COMANDO DA AERONÁUTICA

CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE ACIDENTES AERONÁUTICOS

FINAL REPORT
A - 137/CENIPA/2016

OCCURRENCE:	**ACCIDENT**
AIRCRAFT:	**PR-STN**
MODEL:	**A300-B4-203**
DATE:	**21OCT2016**

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 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 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. 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 21OCT2016 accident with the A300-B4-203 aircraft model, registration PR-STN. The accident was classified as “[LOC-G] Loss of Control on the Ground” and “[RE] Runway Excursion”.

During the run after landing on RWY 18 of the Gilberto Freyre International Aerodrome (SBRF), Recife - PE, the aircraft drifted to the right, crossed the runway's lateral limit and stopped in the adjacent grassy area.

The aircraft had substantial damage.

All occupants left unharmed.

An Accredited Representative of the *Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile* (BEA) - France, (State where the aircraft was designed/manufactured) was designated for participation in the investigation.

CONTENTS

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	Brazil National Civil Aviation Agency
AP	Autopilot
ATS	Autothrottle System
BEA	Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile
CA	Airworthiness Certificate
CAS	Computed Airspeed
CENIPA	Aeronautical Accident Investigation and Prevention Center
CFR	Code of Federal Regulations
CG	Center of Gravity
CMA	Aeronautical Medical Certificate
CRM	Crew Resource Management
CVR	Cockpit Voice Recorder
FAA	Federal Aviation Administration
FCOM	*Flight Crew Operating Manual*
FDR	Flight Data Recorder
GS	Glideslope
IFR	Instrument Flight Rules
IFRA	Instrument Flight Rating - Airplane
ILS	Instrument Landing System
LABDATA	Flight Data Recorders Read-Out and Analysis Laboratory
LOC	Localizer
METAR	Aviation Routine Weather Report
MMEL	*Master Minimum Equipment List*
PCM	Commercial Pilot License – Airplane
PF	Pilot Flying
PLA	Power Levers Angle
PLA	Airline Pilot License – Airplane
PM	Pilot Monitoring
PN	Part Number
PPR	Private Pilot License - Airplane
RA	Radio Altimeter
RBAC	Brazilian Civil Aviation Regulation
RS	Safety Recommendation
SBGR	ICAO Location Designator - Governador André Franco Montoro International Aerodrome, Guarulhos - SP
SBRF	ICAO Location Designator - Gilberto Freyre International Aerodrome, Recife - PE
SIPAER	Aeronautical Accident Investigation and Prevention System

SN	Serial Number
TL1	Throttle Lever Engine 1
TL2	Throttle Lever Engine 2
TLA	Throttle Lever Angle
TPR	Aircraft Registration Category of Regular Public Transport
UTC	Universal Time Coordinated
VFR	Visual Flight Rules

1. FACTUAL INFORMATION.

Aircraft	**Model:** A300-B4-203 **Registration:** PR-STN **Manufacturer:** Airbus Industrie	**Operator:** Sterna Airlines Ltd.
Occurrence	**Date/time:** 21OCT2016 - 0930 UTC **Location:** Gilberto Freyre International Aerodrome (SBRF) **Lat.** 08°07'35"S **Long.** 034°55'22"W **Municipality – State:** Recife – PE	**Type(s):** [LOC-G] Loss of Control on the Ground [RE] Runway Excursion **Subtype(s):** Nil

1.1 History of the flight.

The aircraft took off from the Governor André Franco Montoro International Aerodrome (SBGR), Guarulhos - SP, to the Gilberto Freyre International Aerodrome (SBRF), Recife - PE, at 0646 (UTC), in order to carry cargo, with three crewmembers and one passenger on board.

During the run after landing on SBRF runway 18, the aircraft drifted to the right, overpassed the runway lateral limit and stopped in the adjacent grassy area.

The nose landing gear turned left about 90° and retracted without command.

The aircraft had substantial damage.

All occupants left unharmed.

1.2 Injuries to persons.

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

1.3 Damage to the aircraft.

The nose landing gear collapsed and retracted, due to fractures in the steering, lowering and locking mechanisms.

The aircraft structure was compromised in the region where the nose landing gear was attached. Structural damage has occurred, which has spread to the outer area of the fuselage adjacent to the nose landing gear housing.

The main landing gear brake assemblies overheated, due to the large amount of heat generated by the braking, causing further damage to the left landing gear.

There was also wreckage ingestion by the engines.

Figure 1 - View of the aircraft after stopping out of the runway.

Figure 2 - Detail of damage to the nose landing gear.

Figure 3 - Details of fuselage damage.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

Flight Hours		
	Pilot	Copilot
Total	11.180:00	7.300:00
Total in the last 30 days	50:00	Unknown
Total in the last 24 hours	05:30	05:30
In this type of aircraft	3.000:00	800:00
In this type in the last 30 days	50:00	Unknown
In this type in the last 24 hours	05:30	05:30

N.B.: The data related to the flown hours were informed by the pilots.

1.5.2 Personnel training.

The pilot took the Aviation Officer Training Course at the Brazilian Air Force Academy (AFA) in Pirassununga - SP, in 1977.

The copilot took the PPR course in 1987. No further data on his training could be obtained.

1.5.3 Category of licenses and validity of certificates.

The pilot had the PLA and his A300 Aircraft type (which included the A300-B4-203 model) and IFRA Ratings were valid.

The copilot had the PCM and his A300 Aircraft type and IFRA Ratings were valid.

1.5.4 Qualification and flight experience.

The pilots were qualified and had experience on this kind of flight.

1.5.5 Validity of medical certificate.

The pilots had valid Aeronautical Medical Certificates (CMA).

1.6 Aircraft information.

The aircraft, serial number 236, was manufactured by Airbus Industrie, in 1985 and was registered in the TPR Category.

The Airworthiness Certificate (CA) was valid.

The A300-B4-203 was equipped with an Autothrottle System (ATS), which among other features, could be used to capture and keep a selected speed or to perform engine acceleration during an automatic go-around procedure.

When operating in Speed Select Mode, the Autothrottle controlled the power levers to capture and keep the selected speed on its control panel. This mode was triggered by pressing the Autothrottle Module SPD button (Figure 4).

