COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-111/CENIPA/2021

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PT-LMU**
MODEL:	**Baron 58**
DATE:	**29SET2021**

NOTICE

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

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

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

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

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

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

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

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

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

SYNOPSIS

This is the Final Report related to the accident of 29 September 2021 involving the Beechcraft Baron 58 aircraft, registration PT-LMU. The accident was typified as “[SCF-PP] Engine failure or malfunction | In-flight engine failure”.

While the airplane was cruising between the cities of *Porto Velho*, State of *Rondônia*, and *Cuiabá*, State of *Mato Grosso*, there was oscillation of the fuel flow in the right-hand engine, with subsequent loss of power. The aircraft made a forced landing outside of aerodrome area.

The airplane sustained substantial damage.

Both crewmembers escaped uninjured.

For being the USA the State of Aircraft Design, an Accredited Representative of the National Transportation Safety Board (NTSB) was designated for participation in the investigation of the accident.

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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ADE	Category of registration for aircraft under direct state-administration
ANAC	Brazil's National Civil Aviation Agency
CBMRO	State of *Rondônia's* Military Fire-Fighting Department
CENIPA	Aeronautical Accidents Investigation and Prevention Center (Brazil)
CMA	Aeronautical Medical Certificate
COA	Command of Air Operations
CVA	Airworthiness Verification Certificate
GOA	Air Operations Group
IAM	Annual Maintenance Inspection
MGSO	Manual of Operational Safety Management
MLTE	Multi-Engine Land-Airplane Class Rating
MNTE	Single-Engine Land-Airplane Class Rating
MOP	Air Operations Manual
NTSB	National Transportation Safety Board (USA)
OM	Maintenance Organization
OS	Service Order
PCM	Commercial Pilot License (Airplane)
PF	Pilot Flying
PIC	Pilot in Command
PN	Part Number
POH	Pilot's Operating Handbook
PPR	Private Pilot License (Airplane)
PTAF	Fixed-Wing Aircraft Pilots' Training Program
RBAC	Brazilian Civil Aviation Regulation
RPM	Revolutions Per Minute
SBCY	ICAO location designator – *Marechal Rondon* Intl A/D , Cuiabá, MT
SBPV	ICAO location designator - *Governador Jorge Teixeira de Oliveira* A/D, *Porto Velho*, RO
SBVH	ICAO location designator – *Aeródromo Público do Governo do Estado*, *Vilhena*, RO
SIC	Pilot Second in Command
SIPAER	Aeronautical Accidents Investigation and Prevention System
SN	Serial Number
SOP	Standard Operating Procedures
SSZD	ICAO location designator - *Zirondi* A/D, *Porto Velho*, RO
TSN	Time since New
UAP	Public Air-Unit

UTC Universal Time Coordinated

1. FACTUAL INFORMATION.

Aircraft	**Model:** Baron 58 **Registration:** PT-LMU **Manufacturer:** *Beechcraft Aircraft*	**Operator:** *Corpo de Bombeiros Militar de Rondônia* - CBMRO
Occurrence	**Date/time**: 29SET2021 - 16:50 UTC **Location:** *Fazenda Lagoa Bonita* **Lat.** 12°62'40"S **Long.** 059°96'27"W **Municipality – State:** *Vilhena* - RO	**Type(s):** [SCF-PP] Powerplant failure or malfunction

1.1. History of the flight.

At around 14:05 UTC, the aircraft took off from SBPV (*Governador Jorge Teixeira de Oliveira* Aerodrome, *Porto Velho*, State of *Rondônia*) bound for SBCY (*Marechal Rondon* Aerodrome, *Cuiabá*, State of *Mato Grosso*) with two crew on board, on a ferry flight for provision of scheduled maintenance.

While the aircraft was cruising, there was oscillation of the fuel flow in the right-hand engine, which lost power subsequently.

The aircraft made a forced landing outside of aerodrome area in an agricultural zone located on *Fazenda Lagoa Bonita*, municipality of *Vilhena*, State of *Rondônia*.

The aircraft sustained substantial damage. Both crewmembers escaped uninjured.

Figure 1 – View of the aircraft after the occurrence.

