COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A-006/CENIPA/2022

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-SOD**
MODEL:	**PA-25-260**
DATE:	**15JAN2022**

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 considering 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 distinct 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 in the Brazilian legal system by virtue of the 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 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. Considering 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 15 January 2022 accident with the PA-25-260 aircraft, registration marks PR-SOD. The accident was typified as “[LOC-G] Loss of control on the ground and [RAMP] Ground operations”.

After the aircraft landed, its right wing struck a support vehicle parked on the runway.

With the collision, the aircraft veered to the right, and its propeller hit the airstrip assistant, who was standing next to the vehicle and preparing for the provision of supplies.

The aircraft sustained minor damage.

The pilot suffered no injuries, whereas the airstrip assistant was fatally injured.

Being Argentina the State of aircraft design, an Accredited Representative of the JST (*Junta de Seguridad en el Transport*) was appointed for participation in the investigation of the accident.

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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	Brazil's National Civil Aviation Agency
CA	Certificate of Airworthiness
CAVOK	Ceiling and Visibility OK – base of clouds above 5,000 ft, horizontal visibility more than 10 km
CENIPA	Brazil's Aeronautical Accidents Investigation and Prevention Center
CIV	Pilot Logbook
CMA	Aeronautical Medical Certificate
COA	Air Operator Certificate
DECEA	Department of Airspace Control
GRSO	Safety Risk Management
IPC	Illustrated Parts Catalogue
JST	Argentina's *Junta de Seguridad en el Transporte*
METAR	Routine Meteorological Aerodrome Report
MGSO	Safety Management Manual
MGWS	Main Gear Wheel Span
MNTE	Single-Engine Land Airplane Rating
NSCA	Norm of the Command of Aeronautics
PAGA	Agricultural Aircraft Rating (Airplane)
PCM	Commercial Pilot License (Airplane)
PIC	Pilot in Command
POH	Pilot's Operating Handbook
PPR	Private Pilot License (Airplane)
PSO-BR	Brazilian Civil Aviation Safety Programme
RBAC	Brazilian Civil Aviation Regulation
SAE-AG	Specialized Public Air Service Registration Category (Aeroagricultural)
SBSR	ICAO location designator - Aerodrome of *São José do Rio Preto*, State of *São Paulo*
SGSO	Safety Management System
SIPAER	Aeronautical Accidents Investigation and Prevention System
TCU	Towering Cumulus
UTC	Coordinated Universal Time
VTI	Initial Technical Inspection

1. FACTUAL INFORMATION.

Aircraft	**Model:** PA-25-260 **Registration:** PR-SOD **Manufacturer:** Piper Aircraft	**Operator:** *Soldeira Aviação Agrícola Ltda. - ME*
Occurrence	**Date/time**: 15JAN2022 - 09:50 UTC **Location:** *Usina São Domingos* **Lat.** 20°57'46"S **Long.** 049°12'49"W **Municipality – State:** *Uchoa – São Paulo*.	**Type(s):** [LOC-G] Loss of control - ground [RAMP] Ground Handling

1.1. History of the flight.

At around 09:30 UTC, the aircraft took off from the airstrip for aero-agricultural use of *São Domingos* Sugar Mill, municipality of *Uchôa*, State of *São Paulo*, on a local flight for the application of agricultural products, with 01 POB (pilot).

During the landing run, the aircraft collided with a vehicle and veered to the right, hitting a truck and the runway assistant standing next to the vehicle.

The aircraft sustained minor damage.

The crewmember got out unhurt, whereas the runway assistant sustained fatal injuries.

1.2. Injuries to persons.

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

1.3. Damage to the aircraft.

The aircraft was slightly damaged.

There were dents on both wings, due to collision of the leading edges with vehicles and equipment on the ground. The blades of the propeller sustained damage, too.

1.4. Other damage.

There was damage to vehicles parked within the limits of the landing area and to the agricultural pesticide-mixing equipment.

1.5. Personnel information.

1.5.1. Crew's flight experience.

FLIGHT EXPERIENCE	
	PIC
Total	448:47
Total in the last 30 days	27:00
Total in the last 24 hours	01:24
In this type of aircraft	29:00
In this type in the last 30 days	27:00
In this type in the last 24 hours	01:24

N.B.: data on the pilot's flight experience obtained from records of his CIV (pilot logbook) and through information extracted from the aircraft logbook.

