

**COMANDO DA AERONÁUTICA**  
**CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE**  
**ACIDENTES AERONÁUTICOS**



**FINAL REPORT**  
**A - 082/CENIPA/2018**

<b>OCCURRENCE:</b>	<b>ACCIDENT</b>
<b>AIRCRAFT:</b>	<b>PP-MHJ</b>
<b>MODEL:</b>	<b>PZL-SW4</b>
<b>DATE:</b>	<b>04MAY2018</b>



## 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 04MAY2018 accident with the PZL-SW4 aircraft model, registration PP-MHJ. The accident was classified as “[SCF-NP] System/Component Failure or Malfunction Non-Powerplant – Loss of Part in Flight”.

During the cruise flight, the pilot and passengers heard a loud noise.

The commander performed the autorotation procedure and landed on an open area.

The aircraft had substantial damage.

The pilot and passengers left unharmed.

An Accredited Representative of the *Państwowa Komisja Badania Wypadków Lotniczych* (PKBWL) - Poland, (State where the aircraft was manufactured) and an Accredited Representative of the National Transportation Safety Board (NTSB) - USA, (State where the engine was manufactured) were designated for participation in the investigation.



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## GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

AGL	Above Ground Level
ANAC	Brazil's National Civil Aviation Agency
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CG	Center of Gravity
CIV	Pilot's Flight Logbook
CMA	Aeronautical Medical Certificate
DCTA	Department of Science and Airspace Technology
HMLT	Helicopter Multi-Engine Rating
HMNC	Conventional Single-Engine Helicopter Rating
HMNT	Single-Turbo Helicopter Rating
IAM	Annual Maintenance Inspection
IFRH	Helicopter Flight IFR rating
INVH	Flight Instructor Rating - Helicopter
NTSB	National Transportation Safety Board (USA)
OAT	Outside Air Temperature
PCH	Commercial Pilot License – Helicopter
PKBWL	Państwowa Komisja Badania Wypadków Lotniczych
PLH	Airline Pilot License – Helicopter
PPH	Private Pilot License – Helicopter
RFM	Rotorcraft Flight Manual
SN	Serial Number
SERIPA V	Fifth Regional Aeronautical Accident Investigation and Prevention Service
SDEM	ICAO Location Designator - Porto Belo Aerodrome – SC
SIPAER	Aeronautical Accident Investigation and Prevention System
SSKU	ICAO Location Designator - Curitiba Aerodrome, Lauro Antônio da Costa - SC
TPP	Registration Category of Private Service
UTC	Universal Time Coordinated
VMC	Visual Meteorological Conditions

## 1. FACTUAL INFORMATION.

Aircraft	<b>Model:</b> PZL-SW4	<b>Operator:</b> Number One <i>Construtora e Incorp</i> Ltd.
	<b>Registration:</b> PP-MHJ	
	<b>Manufacturer:</b> WSK PZL-SWIDNIK	
Occurrence	<b>Date/time:</b> 04MAY2018 - 1640 UTC	<b>Type(s):</b> "[SCF-NP] System/Component Failure or Malfunction Non- Powerplant"
	<b>Location:</b> Rural Area	
	<b>Lat.</b> 27°16'17"S <b>Long.</b> 050°28'32"W	<b>Subtype(s):</b> Loss of Part in Flight
	<b>Municipality – State:</b> Curitiba – SC	

### 1.1 History of the flight.

The aircraft took off from the Curitiba Aerodrome - Lauro Antônio da Costa (SSKU) - SC, to the Porto Belo Aerodrome (SDEN) - SC, at about 1630 (UTC), in order to transport personnel, with a pilot and four passengers on board.

With about ten minutes of flight, the aircraft was passing through 600ft AGL, rising to 1,000ft AGL, when there was a loud noise, followed by loss of power.

The pilot performed the autorotation procedure and landed in an open area.

The aircraft had substantial damage.

The crewmember and four passengers left unharmed.

### 1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Minor	-	-	-
None	1	4	-

### 1.3 Damage to the aircraft.

The aircraft had substantial damage to the main rotor, the structure (transmission fairing on the right side), the tail cone and the horizontal stabilizer (Figures 1, 2, 3 and 4).



Figure 1 - PP-MHJ aircraft shortly after the occurrence.



Figure 2 - Damage to the aircraft's tail cone and horizontal stabilizer.



Figure 3 - Damage to the main rotor blades.



