

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
A-061/CENIPA/2016

OCCURRENCE:	ACCIDENT
AIRCRAFT:	PR-CRF
MODEL:	208B
DATE:	04APR2016



NOTICE

According to the Law n  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 n  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 04APR2016 accident with the 208B aircraft, registration PR-CRF. It was classified as [SCF-PP] System/Component Failure or Malfunction Powerplant.

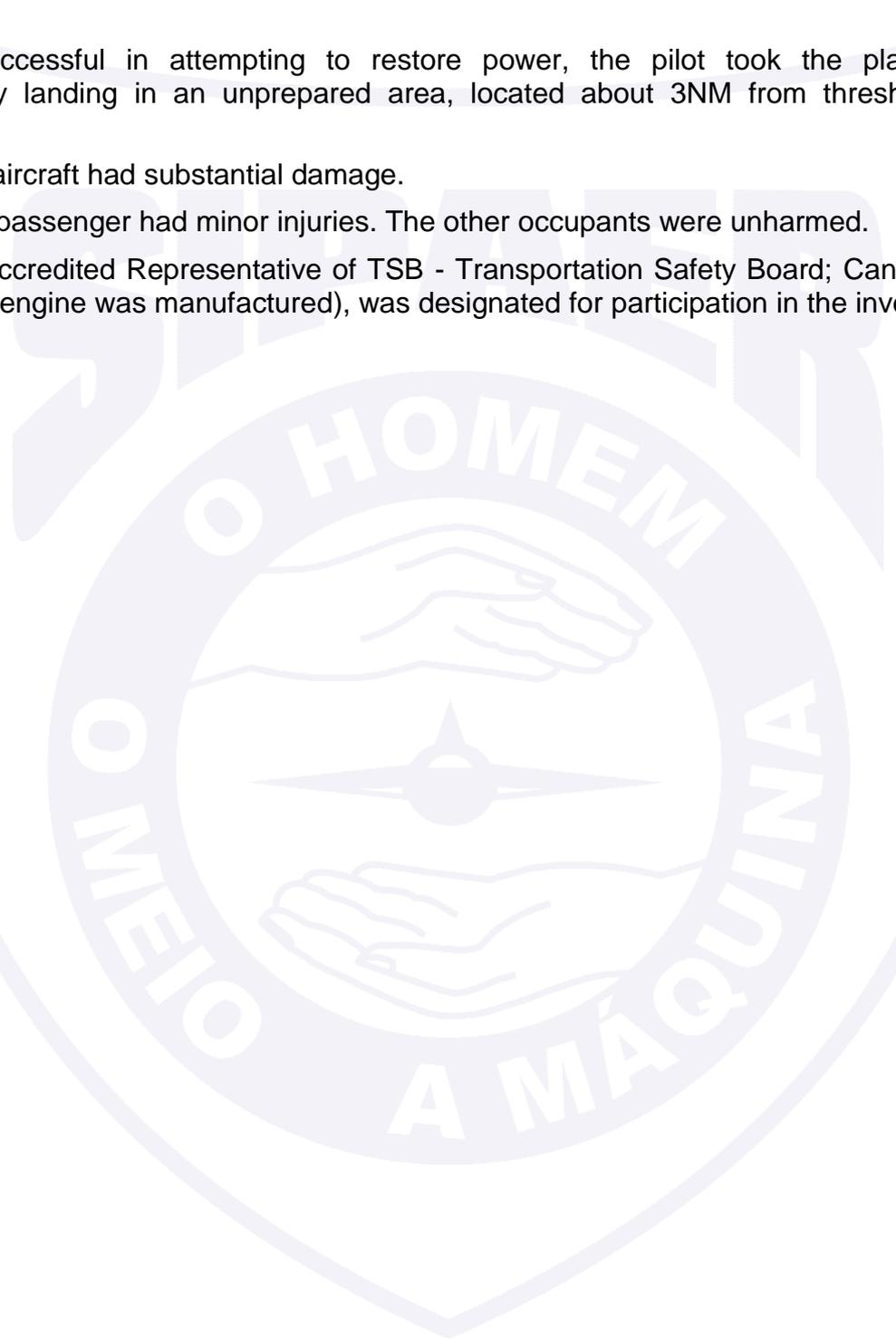
After takeoff, the aircraft presented a sudden drop of power with subsequent engine shutdown.

Unsuccessful in attempting to restore power, the pilot took the plane to an emergency landing in an unprepared area, located about 3NM from threshold 08 of SBMQ.

The aircraft had substantial damage.

