

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
A - 174/CENIPA/2018

OCCURRENCE:	ACCIDENT
AIRCRAFT:	PP-OEG
MODEL:	C525
DATE:	26NOV2018



NOTICE

According to the Law n° 7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System – SIPAER – is responsible for the planning, guidance, coordination and execution of the activities of investigation and prevention of aeronautical accidents.

The elaboration of this Final Report was conducted taking into account the contributing factors and hypotheses raised. The report is, therefore, a technical document which reflects the result obtained by SIPAER regarding the circumstances that contributed or may have contributed to triggering this occurrence.

The document does not focus on quantifying the degree of contribution of the different factors, including the individual, psychosocial or organizational variables that conditioned the human performance and interacted to create a scenario favorable to the accident.

The exclusive objective of this work is to recommend the study and the adoption of provisions of preventative nature, and the decision as to whether they should be applied belongs to the President, Director, Chief or the one corresponding to the highest level in the hierarchy of the organization to which they are being forwarded.

This Report does not resort to any proof production procedure for the determination of civil or criminal liability, and is in accordance with Appendix 2, Annex 13 to the 1944 Chicago Convention, which was incorporated in the Brazilian legal system by virtue of the Decree n° 21713, dated 27 August 1946.

Thus, it is worth highlighting the importance of protecting the persons who provide information regarding an aeronautical accident. The utilization of this report for punitive purposes maculates the principle of “non-self-incrimination” derived from the “right to remain silent” sheltered by the Federal Constitution.

Consequently, the use of this report for any purpose other than that of preventing future accidents, may induce to erroneous interpretations and conclusions.

N.B.: This English version of the report has been written and published by the CENIPA with the intention of making it easier to be read by English speaking people. Taking into account the nuances of a foreign language, no matter how accurate this translation may be, readers are advised that the original Portuguese version is the work of reference.

SYNOPSIS

This is the Final Report of the 26NOV2018 accident with the C525 aircraft model, registration PP-OEG. The accident was classified as “[CTOL] Collision with obstacle during take-off or landing”.

During the final landing approach, the aircraft collided with an obstacle that was located on the extension of the runway axis.

The aircraft was destroyed.

The pilot and three passengers suffered fatal injuries.

An Accredited Representative of the National Transportation Safety Board (NTSB) - USA, (State where the aircraft was manufactured) was designated for participation in the investigation.



CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS	5
1. FACTUAL INFORMATION.....	6
1.1 History of the flight.....	6
1.2 Injuries to persons.....	6
1.3 Damage to the aircraft.....	6
1.4 Other damage.....	6
1.5 Personnel information.....	6
1.5.1 Crew's flight experience.....	6
1.5.2 Personnel training.....	6
1.5.3 Category of licenses and validity of certificates.....	7
1.5.4 Qualification and flight experience.....	7
1.5.5 Validity of medical certificate.....	7
1.6 Aircraft information.....	7
1.7 Meteorological information.....	7
1.8 Aids to navigation.....	7
1.9 Communications.....	7
1.10 Aerodrome information.....	7
1.11 Flight recorders.....	7
1.12 Wreckage and impact information.....	7
1.13 Medical and pathological information.....	10
1.13.1 Medical aspects.....	10
1.13.2 Ergonomic information.....	10
1.13.3 Psychological aspects.....	10
1.14 Fire.....	10
1.15 Survival aspects.....	11
1.16 Tests and research.....	11
1.17 Organizational and management information.....	11
1.18 Operational information.....	12
1.19 Additional information.....	13
1.20 Useful or effective investigation techniques.....	16
2. ANALYSIS.....	16
3. CONCLUSIONS.....	17
3.1 Facts.....	17
3.2 Contributing factors.....	17
4. SAFETY RECOMMENDATION.....	18
5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.....	18

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	Brazil's National Civil Aviation Agency
CA	Airworthiness Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CIV	Pilot's Flight Logbook
CMA	Aeronautical Medical Certificate
DECEA	Airspace Control Department
IAM	Annual Maintenance Inspection
IFRA	Instrument Flight Rating - Airplane
NTSB	National Transportation Safety Board (USA)
OPEA	Object Projected in Airspace
PBZPA	Aerodrome Protection Zone Basic Plan
PCM	Commercial Pilot License – Airplane
PIC	Pilot in Command
PLA	Airline Pilot License – Airplane
PPR	Private Pilot License – Airplane
PSO-BR	Operational Safety Plan for the Brazilian Civil Aviation
PSSO	Operational Safety Supervision Plan
RBAC	Brazilian Civil Aviation Regulation
RBHA	Brazilian Aeronautical Certification Regulation
SBBH	ICAO Location Designator - Pampulha Aerodrome - Carlos Drummond de Andrade, Belo Horizonte - MG
SERIPA III	Third Regional Aeronautical Accident Investigation and Prevention Service
SGSO	Safety Management System
SIC	Second in Command
SNJI	ICAO Location Designator - Fortaleza de Santa Terezinha Farm Aerodrome, Jequitaiá, MG
TPP	Registration Category of Private Service - Aircraft
UTC	Universal Time Coordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

