COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-054/CENIPA/2019

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PT-FEG**
MODEL:	**EMB-121 A1**
DATE:	**02ABR2019**

NOTICE

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

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

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

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

This Final Report has been made available to the ANAC and the DECEA so that the technical-scientific analyses of this investigation can be used as a source of data and information, aiming at identifying hazards and assessing risks, as set forth in the Brazilian Program for Civil Aviation Operational Safety (PSO-BR).

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

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

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

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

SYNOPSIS

This is the Final Report of the 02 April 2019 accident involving the EMB-121 A1 aircraft of registration marks PT-FEG. The occurrence was typified as “[SCF-NP] System/component failure or malfunction”.

During the climb, between the locations of *Sorocaba*, State of *São Paulo*, and *Palmas*, State of *Tocantins*, the “FIRE” light on the alarm panel relative to the aircraft’s right-hand engine illuminated. The Pilot in Command (PIC) performed the “In-Flight Engine Fire” emergency procedure, intentionally shutting down the affected engine.

The aircraft diverted to *Campinas*, State of *São Paulo*, as an alternate aerodrome, and during the approach, made a forced landing in a rural area located at a distance of 3.75 NM short of the runway threshold.

The aircraft sustained substantial damage.

The PIC and one of the passengers suffered no injuries, whereas the other three passengers were slightly injured.

Being Canada the State of design and manufacture of the engine, the Canadian TSB (Transportation Safety Board) designated an Accredited Representative for participation in the investigation of the accident.

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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	Brazil's National Civil Aviation Agency
APP-SP	*São Paulo* Approach Control
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATS	Air Traffic Service
CA	Certificate of Airworthiness
CANAC	ANAC code
CAVOK	*Ceiling And Visibility Ok* (no clouds below 5,000 ft. or below the minimum height of the highest sector (whichever the greater) and horizontal visibility more than 10 km; absence of CB clouds or absence of significant weather condition for aviation
CENIPA	Brazil's Aeronautical Accidents Investigation and Prevention Center
CG	Center of Gravity
CHST	Supplemental Type Approval Certificate
CIV Digital	Digital Pilot-Logbook
CMA	Aeronautical Medical Certificate
DECEA	Command of Aeronautics' Department of Airspace Control
FAA	Federal Aviation Administration
HSI	Hot Section Inspection
IAC	Civil Aviation Instruction
ICA	Command of Aeronautics' Instruction
IFRA	IFR Flight Rating - Airplane
INVA	Flight Instructor Rating - Airplane
IAM	Annual Maintenance Inspection
ILS	Instrument Landing System
IS	Supplementary Instruction
METAR	Routine Meteorological Aerodrome Report
MLTE	Multi-Engine Land Airplane Class Rating
MNTE	Single-Engine Land Airplane Class Rating
MO	Pilot Operating Handbook (POH)
MORE	Maintenance On Reliable Engines
NSCA	Command of Aeronautics' System Norm
OM	Maintenance Organization
PCM	Commercial Pilot License
PIC	Pilot in Command
PMD	Maximum Takeoff Weight

PPR	Private Pilot License - Airplane
PSO-BR	Brazilian State Program for Civil Aviation Safety
PWC	Pratt & Whitney Canada
QAv-1	Aviation Kerosene
RADAR	Radio Detection and Ranging
SBKP	ICAO location designator - *Viracopos* Aerodrome, *Campinas*, State of *São Paulo*
SBPJ	ICAO location designator - *Brigadeiro Lysias Rodrigues* Aerodrome, *Palmas*, State of *Tocantins*
SDCO	ICAO location designator - Aerodrome of *Sorocaba*, State of *São Paulo*
SIPAER	Aeronautical Accidents Investigation and Prevention System
SN	Serial Number
STC	Supplemental Type Certificate
TBO	Time Between Overhauls
TPP	Private Air Services Registry Category
UTC	Coordinated Universal Time
Vi	Indicated Speed
V_{MC}	Minimum Control Speed
V_{Ref}	Reference Speed
V_{YSE}	Best rate-of-climb speed with one engine inoperative

1. FACTUAL INFORMATION.

Aircraft	**Model:** EMB-121 A1 **Registration:** PT-FEG **Manufacturer:** EMBRAER	**Operator:** *Solution Air Locadora de Aeronaves - EIRELI*
Occurrence	**Date/time**: 02ABR2019 - 02:47 (UTC) **Location:** Vicinity of SBKP **Lat.** 22°58'05"S **Long.** 047°12'23"W **Municipality – State:** *Campinas- São Paulo*.	**Type(s):** [SCF-NP] System/component failure or malfunction (non-powerplant)

1.1. History of the flight.

At 23:30 UTC of 01 April 2019, the aircraft took off from SDCO (Aerodrome of *Sorocaba* , State of *São Paulo*) bound for SBPJ (*Brigadeiro Lysias Rodrigues* Aerodrome, *Palmas*, State of *Tocantins*), on a private flight with a pilot and four passengers on board.

During the climb, the "FIRE" light on the alarm panel relative to the aircraft's right-hand engine illuminated. The PIC intentionally shut down the affected engine and requested from Air Traffic Control (ATC) to continue flying single-engine toward SBKP *(Viracopos* Aerodrome, *Campinas*, State of *São Paulo*), as an alternate aerodrome.

During the approach to SBKP, the aircraft made a forced landing in a rural area short of the runway, at a distance of 3.75 NM of the runway 15 threshold.

Figure 1 - Image of the aircraft after coming to a complete stop.

1.2. Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Minor	-	3	-
None	1	1	-

1.3. Damage to the aircraft.

The aircraft sustained substantial damage to the lower section of the fuselage, landing gear assembly, propellers, engines, flaps, ailerons, underside of the wings, and empennage.

1.4. Other damage.

NIL.

1.5. Personnel information.

1.5.1. Crew's flight experience.

FLIGHT EXPERIENCE	
	PIC
Total	2.031:00
Total in the last 30 days	47:57
Total in the last 24 hours	02:16
In this type of aircraft	276:00
In this type in the last 30 days	02:16
In this type in the last 24 hours	02:16

RMK: flight experience data obtained from the records of the PIC's Digital Pilot-Logbook on the ANAC's website**.**

1.5.2. Personnel training.

The PIC did the PPR course (Private Pilot – Airplane) in 2012, at the *Aeroclube de Sorocaba*, State of *São Paulo*.

One of the passengers, who was also a pilot, was sitting in the right-hand seat of the cockpit. He did his PPR course in 2015, at *GO AIR School* in *Sorocaba*, State of *São Paulo*.

1.5.3. Category of licenses and validity of certificates.

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

The pilot sitting in the right seat, from now on referred to as "Unqualified Pilot" in this Final Report, held a PPR License (Private Pilot - Airplane) as well as a valid MNTE rating (Single-Engine Land Airplane). At the time, he did not hold an MLTE rating (Multi-Engine Land Airplane). For not being qualified, he could not perform crew duties onboard that aircraft.

According to interviews, the "Unqualified Pilot" was sitting in the right seat only to "observe the flight". He had approximately 170 total flight hours, 15 hours of which were instructions in the model of the accident aircraft. The other flight hours were performed on 7EC, C152, AB115, C172N, PA-46-350P and EMB 711 aircraft.

1.5.4. Qualification and flight experience.

According to reports, the PIC operated the PT-FEG aircraft as a freelancer. He had experience in the CAP-4 (*Paulistinha*), C172, C152, EMB 712 (*Tupi*), PA46T (*Jetprop*) and EMB-121 A1 (*Xingu*) aircraft. Of the total hours recorded, approximately 323 hours were in "class[1]" aircraft (both single- and multi-engine), and 276 hours specifically in the model of the accident aircraft.

In May 2017, he began his training period in multi-engine aircraft, earning his MLTE rating in August 2017. His proficiency test (checkride) was performed in a Beechcraft BE-55 aircraft.

Since he earned his MLTE rating after 30 June 2017, he just had to undergo training at the discretion of the endorsing pilot, and log the respective endorsement in the CIV for the models specified in Appendix B of the IS n° 61-006 Rev. C, dated 12 April 2017, which was the case of the EMB-121 A1 *Xingu* aircraft (Figure 2).