1.5.2. Personnel training.

The PIC (Pilot in Command) did his PPR course (Private Pilot - Airplane) in 2011, at the *Aeroclube de Tietê*, State of *São Paulo*.

1.5.3. Category of licenses and validity of certificates.

The PIC held a PCM license (Commercial Pilot – Airplane), as well as valid MNTE (Single-Engine Land Airplane) and PAGA (Agricultural Pilot – Airplane) ratings.

1.5.4. Qualification and flight experience.

The records of the pilot's electronic CIV indicated that his first operation of a PA-25 series aircraft took place in 2015.

According to records, his first flight with the accident aircraft took place in August 2021.

According to the aircraft logbook records, the day of the occurrence was the third day the crewmember was operating in that landing area.

The pilot had qualification and experience for the type of flight.

1.5.5. Validity of medical certificate.

The PIC held a valid Aeronautical Medical Certificate.

1.6. Aircraft information.

The SN 255154 aircraft was a product manufactured by Piper Aircraft in 1969, registered in the SAE-AG (Public Specialized Air Service Private Registration Category - Aeroagricultural).

The CVA (Airworthiness-Verification Certificate) of the aircraft was valid.

The copies of the airframe, engine, and propeller logbooks handed in to the investigation commission were incomplete, making it impossible to verify their updateness.

The last inspection of the aircraft to which the investigation commission had access was the Initial Technical Inspection (VTI) in the SAE-AG category due to nationalization. On the occasion, one found that the equipment was airworthy and in accordance with the legislation in force at the time.

The referred VTI was performed by the ANAC on 19 April 2021, when the aircraft had a total flight time of 2,447 hours and 36 minutes.

According to the aircraft's logbook, the PR-SOD had a total of 2,477 hours and 36 minutes on the date of the occurrence.

The first inspection prescribed in the aircraft Maintenance Manual was to be performed after 50 hours.

Main landing gear and tailwheel system

The aircraft had a conventional landing gear, consisting of two main legs and a tailwheel. The latter was normally connected to the rudder for directional control by means of the pedals (Figure 1).

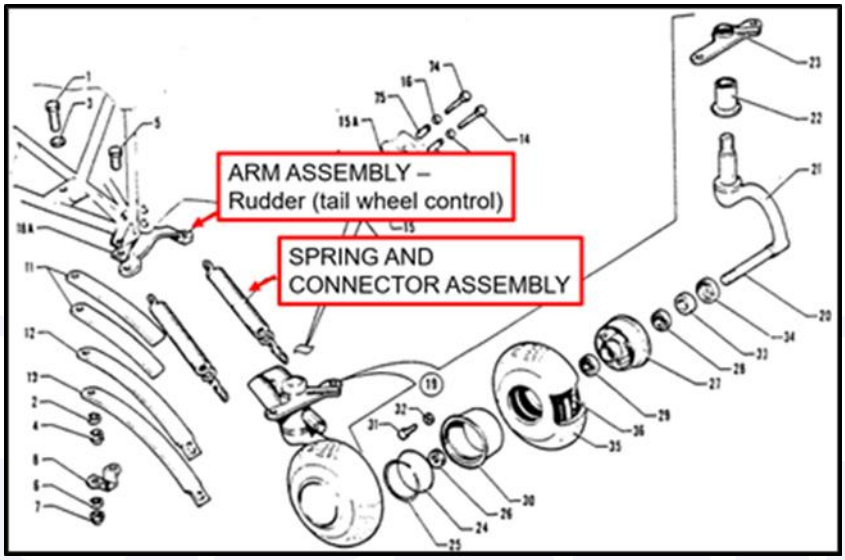

Figure 1 - Pictographic description of the tailwheel assembly, highlighting the set of springs, connectors, and arm connection to the steering rudder, extracted from the IPC (Illustrated Parts Catalog).

The aircraft Maintenance Manual, in section 4.1 (*description*), described the steel springs as integral parts of the tailwheel assembly, as transcribed below:

> *The tail wheel of 8", steerable, full-swivel is PA-25's standard equipment. This unit is combined with steel leaf springs, easily replaceable if necessary. The tire is 3.00 x 4, four ply.*

Section III of the aircraft service manual (*Piper Pawnee* PA-25 *Service Manual*), in describing the inspections to be undergone by the aircraft, informed that the tailwheel spring assembly should be checked for possible looseness (Figure 2).