One passenger had minor injuries. The other occupants were unharmed.

An Accredited Representative of TSB - Transportation Safety Board; Canada (State where the engine was manufactured), was designated for participation in the investigation.



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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	National Civil Aviation Agency
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CG	Center of Gravity
CIV	Pilot's Flight Logbook
COA	Air Operator Certificate
DCTA	Aeronautics' Science and Technology Department
EO	Operating Specifications
FCU	Fuel Control Unit
IAE	Aeronautics and Space Institute
IFRA	Instrument Flight Rating - Airplane
MNTE	Airplane Single Engine Land Rating
PAMA-LS	Lagoa Santa Aeronautical Material Park
PCM	Commercial Pilot License – Airplane
PLA	Airline Pilot License - Airplane
PPR	Private Pilot License - Airplane
RS	Safety Recommendation
SBMD	ICAO location designator – Monte Dourado Aerodrome – PA
SBMQ	ICAO location designator - Alberto Alcolumbre Intl. Airport - AP
SERIPA I	First Regional Aeronautical Accident Investigation and Prevention Service
SIPAER	Aeronautical Accident Investigation and Prevention System
SN	Serial Number
TPX	Registration Category of Non-Regular Public Air Transport
TSB	Transportation Safety Board - Canada
UTC	Universal Time Coordinated

1. FACTUAL INFORMATION.

Aircraft	Model: 208B Registration: PR-CRF Manufacturer: Cessna Aircraft	Operator: TWO Air Taxi Ltd.
Occurrence	Date/time: 04APR2016 - 1014 UTC Location: <i>Goiabal</i> Neighborhood Lat. 00°01'07"N Long. 051°07'19"W Municipality – State: Macapá - AP	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 Alberto Alcolumbre International Airport – AP (SBMQ), to the Monte Dourado Aerodrome - PA (SBMD), at 1010 (UTC), in order to transport cargo and personnel, with two pilots and three passengers on board.

During take-off, while the plane was cruising at approximately 1,800 feet altitude, there was a sudden loss of power with subsequent engine shutdown.

According to the statements made, there was an attempt to turn on the engine again, without success.

Faced with this condition, the aircraft was conducted to make a forced landing on an unprepared area, about 3NM from threshold 08 of SBMQ.

After touching the ground, the plane traveled about 100 meters to the full stop and had the nose gear separated on that route.

The aircraft had substantial damage. The pilot, the co-pilot and two passengers were unharmed. One passenger suffered minor injuries.

1.2 Injuries to persons.

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

1.3 Damage to the aircraft.

The aircraft had substantial damage to the propeller, engine, nose landing gear, and right wing.



Figure 1 - Aircraft with broken nose landing gear and propeller blade damage.



Figure 2 - Marks on the ground and wheel of the nose landing gear.



Figure 3 - Damage to the right wing.



Figure 4 - Detail of damage to the right wing.

1.4 Other damage.

Nil.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Hours Flown		
	Pilot	Copilot
Total	16.000:00	3.000:00
Total in the last 30 days	66:00	45:30
Total in the last 24 hours	01:25	01:25
In this type of aircraft	10.000:00	1.200:00
In this type in the last 30 days	66:00	45:30
In this type in the last 24 hours	01:25	01:25

N.B.: The Data on the flown hours were obtained from the operator's records.

1.5.2 Personnel training.

The pilot took the Private Pilot Course – Airplane (PPR), at Pará Aeroclub - PA, in 1987.

The copilot took the Private Pilot Course – Airplane (PPR), at Pará Aeroclub - PA, in 2007.

1.5.3 Category of licenses and validity of certificates.

The pilot had the Airline Pilot License – Airplane (PLA) and had valid MNTE and IFRA Ratings.

The copilot had the Commercial Pilot License – Airplane (PCM) and had valid MNTE and IFRA Ratings.

1.5.4 Qualification and flight experience.

The pilots were qualified and had experience in that kind of flight.

1.5.5 Validity of medical certificate.

The pilots had valid Aeronautical Medical Certificates (CMA).

1.6 Aircraft information.

The aircraft, serial number 208B-2227, was manufactured by Cessna Aircraft, in 2010 and it was registered in the TPX category.

The aircraft had valid Certificate of Airworthiness (CA).

The airframe, engine and propeller logbook records were updated.

The last inspection of the aircraft, the "Document 06, 07, 08, 09, 10, 11" type, was performed on 03APR2016, by the TWO Air Taxi Ltd. shop, Belém – PA, having flown 01 hour and 20 minutes after the inspection.