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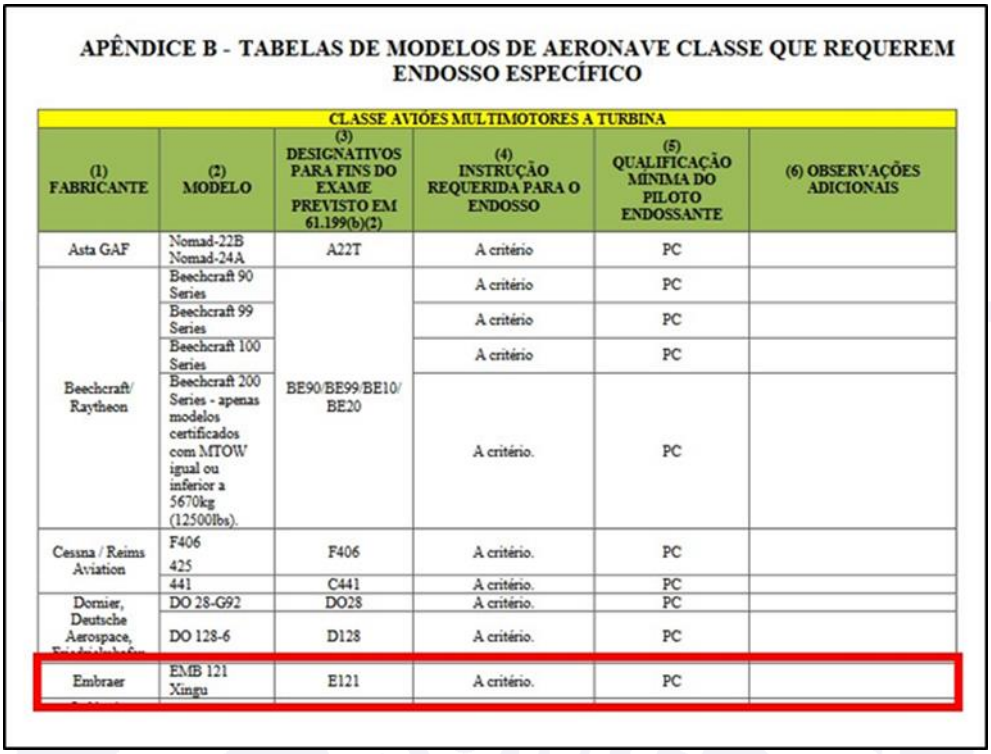
[1] when used in reference to aircraft certification, it means a general group of aircraft having similar propulsion, flight or landing characteristics. Example: airplanes, rotary wing aircraft, gliders, balloons, land planes, seaplanes, etc. Source: ANAC.



APÊNDICE B - TABELAS DE MODELOS DE AERONAVE CLASSE QUE REQUEREM ENDOSSO ESPECÍFICO

CLASSE AVIÕES MULTIMOTORES A TURBINA					
(1) FABRICANTE	(2) MODELO	(3) DESIGNATIVOS PARA FINS DO EXAME PREVISTO EM 61.199(b)(2)	(4) INSTRUÇÃO REQUERIDA PARA O ENDOSSO	(5) QUALIFICAÇÃO MÍNIMA DO PILOTO ENDOSSANTE	(6) OBSERVAÇÕES ADICIONAIS
Asta GAF	Nomad-22B Nomad-24A	A22T	A critério	PC	
Beechcraft/ Raytheon	Beechcraft 90 Series	BE90/BE99/BE10/ BE20	A critério	PC	
	Beechcraft 99 Series		A critério	PC	
	Beechcraft 100 Series		A critério	PC	
	Beechcraft 200 Series - apenas modelos certificados com MTOW igual ou inferior a 5670kg (12500lbs).		A critério.	PC	
Cessna / Reims Aviation	F406 425	F406	A critério.	PC	
	441	C441	A critério.	PC	
Dornier, Deutsche Aerospace,	DO 28-G92	DO28	A critério.	PC	
	DO 128-6	D128	A critério.	PC	
Embraer	EMB 121 Xingu	E121	A critério.	PC	

Figure 2 - Appendix B to the IS n° 61-006 Rev. C, dated 12 April 2017.

With regard to the "*at discretion*" training in a specific aircraft model, the IS n° 61-006 mentioned the instruction prescribed in section 61.195 of the RBAC-61 for the relevant class, when the instructor's endorsement was issued for release for the class rating check.

In the PIC's Digital CIV, one observed records of instruction flights with the EMB-121 A1 aircraft between 15 and 19 September 2017, which were not compliant with the IS 61-006 Rev. C, that is, without the proper information of the endorsing pilot's ANAC Code (CANAC). In addition, no records were found of specific endorsement for the EMB-121 A1 aircraft, except for records relative to the conduction of instruction flights on this aircraft model. Therefore, one concluded that there was evidence of training to obtain the endorsement, but the incomplete data logged did not allow plain confirmation of the training provided (Figure 3).

Data	Matrícula	Habilitação	Piloto Participante (Canac-Função)	Pousos	Origem	Destino	Observação	Função	Diurno	Noturno	Naveg.	Inst.
19/09/2017	PTMSA	MLTE	-	1	SIAQ	SDCO		Pil. em Instrução	03:12	00:00	00:00	02:42
19/09/2017	PTMSA	MLTE	-	1	SDCO	SIAQ		Pil. em Instrução	03:00	00:00	00:00	02:30
18/09/2017	PTMSA	MLTE	-	1	SBMT	SDCO		Pil. em Instrução	00:36	00:00	00:00	00:00
17/09/2017	PTMSA	MLTE	-	1	SIAQ	SBMT		Pil. em Instrução	02:30	00:00	00:00	02:00
16/09/2017	PTMSA	MLTE	-	1	SBAT	SIAQ		Pil. em Instrução	01:42	00:00	00:00	01:18
16/09/2017	PTMSA	MLTE	-	1	SWXM	SBIH		Pil. em Instrução	02:48	00:00	00:00	02:36
16/09/2017	PTMSA	MLTE	-	1	SBIH	SBAT		Pil. em Instrução	01:54	00:00	00:00	01:54
16/09/2017	PTMSA	MLTE	-	1	SBCY	SWXM		Pil. em Instrução	01:36	00:00	00:00	01:12
15/09/2017	PTMSA	MLTE	-	1	SDCO	SBCY		Pil. em Instrução	02:18	00:00	00:00	02:06

Figure 3 - Extract from the PIC's Digital CIV without the logging of the endorsing pilot's CANAC and respective endorsement. Source: adapted from the Digital CIV - ANAC.

Since the Investigation Committee did not have access to the PIC's physical CIV, it was not possible to verify the endorsement for the aircraft model or confirm whether he had qualification and experience for the type of flight.

According to accounts, the PIC used to fly a PA46T aircraft twice a week at the time, destined for *Cuiabá*, State of *Mato Grosso*, and *Campo Grande*, State *of Mato Grosso do Sul*.

1.5.5. Validity of medical certificate.

The PIC held a valid CMA (Aeronautical Medical Certificate.

1.6. Aircraft information.

The Serial Number 121057 aircraft was manufactured by EMBRAER in 1982, and registered in the Private Air Services Registration Category (TPP). The Airworthiness Certificate (CA) of the aircraft was valid.

The latest Annual Maintenance Inspection (IAM) took place on 12 September 2018 on the premises of the Maintenance Organization (OM) *CONAL - Construtora Nacional de Aviões*, in *Sorocaba*, State of *São Paulo*. The aircraft flew approximately 63 hours after the inspection, reaching a total time of 5,683 flight hours.

The engines equipping the PT-FEG aircraft (model PT6A-135, SN PCE-92670 and SN PCE-92662, respectively left- and right-hand engines) were maintained in accordance with the MORE (Maintenance On Reliable Engines) program.

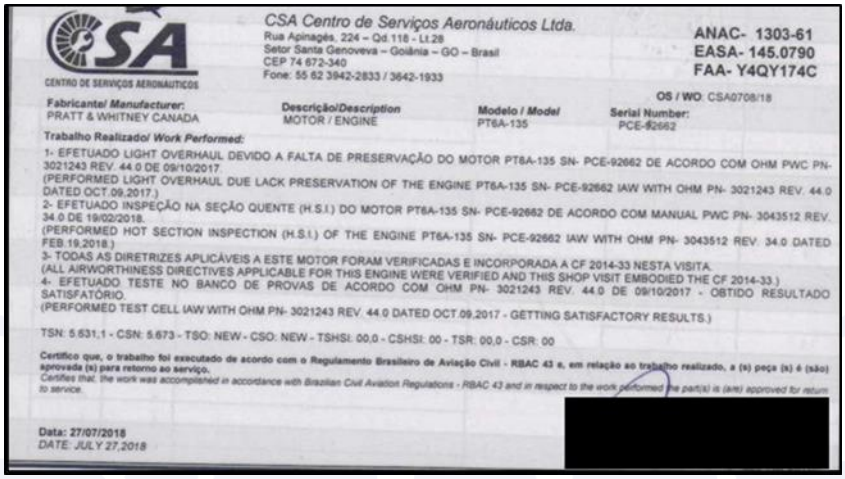
The MORE program, originally from an American company, had the Supplementary Type Certificate (STC) n° SE00002EN, issued by the Federal Aviation Administration (FAA) and accepted by the ANAC in accordance with the Supplemental Type Approval Certificate (CHST) 9609-06 of the MORE COMPANY, INC.

Such program proposed the extension of the Time Between Overhauls (TBO) of engines of the models PT6A-34, -34AG, -34B, -36, -114, -114A, -116, -135 (which equipped the PT-FEG) and -135A. The program was intended to supplement the Overhaul and Maintenance manuals, the parts catalog, and the service bulletins, among other publications related to the engines. The program was to be used in conjunction with the engine manufacturer's documents and manuals, and was not intended to supersede them.

The program followed maintenance procedures specified by Pratt & Whitney (PWC), with shorter inspection intervals in comparison with the ones specified by the engine manufacturer. It adopted, as maintenance tools, spectrometric analysis of the oil; continuous monitoring of the engine performance trends (Trend Monitoring); vibration analysis, with the purpose of seeking to reduce engine vibration; and periodic inspection of the engine's hot section and compressor using borescope equipment.

Preventive maintenance took place at intervals of 150 hours, 300 hours or 450 hours. Depending on the results of such inspections, it would be possible to extend the engine overhaul interval to up to 8,000 hours.

