

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



**FINAL REPORT**  
**A - 045/CENIPA/2021**

|                    |                  |
|--------------------|------------------|
| <b>OCCURRENCE:</b> | <b>ACCIDENT</b>  |
| <b>AIRCRAFT:</b>   | <b>PU-AVD</b>    |
| <b>MODEL:</b>      | <b>ASTORE</b>    |
| <b>DATE:</b>       | <b>20MAR2021</b> |



## 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 20MAR2021 accident with the ASTORE aircraft model, registration PU-AVD. The accident was classified as “[LOC-I] Loss of Control in Flight”.

After the take-off, when making a right turn, the aircraft lost altitude and crashed into the ground.

The aircraft had substantial damage.

The Pilot in Command (PIC) and the passenger suffered fatal injuries.

An Accredited Representative of the *Agenzia Nazionale per la Sicurezza del Volo* (ANSV) - Italy, (State where the aircraft was manufactured) was designated for participation in the investigation.



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## GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

|          |                                                                           |
|----------|---------------------------------------------------------------------------|
| AAFT     | Fixed Wing Aerosports Aircraft Rating                                     |
| ABRAFAL  | Brazilian Association of Light Aircraft Manufacturers                     |
| ANAC     | Brazil's National Civil Aviation Agency                                   |
| ANSV     | <i>Agenzia Nazionale per la Sicurezza del Volo</i>                        |
| CA       | Airworthiness Certificate                                                 |
| CAVE     | Experimental Flight Authorization Certificate                             |
| CENIPA   | Aeronautical Accident Investigation and Prevention Center                 |
| CIV      | Pilot's Flight Logbook                                                    |
| CMA      | Aeronautical Medical Certificate                                          |
| CPA      | Sports Pilot License - Airplane                                           |
| CPR      | Recreational Pilot License                                                |
| FAA      | Federal Aviation Administration                                           |
| METAR    | Meteorological Aerodrome Report                                           |
| PET      | Experimental Private Aircraft Registration Category                       |
| PIC      | Pilot in Command                                                          |
| RADAR    | Radio Detection And Ranging                                               |
| RBAC     | Brazilian Civil Aviation Regulation                                       |
| RIAM     | Annual Maintenance Inspection Report                                      |
| SBFI     | ICAO Location Designator - Cataratas Aerodrome, Foz do Iguaçu - PR        |
| SDSJ     | ICAO Location Designator – Executive Aerodrome, Cascavel - PR             |
| SERIPA V | Fifth Regional Aeronautical Accident Investigation and Prevention Service |
| SILQ     | ICAO Location Designator - Aeroleve Private Aerodrome, Cascavel- PR       |
| SIPAER   | Aeronautical Accident Investigation and Prevention System                 |
| UTC      | Universal Time Coordinated                                                |

## 1. FACTUAL INFORMATION.

|                   |                                                                                                                                                                   |                                                                           |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| <b>Aircraft</b>   | <b>Model:</b> ASTORE<br><b>Registration:</b> PU-AVD<br><b>Manufacturer:</b> TECNAM                                                                                | <b>Operator:</b><br>Private                                               |
| <b>Occurrence</b> | <b>Date/time:</b> 20MAR2021 - 2131 UTC<br><b>Location:</b> Espigão Azul<br><b>Lat. 24°52'08"S Long. 053°28'32"W</b><br><b>Municipality – State:</b> Cascavel - PR | <b>Type(s):</b><br>Loss of Control in Flight<br><b>Subtype(s):</b><br>NIL |

### 1.1 History of the flight.

The aircraft took off from the Executive Aerodrome (SDSJ), Cascavel - PR, to the Aeroleve Private Aerodrome (SILQ), Cascavel - PR, at about 2131(UTC), to perform a private flight, with a crewmember and a passenger on board.

After the take-off, when making a right turn, the aircraft lost altitude and crashed into the ground.

The aircraft had substantial damage.

Both occupants suffered fatal injuries.

### 1.2 Injuries to persons.

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

### 1.3 Damage to the aircraft.

The aircraft had substantial damage. The impact occurred with the front of the aircraft and wings against the ground. The auxiliary landing gear detached and was thrown forward. There was extensive damage to the powertrain and nacelle.

### 1.4 Other damage.

None.

