COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 116/CENIPA/2020

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PT-POH**
MODEL:	**SZD-48-3**
DATE:	**20SEPT2020**

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 by taking into account the contributing factors and hypotheses raised. The report is, therefore, a technical document that 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 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 into the Brazilian legal system by 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 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 20SEPT2020 accident with the SZD-48-3 aircraft model, registration PT-POH. The accident was classified as “[SCF-NP] System/Component Failure or Malfunction Non-Powerplant and [LOC-I] – Loss of Control in Flight”.

After a low pass, the pilot performed a loop. Soon after, the aircraft tended to pitch up, sometimes losing lift. Finally, it went into an abnormal attitude, out of control, until its collision with the ground.

It was found that there was a disengagement of the housing fixing bolt located in the rear lock of the horizontal stabilizer, leading to a loss of the elevator control.

The aircraft had substantial damage.

The pilot died at the accident site.

An Accredited Representative of the *Państwowa Komisja Badania Wypadków Lotniczych (PKBWL)* - Poland, (State where the aircraft was manufactured and the type certificate holder is located) was designated for participation in the investigation.

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	Brazil's National Civil Aviation Agency
APC	*Planalto Central* Aeroclub
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CIV	Pilot`s Flight Logbook
CMA	Aeronautical Medical Certificate
IAE	Aeronautics and Space Institute
IAS	Indicated Air Speed
METAR	Meteorological Aerodrome Report
MNTE	Airplane Single-Engine Land Rating
PIC	Pilot in Command
PKBWL	*Państwowa Komisja Badania Wypadków Lotniczych*
PLAN	Glider Rating
PPL	Glider Pilot License
PPR	Private Pilot License – Airplane
SBBR	ICAO Location Designator - Presidente Juscelino Kubitschek Aerodrome, Brasília - DF
SERIPA VI	Sixth Regional Aeronautical Accident Investigation and Prevention Service
SN	Serial Number
SWFR	ICAO Location Designator – Formosa Aerodrome, Goiás
TCH	Type Certificate Holder
TPP	Private Air Service Aircraft Registration Category
UTC	Universal Time Coordinated
Vb	Velocity in Turbulence
VFR	Visual Flight Rules
Vne	Velocity Never Exceed

1. FACTUAL INFORMATION.

Aircraft	**Model:** SZD-48-3 **Registration:** PT-POH **Manufacturer:** PZL-BIELSKO	**Operator:** Private
Occurrence	**Date/time:** 20SEPT2020 - 1845 UTC **Location:** Formosa Aerodrome (SWFR) **Lat.** 15°33'22"S **Long.** 047°20'43"W **Municipality – State:** Formosa – GO	**Type(s):** "[SCF-NP] System/Component Failure or Malfunction Non-Powerplant and [LOC-I] – Loss of Control in Flight" **Subtype(s):** NIL

1.1 History of the flight.

The aircraft took off from the Formosa Aerodrome (SWFR) - GO, at around 1635 (UTC), to perform a local private flight with a pilot on board.

After two hours and ten minutes of flight, during the return for landing, the pilot performed a low pass and then a loop. Soon after, the aircraft tended to pitch up, sometimes losing lift.

The pilot reported on the radio that there was a malfunction. Finally, the aircraft entered an abnormal attitude, without control, until its collision with the ground.

The aircraft had substantial damage, and the pilot suffered fatal injuries.

1.2 Injuries to persons.

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

1.3 Damage to the aircraft.

The aircraft had substantial damage. There was a breakage of the tail cone, canopy and wings.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours	PIC
Total	1.351:00
Total in the last 30 days	06:16
Total in the last 24 hours	02:10
In this type of aircraft	208:17
In this type in the last 30 days	02:30
In this type in the last 24 hours	02:10

N.B.: The data relating to the flown hours were obtained through the Pilot's Digital CIV records.

1.5.2 Personnel training.

It was not possible to identify the PIC`s training school, due to the absence of records and the lack of knowledge on the part of those closest to him.

1.5.3 Category of licenses and validity of certificates.

The PIC had the PPR and the PPL Licenses and had valid MNTE and PLAN Ratings.

1.5.4 Qualification and flight experience.

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

1.5.5 Validity of medical certificate.

The pilot had a valid CMA.

1.6 Aircraft information.

The aircraft, serial number B-1908, was manufactured by PZL-BIELSKO in 1989 and was registered in the TPP Category.