In addition to the inspections mentioned above, according to the maintenance records, one observed that, on 27 July 2018, the engines underwent a Light Overhaul, a Hot Section Inspection (HSI) and a bench test, with satisfactory results, without any further records related to new inspections (Figure 4).



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ANAC- 1303-61
EASA- 145.0790
FAA- Y4QY174C

OS / WO: CSA0708/18

Fabricante/ Manufacturer:	Descrição/Description	Modelo / Model	Serial Number:
PRATT & WHITNEY CANADA	MOTOR / ENGINE	PT6A-135	PCE-92662

Trabalho Realizado/ Work Performed:

1- EFETUADO LIGHT OVERHAUL DEVIDO A FALTA DE PRESERVAÇÃO DO MOTOR PT6A-135 SN- PCE-92662 DE ACORDO COM OHM PWC PN-3021243 REV. 44.0 DE 09/10/2017.
(PERFORMED LIGHT OVERHAUL DUE LACK PRESERVATION OF THE ENGINE PT6A-135 SN- PCE-92662 IAW WITH OHM PN- 3021243 REV. 44.0 DATED OCT.09.2017.)
2- EFETUADO INSPEÇÃO NA SEÇÃO QUENTE (H.S.I.) DO MOTOR PT6A-135 SN- PCE-92662 DE ACORDO COM MANUAL PWC PN- 3043512 REV. 34.0 DE 19/02/2018.
(PERFORMED HOT SECTION INSPECTION (H.S.I.) OF THE ENGINE PT6A-135 SN- PCE-92662 IAW WITH OHM PN- 3043512 REV. 34.0 DATED FEB.19.2018.)
3- TODAS AS DIRETRIZES APLICÁVEIS A ESTE MOTOR FORAM VERIFICADAS E INCORPORADA A CF 2014-33 NESTA VISITA.
(ALL AIRWORTHINESS DIRECTIVES APPLICABLE FOR THIS ENGINE WERE VERIFIED AND THIS SHOP VISIT EMBODIED THE CF 2014-33.)
4- EFETUADO TESTE NO BANCO DE PROVAS DE ACORDO COM OHM PN- 3021243 REV. 44.0 DE 09/10/2017 - OBTIDO RESULTADO SATISFATÓRIO.
(PERFORMED TEST CELL IAW WITH OHM PN- 3021243 REV. 44.0 DATED OCT.09.2017 - GETTING SATISFACTORY RESULTS.)

TSN: 5.631,1 - CSN: 5.673 - TSO: NEW - CSO: NEW - TSHSI: 00,0 - CSHSI: 00 - TSR: 00,0 - CSR: 00

Certifico que, o trabalho foi executado de acordo com o Regulamento Brasileiro de Aviação Civil - RBAC 43 e, em relação ao trabalho realizado, a (s) peça (s) é (são) aprovada (s) para retorno ao serviço.
Certifies that, the work was accomplished in accordance with Brazilian Civil Aviation Regulations - RBAC 43 and in respect to the work performed the part(s) is (are) approved for return to service.

Data: 27/07/2018
DATE: JULY 27,2018

[redacted]

Figure 4 - Record of the latest inspection carried out on the PT-FEG's right-hand engine.

Fire Detection and Extinguishing System

The engines were equipped with a fire detection and extinguishing system powered by 28V DC from the essential bus that comprised: 18 fire detectors (9 on each engine); an indicator panel and controller with independent actuation for each engine; two control units; two general alarm lights; a horn; and two bottles supplied with an extinguishing agent.

The detector system had the ability to indicate either an overheating condition (temperatures above 200°C) or fire in the engines. The bimetallic detectors featured in-series connections, normally closed, and installed inside the engine nacelles (Figure 5).

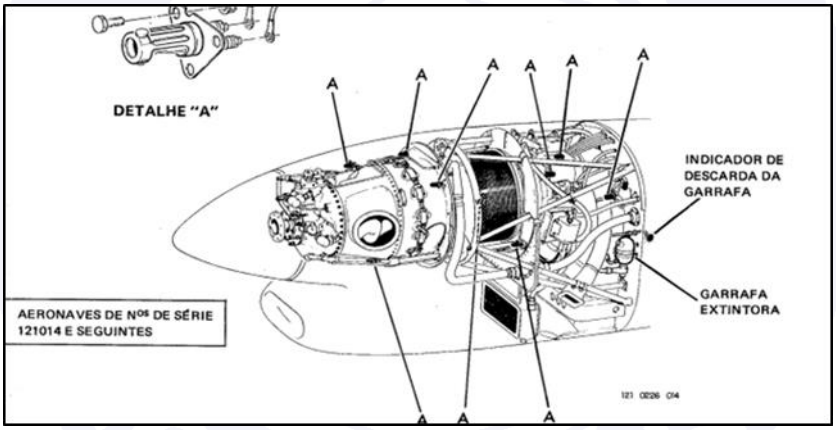


Figure 5 – Illustration of the engine and its temperature sensors (indicated by the letter "A").

If the temperature around one of the detectors exceeded its set value (200°C), the bimetallic strips would open the circuit, causing a relay to switch and consequently activate the audible and visual alarms.

The general alarm and the horn could be canceled by pressing the frame of any of the "GENERAL" lights. The "FIRE" light, however, would only go out when the temperature in the detector fell below 200°C, closing the circuit or contact of the detectors.

The control panel had two "FIRE DETECTION TEST" buttons, one for each engine, which simulated the opening of one of the detectors and allowed verification of the correct functioning of the circuits (Figure 6).

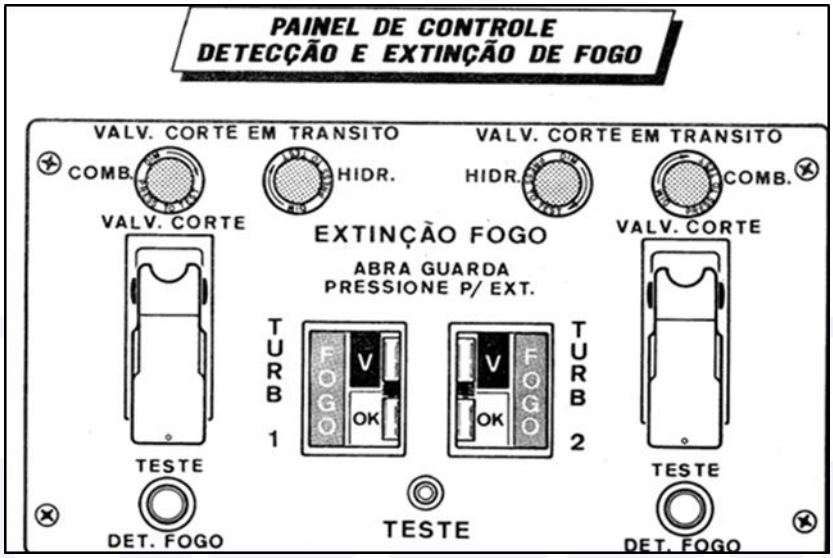


Figure 6 - PT-FEG's Fire Detection Control Panel.

The extinguishing system consisted of two independent bottles with CBrF3 (bromotrifluoromethane) extinguishing agent, one for each engine, without interconnections.

The extinguishing system would be activated by means of actuation handles on the control panel, which deflagrated an explosive capsule and allowed the agent to be emptied into the affected region of each engine (Figure 7).

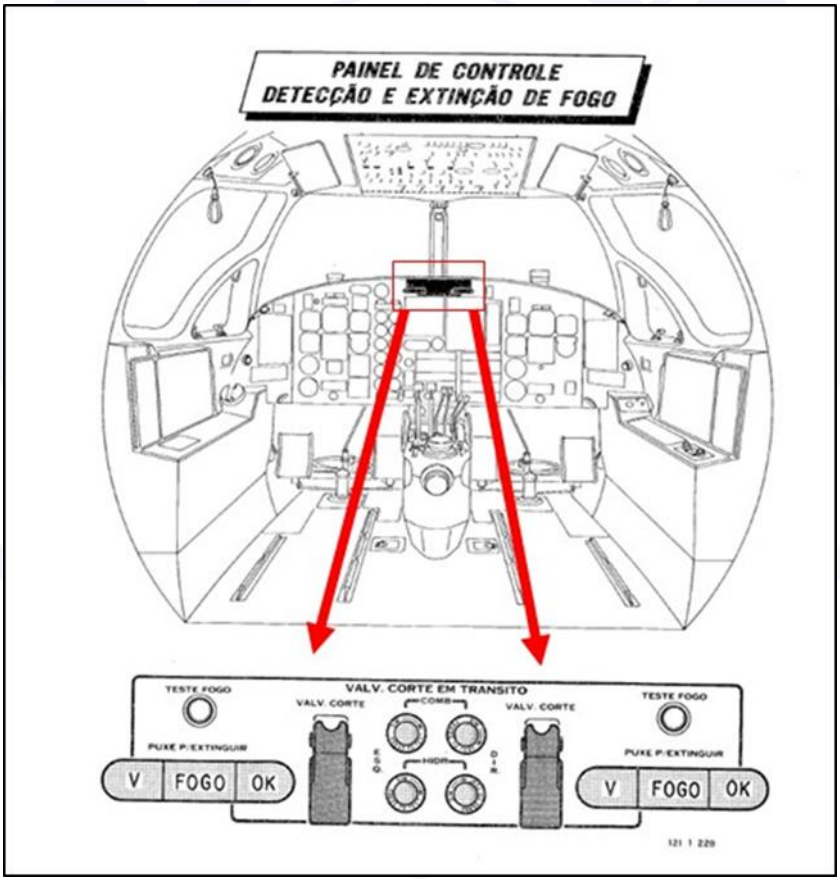


Figure 7 - PT-FEG's extinguisher activation control panel.