### 1.5 Personnel information.

#### 1.5.1 Crew's flight experience.

| Flight Hours                      | Pilot   |
|-----------------------------------|---------|
| Total                             | Unknown |
| Total in the last 30 days         | Unknown |
| Total in the last 24 hours        | 00:10   |
| In this type of aircraft          | Unknown |
| In this type in the last 30 days  | Unknown |
| In this type in the last 24 hours | 00:10   |

**N.B.:** The records relating to the flown hours by the crewmember were not found with the aircraft, were not made available to the Investigation Team, and were not recorded by the pilot in the digital CIV. The 10 minutes flown in the last 24 hours refer to a flight carried out on the morning of the accident between SILQ and SDSJ.

#### 1.5.2 Personnel training.

The PIC trained as an AeroSport pilot at *Asa Esporte* Aeroclub Ltd., PR, in 2017.

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

The PIC had the CPA and CPR Licenses and had a valid AAFT Rating.

### 1.5.4 Qualification and flight experience.

Due to the absence of records, it was not possible to verify whether the PIC was qualified and whether he had experience in the type of flight.

### 1.5.5 Validity of medical certificate.

The PIC had his CMA expired since 25SEPT2020.

### 1.6 Aircraft information.

The aircraft, serial number 031, was manufactured by TECNAM S.R.L. in 2014 and was registered in the PET Category.

The aircraft CAVE was valid.

The airframe, engine, and propeller logbook records were not found.

The last aircraft inspection record, the "RIAM" type, was carried out on 27MAR2020 by the ABRAFAL.

### 1.7 Meteorological information.

The meteorological conditions were favorable for the flight, according to satellite image analysis and meteorological RADAR.

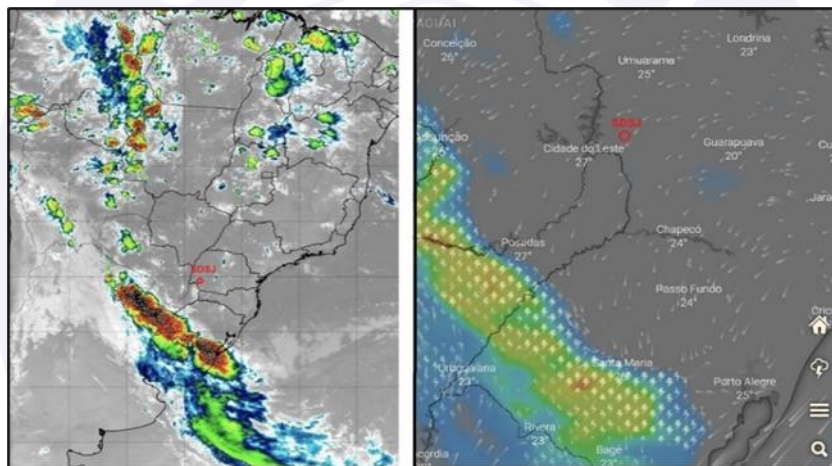


Figure 1 - Shortwave satellite image and RADAR image.

### 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.

The impact occurred about 640 meters from threshold 09 of the SDSJ runway, with no evidence of a previous impact. The distribution of the wreckage was of the concentrated type.

The impact occurred in a pitched down attitude (approximately 60°) and with the wings leveled, causing the collision of the powertrain system against the ground and the rupture of the fuselage at the height of the cabin (Figure 2).



Figure 2 - Situation of the wreckage.

The landing gear was fixed. The flaps were down. The elevator trim tabs were symmetrical and positioned in neutral.



Figure 3 - General condition of the nacelle.

It was found that the main landing gear did not have significant damage. The distribution of the wreckage and the verification of the damage caused by the impact against the ground indicated a possible frontal collision, with low speed ahead and high impact angle.



Figure 4 - View of the lowered left flap position.



Figure 5 - Left flap of the PU-AVD.



Figure 6 - Left main landing gear of the PU-AVD.



Figure 7 - Condition of the main landing gears after impact.

### **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.**

The PU-AVD was equipped with the ROTAX engine, model 912ULS2, with a power announced by the manufacturer of 100 hp. The engine did not have a design, production, or airworthiness certification issued by the ANAC.

Thus, there was no proof, attested by a civil aviation certification agency, that the engine met the requirements established in the RBAC 33, valid at the time, which dealt with "Airworthiness Requirements for Aeronautical Engines", or Title 14 Code of Federal Regulations Part 33, issued by the FAA to which the RBAC 33 referred to.

