICAO location designator - Paraty Aerodrome
SIGWX	*Significant Weather*
SIPAER	Aeronautical Accident Investigation and Prevention System
ST	Stratus
TCU	Towering Cumulus
TPP	Aircraft registration category of private air service
TSB	Transportation Safety Board of Canada
UTC	Universal Coordinated Time
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	**Model:** C90GTI **Registration:** PP-LMM **Manufacturer:** Hawker Beechcraft	**Operator:** SHIBATA Supermarket Ltd.
Occurrence	**Date/time:** 03JAN2016 - 17:21 (UTC) **Location:** Corumbê Hill **Lat.** 23°09'31"S **Long.** 044°43'26"W **Municipality – State:** Paraty - RJ	**Type(s):** Controlled flight into terrain **Subtype(s):** NIL

1.1 History of the flight.

The aircraft took off from Campo de Marte Aerodrome, SP (SBMT) to the Paraty Aerodrome - RJ (SDTK) at 1624 (UTC), in order to carry out a transfer flight, with two pilots on board.

During a go-around procedure, after an attempt of landing in SDTK, under adverse meteorological conditions, the aircraft collided against elevations in the vicinity of the Aerodrome.

The aircraft was destroyed.

The two crewmembers suffered fatal injuries.

1.2 Injuries to persons.

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

1.3 Damage to the aircraft.

The aircraft was destroyed.

1.4 Other damage.

Nil.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Hours Flown		
	Pilot	Copilot
Total	801:50	159:35
Total in the last 30 days	03:00	00:00
Total in the last 24 hours	00:00	00:00
In this type of aircraft	319:45	00:00
In this type in the last 30 days	01:15	00:00
In this type in the last 24 hours	00:00	00:00

N.B.: The Data on flown hours were obtained from the ANAC's records in the Civil Aviation Information System (SACI).

1.5.2 Personnel training.

The pilot took the Private Pilot course - Airplane (PPR) at Aeroclube de São Paulo, SP, in 1993.

The co-pilot took the Private Pilot course - Airplane (PPR) at EJ Escola de Aviação, SP, in 2012.

1.5.3 Category of licenses and validity of certificates.

The pilot had the Commercial Pilot License (PCM) and his Aircraft BE90 type, Airplane Multiengine Land (MLTE) and Instrument Flight - Airplane (IFRA) were valid.

The copilot had the Commercial Pilot License (PCM) and his Airplane Multiengine Land (MLTE) and Instrument Flight - Airplane (IFRA) Ratings were valid.

The copilot did not have the type Rating BE90.

1.5.4 Qualification and flight experience.

The pilot was qualified and had experience on this kind of flight.

The co-pilot was not qualified and had no registered experience in BE90 aircraft.

The aircraft was certified as a single-pilot airplane, so a co-pilot was not required.

1.5.5 Validity of medical certificate.

The pilots had valid Aeronautical Medical Certificates (CMA).

1.6 Aircraft information.

The aircraft, serial number LJ-1866, was manufactured by Hawker Beechcraft in 2008 and was registered in the Private Air Services Category (TPP).

The Certificate of Airworthiness (CA) was valid.

The airframe, engines and propellers maintenance records were up to date.

The maintenance program, established by the manufacturer, provided that inspections were divided into four phases and did not establish a general overhaul of the aircraft.

The last aircraft inspection, phases 3 and 4, and the Annual Maintenance Inspection (IAM) were performed on 17DEC2015 by MTX AVIATION shop, in Sorocaba, SP, having flown 8 hours and 25 minutes after the inspection.

1.7 Meteorological information.

The Significant Weather Chart (SIGWX) generated at 09:58 (UTC), valid until 00:00 (UTC), showed the presence of few Towering Cumulus (TCU) clouds based on 2,000ft and top in FL210. There was also the presence of Stratus (ST) and Stratocumulus (SC) clouds with base at 800ft and top at 2,000ft associated with rain showers (Figure 1).

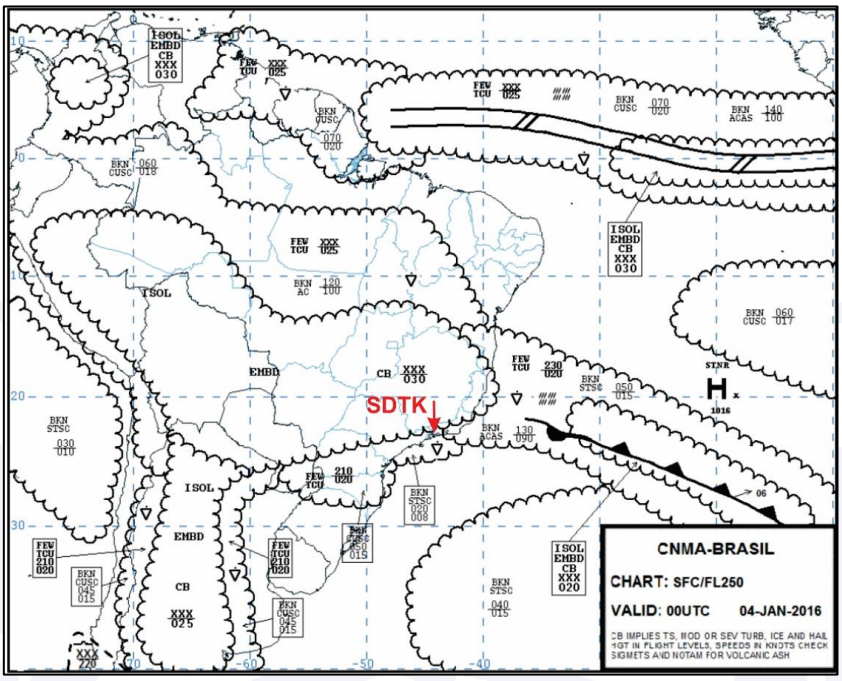

Figure 1 - 03JAN2016 SIGWX chart, valid until 04JAN2016, 00:00 (UTC).