1.2. Injuries to persons.

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

1.3. Damage to the aircraft.

There was substantial damage to the left-hand main landing gear, left-hand engine, left-hand propeller assembly, left-hand wing, and to the left-hand flap and aileron. In addition, the left-hand elevator received slight damage.

1.4. Other damage.

NIL.

1.5. Personnel information.

1.5.1. Crew's flight experience.

Flight Experience		
	PIC	Extra Pilot
Total	2,100:00	108:00
Total in the last 30 days	99:25	07:30
Total in the last 24 hours	02:50	02:50
In this type of aircraft	800:00	07:30
In this type in the last 30 days	53:25	07:30
In this type in the last 24 hours	02:50	02:50

NB.: Data on the hours flown provided by the very pilots. The pilot occupying the right-hand seat could not compose the crew, and received the identification of "extra pilot" for registration purposes.

1.5.2. Personnel training.

The PIC (Pilot in Command) did his PPR course (Private Pilot - Airplane) in 2010, at *Aeroclube de Pará de Minas*, State of *Minas Gerais*.

The right-hand seat pilot did the PPR course in 2021, at the *Aeroclube de Porto Velho*, State of *Rondônia*.

1.5.3. Category of licenses and validity of certificates.

The PIC held a PCM license (Commercial Pilot – Airplane), as well as valid MLTE (Multi-Engine Land-Airplane) and IFRA (IFR Flight – Airplane) ratings.

The pilot occupying the right-hand seat had a PPR License (Private Pilot - Airplane), and a valid MNTE (Single-Engine Land-Airplane) rating. He did not hold an MLTE rating.

1.5.4. Qualification and flight experience.

The PIC had qualification and experience for the type of flight.

For not having an MLTE rating, the pilot on the right-hand seat was not qualified and did not have experience for the type of flight of the occurrence.

1.5.5. Validity of medical certificate.

Both pilots held valid Aeronautical Medical Certificates (CMA).

1.6. Aircraft information.

The Beechcraft Aircraft manufacturer built the SN TH-1320 airplane in 1982. The aircraft was registered in the Direct State-Administration Registration Category (ADE).

The airplane Airworthiness Verification Certificate (CVA) was valid.

Goiás Aviação maintenance organization was responsible for the provision of maintenance services to the aircraft until March 2021. After that date, *FORMAER Comércio e Serviços Ltda. maintenance organization* (located in *Formosa*, State of *Goiás*) was in charge of the aircraft maintenance. On that occasion, the aircraft was subject to a "50-hour type" inspection, and received an Airworthiness Verification Certificate (CVA). The airplane had a total 5,469 hours of flight.

The aircraft underwent a "100-hour type" inspection on 27 April 2021 at *FORMAER Comércio e Serviços Ltda*., and flew 111 hours after the referred inspection.

The last inspection ("50-hour" type) took place on 31 August 2021 at the premises of *FORMAER Comércio e Serviços Ltda*., when the aircraft had a total 5,760 hours and 25

minutes of flight. At the time of the accident, the aircraft had flown 54 hours and 55 minutes after the said inspection.

During the investigation, one received information that, since one year before, the aircraft fuel would frequently leak from the right-hand wing when the tank was full. Even so, the aircraft continued in normal operation, under the condition of not filling up the referred tank to the full.

Furthermore, there was information that the fuel gauge was not reliable. The problem had been identified when the operator received the aircraft. Nevertheless, there were no records in the aircraft logbook concerning the issue.

1.7. Meteorological information.

The meteorological conditions were consistent with VFR flights.

1.8. Aids to navigation.

NIL.

1.9. Communications.

NIL.

1.10. Aerodrome information.

The occurrence was outside of aerodrome area.

1.11. Flight recorders.

Neither required nor installed.

1.12. Wreckage and impact information.

NIL.

1.13. Medical and pathological information.

1.13.1. Medical aspects.

NIL.

1.13.2. Ergonomic information.

NIL.

1.13.3. Psychological aspects.

The PIC had done his entrance exam for the Military Fire-Fighting Department of *Rondônia* (CBMRO) in 2006, and received commission in 2010. He had been in the Air Operations Command (COA) since the creation of that Public Air Unit (UAP) in 2012.

At the time of the accident, he was the Chief of the Air Operations Group (GOA).