1. FACTUAL INFORMATION.

Aircraft	Model: C525 Registration: PP-OGE Manufacturer: Cessna Aircraft	Operator: ARG Ltd.
Occurrence	Date/time: 26NOV2018 - 0830 (UTC) Location: Fortaleza de Santa Terezinha Farm (SNJI) Lat. 17°11'09"S Long. 044°38'47"W Municipality – State: Jequitai – MG	Type(s): "[CTOL] Collision with obstacle during take-off or landing" Subtype(s): Nil

1.1 History of the flight.

The aircraft took off from the Pampulha Aerodrome - Carlos Drummond de Andrade (SBBH), Belo Horizonte - MG, to the Fortaleza de Santa Terezinha Farm Aerodrome (SNJI), Jequitai - MG, at about 0740 (UTC), in order to transport personnel, with a Pilot in Command (PIC) and three passengers on board.

During the final approach for landing on runway 20 of SNJI, the aircraft collided with a metallic structure and then with the ground a few meters from the runway threshold.

There was a go-around procedure attempt, followed by the loss of control of the aircraft, which began a left turn, in a descending trajectory until it collided with the ground.

The aircraft was destroyed.

The crewmember and the three passengers suffered fatal injuries.

1.2 Injuries to persons.

Injuries	Crew	Passengers	Others
Fatal	1	3	-
Serious	-	-	-
Minor	-	-	-
None	-	-	-

1.3 Damage to the aircraft.

The aircraft was destroyed.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours	PIC
Total	11.000:00
Total in the last 30 days	40:54
Total in the last 24 hours	01:42
In this type of aircraft	522:00
In this type in the last 30 days	15:24
In this type in the last 24 hours	01:42

N.B.: The data related to the flown hours were obtained through the pilot's CIV.

1.5.2 Personnel training.

The PIC took the PPR course at the aeroclub in Lafaiete – MG, in 1991.

1.5.3 Category of licenses and validity of certificates.

The PIC had the PLA License and valid C525 aircraft type Rating (which included the 525 model) and IFRA Rating.

1.5.4 Qualification and flight experience.

The PIC was qualified, had experience in the aircraft, in the type of flight and had already operated in the location several times.

1.5.5 Validity of medical certificate.

The PIC had valid CMA.

1.6 Aircraft information.

The aircraft, serial number 525-0849, was manufactured by Cessna Aircraft, in 2014, and it was registered in the TPP category.

The aircraft had valid Airworthiness Certificate (CA).

The airframe and engines logbook records were updated.

The last inspection of the aircraft, the "IAM" type was carried out on 04OCT2018 by the maintenance organization TAM, with the aircraft having flown 19 hours and 45 minutes after the inspection.

1.7 Meteorological information.

The weather conditions were favorable for the visual flight.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The Aerodrome was private and operated under VFR during the day.

The runway was made of asphalt, with thresholds 02/20, dimensions of 1,080 x 18m, with elevation of 1,640 ft.

1.11 Flight recorders.

Neither required nor installed.

1.12 Wreckage and impact information.

The aircraft collided with an irrigation pivot (440m long metallic structure, which revolves around a point in the center of the cultivated area), cutting the steel cables that supported the last "arm" of the referred equipment, which fell on the plantation after the impact (Figures 1 and 2).



Figure 1 - View of the last "arm" of the pivot, fallen over the plantation.

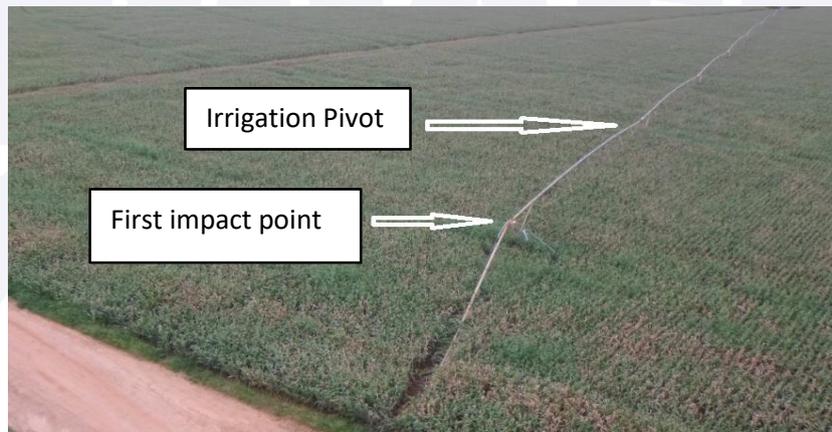


Figure 2 - Aerial view of the irrigation pivot and the first impact point.