The satellite image of 17:30 (UTC) indicated the significant presence of cloudiness in the region of Paraty, RJ.

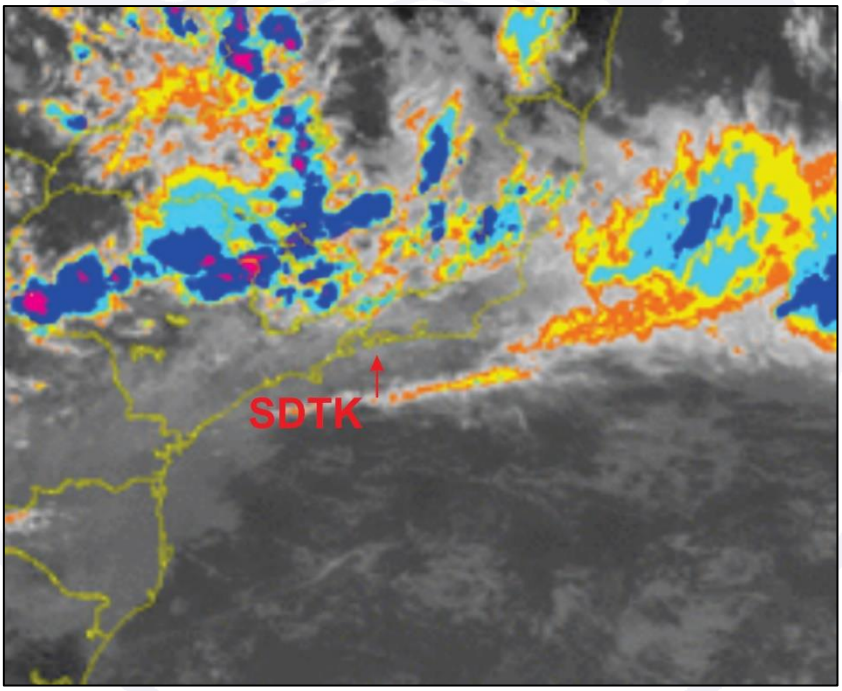

Figure 2 - Satellite image highlighted at 17:30 (UTC).

Likewise, RADAR images from Pico do Couto, RJ, generated at 17:20 (UTC) showed the presence of precipitable water over the region of Paraty, RJ, especially on SDTK Aerodrome and the crash site of the PP-LMM aircraft (Figure 3).

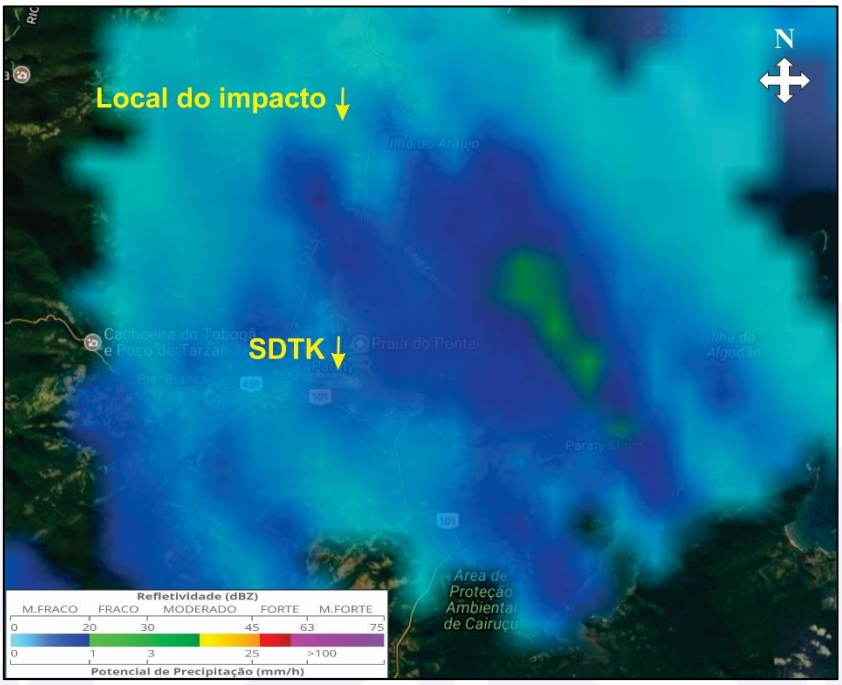

Figure 3 - Image of the meteorological RADAR of *Pico do Couto*, RJ at 17:20 (UTC).

It was found that it was raining throughout the coastal region of the State of Rio de Janeiro, with restricted visibility, and that some Aerodromes operated under instrument flight rules (IFR)

In the period that comprised the flight of the PP-LMM, the meteorological conditions in the region of Paraty were unfavorable to the visual flight.

1.8 Aids to navigation.

Nil.

1.9 Communications.

According to the transcripts of the communication audio between the PP-LMM, the control units and other aircraft in the frequency of coordination, it was verified that the crew maintained permanent radio contact and that there was no technical abnormality of communication equipment during the flight.

1.10 Aerodrome information.

The Paraty Aerodrome, RJ, was public and administered by the City Hall. It operated only under visual flight rules (VFR), in daytime and did not have Air Traffic Services (ATS) or Aeronautical Meteorology Service.

The runway was made of asphalt, designed 10/28, dimensions of 700 x 23m, with elevation of 10ft.