Figure 4 - Damage to the transmission fairing door on the right side.

**1.4 Other damage.**

None.

**1.5 Personnel information.****1.5.1 Crew's flight experience.**

Flight Hours	Pilot
Total	1.252:00
Total in the last 30 days	15:00
Total in the last 24 hours	1:50
In this type of aircraft	242:00
In this type in the last 30 days	07:00
In this type in the last 24 hours	01:50

**N.B.:** The data related to the flown hours were obtained through information provided by the pilot.

**1.5.2 Personnel training.**

The pilot took the PPH course at the *Escola de Aviação Civil de Asas Rotativas* (EACAR), Joinville - SC, in 2011.

**1.5.3 Category of licenses and validity of certificates.**

The pilot had the PCH License and had valid HMNT, HMLT, INVH and IFRH Ratings.

**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 60.04.03, was manufactured by PZL-SWIDNIK, in 2011 and it was registered in the TPP category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe and engine logbooks records were updated.

The last inspection of the aircraft, the "daily inspection" type, was performed on 24MAR2018, by the maintenance organization Agusta Westland do Brasil Ltd., in São Paulo - SP, having flown 6 hours and 59 minutes after the inspection.

The last IAM was performed on 05DEC2017, by the maintenance organization Agusta Westland do Brasil Ltd., in São Paulo - SP, having flown 17 hours and 57 minutes after the inspection.

**1.7 Meteorological information.**

According to the commander, the conditions at the accident site were favorable for visual flight, with visibility above 10km and absence of cloudiness. He estimated that the wind was constant, with a direction of 100° and intensity of 12kt, which corresponded to a tailwind at the moment of the landing.

**1.8 Aids to navigation.**

Nil.

**1.9 Communications.**

Nil.



### 1.10 Aerodrome information.

The occurrence took place out of the Aerodrome.

### 1.11 Flight recorders.

Neither required nor installed.

### 1.12 Wreckage and impact information.

After the power reduction, the pilot performed the autorotation procedures, landing the aircraft on an open area.

The aircraft touched the ground and ran about 15 meters. At the moment of the touch, the blades of the main rotors collided with the tail cone and against the horizontal stabilizer.

Some wreckage from the main rotor blade were found about 65 meters away from the aircraft (Figure 5).



Figure 5 - Aircraft trajectory until the final stop spot.

### 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 fire.

### 1.15 Survival aspects.

Nil.

### 1.16 Tests and research.

Considering the pilot's statement that the aircraft had sunk after the noise heard by everyone on board, the investigation initially focused on examining and testing the aircraft's engine.

In this sense, the Rolls-Royce engine, model M250-C20R / 2, Serial Number (SN) CAE 295978, which equipped the aircraft at the time of the accident, was sent to the maintenance organization *Indústria de Aviação e Serviços* (IAS), in São José da Lapa - MG, for examination and tests.

The tests carried out on the pneumatic lines of the engine, in order to check for possible leaks, did not detect any abnormality that would prevent its operation.

Likewise, the inspection of the upper and lower chip detectors, as well as the oil filter pre-obstruction indicator, did not reveal the presence of fragments that pointed to a failure in the internal bearings of the engine. Little carbonization was found in the oil filter housing.

The engine was manually rotated and no rubbing or strange noise was noticed that could prevent its activation in the test bench.

In addition, the reports of physical-chemical tests performed on samples of aviation kerosene and lubricating oil collected in the propellant showed that both were in accordance with the specifications and showed no evidence of contamination.

After these checks, the engine was installed on the test bench and started. It started operating on the first attempt and, after completing the start cycle, remained in "idle" condition.

In this condition, it was noticed that the engine was at high temperatures and so it was decided to cut it off.

Then, the volume of fuel in the line that feeds the nozzle and the angle of the atomization fan were checked. The nozzle was also subjected to bench testing and no abnormality in its operation was detected.

Testing the engine temperature sensor indicated that it was in normal operating condition.

Subsequently, the Rolls-Royce investigator reported that this series of engines had a tendency to work at high temperatures when it was "idle". Thus, it was concluded that the behavior observed in the PP-MHJ propellant was normal and the bench tests continued.

The engine ran for about 100 minutes and, during that time, no discrepancies were detected that could compromise its performance.

The altitude of the departure Aerodrome (SSKU) was 3,209 feet (978m). According to the pilot, the temperature was of 22°C. Based on these data, it was calculated that the maximum take-off weight of SSKU would be 1,695 kg (Figure 6).