During the execution of these maintenance services, the "200 Hour Engine Minor" inspection was carried out, as per Table 601 of the Pratt & Whitney Canada Maintenance Manual (PWC), PN 3043512, Rev. 31, 24AUG2015.

In addition, the compressor was cleaned according to CAP 71-00-00 of the PWC Maintenance Manual, referenced above.

1.7 Meteorological information.

Nil.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The occurrence took place outside the Aerodrome.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The aircraft landed on an unprepared area, about 3NM from threshold 08 of SBMQ.

The trajectory to the landing was controlled, so that the wreckage were arranged in a linear way.

After touching the ground, the aircraft traveled approximately 100 meters and went left.



Figure 5 - Aerial view of the occurrence site.

During this trajectory, the nose landing gear broke, whose wheel was separated from the aircraft, as shown in Figure 2.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Not Investigated.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

Not Investigated.

1.14 Fire.

There was no evidence of fire in flight or after the aircraft has stopped.

1.15 Survival aspects.

Nil.

1.16 Tests and research.

During the initial action, the following engine components were collected for testing and research:

- Fuel Pump;
- Fuel Control Unit (FCU); and
- Fuel transfer tube and its latch.

The fuel pump, model 025323-150, Serial Number (SN) 1638, and the FCU, model DP-F2, SN 310836, were analyzed and submitted to bench test in a maintenance organization certified by the ANAC.

This work was carried out by the professionals of the company and accompanied by representatives of SERIPA I, Pratt & Whitney Brasil, the aircraft operator and the DCTA.

External inspection on the fuel pump revealed no abnormal condition in its structure. In bench tests, it was verified that all operating parameters were within the limits foreseen by the manufacturer.

In the same way, in the examinations and tests performed, the operating parameters of the FCU were within normal limits. No anomaly was detected that could compromise the fuel supply to the PR-CRF engine.

After the initial action, the aircraft was transported to the headquarters of the TWO Company, in Jundiaí - SP. The engine was then submitted to a boroscopic inspection. Again, the results were considered normal and no discrepancy was found.

However, during this inspection, it was observed that one of the transfer tubes of the fuel injection nozzle, near the igniter, located at the 4 o'clock position of the external area of the engine at the combustion chamber level, appeared to have moved from its position (Figure 6).

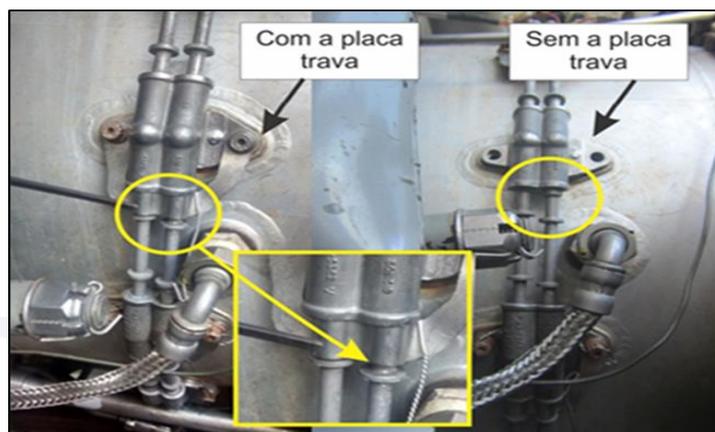


Figure 6 - Evidence of displacement of the fuel transfer tube to the injector nozzle.

A deformation in the latch plate of these transfer tubes was also observed (Figure 7).

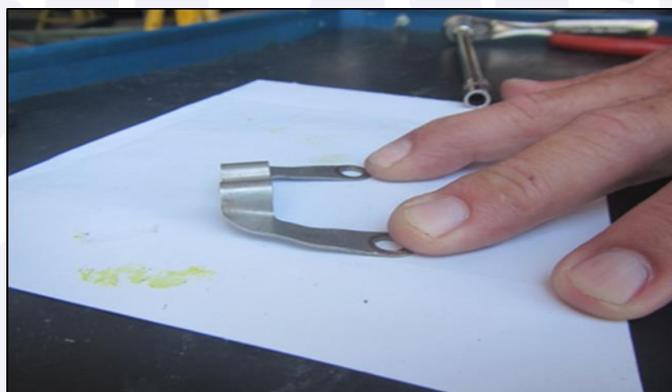


Figure 7 - The latch plate of the transfer tubes with deformation.



Figure 8 - Injector nozzle assembly and transfer tubes.

