COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-089/CENIPA/2017

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-MFR**
MODEL:	**210M**
DATE:	**03JUL2017**

This report replaces the RF A-089 / CENIPA / 2017, from August 6th, 2019, previously published on the CENIPA website.

NOTICE

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

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

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

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

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

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

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

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

SYNOPSIS

This is the Final Report of the 03JUL2017 accident with the 210M aircraft model, registration PR-MFR. The accident was classified as “[SCF-PP] System/Component Failure or Malfunction Powerplant – Engine Failure in Flight”.

During the take-off, the aircraft couldn’t keep the climb, crashing against trees, and later, against the ground. There was fire after the final impact.

The aircraft was destroyed.

The pilot and three passengers died on the spot. Another passenger had serious injuries.

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

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	Brazil's National Civil Aviation Agency
ANP	National Agency of Petroleum, Natural Gas and Biofuels
APP	Approach Control
APP-BV	Boa Vista Approach Control
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CG	Center of Gravity
CM	Registration Certificate
CMA	Aeronautical Medical Certificate
COM	Maintenance Organization Certificate
EO	Operating Specifications
IAM	Annual Maintenance Inspection
IAE	Aeronautics Space Institute
METAR	Aviation Routine Weather Report
MGO	General Operations Manual
MNTE	Airplane Single Engine Land Rating
NTSB	National Transportation Safety Board (USA)
Pb	Lead
PLA	Airline Pilot License – Airplane
POH	Pilot's Operating Handbook
PPR	Private Pilot License – Airplane
RBAC	Brazilian Civil Aviation Regulation
RBHA	Brazilian Aeronautical Certification Regulation
SN	Serial Number
SWAE	ICAO Location Designator – Uaicas Aerodrome, Alto Alegre - RR
SWPD	ICAO Location Designator - Pouso da Águia Aerodrome, Cantá - RR
TPX	Aircraft Registration Category of Non-Regular Public Air Transport
UTC	Universal Time Coordinated
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	**Model:** 210M **Registration:** PR-MFR **Manufacturer:** Cessna Aircraft	**Operator:** Paramazônia Air Taxi Ltd.
Occurrence	**Date/time:** 03JUL2017 - 1510 UTC **Location:** Pouso da Águia Aerodrome (SWPD) **Lat.** 02°47'30"N **Long.** 060°35'24"W **Municipality – State:** Cantá – RR	**Type(s):** "[SCF-PP] System/Component Failure or Malfunction Powerplant" **Subtype(s):** Engine Failure in Flight

1.1 History of the flight.

The aircraft took off from the Pouso da Águia Aerodrome (SWPD), Cantá - RR, to the Uaicas Aerodrome (SWAE), Alto Alegre - RR, at about 1510 UTC, in order to transport personnel, with a pilot and four passengers on board.

After the takeoff, the aircraft lost power and did not maintain a positive climb rate. After that, the left elevator collided with a tree and fell.

There was fire after impacting the ground. Only one passenger managed to abandon the aircraft.

The aircraft was destroyed.

A passenger was seriously injured.

The pilot and three passengers died on the spot.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	1	3	-
Serious	-	1	-
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	10.336:60
Total in the last 30 days	32:20
Total in the last 24 hours	00:00
In this type of aircraft	100:00
In this type in the last 30 days	12:55
In this type in the last 24 hours	00:00

N.B.: The data related to the flown hours were obtained from the aircraft's operating company.

1.5.2 Personnel training.

The pilot took the PPR course at the São Carlos Aeroclub – SP, in 1987.

1.5.3 Category of licenses and validity of certificates.

The pilot had the PLA License and had valid MNTE Rating.

1.5.4 Qualification and flight experience.

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

1.5.5 Validity of medical certificate.

The pilot had valid CMA.

1.6 Aircraft information.

The aircraft, serial number 21061795, was manufactured by Cessna Aircraft, in 1977, and it was registered in the TPX category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe, engine and propeller logbook records were updated.

The last inspection of the aircraft, the “200 hours” type was carried out on 28JUN2017 by the maintenance organization Paramazônia Air Taxi, in Cantá - RR, with the aircraft having flown 10 hours and 50 minutes after the inspection.

The last revision of the aircraft, the “IAM” type was carried out on 28MAR2017 by the maintenance organization Paramazônia Air Taxi, in Cantá - RR, with the aircraft having flown 107 hours and 40 minutes after the revision.

1.7 Meteorological information.

The METAR of the Boa Vista Aerodrome (SBBV), 7.2 NM away from the accident site showed the following information:

METAR SBBV 031500Z 13005KT 9999 VCSH BKN020 FEW025TCU 30/24 Q1015=

The weather conditions were favorable for the visual flight, with visibility above 10km, rain showers in the vicinity, 5 to 7 eighths of sky cover at 2,000ft and few clouds at 2,500ft of towering cumulus type. The wind was 5kt.

1.8 Aids to navigation.

Nil.

1.9 Communications.

According to the transcripts of the communication audios between the PR-MFR and the control agencies, it was verified that the crewmembers kept radio contact with the Boa Vista Approach Control (APP-BV) and that there was no technical abnormality of communication equipment.

In order to substantiate the analyses about the sequence of events that preceded the aircraft crash, the Investigation Team highlighted some transmissions that can help in understanding the dynamics of the accident. For the registration of the times described in this field, the UTC was used as reference.

At 15h05min33s, the PR-MFR informed the APP-BV that it was with the engine running in SWPD, with five people on board, five hours of autonomy, that it would follow the 302 radial and climb to FL065.

Then, the APP-BV informed the transponder code that the aircraft should select and asked it to inform control when it was off the ground, that is, after takeoff.

At 15h13min55s, the PR-NYA asked control if it had already called the firefighters, because the PR-MFR aircraft had crashed after the takeoff. It requested the firefighters to be sent urgently to the Aerodrome.