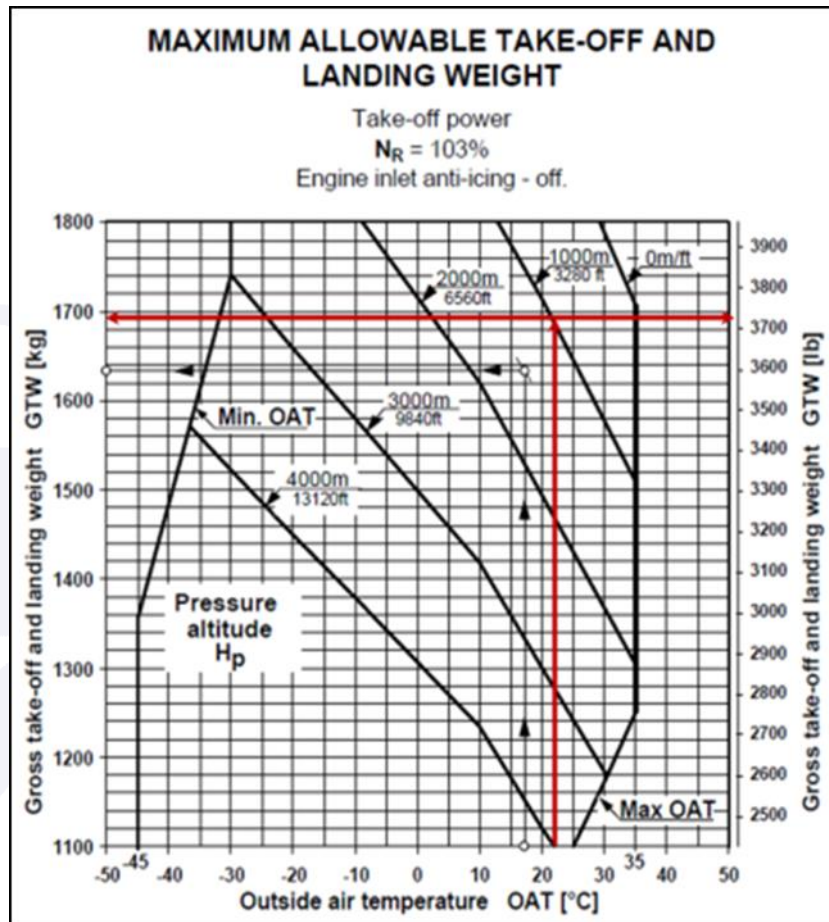


Figure 6 - Calculation of the maximum takeoff weight for a temperature of 22°C.

The Examination of the main rotor blades revealed the presence, in one of them, of damage to its leading edge, in a region close to its root (Figure 7).



Figure 7 - Damage marks on the leading edge of the rotor blade and the fairing door.

These damages, apparently, were not enough to produce major changes in its aerodynamic function.

The transmission fairing door had a fracture in a region aligned with the passage of the main rotor blades. (Figure 8).

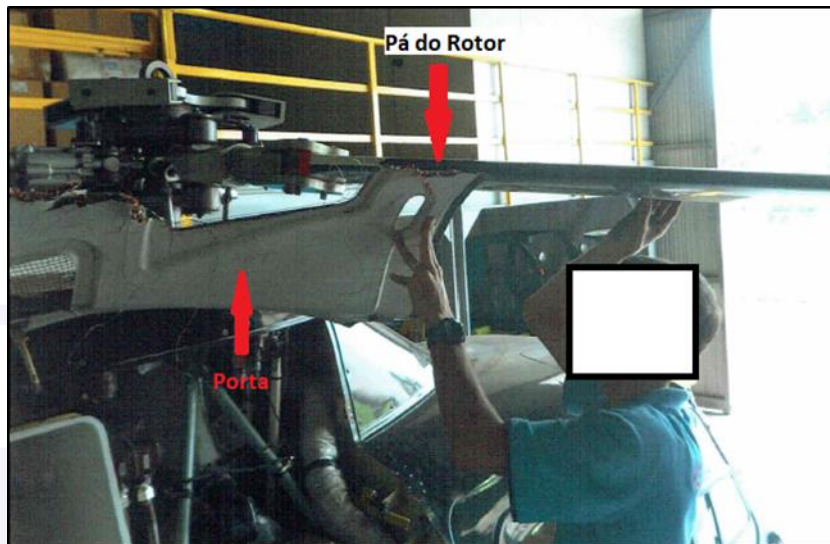


Figure 8 - Alignment between the fairing fracture and the rotor blade.