The last inspection of the aircraft, the “IAM” type, was carried out in July 2019 by the Maintenance Organization FORMAER - *Comércio e Serviços* Ltd., in Formosa - GO, with 49 hours and 38 minutes flown after the inspection.

According to Ordinance No. 879, of 08MAR2020, the expiration of the CA, the Airworthiness Condition Reports, and the IAM were postponed by the ANAC for 120 days. The measure taken by the Agency was due to the Coronavirus (COVID-19) pandemic. With that, the CA and the IAM were valid.

During an interview with the technical shop specialized in the model, it was found that there was no provision in the manual for the removal of the fixing bolt from the housing located in the rear lock of the horizontal stabilizer during the maintenance action. Its removal was more common when the aircraft was being transported.

It was not possible to confirm whether the operator performed the removal and replacement of the bolt for some glider transport.

The airframe logbook was updated.

The Flight Manual, Chapter 4.8.4. it. 5, provides the detailed instruction how to rig the horizontal tailplane: “Lock the bolt rotating it 90’ till the red line on bolt and the fin make a straight line.” This procedure assures the proper engagement of the bolt and sets its grove to the demanded horizontal position where the locking spring on vertical fin gets into.

A manufacturer's document, called Bulletin Nº BE-029/87, stated that, due to reported doubts about the reliability of the tail bolt attachment in relation to a possible accidental disconnection, an additional way for its attachment was developed. It also said that each user could decide whether to adopt it or not.

The change consisted in making a hole through the head of the bolt and adapting the vertical stabilizer to receive a screw. This bulletin was not implemented on the crashed aircraft.

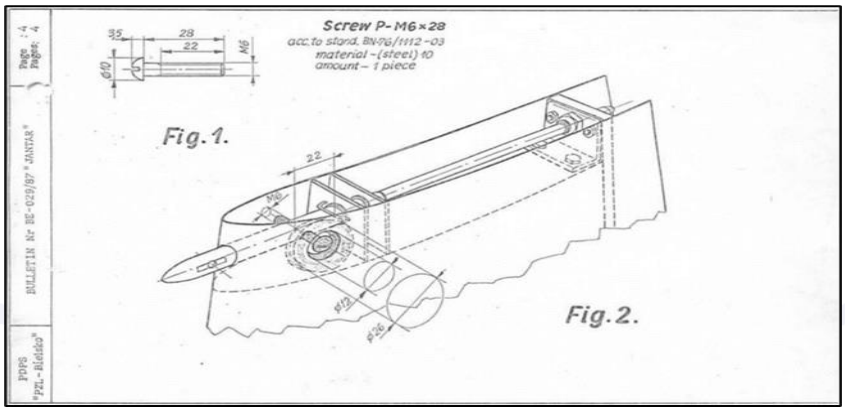

Figure 1 - Schematic drawing of the adaptation suggested in Bulletin Nº BE-029/87.

1.7 Meteorological information.

On the day of the occurrence, observers saw a region of turbulent air in the aircraft's trajectory, near the threshold of the runway.

The data from the meteorological station at the Aerodrome indicated moderate wind speed, without significant variations in direction, especially in the period between 15h43min (local) and 15h45min (local).

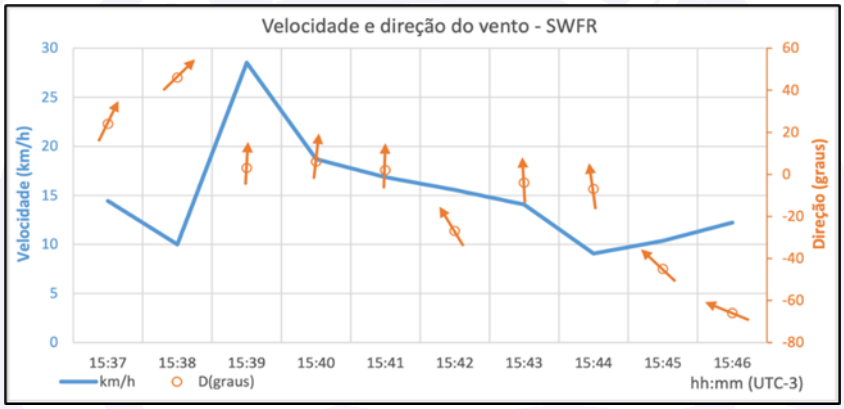

Figure 2 - Wind graph. The blue line corresponds to the speed in km/h and the orange data shows the direction variation.