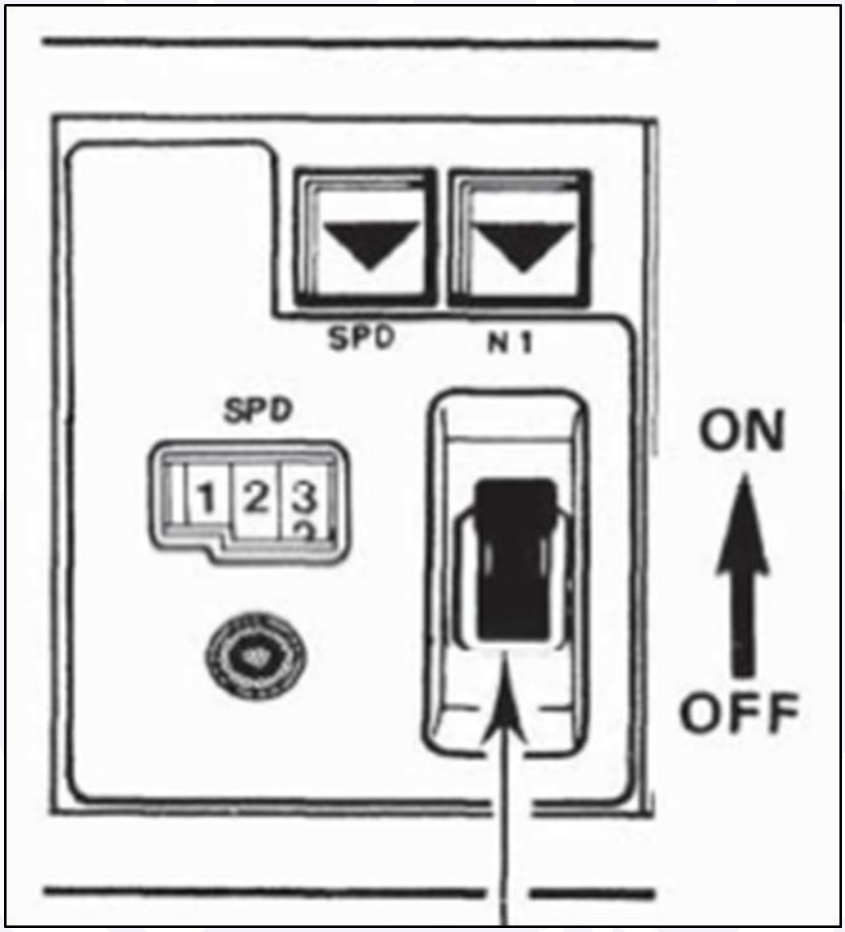


Figure 4 - Autothrottle Module Panel.

During its operation, if the aircraft speed reached a value 4kt lower than that selected, the power throttles would be moved forward to quickly reduce this difference.

During an approach to engaged Autopilot (AP) Land mode, the Autothrottle System would reduce the throttles to the position corresponding to a 5° Power Levers Angle (PLA) when the aircraft crossed 20ft radio height (Figure 5).

AUTOTHROTTLE SYSTEM

GENERAL (CONT'D)

NOTES : a) Threshold schedule :

If the aircraft speed is lower than the selected speed by more than 4 Kts, a fixed output moves the throttle control levers forward to rapidly reduce the difference. This function is inhibited in automatic final approach (LAND mode).

b) Automatic reduction :

When LAND mode is engaged the autothrottle system automatically returns the throttle control levers to the 5° electrical stop at 20 ft.

Figure 5 - FCOM 7.03.04 Extract.

The Speed Select Mode was automatically canceled when the following conditions were met: compressed landing gear bumpers; AP Land mode in the flare-out phase and power levers in the 5° PLA position (Figure 6).

AUTOTHROTTLE MODE CANCELLATION

(Change from engaged condition to armed condition)
The cancellation can be intentional or automatic.

INTENTIONAL ACTION

. By action on the push-button of the mode already engaged, the mode light goes off (impossible in GA), the THR OFF warning light flashes on the Failure and Performance Indicator.

. By action on the instinctive disconnect push-button located on the throttle control levers, the mode push button light goes off and amber THR OFF warning light flashes on Failure and Performance Indicators.

. By engagement of IAS mode at FD or at AP for the SPD SEL mode (THR OFF warning light flashes on Failure and Performance Indicators.

AUTOMATICALLY FOR SPEED SELECT MODE

. when the following conditions are met :

- L/G shock absorbers compressed, LAND mode flare-out phase and 5° stop contacts of the throttle control levers.

Figure 6 - FCOM 7.03.04 Extract.

The triggering of the go-around mode was made by acting on the go levers / go-around tabs.

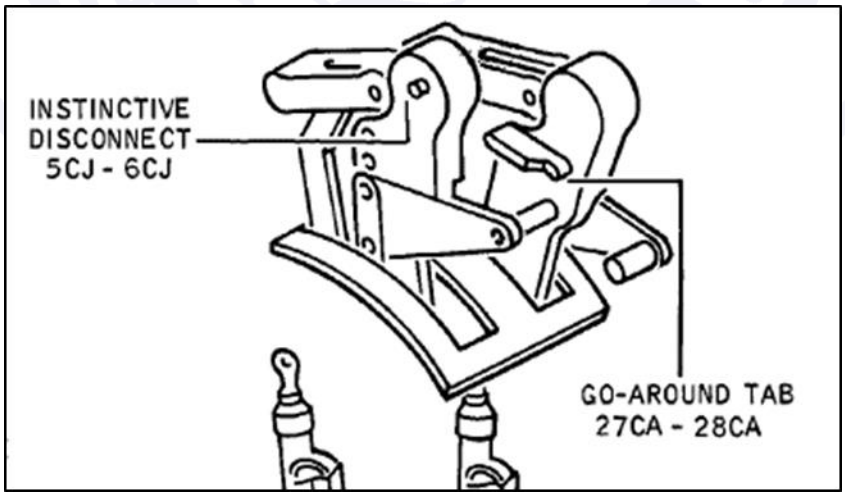


Figure 7 - Thrust Levers pedestal drawing indicating the go levers position (Source: A300 Aircraft Maintenance Manual).

In this case, the ATS would capture and keep the engine speed for a go-around procedure calculated by the N1 Limit Computer.