Air Conditioning and Bleeding System

The aircraft's air conditioning system utilized the bleed-air from the engine compression stages to air-condition the cabin, by introducing a controlled flow of air, free of contaminants and humidity, and with controlled temperature.

An alternate ventilation system provided, should the engine bleed or air conditioning system be cut off, the introduction of external (unconditioned) air into the cabin, coming from an inlet located in the dorsal fin of the empennage, as illustrated in the diagram in Figure 8.

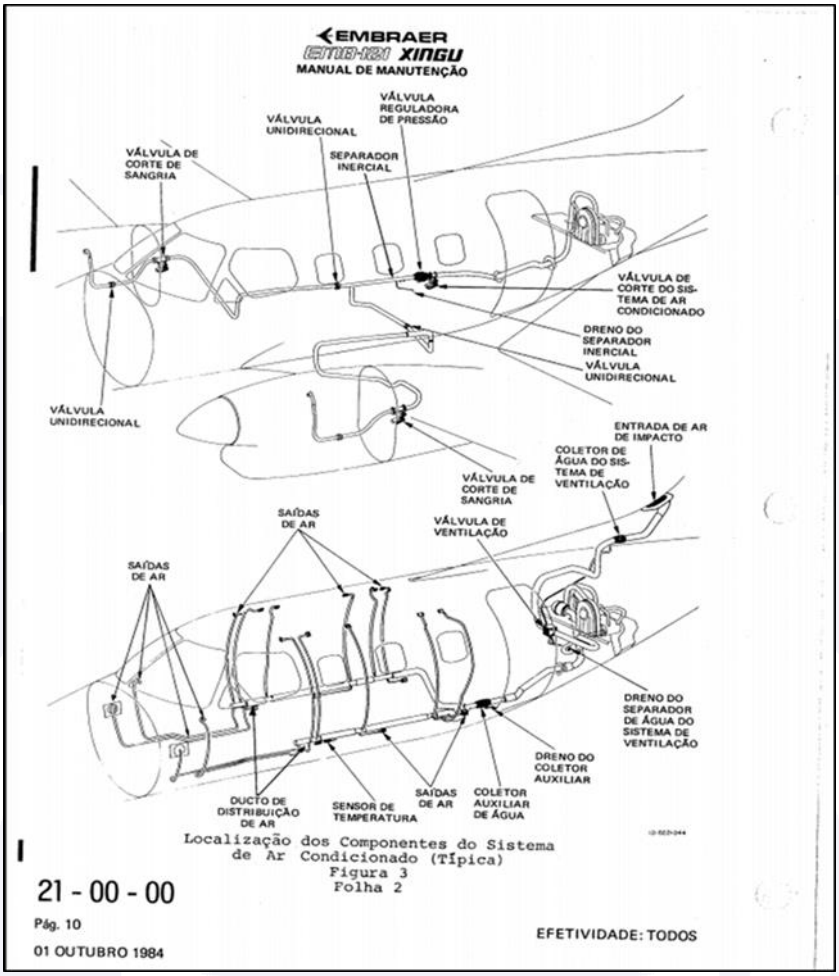


Figure 8 - Illustration of the EMB-121 A1's air conditioning system.

1.7. Meteorological information.

METARs of SBKP (*Viracopos* Aerodrome, located at a distance of 3.75 NM from the accident site) contained the following information:

METAR SBKP 020200Z 13013KT CAVOK 20/16 Q1017=

METAR SBKP 020300Z 12011KT CAVOK 20/16 Q1017=

The meteorological conditions were above the minimums for the flight, with visibility equal to or greater than 10 km, and no clouds below 5,000 ft. or below the minimum height of the highest sector. According to the 02:00 UTC METAR, the wind speed was 13 kt. and, therefore, within the limits for the operation.

1.8. Aids to navigation.

All navigation and landing aids were operating normally while the aircraft was approaching the airfield.

1.9. Communications.

The transcripts of the audio communications between PT-FEG and the ATC agencies, showed that the PIC maintained radio contact with *São Paulo* Approach Control (APP-SP) without any technical abnormalities in the communication equipment during the flight.

In order to support the analyses of the sequence of events preceding the aircraft's forced landing, the Investigation Committee highlighted some transmissions that can help

to understand the dynamics of the accident. Coordinated Universal Time (UTC) is used as a reference.

- At 02:32:28, the PIC informed APP-SP that the aircraft was flying in single-engine mode, and requested to divert to SBKP. APP-SP then asked him to confirm whether the aircraft was experiencing any navigation failure. The pilot of the PT-FEG reported again that the aircraft was in the single-engine mode.
- At 02:32:55, APP-SP confirmed having received and understood the message, and requested the aircraft to fly to the "DADGO" position. The ATC unit then asked the pilot if they would need any ground support, to which the PT-FEG pilot responded that it would not be necessary, and requested APP-SP to give them a heading.
- At 02:35:11, APP-SP reported the start of RADAR vectoring service, and determined a heading of 060° for the PT-FEG aircraft.

After that, APP-SP asked the pilot to confirm the aerodrome of origin, the aircraft's destination, POB, and whether the PT-FEG was carrying any dangerous cargo. The pilot responded that they were coming from *Sorocaba* bound for *Palmas*, with 05 POB, and were not carrying any dangerous items.

- At 02:38:43, APP-SP inquired PT-FEG again about ground support, and the aircraft reported that they would not need it "for the moment".
- At 02:39:58, APP-SP transmitted the following message: "Roger. Descend to five thousand five hundred feet, Fox Echo Golf. On this heading, you are authorized to intercept the X ILS final, runway one five, to... to runway one five. Report stabilized, Fox Echo Golf." The aircraft requested confirmation of the procedure to be executed, and APP-SP ratified the information.
- At 02:40:59, APP-SP reported: "Fox Echo Golf, you are slightly above the ramp. If you deem it necessary to perform a three-six-zero turn to lose altitude, just inform control" (sic).
- At 02:41:15, the aircraft responded: "No. Negative. Fox Echo Golf will continue the approach."

Then, the control agency asked which of the engines had failed, and the PT-FEG informed that it was the right-hand engine.

- At 02:43:49, APP-SP reported: "Papa Tango Fox Echo Golf, you are slightly left of the course, to the right of the course, the course is to your left. Confirm if you already have visual references with the airport!" The crew of the PT-FEG acknowledged the message and reported that they were visual.

Subsequently, APP-SP requested the aircraft to change to the frequency of Campinas TWR on 118.25 MHz, and wished to crew a good landing. The PIC read back the frequency and thanked the control agency.

After that, there was no further communication between the PT-FEG aircraft and APP-SP. It is worth noting that, at no time, did the PT-FEG crew inform an urgent or emergency situation to ATS (Air Traffic Service).

Regarding the report of an urgency or emergency condition, the Command of Aeronautics' Instruction (ICA) 100-12 - Rules of the Air determined the following:

> 3.6 AIRCRAFT IN EMERGENCY
>
> The aircraft in emergency that is in a distress or urgency situation must use, by radiotelephony, the corresponding message (signal) provided for in Annex A and in the MCA100-16 (Air Traffic Phraseology). The distress and urgency conditions are defined as:

a) Distress: a condition in which the aircraft is threatened by a serious and/or imminent danger and requires immediate assistance; and

NOTE: The distress condition also refers to the emergency situation in which the aircraft accident is inevitable or has already occurred.

b) Urgency: a condition that involves the safety of the aircraft or of some person on board, but that does not require immediate assistance.

1.10. Aerodrome information.

Not applicable - occurrence out of aerodrome area.

1.11. Flight recorders.

Neither required nor fitted.

1.12. Wreckage and impact information.

The aircraft was located in a rural area, outside the airfield zone, at a distance of 3.75 NM from SBKP (Figure 9).

Figure 9 - PT-FEG forced landing site and distance to SBKP threshold 15.
Source: adapted from Google Earth.

The forced landing was performed at low speed and low descent rate. After touching down, the aircraft moved a few meters forward.

The wreckage distribution was of the linear type, and the landing site consisted predominantly of irregular terrain covered by low vegetation with the presence of scattered trees and bushes.

1.13. Medical and pathological information.

1.13.1. Medical aspects.

NIL.

1.13.2. Ergonomic information.

NIL.

1.13.3. Psychological aspects.

NIL.

1.14. Fire.

According to reports from both the PIC and the “Unqualified Pilot”, the “FIRE” light relative to the right-hand engine illuminated during the cruise flight, indicating that the engine temperature was above 200°C.

They also reported that, after such visual alert in the cabin, the right-hand engine was “incandescent and there were controlled flames” (sic), implying that it was the exhaust area, a condition that seemed abnormal to them at the time of the failure. They also said that the passengers had smelled a strong odor coming from the air conditioning system.

There was no fire as a result from the impact with the ground.

1.15. Survival aspects.

NIL.

1.16. Tests and research.

The engines were removed from the PT-FEG aircraft, and analyzed by members of the Investigation Committee.