A wooden stake of the fence that delimited the airfield, approximately 1.5 m high, located 100 m from the runway threshold, was also hit at the top.

The nose gear wheel was found 190 m from the point of the aircraft's first impact with the ground.

The second and definitive impact of the aircraft against the terrain occurred 500 m away from the first.

The wreckage was distributed linearly along 75 m, with its core about 600m away from the site of the first impact with the ground (Figure 3).

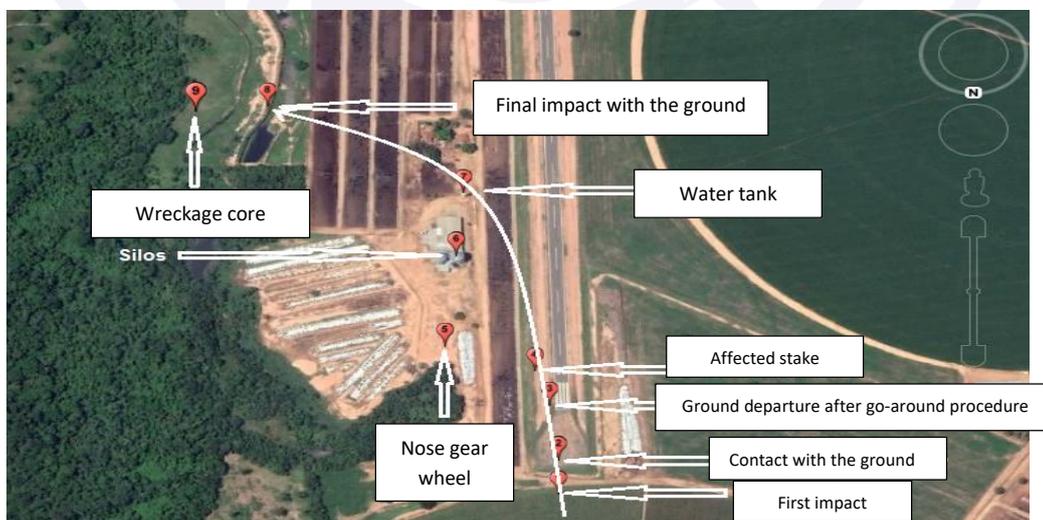


Figure 3 - Sketch of the aircraft trajectory, from the first impact to the final impact with the ground. Source: adapted from Google Earth.

The first contact with the ground took place 67m before the threshold 20. This condition was evidenced by marks produced on the pavement, indicative of a dragging with a metallic aspect and, subsequently, by tire marks, produced by the aircraft wheels, both on the paved part and on the unpaved part on the side of the road. This evidence can be identified in the image shown in Figure 4.

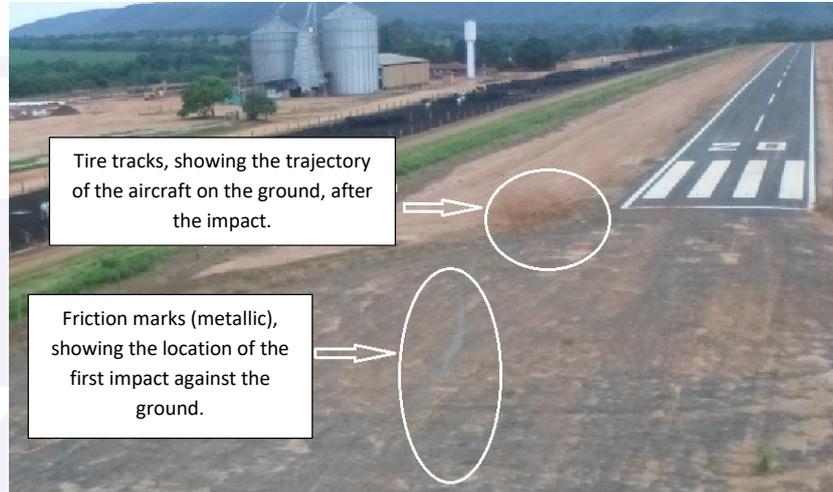


Figure 4 - View of the site of the first impact against the ground.