In Figure 2, the orange circles/arrows (degrees - true North) were plotted from 15h:37min to 15h46min (local), on 20SEPT2020. Data extracted from the SWFR Aerodrome meteorological station. The arrows are the graphical representation of the information displayed on the secondary axis.

The METAR from the Presidente Juscelino Kubitschek Aerodrome, Brasília - DF, approximately 40 nautical miles from the accident site, provided the following information:

METAR SBBR 201900Z 01005KT 330V030 9999 FEW040 SCT100 34/06 Q1014=

METAR SBBR 202000Z 04005KT CAVOK 34/07 Q1014=

1.8 Aids to navigation.

Nil.

1.9 Communications.

Regarding communication at the time of the occurrence, three videos were obtained in which it was possible to identify the dynamics of the accident, and the third video also contained radio communication between the pilot and an interlocutor as shown below:

Pilot: I'm in an emergency;

Interlocutor: Try the compensator;

Pilot: I've tried everything;

Interlocutor: Keep on a curve, keep on a curve. Aileron in curve.

After that, there was no more contact between the interlocutor and the pilot, and the aircraft entered an abnormal attitude heading toward the sun.

1.10 Aerodrome information.

The Aerodrome was public, managed by the State of Goiás Government and operated under VFR.

The runway was made of asphalt, with thresholds 05/23, dimensions of 1,400 x 30 m, with an elevation of 3,186 ft.

1.11 Flight recorders.

Three devices with volatile memory were found, which recorded some flight data: avionics Naviter Oudie2, SN 20180012001715, Nano Flight Recorder, SN 01364 and 303 Navigation Display. Data was extracted from all equipment so that the researchers could use them as a reference for the analyses.

The data recorded by the equipment were extracted at the APC office, by the president of the aeroclub, and made available for investigation. The data considered of great interest were speed and altitude, in addition to the traveled trajectory and respective times.

The synchronization of the videos obtained in the Field Action with the data recorded in the equipment indicated that the low pass occurred between 15h43min51s and 15h43min58s (local), when the Naviter Oudie2 recorded an IAS of 310.3 km/h, at 15h43min58s.

Approximately 1 minute and 25 seconds after the end of the low pass and beginning of the climb, the aircraft crashed into the ground. The data record closest to that moment was made by Naviter Oudie2, at 15h45min23s (local) (Figure 3).

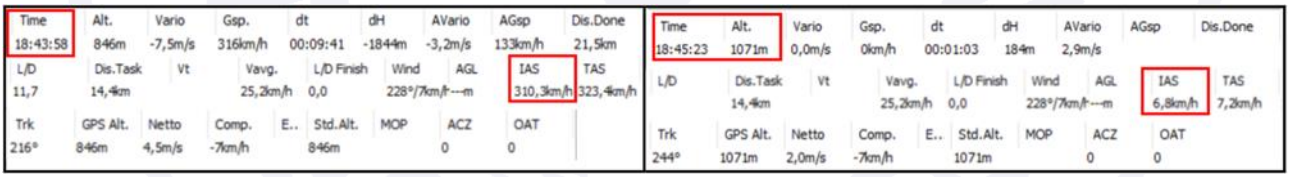

Figure 3 - Logs extracted from Naviter Oudie2.

The Nano Flight Recorder registered an IAS of 321.5 km/h at 15h43min53s (Figure 4).

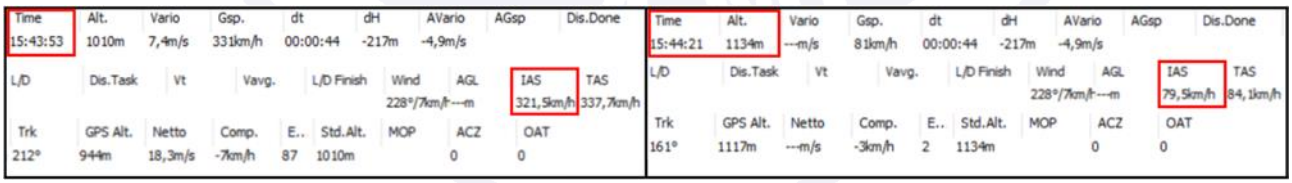

Figure 4 - Records extracted from Nano Flight Recorder.

The 303 Navigation Display recorded an IAS of 308.6 km/h at 15h43min51s (Figure 5).