In view of these findings, the fuel transfer tubes and the packing rings were sent to the Aeronautical Propulsion Division of the Aeronautics and Space Institute (IAE) of the DCTA for analysis and examinations.

It was found that the sealing rings exhibited tearing, cracking and uneven wear on the sealing surfaces.



Figure 9 - Worn transfer tube sealing ring (packing).



Figure 10 - Worn transfer tube sealing ring (packing).

The tearings on the transfer tube's sealing rings may have been caused by the action of the fuel on it, since, due to the high working pressure in that region, occurring a leak, the fluid would produce damages equivalent to those of a cutting object.

The cracks and wear indicated that they were no longer fit for use.

On the deformation in the latch plate of the transfer tubes, it was concluded that it occurred because the safety wire of the spark plug cable, at the 4 o'clock position, was anchored therein.

This wire, when pulled excessively, deformed the latch plate and pushed it away from the transfer tubes, leaving them free to move.

Under these conditions, the high working pressure of the fuel in that region caused the fuel transfer tube to recede and move from its original working position. This resulted in a fuel leak that resulted in loss of power and subsequent engine shutdown.

1.17 Organizational and management information.

TWO Air Taxi Ltd. started its activities on 25JAN2001, as a non-regular public air transport company.

Located in Jundiaí Airport - SP, it carried out passenger transport operations, cargo transportation and specialized air service in the air survey, air publicity and air transportation of sick passengers, in accordance with the Air Operator Certificate (COA) 2001 -11-4CHG-01-02 and revision 45 of the Operating Specifications (EO).

Its fleet was constituted of eighteen Cessna 208 aircraft, being sixteen of the 208B model, counting on the crashed aircraft.

The Company's Training Program had been complied with in an adequate manner and attended the current legislation.

Its Operational Safety Management Manual included an emergency response plan, which was performed in an established manner during the occurrence in question.

1.18 Operational information.

In the flight phase that preceded the occurrence, the aircraft moved from the Belem International Airport (SBBE) to SBMQ, and no abnormalities were observed in its operation.

For the following leg, which would be carried out from SBMQ to SBMD, the pilot, co-pilot and three passengers were on board.

In order to fulfill this leg, 252 liters of fuel were added to the tanks of the aircraft in Macapá, so that it took off to Monte Dourado with a total of 1,030 liters, its maximum capacity.

The cargo manifest had a weight of 225kg for the three passengers on board, 188kg of cargo and 1,000kg (2,200lb) of fuel.

According to this document, the basic operating weight, 2,532 kg, added to the weight of the passengers, the dispatched cargo and the fuel resulted in a total of 3,945 kg, value within the limits established by the manufacturer for the maximum take-off weight.

According to its certificate of airworthiness, the aircraft could be operated with the minimum crew of one pilot. However, the operation in the company was conducted with two, in order to comply with the current legislation, one of them being designated as pilot in command and the other as a co-pilot or second in command.

1.19 Additional information.

Nil.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a passenger and cargo transport flight, which would be carried out in the SBMQ leg for SBMD.

During the take-off from SBMQ, the engine of the aircraft lost power and subsequently shutdown, forcing the crew to make a forced landing.

From this information, provided by the pilots, the investigation looked for elements that could prove and explain the failure of the PR-CRF propellant.

To that end, the main components responsible for supplying fuel to the engine, the pump, model 025323-150, SN 1638 and FCU, model DP-F2, SN 310836, were verified and bench tested.

Considering that the analyzes performed by the Aeronautical Propulsion Division of the Aeronautics and Space Institute of DCTA, in these accessories, did not identify anything that could jeopardize its operation and that all its parameters of operation were within the limits provided by the manufacturers, the hypothesis that they caused the engine failure of the aircraft was discarded.

On the other hand, the fuel transfer tube away from its housing could explain the loss of engine power.

According to the report presented to the investigators, the high working pressure of the fuel in that region was the cause of this displacement, since the latch plate that was supposed to hold it and to avoid its movement was deformed.

Thus, the instant the seal ring approached the entrance of the body of that injector nozzle, a fuel leak occurred, since that seat had a conical shape.

As the pressure in the power line decreases, the engine nozzles cease to function, resulting in loss of power.

The displacement of the transfer tube was possible because the igniter cable wire, at the 4 o'clock position, had been anchored on its latch plate. When the wire was pulled too far, it lifted and deformed this plate, as shown in Figure 6 of this report.

As a result, the fuel transfer tube has been free to move from its correct working position.