According to him, the purpose of the flight in question was to take the aircraft for provision of a scheduled maintenance. The plane had received fuel up to the maximum fuel-tank capacity in *Porto Velho* and, according to the PIC's reports, the right-hand engine began to "choke" during the cruise flight, and it was difficult to identify the reason for the problem.

Despite the emergency checklist prescriptions, namely reducing the power, feathering the propeller, and shutting down the troubled engine, the PIC considered that the aircraft would not be able to maintain level flight in a single-engine condition. He also said that he hoped the engine would restart eventually.

In that scenario, the PIC decided to proceed for a landing in SBVH (State-Government Public Aerodrome in *Vilhena*). However, on the way to the aerodrome, he

realized that the aircraft would not be able to reach the runway, so he performed a forced landing in an open area that had been prepared for plantation.

According to interviewees, it was common for CBMRO members to accumulate functions, as well as to fly beyond the time limit on their flight journeys. The PIC himself was overwhelmed with tasks, since, besides coordinating the UAP air operations, he participated in the flight schedule as a crewmember.

The PIC described himself as a person open to dialogue, and someone who made decisions together with his fellow workers.

On the day before the accident, he had flown with the same right-hand seat pilot, who had no experience in the type of flight, and was not qualified to operate multi-engine aircraft.

In the interviews, one observed that the right-hand seat pilot was highly motivated to participate in the flights, as he envisaged the possibility of doing his check to earn the multi-engine license.

1.14. Fire.

There was no fire.

1.15. Survival aspects.

NIL.

1.16. Tests and research.

The right-hand engine (model IO-520-CB9B, SN 1034348) manufactured by Continental, had been installed new in the aircraft on 15 December 2017.

On 31 August 2021, the engine was subject to a 50-hour type inspection, when it had 487 hours and 30 minutes of flight (Time since New). On the date of the occurrence, the engine flight-time was 522 hours and 20 minutes (TSN).

The investigation identified no damage to the right-hand engine on account of the forced landing, except for some damage to the ends of the blades of its propeller assembly, which were subject to effort derived from the landing, and characteristic of collisions at low power.

The bench test of the engine included different power regimes. The engine presented normal operation without any loss of power.

After removal, the magnetos equipping the engine were also tested on the bench. They showed normal operation with sparking on all the output terminals of the spark-plug wires.

The items below were analyzed and verified as to the operating parameters (in accordance with the manufacturer's Standard Practice Maintenance Manual, M-0, Revision 1, Change 2, August 2021):

The fuel distributor (PN 631427-2A23 and SN C17FA106) underwent flow-rate and flow-pressure testing on the bench. The result was normal operation, with no irregularities.

The fuel injector (-fuel controller/metering- PN 653377A4 and SN A17FA156) also underwent flow-rate and flow-pressure testing on the bench. The result was normal operation, which reached flow-rate patterns of 200 PPH (Pounds per Hour) and flow-pressure of 20 psi, with no discrepancies detected.

The mechanical fuel pump (PN 646212-52A3 and SN B17FA130) underwent flow-rate and flow-pressure bench testing, simulating the engine in operation. In the test, the pump presented malfunction, as shown in the tables of Figures 2 and 3. The values at the specific regimes of 600 RPM and 2,700 RPM were as shown below:

REGIMES	PRESSÃO	VAZÃO
600 RPM	7 PSI	10 GL
2700 RPM	31 PSI	24 GL

Figure 2 - Table 1 with data collected during the fuel pump test.

The flow-pressure and flow-rate parameters specified by the manufacturer in the aforementioned maintenance manual are the ones described in the table below.

REGIMES	PRESSÃO	VAZÃO
600 RPM	8 PSI – 10 PSI	25,9 GL – 27,3 GL
2700 RPM	31,6 PSI – 37,8 PSI	

Figure 3 - Table 2 with data extracted from the manufacturer's manual, page 13-12.

The values obtained in the test remained below the ones prescribed in the manual for both regimes (600 RPM and 2,700 RPM), that is, the performance of the pump remained below the parameters specified in the maintenance manual.

For the correct functioning of the fuel pump, an adjustment was necessary, made by means of the “pressure-adjustment screw”. The pump manufacturer's manual contained a description of the correct procedure for such adjustment, and a qualified professional was required for the execution of the procedure on the bench.