6.-Tail Wheel.

a) Check tail wheel and spring assenmbly for looseness.
b) Check condition of tail spring pad.
c) Remove wheel, wash and repack bearing.

Figure 2 - Extract from the aircraft Service Manual, section III, "*inspection*".

1.7. Meteorological information.

The Routine Meteorological Aerodrome Report (METAR) from SBSR (*São José do Rio Preto* Aerodrome, State of *São Paulo*) located a distance of 13.8 NM from the accident site, provided the following information:

METAR SBSR 150900Z 00000KT CAVOK 24/18 Q1018=

METAR SBSR 151000Z 12003KT CAVOK 26/18 Q1018=

The meteorological conditions in the region were consistent with visual flights, showing calm winds, visibility greater than 10 km, absence of clouds and without significant weather events.

On the night before the flight, however, there was presence of rain at the aerodrome, and Towering Cumulus clouds in the region.

Interviews with workers of the Sugar/Ethanol Mill confirmed the occurrence of rain on the airstrip, the edges of which were still muddy on the day of the occurrence.

1.8. Aids to navigation.

NIL.

1.9. Communications.

NIL.

1.10. Aerodrome information.

The airstrip for aero-agricultural use of the Sugar/Ethanol Mill of *São Domingos* was a dirt airstrip, with thresholds 01/19, measuring approximately 900 m x 25 m, at an average elevation of 1,798 ft.

Threshold 01 had an elevation of 1,814 ft, while threshold 19 was at 1,781 ft. The gradient between the thresholds was 1.1%, with slope variations from -0.4% to 6% along its length.

Approximately halfway between the thresholds, there was an elevation of land noticeable to the naked eye, with an estimated slope of 24º.

Figure 3 contains the estimated vertical profile of the landing area, highlighting the referred elevation.

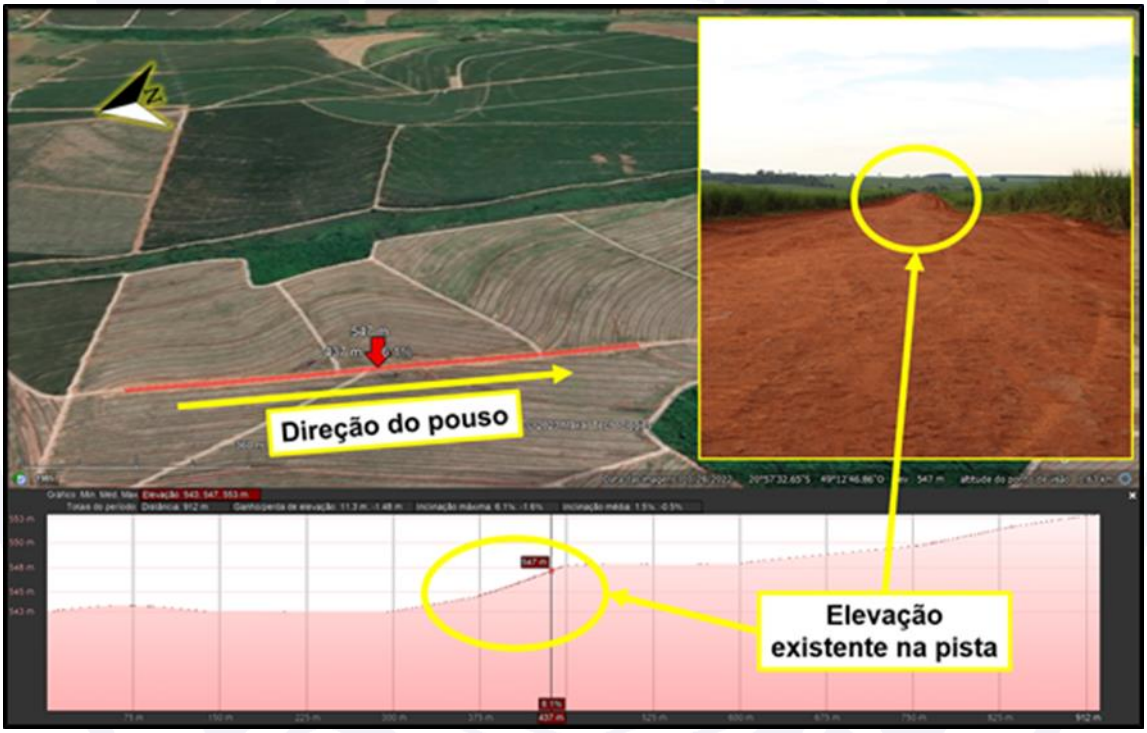

Figure 3 - Estimated vertical profile of the landing area, highlighting the elevation close to midpoint. Source: adapted from Google Earth.