After the go-around procedure, the aircraft flew about 500m until it hit the ground again, separating into many parts, in a predominantly linear arrangement, as can be seen in Figure 5.

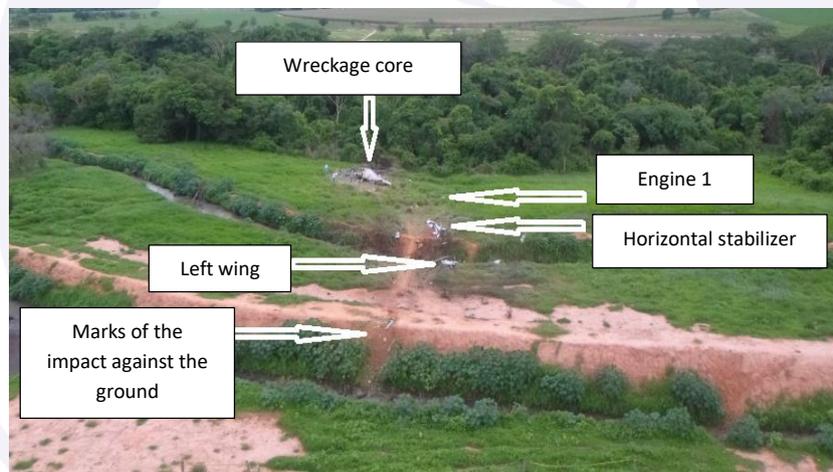


Figure 5 - Aerial view of the wreckage, where the final collision with the ground occurred.

A part of the left wing (the tip) was found 74m away from the wreckage core; the horizontal stabilizer at 34m; and engine 1 (left) was 23m away from the aforementioned core.

In both engines, marks of friction (rubbing) of the blades against the internal walls of the air intake were identified, and these blades presented predominantly uniform deformations, indicating that the two engines were developing power when they collided, as can be seen in Figure 6.

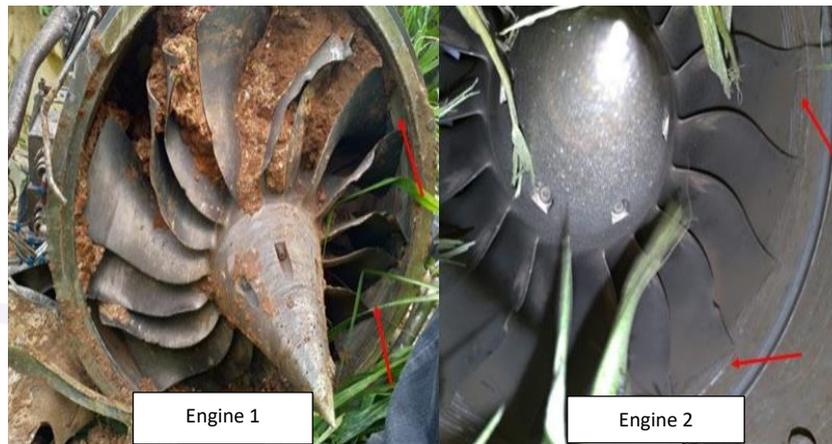


Figure 6 - View of the air inlet of the engines, with an indication of the friction areas of the blades on the walls of the compressor.

No evidence of engine failure or loss of power was found in flight. After the final impact with the ground, engine 1 detached itself from the aircraft and engine 2 remained attached to the fuselage.

The right main landing gear was extended, as was the power nose landing gear, indicating that the landing gear remained down throughout the chain of events.

Also, it was observed that the marks of the touches of the wheels on the pavement were concentrated before the touchdown zone (mark of 1,000 ft), close to the threshold of the runway. Some marks were found in the area of the threshold strips (zebra).

1.13 Medical and pathological information.

1.13.1 Medical aspects.

Nil.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

Nil.

1.14 Fire.

There was fire, apparently of long duration, in the core of the wreckage that hit many parts of the aircraft, especially the flight deck, the right wing and the passengers` cabin, as can be seen in Figure 7.



Figure 7 - View of the wreckage, showing the areas most affected by the fire.

Fire signs were also identified in other parts of the aircraft, apparently of short duration, whose main focuses were observed in the left wing, in the horizontal stabilizer and in the trajectory described by the aircraft wreckage after impact with the ground (Figure 8).



Figure 8 - Fire marks on vegetation and other parts of the aircraft.

1.15 Survival aspects.

There were no survivors.

1.16 Tests and research.

Nil.

