COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 119/CENIPA/2019

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PT-NKK**
MODEL:	**EMB-710C**
DATE:	**11AUG2019**

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 by taking into account the contributing factors and hypotheses raised. The report is, therefore, a technical document that 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 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 into the Brazilian legal system by 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 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 11AUG2019 accident with the EMB-710C aircraft model, registration PT-NKK. The accident was classified as “[LOC-I] Loss of Control in Flight”.

After the take-off, the aircraft turned right, lost height, and, about 1.6 km from the beam of the area used for take-off, collided with the right wing against a tree, hitting the ground afterward.

The characteristics of high angle and energy at impact led the investigators to infer that the pilot did not maintain complete control of the aircraft in the moments before the collision.

The aircraft was destroyed.

The pilot and two passengers suffered fatal injuries.

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

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

AD	Airworthiness Directive
ANAC	Brazil's National Civil Aviation Agency
BS	Service Bulletin
CA	Airworthiness Certificate
CAVOK	Ceiling and Visibility OK
CENIPA	Aeronautical Accident Investigation and Prevention Center
CHST	Supplemental Type Approval Certificate
CMA	Aeronautical Medical Certificate
CT	Type Certificate
DA	Airworthiness Directive
DCTA	Department of Science and Airspace Technology
EA	Aircraft Specification
ETSP	Toxicological Examination of Psychoactive Substances
IAM	Annual Maintenance Inspection
ICA	Command of Aeronautics' Instruction
MLTE	Airplane Multi Engine Land Rating
MNTE	Airplane Single-Engine Land Rating
NTSB	National Transportation Safety Board (USA)
OM	Maintenance Organization
PAGA	Agricultural Pilot Rating
PCM	Commercial Pilot License – Airplane
PN	Part Number
RBAC	Brazilian Civil Aviation Regulation
RBHA	Brazilian Aeronautical Certification Regulation
SACI	Integrated Civil Aviation Information System
SERIPA I	First Regional Aeronautical Accident Investigation and Prevention Service
SIGWX	Significant Weather
SIPAER	Aeronautical Accident Investigation and Prevention System
SN	Serial Number
TPP	Private Air Service Aircraft Registration Category
UTC	Universal Time Coordinated
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	**Model:** EMB-710C **Registration:** PT-NKK **Manufacturer:** Neiva	**Operator:** Private
Occurrence	**Date/time:** 11AUG2019 - 1700 UTC **Location:** Segundo Sol Mining **Lat.** 06°04'38"S **Long.** 055°17'57"W **Municipality – State:** Altamira – PA	**Type(s):** "[LOC-I] Loss of Control in Flight" **Subtype(s):** NIL

1.1 History of the flight.

The aircraft took off from an unregistered runway at Segundo Sol Mining, Altamira - PA, to another unregistered runway in the district of Moraes Almeida, Itaituba - PA, around 1655 (UTC), to perform a private flight for the transport of cargo and personnel, with one crewmember and two passengers on board.

After the take-off, the aircraft turned right, lost height, and, about 1.6 km from the take-off location, collided with the right-wing against a tree, hitting the ground afterward.

There was a rupture of the front structure of the cabin and the entire front section. Cargo and personnel on board were projected 45 m ahead.

The aircraft was destroyed.

Figure 1 - Final position of the aircraft.

1.2 Injuries to persons.

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

1.3 Damage to the aircraft.

The aircraft was destroyed.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours	Pilot
Total	452:59
Total in the last 30 days	Unknown
Total in the last 24 hours	Unknown
In this type of aircraft	Unknown
In this type in the last 30 days	Unknown
In this type in the last 24 hours	Unknown

N.B.: The data related to the pilot`s flown hours were extracted from the Digital CIV in the ANAC`s SACI.

The last recorded flight was on 25SEPT2017.

1.5.2 Personnel training.

The PIC took the PPR course at the Votuporanga Aeroclub - SP, in 2013.

1.5.3 Category of licenses and validity of certificates.

The PIC had a PCM License and valid MNTE and PAGA Ratings.

1.5.4 Qualification and flight experience.

There was no information on the pilot's recent experience, and it was not possible to say whether he was qualified for the flight.

1.5.5 Validity of medical certificate.

The PIC had the CMA expired since 12APR2019.

1.6 Aircraft information.

The aircraft was manufactured by Neiva in 1977 and was registered in the TPP Category.

The aircraft`s CA was valid.

The airframe, engine, and propeller logbook records were outdated.

The accident aircraft model was an EMB-710C, and its serial number was 710149. However, it was found in the OS of the last inspection, that in the airframe logbook, Part II, page 106, and in the propeller logbook, Part IV, page 102, the EMB-720 was registered as an aircraft model, and 72000 as a serial number (Figure 2).

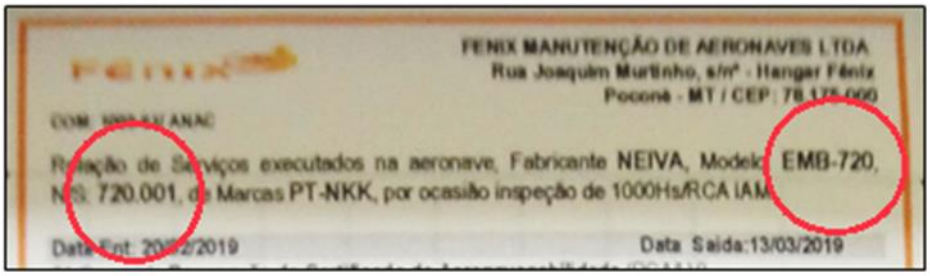


Figure 2 - Inspection Compliance Form in Part II of the airframe logbook with incorrect aircraft model and serial number.

The aircraft operator's supervision of the maintenance services was prevised in section 91.405(b) of the RBHA No. 91, in effect at the time of the occurrence, which described that "it must ensure that maintenance personnel have made appropriate notes in the aircraft maintenance records indicating that the aircraft has been approved for return to service."

The aircraft's logbook was not provided to the Investigation Team, and the operator reported not having copies of the flight logs.

Due to the lack of access to the aircraft's Logbook data, it was not possible to verify the hours flown after the inspection.

Such condition of the logbooks was against item 5.6.2 of ANAC's IS No. 43.9-003, Revision A, which stated that:

> The update of Part I of the airframe, engine, and propeller logbooks, must be done until the fifth day of the subsequent month whenever there is a change in the operating times cited in paragraphs 4.4 and 4.5 of this IS. Thus, if an aircraft, engine, or propeller operates after an inactive period longer than one month, this inactivity must be cited in a single line in the field Monthly Control of Parts I of the respective logbooks. Ex: Not totaled hours from 30APR02 to 30SEPT02 - reason IAM.