The investigation commission found that vehicles from the Sugar/Ethanol Mill normally utilized the landing strip whenever there were no aircraft making use of it.

1.11. Flight recorders.

Neither required nor installed.

1.12. Wreckage and impact information.

The impact of the aircraft with parked vehicles occurred after landing, as the pilot attempted to apply the brakes to reduce speed.

As the aircraft's right-hand wing hit the fuel supply vehicle (a pick-up truck), the aircraft rotated approximately 120º around its vertical axis, still at forward speed, resulting in collision of the left-hand wing with the truck, while the propeller hit the airstrip assistant, who was standing between the two axles of the truck (Figure 4).

Figure 4 - Pictographic representation of the impact dynamic.

The sole witness of the collision was the truck driver, who watched the aircraft's approach in his vehicle's rear-view mirror. The airstrip assistant had his back turned to the aircraft, as he was preparing the replenishment of supplies.

1.13. Medical and pathological information.

1.13.1. Medical aspects.

There was no evidence that issues of physiological nature or incapacitation might have affected the pilot's performance.

1.13.2. Ergonomic information.

NIL.

1.13.3. Psychological aspects.

There was no evidence that psychological issues might have affected the pilot's performance.

1.14. Fire.

There was no fire.

1.15. Survival aspects.

Immediately after the aircraft stopped, the pilot cut off the engine and got out of the aircraft through its conventional exit, in order to help the airstrip assistant hit by the propeller.

1.16. Tests and research.

During the initial investigation action, with the aircraft still on the accident site, the landing gears, the braking system, and the freedom of movement of the aircraft's flight controls were checked both visually and functionally, and were found to be corresponding and free in their entire amplitude of application.

The main landing gear was undamaged, and its general condition was good. The braking system had no apparent damage. However, the region of the brake disk contained dirt, which resulted from the accumulation of the fine dust that covered the landing area (Figure 5).

Figure 5 - Main landing gear legs, wheels and brakes.

The braking system was checked for functionality. When one operated the brake pedals from the cockpit, the wheels locked normally, with no apparent problems being identified.

The auxiliary landing gear was moving freely, showing no signs of locking. During the initial action, one found that the springs of the rudder/tailwheel connection were missing, as shown in Figure 6.

Figure 6 - Auxiliary landing gear, highlighting the absence of springs of the connection with the steering rudder.

1.17. Organizational and management information.

The headquarters of the company responsible for the operation was located in the municipality of *Andirá*, State of *Paraná*. The referred company held an Air Operator Certificate (COA) issued by the ANAC.

According to the Declaration of Conformity presented in September 2019, the company's managers were aware of the requirements related to Safety Risk Management (GRSO), as well as of those related to operations in an airstrip for aeroagricultural use.

The Safety Management Manual (MGSO), Rev. 01, issued in September 2019, contained the entire structure provided for in the Brazilian Civil Aviation Regulation nº 137 (RBAC-137), including aspects of hazard identification, risk management, assessment and mitigation of risks. Subitem 9.1 of the aforementioned manual provided information on the methods of collection used for the identification of hazards, among which the following ones stood out:

Field inspections;

Inspections performed during the company's activities in the field.

It is in this method that one finds the SRM on occasional landing strips and registered runways before the start of on-site operations.

The investigation commission did not obtain access to the SRM specific to the location where the accident occurred, something that made it impossible to verify its implementation or assess its suitability.

1.18. Operational information.

According to reports collected by the investigation commission, the company had been operating in the landing area of *São Domingos* Sugar/Ethanol Mill for three days, with the same aircraft and crew involved in the accident in question. The accident flight was the first one of the day, and there had not been any problems in the operations performed in the days before.

The aircraft was within the weight and balance limits specified by the manufacturer.