1.17 Organizational and management information.

It was a private operation with an aircraft registered in the TPP category, so there were no requirements related to organizational issues or the SGSO required for this operation.

The purpose of the flight was to transport the owner of the company and his wife from Belo Horizonte to the runway of the Fortaleza de Santa Terezinha farm. This type of operation was commonplace for the PIC, but, according to the farm's employees, it was always done with some advance notice, enough to allow the PIC to coordinate with the employees, warning them about their arrival.

This time, according to information obtained at the farm's headquarters, the owner's transport would be done by land, but there was a change in plans regarding this displacement. The owner gave up going by car and called the PIC on the eve of the intended day to travel to the destination.

The workers said that the PIC always warned them about their arrival and warned them about the pivot's positioning in relation to the runway. However, in this opportunity, they were not notified and only found out about the flight, at 0520 (local) - 0720 (UTC), moments before the arrival of the aircraft.

The PIC was experienced and qualified to fly that type of aircraft and had operated on that runway for some time. At the time of the occurrence, only this pilot landed in the locality.

There was another pilot on board, who was sitting in the cockpit as a passenger. He had been hired for the role of Second in Command (SIC), but still did not have a license for that aircraft model. No register of flight hours on the model were found in his records.

The pilot hired that year as SIC took the PPR course at the Minas Gerais state Aeroclub - MG, in 2009, held the PCM License and had valid IFRA Rating. However, he did not have a C525 aircraft Type Rating. He had a total of 775 hours of flight and, as he was not qualified, he could not work on board.

It should be noted that the aircraft was certified for single pilot operation, that is, it could be operated by only one pilot.

1.18 Operational information.

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

The flight was uneventful until its destination, with favorable weather, normal bilateral contact with air traffic control units, and no signs of aircraft failure.

The destination Aerodrome was located on a corn plantation farm.

In the final approach to runway 20, there was an irrigation pivot. At the end of this structure, there were two metal rods, in the shape of a fork, to which the steel cables that supported the last "arm" of the pivot (swing). They were 27m long and their end was 110m from the threshold 20. The average height of the pivot was 4m; the cable mooring structure (fork) was 3m high, making a total of 7m.

The aircraft, 126m away from threshold 20, collided the left main landing gear against the support structure of the last "arm" of the pivot, sectioning some steel cables of this structure.

After this impact, it crashed into the ground, 67m before the threshold, and returned to flight, covering 75m on the ground, on the side of the runway, initially maintaining an ascending and straight trajectory towards the silos; and, later, it entered a left turn, after passing behind the water tank, in a descending trajectory, culminating with the final collision with the ground, at a distance of 280m from the side of the road.

According to reports from farm employees, the PIC did not inform his expected arrival time, so that the pivot was positioned outside the approach sector of runway 20. Thus, that would have been the first time the pivot was in that position before the arrival of the aircraft.

Employees reported that the pivot's usual resting position was over the access road to the center of the plantation.

However, due to problems with one of the engines used to pull this structure, it was left in a different position (Figure 9), in the approach sector of runway 20, almost aligned with the direction of the runway, as can be seen in Figure 10.

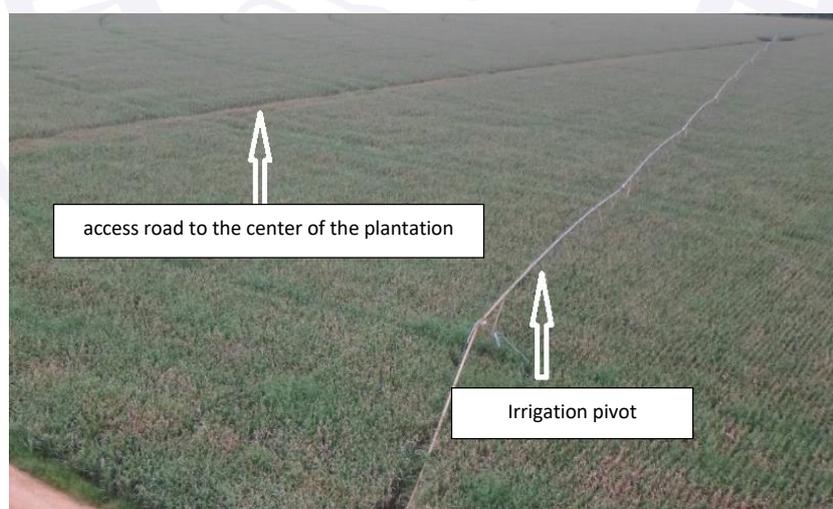


Figure 9 - View of the access road to the center of the plantation and the irrigation pivot.