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

Nil.

### 1.18 Operational information.

The PIC was licensed for the operation. However, statements from friends reported that he had flown a few times in the model, with a certain spacing between flights. The flight that gave rise to this occurrence would be the second displacement of the day. The first segment flown was between the runways of SILQ and SDSJ.

According to research on the AISWEB website, on the internet, the time of sunset in SDSJ on 20MAR2021 would be at 2144 (UTC).

It was not possible to determine the level of fuel present in the tanks at the time of the occurrence, due to its rupture during the impact. Also, it was not possible to determine whether the aircraft was within the weight and balance limits.

No records of the last fuelings made by the PIC were found.

Since, according to the reports of other pilots who operated from the SILQ Aerodrome, the PU-AVD pilot had the habit of keeping the tanks at half their capacity (50 liters) and, considering that about 10 liters of fuel during the last displacement performed on the morning of the day of the accident, it was concluded that the volume of fuel present in the tanks would be approximately 40 liters or about 36 kg, a sufficient quantity to carry out the intended flight.

In order to try to determine the weight of the aircraft at the time of the take-off, the following parameters were considered:

- the distance between SILQ and SDSJ runways was 3.9 NM;
- the aircraft, possibly, would have taken off from SILQ with half of its total capacity (50 liters);
- the fuel consumption in the leg was calculated as the maximum indicated by the manufacturer (24 l/h), as shown in Figure 8; and
- considering the average speed of 100 kt, including the take-off and landing procedures, the flight time would be approximately 10 minutes.

| 1.10) Fuel consumption                              |                         |                         |
|-----------------------------------------------------|-------------------------|-------------------------|
| Fuel consumption                                    | 912 A/F/UL              | 912 S/ULS               |
| At take-off performance                             | 24.0 l/h (6.3 gal/h)    | 27.0 l/h (7.1 gal/h)    |
| At max. continuous performance                      | 22.6 l/h (5.6 gal/h)    | 25.0 l/h (6.6 gal/h)    |
| At 75 % continuous performance                      | 16.2 l/h (4.3 gal/h)    | 18.5 l/h (4.9 gal/h)    |
| Specific consumption at max. continuous performance | 285 g/kWh (0.47 lb/hph) | 285 g/kWh (0.47 lb/hph) |

Figure 8 - Fuel consumption information for the ASTORE model, according to the manual.

The aircraft weight of 405 kg, the fuel volume of 40 liters of AvGas (28.8 kg), the pilot weight of about 75 kg and the passenger weight of about 95 kg were considered, resulting in an estimated total of 603.8 kg, close to its maximum take-off weight, 600 kg (Figure 9).

### 1.3.2. Weights and capacities

|                                                    |               |          |
|----------------------------------------------------|---------------|----------|
| MTOW                                               | 1320 lb       | 600 kg   |
| Ramp Weight                                        | 1324 lb       | 600.5 kg |
| Maximum allowed empty weight (100 hp Rotax 912ULS) | 892 lb        | 405 kg   |
| Maximum allowed empty weight (115 hp Rotax 914)    | 885 lb        | 402 kg   |
| Maximum allowed baggage weight                     | 77 lb         | 35 kg    |
| Total usable fuel                                  | 2x15.9 US Gal | 2x60 lt  |

Figure 9 - Information on the weight capacities of the ASTORE model, according to the manual.

During the investigation, it was observed that the take-off profile from the SDSJ Aerodrome to the SILQ Aerodrome, crossed a high voltage power grid, with a height of about 35 meters above the ground (Figure 10).



Figure 10 - Top view of the SDSJ take-off profile.

The SDSJ Aerodrome was at an altitude of 2,293 ft. Based on information from the Cataratas` METAR (SBFI), in Foz do Iguaçu - PR, the temperature at the time of the occurrence was close to 25° C.

