



**MINISTÉRIO DA ECONOMIA E DO EMPREGO**  
**GABINETE DE PREVENÇÃO E INVESTIGAÇÃO DE ACIDENTES COM AERONAVES**

## **ACCIDENT FINAL REPORT**

**Operator : Private**

**Aircraft: PIPER PA-38-211**

**D-EJLK**

**Côja**

**23<sup>rd</sup> of August 2011**

## Foreword

The sole objective of the safety investigation shall be the prevention of further accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

The present report was performed in conformity with Annex 13 to the Convention on International Civil Aviation, Chicago 1944, with the Regulation (EU) N.º 996/2010 of the European Parliament and the Council, of 20<sup>th</sup> October 2010, and with Decree-Law N.º 318/99, article 11º, n.º 3, 11<sup>th</sup> of August.

*This report has been released in Portuguese and English Languages.  
In case of conflict, Portuguese version will take precedence*

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## **SYNOPSIS**

The aircraft had just performed a touch-and-go on the runway 11 of the Côja aerodrome and initiating its climb, in a mountainous area with steep slopes, when crashed into the treetops, ending up suspended by two trees branches.

Two Portuguese pilots were onboard who managed to leave the aircraft and coming down the trees, with the help of a ladder brought by popular residents who have assist them on the crash site.

One of the pilots suffered minor injuries, namely scratches in his leg and face. However, the other pilot suffered no injury.

The aeroplane was destroyed

An IT, consisting of two GPIAA safety investigators, visited the crash site

The IT determined that the accident was due to the inability of the aircraft overcome the obstacles ahead due to decreasing of the propeller thrust.

## **1. Factual information**

### **1.1 History of the flight**

On 23<sup>rd</sup> of August, 2011, at 16:45 hours UTC<sup>1</sup>, the aircraft TOMAHAWAK Piper, PA-38-112, registration marks D-EJLK, struck two trees near Côja runway, where it had just taken off.

At the flight controls was a pilot (PF), age 31, performing a refreshment flight, supervised by another pilot (PNF), age 48. Both aviators were Portuguese's.

The aircraft took off from the Coimbra aerodrome, about 16h00, and headed to Lousã airfield where it performed two "touch-and-go" continuing to northwards, at altitude 500ft. AGL, towards Viseu airfield. The pilots were applying the MCC method inflight.

When the aircraft approached to Côja aerodrome, the PNF suggested to the PF to land on this airfield. PNF also added that was very familiar to it, from where he had already flown fighting fire aircrafts. The PF did not hesitate and began to manoeuvre the aircraft to fly the left downwind "Runway 11". Meanwhile, the PNF was trying to check out the wind direction by unspecified ground smoke. The both pilots have followed the checklist procedures, nevertheless without mentioning the type of landing they would perform.

The presence of an antenna on the runway final approach path, not seen by the pilots, making that the turn to the final approach had been flown slightly higher. On the final approach to the runway, the PF reduced the engine power to "idle", configured the aircraft final approach with "full flaps" and he applied sideslip to dissipate altitude. The aircraft finally intercepted the runway slope near the touch down point. At this moment, PF slightly increased engine power, to reduce the rate of descent, after which he decreased the engine power to idle and flaring the aircraft attitude.

The aircraft touched down at  $\frac{1}{3}$  after the runway threshold. The landing was performed on the left side of the runway, with the left wheel to roll over the edge of the asphalt crushing the grass. Then the PF increased engine power and continued with the "touch-and-go" as he had done before on the Lousã airfield. This maneuver caught PNF unexpectedly, who merely yelled "it was to stay" but not interfering with the takeoff. Following this, the aircraft would eventually take off approximately 100 meters before the runway ending. In the meantime, PNF took over the aircraft piloting; he retracted flaps up to one notch, and started turning to the right and looking for the lowest elevation site and trying to overfly it. Meanwhile, the pilot under refreshment monitored the speed and informed the pilot in command.

In the ultimate attempt to avoid collision with obstacles, the PF began to replace speed for altitude causing the stall warning to sound over and over again. Finally, the aircraft eventually crashed into the crown of two strong trees, which have dampen the fall and in consequence, it was hung by the branches in a vertical nose down position, about twenty feet high above ground.