1.11 Flight recorders.

The Cockpit Voice Recorder (CVR) FA2100, SN 501410, installed in the aircraft, was sent to CENIPA's LABDATA, to carry out the readings of the communications maintained by the crew in the cabin of command.

Through validated audio, it was not possible to identify any abnormal functioning in the systems, nor comments of the pilots that could recognize a failure on the aircraft, in the moments that preceded the accident.

Communication between the pilots in the cabin, as well as with the pilots from other aircraft, indicated that the crew was on the second attempt to make the approach and landing procedures at Paraty Aerodrome, in adverse weather conditions.

A few minutes before the second attempt, an aircraft reported that it had landed in Paraty, despite of adverse weather conditions. The PP-LMM pilots asked about visibility and ceiling conditions in SDTK to the crew of the aircraft that had just landed. The pilot of that aircraft said that the visibility was not good and that the ceiling was between 400ft and 500ft above ground level (AGL).

According to the data obtained from the CVR, it was not possible to identify the landing gear retraction sound during the second go-around procedure.

The aircraft was also equipped with an Enhanced Ground Proximity Warning System (EGPWS). The CVR registered some aural warnings from the EGPWS during approach and landing attempts prior to the accident.

It was not possible to recover the EGPWS from the wreckage due to the terrain characteristics and the risk of injuries for the investigators.

1.12 Wreckage and impact information.

The aircraft crashed into a hill at an angle of approximately 10 degrees, in a positive pitch attitude and with level wings, at a distance of 3.9NM from the SDTK, threshold 28.

The site of the impact was difficult to access, in a dense forest, at an altitude of 1,800ft.

The wreckage was concentrated in the area of impact, within a radius of 15 meters.

Evidence was found that, at the time of impact, the landing gear was not locked in up position.

Figure 4 - Landing gear outside its compartment.

The left engine was found separated from the aircraft, upside down and with the propeller blades deformed. The right engine remained attached to the aircraft structure and also had significant deformations in the propeller. Both engines had evidences of high-speed collision.

Figure 5 - Left engine with deformation in the propeller.

Figure 6 - Right engine with deformation in the propeller.

The terrain on crash site had a large inclination and the parts of the aircraft were instable.

Due to the terrain characteristics and to the risk of injuries for the investigators, it was not possible to remove engines, propellers and Enhanced Ground Proximity Warning System (EGPWS) from the crash site for examinations. In addition, it was not possible to access the cockpit and check the radar altimeter and other instruments settings.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

All the occupants had fatal injuries due to polytrauma. There was no evidences of alcohol or prohibited drugs.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

The pilot of the aircraft was 41 years old. He has been described by friends and family as a friendly and affectionate person. Professionally, he was described as an audacious pilot.

He had experience in the route and had landed in the Paraty Aerodrome in several occasions, having piloted aircraft of other operators to Aerodromes in that region.

Although he did not have an employment relationship with the PP-LMM's owner (operator), it belonged to the group of pilots who operated that aircraft approximately five years ago.

The co-pilot was 25 years old and, according to reports from friends and family, he was considered a dedicated and responsible person. He had no experience on that route and never landed in Paraty.

Although he did not have the BE90 qualification, he joined the group of pilots who operated the PP-LMM for approximately one month. Like the others, he had no employment relationship and was in a phase of familiarization with the operation.

After this familiarization stage, the co-pilot's qualification in type BE90 would be initiated.

It was the first flight that the pilot and co-pilot made together, and the first contact between them had occurred moments before boarding the aircraft.

According to reports from other pilots' friends, they both had a stable bond with their peers and the team in general. It was also reported that there was a good interpersonal relationship between them and people who worked at SBMT.

On the day of the accident, the pilot was off duty and had a party with some friends; however, he was called to replace another pilot who was unavailable for the flight.

It was frequent and a routine for the group of pilots operating the PP-LMM aircraft to fly to the cities of Paraty and Angra dos Reis. In the week prior to the accident, the pilot had taken a flight to the same place with that same aircraft.

On these flights, it was common for pilots to find adverse weather conditions at the destination Aerodrome, as it was a location subject to instability and variations, characteristics of the climate in that region.

According to the interviewees, there was some competition between the pilots, where those who could land under adverse weather conditions were distinguished as the best.

On the day of the accident, there were some pilots flying in the vicinity of the crash site. According to the perception of these professionals, the meteorological conditions were not favorable to the visual flight in the region. They also reported that, despite the risk involved, many pilots tried to land in Paraty and Angra dos Reis, including PP-LMM.

A few minutes later, the PP-LMM attempted to approach and landing procedures, but without success.

There was no records indicating that the pilots had perform a landing checklist on CVR.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

Due to the strong impact on the ground, the occupants died at the site of the accident due to polytrauma.

1.16 Tests and research.

The external damage on both engines indicated that the parts were developing power at the time of impact.

There was no evidence of failure or malfunction of other aircraft systems.

1.17 Organizational and management information.

It was an aircraft registered for private operation under the responsibility of the owner (operator).

The flights were performed by a group of pilots who were hired on a freelance basis, with no employment relationship.

There was a pilot hired by the aircraft operator, who was responsible for issues relating to the management of the aircraft and the freelance pilots' flight schedule. The schedule management occurred informally and, not rarely, pilots were called for flying on the same day of the call.

All freelance pilots competed only on the flight schedule, without performing aircraft management duties, and the pilots' remuneration was by demand. There was no association between the completion of the flight (landing at SDTK) and payment.

Some of these pilots were related to other work activities, in the execution of flights to other operators and also in the execution of non-aviation activities.

