

COMMAND OF AERONAUTICS
AERONAUTICAL ACCIDENT INVESTIGATION AND
PREVENTION CENTER



FINAL REPORT
A - 049/CENIPA/2014

<u>OCCURRENCE:</u>	ACCIDENT
<u>AIRCRAFT:</u>	PR-MHK
<u>MODEL:</u>	A-320-214
<u>DATE:</u>	5 MAY 2008



NOTICE

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

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

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

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

This Report does not resort to any proof production procedure for the determination of civil or criminal liability, and is in accordance with item 3.1, 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.

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SYNOPSIS

This is the Final Report of the 5 May 2008 accident with the A320-214 aircraft, registration PR-MHK. The accident was classified as collision with obstacle on the ground.

During the pushback, the aircraft nose gear hit a mechanic that was monitoring the procedure on the ground.

The mechanic sustained serious injuries to his left leg.

The aircraft sustained no damage.

An accredited representative of the French BEA (*Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile*) was designated for participation in the investigation.

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

ANAC	(Brazil's) National Civil Aviation Agency
ATS	Air Traffic Services
BA	Technical Bulletin
CCF	Aeronautical Medical Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CHT	Technical Qualification Certificate
CVR	Cockpit Voice Recorder
FDR	Flight Data Recorder
IFR	Instrument Flight Rules
INFRAERO	Brazilian Airports Infrastructure Enterprise
Lat	Latitude
Long	Longitude
MLTE	Airplane Multi-engine Land
PCM	Commercial Pilot (Airplane category)
PLA	Airline Transport Pilot (Airplane category)
PPR	Private Pilot (Airplane category)
RTA	Aircraft Technical Report
SBSL	ICAO location designator –São Luís Aerodrome
SIPAER	Aeronautical Accidents Investigation and Prevention System
UTC	Coordinated Universal Time
VFR	Visual Flight Rules

AIRCRAFT	Model: A-320-214 Registration: PR-MHK Manufacturer: AIRBUS	Operator: TAM Linhas Aéreas S/A
OCCURRENCE	Date/time: 5 MAY 2008 / 22:05 local time Location: São Luís Aerodrome (SBSL) Lat. 02°35'13"S – Long. 044°14'10"W Municipality – State: São Luís – MA	Type: Collision with obstacle on the ground

1 FACTUAL INFORMATION

1.1 History of the occurrence

The aircraft started the pushback procedure on the apron of SBSL after being authorized by the control tower, and in coordination (via interphone) with the maintenance mechanic, who was monitoring the procedure outside the aircraft.

While the aircraft was being pushed, the engines' start-up sequence was started.

At the end of the push-back, when the tow-bar was being released, the nose landing gear hit the mechanic, whose leg got stuck under the nose gear tire.

The procedure was discontinued, the engines were shut down, and the aircraft was lifted so that the mechanic's leg could be released.

1.2 Injuries to persons

Injuries	Crew	Passengers	Third parties
Fatal	-	-	-
Serious	-	-	01
Minor	-	-	-
Uninjured	06	90	-

1.3 Damage to the aircraft

Nil.

1.4 Other damage

Nil.

1.5 Personnel information

1.5.1 Information on the crew

HOURS FLOWN		
	PILOT	COPILOT
Total	3,900:35	2,544:55
Total in the last 30 days	75:15	75:05
Total in the last 24 hours	05:00	05:00
In this type of aircraft	572:40	145:15
In this type in the last 30 days	75:15	75:05
In this type in the last 24 hours	05:00	05:00

NB.: Data provided by the operator.

1.5.1.1 Professional formation

The pilot did his Private Pilot Course (Airplane category) in the *Aeroclube de Belo Horizonte*, State of Minas Gerais

The copilot did his Private Pilot Course (Airplane category) in the *Aeroclube do Rio Grande do Sul*, State of Rio Grande do Sul.

1.5.1.2 Validity and category of licenses and certificates

The pilot had an Airline Transport Pilot license (Airplane category). His Airplane Multi-engine Land technical qualification and IFR rating were valid.

The copilot had a Commercial Pilot license (Airplane category). His Airplane Multi-engine Land technical qualification and IFR rating were valid.

1.5.1.3 Qualification and flight experience

The pilots had qualification and enough experience for the flight.