One found out that the discrepancy of the flow-rate values resulted from an incorrect regulating position of the pressure-adjustment screw. It was not possible to identify the reason why the screw had that improper positioning.

At the disassembly of the engine, the cylinders were subject to examination for marks and damage resulting from the detonation phenomenon. One verified that all of them had normal working-appearance and coloring. It was evident that both the rocker arms and the valve train were not submitted to a high-temperature regime, something that might be suggestive of poor operation.

Furthermore, the analysis of the color of the bushings showed that the engine lubrication was normal.

Finally, the pistons, the camshaft, and the valve control system did not show any signs of improper operation, nor were there any signs of lack of lubrication, or operation in over-temperature.

1.17. Organizational and management information.

The Air Operations Command (COA) was within the headquarters of the General Command of the Military Fire-Fighting Department of *Rondônia*. Subordinated to the COA, was the Air Operations Group (GOA), a Public Air Unit (UAP).

The occurrence aircraft belonged to the CBMRO fleet, which comprised four aircraft, namely one helicopter and three airplanes, employed in Rescue and Civil Defense missions.

The COA did not present any documents describing its organizational structure, or the composition of its crews, making it impossible to verify its organizational processes. Besides, no publications were found in the State Official Gazette in relation to the commissioning of its public servants.

The Investigation Committee received three ordinances, electronically signed by the Commander of the CBMRO. The first ordinance (dated 07 June 2019) contained the designation of a military officer for the position of Deputy Commander of the GOA. The second ordinance (date 03 February 2020) had the designation of a military officer as Commander of the COA. The third ordinance (dated 26 May 2021) had the appointment of eleven members to compose the commission responsible for preparing the UAP documentation, as required by the Brazilian Civil Aviation Regulation no. 90 (RBAC-90).

The deadline established in the ordinance was 60 days (counted from the date of publication).

The MGSO (Manual of Operational Safety Management), the MOP (Air Operations Manual), the SOP (Standard Operating Procedures), and the PTAF (Fixed-Wing Pilots' Training Program) were presented to the Investigation Committee. The documents dated from September 2021, but they were neither signed nor published, and had not been formally implemented in the organization.

Furthermore, according to information gathered, a number of crewmembers, in addition to their administrative activities, also participated in the divers' work-schedule.

1.18. Operational information.

The PIC, aged 37, was the Pilot Flying (PF) at the time of the engine failure. He had joined the Air Operations Group on 28 March 2012, date of the GOA's foundation.

At the UAP, in addition to the Baron 58 model, he flew Cessna 208 and Cessna 210 aircraft, in the role of PIC, but no records of his pertinent designation (as a PIC) were available. There were no UAP documents showing his designation as a titular flight-instructor (or, even, as an occasional flight-instructor) for that Public Air Unit.

The RBAC-90, Amendment 00, dated 11 April 2019, in force at the time, dealing with the Requirements for Special Operations of Public Aviation, listed the following concepts and requirements for a pilot to deliver flight instruction in a UAP:

> 90.3 Definitions and acronyms
>
> (a) The following definitions apply to this Regulation:
>
> [...]
>
> (39) aircraft flight instructor: a qualified pilot, in accordance with this Regulation, responsible for practice instructions conducted in an aircraft as defined in this regulation. He/she may or may not have a flight instructor rating (INVA/H) issued in accordance with the RBAC- 61;
>
> [...]
>
> (41) occasional instructor: a professional able to provide theoretical or practice instructions on account of temporary need of exceptional public interest, in consonance with this Regulation;
>
> [...]
>
> (46) crew-members: pilot-in-command, pilot second-in-command, flight attendant, flight instructor, and accredited examiner;
>
> 90.27 Occasional UAP Instructor
>
> (a) On account of temporary need of exceptional public interest, the UAP may have an occasional instructor for a limited period, provided that the professional has recognized expertise, and meets the requirements of paragraph 90.29(a)(6) of these Regulations, (*with the issue being*) accounted for in the UAP Training Program.
>
> 90.29 UAP faculty requirements
>
> [...]
>
> (d) The following are the minimum requirements for exercising the role of flight instructor on an aircraft:
>
> [...]
>
> (2) to be appointed by the public body or entity to provide instruction;
>
> (3) to be pilot-in-command of the aircraft on which one will provide instructions pursuant to Section 90.23 of this Regulation;
>
> (4) to have completed full UAP instructor training, pursuant to section 90.243 of these Regulations;

> (5) to hold a valid license, on the aircraft in which he/she will provide instruction;
>
> [...]
>
> (i) The following are minimum requirements for exercising the role of occasional instructor:
>
> [...]
>
> (2) to be appointed by the public organization or entity for provision of instruction; and
>
> (Emphases added)

The right-hand seat pilot, aged 32, had joined the UAP in September 2019. He did not have a multi-engine aircraft rating. However, he had participated in some flights with an instructor, and possessed endorsed evaluation sheets registered with ANAC.