The control said they would call the municipal fire department, as they believed the Cantá Aerodrome was beyond the reach of the Boa Vista International Airport firefighters.

1.10 Aerodrome information.

The Aerodrome was private, managed by the Paramazônia Air Taxi and operated under visual flight rules (VFR) during daylight hours.

The runway was made of asphalt, with thresholds 06/24, dimensions 750m x 18m, and elevation of 86 feet.

The area after the threshold 24 was clear for about 70m. From this point on there were trees about 30m high.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The impact occurred approximately 100m from the SWPD threshold 24, the opposite takeoff threshold, and there was evidence of an earlier impact of the left horizontal stabilizer with a tree. The wreckage distribution was of the concentrated type.

The first impact occurred in a pitch up attitude, causing the collision of the left horizontal stabilizer against a tree (Figure 1), which caused the detachment of the left elevator (Figures 2 and 3).

Figure 1 - View of the first impact point.

Figure 2 - Left elevator found near the site of the first impact.

Figure 3 - Left horizontal stabilizer without elevator.

After the impacts against the vegetation, according to the wreckage evidence, the aircraft crashed into the ground and came to a complete stop next to a tree.

The landing gear and flaps were retracted (Figure 4). It was not possible to determine the position of the compensators.

Figure 4 - Aircraft destroyed by fire. Landing gear and flaps retracted.

The fire started after the aircraft had come to a complete stop.

The degree of destruction and carbonization of the aircraft prevented the checking of much of the equipment and instruments.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Nil.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

According to the information collected, the pilot was considered, by the interviewees, an experienced professional who had the habit of inspecting the aircraft with criteria and frequency.

On the day of the accident, he inspected the aircraft as usual, got ready and called the passengers to board.

The relationship between the pilot, ground personnel, administrative and technical support was very friendly and mutually respectful.

The crewmember relationship with the owners was based on trust and friendship.

The Organization had experienced two accidents within a month.

1.14 Fire.

The fire started just after the aircraft hit the ground, due to the contact of hot parts and electrical cables with the fuel in the wings.

The fire consumed the entire cabin and part of the wings.

1.15 Survival aspects.

The fall of the aircraft was seen by a company employee who went to the impact site in an attempt to provide help, but was prevented by the intensity of the heat radiated by the fire.

The survivor reported that, after the impact against the ground, he heard the pilot commanding the immediate exit of the aircraft, but only he, who was in the last seat in the back of the cabin, could proceed to abandon the aircraft.

The exit was through the cargo door. The passenger's clothes were on fire and he was taken to the hospital by a vehicle that had arrived on the scene.

The pilot and the other three passengers were unable to leave the aircraft and died on the spot.

1.16 Tests and research.

During the disassembly of the IO-520-L-12B engine, Serial Number (SN) 1002430, it was observed that all cylinder exhaust valves were reddish in color (Figure 5).

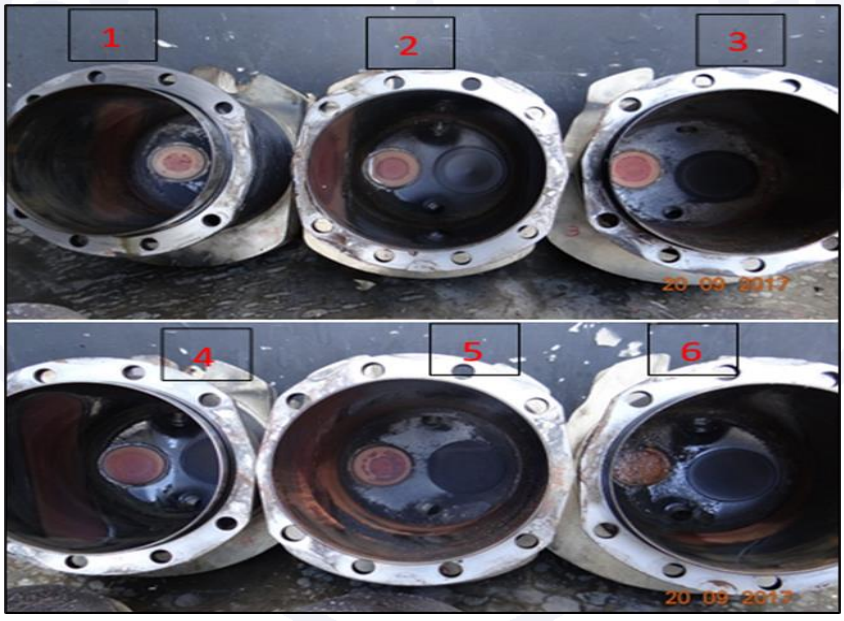


Figure 5 - Interior of the cylinders. Exhaust valves with reddish coloration.

This condition is a consequence of the engine operation with a lean fuel mixture, that is, the adjust of the mixture lever for a fuel and air ratio in the cylinder with less fuel. This procedure allowed the airplane to have a longer range.

Decreasing the fuel beyond that recommended in the manual (a too lean mixture), when used routinely, causes greater engine wear and the consequent gradual loss of power over time.

In flight, the operation with a too lean mixture could reveal itself through a high cylinder head temperature condition and "rough" and/or erratic engine operation.

The valve seats of cylinders 1, 3, and 6 were darkly colored, resulting from poor seating (Figure 6).