According to information obtained from Airbus, during a commanded go-around procedure, the throttle advance rate would be in the order of 8°/sec.

The FCOM carried a note pointing out that, in any mode of operation, the Autothrottle could be overcome by pilots by applying force to the throttle. In this case, as soon as the operating edge of the equipment was exceeded, the required force would be similar to that without the ATS acting.

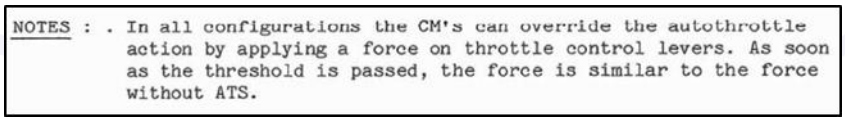

NOTES : . In all configurations the CM's can override the autothrottle action by applying a force on throttle control levers. As soon as the threshold is passed, the force is similar to the force without ATS.

Figure 8 - FCOM 7.03.04 Extract.

The Airbus A300 FCOM stated that if one or both levers were above the IDLE position, the automatic opening of the ground spoilers would be inhibited as shown in the following figure.


NOTE : If one or both throttles remain above the idle position, ground spoilers extension is inhibitied.

Figure 9 - FCOM Extract 8.07.25.

The Operating documentation provided by Airbus, valid at the time of the crash, stated that during landing the reduction of the throttle to the IDLE position should be started at 20ft.

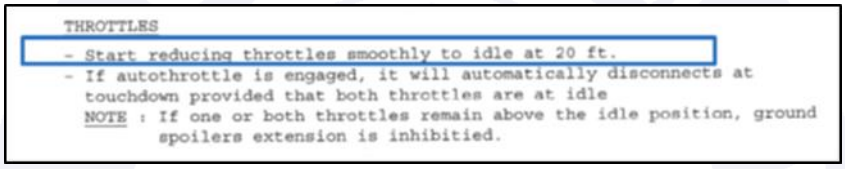
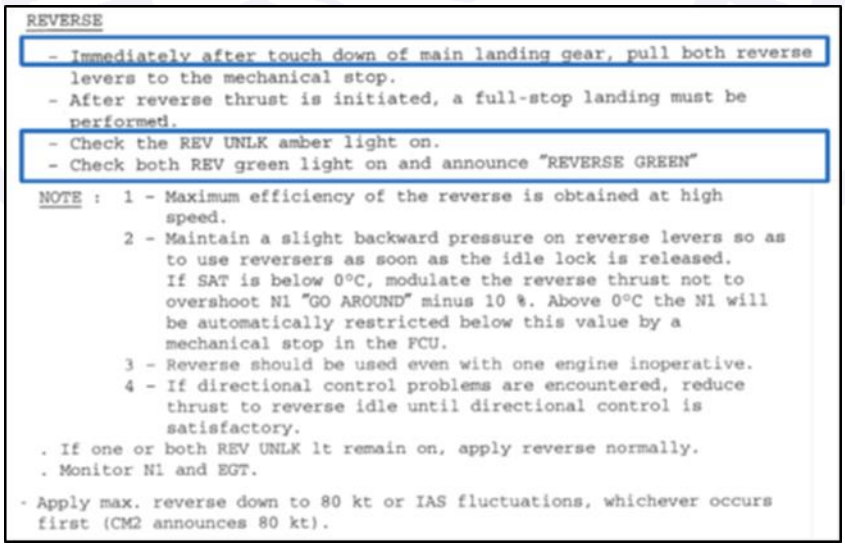

THROTTLES
- Start reducing throttles smoothly to idle at 20 ft.
- If autothrottle is engaged, it will automatically disconnects at touchdown provided that both throttles are at idle
NOTE : If one or both throttles remain above the idle position, ground spoilers extension is inhibitied.

Figure 10 - FCOM Extract 8.07.25.

The use of the inverters, according to the available documentation, should be confirmed by the green REV UNLK light, the green REV light and followed by the REVERSE GREEN callout.


REVERSE
- Immediately after touch down of main landing gear, pull both reverse levers to the mechanical stop.
- After reverse thrust is initiated, a full-stop landing must be performed.
- Check the REV UNLK amber light on.
- Check both REV green light on and announce "REVERSE GREEN"

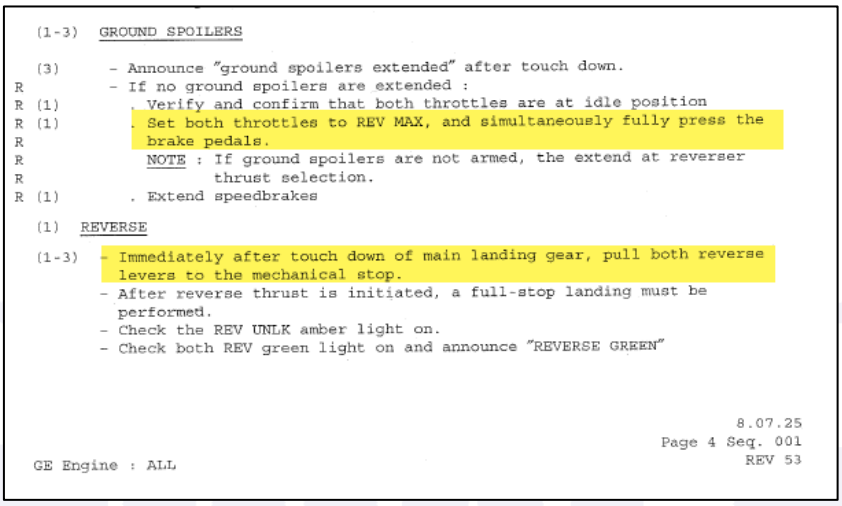
NOTE : 1 - Maximum efficiency of the reverse is obtained at high speed.
2 - Maintain a slight backward pressure on reverse levers so as to use reversers as soon as the idle lock is released. If SAT is below 0°C, modulate the reverse thrust not to overshoot N1 "GO AROUND" minus 10 %. Above 0°C the N1 will be automatically restricted below this value by a mechanical stop in the FCU.
3 - Reverse should be used even with one engine inoperative.
4 - If directional control problems are encountered, reduce thrust to reverse idle until directional control is satisfactory.

. If one or both REV UNLK lt remain on, apply reverse normally.
. Monitor N1 and EGT.