The pilots managed to open one of the aircraft doors and climbed into the tree. The height, to which they were, impaired their descent in safety. Meanwhile, one of the pilots managed to climb to a higher

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<sup>1</sup> Universal Time Coordinated. All times in this report are referred to UTC. Legal Time = UTC + 1

position than the aircraft. This, allowed the other pilot to stay in a lower and better position. The rescue was started by the local resident's help, who carried a ladder from which the pilots stepped down.

In the mean time, a fire brigade as well as GNR rushed to the accident site and took over the event.

Both pilots have been transported to the Arganil Health Centre where were observed and where they had been discharged on the same day.

The accident occurred during the daylight in a forested area (40° 16' 10,22" N, 007° 57' 53,35" W), at 720 meters apart of the runway and aside of the national road No. 342 (elevation + trees = 274 meters).

## 1.2 Injuries to persons

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

## 1.3 Damage to aircraft

The aircraft was destroyed.

## 1.4 Other damage

There was no damage sustained by objects other than the aircraft.

## 1.5 Personnel information

The crew was consisted of two pilots, who are hereby designated "pilot supervisor" and "pilot under refreshment."

| References                       | Pilot Supervisor       |                     | Pilot under refreshment |         |
|----------------------------------|------------------------|---------------------|-------------------------|---------|
| <b><u>Identification:</u></b>    | Gender:                | Male                | Male                    |         |
|                                  | Age:                   | 48                  | 31                      |         |
|                                  | Nationality:           | Portuguese          | Portuguese              |         |
|                                  | Licenses:              | CPL (A)             | CPL (A)                 |         |
|                                  | Valid ratings:         | 31/12/2011          | 21/08/2010              |         |
|                                  | Qualifications:        | SEP/MEP/AGRO/FF/PDR | SEP / MEP               |         |
|                                  | Last medical check-up: | 07JUN2011           | 12FEB2011               |         |
|                                  | Limitations:           | VNL                 | NIL                     |         |
| <b><u>Flight experience:</u></b> | TOTAL                  | ON TYPE             | TOTAL                   | ON TYPE |

|                             |          |        |         |        |
|-----------------------------|----------|--------|---------|--------|
| Total flight hours:         | 2.239:55 | 335:15 | 1255:00 | 181:00 |
| Latest 90 days:             | 99:45    | 13:40  | 50:00   | 01:00  |
| Latest 30 days:             | 53:40    | 13:40  | 12:00   | 01:00  |
| Latest 7days:               | 13:40    | 13:40  | 04:30   | 01:00  |
| Latest 24 hours:            | 00       | 00     | 03:00   | 01:00  |
| Landing on latest 24 hours: | 0        | 0      | 3       | 3      |

## 1.6 Aircraft

| Reference           | Cell                 | Engine           | Propeller  |
|---------------------|----------------------|------------------|------------|
| Manufacture:        | Piper Aircraft Corp. | Textron Lycoming | Sensenich  |
| Make:               | PIPER                | Lycoming         | Sensenich  |
| Model:              | PA-38-112            | O-235-L2C        | 72 CK-0-56 |
| Serial number:      | 38-78A0651           | L-16744-15       | K9062      |
| Year of production: | 1977                 | Unknown          | Unknown    |
| Flying time:        | 2.032h01             | Unknown          | Unknown    |
| Total:              | N/A                  | 179h59           | 179h59     |
| T.S.O.:             | 1.000h00             | 1.000h00         | 1.000h00   |
| Last inspection:    | 2.007h00             | 155h00           | 155h00     |

The aircraft had been recently purchased in Germany. The pilot supervisor flew the aircraft during the journey from Germany to Coimbra aerodrome. This flight occurred on the week before the accident. Already in Coimbra, the pilots reported that the maximum speed of the propeller was low. The maintenance has then tested the engine and found that the maximum achieved were just 2050 rpm and one cylinder presented low compression values.

It was a single-engine low wing airplane and with fixed landing gear, equipped with a Lycoming 112 HP maximum power at 2600 rpm, and a *Sensenich* propeller 72/CK-0-56 with two blades ground adjustable pitch and with frame structure built from aluminum.

According to the *FAA APPROVED AIRPLANE FLIGHT MANUAL*, the propeller had the following limitations<sup>2</sup>:

**“Static r.p.m. at maximum permissible throttle setting not over 2350 r.p.m., not under 2200 r.p.m. No additional tolerance permitted.**

*Diameter: Not over 72 inches, not under 70 inches”.*

<sup>2</sup> Type Certificate data sheet A18SO

The aircraft was equipped with a stall warning system that sounds when the aircraft speed comes down to 5 -10 Kts above the stall speed.