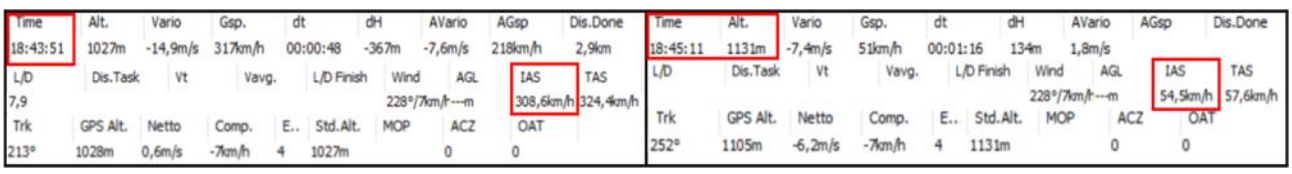

Figure 5 - Records extracted from the 303 Navigation Display.

Note: the times of Figures 3 and 5 were converted to UTC and the time of Figure 4 remained in local time.

1.12 Wreckage and impact information.

The first impact occurred in a pitch up attitude and tilted to the left, causing the left-wing tip to collide with the ground. Subsequently, the collision of the cabin, tail cone and stabilizers occurred.

Figure 6 - Location of the aircraft wreckage in relation to the runway. Point “a” indicates threshold 05, “b” the place of impact and “c” threshold 23.

Figure 7 – Left-wing impact point.

Figure 8 - Point of impact of the aircraft's nose.

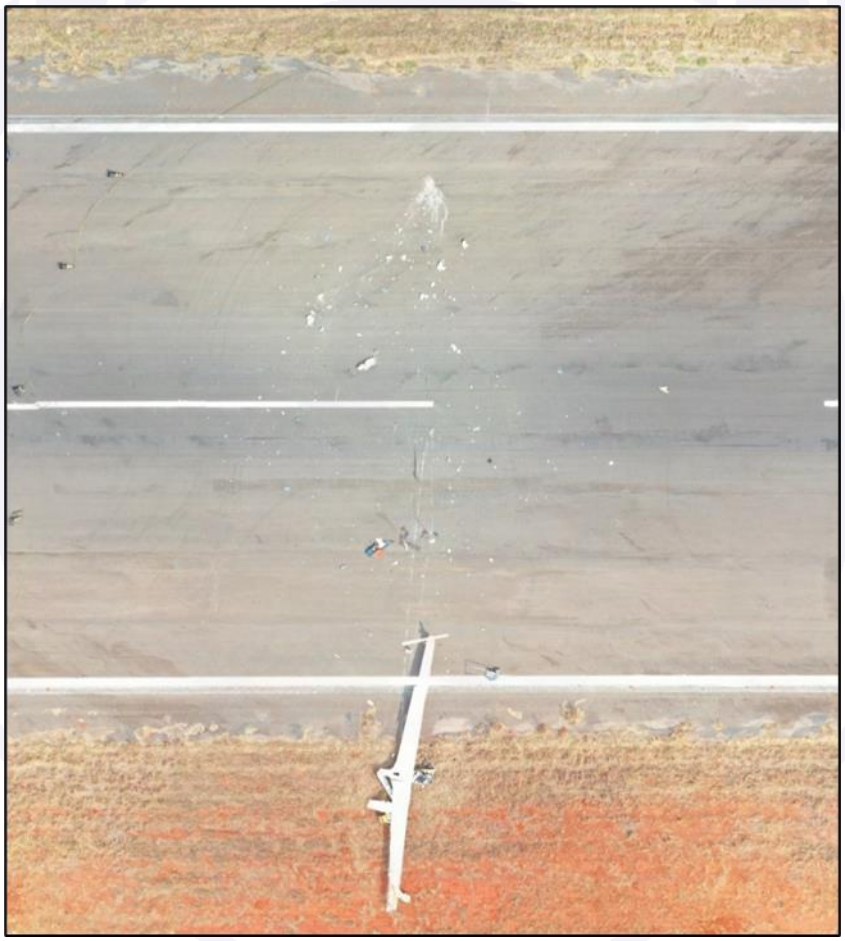

Figure 9 - Final position of the aircraft and its wreckage.

Figure 10 - Position of the aircraft elevator.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

No evidence was found that problems of physiological nature could have affected the flight crew performance.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

No evidence was found that problems of physiological nature or incapacitation could have affected the flight crew's performance.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

Nil.

1.16 Tests and research.

During the Field Action, it was verified that the elevator was locked in the pitch up position. In addition, it was identified that the fixation bolt had its final segmentation of the fitting disengaged from the lock that connected it to the horizontal stabilizer (Figure 11), although the bolt was still next to the rear lock, as shown in Figure 12.

