

COMANDO DA AERONÁUTICA
CENTRO DE INVESTIGAÇÃO E PREVENÇÃO DE
ACIDENTES AERONÁUTICOS



FINAL REPORT
A - 084/CENIPA/2020

| | |
|--------------------|------------------|
| OCCURRENCE: | ACCIDENT |
| AIRCRAFT: | PT-TMO |
| MODEL: | A319-132 |
| DATE: | 09JUL2020 |



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 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 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 09JUL2020 accident with the A319-132 aircraft model, registration PT-TMO. The accident was classified as “[OTHR] Others/With Personnel in Flight”.

During the descent, a maneuver was performed in manual flight to reduce speed, generating a positive load factor of 2.23438 G.

A flight attendant, who was standing on the galley, suffered fractures in the fibula and left ankle.

The aircraft was undamaged.

The flight attendant suffered serious injuries.

All other 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 and manufactured) was designated for participation in the investigation.



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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

| | |
|-------|--|
| ANAC | Brazil's National Civil Aviation Agency |
| APH | Pre-Hospital Care |
| BEA | Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile |
| CA | Airworthiness Certificate |
| CAS | Calibrated Air Speed |
| CG | Center of Gravity |
| CMA | Aeronautical Medical Certificate |
| CVR | Cockpit Voice Recorder |
| FCOM | Flight Crew Operation Manual |
| FDR | Flight Data Recorder |
| IFR | Instrument Flight Rules |
| IFRA | Instrument Flight Rating - Airplane |
| G | Gravity Acceleration Force |
| MMO | Maximum Operating Mach |
| PF | Pilot Flying |
| PIO | Pilot-Induced Oscillation |
| PHTLS | Prehospital Trauma Life Support |
| PLA | Airline Pilot License - Airplane |
| PM | Pilot Monitoring |
| P/N | Part Number |
| PPR | Private Pilot License – Airplane |
| SBAR | ICAO Location Designator - Santa Maria Aerodrome, Aracaju - SE |
| SBGR | ICAO Location Designator - Governador André Franco Montoro Aerodrome, São Paulo - SP |
| S/N | Serial Number |
| TPR | Aircraft Registration Category of Regular Public Transport |
| UTC | Universal Time Coordinated |
| VMO | Very High Frequency |

1. FACTUAL INFORMATION.

| | | |
|------------|---|--|
| Aircraft | Model: A319-132 | Operator: TAM Airlines S/A |
| | Registration: PT-TMO | |
| | Manufacturer: Airbus S.A.S | |
| Occurrence | Date/time: 09JUL2020 - 2027 UTC | Type(s): [OTHR] Others |
| | Location: Out of the Aerodrome | |
| | Lat. 23°25'55"S Long. 046°28'09"W | Subtype(s): With Personnel in Flight |
| | Municipality – State: Guarulhos – SP | |

1.1 History of the flight.

The aircraft took off from the Santa Maria Aerodrome (SBAR), Aracaju - SE, to the Governador André Franco Montoro Aerodrome (SBGR), São Paulo - SP, in order to transport personnel, with five crewmembers and seventy-seven passengers on board.

During the descent, a maneuver was performed in manual flight to reduce speed, causing a maximum positive load factor of 2.23438 G, which culminated in the fall of a crewmember.

The flight continued to the destination and the landing was made without any other abnormalities.

The aircraft was undamaged.

The flight attendant suffered serious injuries and the other occupants of the aircraft left unharmed.

1.2 Injuries to persons.

| Injuries | Crew | Passengers | Others |
|----------|------|------------|--------|
| Fatal | - | - | - |
| Serious | 1 | - | - |
| Minor | - | - | - |
| None | 4 | 77 | - |

1.3 Damage to the aircraft.

There was no damage to the aircraft.

1.4 Other damage.

None.

1.5 Personnel information.

1.5.1 Crew's flight experience.

| | Flight Hours | |
|-----------------------------------|--------------|----------|
| | Pilot | Copilot |
| Total | 9.255:00 | 7.344:14 |
| Total in the last 30 days | 18:00 | 17:05 |
| Total in the last 24 hours | 05:15 | 05:15 |
| In this type of aircraft | 8.255:00 | 6.344:14 |
| In this type in the last 30 days | 18:00 | 17:05 |
| In this type in the last 24 hours | 05:15 | 05:15 |

N.B.: The data related to the flown hours were obtained through the pilots' statements.

1.5.2 Personnel training.

The pilot took the PPR course at the Amarais Aeroclub, Campinas – SP, in 1995.

The copilot took the PPR course at the Itapolis Aeroclub - SP, in 1999.

1.5.3 Category of licenses and validity of certificates.

The pilot and the copilot had the PLA License and had valid A320 aircraft type Rating (which included the A319-132 model) and IFRA Rating.

All flight attendants had valid A320 aircraft type Rating.

1.5.4 Qualification and flight experience.

The pilots were qualified and had experience in the type of flight.

1.5.5 Validity of medical certificate.

The pilots and the flight attendants had valid CMAs.