Figure 10 - Image of the irrigation pivot direction in relation to runway 20.

Still, according to the report of observers, the aircraft carried out normal traffic, similar to the usual ones, entered the traffic circuit on the downwind leg of runway 20, starting the descent when entering the base leg, and continued descending within the framework of the final approach. In this segment, it was observed that the aircraft descended more than “normal”, starting to perform a “low flight”.

It was also reported that the aircraft appeared to be running faster, with a more accelerated engine and making more noise than on other occasions.

Observers reported that, after touching down, the aircraft remained at low altitude, passed behind the water tank, located 300m from the threshold 20, and moved 82m laterally from the runway, at the same height of the top of the water tank, and entered a left turn from that point, in a descending trajectory, until hitting the ground at 513m from the threshold 20.

1.19 Additional information.

The RBHA 91 - “General Rules of Operation for Civil Aircraft”, and the RBAC 61 - “Licenses, Qualifications and Certificates for Pilots” established specific rules regarding licenses, certificates, qualifications and authorizations, according to the requirements transcribed below:

91.5 - REQUIREMENTS FOR CREWMEMBERS

(a) No person may operate a civil aircraft registered in Brazil unless:

[...]

(3) the operation is conducted by crewmembers who are suitably qualified for the aircraft and for the role they perform on board and who hold a valid certificate of physical ability.

61.3 Conditions relating to the use of licenses, certificates, qualifications and authorizations

(a) Pilot license/certificate and qualifications: only those who hold and are holding a pilot license/certificate with their appropriate qualifications for the aircraft operated can act as pilot-in-command or second pilot-in-command on board civil aircraft registered in Brazil, to the operation performed and to the role it performs on board.

Ordinance 957/GC3, of 09JUL2015, deals with restrictions on OPEA that could adversely affect the safety or regularity of air operations. This norm regulated installations close to aerodromes, establishing restrictions and limits that should be observed in the elaboration of this type of project.

The aforementioned ordinance also mentioned the protection zone plans with their respective limiting surfaces of aerodrome obstacles, among other provisions:

ORDINANCE 957/GC3 OF 09JUL2015

Chapter II - DEFINITIONS AND ABBREVIATIONS

[...]

RUNWAY STRIP - defined area on the aerodrome that includes the runway and stopping zones, if available, intended to protect the aircraft during take-off or landing operations and to reduce the risk of damage to the aircraft, in the event of departure from the aircraft runway limits.

[...]

Chapter III - PROTECTION ZONE PLANS

Section I - Aerodrome Protection Zone Basic Plan

Art 6. The PBZPA is defined in terms of the limiting surfaces of aerodrome obstacles.

[...]

Art 10. The approach, take-off, transition, internal horizontal and conical surfaces are intended to discipline the occupation of the ground in order to ensure:

[...]

II - the regularity of air operations, through the maintenance of the aerodrome operational minima within acceptable values.

[...]

Art 84. The objective of the analysis of the OPEC adverse effect is to assess whether a certain object projected into the airspace, natural or artificial, fixed or mobile, of a permanent or temporary nature, causes an impact on the safety or regularity of air operations.

Art 85. The OPEC adverse effect assesses the possibility of interference from an object:

[...]

IV - in air operations under normal conditions;

[...]

VI - in flight safety.

[...]

Art 109. A new object, or extension of object, of any nature, temporary or permanent, fixed or mobile, must be submitted to the authorization of the DECEA Regional Body:

I - within the lateral limits of the approach surface when:

a) be in the first section.

The irrigation pivot (which was mobile) was with its end 110m away from the threshold 20, therefore, within the First Section of the Surface Approaching the Aerodrome Protection Zone, as can be seen in the data of the aforementioned ordinance (Figures 11 and 12).

SUPERFÍCIES ⁽¹⁾	VISUAL				IFR NÃO PRECISÃO				IFR PRECISÃO				
	Código de Referência de Aeródromo												
	1	2	3	4	1	2	3	4	1	2	3	4	3 e 4
APROXIMAÇÃO													
Primeira Seção													
Largura da borda interna (m)	60	80	150	150	150	150	300	300	150	150	300	300	300
Distância da cabeceira (m) ⁽²⁾	30	60	60	60	60	60	60	60	60	60	60	60	60
Abertura total (%) ⁽³⁾	10	10	10	10	15	15	15	15	15	15	15	15	15
Comprimento (m)	1600	2500	3000	3000	2500	2500	3000	3000	3000	3000	3000	3000	3000
Gradiente (%)	5	4	3,33	2,5	3,33	3,33	2	2	2,5	2,5	2	2	2

Figure 11 - Dimensions of Obstacle Limiting Surfaces.