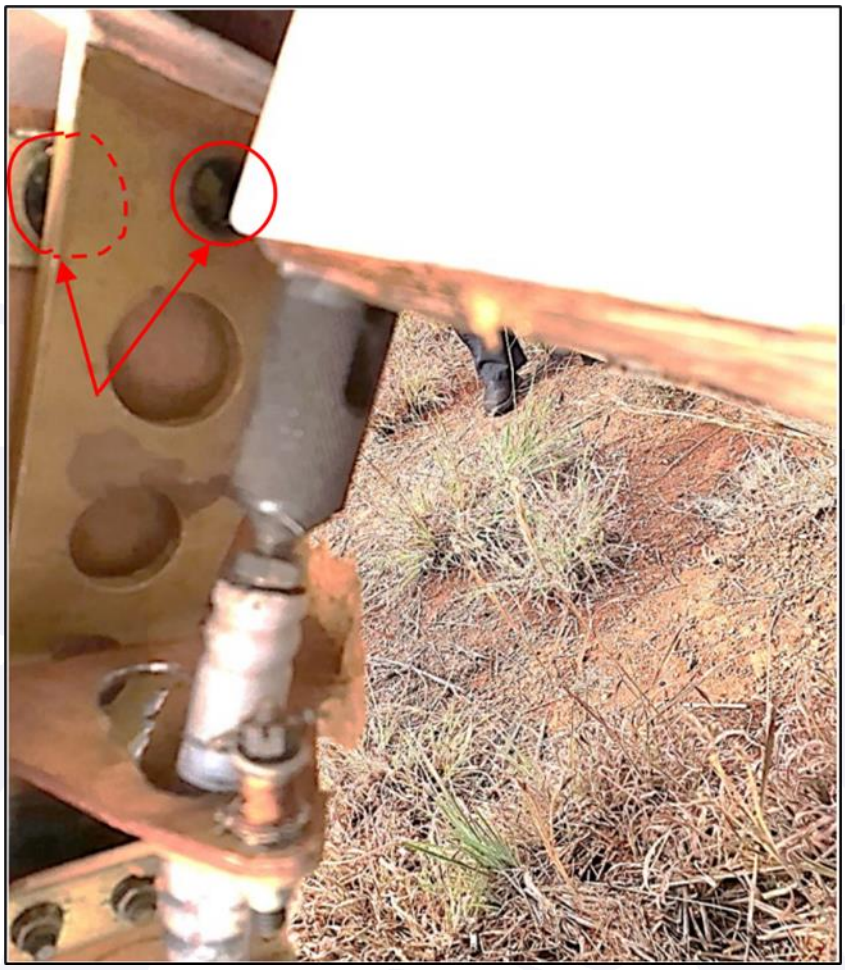

Figure 11 - Misalignment between the bolt housing and the horizontal stabilizer rear lock.

Figure 12 - Fixing bolt and the displacement between the rear parts of the horizontal and vertical stabilizers.

In addition, as can be seen in Figure 13, the elevator control rod showed friction marks with the structures around it, which contributes to the thesis of irregular movement.