1.6 Aircraft information.

The aircraft, serial number 4563, was manufactured by Airbus S.A.S, in 2011, and it was registered in the TPR category.

The aircraft had valid Airworthiness Certificate (CA).

The technical maintenance records were updated.

The last inspection of the aircraft, the “Daily/Weekly Check” type was carried out on 07JUL2020 by the maintenance organization of the Company, in Guarulhos - SP, with the aircraft having flown 22 hours and 15 minutes after the inspection.

The last inspection of the aircraft, the “Check 400FH” type was carried out on 02JUL2020 by the maintenance organization of the Company, in Guarulhos - SP, with the aircraft having flown 49 hours and 09 minutes after the inspection.

1.7 Meteorological information.

In the search of the meteorological information, no elements were found that could indicate the presence of a turbulence area at the destination Aerodrome or on the route.

1.8 Aids to navigation.

Nil.

1.9 Communications.

Nil.

1.10 Aerodrome information.

The occurrence took place out of the Aerodrome.

1.11 Flight recorders.

The aircraft was equipped with a digital Honeywell Flight Data Recorder, model SSFDR (solid state memory), Part Number (P/N) 980-4700-02, Serial Number (S/N) 17801, with a capacity of 256 words (each word had 12 bits), thus carrying out a reading of 256 x 12 every 1 second (words per second).

In addition, it was also equipped with a digital Cockpit Voice Recorder (CVR) Allied Signal, model SSCVR (solid state memory), P/N 980-6022-01, S/N 0526, with capacity for two hours of recording, with 3 channels of 30 minutes in high quality and 1 channel of standard quality with 2 hours of audio.

The main recorded data information follows:

a) 20:26:55 and 20:26:59

- at 20:26:55, the aircraft was crossing 18,800ft and the tailwind started to decrease from 33kt;
- the selected speed was 336kt and the Calibrated Speed (CAS) was increasing from 326kt;
- As the CAS was approaching its target, the autopilot commanded a pitch-up order to slow the speed increase. Consequently a nose-up movement occurred, and the rate of descent was approximately 6,250ft/min.

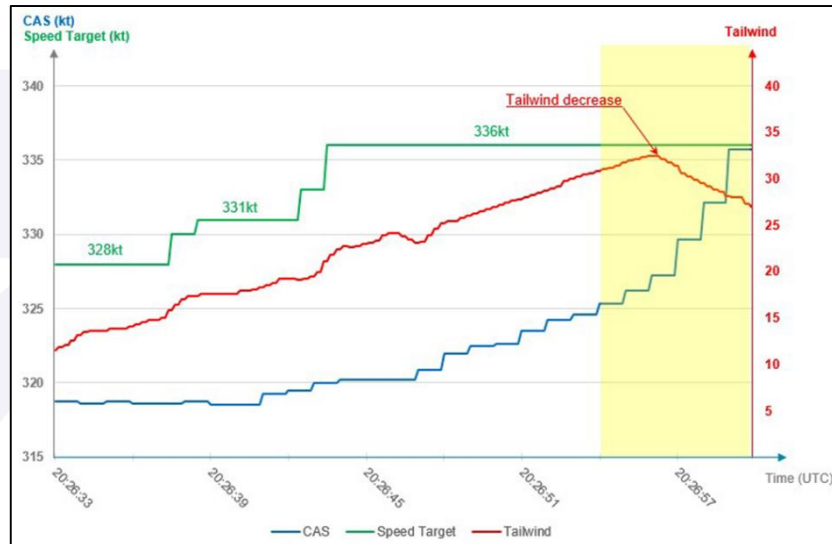


Figure 1 - Graphical information of the CAS, selected speed and tailwind recorded through the FDR between 20:26:55 and 20:26:59.

a) 20:27:00 and 20:27:05

- at 20:27:00, the aircraft was crossing 18,300ft and the tailwind was still decreasing;
- at 20:27:03, the autopilot was changed to Vertical Speed mode and the auto thrust (A/THR) was changed to Speed mode;
- the CAS was still increasing and the speed was selected for 329kts and after 2 seconds for 326kts this value remained for about 40 seconds;
- the pitch angle was still increasing; and
- the rate of descent was going from 5,200ft/min to the selected rate of descent (4,400ft/min).