Empty Mass: 1180 lbs.

MTOM: 1670 lbs.

Stall speed with one notch wing flaps: 49 KIAS

Best Angle-of-Climb Speed( $V_X$ ): 61 KIAS

Best Rate-of-Climb Speed ( $V_Y$ ): 70 KIAS

Fuel remaining (prior to accident): AVGAS 80 litres

Take-off mass: 1620 lbs. (=1180+320+120)

The aircraft Flight Manual was written in Germany language<sup>3</sup>

There was no fire extinguisher on board.

## **1.7 Meteorological Information**

Good weather. Sky clear and the wind was calm. Air temperature 25° C

## **1.8 Aids to navigation**

Not applicable

## **1.9 Communications**

“Transmitting in blind”, because there were not communications service available on the airdrome.

## **1.10 Aerodrome Information**

The airfield is located in Côja (40° 16' 29,61" N 007° 58' 28,50" W), 760 feet above sea level, near Côja village. It was built in the latest 70's to provide, as an infrastructure, support for fighting fires aircrafts. There are two runways, one made on gravel and the other with asphalt pavement. The asphalt runway has a QFU11/29, and its dimensions are 610X6 meters. The asphalt runway has a slight slope towards east.



Figure No. 1. – Runway 11

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<sup>3</sup> The pilot under refreshment had prepared one flight manual copy (in English) that provided to the pilot supervisor.



Figure No. 2. – Runway edge traced by aircraft main gear left wheel.

It is an aerodrome not certified that shows neglected evidences highlighted by the presence of grass on the gravel runway and bunches of tall grass on the edges of the asphalt runway.

Its operation, at that moment classified as "approved aerodrome"<sup>4</sup>, requires INAC prior authorization.

A mountains terrain, with 1500 ft height, is located eastwards of the airfield.

### 1.11 Flight recorders

The aircraft was not equipped neither FDR nor CVR. Neither one was required by the applicable regulations.

### 1.12 Wreckage and impact information

The first collision took place on an oak treetop and ash tree with about 12 meters high. The trees softened the impact and prevented the fall of the aircraft, which was eventually suspended from a pin oak, supported by its wings in a vertical position of the nose down.

The aircraft wreckage was gathered together.

The propeller hub crashed into the trunk of an ash tree which was scratched by propeller rotation. The prop blade tips were curling backwards indicating that they were rotating at high speed.

The wings were dented in several places and especially at their roots.



Figure Nº 3. – Accident site

<sup>4</sup> Aerodrome or heliport with operational restrictions but with minimum safety requirements for its use and for specific purposes for which was approved.

These approvals are granted exclusively in cases where the use of those aerodromes/heliports is applicable to public interest activities such as medical emergencies, forest fire fighting, civil protection or other specific cases duly approved by INAC, IP. Yet, it should be noted in these cases the use of the aerodrome/heliport is restricted to flights and conditions expressly established in the suitable certification issued.

The tail cone was broken during the first impact. This will have helped the aircraft to rotate about the longitudinal axis and taking a nose-down attitude.

The flaps were set down in the 1<sup>a</sup> notch (27°).

### **1.13 Medical and pathological information**

There is no medical evidence that physiological factors or physical disabilities had affected the performance of crew members.

### **1.14 Fire**

There was no evidence of fire inflight or after impact.

### **1.15 Survival aspects**

The aircraft was suspended from two trees enabling to be detached and drag the crew in its fall. For this reason, one of the pilots climbed to an upper position which also allowed more room to the other crewman, who protected himself leaning on the tree trunk. The wing fuel began to leak and pour down the propeller hub which had concerned both pilots.

The alert, for rescue and safety services, was issued by the local inhabitants who came to the site and helped the crew coming down through one ladder.