The last inspection of the aircraft, the “IAM” type, was carried out on 13MAR2019 by the OM Fênix *Produção em Aeronaves* Ltd., in Poconé - MT.

The last more comprehensive inspections of the aircraft, the “1,000 hours/RCA/LV” types, were carried out on 13MAR2019 by the OM Fênix *Produção em Aeronaves* Ltd., in Poconé - MT.

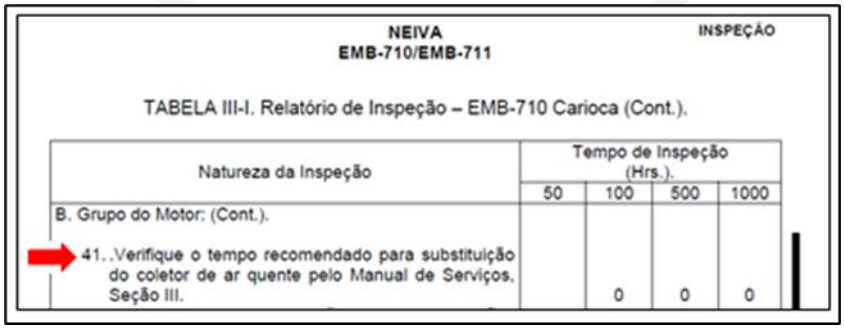
The Checklist (LV) and the Airworthiness Condition Report (RCA) aimed to revalidate the CA.

Likewise, it was not possible to verify the hours flown after these inspections due to the lack of the Logbook.

At the time of these inspections, the maintenance items established in the Service Manual 710/490, Revision 08, and the Continued Airworthiness Program for the aircraft model of the occurrence were fulfilled.

However, it was verified that there were no notes on the replacement of the hot air chamber (muffle), as recommended in the Service Manual, Section III - Inspection, page 3-5, in EMB 710/711 airplanes with 1,000 hours of operation, whose note that “It is recommended to replace the hot air chamber (muffle) in the EMB-710/711 aircraft with 1,000 hours of operation”.

This replacement was also recommended in the verification prevised in item 41 of Group B, Engine Group, contained in Table III-I - Inspection Report - EMB-710 *Carioca* of the Aircraft Service Manual, Section III - Inspection, page 3-17 (Figure 3).



NEIVA
EMB-710/EMB-711

INSPEÇÃO

TABELA III-I. Relatório de Inspeção – EMB-710 Carioca (Cont.).

Natureza da Inspeção	Tempo de Inspeção (Hrs.).			
	50	100	500	1000
B. Grupo do Motor: (Cont.).				
41. Verifique o tempo recomendado para substituição do coletor de ar quente pelo Manual de Serviços, Seção III.		0	0	0

Figure 3 - Cutout from page 3-17 of the 710/490 Service Manual, Revision 08.

The airworthiness approval documentation for export (EASA Form 1, FAA Form 8130-3 or equivalent) of the hot air chamber (muffle) was not presented, as provided for in IS 21-010, Revision B, item 5.8.1, the which said:

> Foreign manufactured aircraft, engine, or propeller components, with approval issued by a foreign authority (such as Parts Manufacturer Approval – PMA, etc.), do not require specific Brazilian approval. However, these products are eligible for installation on Brazilian Standard AC aircraft or on aircraft engines and propellers operated in Brazil only when:
>
> a) their approvals are issued by a foreign authority that has an import/export agreement with the Brazilian authority; and
>
> b) the product is accompanied by an export airworthiness approval (EASA Form 1, FAA Form 8130-3 or equivalent).

The OM did not present the Authorized Release Certificate - SEGVOO Form 003 (F-100-01 - Airworthiness Approval Label), which differed from the provisions of item 5.2.2.1 of IS No. 43.9-002, Revision B, as follows:

> In order to meet the requirements of section 43.9 of the RBAC 43, the Authorized Release Certificate - Form F-100-01 (Airworthiness Approval Label), whose model appears in Appendix A of this IS, must be used as a means of compliance concerning a primary maintenance record for approval for return to service of aircraft engines, propellers, and articles following maintenance, preventive maintenance, overhaul, modification, or repair.

During the investigation, flaws were found in the Secondary Records of Compliance with the OM`s Airworthiness Directives since the items did not apply to the aircraft model in question, namely:

a) in the notes of the Airworthiness Directives Control Information Map - Airframe, in compliance with the DA 77-09-02 that dealt with the Joints of the Control Cables in the Engine, this incorrectly referred to the NEIVA Service Bulletin No. 800-76-0002 instead of No. 700-76-0004 (Figure 4);

MAPA INFORMATIVO DE CONTROLE DE DIRETRIZES DE AERONAVEGABILIDADE - CÉLULA

(Seção 91.417 (a) (2) (v) do RBHA 91ou seção 135.439 (a) (2) (v) do RBHA 135)

Aeronave/Marcas:	PT – NKK	Modelo:	EMB-710C	Nº. de Série:	710-549	Fabricante:	NEIVA
Célula horas totais:	3.778,0	Célula horas após:					00,0

DA	SB/BS	SINOPSE	DATA EMISSÃO	CATEG	FREQ.	CUMPRIMENTO DATA	CUMPRIMENTO HS/TOTAIS	CRÉDITO	METODO UTILIZADO
76-06-01	80.710-33-001	Sistema iluminação instrumentos painel	02/06/1976	A/T	N/A	20/02/2006	3.617,0	N/A	
76-11-04	80.710-28-001	Válvula seletora de combustível	23/11/1976	A/T	N/A	20/02/2006	3.617,0	N/A	
77-04-04	80.790-28-003	Indicadores de combustível	29/04/1977	A/T	N/A	20/02/2006	3.617,0	N/A	
77-05-04	80.790-76-003	Comando potência do carburador	17/05/1977	A/T	N/A	20/02/2006	3.617,0	N/A	
77-09-02	80.800-76-002	Rotula dos cabos de comando do motor	23/09/1977	A/T	N/A	20/02/2006	3.617,0	N/A	
73-16-03	80.790-28-005	Sistema de combustível	21/10/1977	A/R	50 hs	13/03/2019	3.778,0	50 hs	

Figure 4 - Airworthiness Directives Control Information Map – Airframe

b) in the notes of the Airworthiness Directives Control Information Map - Engine (Figure 5):

- in the Synopsis field of the AD 64-16-05 there was “Oil Seal Failure” when it should have been “AC Pumpers”;

- in the AD 69-24-03, the Service Bulletin/Service Bulletin (SB/BS) field was blank when the SBA1-69, from the company Marvel Schebler Aircraft Carburetors, should have been included;