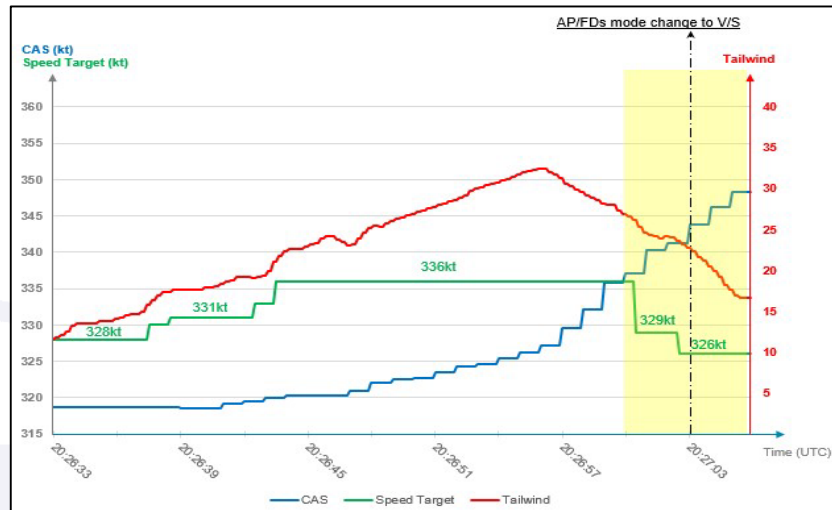


Figure 2 - Graphical information of the CAS, selected speed, and tailwind recorded through the FDR between 20:27:00 and 20:27:05.

a) 20:27:06 and 20:27:26

- at 20:27:06, the aircraft was crossing 17,800ft with the tailwind decreasing, when the CAS reached the VMO value (350kts). The maximum registered value of the CAS was 351kts;
- the autopilot was disconnected and the use of the sidestick in its entirety was recorded for the “full back-stick” position;
- the load factor increased to the maximum of +2.23G.
- immediately after entering the sidestick, the use of the rudder was also recorded;
- the application of the commands lasted approximately 20 seconds;
- the load factor decreased from +2.23G to about +0.82G;
- CAS stabilized around 346kts; and
- around 20:27:06 and for the 40 seconds that followed, the use of the rudder was recorded. The side load factor increased to +0.15G, then stabilized around +0.1G.

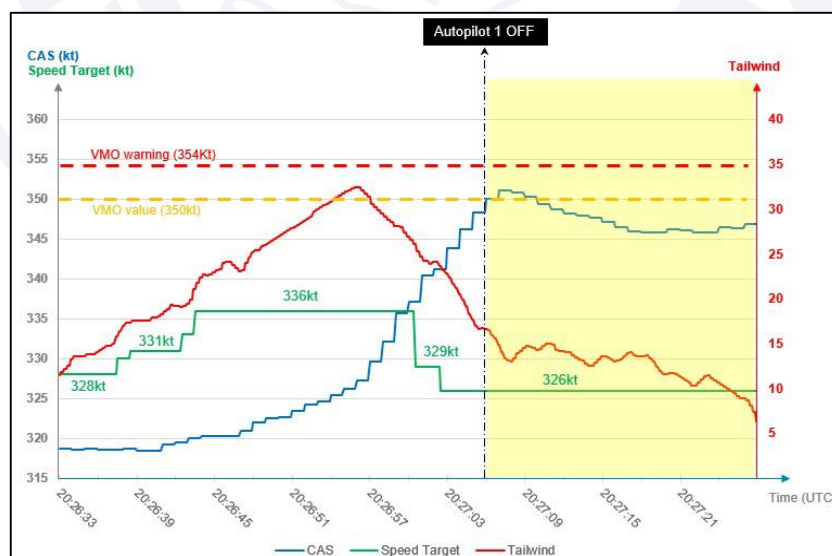


Figure 3 - Graphical information of the CAS, selected speed, and tailwind recorded through the FDR between 20:27:06 and 20:27:26.

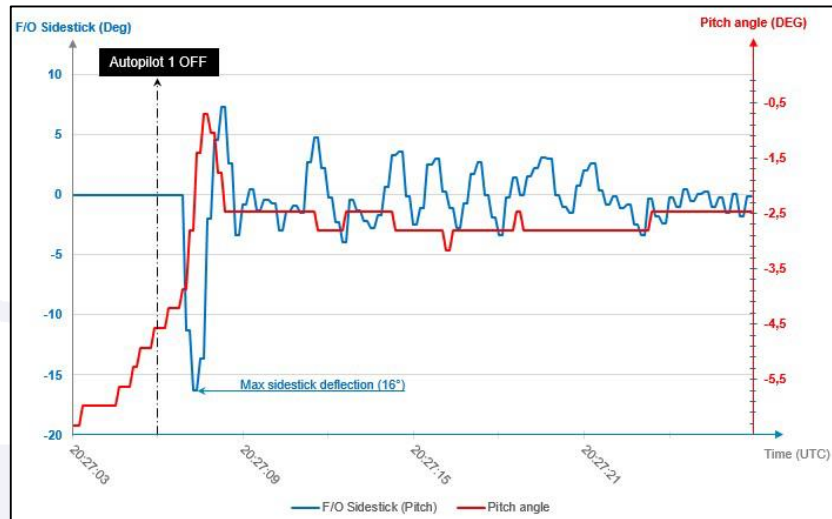


Figure 4 - Graphical information on the use of the sidestick and the aircraft's pitch angle.

The recorded data allowed the joint analysis of the CAS parameters evolution, selected speed, and speed trend, as shown in Figure 5.