- Apply max. reverse down to 80 kt or IAS fluctuations, whichever occurs first (CM2 announces 80 kt).

Figure 11 - FCOM 8.07.25 Extract describing the use of the reversers.

According to the Flight Crew Operating Manual (FCOM) and the Airbus A300 Master Minimum Equipment List (MMEL), both power levers must be setted in the REV MAX position immediately after the main landing gear touches the ground.



(1-3) GROUND SPOILERS

(3) - Announce "ground spoilers extended" after touch down.
R - If no ground spoilers are extended :
R (1) . Verify and confirm that both throttles are at idle position
R (1) . Set both throttles to REV MAX, and simultaneously fully press the brake pedals.
R NOTE : If ground spoilers are not armed, the extend at reverser thrust selection.
R (1) . Extend speedbrakes

(1) REVERSE

(1-3) - Immediately after touch down of main landing gear, pull both reverse levers to the mechanical stop.
- After reverse thrust is initiated, a full-stop landing must be performed.
- Check the REV UNLK amber light on.
- Check both REV green light on and announce "REVERSE GREEN"

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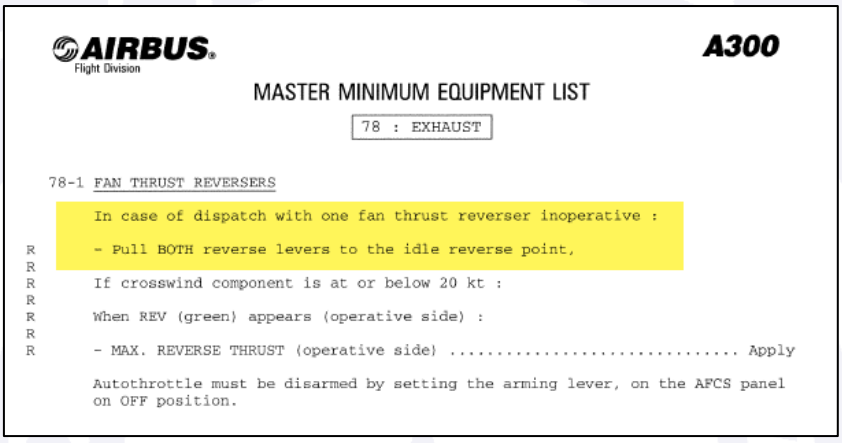
REV 53

GE Engine : ALL

Figure 12 - FCOM Extract 8.07.25.



AIRBUS Flight Division A300

MASTER MINIMUM EQUIPMENT LIST

78 : EXHAUST

78-1 FAN THRUST REVERSERS

In case of dispatch with one fan thrust reverser inoperative :

R - Pull BOTH reverse levers to the idle reverse point,

If crosswind component is at or below 20 kt :

When REV (green) appears (operative side) :

- MAX. REVERSE THRUST (operative side) ..... Apply

Autothrottle must be disarmed by setting the arming lever, on the AFCS panel on OFF position.

Figure 13 - MMEL Extract 2.78.

1.7 Meteorological information.

The METAR of the Gilberto Freyre Aerodrome (SBRF) brought the following information:

METAR SBRF 210900Z 07007KT 9999 BKN020 SCT050 26/23 Q1012=

METAR SBRF 211000Z 08008KT 9999 SCT020 BKN060 28/23 Q1013=

Conditions were found to be favorable for the visual flight. At the time of the occurrence, the wind had intensity between 7kt and 8kt.

1.8 Aids to navigation.

The aid required to the approach using the Instrument Landing System (ILS) for RWY 18 was working properly.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The Aerodrome was public / military, run by INFRAERO and operated under Visual Flight Rules (VFR) and Instrument (IFR), day and nighttime.

The runway was made of asphalt, with thresholds 18/36, dimensions of 3,007m x 45m, with elevation of 33 feet.

1.11 Flight recorders.

The aircraft was equipped with a Flight Data Recorder (FDR), UFDR model, Part Number (PN) 980-4100-DXUS, Serial Number (SN) 3373, and a Cockpit Voice Recorder (CVR) Fairchild, model A100, PN 93-A100-30, SN 51617. Both, the flight data and the cabin voice recorders were of magnetic tape.

Externally, the voice recorder looked in good condition, but internally the tape reel engine (recording media) was locked. The content recorded referred to a flight made in French territory, near the Charles de Gaulle Aerodrome, Paris - France, in that country's language.

It was not possible to accurately establish the date of the flight on which this audio was recorded, however it probably occurred before the aircraft or the recorder was being operated by STERNA.

Figure 14 - FDR and CVR after the aircraft removal.

As for the flight data recorder, the registered content was related to the flight on which the accident in question occurred.

The time and date register mentioned in the plots corresponds to the recording time of the FDR (that is, the time since the recording started).

The machine stopped registering data after 13h05min54sec of recording, which corresponded to an actual time between 09h32min33sec and 09h32min36sec (UTC), approximately.

For reasons that could not be established, the FDR stopped recording during the final deceleration phase of the aircraft, when it was at 57kt.

The equipment recorded, among others, the following data:

Approach and Flare

From 500 feet, indicated by the Radio Altimeter (RA), till the Touch Down, the aircraft configuration was as follows:

- slats / flaps were in CONF FULL (extended);

- Computed Airspeed (CAS) was of 132kt;

- all landing gears were lowered and locked;

- the aircraft was aligned with Glideslope (GS) and Locator (LOC) signals;

- the pitching angle was of +3.6° and the rolling angle was of -1.4°;

- the course varied around 177° (runway 18 - runway magnetic direction was of 184°); and

- the AP2 was disengaged at about 300ft (RA).

The autothrottle modes were not recorded in the FDR.

Touch Down

With 13h05min14sec of recording, the aircraft landed with 128kt (CAS) on its main right landing gear. The following information was also recorded:

- the normal load factor increased to +1,22G;

- the pitching angle was of +6.3° and the rolling angle was of -0.9°;

- the power levers have not been reduced to IDLE; and

- The aircraft heading was of 177°, which means that the nose of the aircraft was to the left of the runway axis.

The ground spoilers' positions were not recorded in the FDR.

The available METAR, issued at 0900 (UTC), (30 minutes before the event) indicated that the wind direction was of 70° and its speed was of 7kt.