- in the AD 73-23-01, the Synopsis field was incomplete and should include “Piston Pin Assembly”;

- in the SB/BS field of the AD 75-08-09 R3, there were SMSB524 and SB3811C, but SB381B and SB385C, both from Textron Lycoming, should be included;

- in the AD 92-12-05, in the SB/BS field, there was 501, when it should have been SB501B, from Textron Lycoming, and in the Synopsis field, it was said “New Parts Installed” when it should have been “Piston Pins”;

- in the AD 97-15-11, the SB/BS field had 527 when it should have SB527C from Textron Lycoming, and the Synopsis field had “Recall of Piston Pin” when it should have had “Cylinder Kits”;

- in the AD 2004-05-24, in the Synopsis field, there was the information “Crankshaft Gear Retaining Bolt”, when it should have the information “Zinc-plated Crankshaft Gear Retaining Bolts”;

- the SB/BS field of AD 2004-10-14 was blank when it should have included Textron Lycoming's “Mandatory Service Bulletin (MSB) 475C”, and in the Synopsis field it had “Crankshaft Gear And Gear Tetainning Bolt” when it should have “Crankshaft Gear”;

- in the AD 2005-19-11, the SB/BS field was blank when it should contain “MSB566”, by Textron Lycoming, and in the Synopsis field, the information “300 HP or Lower Crankshaft” should appear, when it should have “Crankshafts” ;

- in the AD 2006-10-21, in the Synopsis field, there was the information “ECi Cylinder Rods”, when the information “ECi Connecting Rods” should have been included; and

- in the AD 2012-19-01, in the Synopsis field, there was the information “Crankshafts - LW crankshaft” when the information “Crankshafts” should have been included.

MAPA INFORMATIVO DE CONTROLE DE DIRETRIZES DE AERONAVEGABILIDADE -MOTOR

(Seção 91.417 (a) (2) (v) do RBHA 91 ou seção 135.439 (a) (2) (v) do RBHA 135)

Aeronave/Marcas:	PT-NKK	Modelo:	O-540-B4B5	Fabricante	LYCOMING	Nº Serie	L-24347-40A
MOTOR horas totais:	779.3	horas após:	00.0				

AD	SB/BS	SINOPSE	DATA EMISSÃO	CATEG.	FREQ.	CUMPRIMENTO DATA	CUMPRIMENTO HS/TOTAIS	CRÉTIDO	MÉTODO UTILIZADO
63-22-03	SB297	Carburetors	02/12/1966	A/T	N/A	17/10/2008	00,0	N/A	Cumprida pela O.M. "Manav Manut. Aver. Ltda"- COM 7304-09/ANAC
64-15-05	SB298	Oil seal failure	13/07/1964	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao modelo de bomba instalada no motor.. (FCDA)
66-06-03	SB302	Connecting Rod Assemblies	18/01/1969	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao modelo do motor. (FCDA)
66-20-04	SB307	Oil filter adaptor gasket	27/09/1966	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao número de série do motor. (FCDA)
69-24-03	-	Carburetors	29/11/1969	A/T	N/A	17/10/2008	00,0	N/A	Não aplicável ao número de série do carburador. (FCDA)
73-23-01	SB367F	Piston	13/01/1977	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao número de série do motor. (FCDA)
75-08-09 R3	SB524/SI3811C	Oil pump drive shaft	09/07/1975	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao número de série do motor. (FCDA)
87-10-06 R1	SB477A/SI1454	Rocker arm assemblies	01/09/1989	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao número de série do motor. (FCDA)
89-04-02	SSA1-88	Carburetors	08/03/1989	A/T	N/A	17/10/2008	00,0	N/A	Não aplicável ao número de série do carburador. (FCDA)
92-12-05	501	New parts installed	10/07/1992	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável devido a data de fabricação dos pinos do pistão e as series dos motores, não correspondem à série deste motor. (FCDA)
95-07-01	SB95-002/SNL-95-3	Connecting rod bolts	12/04/1995	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável devido os parafusos de bielas serem do PartNumber (FCDA)
96-09-10	524	Replacement Of Oil Pump Impellers	15/07/1996	A/T	N/A	25/06/2017	2.803,0	N/A	Cumprida pela O.M. "Wip Aviação" –COM 0107-01/ANAC
97-15-11	527	Recall of Piston Pin	12/08/1997	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável devido os pinos e pistão a serem de modelos satisfatórios conforme consta no MSB 527C (FCDA)
2004-05-24	MSB554/SB4	Crankshaft gera reataing bolt	08/04/1997	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao número de série listado no SB 554 (FCDA)
2004-10-14	-	Crankshaft gear and gear tetainning bolt N/A devido motor não sofrer parada brusca	25/08/2004	A/T	N/A	25/06/2017	2.803,0	N/A	Cumprida pela O.M. "Wip Aviação" –COM 0107-01/ANAC
2005-12-05	MSB645	Riveted impulse coupling assemblies	19/07/2005	A/T	N/A	25/06/2017	2.803,0	N/A	Cumprida pela O.M. "Wip Aviação" –COM 0107-01/ANAC
2005-19-11	-	300 HP or lower crankshafd	21/10/2005	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao número de série do eixo instalado. (FCDA)
2006-10-21	-	ECi cylinder Rods	22/06/2006	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao P/N das bielas. (FCDA)
2006-12-07	SB05-05	ECi Cylinder assemblies	07/05/2007	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao P/N dos cilindros. (FCDA)
2007-04-19R1	SB806-01 Ver. E	SAP cylinder assemblies	27/03/2012	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável devido à marca e Part Number dos cilindros instalados neste motor não corresponderem a marca dos cilindros citados nesta AD. (FCDA)
2009-26-12	-	Silinder assemblies	24/10/2012	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável devido à marca dos cilindros do motor, não corresponder a marca dos cilindros mencionados na AD. (FCDA)
2012-03-07	SB 18	Carburetor	27/03/2012	A/T	N/A	13/03/2019	779,3	N/A	Não aplicável ao P/N do carburador.
2012-19-01	MSB 569A	Crankshafts- eixo de manivela LW	24/10/2012	A/T	N/A	25/06/2017	2.803,0	N/A	Não aplicável ao número de série do motor e série do eixo de manivela (FCDA)
2017-16-11	MSB 632B	Reciprocating Engine Power Section	15/08/2015	A/T	N/A	13/03/2019	779,3	N/A	Não aplicável ao modelo do motor. (FCDA)

LOCAL/DATA	EMPRESA	C.O.M	Responsavel Tecnico	Assinatura
POCONÉ – MT., 13/03/2019	FENIX MANUTENÇÃO EM AERONAVES LTDA	1009-61/ANAC	Librido Pires Brandoff Cód.ANAC 483981 CFT/RNP: 0804298116	