According to information collected during the initial investigation, it was common practice for the pilot to touch down shortly beyond the unevenness of the airstrip, located approximately halfway along its length. This procedure would aim at preventing the aircraft from floating after touchdown (which could render post-landing control difficult), in addition to optimizing ground time during operations. However, landing after the unevenness, would leave the aircraft with a distance of approximately 450 m to gain control on the ground and come to a complete stop.

The support vehicle and the two trucks for provision of agricultural products were within the limits of the landing area, at the threshold where the accident occurred. This procedure reduced the distance available for landing the aircraft by approximately 50 m, considering the reduction in speed for taxiing and backtracking (a 180º-turn for repositioning the aircraft after landing).

After landing, the aircraft headed to the left side, getting into position for a backtrack maneuver, in order to stop alongside the support and refueling vehicles in view of the next takeoff.

The parking of vehicles within the limits of the landing area and the execution of backtrack aimed at optimizing the operations, reducing the aircraft's ground time between applications (Figure 7).

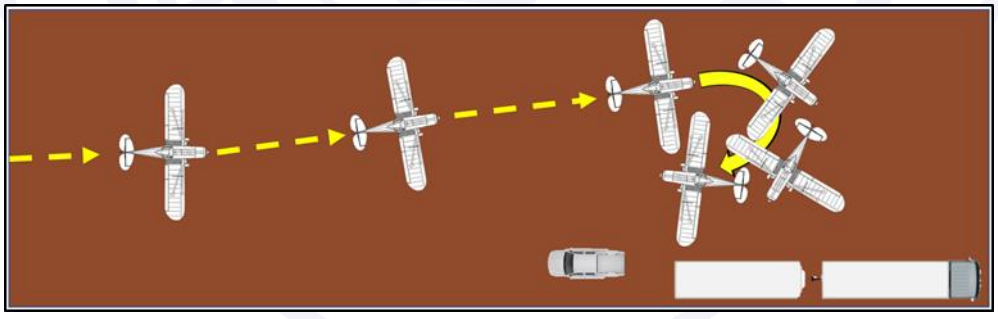

Figure 7 - Representation of the aircraft's usual path after landing.

During the course of the investigation, it was possible to identify both the marks left by the aircraft's tires during the landing roll and the braking attempts.

The marks indicated locking of the wheels, showing that the left brake was more used than the right one (Figure 8).

Figure 8 - Braking marks left by the aircraft in the moments before the collision with the vehicle, highlighted by dotted lines.

The consistency of the marks resulted from the fact that it had rained the night before the flight, the landing area was covered with a layer of dust, and there had not been any operations before or after the occurrence.

The distinction between the marks left by the aircraft in relation to the marks of other vehicles was possible by taking into account the Main Gear Wheel Span (MGWS - distance between axles of the main landing gear wheels), which is the distance between the two wheels of the main gear.

The first mark indicating the aircraft's touchdown on the landing area was located at a distance of 458 m from threshold 19, but it would disappear and reappear at progressively shorter distance intervals, indicating that the aircraft floated after landing (*bounced landing*).

The marks denoted more aggressive braking attempts around 115 m from the first collision, showing that the landing gear tires were skidding on the airstrip. The marks showed occasional discontinuity, consistent with the release of the brake controls at intervals.

With respect to the aircraft's performance information, section 1 of the Pilot's Operating Handbook (POH) - “Specifications” read that 850 ft (approximately 260 m) of length were required for the aircraft to land, considering the weight of 1,700 lbs, under all operating conditions (Figure 9).

PERFORMANCE	Clean	Duster	Sprayer
Take-off Run (ft.)	660	830	680
Take-off Run over 50 ft. barrier	1200	1370	1220
Best Rate of Climb Speed (MPH)	83	83	83
Best Angle of Climb (MPH)			
Rate of Climb (ft. per min.)	775	575	705
Service Ceiling (ft.)			
Top Speed (MPH)	128	113	120
Cruising Speed (75% power) (MPH)	118	103	108
Fuel Consumption (75% power, best power mixture) (gph)	14.1	14.1	14.1
Fuel Consumption (75% power, full rich mixture) (gph)	19.3	19.3	19.3
Cruising Range (75% power, best power mixture) (mi)	300	260	275
Cruising Range (75% power, full rich mixture) (mi)	220	192	201
Stalling Speed at Maximum gross, flap down (MPH)	61	61	61
Stalling Speed as usually landed	46 (at 1700 lbs.)	46 (at 1700 lbs.)	46 (at 1700 lbs.)
Landing Roll at gross	850	850	850

Figure 9 – Aircraft-performance table, highlighting the expected landing distance for a weight of 1,700 lbs.