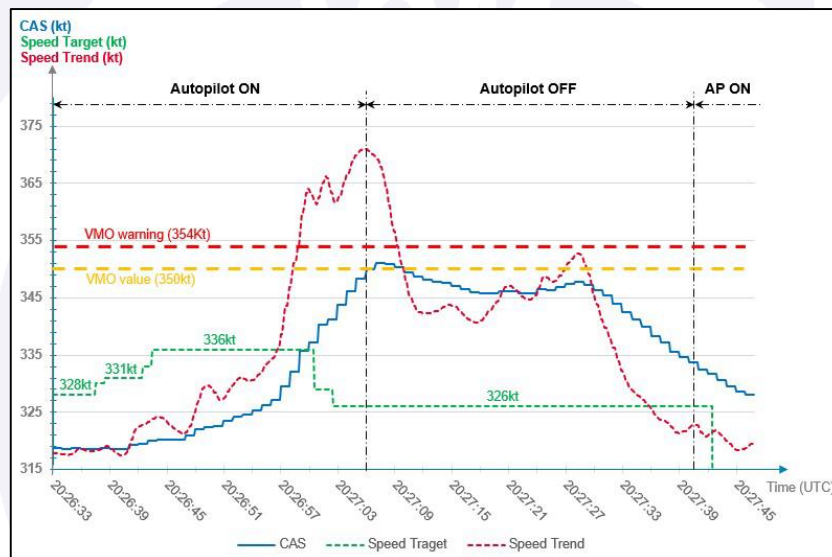


Figure 5 - Evolution of the CAS parameters, selected speed, and speed trend.

1.12 Wreckage and impact information.

Nil.

1.13 Medical and pathological information.

1.13.1 Medical aspects.

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

The flight attendant suffered a fracture in her left ankle, requiring surgical intervention.

1.13.2 Ergonomic information.

Nil.

1.13.3 Psychological aspects.

The commander had been with the company for approximately fifteen years. According to his report, he felt rested for the performance of the flight.

Due to the pandemic, he took only one month of unpaid leave, having returned to the flight schedule in July. However, in his evaluation, his flight spacing was longer than the period considered normal.

For him, to be experiencing a pandemic did not negatively imply the operation of the aircraft. He stated that the pilots had more time to prepare the airplane and the main concern was with the hygiene of the aircraft and the correct use of protective equipment.

About the flight, he said he held a short briefing with the crew. As for the division of legs, he reported having chosen to take the flight from SBAR to SBGR, due to the possibility of strong wind that would be present in this path. However, he said the flight was smooth, without turbulence.

According to his report, the event took place very quickly. They were prepared to land on runway 27L, but the control changed the runway to 27R. As a result of this modification, which required changes and checking procedures, he passed the commands to the copilot and started checking the changes made. At that time, the aircraft was above the ramp and the copilot made the corrections that he deemed appropriate.

The commander said that he did not see when the copilot increased the speed, as he was focused on checking the changes in procedures, and that, with the movement of the aircraft, he was startled. Then he stopped what he was doing to check what happened and took back the commands.

When asking the copilot to contact the flight attendants to find out about the situation in the passengers' cabin, they learned that a flight attendant had been injured.

Then, they made the necessary coordination to resolve the situation with the air traffic control, since they tried several contacts with the company but didn't get any answer.

The copilot had been with the company for thirteen years, three as a cabin crewmember and ten as a pilot. According to his report, he was rested and calm for the flight.

In view of the necessary changes in procedures, due to the control request, he received the aircraft from the commander at altitude above the ramp (he did not know how much to specify), and chose to raise the speed by increasing the rate of descent.

According to the copilot, this strategy was considered more daring and required greater vigilance in the parameters during its execution. It was usually adopted when the route was clear and with a "clear sky", as was the day in question.

When he took command of the aircraft, he increased the speed to 340kt, which was very close to the established limit. As the speed continued to increase, the copilot tried to control it by modifying the parameter inserted in the autopilot. However, as he was unsuccessful, he opted to manually take over the commands, using sidestick, to slow down. According to his report, the aircraft's response was "aggressive", that is, the nose went up very quickly and "galloped", as if it were a clear sky turbulence.

After the event, the commander regained control of the aircraft and the copilot began to make the necessary arrangements for the attendance of the fallen flight attendant.

According to the pilots, when a commander passed the aircraft's commands with it above the ramp, it was common for the copilot to try to make the correction before passing the commands back.

Both had already flown together before and reported that they had good dynamics in flight, as there was an openness to talk and a taste for aviation was common among them.

The copilot reported that he had only two months (April and May) of unpaid leave due to the pandemic, returned in June to the roster, but made few flights in that period until the event in question.

The flight attendants' chief had been with the company for more than 10 years. She had been on unpaid leave for three months and the occurrence flight was her first after her return.

Regarding the flight, she said she was calm, until the moment when she felt a different and unexpected movement, as if she had gone through a "big wave". She also reported that, even though she was seated at the front of the aircraft, she felt the movement more aggressively than a turbulence. At the moment, the fasten seat belts warning was turned off.