Shortly after landing, the head of the aircraft began to widen, although no rudder deflection was recorded.

Ground Run

With 13h05min17sec of recording, three seconds after the touch down, while the speed was still at 128kt (CAS), the following information was recorded:

- engine lever 1 (Thrust Lever - TL1) has been driven to maximum takeoff power (+55° Thrust Lever Angle - TLA);

- engine lever 2 (Thrust Lever - TL2) has been simultaneously adjusted for idle and then reverse in an intermediate position between REV IDLE and MAX REV (-68° Thrust Lever Angle - TLA);

- the engines reacted by responding to TL (maximum takeoff and reverse power) adjustments; and

- the indication of the compressed left landing gear was recorded for approximately 1 second.

At 13h05min19sec of recording, while the head was of 183° and increasing, the rudder was steered left to +29.8°, its maximum deflection.

The heading stopped increasing (after reaching 185°) and began to decrease. It stabilized at around 180° for about 10 seconds, while the left rudder deflection was maintained at about 19° (2/3 of its maximum) and constant speed around 125kt (CAS).

The indications of the left main landing gear and the compressed nose were recorded at 13h05min24sec and 13h05min26sec, respectively, approximately 10 seconds after the initial touch down on the right main landing gear.

At 13h05min38sec of recording, the speed had decreased to 112kt (CAS) and the maximum thrust asymmetry was reached. Although the rudder surface was fully deflected to the left, the head increased rapidly (up to 195°), causing the aircraft to steer to the right.

Analysis of the left throttle angles during the aircraft ground run showed that its advance rate was around +2°/sec.

Runway Excursion

With 13h05min51sec of recording, when the speed was of 67kt (CAS), the TL1 was set to REV. Then, the following records were registered:

- the longitudinal load factor started to increase from + 0,27G to + 0,88G;

- the normal load factor oscillated between + 0.64G and + 1.47G;

- the heading has decreased to 191°; and

- the pitching angle decreased sharply to -9.6°.

The FDR stopped registering with 13h05min54sec recording.

1.12 Wreckage and impact information.

When the aircraft entered the grassy area adjacent to the airstrip, the nose landing gear was commanded to the left.

The overlapping tire marks left on the paved area prior to the runway excursion demonstrated that, due to the trajectory described by the plane, the wheels of the nose landing gear were skidding.

Figure 15 - Overlapping nose landing gear tire markings (white arrow).

1.13 Medical and pathological information.

1.13.1 Medical aspects.

According to the statements taken, all crewmembers considered themselves able to carry out the planned flight schedule. There were no reports of feeling unwell or tired. However, it was reported that the landing time was close to the working day limit stipulated by the legislation in force at the time of the occurrence.

The commander stated that he woke up at about 0930 (UTC) the previous day and traveled to the city of Recife on a commercial flight. He had arrived at SBRF at about 1500 (UTC) and, after eating, he rested in the afternoon.

The presentation for the flight took place at 0100 (UTC). At that time, the aircraft was already fueled and ready for departure.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

The pilots involved in this occurrence had already performed several flights together on the Sterna. From the operator's point of view, the commander and the copilot were his most experienced crew.

The aircraft commander had been in aviation as an airline pilot for approximately 27 years, having flown several large aircraft throughout his professional career. As reported, he had started his operational activities at the company in July 2016, after completing the planned training.

Other airline professionals described him as a calm and competent person. According to reports, he had already flown with some of the company's other crewmembers throughout his professional life on occasions prior to his arrival at Sterna.

The copilot was working for the company for about two years. Initially, he performed administrative activities, assisting in the process of preparing the documentation required by the ANAC, so that the company could operate. In 2016, with the start of operational activities, he began to take part in the flight schedule.

In addition to the pilots, the crew also had a flight engineer. This professional had started his operational activities in the company in August 2016. He was also responsible for monitoring the aircraft maintenance activities in a third party, when designated by the operator.

According to the information obtained, there were no conflicts between the crew. They had flown together on previous occasions without any interpersonal difficulties. It was also stated that they had not experienced critical situations in flight.

For the crew, the type of flight performed was routine, since the company had been operating on the route for 40 days in the same period.

On the last two flights, the crew realized that, during the landing, the aircraft was not behaving as usual, requiring more braking action.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

The crew left the aircraft through the left front door. Upon completion of the inflating sequence, the escape slide came away the door sill.

1.16 Tests and research.

Initial examinations focused on the condition of all main landing gear tires and brake assemblies. In these components, no evidence was identified that inadequate conditions were present before the occurrence.

The markings found on the runway, as well as the changes observed in the brake assemblies and tires, indicated that braking had occurred with a large amount of energy dissipation. The brakes were darkened and the tires were heavily worn. The marks left by the tires of the left main landing gear were more evident.

Figure 16 - Marks of the left main landing gear. On the detail, the wear observed on the tires of this landing gear.

The rubber trail left by the nose landing gear tires indicated that they had skidded as the aircraft drifted off the runway.

The wear diagonally to the groove direction was most pronounced on the outside of the right tire.

Figure 17 - Nose landing gear marks and tire wear indicating skidding.

The following brake and directional system components have been collected for exams and tests:

- Master Warning Controller, PN 3544001044, SN 132;

- Control Box Brake System, PN C20030016, SN 236;

- Auto Brake Control Unit, PN 355511007, SN 295;

- Position Deflector Unit, PN 65-116-010-01, SN 446; and

- Panel 35 VU Brake System Test, PN 353491002, SN 219.

In the aircraft maintenance records, it was found that the nose landing gear, PN C23137002-11, SN 611, had been overhauled on 25AUG2016.

This service was performed by a Repair Station certified by the FAA as set forth in the United States CFR 14, Part 145.

After the overhaul, the landing gear was installed on the aircraft on 05SEPT2016 in an ANAC certified maintenance organization located in Brazil.

The aircraft had performed about sixty cycles with this component by the day of its occurrence. This nose landing gear was also removed so that a thorough check on the component could be properly conducted.

After several interactions with the aircraft and nose landing gear manufacturers, the component was reviewed at Safran Landing Systems facilities. The work was managed by the CENIPA and was supported by the BEA, an equivalent agency in France.