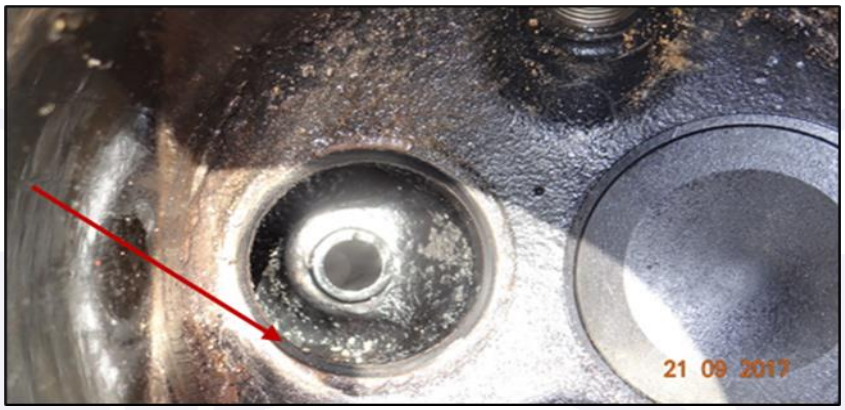


Figure 6 - Valve seat with dark coloration.

The valve guides of cylinders 1 and 4 showed discrepancies when checked according to the Manual Overhaul (X30039), whose result indicates whether the component is fit (GO) or not (NO GO) to be used (Figure 7).

Cilynders	Valve Seats	Valve Guides
1	Leak	Stuck valve
2	Normal	Ok
3	Oxidation	Ok
4	Leak	Excessive Looseness
5	Leak and Oxidation	Ok
6	Leak	Ok

Figure 7 - Analysis of the cylinders.

The valve guide looseness was characteristic of hot engine operation, caused by the use of lean mixture fuel.

The camshaft drive assembly showed wear on one cam on the camshaft (Figure 8) and on three tappets (Figure 9).

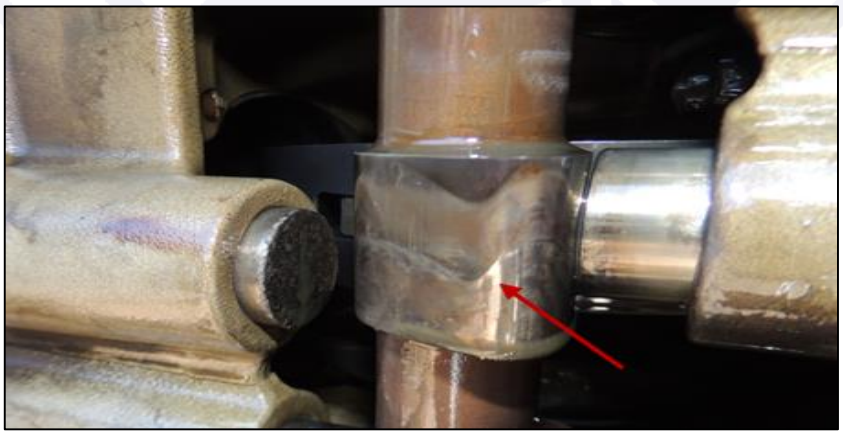


Figure 8 - Wear on the cam of the camshaft drive assembly.

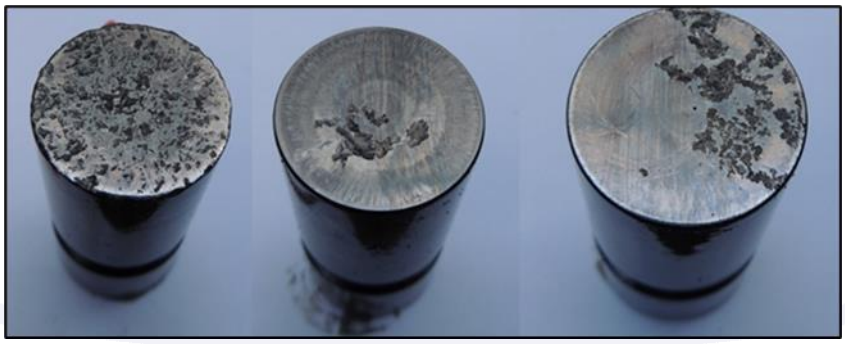


Figure 9 - Worn tappets.

The wear observed on the hydraulic tappets could generate microparticles and these were not retained by the primary and main oil filters.

They followed the normal flow of engine lubrication, causing scratches on the camshaft support bearings (Figure 10), on the rear bearing of the crankshaft (Figure 11) and on the inside of the oil pump body. Fine filings were also observed in the residual oil in the crankcase.

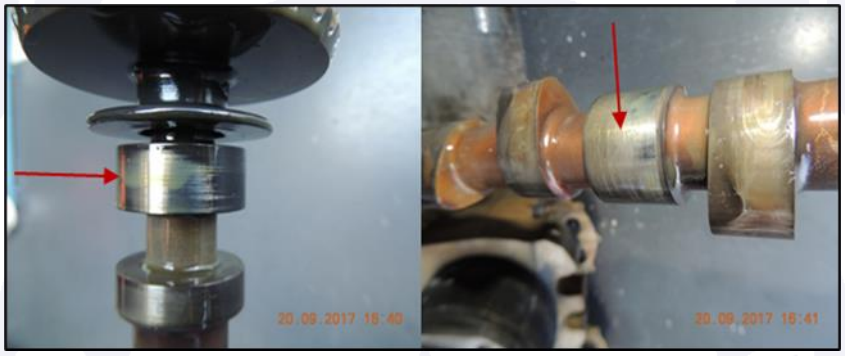


Figure 10 - Camshaft support bearings.