1.5.1.4 Validity of the medical certificate

The pilots had valid aeronautical medical certificates.

1.6 Aircraft information

The aircraft (SN3058) was manufactured by Airbus in 2007.

Its airworthiness certificate was valid

The airframe and engine logbooks had up-to-date records.

The last inspection of the aircraft (type "48 hours Daily Check") was made by the TAM Airlines workshop, and the aircraft flew 20 hours after the inspection.

The last overhaul of the aircraft (type "300 hours") was made by the TAM Airlines workshop, and the aircraft flew 80 hours after the overhaul.

There were no records of breakdowns or abnormalities in the Aircraft Technical Report (RTA) related either to the communication system (interphone) between the pilots and the mechanic or to the aircraft braking system.

1.7 Meteorological information

There were no restrictions to visibility, with scattered clouds.

Weather conditions were VMC.

1.8 Navigational aids

Nil.

1.9 Communications

Communications between the aircraft and ATC units were satisfactorily established, based on the recordings of the Cockpit Voice Recording (CVR).

The communications via interphone between the aircraft crew and the mechanic who monitored the push back were also satisfactory, as far as the audio quality and clarity of the messages are concerned.

1.10 Aerodrome information

The aerodrome is public (under the administration of INFRAERO), operating VFR and IFR during day- and night-time.

In interviews after the accident, the crew reported that the apron had illumination deficiencies, which required extra care during night-time operations, and that the pavement had a declivity.

1.11 Flight recorders

The FDR and VCR data were read out and analyzed.

1.12 Wreckage and impact information

Nil.

1.13 Medical and pathological information

1.13.1 Medical aspects

No evidence was found relative to the contribution of physiological aspects to the accident.

1.13.2 Ergonomic information

Nil.

1.13.3 Psychological aspects

1.13.3.1 Individual information

The mechanic did his professional formation course in 1998. In 1999, he worked as a trainee for Transbrasil Airlines. In 2001, he became an employee of Varig Airlines, and stayed in the company for one year and a half.

In 2003, he was hired by TAM Airlines.

At the time of the accident, he had not been taking medicine or drinking alcoholic beverages.

According to information provided by him, he had not been experiencing any personal or family problems, and had begun his work shift after having gotten enough rest.

1.13.3.2 Psychosocial information

The mechanic considered his work environment excellent, and had a good relationship with his workmates.

He also said that he had a good relationship with the crews to whom he provided support, including the crew he was working with at the moment of the accident.

1.13.3.3 Organizational information

The mechanic said that the airline company policy was to provide the required technical courses and give support to the professional.

According to the mechanic, he did not feel overworked, since there was not much to do in a work shift. Only one mechanic was on duty per shift, on account of the small numbers of company aircraft in SBSL.

The shift during which the accident occurred had started at 18:00 and was expected to finish at 24:00. It was considered the most uneventful shift, since there were only two flights, one at 19:30 and another at 22:00.

On the day before the accident, he had worked in the same shift, and there had been nothing to report.

Relatively to the job to be done, the mechanic said that there was a checklist to be complied with, appropriate for demands of the activity.

1.14 Fire

There was no fire.

1.15 Survival aspects

Nil.

1.16 Tests and research

Nil.

1.17 Organizational and management information

Nil.

1.18 Operational aspects

The maneuver known as pushback, utilized in the majority of airports, has the purpose of removing aircraft from their parking stand and positioning them in a safe place, from which they can start taxiing.

Aircraft usually start up engines concomitantly with pushback.

For the maneuver to be carried out, there is coordination between the aircraft and the control tower, as well as between the flight crew and the mechanic in charge of monitoring the operation.

The communication between the crew and the mechanic supporting the maneuver on the ground is made via interphone.

In addition to the supporting mechanic, there is participation of the driver of the tug which pushes the aircraft.

The standardization of the procedures related to the pushback were defined by the Work Instruction ITT-23-02-02 "Aircraft Pushback and Towing Operations" and by the ITT-23-02-01 "Communication between Maintenance and Cockpit at Pushback", both of which known to the pilot.

From the analysis of the CVR recordings, the pushback procedures were performed normally on the day of the occurrence, and in accordance with the prescriptions of the documents aforementioned.