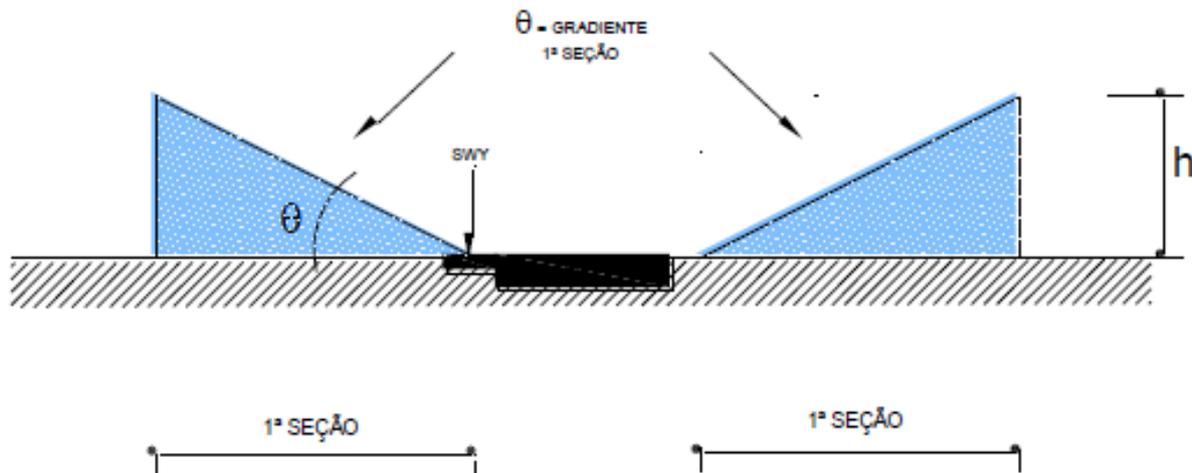


Figure 12 - First Section of the PBZPA Approach Surface.

Thus, observing the runway data highlighted in Figure 11, that is, the runway (classified as code 2 - from 800 to 1,200m), the distance of 6 m from the obstacle to the beginning of the runway strip (60m from the threshold) and the gradient of 4%, a value of 2.64 m of height of the PBZPA approach surface at that point is reached, considering the threshold of the runway and the obstacle with the same altitude.

Thus, as the obstacle was 7m high, subtracting 2.64 m from this value, it appears that, at that location, this obstacle was impairing the gauge of this surface by 4.36m.

The low-angle approach has caused a significant number of accidents. For comparison, Final Reports A-121/CENIPA/2016 and A-144/CENIPA/2019 address accidents with similar characteristics to those dealt with in this Report.

According to Report A-121/CENIPA/2016, on 17SEPT2016, a C-525A model aircraft touched down with the main landing gears before the beginning of the runway. In the run after landing, the plane lost the straight to the right, leaving by its side.

When leaving the runway, the auxiliary landing gear ruptured. The plane stopped outside the paved area, with the left wingtip over the right side of the runway.

According to Report A-144/CENIPA/2019, on 14NOV2019, a C-550 model aircraft made a short landing, causing the main and auxiliary landing gear to break. The plane moved along the runway, dragging the lower fuselage and the underside of the wings, leaving the runway by its left side and stopping with the heading lagged, approximately 210° in relation to the landing trajectory.

In both reports there is information for the prevention of new occurrences.

The type of occurrence of this investigation, classified as CTOL is one of the highest risk event categories included in the ANAC's PSSO for the years 2020-2022:

Objective 5 consists in concentrating efforts on the categories of accidents and incidents that Brazil considers to be the most worrisome, taking into account all segments of our aviation. It should be noted that, during the preparation of the PSO-BR 2019-2022, its implementation group analyzed the main categories of aeronautical occurrences recorded with national aircraft in the period between 2008 and 2017. Of these, it identified five categories of highest-risk events that will be subject to follow-up and dedicated efforts, as listed below.

- 1 – System Component Failure - Powerplant (SCF-PP);
- 2 - Loss of Ground Control (LOC-G);
- 3 - Loss of Control in Flight (LOC-I);
- 4 - Runway Excursion (RE);
- 5 - Collision with Obstacles during Take-off or Landing (CTOL).

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a private flight, carrying three passengers.

The Investigation Team found that the PIC was experienced and used to performing that flight.

The evidence found indicated that the flight was uneventful to the destination, including the descent and visual traffic to runway 20 of the Fortaleza de Santa Terezinha farm.