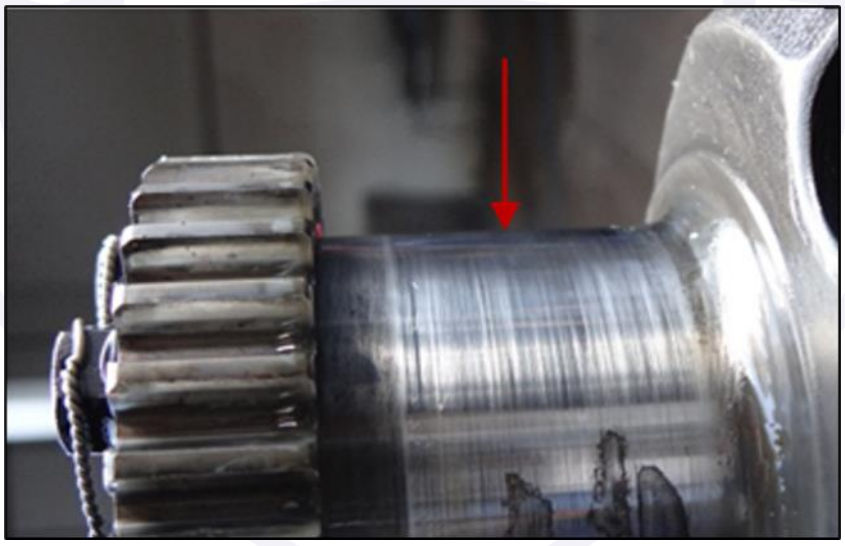


Figure 11 - Crankshaft rear bearing.

A white powder was found on the fuel distributor filter screen and on the bottom of the distributor diaphragm (Figure 12). After laboratory analysis, it was found that the presence of the residue was partially blocking the fuel filter screen.

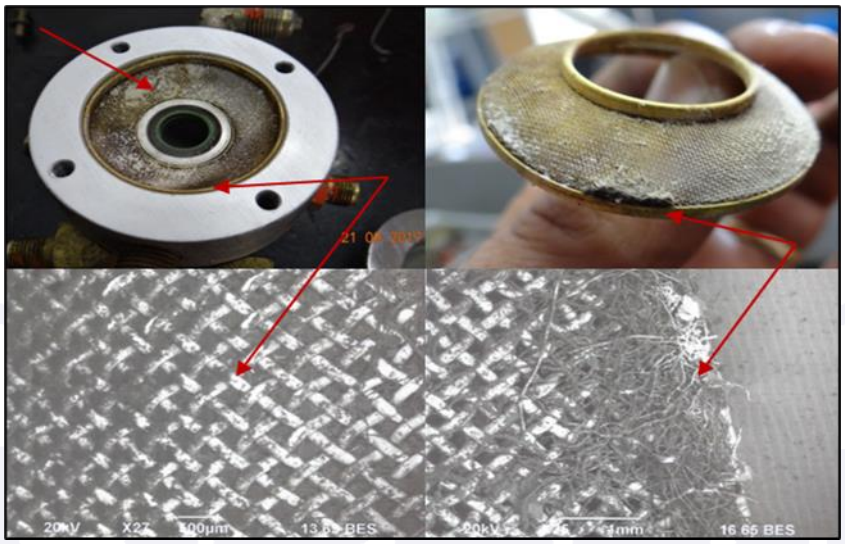


Figure 12 - Fuel distributor filter with lead powder.

It was also possible to confirm the presence of lead (Pb), resulting from fuel degradation. This occurs when the fuel is stored or transported in a clear container, allowing contact with sunlight. This contact promotes the precipitation, in powder form, of the fuel's tetraethyl lead.

At the last inspection (of 200 hours), there was a task to check the fuel distributor (spider) for leaks only. There was no provision for inspection of the distributor screen.

Although not foreseen in the above inspection, if the engine was running rough, the Trouble Shooting in the Service Manual produced by the aircraft manufacturer dedicated to solve problems in the IO-520-L-12B engine considered that one of the probable causes of the problem could be a restriction in the fuel injection system. In that case, it recommended that the fuel system be cleaned and that all defective units be replaced.

The main filter of the fuel system, through which the aviation gasoline passed before reaching the spider, was not found in the wreckage, as it was probably consumed by the fire.

The propeller assembly had its blades dented backwards and had transverse scratches on its ends (Figure 13). This denoted that, at the moment of impact against the ground, the engine was developing little power, however, in the field investigation, it was observed that the metering valve was in the maximum power position.

Figure 13 - Scratches and dents on the propeller blades.

Two samples containing 1,000ml of aviation gasoline were collected from the fuel tank at the headquarters of the company that owns the aircraft, on 04JUL2017. They were sent to the IEA for physical-chemical tests to verify compliance with the specifications of the ANP Resolution and/or the presence of contaminants.

The results presented concluded that the samples were in accordance with their specifications and showed no evidence of contamination.

1.17 Organizational and management information.

The company Paramazônia Air Taxi operated under the RBAC 135. It was based in Cantá - RR, where it operated from its own runway. It had an inventory of eighteen aircraft, including two helicopters.

It had, at the time, approximately 25 pilots. Flight safety was the responsibility of the Operational Safety Manager. The company had two accidents in one month, which, according to the interviewees, generated a climate of fragility.

According to the professionals interviewed, the company was concerned about flight safety and tried to comply with the requirements made by the regulatory agencies.

There were reports that the crashed aircraft had already presented a problem in previous flights and that the maintenance sector was aware of it.

The MGO, dated 20JUN2013, in its item 4.6.7, Responsibilities and Obligations of the Flight Coordinator, states:

> 1 - Plan, organize, and control flights, scheduling departure and arrival times, passengers' list with ID and telephone number of a relative, and file for a minimum of 120 days.

Item 6.4.1, Criteria for Flight Planning, sub-item "f", provided:

> Check if the passengers' list has the name, ID, and telephone number of a relative of the passengers.

The passengers' list was not provided by the company.