With the copilot's questioning about the situation of the passengers' cabin, she verified and identified that the flight attendant who was at the rear of the aircraft was down.

She immediately made arrangements for the flight attendant to be accompanied by the other flight attendant, since she was not in a position to walk or sit, and took over the duties in the passengers' cabin, preparing for the landing that was nearby.

The flight attendant who was part of the team had been with the company for about 12 years. He did not take leave during the pandemic period, but due to the cancellation of flights, he flew little (around 3 to 4 flights in total) from March to July.

Like the other crewmembers, he reported that the flight was smooth until the moment of the occurrence. The cabin atmosphere was good, with the team well connected.

He was asked to go to the cockpit and shortly after leaving there he felt the swing, a fact that led him to hit his arm on a surface of the galley. According to him, everything happened very fast.

Then he asked passengers to keep their seat belts fastened and when he checked the cabin, together with the chief, he spotted the fallen flight attendant.

As instructed by the chief flight attendant, he accompanied the flight attendant, who complained a lot of pain.

He informed that he had already gone through a similar situation of overspeed in flight, but there was recovery without any changes.

The flight attendant who had an accident on the flight had been with the company for 13 years, having worked for three years on the ground and ten years on the flight. She did not take leave during the pandemic period.

Moments before the incident, she was happy when she learned, from the commander's speech to the passengers, that the landing would be ahead of schedule.

The flight was very smooth until the moment she got up to accompany a child who had gone unaccompanied to the toilet. After the child sat down, the aircraft moved. She thought it would be a clear sky turbulence.

At that moment, according to her perception, it was as if her feet had been glued to the floor of the plane and, with the weight of her body on her bones, she fractured them.

According to her, she received all the support of the crew.

Just like her, the other crewmembers said that the team showed to be well to fly and there was a good working atmosphere.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

According to the medical care report, the APH team was called at 17h39min (local time) and arrived at 17h43min.

Rescuers found the crewmember lying near the rear boarding / landing doors on the aircraft floor and being supported by her cabinmates. They started the trauma immobilization procedures, according to the PHTLS protocol, immobilizing the cervical spine, the two lower limbs and, finally, they performed the immobilization on a spine board (Figure 6).



Figure 6 - Long spine board for immobilization available in Basic and Advanced Support Ambulances, in SBGR.

The flight attendants reported that the team that provided the assistance requested the help of one of the flight attendants to perform the removal of the injured crewmember, using the ladder positioned at the rear of the aircraft.

However, such a request was denied, as, in the crew's assessment, it would not be a safe way to make the disembarkation and could cause a fall, causing greater injuries to the flight attendant.

Although the aircraft was parked on a finger, the width of the corridor made it impossible for the patient to travel to the front door for disembarking.

Therefore, the Ambulift (Figure 7) was requested for the disembarkation of the patient and, according to the report of the crew, it took approximately 25 minutes to reach the place where the aircraft was parked.



Figure 7 - Image of an Ambulift equipment used for boarding and disembarking passengers, with mobility difficulties, in SBGR.

Upon consulting the Aerodrome administration, it was informed that LATAM requested the Ambulift at 18h06min (local time) and that it was in position at 18h10min.

The crewmember was removed from the aircraft, immobilized on a spine board, using the Ambulift.

1.16 Tests and research.

Nil.

1.17 Organizational and management information.

With the crisis caused by the coronavirus pandemic, in early March, in Brazil, the company's air operations were reduced by 95% until the month of May and showed a small growth in the following months.

To face the situation, it was offered the employees the possibility of asking for unpaid leave for up to three months and, for those who continued to fly in that period, there would be a reduction in wages, along with a reduction in the working hours. For these people, regular training was maintained.

In addition, at the same time, a permanent salary reduction proposal was in progress, associated with a decrease in the workforce, in case it was not approved. The LATAM joined, along with the rest of the LAN group companies, the US Chapter 11 - financial reorganization process, in the USA, in order to ensure that the company, which faced the need for restructuring, managed to do it in a sustainable way, from the financial point of view.

Because of this context, according to the information collected, the company was experiencing a bad organizational climate. Although it maintained an open communication channel, employees were not comfortable with the proposed salary adjustment.

Employees reported that they perceived the company's Safety sector to be more proactive and discerning, and that the Operations Sector was passing on a greater volume of information.

However, they reported that there was no flexibility to negotiate the company's proposals. Live transmissions were made, via digital social networks, to inform employees about the progress of the proposals and the company's situation.

According to the data obtained, there were employees who were distressed when watching these "lives", fearing the possible consequences, such as the dismissal or significant reduction of the salary permanently. Because of this situation, there was a veiled fear of making a mistake, during the operation of the aircraft, and thus providing a motivation to be fired from the company.

All training of the company's crew was carried out according to the schedule, without reservations. In simulator training conducted by the copilot in the last three years, he showed satisfactory technical proficiency, including in manual piloting.

1.18 Operational information.

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

The crewmembers took over the aircraft with a recurring indication of excess pressure in the cabin, which occurred after landing. The warning was spurious, however, the crews carried out the recommended procedure for the failure.