The set was partially disassembled so that the fractured parts could be subjected to laboratory tests, in order to know the mechanism that led to the failures. The disassembly also made it possible to check if there were any nonconformities in the parts, seals, fluids and other components that constituted this landing gear.

Figure 18 - Landing gear undergoing disassembly for Safran exams.

Figure 19 - Details of the fractures analyzed.

At the end of the examinations and tests, it was found that the fractures observed in components of the nose landing gear occurred due to overload. It was not found any component incompatible with the manufacturer's specifications and there were no contaminants in the fluids, except for dust residues collected during the runway excursion.

It was also found that the components of the brake and directional systems showed no evidence of abnormalities prior to the accident that could compromise their normal operation.

1.17 Organizational and management information.

The aircraft belonged to Sterna Airlines Ltd., a company dedicated to air cargo transportation. At the time of the accident, it was based in Brasilia - DF.

The operational activities with the PR-STN had started in mid-2016, being the only aircraft available for air operations.

Approximately 40 days before this accident, the company started to provide services in support of the Post Office Company, performing daily flights, from Monday to Friday, on the SBRF / SBGR / SBRF route, always at nighttime.

According to the data obtained, Sterna had four professionals qualified to act as commander, three copilots and four flight engineers.

The pilots had already flown in other companies throughout their professional career. The operator reported that previous work experience was one of the requirements adopted for staff selection.

All crewmembers had the required training to operate the A300-B4-203. The pilot and copilot involved in this accident had conducted flight simulator training before commencing their operational activities at the company.

Some crewmembers also performed administrative duties, performing activities related to operations management and organization of the schedule, as well as those related to aircraft maintenance, instruction and flight safety.

Because it is a small company, many communications between the different teams flying the aircraft were reported to take place informally, mostly through phone messages or social media groups.

There was no system for access to general information and it was not common to hold face-to-face meetings.

In the perception of the crew, the company had a good management regarding flight safety and strived for compliance.

As reported, Sterna Airlines had set operating standards and, according to respondents, crews in the execution of air operations respected these parameters.

However, flight crews used to not recording occurrences in the aircraft logbook. In this case, although the crew had chosen to avoid using the left side, due to problems with previous flights, there was no notation regarding this failure.

1.18 Operational information.

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

The flight in question was considered routine for the crew and, as a rule, was performed at dawn.

As stated by the commander, the crew reported to take over the flight at around 0100 (UTC).

The first leg of his workday, taking off from SBRF to SBGR, was carried out without any complications. During the permanence of the aircraft on the ground in Guarulhos, the flight engineer was replaced, as predicted by the crew flight schedule.

On the second and last stage, the aircraft took off from SBGR to SBRF and the landing was made at around 0930 (UTC).

There were no discrepancies noted in the logbook. However, according to information provided by the crew, the left reverser had problems on previous flights (it did not close after use). This information was being passed on informally among the crew.

Another unrecorded piece of information that the commander claimed to know was that on a previous flight, the ground spoilers had not opened automatically as expected.

During the SBGR / SBRF flight leg, the commander was in the Pilot Monitoring (PM) function and occupied the left seat. The copilot performed the role of Pilot Flying (PF), occupying the right seat.

The METAR of the Gilberto Freyre Aerodrome, at 0900 (UTC) indicated that the wind direction was of 070° with 07kt intensity, which would result in a left crosswind as illustrated in the figure below.

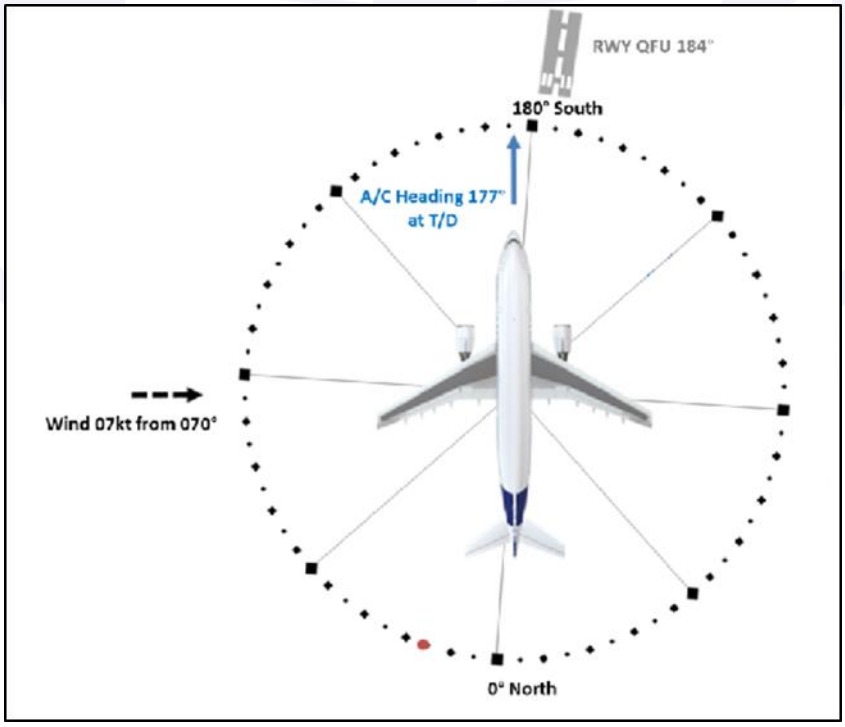


Figure 20 - Wind direction and head of the aircraft at the moment of landing.

During the final phase of the approach, the aircraft was with the Autopilot (AP) engaged, flaps fully deflected, and landing gears were lowered and locked at 500ft of Altitude Radio.

According to information from the crew, after landing, the ground spoilers did not open automatically and were activated by the commander.

The PM reported that, as the aircraft was decelerating more slowly than usual, he applied the brakes and a momentary deceleration occurred. He reported using steering to try to control the yaw of the aircraft.

The crew also reported that as soon as the nose landing gear hit the ground, the CONFIG audio message was activated.

According to interviewees, generally in this type of operation, there was no need to use the brake, because the aircraft slowed along the runway even without the use of braking system.

However, even after braking and steering, the crew found it difficult to control the aircraft and stop, resulting in the exit of the runway by its right side.

According to information gathered, in the months prior to this accident, there had been minor events with the aircraft, such as brake expansion and tire thermal fuse opening. About two months before this aeronautical occurrence, the commander had made a flight in which, during landing, there were malfunctions with the speed brakes and the spoilers.