Figure 5 - Airworthiness Directives Control Information Map - Engine

c) in the notes of the Airworthiness Directives Control Information Map - Propeller (Figure 6):

- “HC-C3YF-1RF” was included in the Model field, when “HC-C3YR-1RF” should be included, according to the aircraft's propeller log;

- in the SB/BS field of AD 2005-14-11, the “SA1B NE-01-19” was included, but the “Special Airworthiness Information Bulletin (SAIB) NE-01-09” by Hartzell Propeller Inc. should be included;

- the SB/BS field of AD 2005-18-20 was blank, when the “Alert Service Bulletin (ASB) 30-60-00-1” by Goodrich De-icing and Specialty Systems should have been included;

- the SB/BS field of AD 2008-13-28 was blank, when it should have included “ASB HC-ASB-61-297”, from Hartzell Propeller Inc.;

- the SB/BS field of AD 2009-22-03 was blank, when the “Service Bulletin (SB) HC-SB-61-269” by Hartzell Propeller Inc. should have been included; and

- on DA 90-11-07R1, in the SB/BS field, “SB142B” was stated, when it should have been “SB165E”, by Hartzell Propeller Inc.

MAPA INFORMATIVO DE CONTROLE DE DIRETRIZES DE AERONAVEGABILIDADE-HÉLICE

(Seção 91.417 (a) (2) (v) do RBHA 91ou seção 135.439 (a) (2) (v) do RBHA 135)

Aeronave/Marcas: PT-NKK | Modelo: HC-C3YF-1RF | N°. de Série: PA-649B | Fabricante: HARTZELL

Helice horas totais: 52.3 | Célula horas após: 00.0

AD	SB/BS	SINOPSE	DATA EMISSÃO	CATEG.	FREQ.	CUMPRIMENTO DATA	CUMPRIMENTO HS/TOTAIS	CRÉTIDO	METODO UTILIZADO
94-17-13	SB 165E	Grease Fitting Holes	15/09/1994	A/T	N/A	01/06/2017	52,3	N/A	Não aplicável ao número de série da hélice
2001-07-03	-	Overhaul	04/05/2001	A/T	N/A	01/06/2017	52,3	N/A	Não aplicável hélice não revisada pela BASCO. (FCDA)
2003-13-17	-	Propeller blades	18/07/2003	A/T	N/A	01/06/2017	52,3	N/A	Não aplicável hélice não revisada pela T e W propellers, Inc. (FCDA)
2006-14-1	SA18 NE-01-19	Failed propeller blades	13/08/2006	A/T	N/A	01/09/2017	52,3	N/A	Não aplicável hélice não rev. pela Southern California Propeller Service. (FCDA)
2006-18-2	-	"FAST prop" propeller de-icers	14/10/2006	A/T	N/A	01/09/2017	52,3	N/A	Não aplicável não instalado equipamento de anti gelo (de gelo). (FCDA)
2006-24-07	-	Propeller blades	03/01/2007	A/T	N/A	01/09/2017	52,3	N/A	Não aplicável hélice não revisada pela Oxford Aviation Services Limited. (FCDA)
2007-26-09	SB118A	Initial blades	30/01/2008	A/R	O/H	01/09/2017	52,3	2.400 OHs	Cumprida pela O.M."Hélices Flamar Ltda"- COM 0302-03/ANAC. (FCDA)
2008-13-2	-	Propeller	13/07/2008	A/R	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
2009-22-0	-	Propeller hub	12/11/2009	A/R	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
DA	**SB/BS**	**SINOPSE**	**DATA EMISSÃO**	**CATEG.**	**FREQ.**	**DATA**	**HS/TOTAIS**	**CRÉTIDO**	**METODO UTILIZADO**
75-05-03	SB 819-61-301	Pressão de abastecimento ar da hélice	08/05/1976	AT	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
78-09-02R2	-	Parafusos de fixação da hélice	28/09/1983	AT	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
79-08-01	SB 118-61-308	Rebocagem fixação spinner	03/08/1979	AT	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
80-12-03R1	SB 118-30-306	Pistas de cobre das hélices	13/08/1982	AT	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
83-05-05R2	SB 118-61-325	Pás de liga de alumínio	15/08/1983	AT	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
83-12-01	SB 118-61-327	Hélices	16/12/1983	AT	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
87-03-05	SB 142B	Cubos das hélices	31/03/1987	AR	2400Hs	01/09/2017	52,3	2.400 OHs	Cumprida pela O.M."Hélices Flamar Ltda"- COM 0302-03/ANAC. (FCDA)
90-11-06	SB 154A	Cubo de hélice	26/11/1990	AT	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice
90-11-07R1	SB 142B	Cancelamento da DA da Hartzell	26/11/1990	AT	N/A	01/09/2017	52,3	N/A	Não aplicável ao modelo da hélice

Figure 6 - Airworthiness Directives Control Information Map – Propeller

It was not possible to track correct compliance with the Airworthiness Directives through the Airworthiness Directive Compliance Forms (FCDA), which are the primary record of compliance with an AD, as the company does not make them available.

Section 91.417(a)(2)(v) of the RBHA 91 stated that:

> Except for work performed under sections 91.411 and 91.413 of these Regulations, each owner or operator must keep, for the periods set forth in paragraph (b) of this section, the following records:
>
> (2) records containing the following information:
>
> (v) the current status of applicable airworthiness directives (AD), including, for each, the method for complying with them, the AD number, and the AD revision date. If the AD requires periodic actions, the time and date when the next action will be required.

1.7 Meteorological information.

The Enhanced Satellite Image at 1700 (UTC), on the 11AUG2019, did not show significant formations that could restrict visibility at the time of the accident.

The SIGWX generated at 1200 (UTC) on 11AUG2019, valid until 1200 (UTC) on 12AUG2019, illustrated that there were no formations that could restrict visibility.

It was verified with observers on the ground that the weather conditions were favorable for the flight.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The occurrence took place out of the Aerodrome.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The first impact occurred with the collision of the right half wing against a tree at a height of 25 m from the ground and about 1.6 km from the unregistered runway of Segundo Sol Mining, Altamira - PA, heading 330°, in attitude (approximately 30°) and with a lateral inclination of approximately 30° to the right.

The second impact occurred with the aircraft leaning to the right, colliding with the right half wing and then with the aircraft's nose against the ground.

After the second impact, the aircraft remained on its back, 15° lagged with the trajectory angle, inclined approximately 135° and with the wings level.

There was a separation of the cabin near the doors, which was projected 45 m ahead on the ground (Figure 7).