According to the determinations of the aircraft's owner (operator), all operations were performed with pilot and co-pilot, although the aircraft was homologated for single pilot operations. According to the information obtained, this determination aimed at raising the level of safety.

In the accident flight, the presence of the co-pilot, who did not have a qualification in the aircraft, was justified by the intention to promote experience to this professional, since he had recently joined that group.

It was a common practice to aggregate unqualified people on flights to familiarize themselves with the operations and informally receive some instructions. If performance was considered satisfactory, formal training started to be performed.

1.18 Operational information.

The aircraft was calculated to be within the weight and balance limits specified by the manufacturer at takeoff and also at the time of the accident.

The flight plan was filled by the pilot with the letter "Z" in field 8 "Flight Rules". This entry meant that the flight would initially be conducted under VFR (Visual Flight Rules), followed by one or more subsequent changes of the flight rules. The PP-LMM's flight plan was filled indicating that the aircraft would take off under VFR, change to IFR during the climb and change back to VFR when crossing DORLU position, during descend, until the destination.

On the day of the flight, it was raining throughout the coastal region of the State of Rio de Janeiro and several Aerodromes operated under IFR rules.

According to reports, the pilot was aware of the restrictions on landing and taking off operations in unfavorable meteorological conditions to the visual flight in that region, since he had operated there several other times.

After takeoff, the aircraft was authorized by the São Paulo Approach Control (APP-SP) to climb to the FL130 and continue en route, under IFR rules.

Later, the aircraft requested the APP-SP to descend and to change the flight rules for VFR. IFR descent to FL080 was allowed, in order to listen to the frequency of APP-SP.

Upon reaching FL080, the aircraft was instructed to continue descend, now under VFR rules, to the pattern altitude of the destination Aerodrome, calling at the coordination frequency.

During the flight, the pilot explained the operation of the aircraft to the co-pilot, highlighting some details of the aircraft and the type of approach they would take in Paraty, while the co-pilot made all communications with ATC and the checklist items requested by the pilot.

According to the APP-SP RADAR image, the aircraft passed at SDTK vertical with approximately 4,500ft of altitude and then proceeded downward with sea bow, reaching 3,200ft.

After the loss of the RADAR contact of the aircraft, there was still, for a brief moment, the identification of the PP-LMM on the sea, at 900ft.

According to the audio recorded in the cockpit, the pilot commented with the co-pilot that the weather conditions were very bad, but that he would try to make a visual approach to land at the Paraty Aerodrome.

During the approach, the pilot assumed the radio communications, informing the other aircraft that were listening to the coordinating frequency, that he was performing a go-around procedure, with a right turn, and that he would return to Paraty Bay.

Then the pilot informed in the radio that they would make only one more attempt to land in Paraty and that, if they did not succeed, they would proceed to SBMT.

During the second go-around procedure, the CVR recorded the sound of brief comments among pilots about the aircraft's proximity to some trees, followed by loud noise and recording interruption.

Figure 7 - Distance from the threshold 28 to the crash site (Google Earth).

Residents near the accident site reported that they saw the aircraft flying at low altitude and then heard a loud noise. A few hours later, villagers found the wreckage, which they thought was the aircraft and called the city's Fire Department.

1.19 Additional information.

Visual Flight Rules

At the time of the accident, the Command of Aeronautics' Instruction ICA 100-12 established that:

> 5 VISUAL FLIGHT RULES
>
> 5.1 GENERAL CRITERIA
>
> 5.1.1 Except when operating as a special VFR flight, VFR flights shall be conducted in such a way that the aircraft fly in conditions of visibility and cloud distance equal to or greater than those specified in Table 1.
>
> 5.1.2 Notwithstanding 5.1.1 above, VFR flights shall only be carried out when simultaneously and continuously they can meet the following conditions:
>
> a) Maintain reference to the ground or water, so that meteorological formations below the flight level do not obstruct more than half of the pilot's area of vision;
>
> b) Fly below FL 150; and
>
> c) Fly with the speed established in table 1.
>
> 5.1.3 Except as authorized by the ATC body to serve a special VFR flight, VFR flights may not land, take off, enter ATZ or the traffic circuit of such aerodrome if:
>
> a) The ceiling is less than 450m (1,500 feet); or
>
> b) The horizontal visibility is less than 5km.

Requirements for Aircraft Qualification

The C90GTI aircraft, registered in the TPP category, could perform single pilot operations, by a pilot with a valid Type Rating BE90.

The co-pilot did not have the type Rating required for the aircraft at that time. His intention, according to what was verified, was to gain experience to be hired by the operator as a fixed co-pilot or by another one that possessed the same aircraft model.

According to reports, entry of new pilots into general / executive aviation was common, as members of an operator's pilot group, without required qualification.

These pilots performed familiarization flights on the equipment in order to accumulate flight hours, which were not registered with the National Civil Aviation Agency (ANAC).

At the same time, the older pilots assessed whether the newcomers performed well and, if they performed the theoretical training required by the ANAC, they could be included in that operator's group of pilots, either as freelancers or as hired ones.

According to a query made to ANAC, the condition for a pilot to obtain the qualification to fly the C90GTI aircraft was foreseen in Amendment 05 of the RBAC 61, valid on 03JAN2016.