The borescope inspection showed that the left-hand engine (SN PCE 92670) had sustained damage consistent with the impact. One observed that the engine compressor rotated freely, whereas the power turbine rotor was stuck.

The right-hand engine (SN PCE 92662) was clean, and showed no signs of fire. Its bearings were free, allowing the rotation of both the compressor and the power turbine, which would enable the engine to be tested on a test bench for more comprehensive assessments of its operation and performance. However, at the request of the operator, these tests were not performed, on account of the costs related to the transport and maintenance of the engine on the premises of the P&WC headquarters in Canada.

In addition to the pieces of evidence mentioned, the other damaged parts showed signs compatible with the impact conditions.

Two oil samples from each engine, collected from the detector chip and from the gearbox, underwent laboratory analysis.

The four samples met the specifications for kinematic viscosity at 100°C (mm^2/s), kinematic viscosity at 40°C (mm^2/s), and Cleveland flash point (°C), showing no evidence of contamination.

In addition to the analyses mentioned above, since it was not possible to perform a bench-test of the right-hand engine, one removed two of its CT disk blades and analyzed them in a laboratory specific for analysis of materials. For this analysis, one blade was kept intact, while the other one was sectioned into five parts, in order to evaluate its microstructure (Figure 10).

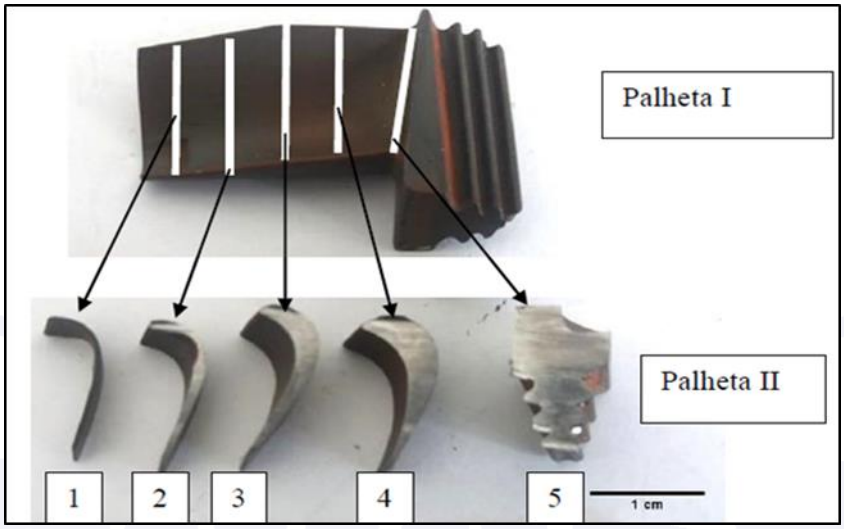


Figure 10 - Image of the engine blades analyzed.

The analysis showed that, at the base of the blade, the microstructure was homogeneous (Figure 11) and, at the end, the microstructure was heterogeneous (Figure 12), indicating that there was growth and coalescence[2] of the grains.

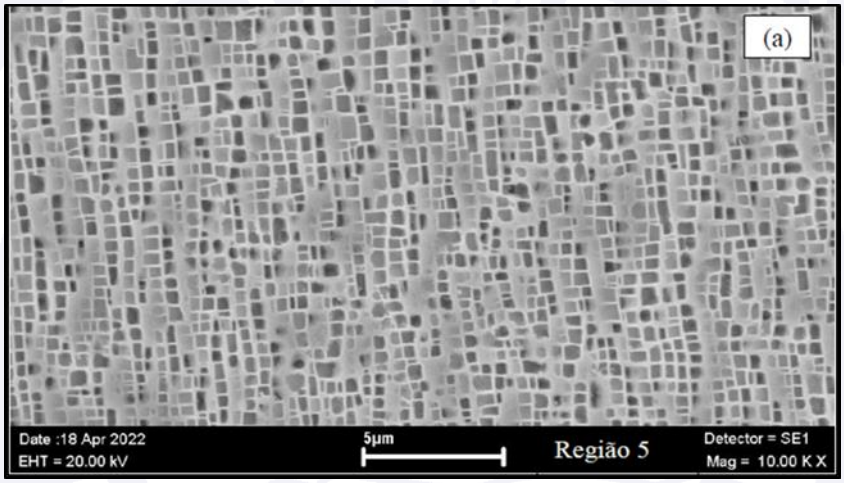


Figure 11 - Homogeneous microstructure at the base of the blade.

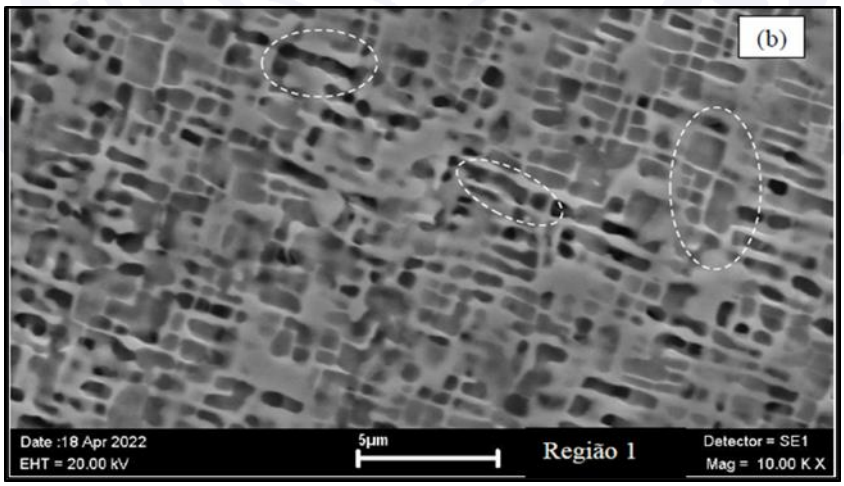


Figure 12 - Heterogeneous microstructure at the tip of the blade

[2] The term "coalescence" refers to the act or process of coalescing, which means to unite, merge, or come together to form something larger or more solid. It is a term often used in physics and chemistry to describe the merging or joining of particles or substances into a single entity.

This coalescence and growth indicate that the blade had overheated. However, the analysis was not sufficient to determine when the overheating occurred, possibly during a flight prior to the one of the occurrences.

As no signs of fire were detected in the right-hand engine during subsequent examinations, and, according to the reports from the PIC and from the “Unqualified Pilot”, the FIRE light had illuminated, the Investigation Committee consulted EMBRAER regarding the existence of any tests for verification of the detection system, and also whether there was a possibility that the strong smell perceived by the occupants, originating from the air conditioning system, could somehow be related to the occurrence of an engine fire.

EMBRAER informed that there were no other tests of the detection system, other than that the one performed by the pilot by means of the FIRE DETECTION TEST buttons on the control panel. Furthermore, the aircraft fuselage sustained serious damage in the occurrence (with separation of the powerplant from the rest of the airframe). With a multimeter, one tested the conductivity of the part of the system that remained in the engine, and no discrepancies were detected.

As for the strong smell, EMBRAER argued that it could not be related to an engine fire, since the air conditioning system receives bleed air from the compression stage of the engines, and not from the hot section.

1.17. Organizational and management information.

The PT-FEG aircraft belonged to the company *VMF Turbinas e Consultoria Ltda*. (CNPJ 20.804.914/0001-12) and was operated by *Solution Air Locadora de Aeronaves - Eireli* (CNPJ 30.424.553/0001-32). The operational lease agreement between the parties was registered with ANAC on 24 September 2018.

The operator utilized the aircraft for private flights.

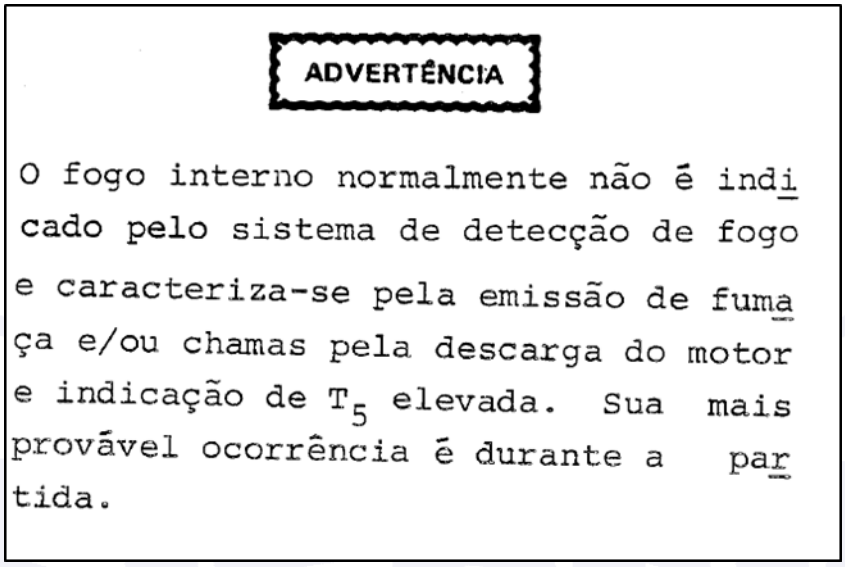
1.18. Operational information.

It was a private flight for the transport of passengers.