According to the investigators, at that time, there was a longer delay in stopping the aircraft, but there were no other consequences. In addition, in the days prior to this accident, crews had experienced problems with the left reverse. Because of this, contrary to the Standard Operating Procedures, the pilots started to use only the right one.

In the course of the investigation, procedures were also reported that differed from the operating standard stipulated in the aircraft manual, such as delaying the reduction of throttles to IDLE during landing.

1.19 Additional information.

The RBAC No. 121 valid at the time of this accident provided, in its section 121.563 Reports of airplane irregularities, as follows:

> 121.563 Reports of airplane irregularities
>
> The pilot-in-command shall ensure that all flight malfunctions observed in flight are recorded in the aircraft maintenance logbook at the time of the first landing. Before each flight, the pilot-in-command shall ascertain the status of each irregularity registered in the record at the end of the preceding flight.

After this accident, Sterna Airlines stopped operating. As a result, information and documents that remained with the company that would be needed to elucidate some questions related to the investigation of the occurrence could not be obtained.

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a regular air cargo flight on the SBGR / SBRF leg.

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

The crew that took over the flight on 21OCT2016 was qualified and had already performed that same stage, on the same aircraft, on dates prior to the occurrence in question.

Based on the crew's statements, there were no interpersonal difficulties between them and everyone considered the flight commonplace, since the company began providing services in support of the Post Office Company about 40 days prior to this accident, they often performed that schedule.

The logbook did not contain records of technical problems with the aircraft. However, there was a culture in Sterna of conveying some information informally, through messages in social media groups, without formal annotations in the relevant documents.

This situation prevented the correct perception of the operating limitations of the aircraft, as well as the proper monitoring of its airworthiness condition, and did not comply with the provisions of RBAC No. 121 regarding the report of aircraft irregularities.

It is noteworthy that the crew consisted mostly of professionals who already had experience in the aviation field and enjoyed the confidence of the operator.

Thus, it is possible that the confidence placed in the crew's capacity has favored an informal environment conducive to the adoption of divergent practices from the anticipated procedures.

Under these circumstances, although this fact apparently did not contribute to the accident in question, the lack of record of the plane's irregularities in the logbook indicated a failure in the company's technical maintenance management processes, which prevented effective control about the airworthiness condition of the aircraft.

According to data recorded by the FDR, at 500 feet, indicated by the Radio Altimeter (RA), the aircraft was in stabilized approach, with the autopilot engaged and set for landing.

The crew was aware that, on previous flights, the left reverser had presented problems and, as a result, chose to perform the landing using only the one on the right. This is a non-respect of the Standard Operating Procedures, which should have been monitored and detected by the Flight Data Analysis department.

Although the SBRF METAR indicated that the landing would be made with a left crosswind, its intensity was of only 7kt, which would not imply extreme difficulty in controlling the aircraft.

Tests conducted on the brake components and directional systems led to the conclusion that they did not show any evidence of abnormalities that could have contributed to the loss of control in the landing run.

Based on the laboratory tests performed, it was concluded that the fractures observed on the nose landing gear occurred due to overload. Thus, its collapse probably occurred because of the effort due to misalignment in relation to the displacement of the aircraft, aggravated by the entry of the plane on soft ground. The breaking of this component possibly resulted in the pitch being reduced to -9.6°.

Thus, the hypothesis that a mechanical failure has contributed to this accident has been ruled out.

On the other hand, movements in opposite directions of the left and right power throttles, recorded by the FDR shortly after the touch, explained the difficulty encountered by pilots in keeping the aircraft within runway limits.

Since the thrusters reacted appropriately to the position of the throttle, the thrust asymmetry produced a resultant right-turn moment that was initially countered by using the full-scale rudder, differential braking, and left steering command.

However, 24 seconds after the touchdown, as the speed decreased, which reduced the rudder's aerodynamic efficiency, and thrust asymmetry reaching its maximum value,

maintaining the aircraft on the runway axis became difficult and it began a steeper turn to the right and out of the paved area.

Thus, the data recorded by the FDR led to the conclusion that the thrust asymmetry observed during almost the entire ground run was the root cause of the runway excursion.

From this finding, the investigation sought to explain how the aircraft could have come to this situation. It was initially assumed that such a discrepant condition of normal aircraft operation would probably not have been intentionally commanded by the pilots.

Thus, the possibility that the Autothrottle System has accelerated the left engine has been considered.

One of the hypotheses studied was that, by activating the reverse on the right engine, the PF had inadvertently commanded one of the go levers, which would result in the Autothrottle entering in the go-around procedure mode.

However, considering the information provided by Airbus that during a go-around procedure commanded by the go levers activation, the throttle progress rate would be in the order of + 8°/sec, this hypothesis was ruled out, since the speed of the left throttle movement recorded was about + 2°/sec.

A second possibility studied was that the ATS increased power to maintain a selected speed. However, since the PF was commanding the right engine to reverse, this action would have surpassed the Autothrottle command with respect to that engine, as described in FCOM 7.03.04.

According to the recorded data, the aircraft approached for landing with 132kt of speed.

Assuming the crew was using the autothrottle to maintain that speed during the final and had not disengaged it, the Speed Select Mode could still be running the engines during flare and landing, as the conditions for automatic cancellation had not been met in full, since:

- initially only the right main landing gear damper was recorded compressed;

- the AP was disengaged; and

- the power levers have not been reduced to IDLE at the 20ft (RA) intersection.

This hypothesis seemed to corroborate the fact that the left engine started to accelerate when the aircraft was with 128kt, which would be exactly the tolerance limit of the Speed Select Mode, as reported by FCOM 7.03.04.

In this scenario, it would be possible that the Autothrottle had accelerated the left engine, surprising the pilots who apparently only realized their performance when the runway excursion was already underway.

In this case, an inadequate use of the aircraft controls, particularly as regards the mode of operation of the Autothrottle in use and the non-reduction of power levers at the time of the touch down, would have led to a conflict between the pilots' intent to perform the landing and the automation logic active during the approach.

Although this was considered the strongest hypothesis to explain the sequence of events of this accident, it could not be proven, as the condition of the Autothrottle was not recorded by the FDR.