Item 6.9.4.2, Authorized Inspections and Maintenance, stated:

> Paramazônia Air Taxi, according to item III of the operational specifications, is authorized to perform the inspection and maintenance services listed below on the aircraft in its fleet. (Figure 14)

EQUIPAMENTO		LIMITAÇÕES	BASE
FBRICANTE	MODELO/PN		
CESNNA	U206D	Inspeções de até 100 horas e IAM, cumprir AD/DA de complexidade equivalente e MANUTENÇÕES PREVENTIVAS, citadas no APÊNDICE "A" parte C do RBHA 43.	SWPD
CESSNA	U206E U206F	Inspeções de até 100 horas e IAM, cumprir AD/DA (somente inspeção visual) de complexidade equivalente e MANUTENÇÕES PREVENTIVAS, citadas no APÊNDICE "A" parte C do RBHA 43 e Manutenção de Linha conforme IAC 119-1001B (somente tarefas descritas no MGM)	SWPD
CESSNA	C201L	Inspeções de até 100 horas e IAM, cumprir AD/DA de complexidade equivalente e MANUTENÇÕES PREVENTIVAS, citadas no APÊNDICE "A" parte C do RBHA 43 e Manutenção de Linha conforme IAC 119-1001B (somente tarefas descritas no MGM)	SWPD
NEIVA	EMB720D	Inspeções de até 100 horas e IAM, cumprir AD/DA de complexidade equivalente e MANUTENÇÕES PREVENTIVAS, citadas no APÊNDICE "A" parte C do RBHA 43 e Manutenção de Linha conforme IAC 119-1001B (somente tarefas descritas no MGM)	SWPD

Figure 14 - Table of aircraft and inspections.

The 210M model was not listed in the table, but the 50, 100, 200-hour inspections and IAM were performed by Paramazônia.

Item 8.2.3 of the MGO established the procedure for weighing passengers, cargo and baggage:

> For the purpose of weighing calculation, the Paramazônia Air Taxi establishes that all passengers, cargo and baggage, including carry-on baggage, will be weighed prior to boarding the Company's aircraft.

The survivor reported that he and the other passengers were not weighed.

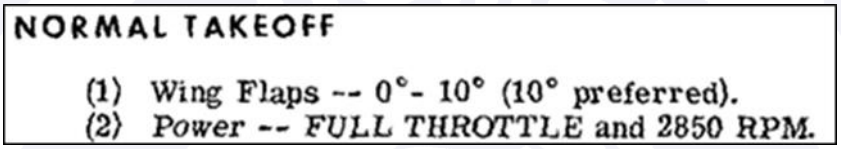
After the occurrence, there was a change in the name of the company that operated the aircraft. According to Ordinance No. 2.408/SAS, of 03AUG2018, the name Paramazônia Air Taxi LTD. was changed to Voare Air Taxi LTD.

New managers took over the management of the company and replaced the directors of operations, maintenance and the Operational Safety Manager.

The maintenance organization also had its name changed to Voare, according to the Maintenance Organization Certificate (COM) No. 1506-61/ANAC, dated 19OCT2018.

1.18 Operational information.

For takeoff, as stated in the POH, Section 4 - Normal Procedures, page 4-8, Checklist Takeoff, the flaps were to be selected between the 0º and 10º positions, preferably using the 10º position (Figure 15).


NORMAL TAKEOFF

(1) Wing Flaps -- 0°- 10° (10° preferred).
(2) Power -- FULL THROTTLE and 2850 RPM.

Figure 15 - Flap setting provided for normal takeoff.

Also, according to the POH, in the case of a short field takeoff, in which the available length did not allow a safe abort within its limits, it provided for the use of the flaps in the 10º position (Figure 16).


SHORT FIELD TAKEOFF

(1) Wing Flaps -- 10°.
(2) Brakes -- APPLY.
(3) Power -- FULL THROTTLE and 2850 RPM.

Figure 16 - Flap setting predicted for a short field takeoff.

In this type of takeoff, an initial climb should be performed with 72Kt, flaps in the 10º position, and landing gear extended until obstacles are overcome. The performance data available in section 5 took this speed and configuration into account when making these calculations.

In section 5 - Performance, page 5-4, it was informed that the takeoff distances informed in the tables were calculated based on a short field takeoff.

The five hours of autonomy, informed by the pilot to the control at the beginning of the taxi, would require 400lb of fuel.

The estimated weight of each passenger was informed by the survivor. The basic weight of the aircraft was taken from the aircraft's weight and balance sheet, dated 17MAR2017.

With this data, it was possible to estimate that the aircraft was at its maximum takeoff weight of 1,723kg, as provided in the POH, so the aircraft was considered to be within the weight and balance limits specified by the manufacturer.

To calculate the aircraft's takeoff performance, the following data was used: Temperature of 30ºC, calm wind, altitude of 86ft, and Takeoff Weight of 3,800lbs.

According to the POH, figure 5-14 - Takeoff Distance, page 5-12 (Appendix A), it was stated that for these conditions, performing the short field technique, that is, flaps at 10º, the aircraft would fly a total distance of 2,265ft (690m) to clear an obstacle at 50ft.

As observed in the field investigation, the flaps were found to be in the 0º position, that is, retracted.

For this configuration, it was described on page 4-16, that using the flaps in the 10° position reduced the ground clearance distance and the total obstacle clearance distance by approximately 10%.

In the event of a takeoff with the flaps at 0° (retracted), the aircraft would travel a total distance of 2,491ft (760m) to clear a 50ft obstacle after takeoff.

As reported by the survivor, the aircraft crashed into the trees in a pitch up attitude.

Item 6.9.3 of the MGO, Reporting and Recording of Operating Irregularities, stated:

> The Paramazônia Air Taxi establishes that the Company's pilots in command must record in the logbook, all discrepancies found before, during and after the flight, relating to operational irregularities in the aircraft. The report must be succinct, but clear and objective, and also clarify directly to the mechanics the reports recorded.

During the interviews, some pilots reported that the aircraft had a "weak" engine, that the ground run was longer than normal and that the aircraft had difficulty climbing, but no records of engine malfunctions were found. It was also noticed that some pilots were dissatisfied with the maintenance and did not trust the services performed.