The C90GTI aircraft required a type rating according to RBAC 61, paragraph 61.5 (3) (ii):

> 61.5 Licenses, certificates and ratings issued in accordance with this Regulation
>
> (...)
>
> (3) type rating: shall be made in aircraft, helicopter and vertical takeoff aircraft licenses in the following cases:
>
> (i) for each type of airplane certified for operation with a minimum crew of two (2) pilots;
>
> **(ii) turbine multi-engine airplanes*;**

The rule for granting this rating determined that:

> 61.213 Granting of type rating
>
> (...)
>
> (3) flight training:
>
> (i) the applicant for a type rating shall demonstrate that he / she has successfully completed, within six (6) months prior to the proficiency examination, the flight training program for the type of aircraft in which he / she intends to obtain the rating; (ii) the flight training program shall be conducted:
>
> (A) in CTAC**, for airplanes, helicopters with two or more engines, airships and power-sustaining aircraft; or
>
> (...)
>
> (C) The flight training program must be approved or validated by the ANAC; and
>
> (D) If flight simulation training devices are used, such devices must be qualified or validated by ANAC;
>
> (...)
>
> (iii) **if it doesn't exist, until the date on which the candidate initiates the flight training, CTAC***, civil aviation school or Aeroclub certified or validated by the ANAC to administer it, **flight training may be given by an enabled PCM or PLA*** qualified in the aircraft including, as a minimum:
>
> (A) 20 (twenty) flight hours for turbojet aircraft and **12 (twelve) flight hours for turboprop* or conventional airplanes**;
>
> (...)
>
> (...)
>
> **(iv) aircraft type and flight training must be registered on the digital CIV by the applicant as well as recorded and signed by the instructor on the applicant´s CIV*;**

As for ground school, this was provided in paragraph 61.213 (2), and followed basically the same rule of the flight training:

> 61.213 Granting of type rating
>
> (...)
>
> (2) theoretical knowledge and ground training:
>
> (i) the applicant for a type rating must prove that he has successfully completed, within the 12 (twelve) months preceding the proficiency examination, the ground training program for the type of aircraft in which he intends to obtain the rating;
>
> (ii) t**he ground training program should be conducted*:**
>
> (A) **in a CTAC, for airplanes***, helicopters with two or more engines, airships and power-sustaining aircraft; or (B) in a CTAC, civil aviation schools or Aeroclubs, for single-engine helicopters;
>
> (C) The ground training program must be approved or validated by the ANAC;
>
> (iii)) **if it doesn't exist***, until the date on which the candidate starts ground training, CTAC, civil aviation school or Aeroclub certified or validated by the ANAC to administer it, ground training **may be given by an enabled PCM or PLA, qualified in the aircraft***;
>
> *highlighted by us
>
> **CTAC - Civil Aviation Training Center

Thus, since there was no Civil Aviation Training Center (CTAC) that offered the ground school and flight training for the BE90, an enabled PCM or PLA, qualified in this type of aircraft, could provide these trainings.

During the investigation, no evidence was found that the co-pilot had completed any theoretical training in C90GTI aircraft.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

The aircraft carried out a transfer flight from SBMT to SDTK, with two pilots on board.

The pilot was properly certificated and qualified in accordance with Brazil regulations.

The copilot, although not required, was not properly certificated and qualified in accordance with Brazil regulations.

The airframe, engines and propellers logbooks records were up to date. There was no evidence of improperly maintenance regarding manufacturer required inspections and no outstanding maintenance items that could preclude its normal operation.

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

The region where the cities of Paraty and Angra dos Reis are located is known as an unstable weather area. However, flights from SBMT to SDTK were frequent and part of the pilot's routine. The pilot has made several flights on this route, including one in the week prior to the accident, flying the same aircraft.

The pilot, described as friendly, affectionate and audacious, belonged to the group of pilots who operated the PP-LMM aircraft for a longer time. In addition, he had previously flown other aircraft from Campo de Marte (SBMT) to these locations.

Thus, it was observed that the pilot had experience on the route and was well acquainted with the difficulties arising from operating under adverse weather conditions.

On the day of the accident, it rained in the region, and some pilots were flying near the accident site. Such professionals claimed that weather conditions were not favorable to visual flight but, despite the risk involved, many pilots were trying to land in both Paraty and Angra dos Reis, including the PP-LMM crew.

The PP-LMM pilots asked to an aircraft that had landed in Paraty about visibility and ceiling conditions. The pilot of that aircraft said that the visibility was not good and that the ceiling was between 400ft and 500ft above ground level (AGL).

The PP-LMM took off from SBMT under VFR, changed to IFR during the climb and changed back to VFR when crossing DORLU position, during descend, demonstrating the intention to attempt the visual landing in Paraty, RJ, despite of the unfavorable climatic conditions of the region.

According to the APP-SP RADAR image, the aircraft flown over SDTK with approximately 4,500ft of altitude and then proceeded downward with sea bow, reaching 3,200ft. Such a procedure may have been carried out in an attempt to get as much as possible down to the sea, until reaching visual conditions in the sector and, thus, proceed to approach and land in Paraty.

This hypothesis was corroborated by the conversation between the pilots. According to the investigation data, the commander informed that they would remain in visual conditions maintaining 900ft, awaiting for better weather conditions.

In addition, there was still, for a brief moment in the APP-SP RADAR, the identification of the PP-LMM over the sea, at 900ft.

The pilot then commented to the copilot that the weather was very bad, but that he would try to make a visual approach to landing at Paraty Aerodrome.

Later, he warned the other aircraft in the region that he was performing a go-around procedure, making a turn to the right and flying towards the sea area. Then he made another comment to the co-pilot, alerting him that they would make only one more attempt to approach and land in Paraty and that they would proceed to SBMT if they did not succeed. The pilots did not talk about diverting to another airport different of SBMT or SDTK.

Considering that the conditions on the sea would allow the visual flight, the crew decided to start a new approach procedure to runway 28 of Paraty Aerodrome. However, in the vicinity of the Aerodrome, visibility has deteriorated, causing the crew to decide to perform another go-around procedure, under instrument flight conditions, despite of the inexistence of any official instrument approach chart at that Aerodrome, which operated only VFR.