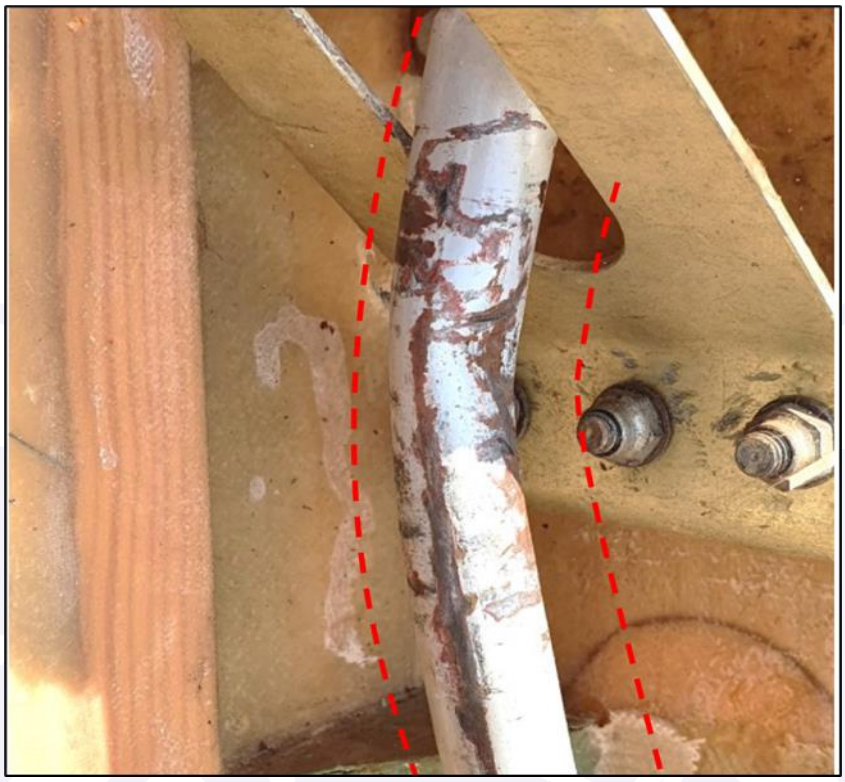

Figure 13 - Elevator control rod. The marks of friction with the surrounding structures (dark brown) are highlighted.

Some components of the tail cone of the PT-POH glider were sent for analysis at the IAE`s Materials Division.

At the IAE, the disassembly of the vertical stabilizer structure and the evaluation of the fitting of the fixing bolt, the fitting of the horizontal stabilizer in the vertical stabilizer and the fixing bolt in the set were carried out.

Figure 14 shows the schematic representation of the fitting system of the horizontal stabilizer in the vertical stabilizer.

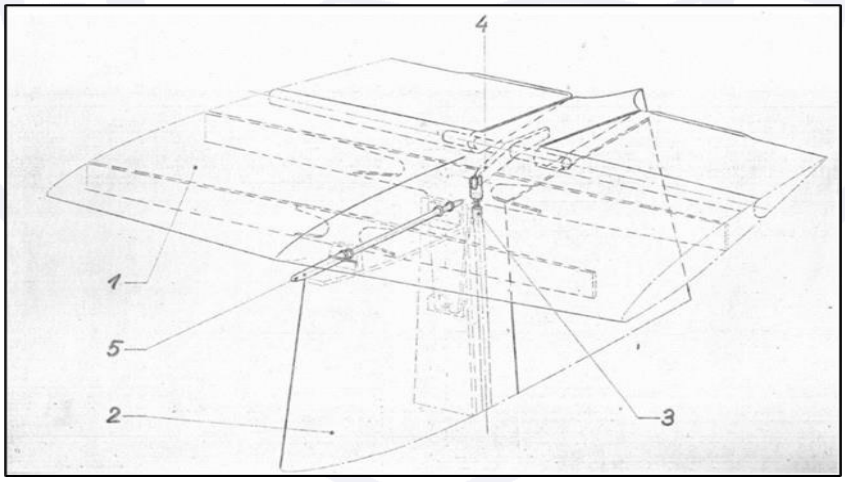

Figure 14 - Schematic representation of the horizontal stabilizer fitting system in the vertical stabilizer.

Figure 15, item (I), shows the assembly scheme of the bolt next to the elevator stabilizer according to the spare parts catalog of the SZD-48-3 aircraft and in (II) the bolt of the crashed aircraft.

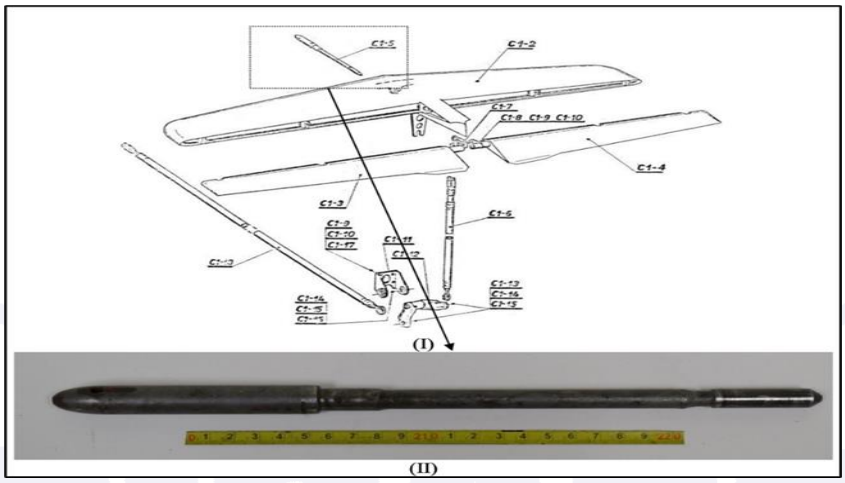

Figure 15 - In (I) scheme of the bolt assembly next to the elevator stabilizer and in (II) the bolt of the crashed aircraft.