In the documentation of the aircraft was recorded in 03ABR2016, some maintenance interventions, among which the compressor turbine washing.

According to CAP 71-00-00, Pratt & Whitney Canada's Maintenance Manual (PWC), PN 3043512, Rev. 31, 24AUG2015, in order to perform this task, the technicians of the TWO Air Taxi shop would have to remove the igniter from the 4 o'clock position.

After the compressor turbine wash has been completed, the igniter should be reinstalled and safety wired according to the procedures described in CAP 74-20-00 in the PWC Maintenance Manual.

Thus, the deformation of the latch plate of the transfer tubes, which allowed its displacement, probably occurred during the execution of this safety wired.

Thus, it was characterized the inadequacy of maintenance services performed on the aircraft as a contributing factor to the failure of the PR-CRF engine.

In addition, failure to identify this wrong procedure indicated that the managerial supervision of the implementation activities in the technical area was not adequate.

3. CONCLUSIONS.

3.1 Facts.

- a) the pilots had valid Aeronautical Medical Certificates (CMA);
- b) the pilots had valid MNTE and IFRA Ratings;
- c) the pilots were qualified and had experience in that kind of flight;
- d) the aircraft had valid Airworthiness Certificate (CA);
- e) the aircraft was within the weight and balance parameters;
- f) the airframe, engines and propeller logbook records were updated;
- g) the aircraft was inspected the day before the occurrence;
- h) on that same day, the compressor was washed, a procedure that involved the removal and reinstallation of the igniter;
- i) during the investigation it was observed that one of the transfer tubes of the fuel injector nozzle, near the igniter, located at the 4 o'clock position of the external area of the engine at the combustion chamber level, was displaced from its normal operating position;

- j) it was observed that the latch plate of the transfer tubes of this position was deformed and that, in this condition, would allow that to move;
- k) the deformation of the latch plate of the transfer tubes was caused by the safety wire of the igniter cable anchored thereto, which, when pulled, moved away from the tubes, leaving them free to move;
- l) the high working pressure of the fuel in that region caused the transfer tube to retract, resulting in a fuel leak, which led to the loss of power and the engine shutdown;
- m) during take-off, there was a sudden loss of power with subsequent engine shutdown;
- n) the aircraft was conducted to perform a forced landing on unprepared ground at about 3 NM from the SBMQ threshold 08;
- o) the aircraft had substantial damage; and
- p) one of the passengers suffered minor injuries and the other occupants were unharmed.

3.2 Contributing factors.

- Aircraft Maintenance - a contributor.

The improper anchorage of the safety wire of the igniter cable, excessively pulled, that caused the deformation on the latch plate and left the fuel transfer tubes free to move, characterized a deficiency in the maintenance services performed on the aircraft engine and was a contributing factor for the occurrence.

- Managerial oversight - a contributor.

The non-identification of the improper anchorage of the safety wire of the igniter cable, excessively pulled, that caused the deformation on the latch plate and left the fuel transfer tubes free to move, indicated that the managerial supervision of maintenance activities was not adequate.

4. SAFETY RECOMMENDATION.

A measure of preventative/corrective nature issued by a SIPAER Investigation Authority or by a SIPAER-Link within respective area of jurisdiction, aimed at eliminating or mitigating the risk brought about by either a latent condition or an active failure. It results from the investigation of an aeronautical occurrence or from a preventative action, and shall never be used for purposes of blame presumption or apportion of civil, criminal, or administrative liability.

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

Recommendations issued at the publication of this report:**To the Brazil's National Civil Aviation Agency (ANAC):****A-061/CENIPA/2016 - 01****Issued on 11/07/2018**

Act with TWO Air Taxi Ltd. in order to ensure that the performance and supervision of the services performed on the Cessna 208B aircraft engines by this company are in accordance with that established by the engine manufacturer, in particular with regard to the CAP 70- 00-00 (Standard Practices - Maintenance Practices) of the Pratt & Whitney Canada Maintenance Manual.

A-061/CENIPA/2016 - 02**Issued on 11/07/2018**

Disseminate the lessons learned in the present investigation, in order to alert aircraft maintenance companies and Cessna 208B aircraft operators to the risks arising from non-compliance with the certified maintenance manuals.

To the Lagoa Santa Aeronautical Material Park (PAMA-LS):**A-061/CENIPA/2016 - 03****Issued on 11/07/2018**

Disseminate the lessons learned in the present investigation in the internal scope of the C-98 project, as well as among the Air Units operating that aircraft.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

Nil.

On November 7th, 2018.