The aircraft took off from SBAR, at 1823 (UTC), to SBGR.

The aircraft commander was Pilot Flying (PF) and the copilot was Pilot Monitoring (PM). Both reported that there was no turbulence and that the "weather was fine" for the flight to take place.

The crew prepared the aircraft for the descent and landing on the RWY 27L and carried out the MOXEP 1B arrival briefing for the RWY 27L ILS.

However, when transferred to São Paulo Control, the procedure was changed to the RWY 27R and was allowed to fly directly to the ANSUG position.

The modification of the runway and the directive of shortening the arrival, left the aircraft above the ideal ramp, being necessary, in the evaluation of the crew, to adopt the correction, which was initiated by selecting the Open Descend mode by the PF.

The PM carried out the necessary programming modifications, due to the change of procedure, and received the commands from the PF aircraft that started checking the letters and the programming carried out.

Upon taking over the commands, the PM increased the speed to 340kts, seeking a faster ramp correction. However, the speed did not stabilize when reaching the selected parameter and continued to increase. The PM tried, without success, to reduce the speed through the autopilot, since the VMO was reached.

The aircraft's FCOM provided information that the "Maximum Operating Speed" was M 0.82 for MMO and 350kts for VMO, as shown in Figure 8.

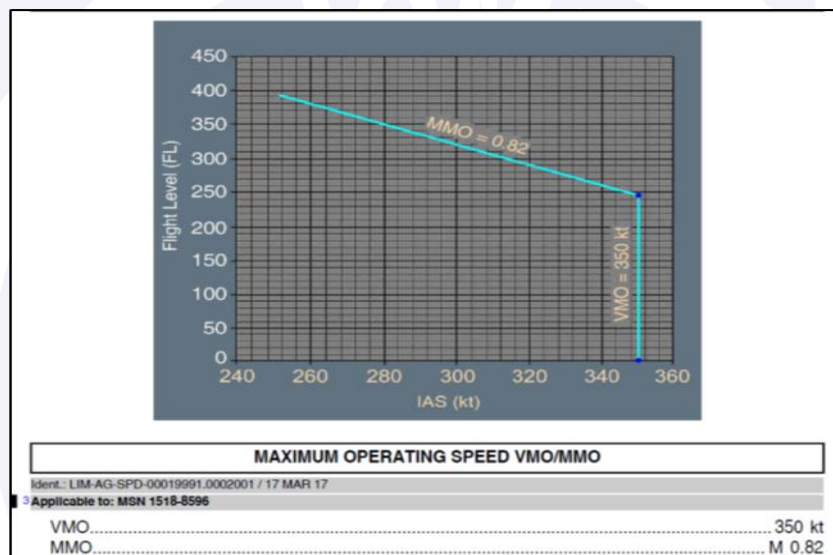


Figure 8 - Presentation of MMO and VMO information on the aircraft's FCOM.

Even though the aircraft's VMO is 350kts, the Overspeed warning appears only when the airspeed reaches VMO+4kts (354kt). According to the recorded data, the Overspeed warning did not occur during the event, with 351kt being the maximum CAS recorded.

As described by the copilot, when he was not successful in reducing speed, he chose to use the Sidestick and pitch up the aircraft, however, there was a very sharp movement, which generated a PIO.

The PIO phenomenon is caused by the inadequate interaction between pilot and aircraft. This occurs when the pilot inadvertently commands a series of corrections in opposite directions, trying to correct the aircraft's reaction to the previous command.

In the FCOM, the aircraft had different described load factor G limitations for the configurations described as "Clean Configuration" and "Other Configurations" as described in Figure 9.

| FLIGHT MANEUVERING LOAD ACCELERATION LIMITS | |
|---|----------------|
| Ident.: LIM-AG-F_CTL-00020793.0001001 / 17 MAR 17 | |
| Applicable to: ALL | |
| Clean configuration..... | -1 g to +2.5 g |
| Other configurations..... | 0 g to +2 g |

Figure 9 - Description of the load factor limitations.

The aircraft did not exceed the acceleration limits described in the FCOM.

The commander took over the aircraft's controls and asked the PM to check with the cabin crew if there were any complications.

As soon as the communication with the flight chief was established, the PM was informed that a crewmember was injured. The Fasten Seat Belt warning was not active during the start of the descent and was not required.

Coordination was carried out in order to take priority in landing and, in order to make available the necessary means for medical assistance in advance.

The procedure and the landing, after the event, were carried out without further complications.

After landing, prompt support was provided and the injured crewmember was removed.

The procedure and recommendations associated with an Overspeed situation were described in the Flight Crew Techniques Manual (FCTM) and presented prevention and recovery techniques.

Among the actions, to prevent an Overspeed, the autopilot and the auto thrust should be and remain engaged, since they reduce the variations of the vertical load factor.

The selected speed should be reduced to prevent this type of event, seeking to increase the margin for the VMO and, if the speed was approaching the VMO, the speed brakes should be extended to the most appropriate position for the situation.