Figure 7 - Cabin front structure with the aircraft panel.

Also, they were projected together with the cabin, pilot, passengers, and cargo (toolboxes and a motorcycle).

There was a fire in the engine and propeller assembly after the impact.

The landing gear was of the fixed tricycle type and, on the impact on the ground, had the nose gear broken.

The position of the compensators was unknown.

The flaps were found in the up position. However, the flap control lever, located on the flight control pedestal was fully pulled up, in order to extend the flaps to the 40 degrees (full flap) position.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

The forensic examination concluded that the pilot's cause of death was multiple trauma.

A search for alcohol concentration was performed by gas chromatography with headspace injection. The presence of 3.25 decigrams of ethyl alcohol per liter of blood was detected.

However, this examination was hampered as the material collection time was longer than 21 hours that is, it exceeded 8 hours for the ETSP prevised in section 120.339 of the RBAC 120, as follows:

> [...]
>
> (c) Post-accident ETSP: every responsible company must conduct post-accident ETSP, in accordance with the following requirements:
>
> [...]
>
> (4) the conditions suitable for carrying out a post-accident ETSP mentioned above are such that:
>
> [...]
>
> (ii) have not elapsed:
>
> (A) 8 (eight) hours after the accident, for an alcohol concentration test;

Information was obtained that, on the eve of the occurrence, the pilot had participated in a party to celebrate Father's Day, in which alcoholic beverages were consumed.

In the same sense, according to reports obtained, there was alcohol consumption by the crew and passengers in the mining before the take-off.

The pilot had the CMA expired since 12APR2019, and section 91.5 of the RBHA 91 established that:

> [...]
>
> (a) no person may operate a civil aircraft registered in Brazil unless:
>
> [...]
>
> (3) the operation is conducted by crewmembers who are suitably qualified for the aircraft and for the role they perform on board and who hold a valid certificate of physical ability. (our emphasis)

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

The PIC involved in this occurrence was 33 years old and began his aviation training in 2013 as a Private Pilot. In 2015, he obtained the Commercial Pilot License, which allowed him, as a prerogative, to carry out remunerated activity as provided for in section 61.105 of the RBAC 61.

According to the information obtained, the pilot was available to fly as an agricultural pilot during harvests with various operators in the region without a formal contract, having operated during the soybean and grass seed harvest from 2018 to 2019.

The PIC was noted to have an excellent operational profile, acting responsibly and with mastery of the aircraft.

In the information the operator provided, he reported that the pilot was hired on the recommendation of his son, who knew and recommended him, but provided a service without an employment relationship.

On the day of the occurrence, the pilot was providing services to carry out a cargo and personnel transport flight, with the objective of taking a mechanic to check a hydraulic excavator at the Segundo Sol Mining.

The investigation collected information from third parties about the working group culture, in which it was raised that it was common for aircraft operating in the region to perform low-altitude passages in the take-off areas used, being reported as a moment of euphoria and excitement of the pilots.

From the operator's perspective, he never witnessed the pilot consuming alcohol without moderation and was confident in his professional performance.

1.14 Fire.

After the aircraft impacted the ground, the cabin was separated and due to the rupture of the fuel and lubrication systems` pipes and hoses, these fluids came into contact with the powertrain at a high temperature, starting the fire.

1.15 Survival aspects.

Nil.

1.16 Tests and research.

Tests and disassembly of the Bendix Electric Fuel Pump (Plunger Type), PN 480543, SN 18503, belonging to the aircraft of the occurrence in an OM approved by the ANAC were performed.

During the bench tests, the pump showed normal fuel flow and operating pressure, obtaining values of 18 gallons per hour and 8 PSI, respectively.

During the disassembly and inspection, the internal parts of this pump showed no visible damage and did not contain signs of biological contamination, being in perfect working order.

The fuel selector valve, PN 492290, SN N/A, was dismantled for analysis by the DCTA.

The Neiva 710/490 Service Manual, Rev. 8, from 01DEC 2016, p. 9-4, described that the selector valve was remotely controlled by a selector mechanism located on the inclined face of the control duct.

This activation was performed by means of a rod that extended from the fuel selector to the articulation of the fuel selector valve, according to item 89 of Figure 55 - Fuel System Installation, pages. 2L16 and 2L21, from the Illustrated Parts Catalog (CIP) 710C/975, November 2004 (Figure 8).

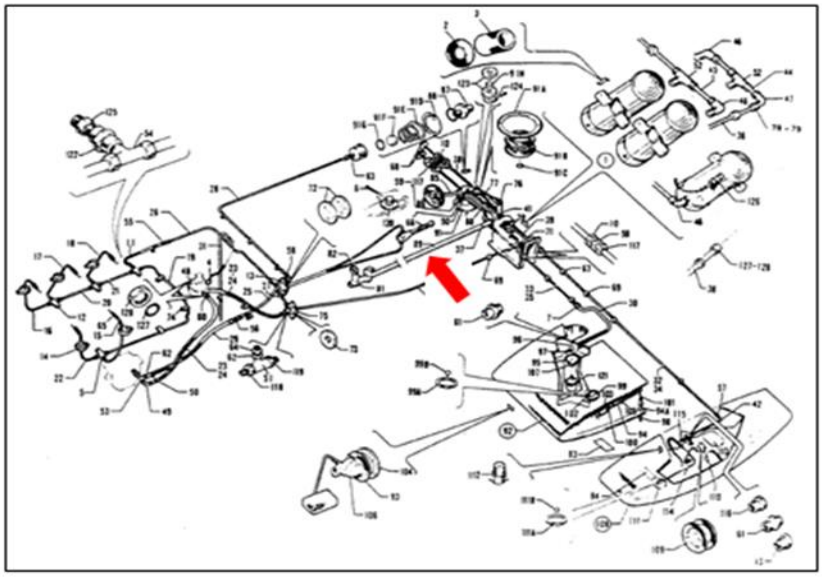


Figure 8 - Torque Tube for activating the fuel selector valve.

At the time, it was identified that the internal fuel filter on the underside of the selector valve did not contain contamination.

Analyzing the internal disc of the fuel selector valve, it was found that it was in the closed position (Figure 9).

Figure 9 - Fuel selector valve internal disc in the closed position.

However, during disassembly, when observing the disk face that was in contact with the fuel passage holes coming from the aircraft tanks, it was found that the contact area between the disk and the fuel outlets was clean, that is, without soot (Figure 10).

Figure 10 - Face of the fuel selector valve disc with clean area.

This condition pointed to the fact that the internal disc of the fuel selector valve was in the open position at the time of the accident but was moved to the closed position after the impact.