The MGO in its item 6.10.3, Verbal Instructions to Passengers, provided:

> Use of seat belts: Give instructions on how to put on, adjust, and remove seat belts;
>
> Seatbacks in the upright position: instruct on placing the seatbacks in the upright position before each takeoff and landing;
>
> Emergency entrance and exit doors: instruct on the location and manner of opening them;
>
> Survival Equipment: instruct on their location in the aircraft;
>
> Water Landing: instruct on procedures to be followed in case of water landing;
>
> Fire Extinguishers: instruct on the location and operation of fire extinguishers; and
>
> Portable Electronic Equipment: instruct on restrictions on use on board the aircraft and en route between boarding and disembarkation.
>
> Before each take-off, the commander must ensure or instruct on procedures for persons requiring assistance to move if an emergency occurs and for that person's assistant, if any, in the event of an emergency evacuation.
>
> Bags located behind passenger seats contain Passenger Information Cards that provide guidance on in-flight procedures. The commander must inform passengers of their location and read them.

The survivor reported that the emergency procedures were not explained.

Item 6.10.14 of the MGO, Boarding and disembarkation of passengers with the engine(s) running, stated:

> The Paramazônia Air Taxi will not allow passenger boarding and disembarkation operations with the aircraft engine running.

The boarding was done with the engine running. However, the MGO itself referenced the RBHA 91.102:

(e) No pilot in command of an aircraft may allow passengers to board or disembark from his aircraft with the aircraft engine(s) running unless:

(1) for an aircraft, its geometry permits passengers to use a normal boarding and disembarkation door without passing in front of or behind running engine(s);

(3) The pilot in command assumes responsibility for the operation and takes appropriate action to ensure its safety.

The flight schedule, stand-by, maximum flight time and allotted rest were regulated by the MGO. The pilot had flown, in the model, 12 hours in the last 30 days, with the last flight in the aircraft being 24JUN2017. There was no flight record within the last 48 hours prior to the accident.

The survivor reported that he noticed the aircraft in a pitch up attitude moments before the first impact.

1.19 Additional information.

The Operational Specifications (EO) approved by the ANAC, dated 05APR2016, contained conflicting information.

Item II.6 - Cargo Transport (Figure 17) did not contain the registration of the PR-MFR, however, in the table presented in Figure 18, of the same EO, the aircraft was authorized to carry cargo.

II.6 – Transporte de Carga

Autorizadas somente as aeronaves PT-DNT, PT-FBO, PT-KKN, PT-KLT, PT-KVW, PT-KAG, PT-KGC e PR-GPG, PT-IXS, PT-OJD e PR-GPI que possuem configuração cargueira aprovada.

Figure 17 – Extract of the EO.

TABELA 1 – AERONAVES AUTORIZADAS

					Operações Autorizadas															PAX
ITEM	MARCAS	FABRICANTE	MODELO	Nº SÉRIE	PSG	CRG	ARP	AEM	LGS	LAR	OFS	ETOPS	BRNAV	NATMNPS	RVSM	C2	GPS	CJ	CCA	
1.	PR-NYA	CESSNA	C210L	21060165	S	S	S	N	N	N	N	N	N	N	N	N	N	N	N	5 (cinco)
2.	PT-DNT	CESSNA	U206E	U20601565	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
3.	PT-FBO	CESSNA	U206F	U20602579	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
4.	PT-KKN	CESSNA	U206F	U20602515	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
5.	PT-KLT	CESSNA	U206F	U20602493	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
6.	PT-KVW	CESSNA	U206F	U20603019	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
7.	PT-RXS	NEIVA	EMB-720	720183	S	S	S	N	N	N	N	N	N	N	N	N	N	N	N	6 (seis)
8.	PT-KAG	CESSNA	U206F	U20602420	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
9.	PT-KGC	CESSNA	U206F	U20602494	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
10	PR-MFR	CESSNA	C210M	21061795	S	S	S	N	N	N	N	N	N	N	N	N	N	N	N	5 (cinco)
11	PR-GPG	CESSNA	C210L	21061183	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
12	PP-JCS	CESSNA	C210L	21060984	S	S	S	N	N	N	N	N	N	N	N	N	N	N	N	5 (cinco)
13.	PT-VKS	NEIVA	EMB720D	720255	S	S	S	N	N	N	N	N	N	N	N	N	N	N	N	6 (seis)
14.	PT-EBZ	NEIVA	EMB720C	720021	S	S	S	N	N	N	N	N	N	N	N	N	N	N	N	5 (cinco)
15.	PT-HRM	BELL	206B	4127	S	S	S	N	N	N	N	N	N	N	N	N	N	N	N	4 (quatro)
16.	PT-IXS	CESSNA	U206F	U20602130	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
17	PR-GPI	CESSNA	U206F	U20603150	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	4 (quatro)
18.	PT-OJD	CESSNA	U206F	U20602884	S	S	S	N	N	N	N	N	N	N	N	N	N	N	S	5 (cinco)
19.	PT-YDG	BELL	206B	4457	S	N	S	N	N	N	N	N	N	N	N	N	N	N	N	4 (quatro)

Figure 18 - Table of operations authorized by the EO.

The cargo manifest and the passengers' list were not presented, not complying with the MGO and RBAC 135, subpart 135.63, item "c" and "d" (Figure 19).

(c) Cada detentor de certificado é responsável pela preparação e precisão de um manifesto de carga em duplicata contendo informações concernentes ao carregamento da aeronave. O manifesto deve ser preparado antes de cada decolagem e deve incluir:

(1) o número de passageiros;

(2) o peso total da aeronave carregada;

(3) o peso máximo de decolagem permitido para o voo;

(4) os limites do centro de gravidade;

(5) o centro de gravidade da aeronave carregada, exceto que o centro de gravidade real não precisa ser calculado se a aeronave for carregada de acordo com um planejamento de carregamento ou outro método aprovado que garanta que o centro de gravidade da aeronave carregada está dentro dos limites aprovados. Nesses casos deve ser feita uma anotação no manifesto indicando que o centro de gravidade está dentro dos limites conforme um planejamento de carregamento ou outro método aprovado;

(6) a matrícula de registro da aeronave ou o número do voo;

(7) a origem e o destino; e

(8) identificação dos tripulantes e as suas designações.