He did not have the required qualification to compose the crew, considering that the UAP had not designated the PIC as a flight instructor on the referred aircraft.

Initially, there was information that he had no role on board, but his name was mistakenly included in the aircraft logbook as pilot Second in Command (SIC) both on the flight of the occurrence and on other flights of the aircraft in question. However, no records were available regarding the required training.

Although the aircraft had certification to operate with just one crewmember, the RBAC-90 allowed a pilot to perform the role of SIC, pursuant to the requirements established in section 90.25:

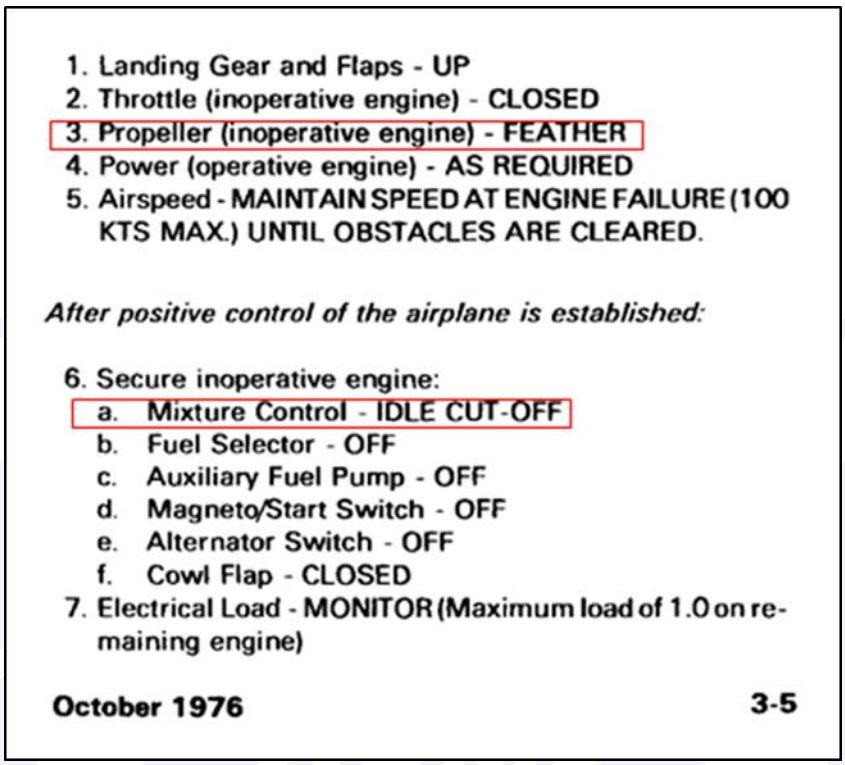
> 90.25 Requirements to exercise the function of pilot second in command:
>
> (a) The following are the minimum requirements to exercise the role of pilot second-in-command in aircraft certified with a minimum crew of 1 (one) pilot (single pilot):
>
> (1) to be a public agent, in accordance with the UAP;
>
> (2) notwithstanding the provisions of section 61.85 of RBAC nº 61, to hold a PPL A/H license with at least 10 (ten) flight hours logged in the model of the aircraft in which he/she will perform his referred function;
>
> (3) to have completed, as pilot second in command, the initial, periodical, or transition training provided for in this Regulation; (emphasis added)
>
> (4) to hold a valid category, type, and/or class rating for the aircraft on which he/she will perform their duties; (emphasis added)
>
> (5) to have a valid 1st Class CMA, pursuant to RBAC-67; and
>
> (6) to comply with the requirements to exercise the function of pilot second in command established by the aircraft manufacturer, by the operational evaluation report, or OSD published by ANAC or by the civil aviation authority, if applicable.