In order to improve the understanding, Figure 11 shows a view of the face at the top of the fuel selector valve, showing the communication holes with the aircraft's fuel tanks and the outlet to feed the engine.

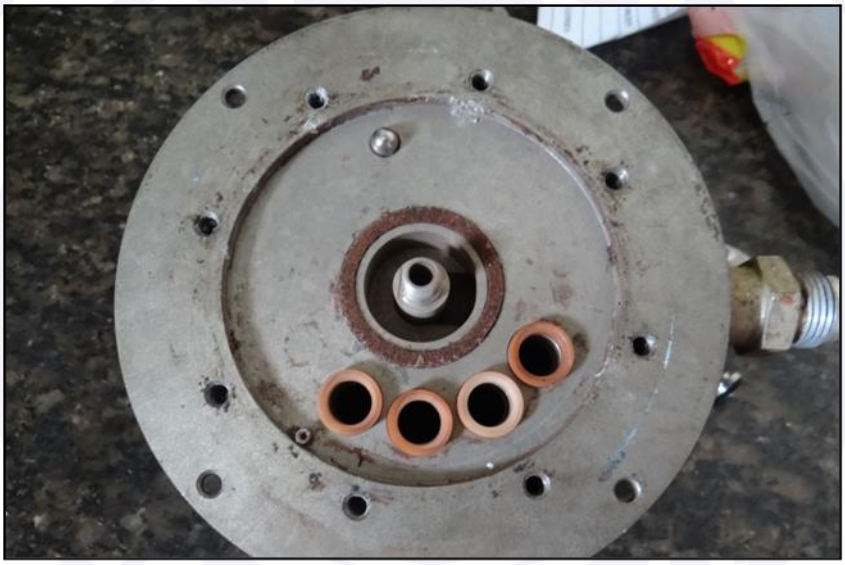


Figure 11 - General view of the fuel selector valve communication holes with the aircraft's fuel tanks.

It was not possible to establish the position of the fuel selector in the cabin as it was destroyed.

The mechanical fuel pump, carburetor, fuel distributor, hoses, pipes, and injectors were not analyzed, as they were consumed by the fire.

The flap surfaces were in the up position. However, the control lever was fully pulled up to extend the flaps to the 40-degree (full flap) position (Figure 12).

Figure 12 - View of the flap control lever at 40-degree position.

The Textron Lycoming Engine O-540-B4B5, SN L-234347-40A and the Hartzell Propeller HC-C3YR-1RF, SN PA649B were also analyzed by the DCTA.

The engine had severe damage as a result of the fire that followed the crash of the aircraft.

Due to the long exposure to fire resulting from the accident, all cylinders underwent a fusion process, which made it impossible to remove them from the engine block.

The crankshaft and connecting rods were intact. The camshaft was also inspected inside the engine block, and no damage was identified.

It was observed that a large part of the engine was consumed by the fire and that several components such as magnetos, carburetor, rear cover, and crankcase were directly affected. Therefore, there was no condition to analyze them.

The other components, such as the block, crankshaft, cylinders, pistons, and camshaft, showed severe oxidation, which prevented complete disassembly.

The upper ignitors of cylinders 1, 2, 3, 4 and 6 could be removed, but they were oxidized and showed corrosion (Figure 13).

Figure 13 - View of the upper ignitors of cylinders 1, 2, 3, 4 and 6.

There was a lot of soot in the upper ignitors of cylinders 2, 4 and 6; possibly resulting from the fire that the aircraft suffered.

The other igniters were melted in their respective quarters.

This engine's lubrication system was not inspected or analyzed, as its only component that was in the engine was the oil pump. The other components were consumed by the fire, such as the primary and main oil filters as well as the crankcase.

After the analysis carried out on the Textron Lycoming Engine O-540-B4B5, SN L-234347-40A, it was found that the long period of exposure to high temperatures allowed

the fire to consume or melt the components that contained aluminum in its composition, which meant exposure to temperatures above 820°C.

In this way, the components of the lubrication system, fuel supply, ignition, in addition to the cylinders, pistons, and semi-casings were consumed entirely or partially.

The high temperature also caused the fusion of internal components, such as the bearings and connecting rods, a fact that prevented the complete disassembly of these engine components for analysis.

According to the EA No. 7503-05, of 03MAY2018, an integral part of Type Certificate No. 7503, updated due to the transfer request from *Indústria Aeronáutica* Neiva S.A. to the EMBRAER S.A., the propeller planned for the aircraft model EMB-710C was the model Hartzell HC-C2YK-1( )F/F8468A-4.

However, it was possible to use the Hartzell HC-C3YR-1RF propeller that equipped the aircraft at the time of the occurrence. Because it was verified that the CHST No. 2005S04-02 authorized the modification to the product type design, since the specified limitations and conditions were met, satisfying the applicable airworthiness conditions for the installation of the Hartzell HC-C3YR-1RF/F7693F propeller according to Hartzell Propeller Instruction no. HP3235IM, Rev. Original, dated 30JUL2001.

The propeller that equipped the aircraft was analyzed by the DCTA, showing backward bending in the three blades (Figure 14).

Figure 14 - Front view of the Hartzell HC-C3YR-1RF propeller still mounted on the engine.

Forward bending was verified at the ends of two propeller blades and, in the third, the presence of longitudinal scratches (Figure 15).

Figure 15 - View of forward-facing bends at the end of two blades and longitudinal scratches at the third.

Also in this analysis, in addition to a deformation of the pin that makes up the pitch change mechanism in one of the blades, the rupture of this pin in two blades was also verified, which occurred due to overload (Figure 16).

Figure 16 - View of the overload rupture of the blade pitch change pin.

1.17 Organizational and management information.

Regarding the OM, it was verified that the aircraft`s primary and secondary records control were unsatisfactory, considering the fact that the airframe, engine, and propeller logbook registers were outdated. There were also erroneous entries in Part II of the airframe logbook and Part IV of the propeller logbook, as well as several discrepancies in the Airworthiness Directive Compliance Maps for the airframe, engine, and propeller.

Nonconformities of this OM were observed in the compliance with the requirements established in the Service Manual 710/490, Revision 08 and in the Continued Airworthiness Program for the aircraft model, since there are no notes about the replacement of the hot air chamber (muffle), as recommended by the manufacturer in the Service Manual, Section III - Inspection, page 3-5, in EMB 710/711 airplanes with 1,000 hours of operation.

1.18 Operational information.

Analyzing the data extracted from the ANAC's SACI, a private individual was identified as the aircraft operator. However, during the investigation, another individual posed as such without presenting documents for the purchase and sale of the aircraft.

The latter would have acquired the aircraft 8 months ago for family use, aiming to provide his youngest son with the acquisition of experience, obtain a pilot's license, and transport passengers.