### **1.16 Tests and research**

Performance aircraft calculation (flaps 21°)

|  |            |
|--|------------|
| ❖ Landing distance   | 750 ft.    |
| ❖ Take-off distance  | 1050 ft.   |
| ❖ Take-off distance in order to overfly an obstacle of 50 ft. height | 1700 ft.   |
| ❖ Rate of climb (ft./min)  | 570 ft     |
| ❖ Distance covered   | 2700 ft    |
| ❖ Flying time  | 27 seconds |
| ❖ Calculated altitude (after 27 seconds of flight)                   | 1000 ft    |
| ❖ Altitude at accident site (tree tops)                              | 900 ft.    |

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

NIL

### **1.18 Additional information**

The pilots reported that the engine did not exceed more than 2150 rpm at the beginning of the takeoff.

## 2. Analysis

### 2.1 General

The information, gathered from the pilots, was enough to determine the circumstances and identify the causes that led to this accident. In case of flight recorders lacking, that information was only achievable thanks to the willingness and cooperation of the involved pilots, which have constituted a valuable contribution to the accident prevention purpose, and it should be acknowledged.

### 2.2 Flight operations

#### 2.2.1 Operational procedures

At the beginning of final approach to Côja runway, the aircraft was too high and the pilot had to maneuver it in order to lose altitude. To achieve this aim, the pilot set down to *full flaps*, reduced engine power and sideslip the aircraft, then “intercepted” the visual glide slope angle, which just happened close to the runway and when he adjusted the power to reduce the rate of descent. This approach resulted in a lengthy landing and consequently less distance available to perform the “touch-and-go” and less time to decide whether to land or to discontinue the landing.

Following the “touch-and-go”, the aircraft took-off near the end of the runway. Then, the supervisor pilot got the flight control, keeping flaps with one notch set, initiating its climb at a speed of 61 Kts, to ensure the best angle of climb ( $V_x$ ).

Because the aircraft did not climb enough, the pilot was replacing speed for altitude, in an attempt to avoid, or postpone, the collision with obstacles. However, the stall warning system was triggered several times, meaning that the aircraft was flying near the stall-speed (5 to 10 kts above). In such circumstances, the aircraft lift was significantly degraded and, at the end, the aircraft crashed into the treetops.

#### 2.2.2 Aerodrome

The Côja airfield is neither certified nor approved by the Civil Aviation Authority and as such not included in the VFR Flight Manual. Therefore, the availability of relevant information was scarce for pilots, outdated and unofficial.

The tall grass, along the runway edges, was an obstacle to a low-wing aircraft and enhanced the pilot tendency to compensate into the opposite side.

The east mountain area slope and closeness of the airfield dissuade take-offs as well as other maneuvers, like “touch-and-go”, performed from runway 11.

## 2.3 Airplane

### 2.3.1 Power system

The aircraft engine was powered with two blades propeller 72 inch in diameter, ground adjustable pitch which has been set to “*higher pitch*”. This propeller setting had the advantage of improving the

performance of the aircraft while cruising a high altitude. On the other hand, a consequent drawback will occur at low altitude by means of a performance dropping, which implying longer take-off runs and lower rates-of-climb, as well.

**the higher pitch propeller should be chosen only if take-off and climb are not critical.**

Furthermore, the propeller did not get to the minimum of 2200 rpm (static), according to Flight Manual, which means its power capability was below of the minimum permissible (no tolerance). Therefore, the aircraft revealed a "non-conformity".

### **2.3.2 Aircraft performance**

The performance calculations indicate that to overcome a 50 ft. obstacle after takeoff, the aircraft needed to fly a distance of 650 ft. It was also estimated that this point would be located 320 ft. beyond the end of the runway. From this point, the aircraft would begin to climb about 570 ft. rate-of-climb and spend another 20 seconds to reach the crash site (900 ft. height), where it should be flying at 1000 ft. MSL (True Altitude).

However, the facts indicate that the aircraft climbed about 100 ft., during 20 seconds, and it did not reach the 570 ft. rate-of-climb, due to the capability of the propeller thrust lessening, far below the values of performance calculated.

### **2.4 Human factors**

From the point of view of the pilot supervisor, the pilot under refreshment was flying the aircraft with high proficiency, since he possessed a vast flight experience and he is a high performance aircraft pilot. This feeling has conditioned his assistance, particularly during landing.

From the point of view of pilot under refreshment, the pilot supervisor was more experienced in that type of aircraft and was familiar with the Côja airfield, where he had operated aircrafts involved in forest fighting fires. On the other hand, due to his professional training led him naturally to accept the decisions of the pilot supervisor, right away.