Moments before the second attempt of the PP-LMM to land in Paraty, another aircraft successfully landed. Aware of this information, the pilot verbalized his intention to also proceed to approach and land, despite of the visibility and ceiling information provided by that aircraft.

These facts evidenced that, even in the face of unfavorable circumstances, the pilot assumed a posture of excessive self-confidence, despite the restrictive meteorological conditions.

This attitude was shaped by the professional culture adopted by pilots operating in that region, as there was a collective practice of accepting high operational risks. Before the group, the performance in unfavorable conditions was recognized as proof of proficiency and professional competence, which promoted a competition environment between the pilots.

In the case in point, the successful landing of another aircraft may have raised the motivation of the pilot to seek the recognition of others, including his co-pilot, not yet qualified in the type of aircraft.

Thus, it was observed that these circumstantial and cultural aspects had an impact on the decision-making process presented by the pilot. The attempt to proceed to landing in deteriorated weather conditions indicated an inadequate acceptance of the minimum visibility parameters.

It should be noted that this cognitive bias in the decision-making process is a tendency of the human being, where the decision is anchored in only a limited part of all available information. In this process, the attention is directed to a recently received information, which is used to base the decision, to the detriment of others.

Thus, the competition behavior installed between the pilots may have contributed to the pilot's mistaken decision, leading him to disregard relevant information due to the prioritization of his objective. In this context, it is possible that the pilot based his decision only on the successful landing of another aircraft, limiting its scope of evaluation.

The copilot, described as a dedicated and responsible person, belonged to the crew group that accompanied the company's aircraft flights about a month ago, but did not have technical qualification of the aircraft and had never landed in Paraty.

The hypothesis is that the co-pilot made flights informally to gain experience, since there were no flight records on that aircraft type in his Pilot’s Flight Logbook (CIV). Nevertheless, during the flight he made all communications with ATC and the checklist items requested by the pilot.

This practice, informally adopted by the pilots, denoted weaknesses regarding the minimum level of technical knowledge of the aircraft required to perform that function and there was no management of the risks related to such informal instructions.

As a result, the pilots involved in the occurrence did not know each other and had the first contact moments before boarding. Throughout the flight, however, both demonstrated cordial conduct in the cabin, with the pilot explaining details of the operation of the aircraft and the type of approach procedure they would make in Paraty.

The presence of an unlicensed co-pilot under informal conditions of instruction may have influenced the flight, causing deconcentration or diverting attention of the commander, or reinforced his attitude of excessive self-confidence and boldness.

Investigation data showed that the crew did not retract the landing gear during the second go-around procedure. This information was corroborated by the fact that the landing gear was found outside of its compartment at the point of impact, indicating that the crew forgot to perform this checklist item.

It is possible that the go-around procedure performed by the pilot with the landing gear extended had increased the drag and reduced the rate of climb of the aircraft, which may have contributed to the impact against the terrain elevation.

The evidences in the wreckage observed on the crash site, corroborated by the CVR audio, indicated that the engines developed high power at the moment of impact. This condition, consistent with the flight phase (go-around procedure), indicated that there were no technical problems that might have contributed to the occurrence.

Thus, it is possible that there has been a lowering in the level of the situational awareness of the crew, impairing the proper perception that they were dangerously approaching high hills, in a full instrument flight conditions.

In the final moments of the flight, comments of the pilots were recorded about a proximity of the aircraft with trees. A moment later, in the records, it was possible to hear a loud noise and then the recording was interrupted. This is an evidence that they did not perceive the imminence of the shock, a classic characteristic of CFIT.

3. CONCLUSIONS.

3.1 Facts.

a) the pilots had valid Aeronautical Medical Certificates (CMA).

b) the pilot's Aircraft Type Rating BE90, Airplane Multiengine Land (MLTE) and Instrument Flight - Airplane (IFRA) Ratings were valid.

c) the copilot, though not required, did not have the Aircraft Type Ratings BE90 but his Airplane Multiengine Land (MLTE) and Instrument Flight - Airplane (IFRA) Ratings were valid.

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

e) the copilot was not qualified and did not have experience in that kind of aircraft;

f) the aircraft had a valid Airworthiness Certificate (CA);

g) the aircraft was within the weight and balance parameters at the time of takeoff and also at the time of the accident;

h) the airframe, engines and propellers logbooks records were up to date;

i) the aircraft took off from SBMT to SDTK, with two pilots on board;

j) the meteorological conditions in the Paraty region, on the day of the occurrence, were unfavorable to the visual flight;

k) after take-off, the aircraft was authorized by APP-SP to maintain FL130, in an IFR route;

l) during the en-route flight, the aircraft requested to descent and to modify from IFR flight rules to VFR flight rules;

m) during the flight, the pilot explained the operation of the aircraft to the co-pilot;

n) the co-pilot made the communications with ATC and the checklist items requested by the pilot;

o) on the second go-around procedure, with the landing gear extended, the aircraft collided with an elevation in the vicinity of the Aerodrome;

p) the aircraft was destroyed; and

q) the pilots suffered fatal injuries.

3.2 Contributing factors.

- **Attention - undetermined.**

Moments before the accident, another aircraft successfully completed the landing at the Paraty Aerodrome. It is possible that the pilot's attention was focused on this information, which indicated the possibility of landing, despite the critical conditions encountered, leading to high risk of landing.

In addition, the presence of a co-pilot who was not qualified to operate the aircraft may have influenced the pilot's cognitive processes, causing deconcentration or diversion of attention.

- **Attitude - a contributor.**

The recurring attempts to land indicated an overconfidence on the part of the pilot, leading him to proceed on the flight to Paraty aerodrome, even in adverse weather conditions.