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

The flight started as the aircraft took off from the “GOA’s Base”, located at SSZD (*Zirondi* Aerodrome, *Porto Velho*, RO), and headed for SBPV. From SBPV, the flight would proceed to SBCY on FL095, a type of mission with which the PIC was familiar.

The crew reported that there was an oscillation in the fuel flow of the right-hand engine, which subsequently lost power.

As per the Pilot's Operating Handbook (POH) of October 1976 (Revision of July 1994, Section III, Emergency Procedures), in case of engine failure problems in flight, the following procedures, described in the topic *Engine Failure after lift-off and in flight* (Figure 4), were to be adopted.



1. Landing Gear and Flaps - UP
2. Throttle (inoperative engine) - CLOSED
3. Propeller (inoperative engine) - FEATHER
4. Power (operative engine) - AS REQUIRED
5. Airspeed - MAINTAIN SPEED AT ENGINE FAILURE (100 KTS MAX.) UNTIL OBSTACLES ARE CLEARED.

After positive control of the airplane is established:

6. Secure inoperative engine:
   a. Mixture Control - IDLE CUT-OFF
   b. Fuel Selector - OFF
   c. Auxiliary Fuel Pump - OFF
   d. Magneto/Start Switch - OFF
   e. Alternator Switch - OFF
   f. Cowl Flap - CLOSED
7. Electrical Load - MONITOR (Maximum load of 1.0 on remaining engine)

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Figure 4 - extract from the POH, procedures for in-flight engine failure. Highlighted in red, the procedures for propeller feathering and engine cut-off (idle cut-off).

One verifies that among the items of the established sequence, the PF was supposed to feather the propeller and shut down the faulty engine.

Upon completion of the previous procedure, the pilot should establish a single-engine flight condition.

To perform this type of operation, the pilot should consult the Service Ceiling diagram for the following condition: one inoperative engine, continuous maximum power, landing gear retracted, inoperative engine propeller feathered, and flaps retracted.

The diagram shown in Figure 5, extracted from the Performance Section of the aforementioned POH, illustrates the calculation. It shows that the aircraft, weighing 4,453 lb., would maintain straight and level flight up to 11,000 ft., given the approximate condition of the external air temperature (10º C).

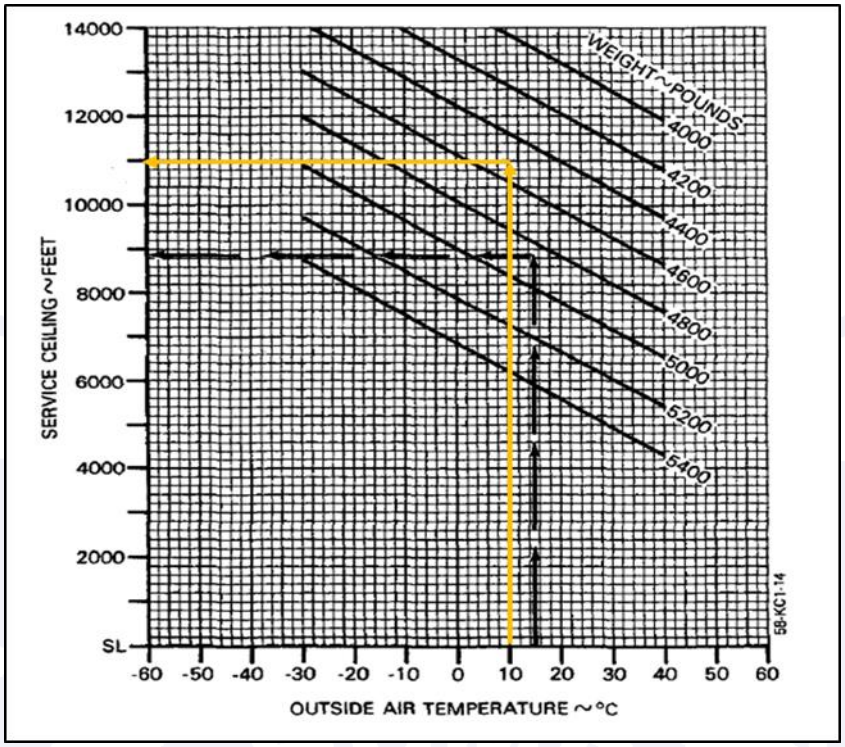

Figure 5 - Service ceiling diagram. The yellow arrows indicate the calculation reasoning.