The “Unqualified Pilot” sitting in the right-hand seat was merely observing the flight, since the aircraft was certified to operate with a single pilot. He reported that, despite having undergone some training flights with the EMB-121 A1, he refrained from giving opinions during the flight and assisting in the management of the failure, since he was not familiar with the aircraft.

He also stated that he only assisted with phraseology after characterization of the failure, when he realized that the PIC was overloaded. Furthermore, it is worth noting that he would have been in a better position to observe possible signs of fire in the right-hand engine, since he was sitting in the seat corresponding to the engine that had supposedly had a failure.

A notice in the Pilot Operating Handbook (POH) pointed out that internal fire was not normally indicated by the fire detection system, and would be characterized by the emission of smoke and/or flames from the engine exhaust and an indication of high T5 (Figure 13).



ADVERTÊNCIA

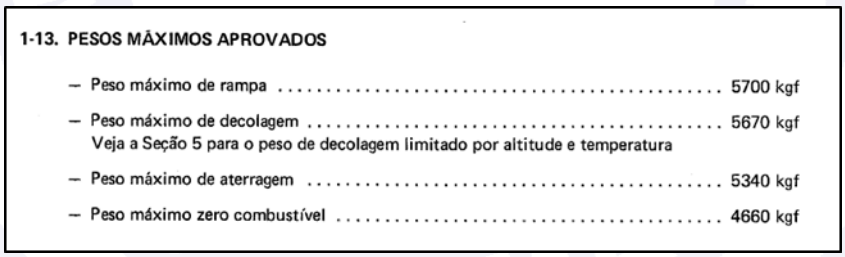
O fogo interno normalmente não é indicado pelo sistema de detecção de fogo e caracteriza-se pela emissão de fumaça e/ou chamas pela descarga do motor e indicação de T_5 elevada. Sua mais provável ocorrência é durante a partida.

Figure 13 - Notice in the POH related to fire.

The intended route had been proposed via flight plan “Z”, with takeoff from SDCO at 02:00 UTC destined for SBPJ, with an estimated flight time of 3 hours and 26 minutes.

The aircraft’s basic operating weight was 3,759 kg (8,287.18 lb.). The aircraft was fueled with 1,374 kg (3,031 lb.) of QAV-1. Adding up the weight of the crew, passengers, and luggage, the takeoff weight was 5,723 kg (12,617 lb.). The aircraft’s maximum takeoff weight (MTOW) stipulated by the manufacturer was 5,670 kg (12,500 lb.). Although the weight was above the MTOW, the position of the Center of Gravity (CG) was within the limits prescribed for the aircraft.

At the time of the forced landing, the estimated weight was approximately 5,597 kg (12,339 lb.), taking into account the fuel consumption of 127 kg (280 lb.), which means that it was approximately 257 kg above the maximum landing weight of 5,340 kg, according to the POH (Figure 14). Despite that, the CG position at the time of the accident was within the limits established by EMBRAER.



1-13. PESOS MÁXIMOS APROVADOS

– Peso máximo de rampa ..... 5700 kgf

– Peso máximo de decolagem ..... 5670 kgf
Veja a Seção 5 para o peso de decolagem limitado por altitude e temperatura

– Peso máximo de aterragem ..... 5340 kgf

– Peso máximo zero combustível ..... 4660 kgf

Figure 14 - Maximum weights according to the POH.

The PIC reported that no abnormalities were found during the initial checks of the aircraft, engine start-up, and engine check, including the test of the fire detection and extinguishing system performed during the internal inspection.

The aircraft took off from the runway 18 of SDCO with a left turn.

According to the PIC, during the climb procedure, both he and the "Unqualified Pilot" attempted to adjust the aircraft's air conditioning, since the passengers complained about the high temperature in the cabin during the beginning of the flight.

With the aircraft passing through FL 180, while they were still trying to adjust the air conditioning system, the PIC and the "Unqualified Pilot" observed that the FIRE light relative to the right-hand engine illuminated on the aircraft's panel. The "Unqualified Pilot", however, reported that the engine's T5 (turbine interstage temperature) was within the normal range.

The climb was discontinued, and the PIC decided to perform the emergency procedure for INFLIGHT ENGINE FIRE, which involved intentionally shutting down the affected engine.

After shutting down the right-hand engine, the PIC activated the fire extinguisher in the fire-fighting system, as provided for in the aircraft's checklist.

According to reports, the PIC initially decided to return to SDCO. However, after considering that SBKP was nearby and would offer greater availability of runways and resources, he decided to divert to the latter location.

Upon contacting APP-SP, the PIC decided not to declare an emergency, only informing that the aircraft was in single-engine condition and requesting to divert to SBKP. Therefore, the Air Traffic Controller (ATCO) initiated RADAR vectoring and authorized the X ILS procedure for runway 15.

During the approach, APP-SP initially informed that the aircraft was “high in relation to the ramp”, offering the pilot the possibility to perform a 360° descent for better alignment. The ATC unit then informed that the aircraft was off course, asking whether the crew had visual contact with the runway. According to reports, influenced by the alert given by the ATCO, the PIC of PT-FEG began configuring the aircraft, lowering the landing gear, flaps, and reducing speed.

The PIC and the “Unqualified Pilot” also reported that the aircraft’s configuration for landing and the reduction in speed left the aircraft close to the Minimum Control Speed (V_{MC}).

The POH (MO) contained the following definition of Minimum Control Speed (V_{MC}):

– V_{MC} (Velocidade Mínima de Controle)

É a velocidade mínima de vôo, na qual o avião é controlável, após um motor tornar-se subitamente inoperante, estando os flapes na posição de decolagem, o trem de pouso recolhido, os compensadores de leme e aileron em neutro, o sistema de embandeiramento automático atuando e o motor restante operando na potência de decolagem, e o avião inclinado 5° sobre o motor bom.

Figure 15 - Definition of Minimum Control Speed extracted from the POH.

Due to their flying in single-engine conditions, there was also some difficulty in coordinating the aircraft's rudder and ailerons, something that contributed to a substantial increase in the rate of descent, which led them to realize that they would not make it to the runway of SBKP.

For this reason, they abandoned the final approach axis and made a right turn in search of a more suitable landing area as it was nighttime. The landing took place at a distance of 3.75 NM short of the threshold of the SBKP runway.

By means of the RADAR image rerun, it was possible to observe that, during the final approach to SBKP, there was a reduction in the speed of the aircraft. As it approached the runway, the speed gradually dropped from 168 kt. at 3 NM from the threshold to 104 kt. at 1.4 NM (Figures 16 and 17). When initiating the right turn, the speed initially decreased to 90 kt. and, during the turn, increased to 126 kt. at the moment of impact with the ground.

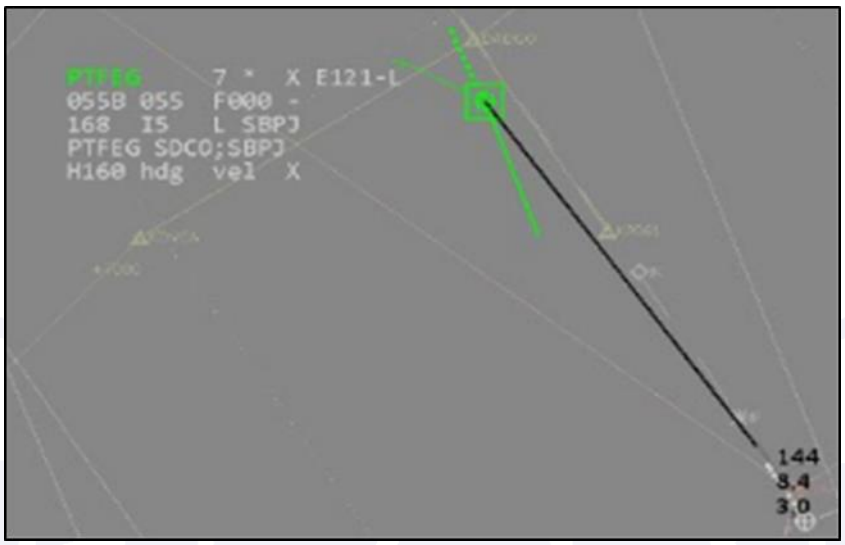


Figure 16 - Aircraft position at 3 NM from the threshold, speed 168 kt.

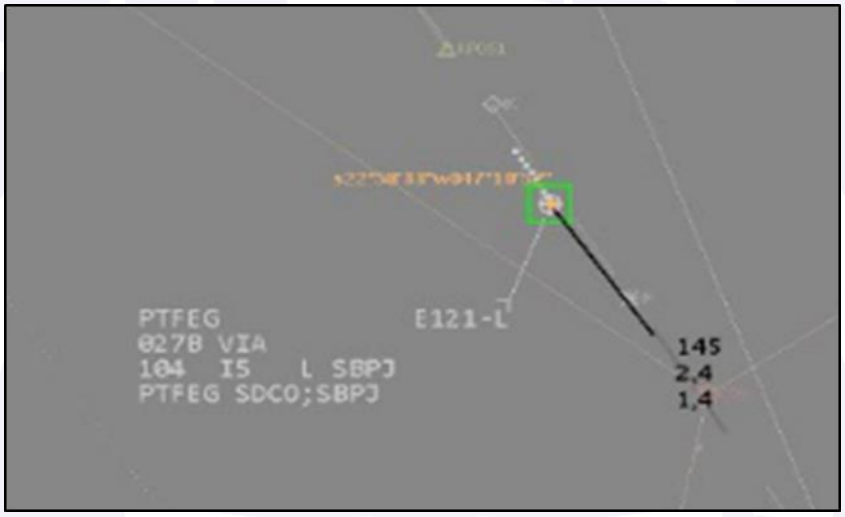


Figure 17 - Aircraft position at 1.4 NM from the threshold, speed 104 kt.