The pilot's bold operational profile, his past experience and the rules and values informally adopted in the pilot group are possible factors that influenced the development of this attitude of excessive self-confidence.

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

On the day of the accident, weather conditions were not favorable to the visual flight at the Paraty Aerodrome.

- **Work-group culture - a contributor.**

Among the pilots operating in the region of Paraty, a competitive behavior was established, valued by the social recognition attributed to those who could operate in critical conditions. Above all, landing under adverse weather conditions in the region was considered a manifestation of proficiency and professional competence. The values shared by that group of pilots favored the weakening of the collective perception about the present operational risks.

The presence of other pilots, who also attempted to land in the region on the day of the occurrence, as well as the landing performed by one of these aircraft, moments before the accident and also the realization of two failed attempts of the PP-LMM aircraft, show a clear evidence of this behavior.

- **Pilot’s forgetfulness - undetermined.**

The fact that the landing gear was not retracted during the second go-around procedure indicated a failure, fostered by the possible forgetfulness of the crew, to perform the intended procedure.

Keeping the landing gear in the lowered position affected the performance of the aircraft during the climb, which may have contributed to the aircraft not reaching the necessary altitude to clear the obstacles.

- **Piloting judgment - undetermined.**

The possible decision of not retracting the landing gear during the go-around procedure affected the performance of the aircraft during the climb, which may have contributed to not reaching the necessary altitude to clear the obstacles.

- **Motivation - undetermined.**

The successful landing of another aircraft's pilot, even under unfavorable weather conditions, may have raised the motivation of the pilot of the PP-LMM aircraft to complete the approach and land procedure in order to demonstrate his proficiency and professional competence.

- **Perception - a contributor.**

The occurrence of a collision against the ground, in controlled flight, indicated that the crew had a low level of situational awareness at the time of the occurrence. This imprecise perception of the circumstances of the flight prevented the adoption of possible measures that could avoid the collision.

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

The pilot chose to make two attempts of landing at Paraty Aerodrome, despite adverse weather conditions, indicating an inaccurate evaluation of the risks involved in the operation.

This evaluation process may have been adversely affected by the competitive behavior among pilots. In this context, it is possible that the pilot based his decision only on the successful landing of another aircraft, which limited his scope of evaluation.

- **Organizational processes - undetermined.**

The PP-LMM aircraft was operated by a group of pilots, composed mostly of freelance professionals, who were informally managed by a hired pilot. There was, therefore, no formal system used by the operator to recruit, select, monitor and evaluate the performance of the professionals.

Failures related to the management of this process may have led to inadequate pilot selection, crew scheduling, untimely actuations and, as in the case in question, in the choice of crewmember not authorized to perform duties on board.

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".

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

A-001/CENIPA/2016 - 01 Issued on 09/24/2018

Disseminate the lessons learned in the present investigation, in order to alert pilots and operators, especially of the Executive Aviation that operate in the coastal region of the states of São Paulo and Rio de Janeiro, on the importance of minimum operating requirements and visual flight rules.

A-001/CENIPA/2016 - 02 Issued on 09/24/2018

Perform prevention actions with pilots and operators of the Executive Aviation, especially those operating in the coastal region of the states of São Paulo and Rio de Janeiro, in order to implant a change in the work groups and organizational culture. Such actions should aim at raising the collective perception about the risks inherent to the operation in that region and the alignment of the set of beliefs and values shared by the members of those groups of professionals with the faithful compliance with the rules established by the regulatory bodies of the Civil Aviation System.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On September 24th, 2018.

ANNEX A

COMMENTS BY THE NTSB NOT INCLUDED IN THE FINAL REPORT

Below, there is a list of all the comments forwarded by the National Transportation Safety Board, which were not included in this Final Report wording.

COMMENT 3

Regarding the entire Final Report wording.

Text proposed by NTSB

Hawker Beechcraft Corporation.

NTSB´s comment

Change the manufacturer of the aircraft from Hawker Beechcraft to Hawker Beechcraft Corporation, to match the U.S Airworthiness Certificate.

CENIPA´s comment

Brazil has a national aircraft database managed by the Brazilian Civil Aviation Authority (ANAC). For standard national purposes regarding statistics, CENIPA uses the manufacturer defined by ANAC on Final Reports wording, Hawker Beechcraft in this case.

COMMENT 4

Regarding Section “1.1 History of the flight”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add whether any of the flight crew obtained any preflight weather briefing. Add whether there were any witnesses to the accident and their accounts as to what they saw and the weather conditions. Add whether the airplane crashed before reaching the airport or after. Add the distance, the direction and the elevation of the accident site. Add type of flight plan and whether the flight was operated as a visual flight rules or instrument flight rules Add what runway they were attempting to land on.

CENIPA´s comment

There is no evidences that the pilot obtained preflight weather briefing. It is possible they have obtained weather information by their own, using internet apps or online resources.

Some pilots were flying around SDTK and their accounts regarding weather at the time of the accident are described on section “1.13 Medical and pathological information” and “2 Analysis”.

On section “1.18 Operational information” is described the sequence of events, informing that the aircraft has crashed during the second Go Around attempt.

On section “1.12 Wreckage and impact information” the crash site is described, including the distance from SDTK and altitude. The direction was added on Figure 7.

On section “1.18 Operational information” is described that the approved flight plan included part of the flight under VRF and a part under IFR.

On section “1.11 Flight recorders” and “1.18 Operational information” is described that the aircraft has crashed during the second Go Around, right after the second attempt of landing on runway 28.

COMMENT 5

Regarding Section “1.1 History of the flight”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add whether there was a post crash fire.