The driver of the support truck was in the vehicle's cabin at the time of the occurrence. He reported having become accustomed to observing the aircraft's approach in his rear-view mirror, following the aircraft until it stopped to receive new supplies. In relation to the approach of the aircraft in the moments before the occurrence, his perception was that it occurred at a “faster rate than normal”.

After touching down, the aircraft’s right-hand wing collided with a support vehicle parked on the landing area. The airplane rotated to the right around its vertical axis. This change in direction was enough for the moving propeller to hit the airstrip assistant, who was standing next to the truck and facing away from the aircraft.

The airstrip assistant was handling the agricultural products that would be provided to the aircraft. According to one of the employees who participated in the operation, it is possible that, due to the loud noise of the agricultural equipment, the assistant did not notice the noise of the approaching aircraft, or the noise caused by the collision of the aircraft with the first vehicle in time to protect himself. Furthermore, he was used to the aircraft approaching from his rear, as this was the profile of the operation in previous days.

1.19. Additional information.

As for the requirements relative to landing areas for aeroagricultural use, section 137.301 of RBAC-137, Amendment 04, dated 01 June 2020, contained the following information:

> 137.301 Landing area for aeroagricultural use
>
> (a) The construction and/or provision of a landing area for aeroagricultural use is the sole responsibility of the area owner.
>
> (b) The COA holder must perform an SRM prior to the start of operations at each location.
>
> (c) The COA holder must prepare and maintain the SRM analysis at the operational headquarters.
>
> (d) The landing area for aeroagricultural use does not need to be registered with the ANAC.
>
> (e) No-one may operate an aircraft in a landing area for aeroagricultural use, unless:
>
> (1) the operation is exclusive to aeroagricultural activities, for a previously defined period;
>
> (2) the owner of the area has agreed to its construction and use;
>
> (3) the agricultural aircraft does not carry passengers;
>
> (4) the area to be used meets the requirements for the safe operation of the agricultural aircraft at its maximum performance, in accordance with the respective flight manual; and
>
> (5) the use of the chosen area is not prohibited by any legal or regulatory provisions.
>
> (f) The use of a landing area for aeroagricultural use is the sole responsibility of the aeroagricultural operator. (emphasis added)

Furthermore, with regard to the maintenance requirements contained in section 137.203 of RBAC 137, Amendment 04, dated 01 June 2020, there were the following considerations:

> (b) The aeroagricultural operator must ensure that the tasks performed are conducted in accordance with the manufacturer's maintenance instructions, using approved technical data and appropriate tools.

1.20. Useful or effective investigation techniques.

NIL.

2. ANALYSIS.

It was an aeroagricultural application flight.

The company responsible for the operation had been hired by *Usina São Domingos* for the spraying of agricultural products on its plantations. The accident flight took place on the third day of operations, with the same aircraft and pilot.

The aircraft had a valid CVA, and operated within the weight and balance limits specified by the manufacturer.

The maintenance logbooks handed in to the investigation commission were not complete. Analysis of the documentation received allowed the commission to find that the latest record was the Initial Technical Inspection due to nationalization carried out on 19 April 2021. At the time, a total of 2,447 hours and 36 minutes had been logged for the aircraft. According to the logbook records, the aircraft had 2,477 hours and 36 minutes on the date of the occurrence, which translates into 30 hours of flight in the nine months after the aforementioned inspection.

Even though the 30 hours recorded are less than the minimum required for the first inspection provided for in the aircraft's Maintenance Manual (50 hours), the partial records in the logbooks received made it impossible to determine whether they were up to date.

The aircraft manual read that the tailwheel was connected to the rudder by means of springs, so that directional control on the ground was provided by the application of the pedals. This connection was detailed in the aircraft's IPC and was a check item in periodic maintenance of the equipment.

During the initial action, one found that the aforementioned connection was missing. When connected, the springs would restrict the aircraft's turning radius on the ground to the limits of the rudder stops. Once absent, directional control was achieved through alternate application of the main landing gear brakes.