(d) O piloto em comando de uma aeronave deve ter consigo, até o destino do voo, uma cópia desse manifesto. O operador deve conservar uma cópia do mesmo, em sua sede operacional, por, pelo menos, 90 dias após a realização do voo.

Figure 19 - Extract from the RBAC 135.

Item 8.5 of the MGO, CG Position Calculation, Preparation and Distribution of Weight and Centering Report (Cargo Manifest), stated:

> The Paramazônia Air Taxi establishes that the Company's pilots in command are responsible for the preparation and accuracy of a cargo manifest in duplicate containing information concerning the loading of the aircraft...
>
> ...the Paramazônia Air Taxi establishes that the Company's pilots-in-command, after preparing the cargo manifest, in duplicate, shall:
>
> 1 - Leave a copy of the manifest at the origin of the flight.
>
> 2 - Keep the other copy of the manifest with them until the flight destination...
>
> ...Paramazônia Air Taxi will keep a copy of the manifest in the Operations sector for at least 90 days after the flight.

The May 2016 Standard Practice for Spark Ignited Engines, Publication M-0, Change 1, Continental Motors maintenance manual, referring to the aircraft engine, described, in Chapter 6, Engine Inspection and Service, page 6-8, an oil analysis procedure through a collected sample, according to the instructions in Section 6-4.8.4 (Oil Sample Collection) and Section 6-4.8.5 (Trend Monitoring and Spectral Oil Analysis):

> 6-4.3. 50-Hour Engine Inspection, Procedure, item 3, "Establish and oil analysis profile by collecting an oil sample according to the instructions in Section 6-4.8.4, "Oil Sample Collection" and Section 6-4.8.5, "Oil Trend Monitoring and Spectrographic Oil Analysis.

This procedure was also prevised for the 100h engine inspections, in 6-4.4. 100-Hour (Annual) Engine Inspection, Procedure, item 3.

Although the 50h inspection was performed in the aircraft logbooks, no records of trend monitoring or spectral analysis of the engine oil were found.

The last overhaul of the engine and fuel distributor was performed on 23JUN2016.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a passenger transport flight between the municipalities of Cantá - RR and Alto Alegre - RR.

According to information, the relationship between the company's employees was good. The organizational climate, however, was fragile due to two accidents that occurred within a month. However, no evidence was found that this had influenced the accident in question.

The aircraft had its 50, 100, 200 hour and IAM inspections done by the maintenance organization owned by the operator. Some pilots reported that they were not satisfied with the maintenance and did not trust the service, however, all documentation was updated.

Before the aircraft began its 200-hour inspection, there were at least two verbal reports that the aircraft's engine was "weak" and had poor takeoff traction.

Pilots reported that the ground run was longer than normal and the aircraft had difficulty climbing. Maintenance was reported, verbally, however, no logbook record was found.

The mechanics confirmed that they received verbal information and checked the engine's compression ratio, fuel system, and oil filter. The results, according to them, were within the manufacturer's manual. However, no formal record of these interventions/maintenance checks was found.

Analyzing the Service Manual table produced by the aircraft manufacturer dedicated to Trouble Shooting the IO-520-L-12B engine, it was observed that if the engine was running rough, one of the probable causes of the problem could be a restriction in the fuel injection system.

In this case, it was recommended that this system be cleaned and that all defective units be replaced. Given the condition in which the fuel distributor screen was found, it could be inferred that the recommended cleaning was not properly performed.

The mechanics did not inform how the checks were performed, and no records were found in the logbook about the checks for low engine power. It was also verified that some important items foreseen in the MGO were not being complied with.

Thus, it was possible to observe the existence of informal practices in the organization, both in operation and maintenance, which weakened flight safety, the consequences of which could be observed in this occurrence.

The survivor reported that he noticed the aircraft in a pitch up attitude, signaling a possible attempt by the pilot to go over the trees, but the horizontal stabilizer collided with the top of a tree and detached from the aircraft, causing partial loss of pitch control. As a result, the aircraft lost control and crashed.

The lack of engine power may be related to leakage in the valves of cylinders 1, 4, 5, and 6, allowing the air/fuel mixture to escape during compression time and causing low burning efficiency inside the combustion chamber. Cylinders 1 and 4 did not pass the GO/NO GO test.

The lead found on the fuel distribution filter screen partially obstructed the fuel passage to the nozzles, reducing the gasoline supply to the cylinders.

The 200-hour inspection previsted in the aircraft manual foresaw a check of the fuel distributor (spider), only when a leak occurred, that is, if there was clogging, without leakage, there was no in loco inspection of the screen.

The boarding of passengers was done with the engines running, in disagreement with what was previsted in item 6.10.14 of the MGO. It was not possible to detect the reason why

boarding was carried out this way, however, it was found that there was a failure to comply with the manuals and rules in force, as well as inadequate pilotage judgment, since when this procedure was carried out, it was inferred that possibly there was a hurry to board and continue the flight.

In this case, when trying to gain time with the boarding of passengers, he may have forgotten important items for the flight, such as the flaps configuration in the 10º position, and also made it impossible for him to notice the error before the takeoff run.

The SWPD Aerodrome had 750m available for takeoff, and about 100m after the opposite threshold, there was a vegetated area with trees approximately 30m high.

According to the performance data extracted from the POH, given the weather conditions on the day of the occurrence, aircraft weight, and using the short runway takeoff technique described in Section 4, the total distance to clear an obstacle at 50ft (30m) was 690m.