Examinations by the IAE Materials Division showed that there was no significant damage to the four grooves of the lock latch on the damaged fairing door. There was no evidence of fracture or severe damage to indicate that the latches had broken their grooves.

The only lock latch found and available for analysis, likewise, had no severe damage or fracture and worked properly. There was no evidence of wear or any other anomaly.

The damage observed in the outermost portion of the main rotor blades, in the tail cone and in the horizontal stabilizer were compatible with an impact after landing.

According to the pilot's report, these components touched during landing in autorotation.

#### **1.17 Organizational and management information.**

The owner had only the crashed aircraft, which was acquired in mid-2017.

#### **1.18 Operational information.**

According to the data provided to the investigators, at the time of the takeoff from SSKU, the weight of the aircraft was of 1,643 kg. The data presented indicated that the position of the Center of Gravity (CG) and the weight of the helicopter were within the limits specified by the manufacturer.

According to a statement collected during the field investigation, before boarding the aircraft through the right front door, the passenger who occupied the right seat in the cabin assisted in boarding the passengers, closed the rear doors and verified the closing of the helicopter fairings. The investigators found no evidence that he was qualified for this or that he had any role on that flight.

According to the pilot's report, shortly after leaving Curitiba vertical, already close to the city of *São Cristóvão do Sul*, a loud noise was heard. The commander declared that, as soon as he noticed this abnormality, he started an autorotation and landed the aircraft on a cornfield ahead of him.

The commander did not report the occurrence of vibration or changes in the operating parameters of the engine after the loud noise that motivated him to put the helicopter in autorotation.

The pilot performed a drift landing in autorotation and, according to him, after touching the ground, the main rotor hit the helicopter's tail cone and there was a strong vibration, which was controlled and eliminated by cutting off the engine and applying the rotor brake.

### 1.19 Additional information.

In the aircraft's flight manual, at the Exterior Check, it was prevised that the fairing door on the right side would be opened in order to check the engine, gearbox, main rotor hub and swashplate, paying attention to the closing of the engine cowlings, so that they were “closed and safe” (Figure 10).

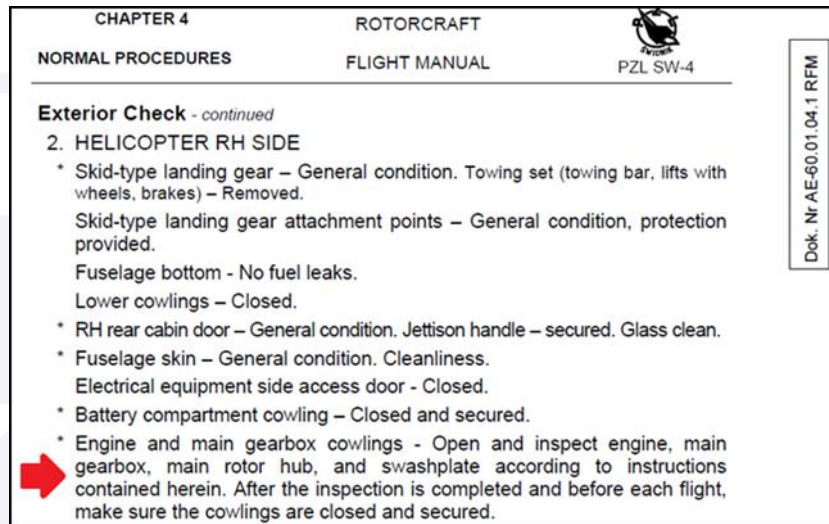


Figure 10 - Statement from the “Flight Manual” of the PZL SW-4.

### 1.20 Useful or effective investigation techniques.

Nil.

## 2. ANALYSIS.

It was a passenger transport flight between the Curitiba and Porto Belo Aerodromes.

According to the pilot's report, during the travel, after hearing a loud noise, he started an autorotation and performed a drift landing on a cornfield ahead of him.

The examinations and tests conducted on the engine did not reveal evidence of any abnormality that could compromise its operation.

The checks carried out on the pneumatic lines, the top and bottom filling detectors and the oil filter pre-obstruction indicator, as well as a manual rotation, indicated that nothing prevented the engine from starting on a test bench.