The pilot of the occurrence had no employment relationship with this operator, acting as a freelancer.

It was verified that the aircraft was operating on runways not registered by the ANAC, since it was headquartered in the district of Moraes Almeida (06°13'38” S 055º37'50” W), Itaituba - PA, the operator's city of residence, in addition, to perform constant flights to the Segundo Sol Mining (06°03'45” S 055º18'06” W), Altamira - PA, in order to support mining activities carried out in the locality.

The aircraft had taken off from the district of Moraes Almeida to the mining region, at around 1000 (UTC), having started its return from the Segundo Sol Mining at around 1655 (UTC).

The operation on unregistered runways disagreed with section 91.102(d) of the RBHA No. 91, in force on the date of the occurrence, which stated that:

> no person may use an aerodrome unless it is registered and approved for the type of aircraft involved and the proposed operation.

The aircraft operation was conducted under Visual Flight Rules (VFR).

Its fueling was performed by drum, and a proof of delivery of 628 liters of aviation gasoline was presented on 11AUG2019.

It was not possible to establish whether the aircraft was within the weight and balance limits specified by the manufacturer, given the impossibility of determining the amount of fuel contained in its tanks.

It is worth noting that the aircraft was carrying toolboxes and a motorcycle as cargo, without the proper lashings.

According to the operator, the purpose of the flight was to transport a hydraulic excavator mechanic to the mine.

Investigators obtained information that it was common for low-flying passes to be made, after the take-off, over the mining trails in the region, and then the pilots proceeded to their destination.

Section 91.13(a) of the RBHA 91 expressed that:

> no person may operate an aircraft in a careless or negligent manner which endangers the lives or property of others.

Item 5.1.4 of the ICA 100-12, stated the following:

> Except in landing and take-off operation, a VFR flight shall not be performed:
>
> (a) over cities, settlements, inhabited places or over groups of people in the open air, at a height of less than 300 m (1000 ft) above the highest obstacle existing within 600 m (1,000 ft) around the aircraft; and
>
> b) in places not mentioned in the previous paragraph, at a height of less than 150 m (500 feet) above the ground or water.

The aircraft described a trajectory that started from a take-off with heading 070°, curving to the right until it reached heading 330° (impact heading), 1.6 km from the area used for take-off (Figure 17).

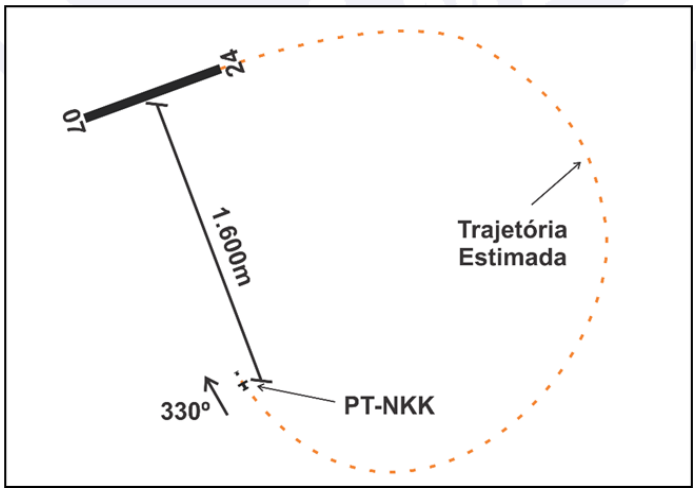


Figure 17 - Estimated trajectory, heading and distance from the accident site.

1.19 Additional information.

Nil.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a private flight for the transport of cargo and personnel, with a pilot and two passengers on board.

At around 1655 (UTC), the aircraft took off from an unregistered runway in the Segundo Sol Mining, Altamira - PA to another unregistered runway located in the district of Moraes Almeida, Itaituba - PA.

The operation in areas that were not registered runways disagreed with the provisions of section 91.102(d) of the RBHA 91, which implied safety levels below the minimum acceptable established by the Brazilian State.

During the investigation, it was found that the pilot`s CMA expired on 12APR2019. Therefore, as prescribed in section 91.5, of the RBHA 91, he was not able to perform the function of PIC, as he did not have his psychophysical aptitudes attested for the flight, which may affect flight safety.

It was found that the airframe, engine, and propeller logbooks were outdated, as Parts I - Monthly Control of the Use of Airframe and Engine Logbooks had the last record dated March 2012, and Part I of the propeller logbook was blank.

This condition of the records was contrary to item 5.6.2 of the IS No. 43.9-003, Revision A.

Still on the documental context, flaws were found in the OM's Maintenance Technical Control, since, although the Service Order indicated as aircraft model the EMB-710C, and serial number 710149, in the airframe logbook Part II, page 106 and in the propeller logbook Part IV, page 102, the EMB-720 was indicated as aircraft model and the serial number was 720001.

At this point, there was a failure in the supervision of the aircraft operator, who, according to section 91.405(b) of the RBHA 91, should ensure the correct notes in the aircraft maintenance records, indicating that it has been approved for return to service.

Regarding the last more comprehensive inspection of the aircraft, it was verified that there were no notes on the replacement of the hot air chamber (muffle), as recommended in the Service Manual.

In addition, the OM did not present the Authorized Release Certificate - Form SEGVOO 003 (F-100-01 - Airworthiness Approval Label), which differed from what was predicted in item 5.2.2.1 of IS No. 43.9-002, Revision B .

Likewise, the airworthiness approval documentation for export (EASA Form 1, FAA Form 8130-3 or equivalent) of the hot air chamber (muffle) was not presented, as previsted in the IS 21-010, Revision B, item 5.8 .1.

In the same sense of problems in documentation, flaws were found in several Secondary Records of Compliance with Airworthiness Directives (DA) by the OM.

In the notes of the Airframe, Engine, and Propeller Airworthiness Directives Control Information Map, acceptable secondary record format, related to the applicability, control and compliance of a DA, there were errors related to the references of Service Bulletins (BS) and in the synopses.

This condition pointed to latent flaws in the OM registration process that, despite not being applicable to the aircraft/engine/propeller model, had the potential to increase the risks in air operations in general.

The last more comprehensive inspection of the aircraft, the 1,000 hours/RCA/LV" type, was carried out on 13MAR2019 and, on that occasion, spreadsheets were made with erroneous information, which were no longer reliable regarding the status of compliance with the AD.

It was not possible to correctly track the compliance with the Airworthiness Directives through the Airworthiness Directive Compliance Forms (FCDA), which are the primary record of compliance with an AD, due to the company not making them available, which contradicted section 91.417 (a)(2)(v) of the RBHA 91.