Figure 16 shows the condition in which the head/body of the bolt reaches the spring, but not the stop, with the system unlocked.

Figure 16 - View of (upside-down) of the pin could be in an inappropriate position, unlocked (i.e. rotated or not fully engaged to its stop), and still be the horizontal stabilizer rear lock fitting in the vertical stabilizer structure.

In Figure 17, the head/body of the bolt reaches the stop, and the system is locked. The bolt head slots fitted into the spring stand out.

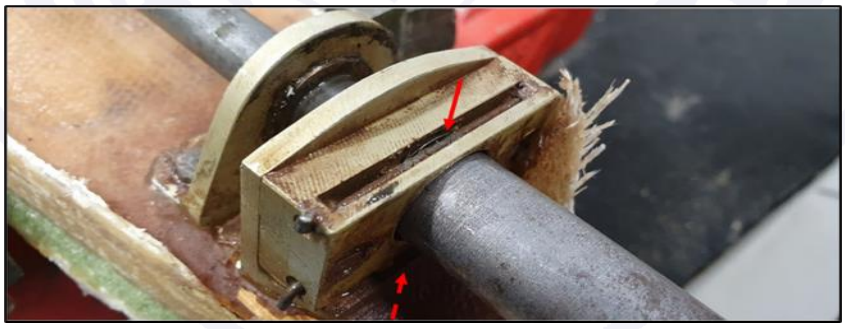

Figure 17 - Fitting the bolt in the vertical stabilizer structure.

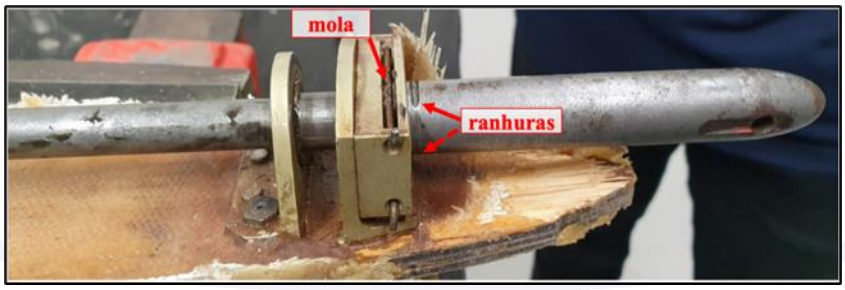

Figure 18 - Fitting the bolt in the vertical stabilizer structure.

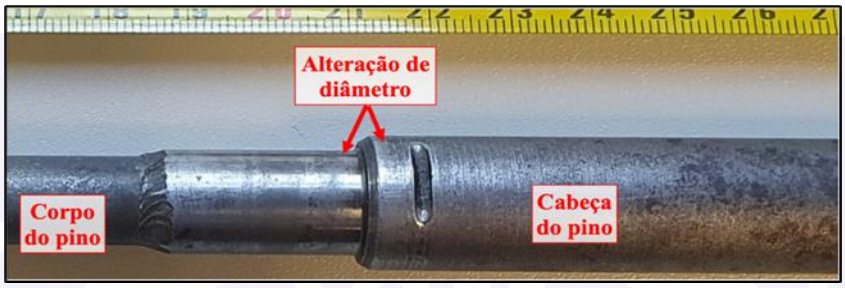

Figure 19 - Change in the head/body diameter of the bolt (scale in millimeters).

During the analysis, it was observed that the conical part of the pin was close to the hole, in such a way that an inappropriate placement, such as not locking it in the slot region, could lead to its displacement and, thus, to the loss of its function. This displacement could still be facilitated by the final conical shape of the pin.

No evidence of structural damage caused by corrosion or fatigue was found.

According to the analysis made, the pin could be in an inappropriate position, unlocked, and still be providing elevator control, until its total release and loss of control occurred.

1.17 Organizational and management information.

Nil.

1.18 Operational information.

On the day of the occurrence, the aircraft returned from a navigation, whose route had already been taken by the pilot at another time, performing a total of 2 hours and 12 minutes of flight.

The pilot performed a low pass and then performed a loop.

The aircraft was within the weight and balance limit.

The technical documentation presented the following maximum speed limits (indicated) as shown in Figure 20:

- in calm air (Vne - Velocity Never Exceed) - 285 km/h;

- in turbulence (Vb) 200 km/h; and

- maneuvering 170 km/h.