Despite being qualified to operate the aircraft, the PIC reported having little familiarity with emergency procedures, besides not having completed practice training sessions that could have prepared him for that situation.

The “Unqualified Pilot” reported that the PIC purposely centralized the actions, working the checklist items during the emergency, for being the only one on board with the proper qualifications to operate the aircraft.

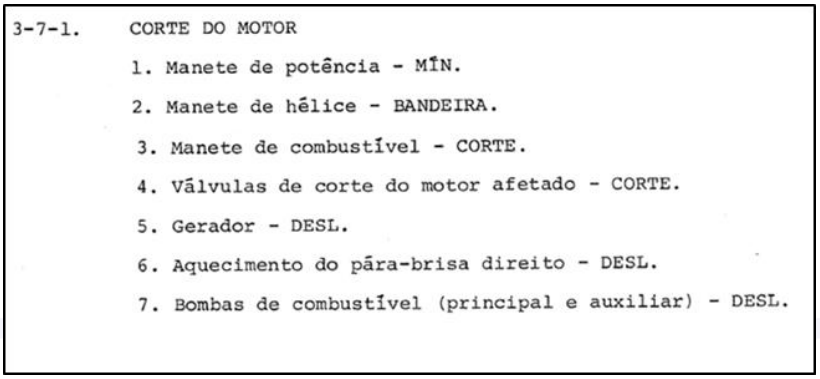
Illumination of the FIRE warning light

In the event of an inflight engine fire, the POH prescribed the Engine Shutdown procedure, followed by the activation of the corresponding engine fire extinguisher (Figures 18 and 19).

II. FOGO NO MOTOR EM VÔO

1. Aplique o procedimento "CORTE DO MOTOR" (veja o parágrafo 3-7-1).
2. Extintor - Dispare.
3. Carga no outro gerador - Verifique dentro dos limites.

Figure 18 - Emergency procedure in case of Inflight Engine Fire, extracted from Section 3 of the POH.



3-7-1. CORTE DO MOTOR

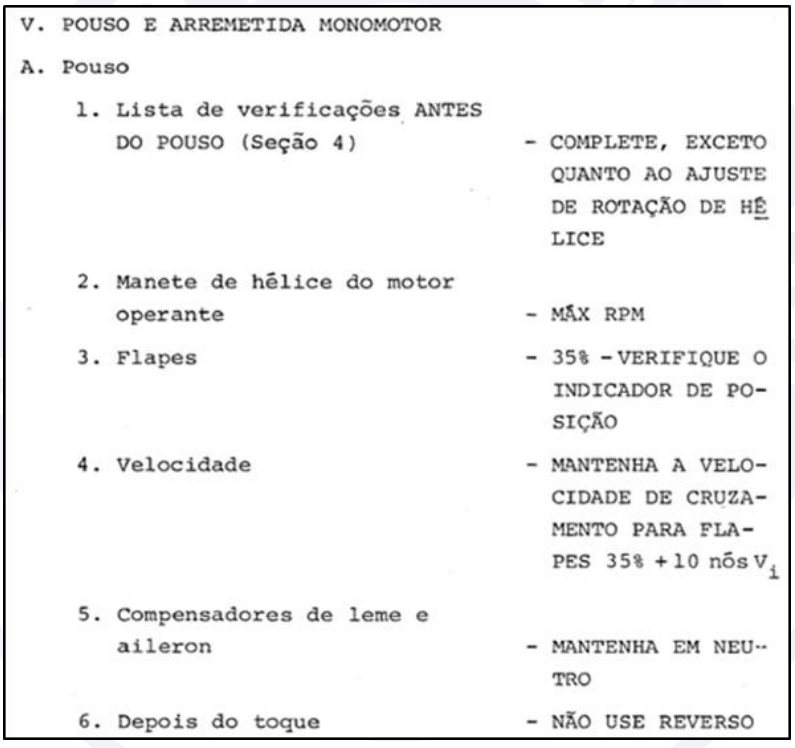
1. Manete de potência - MÍN.
2. Manete de hélice - BANDEIRA.
3. Manete de combustível - CORTE.
4. Válvulas de corte do motor afetado - CORTE.
5. Gerador - DESL.
6. Aquecimento do pára-brisa direito - DESL.
7. Bombas de combustível (principal e auxiliar) - DESL.

Figure 19 - Engine Shutdown Procedure, extracted from the POH.

Single-engine approach procedure

The sudden decrease of power in one of the engines results in a yaw and roll effect that requires the application of corrective force on the rudder pedal (on the same side of the good engine) and also aileron control (rolling over the good engine).

For single-engine approach and landing, the POH prescribes that the “before landing” check is to be performed, maintaining the propeller of the operating engine at 100% Nh, flaps at 35%, crossover speed corresponding to this flap position plus 10 kt. of Indicated Airspeed (Vi), with rudder and aileron trim tabs in neutral, as per Figure 20.



V. POUSO E ARREMETIDA MONOMOTOR

A. Pouso

1. Lista de verificações ANTES DO POUSO (Seção 4)	- COMPLETE, EXCETO QUANTO AO AJUSTE DE ROTAÇÃO DE HÉLICE
2. Manete de hélice do motor operante	- MÁX RPM
3. Flapes	- 35% - VERIFIQUE O INDICADOR DE POSIÇÃO
4. Velocidade	- MANTENHA A VELOCIDADE DE CRUZAMENTO PARA FLAPES 35% + 10 nós V_i
5. Compensadores de leme e aileron	- MANTENHA EM NEUTRO
6. Depois do toque	- NÃO USE REVERSO

Figure 20 - Single-engine landing and go-around procedure as per the POH.

According to images obtained at the crash site, it was possible to observe that the trim tabs were deflected, and that the flaps were lowered to 100% (Figures 21 and 22).

Figure 21 - Image of the rudder, elevator, and aileron trim tabs deflected.

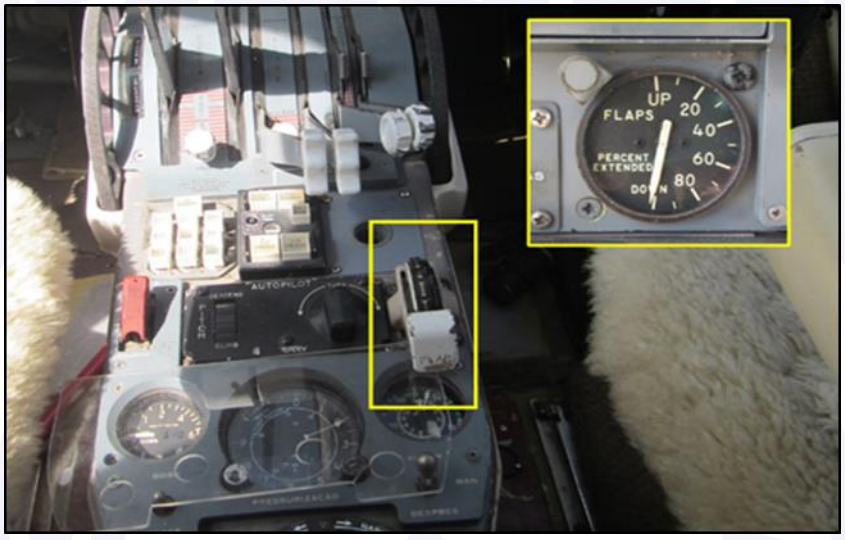


Figure 22 - Position of the flap actuation lever and its indicator showing that the flaps were deployed at 100%.

For the approximate weight of the PT-FEG aircraft in the moments before the accident, it was possible to observe that the crossing speeds (V_{Ref}) would be 122 kt. for flaps at 0%, 107 kt. for flaps at 35% and 100 kt. for flaps at 100%, as highlighted in red in Figure 23.

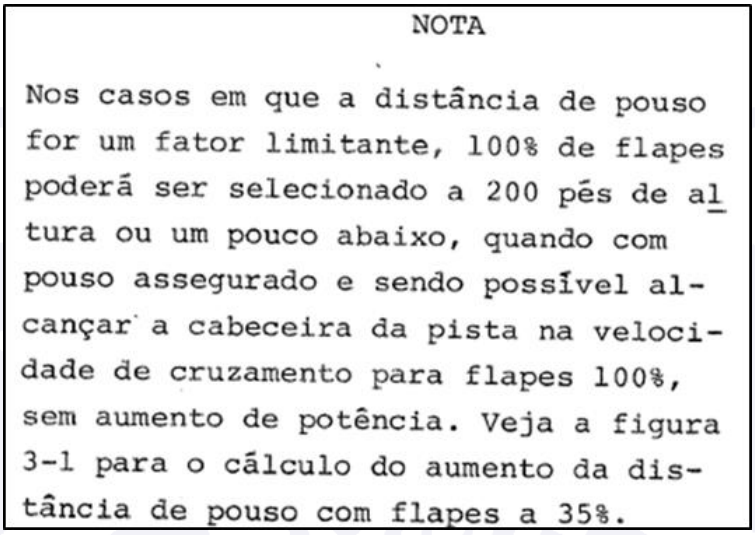
VELOCIDADES DE CRUZAMENTO – NÓS - V_i

PESO kgf	FLAPES - %		
	0	35	100
5600	122	107	100
5000	115	102	95
4700	111	98	92
4400	108	95	89
4100	104	95	86
3800	100	95	83

Figura 5-48

Figure 23 - V_{Ref} as per the POH (Section 5 - Performance).