However, after the start-up of the second engine (left one), the mechanic should have requested the aircraft pilot to apply the parking brakes (PRK BRK) upon completion of the pushback, as prescribed in the Work Instructions, so that he could disconnect the tow-bar from the nose gear.

Below, it is possible to see the translated communication between the mechanic and the flight crew, in the moments that preceded the disconnection of the tow-bar (as prescribed by ITT-23-02-02):

- a) **Maintenance:** “*pushback in progress*”;
- b) **Maintenance:** “*pushback completed*”;
- c) **Maintenance:** “*activate parking brake*”; and
- d) **Cockpit:** “*parking brake activated*”.

Only after confirmation of the PRK BRK application, would the mechanic be allowed to remove the tow-bar and complete the other procedures aimed at releasing the aircraft for starting taxi.

The procedure has the objective of guaranteeing that the mechanic and the aircraft are safe while the mechanic is working, since everyone is certain that the aircraft will not move.

From the analysis of the recordings, it was observed that the mechanic never requested the crew to apply the parking brake, and proceeded with the removal of the tow-bar, without letting the crew know about his intention. The crew was awaiting his request.

The aircraft captain, upon noticing the delay on the part of the mechanic, questioned him (“*Maintenance, what is the matter?*”) and received no answer.

Noticing that something was wrong, the captain made an attempt to communicate with the mechanic anew. Again, no answer was received.

Only after sighting the tug moving away from the aircraft and noticing that the aircraft was still moving because of the running engines and pavement declivity, did the pilot realize that something abnormal had happened.

Then, the captain opened the cockpit window and heard the tug driver shouting outside. He immediately applied the brakes to stop the aircraft, and shut down the engines.

The aircraft ended up stopping when the mechanic’s leg was still under the nose wheel tire.

The aircraft was within the weight and center of gravity limits specified by the manufacturer.

1.19 Additional information

As soon as he learned of what had happened, the captain shut down the aircraft engines and told the copilot to request medical assistance for the mechanic.

It took the ambulance approximately six minutes to arrive at the scene.

1.20 Utilization of other investigation techniques

Nil.

2 ANALYSIS

The mechanic who provided support to the aircraft pushback had enough experience to perform the required tasks.

He had been working as a mechanic for ten years. During the last five years he had been working for the airline company, and had done all the courses and trainings required for performing the prescribed procedures.

There were two work instructions dealing with the standardization of pushback procedures to be performed by the mechanics: ITT-23-02-02 "Aircraft Pushback and Towing Operation" and ITT-23-02-01 "Communication between Maintenance and Cockpit at Pushback". Both were known to the mechanic, who applied them routinely.

No matter how simple the standardized procedures were, the deviation from compliance with them contributed directly to the occurrence of the accident, since they were important safety mechanisms aiming at guaranteeing the physical integrity of the mechanic, as well as the safety of the aircraft and its occupants.

It was not possible to determine the reason why the mechanic did not comply with the standardized actions prescribed, since he had done all the courses and had had all the training necessary for performing the task. No external factor was identified that could have been detrimental to his performance.

It is likely that, due to his performing that type of activity on a routine basis, the mechanic may have inadvertently improvised the procedure, failing to comply with safety-related items.

Despite the fact that it did not contribute directly to the occurrence, the inadequate lighting of the SBSL apron and parking area was reported by the crew. On account of this report, the Safety of the airline company issued a technical bulletin recommending more attention should be paid the ones involved during ground operations.

It took the medical service ambulance approximately six minutes to arrive at the accident site. The response-time was considered excessive, mainly if one considers that the aircraft was on the apron and, therefore, not far from the passengers' terminal.

3 CONCLUSIONS

3.1 Facts

- a) The pilots had valid aeronautical medical certificates;
- b) The pilots had valid technical qualification certificates (CHT);
- c) The pilots had qualification and enough experience for the flight in question;
- d) The pilot had valid qualifications;
- e) The mechanic was an experienced professional, and had done all the courses and trainings required for performing the prescribed procedures;
- f) There were no records of failures or abnormalities in the aircraft technical report (RTA) related to either the communication or braking systems of the aircraft;
- g) The mechanic's work shift was from 18:00 to 24:00, and only two movements of aircraft were programmed;
- h) The aircraft started pushback uneventfully;
- i) Upon completion of the towing, the mechanic began to remove the tow-bar without advising the aircraft crew;
- j) The mechanic did not comply with the procedures prescribed in the ITT's;

k) The aircraft started moving forward on account of its operating engines and of the terrain declivity

l) When the aircraft captain noticed that something was wrong, he activated the aircraft brakes and shut down the engines;

m) The aircraft stopped when the tire was on top of the mechanic's left leg;

n) The aircraft sustained no damage; and

o) The mechanic was seriously injured..