In order to maintain straight and level flight, it is worth highlighting that, besides taking into consideration the aircraft performance, one had to use the appropriate piloting techniques to fly the aircraft with one engine inoperative.

In accordance with the Federal Aviation Administration Manual - FAA-P-8740-66, Aviation Safety Program - AFS-803 (2001), the aircraft should be maintained in a coordinated condition by means of the flight controls, counteracting the yaw and roll to the side of the inoperative engine (the right-hand engine in this occurrence), putting an end to the sideslip.

In practice, the recommendation was to apply both the pedal and the yoke to the left-hand side, leaving the aircraft with a banking of approximately three degrees to the same side of the operating engine.

Figure 6 depicts the use of the flight controls for a left-hand engine failure situation, in a way different from the occurrence in question. Therefore, one must bear in mind that the banking, application of the pedal, and visualization of the pilot would be to the left side.

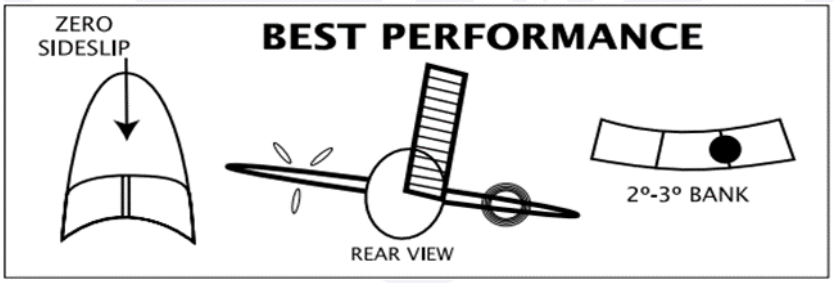

Figure 6 - Image extracted from *Flying Light Twins Safely*. It shows the proper positioning of the aircraft, and how the pilot sees it through the turn-and-bank indicator. In the example above, the inoperative engine is the one on the left-hand-side.

Although the checklist prescribed shutting down the engine, the PIC did not follow the recommended procedure. His justification was that the engine was still generating power, and, therefore, would help to maintain the aircraft's lift. However, it was not possible for

him to reach the intended destination for an emergency landing. Thus, the PIC made a forced landing in an open area located at a distance of approximately 9 NM from SBVH.

1.19. Additional information.

NIL.

1.20. Useful or effective investigation techniques.

NIL.

2. ANALYSIS.

It was a ferry flight from SBPV to SBCY, where the aircraft would receive scheduled maintenance.

The meteorological conditions were consistent with VFR flights.

The PIC had the necessary qualifications for the flight. However, the pilot occupying the right seat did not have an MLTE rating, being, therefore, not qualified and having no experience in the type of flight.

Exams, tests and research revealed that the fuel pump parameters were below those specified in the manufacturer's maintenance manual. Such deficiency caused the oscillations of the right-hand engine fuel flow parameters observed by the crew during the cruise flight. After the oscillations, there was loss of power.

The fuel pump malfunction related to the inadequate positioning of the pressure-adjustment screw, which caused the fuel flow rate to remain below the minimums required in the maintenance manual.

With regard to organizational processes, the investigation committee found out that the UAP did not have a coherent organizational structure for proper functioning. The manuals and the training program, despite having been presented, lacked formal approval by the UAP Commander and, from what was possible to infer, were not adopted by the organization, indicating the presence of weakness in terms of supervision, evaluation of performance or, even, outlining of organizational procedures crucial for the maintenance of operational safety.

Such inefficiency in the management of people and processes may have contributed to the occurrence in question, since failures were identified, both in the operations and in the maintenance sectors, which culminated in the engine shutdown and forced landing of the aircraft.

Additionally, one observed evidence of informal practices in two situations. The first was the lack of records regarding discrepancies and pertinent corrective actions in the aircraft logbook. The second was the composition of the crew with a pilot who was not qualified for that class of aircraft (MLTE), and lack of formal designation of the PIC as a flight instructor by the UAP.