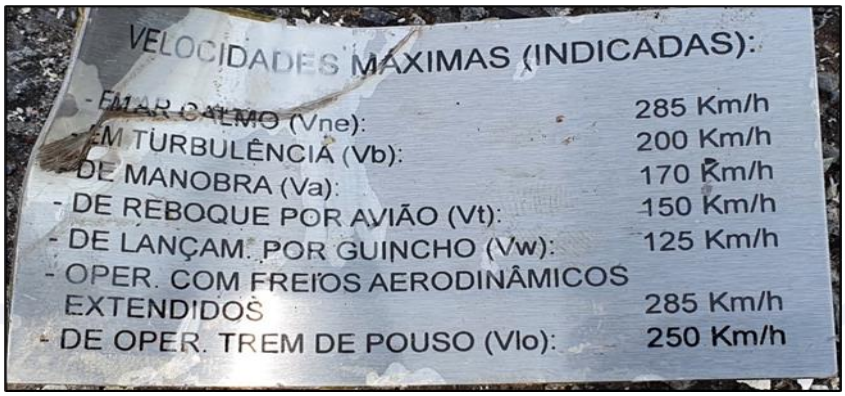

Figure 20 - Plate with the maximum speed limitations indicated.

1.19 Additional information.

Nil.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a local glider flight, which lasted approximately 2 hours and 12 minutes.

On the day of the occurrence, observers saw a region of turbulent air in the aircraft's trajectory near the threshold of the runway.

Data from the meteorological station at the Aerodrome indicated moderate wind speed, without significant variations in direction, especially between 15h43min (local) and 15h45min (local).

Analyzing the existing recorders on the aircraft, there were speed records between 308 and 321 km/h, before the beginning of the loop, which indicates that, at that moment, the aircraft operation was performed with an indicated speed above the limits established for the operation.

In the analyzes performed, it was observed that the housing fixing bolt located in the rear lock of the horizontal stabilizer was disengaged. The bolt disengagement may have occurred due to a possible horizontal stabilizer assembly failure, which was evidenced by the non-locking of the bolt grooves in the spring. There is also the hypothesis that structural efforts resulting from the overspeed of the aircraft, in a region of turbulent air, have contributed to the total disconnection of the unlocked bolt.

It is worth mentioning that, in an interview with the technical shop specialized in the model, it was found that there was no provision in the manual for the removal of the bolt, when maintenance action was carried out, being, more common, the performance of such procedure when it was necessary to transport the aircraft.

It was not possible to confirm whether the operator performed the removal and replacement of the bolt for some glider transport.

Another fact to be considered is that the manufacturer's suggestion to adapt an additional way of fixing the bolt was not implemented in the aircraft.

When the bolt was disengaged, the horizontal stabilizer remained connected to the vertical stabilizer only by the front lock (through which the bolt passed) and by the elevator control rod.

That said, a downward force acted on the elevator lever, deflecting it upwards. In this way, the aircraft remained pitching up until an abnormal attitude, resulting in loss of control and then, a collision with the ground.

3. CONCLUSIONS.

3.1 Facts.

a) the pilot had a valid CMA;

b) the pilot had valid MNTE and PLAN Ratings;

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

d) the aircraft had a valid CA;

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

f) the airframe logbook records were updated;

g) the aircraft took off from SWFR for a local flight;

h) after a low pass followed by a loop, a loss of control occurred;

i) the aircraft collided with the ground;

j) the housing fixing bolt located in the rear lock of the horizontal stabilizer was disengaged;

k) the aircraft had substantial damage; and

l) the pilot suffered fatal injuries.

3.2 Contributing factors.

- **Control skills – undetermined.**

There was an inadequate application of the commands when allowing the indicated speed limit to be exceeded in the moments before the start of the loop, which may have contributed to the loosening of the horizontal stabilizer fixing bolt.

- **Piloting judgment – undetermined.**

The analysis of the data extracted from the equipment on board the aircraft suggests that the risks related to the extrapolation of the indicated speed limit established by the manufacturer were not adequately considered, indicating an inadequate judgment in relation to the flight parameters.

4. SAFETY RECOMMENDATION.

A proposal of an accident investigation authority based on information derived from an investigation made intending to prevent 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 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-116/CENIPA/2020 - 01 **Issued on 04/26/2023**

Disclose the lessons learned in this investigation to the operators of model SZD-48 gliders, alerting them to the need of paying special attention to the assembly of the bolt next to the elevator stabilizer since the non-locking can cause its displacement along the connecting surface and, consequently, the loss of control of the aircraft.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On April 26th, 2023.