Regarding crew procedures during the landing, the habit of not reducing the throttle to the IDLE position when passing by 20ft height diverged from the procedures contained in the aircraft operation manual and prevented the automatic opening of ground spoilers, characterizing an inadequate evaluation of parameters related to aircraft operation.

This option to perform engine landings may also have been responsible for not automatically triggering the ground spoilers on a previous flight, as known to the PM, which may have led him to interpret that it was a failure and to control this equipment manually.

Thus, failure to comply with the procedures provided in the aircraft manual, contributed to placing the equipment in a condition that confused the crew, which expected the automatic trigger of the ground spoilers, which required additional pilot intervention (manual control) and may have made it difficult managing the circumstances that followed the touch.

It was not possible to record cabin crew interaction; however, it is possible that the reverser usage checklist provided in the A300 FCOM was not performed, as the left lever position was not realized until the runway excursion was imminent.

According to the statements gathered, the PM, realizing that the aircraft did not slow down and tended to exit to the right, became involved in his command and acted on the brakes and steering, leaving aside his main responsibility that would be to monitor systems and assist the PF in conducting the flight.

Such initiatives characterized an inefficiency in harnessing the human resources available to operate the airplane, particularly in relation to the management of tasks assigned to each crewmember and compliance with the principles of Crew Resource Management (CRM), and delayed the identification of the root cause of the behavior abnormality presented by the aircraft.

According to data recorded by the FDR, three seconds after the touch down, engine 1 lever was brought to maximum takeoff power and only after 34sec, during runway excursion, this lever was positioned at REV.

Given this scenario, it was possible to infer that the crew only became aware of what could be happening to the aircraft at that time. Thus, the time lapse between the airplane abnormal behavior and the action taken, indicated that there was an inaccurate assessment of the situation, in which the adverse condition was not immediately recognized by the crew.

In addition, the informality characteristic of that organizational context, as well as possible performance without the use of the checklist, may have favored a lowering of the crew's situational awareness level, which contributed to an inaccurate perception of the events experienced at that time of the flight.

Finally, the triggering of the CONFIG audio message that the crew claimed to have heard as soon as the nose landing gear hit the ground, probably occurred due to inconsistencies in the aircraft configuration at that time, as the TL1 had been advanced to MAX TAKE-OFF POWER while the flaps were at 25°, a position used for landing.

3. CONCLUSIONS.

3.1 Facts.

a) the pilots had valid Aeronautical Medical Certificates (CMA).

b) the pilots had valid A300 aircraft type (which included the A300-B4-203 model) and IFRA Ratings.

c) the pilots were qualified and had experience in that kind of flight;

d) the aircraft had a valid Airworthiness Certificate (CA);

e) the aircraft was within the weight and balance parameters specified by the manufacturer;

f) the weather conditions were favorable for the flight;

g) according to the FDR data recorded at 500 feet, indicated by the Radio Altimeter (RA), the aircraft was in stabilized approach, with slats, flaps and landing gear properly configured for landing;

h) the power levers were not reduced to IDLE during the flare to landing;

i) after the touch down, engine lever 1 (TL1) was pushed to maximum takeoff power and engine lever 2 (TL2) was simultaneously adjusted to idle and then to reverse;

j) the aircraft drifted to the right and left the runway;

k) the left main landing gear tires have left marks on the paved area indicating that their brakes were heavily demanded;

l) the overlapping marks left by the nose landing gear on the paved area indicated that, due to the trajectory described by the airplane, its wheels were skidding;

m) the nose landing gear collapsed and retracted after the plane entered the grassy area, due to overload fractures;

n) the tests conducted on the components of the brake and directional systems allowed to affirm that they did not present abnormalities that could compromise their normal functioning before this accident;

o) the aircraft has suffered substantial damage; and

p) all occupants left unharmed.

3.2 Contributing factors.

- **Control skills – undetermined.**

Inadequate use of aircraft controls, particularly as regards the mode of operation of the Autothrottle in use and the non-reduction of the IDLE power levers at touch down, may have led to a conflict between pilots when performing the landing and the automation logic active during approach.

In addition, the use of only one reverse (on the right engine) and placing the left throttle lever at maximum takeoff power resulted in an asymmetric thrust that contributed to the loss of control on the ground.

- **Attitude – undetermined.**

The adoption of practices different from the aircraft manual denoted an attitude of non-compliance with the procedures provided, which contributed to put the equipment in an unexpected condition: non-automatic opening of ground spoilers and asymmetric thrust of the engines.

These factors required additional pilot intervention (hand control), which may have made it difficult to manage the circumstances that followed the touch and led to the runway excursion.

- **Crew Resource Management – a contributor.**

The involvement of the PM in commanding the aircraft during the events leading up to the runway excursion to the detriment of its primary responsibility, which would be to monitor systems and assist the PF in conducting the flight, characterized an inefficiency in harnessing the human resources available for the airplane operation.

Thus, the improper management of the tasks assigned to each crewmember and the non-observance of the CRM principles delayed the identification of the root cause of the aircraft abnormal behavior.

- **Organizational culture – a contributor.**

The reliance on the crew's technical capacity, based on their previous aviation experience, has fostered an informal organizational environment. This informality contributed to the adoption of practices that differed from the anticipated procedures regarding the management and operation of the aircraft.

This not compliance with the procedures highlights a lack of safety culture, as lessons learnt from previous similar accidents (such as those in Irkutsk and Congonhas involving landing using only one reverse and pushing the thrust levers forward), have apparently not been taken into account at the airline level.

- **Piloting judgment – undetermined.**

The habit of not reducing the throttle lever to the IDLE position when passing at 20ft diverged from the procedures contained in the aircraft-operating manual and prevented the automatic opening of ground spoilers.

It is possible that the consequences of this adaptation of the procedure related to the operation of the airplane were not adequately evaluated, which made it difficult to understand and manage the condition experienced.

- **Perception – a contributor.**

Failure to perceive the position of the left lever denoted a lowering of the crew's situational awareness, as it apparently only realized the real cause of the aircraft yaw when the runway excursion was already underway.

- **Decision-making process – a contributor.**

An inaccurate assessment of the causes that would justify the behavior of the aircraft during the landing resulted in a delay in the application of the necessary power reduction procedure, that is, repositioning the left engine power lever.

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:

Nil.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On March 29th, 2021.