Based on the aircraft's operation manual, it was concluded that the take-off distance, under the conditions prevailing at the time of the accident, would be between 501 and 545 meters, which would give the PU-AVD about 1,250 meters of distance to cross the power grid.

| 5.6. Takeoff distances                         |              |                  |     |     |     |     |
|------------------------------------------------|--------------|------------------|-----|-----|-----|-----|
| Weight = 599kg/1320lb                          |              |                  |     |     |     |     |
| Flaps: T/O                                     |              |                  |     |     |     |     |
| Speed at Lift-Off = 39 KIAS                    |              |                  |     |     |     |     |
| Speed Over 50ft Obstacle = 50 KIAS             |              |                  |     |     |     |     |
| Throttle Levers: Full Forward                  |              |                  |     |     |     |     |
| Runway: Grass                                  |              |                  |     |     |     |     |
| Corrections                                    |              |                  |     |     |     |     |
| Headwind: - 5m for each kt (16 ft/kt)          |              |                  |     |     |     |     |
| Tailwind: + 15m for each kt (49 ft/kt)         |              |                  |     |     |     |     |
| Paved Runway: - 10% to Ground Roll             |              |                  |     |     |     |     |
| Runway slope: + 7% to Ground Roll for each +1% |              |                  |     |     |     |     |
| Pressure Altitude [ft]                         |              | Distance [m]     |     |     |     |     |
|                                                |              | Temperature [°C] |     |     |     | ISA |
|                                                |              | -25              | 0   | 25  | 50  |     |
| S.L.                                           | Ground Roll  | 94               | 119 | 147 | 178 | 135 |
|                                                | At 50 ft AGL | 280              | 348 | 425 | 510 | 393 |
| 1000                                           | Ground Roll  | 103              | 130 | 160 | 194 | 145 |
|                                                | At 50 ft AGL | 304              | 378 | 461 | 554 | 420 |
| 2000                                           | Ground Roll  | 112              | 141 | 175 | 212 | 156 |
|                                                | At 50 ft AGL | 330              | 411 | 501 | 601 | 449 |
| 3000                                           | Ground Roll  | 123              | 154 | 191 | 231 | 167 |
|                                                | At 50 ft AGL | 359              | 446 | 545 | 654 | 481 |

Figure 11 - Information on the distances traveled during the take-off of the ASTORE model, according to the manual.

When applying the indicated speed of 68 kt, the ASTORE model would climb at an approximate rate of 693 ft/min reaching a height, in relation to the ground, of 126.38 m when crossing the power grid cables.

| 5.9. En-route Rate of Climb   |                        |                                   |                        |     |     |      |     |
|-------------------------------|------------------------|-----------------------------------|------------------------|-----|-----|------|-----|
| Throttle Levers: Full Forward |                        |                                   |                        |     |     |      |     |
| Flaps: UP                     |                        |                                   |                        |     |     |      |     |
| Weight [kg/lb]                | Pressure Altitude [ft] | Climb Speed V <sub>y</sub> [KIAS] | Rate of Climb [ft/min] |     |     |      |     |
|                               |                        |                                   | Temperature [°C]       |     |     |      | ISA |
|                               |                        |                                   | -25                    | 0   | 25  | 50   |     |
| 599kg<br>1320lb               | S.L.                   | 68                                | 1125                   | 960 | 813 | 680  | 870 |
|                               | 2000                   | 68                                | 1000                   | 838 | 693 | 563  | 772 |
|                               | 4000                   | 68                                | 875                    | 716 | 573 | 445  | 674 |
|                               | 6000                   | 68                                | 750                    | 594 | 454 | 328  | 576 |
|                               | 8000                   | 68                                | 626                    | 473 | 335 | 211  | 477 |
|                               | 10000                  | 68                                | 503                    | 352 | 217 | 95   | 379 |
|                               | 12000                  | 68                                | 379                    | 231 | 99  | -21  | 281 |
|                               | 14000                  | 68                                | 256                    | 111 | -19 | -136 | 183 |

Figure 12 - Information on the climb rate capabilities of the ASTORE model, according to the manual. Red values are negative reasons.

During the investigation, it was verified, along with other pilots who operated experimental aircraft at the Executive Aerodrome, that it was standard procedure to maintain the take-off straight using the best performance of the aircraft, in order to safely cross the obstacles located on the runway extension. Many of these pilots had even taken off from the same location on the day of the occurrence.

No facts were found to justify, as essential, the turn performed after crossing the opposite threshold. People close to them informed that this was a recurrent procedure of the PIC, intending to go up with parameters that they considered the “best performance” of the aircraft.