Likewise, the reports of physical-chemical tests carried out on samples of aviation kerosene and lubricating oil collected in the propellant allowed to rule out the possibility of a failure due to contamination.

Thus, the engine was installed in the IAS Company's test bench and ran for about 100 minutes without any discrepancies being detected, which allowed us to conclude that its failure did not contribute to this occurrence.

Similarly, the study of the aircraft's weight data revealed that the operation took place within the limits specified by the manufacturer. Therefore, it was concluded that this factor did not contribute to an eventual lack of power in the conditions present on that flight.

On the other hand, the examinations performed on the right door of the transmission fairing showed that it had a fracture in a region aligned with the passage of the blades of the main rotor. The existence of corresponding damage to the leading edge of one of the blades,

in a region close to its root, led investigators to conclude that the aforementioned door opened in flight and was hit by the main rotor.

Considering that there was no significant damage to the four grooves of the locks and that there was no evidence of fracture or severe damage to the latches that kept this door closed and locked, it was concluded that, during the preparation for takeoff, it was left in a condition that allowed it to open in flight.

According to the aircraft's flight manual, the Exterior Check prevised checking the engine and transmission by opening the fairing doors that protected these components. After this procedure, it should be checked whether the cowlings were "closed and safe".

Thus, it is likely that the correct closing of the fairing on the right side has not been verified after the execution of this task. Thus, an attitude of complacency may have led the commander to not realize that the locks that kept the door closed were left in a position that would allow it to open in flight.

The report of one of the passengers of the aircraft, who reported having verified the closing of the fairings, was not considered by the investigators, since there was no evidence that he was qualified for this and / or that he had any function on that flight.

In this scenario, the noise reported by the people on board was caused by the collision of the main rotor blade against the mentioned door.

The damage observed on the leading edge of one of the blades of the main rotor, in a region close to its root, apparently, was not sufficient to produce major changes in its aerodynamic function.

Thus, considering that the commander did not report the occurrence of vibration or changes in the engine's operating parameters after the loud noise that motivated him to put the helicopter in autorotation, it was concluded that an inadequate assessment of the aircraft's operating conditions and controllability has led to disregarding the alternative of performing a precautionary landing with normal approach procedure.

Since the most serious damage occurred during the landing in autorotation, this alternative would probably reduce the consequences of the abnormal situation experienced.

The investigators also concluded that the damage observed in the outermost portion of the main rotor blades, the tail cone and the horizontal stabilizer occurred during landing, due to an involuntary and / or very wide movement of the cyclic control.

### **3. CONCLUSIONS.**

#### **3.1 Facts.**

- a) the pilot had valid CMA;
- b) the pilot had valid HMNT, HMLT, INVH and IFRH Ratings;
- 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 specified;
- f) the airframe and engine logbooks records were updated;
- g) according to collected statements, the weather conditions were favorable for the flight;
- h) during the travel from SSKU to SDEN, after approximately ten minutes of flight, a loud noise was heard;
- i) the pilot performed the autorotation procedure and landed on a cornfield;

- j) no evidence of malfunction of the aircraft engine was found;
- k) the fuel and oil samples collected during the engine inspection did not show evidence of contamination;
- l) the transmission fairing door had a fracture in a region aligned with the passage of the main rotor blades;
- m) examinations showed that there was no significant damage to the four grooves of the lock latch on the fairing door;
- n) the only lock latch found and available for analysis did not present severe damage or fracture, and functioned properly;
- o) the damage observed in the outermost part of the blades of the main rotor, in the tail cone and in the horizontal stabilizer were compatible with an impact during landing;
- p) the aircraft had substantial damage; and
- q) the pilot and passengers left unharmed.

### 3.2 Contributing factors.

#### - Control skills – undetermined.

It is likely that the damage observed in the outermost portion of the main rotor blades, the tail cone and the horizontal stabilizer occurred during landing, due to an involuntary and / or very wide movement of the cyclic control, which would characterize an inadequacy in use of the flight controls.

#### - Attitude – undetermined.

It is possible that an attitude of complacency led the commander to fail to realize that the locks that kept the fairing closed and locked were left in a position that would allow it to open in flight.

#### - Piloting judgment – a contributor.

The inadequate assessment of the operating conditions and controllability of the aircraft led the commander to disregard the alternative of performing a precautionary landing with a normal approach procedure.

## 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 at the publication of this report:

Nil.

## 5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On February 12th, 2021.