Thus, the company failed to comply with regulatory requirements adequately and reliably regarding airframe, engine, and propeller AD compliance, which could compromise the aircraft's airworthiness situation, directly affecting the operational safety.

Thus, although it was stated in the ANAC records that its CA was valid, the non-conformities found in the analyzed documentation indicated that the aircraft did not meet the airworthiness requirements.

It was not possible to verify if the aircraft had any discrepancy prior to the accident, which was known by the operator and recorded, due to the non-presentation of the Logbook.

As for the tests and analyzes carried out, during the investigation of the fuel selector valve, it was initially found that it was in the closed position, a situation not consistent with the dynamics of the accident.

When disassembling this component, it was found that the contact region with the fuel inlet holes of the tanks was clean throughout, that is, from open to closed.

This fact denoted that, in the moment of the collision, the fuel selector valve was in the open position, but it would have been moved by the impact.

Considering that the fuel selector was destroyed, there is a possibility that, with the collapse of this device, together with the connections of the torque tube for the activation of the fuel selector valve, there was the positioning of the internal disk to the closed position, independently of the pilot action.

This condition is in line with the dynamics of the accident, as well as providing an explanation for the clean area on the internal disk of that valve.

Following the investigation, it was verified that the flap trigger lever was in the 40-degree position.

However, considering that the surface of the flaps was in the up position and that the rupture of the trigger cables occurred with the sectioning and projecting of the front part of the aircraft 45 m ahead of the impact site, it is possible that the flap control lever has been moved to the 40-degree position at the time of the accident, by direct mechanical action on the lever, regardless of the pilot's action.

When evaluating the condition of the PT-NKK propeller, evidence was found that the aircraft was developing power at the time of the accident.

This statement is based on the deformations and marks found on the propeller blades and on the overload rupture of the pin that makes up the pitch change mechanism. These facts are indicative that the engine was running at the moment the aircraft collided.

According to reports, there was alcohol consumption by the crew and passengers in the mine before taking off.

Even with the commitment of the ETSP, as it was performed beyond the deadline established in the RBAC 120, it can be inferred that the attitude of consuming alcoholic beverages in the mining area before the flight, demonstrated misalignment with the flight safety mentality. It has the potential to degrade the levels of situational awareness in the air activity developed.

According to information gathered on the course of the investigation, it was found that the working group of pilots operating in the gold mines regions had a culture of flying at low altitude over the mining runways after taking off.

Analyzing the flight trajectory described by the aircraft, it was understood that there was an unusual profile for a standard take-off, since the aircraft completed a turn of about 260º to the right.

Associating this trajectory with the culture of the aforementioned group, there is a hypothesis that, after taking off from the runway, the pilot turned right with the intention of performing such a procedure over the takeoff area of the Segundo Sol Mining.

This procedure was in disagreement with air traffic regulations, indicating an inadequate assessment of the risks involved in the operation carried out.

The behaviors presented, such as the use of unregistered runways, the flight with an expired CMA, and the possible intention to perform a low-altitude flight over the mining runway demonstrated an attitude contrary to the rules and procedures, leading to complacency in the face of actions inadequate in air activity.

Understanding that the angle of the first impact was about 30° and the side bank was approximately 30° to the right, as well as conceding that the collision occurred with enough energy to sever the front of the aircraft with the projection of personnel and cargo, it was seen that the pilot did not maintain full control of the aircraft in the moments before the collision.

Thus, it is possible that the pilot performed an inadequate evaluation of the flight parameters to perform the framing curve for low passage over the area.

Thus, considering the evidence highlighted, it is possible to characterize this occurrence as the loss of control of the aircraft during the framing curve for a low-altitude passage over the unregistered runway of the Segundo Sol Mining, which may be associated with the consumption of alcohol before the flight.

3. CONCLUSIONS.

3.1 Facts.

a) the pilot`s CMA expired on 12APR2019;

b) the pilot had valid MNTE and PAGA Ratings. His MLTE Rating was expired;

c) the aircraft had a valid CA;

d) it was not possible to verify if the aircraft was within the weight and balance limits established by the manufacturer;

e) the airframe, engine and propeller logbook records were outdated;

f) the weather conditions were favorable for the flight;

g) there were reports of alcohol consumption before the flight;

h) there was a group of pilots' culture to carry out passages at low altitude over the mining runways, after the take-off;

i) the aircraft took off from an unregistered runway to another unregistered runway;

j) after the takeoff, the pilot made a 260° turn to the right;

k) the aircraft lost height and crashed its right wing into a tree and then into the ground;

l) the aircraft's powerplant was developing power at the time of the occurrence;

m) the angle of the first impact was about 30° in relation to the ground;

n) the energy of the impact severed the front of the aircraft with the projection of personnel and cargo 45 m ahead;

o) the aircraft was destroyed; and

p) the pilot and passengers suffered fatal injuries.

3.2 Contributing factors.

- **Alcohol – undetermined.**

The presence of 3.25 decigrams of Ethyl Alcohol per liter of the crewmember's blood was detected, but the ETSP was compromised because the material collection time was longer than 8 hours.

However, there was a report of alcohol consumption by the crew and passengers in the mine, before the take-off, which would denote a departure from practices related to the safety of the operation.

- **Control skills – undetermined.**

The aircraft made a right turn after the take-off, possibly with the intention of making a low altitude pass over the Segundo Sol Mining runway.

In this condition, considering the various factors involved, it was inferred that there was an inadequate application of the commands and consequent loss of control in flight.

- **Attitude – a contributor.**

The use of unregistered runways, the flight with the expired CMA and the possible intention to fly at low altitude over the mining area demonstrated an attitude contrary to the rules and procedures, leading to complacency in the face of inappropriate actions in the aerial activity.

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

Information collected in the investigation showed that the culture of the work group of pilots who operated in the gold mines regions encouraged the performance of low-altitude flights over the mining runways.

- **Perception – undetermined.**

It is possible that the consumption of alcoholic beverages before the flight has resulted in impairments in the ability to recognize, organize, understand and project the sensations from internal and external stimuli to the operating environment and resulted in the reduction of their situational awareness, leading the pilot to lose control of the aircraft during the maneuver that culminated in the accident.

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

The inadequate judgment of the risks involved in the maneuver resulted in the decision to perform a flight at low altitude, characterizing the compromise of the pilot's decision-making process quality.

4. SAFETY RECOMMENDATION.

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

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

Recommendations issued at the publication of this report:

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

A-119/CENIPA/2019 - 01 Issued on 23/03/2023

Work with the OM Fênix *Manutenção em Aeronaves* Ltd., in order to mitigate recurrences of non-conformities similar to those verified in this investigation.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On March 23th, 2023