Executing a turn in flight increases the minimum speed for loss of lift. The ASTORE model manual determined the relationship between different components and the stall speed, considering a maximum take-off weight of 600 kg and different flap configurations.

| STALL SPEED TABLE     |       |          |      |           |      |           |      |
|-----------------------|-------|----------|------|-----------|------|-----------|------|
| Weight                | Bank  | Flaps 0° |      | Flaps T/O |      | Flaps LND |      |
| [kg/lb]               | [deg] | KIAS     | KCAS | KIAS      | KCAS | KIAS      | KCAS |
| 599/1320<br>[FWD CoG] | 0     | 35       | 44   | 34        | 43   | 32        | 38   |
|                       | 15    | 36       | 46   | 35        | 44   | 32        | 39   |
|                       | 30    | 39       | 49   | 38        | 46   | 35        | 41   |
|                       | 45    | 45       | 54   | 44        | 51   | 40        | 46   |
|                       | 60    | 58       | 64   | 55        | 61   | 50        | 54   |

Figure 13 - Information on minimum speeds for loss of lift of the ASTORE model, according to the manual.

### 1.19 Additional information.

The aeronautical certification is a process of proving compliance with the airworthiness requirements demanded by the local civil aviation authority or by the authorities of the States where it is intended to operate.

The aeronautical certification process consists of evaluating the product by verifying its qualities and reliability.

The aircraft that go through the certification process can receive a CA from the ANAC, but experimental aircraft can receive a CAVE.

Aircraft authorized to operate with a CAVE do not need to meet demonstrated requirements, but, on the other hand, they have operational limitations. Supplementary Instruction No. 21.191-001 - "Amateur Construction Aircraft", issued by the ANAC on 04JUN2012, stated in its item 5.2.1 that "an amateur builder does not need to demonstrate compliance with airworthiness or production requirements corresponding to any category of aircraft".

The civil aviation authority, despite requiring some technical evidence, does not attest to the safety or reliability of the project. The experimental flight authorization is based on the responsibility of the operator, the builder, and the engineer responsible for monitoring the construction.

Another point to be considered is that, in the production of an experimental model, the use of certified aeronautical products is not required. Therefore, there is little or no traceability of the parts or components used.

### 1.20 Useful or effective investigation techniques.

Nil.

## 2. ANALYSIS.

It was a private flight between SDSJ and SILQ Aerodromes.

After the take-off, when making a right turn, the aircraft lost height and crashed into the ground, causing fatal injuries to its occupants.

Since it was an amateur-built aircraft, there was no obligation to use certified products for aeronautical use. Thus, it was also not possible to verify the conditions of "airworthiness" or even the "traceability" of the components used in its construction.

Despite having his CMA expired, there was no evidence that there were problems of a physiological nature or disability in the performance of the crewmember, discarding the medical aspect as a contributor to this occurrence.

The right turn, after the take-off, was not mandatory. However, the Investigation Team found that the pilot had the habit of performing it whenever he took off from SDSJ, perhaps to gain more height before reaching the power grids.

Thus, the most likely hypothesis to explain the dynamics of the accident would be an inadequate use of the flight controls during the climb, after the take-off and, when making a right turn, the aircraft may have entered a stall situation, at a low height, which prevented or made it difficult to recover of the flight.

Taking the aircraft to the stall situation would indicate that there may have also been an inadequate assessment of the operational parameters, which would have contributed to the occurrence.

### **3. CONCLUSIONS.**

#### **3.1 Facts.**

- a) the pilot had his CMA expired since 25SEPT2020;
- b) the pilot had a valid AAFT Rating;
- c) it was not possible to determine whether the pilot was qualified and had experience in the type of flight;
- d) the aircraft had a valid CAVE;
- e) it was not possible to determine whether the aircraft was within the weight and balance limits;
- f) the registers of the airframe, engine and propeller logbook records were not presented;
- g) the weather conditions were favorable for the flight;
- h) after the take-off from SDSJ, the aircraft lost altitude and crashed into the ground;
- i) the aircraft had substantial damage; and
- j) the occupants suffered fatal injuries.

#### **3.2 Contributing factors.**

- **Control skills – undetermined.**

Inadequate use of flight controls may have occurred during the climb, which resulted in a low-altitude stall, preventing the aircraft from recovering altitude and causing it to crash into the ground.

- **Piloting judgment – undetermined.**

There may have been an inadequate assessment of the operational parameters of the aircraft's performance, causing the loss of lift.

- **Decision-making process – undetermined.**

The decision to make a right turn at low flight, in order to gain more altitude before approaching the power grids may have contributed to the stall that led to the loss of control of the aircraft.

#### 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”.*

None.

#### 5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On March 23<sup>th</sup>, 2023.