The investigation commission concluded that the purpose of removing the springs was to reduce the radius of the aircraft's 180º-turn (backtrack), in order to make this procedure possible on narrower runways. Notwithstanding, such procedure was not provided for in the aircraft manuals.

After consultation with the current holder of the Aircraft Type Certificate (*Laviasa Aeroindustria*), one verified that there was no authorization (or even suggestion) for the removal of the aforementioned connection springs. The representative understood that this could be a common practice, in order to perform shorter turns on the ground, even if it increased the risk of runway excursion after landing.

As for the landing area chosen for operation, even though its total extension was adequate to the aircraft's performance requirements, the existence of the protuberance with a high slope and its irregular floor added risk to the landing operations, which was overcome by the pilot through the use of half the distance available for landing.

The investigation commission also found that other vehicles from the Sugar/Ethanol Mill normally used the airstrip whenever ag-aircraft were not making use of it.

In accordance with the requirements of section 137.301 of the RBAC-137, an aircraft could only be authorized to operate in a landing area for aeroagricultural use under the condition that the operation was exclusive for agricultural purposes, and for a certain period.

The frequent use of the airstrip by trucks and other vehicles may have contributed to the deterioration of the airstrip surface conditions, adding further risk to the operation.

Additionally, it had been raining the night before the accident flight, a fact that contributed to the runway becoming slippery. During the initial action of the investigation, performed around nine hours after the accident, the sides of the airstrip were still muddy.

There was also a layer of dust on the central surface, which also reduced the aircraft's grip to the airstrip.

Furthermore, even though the SRM was mandatory before the start of operation at every location, according to section 137.301 (b) of RBAC 137, it was not possible to confirm that the SRM was performed, or even to assess its suitability.

The positioning of vehicles within the limits of the landing area, specifically at the threshold in use for takeoffs, also proved to be inadequate and risky. This procedure, which aimed to allow rapid replenishment of the aircraft, which would execute a backtrack maneuver close to the vehicles, denoted an attempt to optimize operations as much as possible, despite the associated risks.

As for the accident flight, although there are no records of the speed used for landing, the marks left on the landing area allowed the investigators to consider the hypothesis of a touchdown with a level of energy higher than ideal, which may have caused the aircraft to float subsequently, reducing the space available for deceleration and control.

Such condition, added to the slippery surface of the landing area and to the missing connection between the tailwheel and the rudder, made it impossible for the pilot to deviate from the vehicle involved in the first collision.

It was not possible to rule out, however, that the dirt found in the brake assembly of the main landing gears may have contributed to a reduction of the braking efficiency or even to a possible intermittent failure of brake system - even though its functionality was tested during the initial action. If the airstrip were in good condition, the distance available after the central unevenness (around 450 m) would be enough for a complete landing of the airplane.

However, the occurrence of rain a few hours before the operation on an airstrip used by other vehicles contributed to making it impossible to control the aircraft in the space available. Furthermore, the conditions encountered may have favored the occurrence of losses in the operator's attention and performance, since it was necessary to manage several points of attention in a short period.

In fact, the braking marks observed in the 115-meter segment preceding the point of collision with the ground-vehicle showed an attempt of deviation to the left, with the wheel locking in the left direction more frequently than in the right direction. However, the attempt at directional control by the use of differential brakes proved fruitless, as there were both a residual forward speed and a low-grip landing area - which only resulted in the aircraft skidding on the airstrip surface.

In such scenario, the inadequate assessment of the parameters involved in the operation, particularly with regard to the slippery condition of the landing area, the partial use of the space available for landing, and the presence of ground-vehicles in that location, was a contributor to the occurrence.

Furthermore, despite the existence of an SMS documented and approved by the ANAC, the company's management supervision allowed the operation to take place as described herein, in a landing area with characteristics that added risk to the operation. The parking of support vehicles within the limits of the landing area and the suppression of the component that provided directional control of the aircraft on the ground were also allowed. These actions demonstrate the bias towards optimizing operations, even at the expense of operational safety.