As observed at the accident site, the flaps were retracted. Because of this finding, it was used the information available in the POH, which stated that takeoff distances should be increased by 10% for a takeoff with the flaps retracted. In this scenario, given the conditions of that flight, the total distance to clear the obstacle at 50ft would be approximately 760m.

Considering only the manual performance for short field takeoff with the flaps retracted and the distance to the obstacles, the Investigation Team inferred that there was enough room for the aircraft to accelerate and continue the climb under those conditions, however, the aircraft crashed into the trees.

According to the survivor's statement, the aircraft was in a pitch up attitude before the first collision into the trees, indicating that the pilot tried to clear the obstacles, but did not have sufficient performance for this maneuver.

Since the technical analysis performed and the information obtained from other crewmembers indicated that the engine was operating with degraded performance, it was hypothesized that the engine did not achieve the necessary performance to keep the flight. As a consequence, there was an increase in takeoff distance, which may have been aggravated by the incorrect configuration of the flaps for takeoff.

As a result, the aircraft did not have enough performance to overcome the obstacles located at the opposite threshold, it collided with vegetation, crashed into the ground, and subsequently caught fire after the impact.

After the occurrence, there was a change in the name of the company that operated the aircraft. According to Ordinance No. 2.408/SAS, 03AUG2018, the name Paramazônia Air Taxi LTD. was changed to Voare Air Taxi LTD.

New managers took over the management of the company and replaced the directors of operations, maintenance and the Operational Safety Manager.

The maintenance organization also had its name changed to Voare, according to the Maintenance Organization Certificate (COM) No. 1506-61/ANAC, dated 19OCT2018.

3. CONCLUSIONS.

3.1 Facts.

a) the pilot had valid CMA;

b) the pilot had valid MNTE Rating;

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

d) the aircraft had valid CA;

e) the aircraft was within the weight and balance limits;

f) the airframe, engine and propeller logbook records were updated;

g) the maintenance services were considered periodic, but not adequate;

h) the weather conditions were favorable for the flight;

i) the report of aircraft discrepancies was done verbally;

j) the fuel distributor filter screen was partially blocked by lead dust;

k) the exhaust valves of cylinders 1, 4, 5 and 6 were leaking;

l) three hydraulic tappets were excessively worn;

m) there was no cargo manifest and no passengers' list;

n) the passengers were boarded with the engine running;

o) there were no instructions to the passengers regarding the emergency procedures;

p) the aircraft collided the left stabilizer against a tree;

q) in the field investigation, the flaps were found to be in the 0º position, in other words, retracted;

r) the left elevator was detached;

s) the propeller blades were dented backwards;

t) the aircraft was destroyed;

u) one passenger was seriously injured; and

v) the pilot and three passengers had fatal injuries.

3.2 Contributing factors.

- **Organizational culture – a contributor.**

The informal practices adopted in the organization, both in terms of operation and maintenance, demonstrated weaknesses in the organizational culture, which favored the reduction of safety levels in the operation.

- **Piloting judgment – a contributor.**

Since the boarding was performed with the engines running, it was inferred that the pilot sought to reduce ground time by suppressing standardized boarding procedures, this fact increased the workload, demonstrating inadequate judgment regarding operational decisions.

- **Aircraft maintenance – a contributor.**

The verification of verbal reports was based on trust, since there was no written record in the Logbook. In addition, the engine presented excessive wear of parts, compromising its operation.

- **Memory – undetermined.**

Since the boarding was done with the engines running, it was inferred that there was a hurry during the flight preparation, which may have made it possible for the commander to forget to set the flaps to the 10º position, more suitable for that takeoff, which increased the takeoff distance.

- **Organizational processes – a contributor.**

The lack of adequate management of organizational processes, related to aircraft operation and maintenance, allowed the adoption of unsafe conducts and informal actions, which compromised the safe conduct of the flight.

- **Managerial oversight – a contributor.**

There was inadequate oversight of procedures, such as not monitoring trends and oil spectral analysis, verbal reports to mechanics instead of posting discrepancies in the logbook. The pilots were not following what was prevised in the MGO. The company's lack of organization with regard to compliance with internal rules, not filling out the passengers' and weighing list, was considered a latent failure.

4. SAFETY RECOMMENDATION.

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

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

Recommendations issued prior to the publication of this report:

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

A-089/CENIPA/2017 - 01 **Issued on 06AUG2019**

Disseminate the lessons learned from this investigation in order to alert operators and maintenance organizations to the importance of checking, during corrective maintenance procedures, the condition of the fuel system of IO-520-L-12B engines not only for leaks, but also for the possibility that this system may be contaminated by foreign material.

A-089/CENIPA/2017 - 02 **Issued on 06AUG2019**

Work together with VOARE Air Taxi Ltd., so that organization demonstrates that it has and applies all the necessary resources for the proper provision of maintenance services on the CESSNA aircraft, model 210M, and Continental engines, model IO-520-L-12B, as recommended by the legislation in force, the respective technical manuals and the company's List of Capacities.

A-089/CENIPA/2017 - 03 **Issued on 06AUG2019**

Act with VOARE Air Taxi Ltd., so that operator improves its administrative and operational mechanisms of abnormality reports in its aircraft, made by the crewmembers to the maintenance professionals, and the recording of the services performed, as a way to prevent aeronautical occurrences.

Recommendations issued at the publication of this report:

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

A-089/CENIPA/2017 - 04 **Issued on 04OCT2021**.

Work together with VOARE Air Taxi Ltd., so that organization establishes mechanisms to ensure the compliance of its crewmembers with the aircraft flight manual, especially with regard to the correct use of flaps for take-off.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

The ANAC conducted two audits on the company, one in July 2017 and another in October 2017.

On October 04th, 2021.