In turn, for recovery from an Overspeed, the autopilot and auto thrust should be and remain engaged and the speed brakes should be distended. The crewmembers should still monitor the reduction of thrust to idle.

Also, according to the FCTM, the autopilot would automatically disengage only if the overseed event was "severe".

1.19 Additional information.

After a research on the CENIPA website, it was verified the existence of the Final Report A-132/CENIPA/2018, which occurred with the PT-MXA aircraft, on 06AUG2018, where a crewmember fell and suffered a twist in the left ankle, with posterior fracture of the distal tibia with bone sliding and soft tissue enlargement, after the aircraft was subjected to a factor of 1.6 G.

Item 1.18 - Operational information, from the Final Report A-132/CENIPA/2018, contained the following text:

"The flight took off from Brasilia with delay and continued without abnormalities, being operated by the copilot. After feeling a mild turbulence, the commander consulted, through the intercom, one of the flight attendants who was at the bottom of the aircraft if it was necessary to activate the Fasten Seat Belt warning, and the answer was negative."

Item 2 - Analysis, of Final Report A-132/CENIPA/2018, contained the following text:

"There were no Aerodrome warnings or any other message that reported adverse weather conditions or the existence of areas of severe or moderate turbulence at the

destination Aerodrome or on the route, which led to the conclusion that there was no contribution of this factor to the occurrence.

The descent was being performed with the power selected for Idle and in Open Descend. When crossing 18,000ft, the copilot selected the speed for 340kt. The aircraft sought to capture the speed and, passing 14,800ft, exceeded the selected speed.

Before the autopilot initiated an action to correct the speed, the pilots acted simultaneously on the sidesticks, causing a result load of 1.6 G...”

1.20 Useful or effective investigation techniques.

Nil.

2. ANALYSIS.

It was a regular passenger flight between the SBAR and SBGR Aerodromes. The commander and the copilot had already flown together, the relationship between them was friendly, conducive to the proper management of abnormal situations that could potentially arise during the flight.

Although the organizational climate at the company was not favorable at the time of the accident, due to the consequences triggered by the pandemic, which generated anxiety and tension in the crew in general, this situation did not identify any interference of this situation in the performance of the flight crew.

During the aircraft receiving procedures, the pilots became aware that there was a recurring indication of excess pressure in the cabin, which occurred after landing. However, the warning was spurious and, when it occurred, the pilots performed the procedures provided in the checklist without any impact on the operation of the aircraft.

There were no observed meteorological conditions en route and at the destination Aerodrome on the part of the crew that could have interfered or caused changes on this flight. That said, it was concluded that there was no contribution of meteorology to the occurrence.

The commander was operating the aircraft (PF) and the copilot was in the PM condition. The flight proceeded normally and, before starting the descent, the pilots carried out the preparatory briefing for the arrival MOXEP 1B for the RWY 27L.

The descent started with the power selected for Idle in Open Descend, since the PF considered that the aircraft was slightly above the ramp.

Approximately 1 minute after the beginning of the descent, the São Paulo approach control changed the arrival to the RWY 27R runway, which made the aircraft even higher upon arrival. However, according to the crew's report, in a normal condition within the aviation context.

Due to the change in arrival, the PM inserted the new procedures and, shortly afterwards, the aircraft's commands were passed on to the copilot, so that the commander could check the new information inserted.

The copilot, at that moment in the aircraft's controls, increased the speed to 340kt in an attempt to find the altitude of the arrival ramp. However, the aircraft's attitude became excessively pitched down and exceeded the selected speed. He tried to reduce it through the autopilot without success and, when the speed reached VMO, he used the sidestick.

The command application in the sidestick was broad and generated a positive load factor of 2.23438 G. The input was translated into a performance different from that expected by the copilot, with pitching down and pitching up movements in an attempt to stabilize the aircraft.

The amplitude used caused a deflection of -16.1219 in the Stick Right, close to the VMO, suggesting little familiarization of the copilot with manual flight in this condition, which may have contributed to the Pilot-Induced Oscillation.

It is necessary to consider that, according to the FCTM, when trying to control the speed below the VMO, the speed brake should have been used and that, when reaching the VMO, the autopilot should not have been disengaged.

Although the copilot has gone through all the company's training, without reservations about his performance, it is possible that the training offered to avoid and recover from an Overspeed was not enough.

It is also important to note that the FCTM describes that, in severe Overspeed situations, the autopilot may uncouple, therefore, the crew should have proficiency in manual flight. The action, through the sidestick, in the condition in which they were, culminated in the use of the commands in their full amplitude, causing a great oscillation of the aircraft's attitude.

Although the copilot has gone through all the company's training, without restrictions on his performance, it is possible that the training offered for manual flight did not allow sufficient conditioning to achieve the necessary efficiency to act in the condition they were in, culminating in the use of commands in an amplitude that caused the wide oscillation of the aircraft's attitude.