The POH also included a note stating that 100% flaps could be selected at an altitude of 200 ft., or below, if the aircraft was already assured of landing and the landing distance was a limiting factor, but with the caveat that this procedure could be adopted with assured landing and with the expectation of reaching the runway threshold without the need to increase power (Figure 24).


NOTA

Nos casos em que a distância de pouso for um fator limitante, 100% de flapes poderá ser selecionado a 200 pés de altura ou um pouco abaixo, quando com pouso assegurado e sendo possível alcançar a cabeceira da pista na velocidade de cruzamento para flapes 100%, sem aumento de potência. Veja a figura 3-1 para o cálculo do aumento da distância de pouso com flapes a 35%.

Figure 24 - Single-Engine Landing and Go-Around Procedure Note as per the POH.

1.19. Additional information.

The ICA 100-37 - *Air Traffic Services* stated the following with regard to RADAR vectoring:

> 11.13 VECTORING
>
> 11.13.1 Whenever an aircraft is under vectoring, air traffic control service will be provided, with the controller being responsible for the navigation of the aircraft, and providing the pilot with heading instructions and level changes eventually necessary.
>
> 11.13.3 The beginning of a vectoring shall be characterized by information from the controller that the aircraft is under vectoring.
>
> 11.13.13 Upon completion of the vectoring of an aircraft, the controller will instruct the pilot to resume navigation, informing the aircraft's position and giving appropriate instructions, as necessary, in the manner prescribed in 11.12.2, letter "b", if the current instructions have deviated the aircraft from a previously assigned route.

The ICA 100-37 contained the following provisions regarding an emergency descent, in its Section 3.14 - "*Services for Aircraft in Case of Emergency*", in item 3.14.5 - "*Emergency Descent*":

> [...]
>
> 3.14.5.2 The pilot of the aircraft in emergency descent must, as soon as possible, take the following measures appropriate to the circumstances:
>
> a) to navigate as he/she considers appropriate;
>
> [...]

The ANAC's RBAC-91 - "General Requirements for the Operation of Civil Aircraft", Amendment 3, valid at the time, provided the following with regard to the authority of the PIC:

> 91.3 Responsibility and authority of the pilot in command
>
> (a) The pilot in command of an aircraft has the final authority and responsibility regarding its operation and safety of the flight.

(b) In an emergency requiring immediate action, the pilot in command may deviate from any requirements of this Regulation to the extent necessary to address the emergency.

(c) Every pilot in command who deviates from a requirement as per paragraph (b) of this section must record the occurrence in the logbook and submit a written report to the ANAC describing and justifying the deviation.

(d) The report referred to in paragraph (c) of this section must be submitted to the ANAC within a maximum period of 20 (twenty) working days from the date of occurrence, unless a different period is requested or authorized by the ANAC.

1.20. Useful or effective investigation techniques.

NIL.

2. ANALYSIS.

The aircraft was engaged on a private flight for the transport of passengers between SDCO and SBJP.

As verified, the aircraft engines were being serviced in accordance with the MORE Maintenance Program, and their maintenance was up to date. In spite of what was reported in relation to the illumination of the FIRE warning light and the odor inside the cabin, subsequent technical analyses carried out on the right-hand engine did not identify evidence of fire.

The pilots reported that the right-hand engine was “incandescent and there were controlled flames” (sic). This could characterize the occurrence of an internal fire. However, this condition would be inconsistent with the note of the POH that warned that such condition was associated with a high T5 indication, a fact that would not have occurred according to the report from the “Unqualified Pilot”.

It is important to emphasize that a condition of such magnitude would have left visible traces in the engine, prone to be identified during visual inspections and technical analyses. Based on this lack of technical confirmation, it is reasonable to infer that there may have been a false indication of fire on the alarm panel, due to a failure in the detection system.

The PIC had the formal qualification necessary for the operation. That being said, although the Investigation Commission identified evidence of training on the EMB-121 model, the absence of the endorsing pilot's CANAC, as well as the failure to log the endorsement in the Digital CIV, as required by the IS 61-006 Rev. C, did not allow attesting to the PIC's proficiency in the operation of the aircraft.

In addition, the very PIC reported having little familiarity with emergency procedures, and stated that he had not completed practice training that could have prepared him for that situation.

Therefore, it may be deduced that the deficiency in training led him to perform inadequate assessments of the parameters related to the operation of the aircraft, such as shutting down the right-hand engine without a better evaluation of the fire situation, and lowering the landing gear and extending the flaps to 100% without the aircraft being assured of landing.

Thus, the Investigation Committee concluded that the training previously received by the PIC was insufficient, and that he was not given the full knowledge and other technical conditions necessary to perform the duties of pilot in command of an EMB-121 A1, due to either lack of training or poor quality training.

The increased workload in the situation experienced by the PIC, requiring him to perform multiple functions, which included piloting, navigating, communicating, configuring the aircraft for approach and landing, without previous training of emergencies, may also have exceeded his ability to adequately manage that condition.

Although not having contributed to the occurrence, a takeoff performed in excess of the MTOW could reduce the aircraft's performance, adding to the possibility of aggravating the consequences, should a loss of power occur, especially during takeoff and climb, and was considered an unsafe condition by the Investigation Committee.

Such attitude denoted low adherence to operational requirements and procedures, and reinforced the existence of inappropriate postures such as complacency and overconfidence.

With regard to the interaction with the air traffic service, it was observed that the PT-FEG did not communicate the emergency situation to the ATS unit. However, by listening to the communication audios, it was possible to verify that the ATCO acted in accordance with the item 3.14.5 of the ICA 100-37, which reads: “when traffic control has knowledge or perception that an aircraft is making an emergency descent, it must provide all necessary support to safeguard every aircraft involved.”

According to the PIC, after the ATCO informed that they were high on the ramp, the landing gear and flaps were lowered in order to readjust the aircraft to the ideal ramp. This attitude, in turn, led the drag to increase substantially, causing the aircraft to not reach the runway.

3. CONCLUSIONS.

3.1. Findings.

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

b) the PIC held valid ratings for MLTE (Multi-Engine Land Airplane), MNTE (Single-Engine Land Airplane) and IFRA (Instrument Flight – Airplane);

c) it was not possible to attest to the PIC’s proficiency for the type of flight;

d) the aircraft had a valid CA (Certificate of Airworthiness);

e) the aircraft was above the maximum landing weight limit, but within the balance limit at the time of the occurrence;

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

g) the weather conditions were above the minimums for the flight;

h) the FIRE light on the alarm panel illuminated with reference to the right engine;

i) the PIC shut down the right-hand engine and used the fire extinguishing system;

j) the PIC decided to divert to SBKP on account of the emergency condition;

k) the PIC did not communicate an emergency condition to the ATC;

l) the aircraft made an emergency landing at a distance of 3.75 NM short of the runway 15 threshold;

m) evidence of overheating was found in one of the CT disk blades, but it was not possible to determine on which flight the phenomenon had occurred;

n) no evidence of fire was identified in the right-hand engine during the technical analyses and borescope inspection carried out on the powerplant;

o) the aircraft sustained substantial damage; and

p) the PIC and one of the passengers received no injuries, whereas the three other passengers were slightly injured.

3.2. Contributing factors.

Handling of aircraft flight controls – a contributor.

The difficulty in coordinating the aircraft, due to its single-engine flight condition, indicated that inadequate application of controls contributed to the outcome of this incident.

In addition, the early configuration of the aircraft, with the landing gear lowered and with flaps at 100%, led it to fly a ramp that was below the recommended one and influenced the failure to achieve the required landing parameters.

Instruction – a contributor.

The training process previously undergone by the PIC was insufficient, failing to give him the full knowledge and other technical conditions necessary to perform the activity of pilot in command of the EMB-121 A1, due to either lack or poor quality of the training.

Piloting judgment – a contributor.

Deficient training led to inadequate assessment of the parameters related to the aircraft operation that contributed to the occurrence, evidenced by the lack of a better analysis of the situation and the lowering of the landing gear and flaps to 100% without the aircraft being assured of landing.

4. SAFETY RECOMMENDATIONS

A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident.

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

To Brazil's National Civil Aviation Agency (ANAC), it is recommended:

A-054/CENIPA/2019 - 01 **Issued on 11/25/2024**

Assess the relevance of including the requirements of section 61.195 of the RBAC-61 in the "Instruction Required for Endorsement" field of the Supplementary Instruction n° 61-006, avoiding the use of the term "at discretion" when there is no guidance on the specific training to be provided.

A-054/CENIPA/2019 - 02 **Issued on 11/25/2024**

Disseminate the lessons learned from this investigation at events for the promotion of aviation safety developed by the ANAC, in order to inform the pilots on the training criteria for endorsement of a specific class aircraft model, especially with regard to emergency training.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On November 25th, 2024.