On the day of the occurrence, the irrigation pivot was positioned close to the runway, with its end 110 meters from the threshold 20.

According to the information obtained, this was an unprecedented situation, given that the PIC always made prior contact with the farm administrator, the previous day, asking for confirmation of the pivot's position and its repositioning, if it was in the vicinity of the sector approach runway.

In this way, the circumstances found suggest that the flight preparation actions were not effective, since, according to the data obtained, the farm employees learned of the aircraft's arrival at 0720 (UTC), therefore, there was no time for them to change the pivot position.

The aircraft was sighted in the traffic circuit, entering the downwind leg of runway 20 and proceeding to the base leg of the circuit, with no evidence of abnormalities; except for the opinion of observers, who reported that the aircraft, in the final approach, appeared to be lower than usual.

The total height of the obstacle at the point where the collision occurred was approximately 7m. Considering that the aircraft's landing gear collided with the top of the structure and that the collision occurred at 126 m from the threshold 20, an approach angle of around 1.5° was reached.

The normal approach ramp angle for landing should be around 3.3°. Thus, when passing through the obstacle, the aircraft should be crossing at around 16m in height.

As can be seen, based on the evidence, it was found that the approach was performed with a low angle (flat approach).

The PIC was qualified to operate that type of aircraft, while the other pilot on board, despite having been hired for the SIC function, still did not have the license to operate that aircraft.

This situation indicated that the hired pilot was on board as a passenger. However, it is possible that the PIC was demonstrating details of the operation to the contracted pilot.

Given this hypothesis, the PIC would have an increased workload, as, in addition to performing normal actions during the flight, he would be diverting part of his attention to demonstrate them to the hired pilot.

No evidence of failure or malfunction of the in-flight aircraft systems was identified; the engines showed evidence of having collided with the ground in full operation, and the fire, which consumed many parts of the aircraft, showed evidence of having occurred after the impact with the ground.

Another aspect observed in the course of the investigation refers to the irrigation pivot. In the position it was in, the pivot impaired the gauge of the Aerodrome approach surface by 4.36 m.

3. CONCLUSIONS.

3.1 Facts.

- a) the PIC had a valid CMA;
- b) the PIC had valid C525 and IFRA aircraft Ratings;
- c) the hired pilot did not have a C525 type aircraft License;
- d) the PIC was qualified and had experience in the type of flight;
- e) the aircraft had a valid CA;
- f) the aircraft was within the weight and balance limits;
- g) cell and engine bookkeeping records were up to date;
- h) the meteorological conditions were favorable for the flight;
- i) there was an irrigation pivot in the alignment of the end of runway 20, which impaired the approach surface gauge by 4.36m;
- j) farm workers did not find out about the aircraft's arrival in time to change the pivot's position;
- k) the aircraft performed a low-angle approach;
- l) the aircraft collided with the irrigation pivot, 126m from the threshold 20 and then crashed into the ground, 65m before the threshold;
- m) there was a go-around attempt, followed by the loss of control of the aircraft, which started a left turn, in a descending trajectory until it collided with the ground;
- n) the aircraft was destroyed; and
- o) the PIC and the three passengers suffered fatal injuries.

3.2 Contributing factors.

- **Airport infrastructure – a contributor.**

It was found that the irrigation pivot, at the point where the collision took place, was impairing the gauge of the approach surface as described in Ordinance 957/GC3, of 09JUL2015, which provided for restrictions on objects projected into the airspace that could adversely affect the safety or regularity of air operations.

- **Piloting judgment – a contributor.**

The final approach was carried out below the ideal approach ramp, allowing the collision against the pivot, located in the alignment of the runway.

- **Perception – undetermined.**

It is possible that the PIC, when approaching for the landing, did not notice the irrigation pivot and, therefore, collided with the obstacle.

- **Flight planning – a contributor.**

There was no prior coordination with the farm employees, in a timely manner so that the irrigation pivot could be repositioned to a safe location in relation to the flight trajectory on the final landing approach.

4. SAFETY RECOMMENDATION.

A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident. In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies.

In consonance with the Law n°7565/1986, recommendations are made solely for the benefit of the air activity operational safety, and shall be treated as established in the NSCA 3-13 “Protocols for the Investigation of Civil Aviation Aeronautical Occurrences conducted by the Brazilian State”.

Recommendations issued at the publication of this report:

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

A-174/CENIPA/2018 - 01

Issued on 08/07/2022

Intensify the actions prevised under the PSSO 2020-2022, taking into account the lessons learned in this investigation and in the others mentioned in this report, seeking to reduce the number of occurrences categorized as "high operational hazard".

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On July 8th, 2022.