As soon as the movement was controlled by the copilot, the commander resumed the controls and requested that contact be made with the cabin crew, in order to check that everyone was fine. At that point, the pilots were informed that a flight attendant had fallen and was injured.

The load factor to which the aircraft occupants were subjected was the only possible event to be correlated with the fall of the crewmember and, consequently, with her injuries. The crewmember was on her feet, the seat belt warning was not on and neither was she required to be at that time of the flight.

The event showed similarities to what happened, on the date of 06AUG2018, with another aircraft of the company, according to the Final Report A-132/CENIPA/2018.

In both events, there were no significant weather conditions, the descent was being performed in Open Descend and the selected speed, just a few moments before reaching the VMO, was 340kt.

Such similarity suggests that, although the selection of Open Descend was a descent mode that could be used by the crew, the operation in this way required a high level of attention on the part of the aircraft crew, since there was little margin of speed until reaching the VMO.

Therefore, although the copilot was aware of the need for greater monitoring of the parameters during the operation in that condition, the fact of having assumed the functions of operating the aircraft and monitoring at the same time that the commander carried out the verification of the arrival procedures, can have impaired the quality of the attention spent at the moment. It was therefore not possible to anticipate the aircraft's behavior in order to avoid the event.

Therefore, it is possible to conclude that, when using the Open Descend mode, it is necessary to seek ways to mitigate the risks to the aircraft occupants, whenever speeds close to the VMO are used.

In none of the events was there evidence of any abnormal functioning of the aircraft's automation. What was evident in the present report was that the operation of the autopilot may have led the aircraft to achieve a very pitch down attitude, which is difficult to correct

only due to a new speed selection. In both events, the wide use of the sidestick caused a load factor that participated in the accidents.

After the incident, one of the crewmembers started to accompany the victim until the moment of landing in SBGR. The other cabin activities were performed by the other crewmembers.

The landing took place without any other abnormalities. The team that performed the pre-hospital care, after immobilizing the victim on the spine board, requested assistance from one of the crewmembers to disembark the victim by the ladder positioned at the rear of the aircraft.

However, this request was denied, as, in the crewmember's evaluation, it would not be a safe means to make the disembarkation and could cause a fall, causing greater injuries to the flight attendant, thus an Ambulift was requested for the disembarkation of the patient.

3. CONCLUSIONS.

3.1 Facts.

- a) the pilots and flight attendants had valid CMAs;
- b) the pilots had valid A320 aircraft type Rating (which included the A319-132 model) and IFRA Ratings;
- c) the flight attendants had valid A320 aircraft type Rating;
- d) the pilots and flight attendants were qualified and had experience in the kind of flight;
- e) the aircraft had valid CA;
- f) the aircraft was within the weight and balance limits;
- g) the technical maintenance records were updated;
- h) the weather conditions were favorable for the flight;
- i) during the descent for landing in SBGR, the aircraft exceeded the selected speed of 340kt;
- j) the copilot acted manually in the sidestick to correct the speed;
- k) the biggest deflection recorded, through the FDR, in the Stick Right Position Pitch, was -16.1219;
- l) the aircraft was subjected to a load factor of 2.23438 G, according to the FDR record;
- m) a crewmember was injured during the event;
- n) the aircraft landed at SBGR without further consequences;
- o) the sick flight attendant was disembarked from the aircraft by an Ambulift;
- p) on the date of 06AUG2018, an accident occurred with similar characteristics, according to Final Report A-132/CENIPA/2018;
- q) the aircraft was not damaged;
- r) one crewmember suffered serious injuries and the other crewmembers and passengers left unharmed.

3.2 Contributing factors.

- **Control skills – a contributor.**

The wide use of the sidestick, resulting in a reaction of the aircraft different from that expected by the pilot, caused a positive load factor that contributed to the fall of the crewmember.

- **Attention – undetermined.**

It is presumably that there has been a reduction in the level of attention devoted to monitoring the parameters after selecting Open Descend, since, at that time, the copilot was also in charge of the aircraft's controls and that there was little margin for speed until the VMO was reached.

- **Training – undetermined.**

Despite the satisfactory performance presented by the copilot in the training offered by the company, it is possible that an adequate level of conditioning for manual flight has not been reached, since the amplitude used in the controls, caused a deflection of -16.1219 in the Stick Right, close to the VMO, suggesting little familiarization with this condition, which may have contributed to the PIO.

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-084/CENIPA/2020 - 01

Issued on 09/21/2022

Work with the company TAM Airlines S/A (LATAM Brazil), in order to that operator verifies the feasibility of inserting, in its training programs for pilots in A319/320 aircraft, familiarization with the concept of Pilot-Induced Oscillation, so that they are able to recognize and adopt the appropriate actions in face of the phenomenon.

A-084/CENIPA/2020 - 02

Issued on 09/21/2022

Work with the A320 aircraft operators to adopt practices that ensure the safety of passengers and crewmembers during descents in Open Descend/Speed, using speeds that approach VMO.

5. CORRECTIVE OR PREVENTATIVE ACTION ALREADY TAKEN.

None.

On September 21th, 2022.