Furthermore, the PIC reported that he felt overwhelmed because, in addition to coordinating the UAP air operations, he participated in the flight schedule as a crewmember. According to interviewees, it was common for CBMRO crewmembers to work beyond the prescribed hours in their flight journeys, and to accumulate other functions. Such state of affairs may have affected the pilot's performance.

As per the POH, the aircraft would be able to maintain level flight with only one operating engine as high as 11,000 ft, i.e. 1,500 ft above their flight level at the time.

On the other hand, in order to keep the aircraft in flight with just one operating engine, faithful adherence to the prescribed emergency procedure was necessary (as

described in Section 1.18), together with the use of the correct piloting technique for flying in that condition.

Since the procedures prescribed in the checklist for an in-flight engine-failure were not correctly applied and, additionally, since the correct piloting technique was not adopted in the case in question, operational failures became evident during the management of the situation, notably in relation to compliance with emergency procedures, compromising the performance of the aircraft in the single-engine flight condition.

3. CONCLUSIONS.

3.1. Findings.

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

b) the PIC had valid MLTE (Multi-Engine Land Airplane) and IFRA (IFR Flight - Airplane) ratings;

c) the PIC was qualified and experienced for the type of flight;

d) the right-hand seat pilot did not have an MLTE qualification, being, therefore, not qualified and having no experience in the type of flight;

e) the aircraft had a valid Airworthiness Verification Certificate (CVA);

f) the aircraft was within weight and balance limits;

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

h) the meteorological conditions were consistent with the type of flight;

i) the tests of the engine and its accessories revealed that the mechanical fuel pump had a flow rate below the specifications;

j) the pump-pressure adjustment screw was not properly positioned;

k) the UAP did not have its organizational structure formally established;

l) the documents presented were not formally implemented in the organization;

m) despite reports of failures involving the aircraft prior to the accident, there were no records of discrepancies in the aircraft logbook;

n) during the cruise flight, the right-hand engine failed;

o) the emergency procedure prescribed in the POH was not performed correctly;

p) a forced landing was made in an agricultural area at a distance of approximately 9 NM from SBVH;

q) the aircraft sustained substantial damage; and

r) the crew escaped uninjured.

3.2. Contributing factors.

- **Attitude – a contributor.**

Faced with an atypical performance of the aircraft, one did not follow the procedure provided in the manual for emergencies and, thus, improvised actions were evidenced.

Although “trying to take advantage” of the little traction that the propeller could still provide intended to prevent the accident, such attitude led to the need for a forced landing.

- **Organizational culture – a contributor.**

Failures in the organizational culture concerning operational safety, such as non-standard maintenance procedures, faulty organizational processes, a culture of informality,

and non-adherence to prescribed operational procedures were observed in the occurrence in question. Those non-conformities promoted a condition of vulnerability related to the safety of that air operation.

- **Handling of aircraft flight controls – a contributor / undetermined.**

Failure to use the correct aircraft piloting techniques led to a loss of controlled altitude to the point that a forced landing became necessary. In order to keep the aircraft flying with just one engine operating, one should have had faithfully adhered to the correct piloting technique for a flight in that condition.

- **Piloting judgment – a contributor.**

There was inadequate evaluation of the operational parameters when one tried to maintain the level of the flight without performing the actions specified in the checklist and without using the technique recommended for a flight in a single-engine condition.

- **Organizational processes – a contributor.**

There was inefficiency on the part of the operator and the maintenance organization in monitoring and executing the maintenance processes. Such fact demonstrated fragility and a culture of informality present in both organizations.

- **Support systems – undetermined.**

The manuals and the training program lacked formal approval, and were possibly not being followed by the organization. Thus, one may infer the existence of weakness in terms of supervision, evaluation of performance or, even, the outlining of important organizational procedures for maintenance of operational safety.

- **Managerial oversight – a contributor.**

Functions not formally defined and lack of duly approved and implemented manuals created an environment of improvisation and informality, allowing crewmembers to operate outside of the prescribed procedures.

4. SAFETY RECOMMENDATIONS

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

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

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

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Work with CBMRO, aiming to ensure that the operator has approved and implemented all the documentation necessary for safe operations, and is continuously maintaining such documentation appropriate to their reality, ranging from their organizational structure, training, to their operation manuals, in accordance with the prescriptions of the regulations in force.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

NIL.

On September 22th, de 2023.