The pilots had just performed a "touch-and-go" on the Lousã aerodrome and after they headed towards Viseu aerodrome to perform the same landing manoeuvre. Meanwhile, the flight cruising altitude at 500 ft. (AGL), following a course that crossed close to Côja airfield, where it was not foreseen to land in accordance with the flight planning. The decision to land in Côja was taken under the impulse of PNF (pilot supervisor), where he experienced a nasty situation, on the gravel runway, during one air forest fire fighting campaign.

The PNF knew from his past experience that the runway features would not allow any "touch-and-go" landings and naturally assumed that this landing would be a full stop. However, and because it was an unexpected landing, not covered in flight planning, the PF was not aware of this circumstance, he has then assumed that it would be a "touch-and-go", like he was already done on the Lousã runway.

During the final approach, the PNF took the opportunity to explain to the PF some details of the accident he was involved in that airfield, diverting his attention to a no priority event. This narrative, performed during a critical phase of the flight, has conditioned the important runway information flowing.

To guide one's attention to something is a psychological state that exists when a person directs all his attention to a stimulus other than everything else. This is a problem when the person fails to perform a task, processing or detect high priority information or yet, one has no time to answer questions that require immediate attention.

### **3. Conclusions**

#### **3.1 Findings**

1. The crew was licensed and qualified to operate the aircraft;
2. The aircraft presented an engine power non-compliance, due to the propeller does not reach the 2.200 rpm (static) – minimum established by the manufacturer, without tolerance;
3. The Côja aerodrome was not certified by INAC;
4. At East of the aerodrome there is a mountains terrain which restricts the use of asphalt runway;
5. The airfield was in a degraded condition, with tall grass on the edges of the asphalt pavement;
6. The weather conditions were suitable to the VFR flight operation;
7. The landing on Côja airdrome was not foreseen in the flight planning;
8. The crew did not perform any air visual reconnaissance to the runway conditions, previously;
9. Information about the type of landing has not been discussed between the two pilots. The PF has assumed it should be a "touch-and-go", on the other hand PNF assumed a landing with a full-stop;
10. The aircraft performance, due to the engine power non-compliance, was unable to overcome the obstacles positioned ahead;
11. The aircraft has impacted into the treetops and crashed;
12. The propeller tip-bending matches with the engine power output during the impact.

#### **3.2 Cause of accident**

The accident was due to the inability of the aircraft overcome the obstacles positioned ahead, during its climb.

#### **3.3 Contributing factors**

Propeller thrust below the limits and which is specified in the Flight Manual.

#### **4. Safety recommendations**

Considering that the aircraft had a non-compliance engine power – due to the propeller does not reach the 2200 rpm static (**limitation without tolerance**) – which was not been detected by the pilots and, considering the limitations of the propeller as shown in the Flight Manual, the IT does not issue any safety recommendations.

Lisbon, 24<sup>th</sup> of October, 2011

Investigator-in-charge

Investigator

Fernando Lourenço

António Barros

## ACRONYMS

|        |  |
|--------|--|
| ACCID  | Accident   |
| AGL    | Above Ground Level   |
| AGRO   | Agricultural Flight Rating   |
| AVGAS  | Aviation Gasoline  |
| °C     | Degrees Centigrade   |
| CPL    | Commercial Pilot Licence   |
| FF     | Fire Fighting Rating   |
| ft     | Feet   |
| GNR    | <i>Guarda Nacional Republicana</i>                                     |
| GPIAA  | <i>Gabinete de Prevenção e Investigação de Acidentes com Aeronaves</i> |
| HP     | Horse Power  |
| INAC   | <i>Instituto Nacional de Aviação Civil</i>                             |
| IT     | Investigation Team   |
| IAS    | Indicated Air Speed in Knots   |
| Kts    | Knots  |
| LBS    | Pounds   |
| MCC    | Multi Crew Concept   |
| MEP    | Multi Engine Pilot   |
| MSL    | Mean Sea Level   |
| MTOM   | Maximum Take Off Mass  |
| N/A    | Not Applicable   |
| PDR    | Parachutist Dropping Rating  |
| PF     | Pilot Flying   |
| PNF    | Pilot not Flying   |
| r.p.m. | rotations per minute   |
| SEP    | Single Engine Pilot  |
| TSO    | Time Since Overhaul  |
| VFR    | Visual Flight Rules  |
| VNL    | Vision Near Limitation   |