3. CONCLUSIONS.

3.1. Findings.

a) the pilot held a valid CMA (Aeronautical Medical Certificate);

b) the pilot held valid MNTE and PAGA ratings;

c) the pilot had qualification and experience for the type of flight;

d) the aircraft had a valid CVA (Airworthiness-Verification Certificate);

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

f) it was not possible to assess whether the records of the airframe, engine, and propeller logbooks were up to date;

g) the last inspection of the aircraft registered in the logbooks was the Initial Technical Inspection (SAE-AG category) carried out on 19 April 2021 on account of nationalization;

h) there were 30 flight hours logged between the Initial Technical Inspection and the date of the occurrence;

i) the meteorological conditions were consistent with the type of flight;

j) it had rained the night before the accident flight;

k) approximately halfway between the airstrip thresholds, there was a highly sloped unevenness;

l) the vehicles that supported the operation and were used for replenishment of supplies were parked within the limits of the airstrip;

m) the occurrence flight was the first flight of the day;

n) the airstrip used had an uneven surface and was slippery on account of recent rain;

o) on the course of the investigation, one found that the flight controls were free and corresponding;

p) the brake system was tested for functionality, and showed no abnormalities;

q) the tailwheel was moving freely, with no signs of locking;

r) the connection between the tailwheel and the steering rudder was missing at the initial investigation action;

s) after landing, controlling the aircraft on the ground proved difficult;

t) the right wing of the aircraft collided with a support ground-vehicle parked at the airstrip threshold;

u) the propeller of the aircraft, still in motion, hit the airstrip assistant, who was preparing the replenishment of supplies;

v) the aircraft sustained minor damage; and

w) the pilot suffered no injuries, whereas the airstrip assistant was fatally harmed.

3.2. Contributing factors.

- **Attention – undetermined.**

The occurrence of rain hours before the operation, on a runway also used by other vehicles, contributed to the fact that it was not possible to control the aircraft in the space available.

Such conditions may have favored the occurrence of losses in the operator's attention and performance, since it was necessary to manage several distinct points of attention in a short time.

- **Organizational culture – a contributor.**

The practice of keeping ground-vehicles parked within the limits of the landing area, in addition to the procedure of backtracking the aircraft close to the said vehicles, denoted the

intention of speeding up operations, despite the risks associated with such procedures. In addition, the lack of connection between the tailwheel and the steering rudder to make this operation viable, despite the prescriptions contained in the aircraft manuals, allowed to reinforce the existence of misconceptions in collective perceptions with respect to safety.

- **Handling of aircraft flight controls – undetermined.**

The marks left by the aircraft's tires on the surface of the landing area allowed one to raise the hypothesis that the aircraft had floated after the first touchdown, something that might indicate that the speed maintained on the final for landing was higher than ideal.

This fact may have contributed to making it hard to obtain control after landing, leading the aircraft to collide with the parked vehicle.

- **Piloting judgment – a contributor.**

There was inadequate assessment of the parameters involved in the operation in progress, particularly with regard to the slippery condition of the landing area, the partial use of the space available for landing, and the presence of vehicles in that location, contributing to the occurrence.

- **Perception – a contributor.**

The landing took place in a scenario that involved, in addition to accumulation of water and mud due to rain, obstacles on the airstrip resulting from its deterioration by the traffic of vehicles, and reduction in its length.

Furthermore, there was a vehicle parked at the end of the landing area, with which the aircraft collided, showing that the space reserved for the operation was compromised.

Landing under such conditions denoted a reduction in the pilot's situational awareness, as the risks were not adequately assessed.

- **Managerial oversight – a contributor.**

Even though a specific SRM was not presented for the location of operations, the characteristics of the landing area and the positioning of vehicles within its limits posed high risk to the safety of operations, for which there were neither control measures nor possible mitigations.

Also due to the lack of control relative to compliance with the equipment's operating manual, in view of the missing connection between the tailwheel and the steering rudder, as well as practices aimed at optimizing operations, the investigation demonstrated the existence of inadequacies in the oversight processes put in place by the management staff.

4. SAFETY RECOMMENDATIONS

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 consonance with the Law n°7565/1986, recommendations are made solely for the benefit of 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".

To the Brazil's National Civil Aviation Agency (ANAC):

A-006/CENIPA/2022 - 01 Issued on 03/13/2024

Work with *Soldeira Aviação Agrícola*, in order to ensure the suitability of its operations to the requirements established in the RBAC-137, notably with regard to the use of landing areas

for aeroagricultural use, the technical conditions of its aircraft fleet, and management of the risks posed by the operations.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On March 13th, 2024.