3.2 Contributing factors

3.2.1 Human Factor

3.2.1.1 Medical Aspect

Not a contributor.

3.2.1.2 Psychological Aspect

3.2.1.2.1 Individual information

a) Attention – a contributor

The mechanic, despite being experienced and knowledgeable of the work instructions, failed to comply with the procedures prescribed for the situation.

b) Memory – undetermined

It is possible that the mechanic may have had a lapse of memory during the sequence of his work and, consequently, forgot to perform the standard procedure, which he was knowledgeable of. However, it was not possible to detect what might have triggered such situation.

3.2.1.2.2 Psychosocial information

Not a contributor.

3.2.1.2.3 Organizational information

Not a contributor.

3.2.2 Operational Factor

3.2.2.1 Concerning the operation of the aircraft

a) Airport infrastructure – undetermined

The apron and parking area of SBSL had deficient lighting, which may have harmed the quality of operations and ramp services provided by supporting personnel, and may have contributed to the worsening of the mechanic's performance.

b) Support personnel – a contributor

The mechanic failure to request the crew to apply the parking brake upon completion of the pushback contributed to the occurrence.

The mechanic failed to comply with the instructions contained in the ITT-23-02-01 and ITT-23-02-02.

3.2.2.2 Concerning ATS units

Not a contributor.

3.2.3 Material Factor

3.2.3.1 Concerning the aircraft

Not a contributor

3.2.3.2 Concerning ATS technology systems and equipment

Not a contributor.

4 SAFETY RECOMMENDATION

A measure of preventative/corrective nature issued by a SIPAER Investigation Authority or by a SIPAER-Link within respective area of jurisdiction, aimed at eliminating or mitigating the risk brought about by either a latent condition or an active failure. It results from the investigation of an aeronautical occurrence or from a preventative action, and shall never be used for purposes of blame presumption or apportion of civil liability.

In accordance with the Law n°12970/2014, recommendations are made solely for the benefit of the air activity operational safety.

Compliance with a Safety Recommendation is the responsibility of the holder of the highest executive position in the organization to which the recommendation is being made. An addressee who judges to be unable to comply with a Safety Recommendation must inform the CENIPA on the reason(s) for the non-compliance.

Safety Recommendations made by the CENIPA:

To the National Civil Aviation Agency (ANAC):

A-049/CENIPA/2014 – 001

Issued on 29/09/2014

Work in conjunction with the INFRAERO, aiming at conducting an evaluation of the SBSL apron and parking area lighting system so as to guarantee both air and ramp operations safety in the aerodrome, and review the Aerodrome Emergency Plan of São Luís Airport, in order to evaluate the efficiency of the medical service response to emergencies on the apron.

A-049/CENIPA/2014 – 002

Issued on 29/09/2014

Publicize the lessons learned from this investigation relative to apron operations, alerting the airline companies as to the risks resulting from non-compliance with work instructions and safety procedures by the crews and supporting personnel in this phase of the aircraft operation.

5 CORRECTIVE/PREVENTATIVE ACTION ALREADY TAKEN

–The airline company issued a Technical Bulletin (BA238), relative to ground operations in SBSL, warning the crews of the deficiencies of the apron lighting, instructing them to take the necessary precautions in order to guarantee the safety of the referred operations

–The airline company issued a Technical Bulletin (BA-239) relative to communication during pushback operations, alerting the crews as to the compliance with the standard phraseology when talking with mechanics at pushback, being assertive in the conduction of the prescribed procedures, in order to guarantee operation safety and

effectiveness. The bulletin also emphasizes the procedures prescribed for pushback completion and application of the parking brake.

6 DISSEMINATION

- (Brazil's) National Civil Aviation Agency (ANAC)
- Brazilian Airports Infrastructure Enterprise - INFRAERO
- TAM Airlines
- BEA (Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile)

7 APPENDICES

Nil.

On 29 / 09 / 2014.