CENIPA´s comment

On section “1.14 Fire” is described that there was no fire.

COMMENT 7

Regarding Section “1.1 History of the flight”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add cockpit voice recorder (CVR) transcription information into 1.1 section.

CENIPA´s comment

According to Annex 13 provisions *“The records listed in 5.12 shall be included in the Final Report or its appendices only when pertinent to the analysis of the accident or incident. Parts of the records not relevant to the analysis shall not be disclosed.”*

For CENIPA, all the relevant CVR data regarding this accident are contained in Final Report wording.

COMMENT 8

Regarding section “1.1 History of the flight”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add Enhanced Ground Proximity Warning System information in section “1.1 History of the flight”.

CENIPA´s comment

Added on section “1.18 Operational information”.

COMMENT 9

Regarding section “1.1 History of the flight”.

Text proposed by NTSB

…was destroyed by impact and a post-crash fire.

NTSB´s comment

If by fire, add…was destroyed by impact and a post-crash fire.

CENIPA´s comment

On section 1.14 is described that there was no fire evidences on crash site.

COMMENT 10

Regarding section “1.5.3 Category of licenses and validity of certificates”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add here whether there was any record of previous enforcement against his pilot certificate.

CENIPA´s comment

There was not enforcements against pilots’ certificate.

COMMENT 12

Regarding section “1.6 Aircraft information”.

Text proposed by NTSB

Hawker Beechcraft Corporation.

NTSB´s comment

Change the manufacturer of the aircraft from Hawker Beechcraft to Hawker Beechcraft Corporation, to match the U.S Airworthiness Certificate.

CENIPA´s comment

Brazil has a national aircraft database managed by the Brazilian Civil Aviation Authority (ANAC). For standard national purposes regarding statistics, CENIPA uses the manufacturer defined by ANAC on Final Reports wording, Hawker Beechcraft in this case

COMMENT 15

Regarding section “1.6 Aircraft information”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add whether the airplane was equipped with an Enhanced Ground Proximity Warning System, and whether it was located and downloaded.

CENIPA´s comment

Added on section “1.11 Flight recorders”.

COMMENT 17

Regarding section “1.11 Flight recorders”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add how long the audio was, whether the crew obtained any in-flight weather, whether it contained the impact sequence, whether there was any discussion about weather, the approach, the airport, or any concerns by either the pilot or co-pilot.

CENIPA´s comment

All the relevant CVR data regarding this accident are contained in Final Report wording.

COMMENT 19

Regarding section “1.11 Flight recorders”.

Text proposed by NTSB

Nil.

NTSB´s comment

Suggest clarifying whether it was from the approach or departure ends of runway 28.

CENIPA´s comment

The distance was measured from the crash site to threshold 28, what means the beginning of runway 28.

COMMENT 22

Regarding section “1.12 Wreckage and impact information”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add whether all components necessary to sustain flight remained attached or were found in the immediate vicinity of the main wreckage.

CENIPA´s comment

There was no evidence of loss of control inflight before the crash. All the information considered relevant on this accident scenario regarding wreckage distribution are contained in section “1.12. Wreckage and impact information”

COMMENT 23

Regarding section “1.12 Wreckage and impact information”.

Text proposed by NTSB

Nil.

NTSB´s comment

Add that both engines were retained, examined by Pratt & Whitney with oversight from CENIPA, and summarize the findings. Were there any engine recording devices? If so, provide the results.

Add in this section what each propeller looked like (describing blade bending, blade fracture, etc. Were the propellers examined? By whom?

Was airplane equipped with a radar altimeter? If so add what it was set to.

CENIPA´s comment

The wreckage was on a dense forest hill at an altitude of 1,800ft. The terrain had a large inclination and the parts of the aircraft were instable. It was not possible to remove engines and propellers from the crash site for examinations due to the terrain characteristics and due to the risk of injuries for the investigators. Therefore, CENIPA and Pratt & Whitney did not examine engines and propellers.

In addition, it was not possible to access the cockpit and check the radar altimeter settings.

COMMENT 26

Regarding section “1.13.3 Psychological aspects”.

Text proposed by NTSB

Nil.

NTSB´s comment

Were the flight and landing on the previous week conducted in visual meteorological conditions?

CENIPA´s comment

The aerodrome was certified only for VFR operations. There was no information regarding meteorological conditions during the flight on the previous week.

COMMENT 30

Regarding sections “1.1 History of the flight” and “1.18 Operational information”.

Text proposed by NTSB

Nil.

NTSB´s comment

A lot of information in section “1.18 Operational information” can be moved to section “1.1 History of the flight”.

CENIPA´s comment

According to Annex 13 provisions *“The format of the Final Report in Appendix 1 should be used. However, it may be adapted to the circumstances of the accident or incident.”* For CENIPA, some information are specific related to Operational aspects. For this reason, the format of Final Report was adapted including section “1.18 Operational information”.

COMMENT 32

Regarding section “1.18 Operational information”.

Text proposed by NTSB

Nil.

NTSB´s comment

Flight Level (FL) in the U.S. is normally 18,000 feet and above. If the same in Brazil, then suggest dropping FL and change to 13,000 mean sea level (msl).

CENIPA´s comment

Brazil has different rules for altitude and flight level. Here FL is used whenever an aircraft is flying with 1013.2 hPa adjusted in altimeter, even if the aircraft is under 18,000 feet.

COMMENT 47

Regarding section “3.1 Facts”.

Text proposed by NTSB

Nil.

NTSB´s comment

Suggest deleting letter “e” because it was added to letter “c”.

CENIPA´s comment

CENIPA decided to maintain the information on both letters.