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GABINETE DE PREVENÇÃO E INVESTIGAÇÃO DE ACIDENTES COM AERONAVES
GPIAA

FINAL INCIDENT INVESTIGATION REPORT

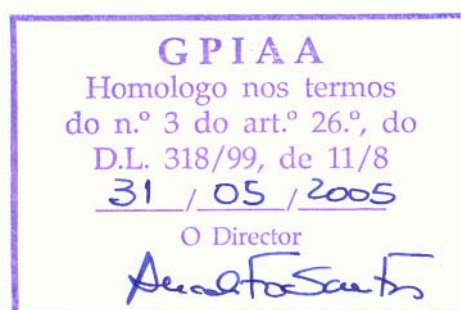
SKYSERVICE LIFE GUARD

LEARJET 35A

C-GRFO

LISBON AIRPORT

25 NOVEMBER 2004



INDEX

	Page
INDEX	2
FOREWORD	3
ABBREVIATIONS	4
SYNOPSIS	5
1. FACTUAL INFORMATION	6
1.1 History of the flight	6
1.2 Injuries to persons	7
1.3 Damage to the aircraft	7
1.4 Damage to third parties	7
1.5 Personnel Information	7
1.6 Aircraft information	8
1.7 Meteorological information	9
1.8 Aids to navigation	9
1.9 Communications	9
1.10 Airport information	9
1.11 Flight recorders	10
1.12 Information on local of the incident	10
1.13 Medical and pathological information	11
1.14 Fire	11
1.15 Survival aspects	11
1.16 Tests and research	11
1.17 Organizational and management	11
1.18 Additional information	12
1.19 Useful or effective investigation techniques	12
2. ANALYSIS	13
2.1 Investigation of the aircraft tires remains	13
2.2 Goodyear Aviation analyses	14
3. CONCLUSIONS	15
3.1 Findings	15
3.2 Causes	16
4. SAFETY ACTIONS	17

FOREWORD

This report expresses the technical conclusions determined by G.P.I.A.A. Investigation Commission about facts and causes involved in this occurrence.

According to Annex 13 to the International Civil Aviation Organization Convention (Chicago 1944), to the Council Directive nr. 94/56/EC (21st November 1994) and to nr. 3, 11th article of Decree-Law 318/99 (11th August), it is not the object of this report to determine blame or liability but solely to identify causes and deficiencies capable of undermining flight safety and to gather information for preventing further occurrences of similar circumstances.

GLOSSARY

AD	Airworthiness Directive
ATP	Airline Transport Pilot
FAA	Federal Aviation Administration
FOD	Foreign Objects Debris
GPIAA	<i>Gabinete de Prevenção e Investigação de Acidentes com Aeronaves</i> (Portuguese Air Accident Investigation Branch)
IR	Instrument Rating
Kts	Knots
LR	Learjet
RWY	Runway
SOA	<i>Serviços de Operações Aeroportuárias</i> (Airport Operations Service)
MEL	Multiengine License
MU	Mitsubishi
SEL	Single Engine License
SW	Swearingen (Fairchild Metro)

SYNOPSIS

On 25th November, at 09:05 p.m. Learjet 35 C-GRFO, with six people on board, initiated a take-off roll to perform an ambulance flight from Lisbon Airport (Portugal) to Dorval Airport in Montreal (Quebec/Canada), via Santa Maria Airport (Azores/Portugal) and St. John's (Newfoundland/Canada).

At a speed of approximately 125 kts, the Captain decided to abort the takeoff due to the blowout of two main gear tires. The aircraft skidded along the runway on the right wheel rims, and at the end of the airstrip, at a low speed, the aircraft veered to the left and had a runway excursion.

There were no personal injuries and no aircraft fire.

The Airport Operations Services (SOA) at LPPT reported this accident to the GPIAA Investigator-on-Call (IOC) at 09:37 p.m. on the day of the accident. The IOC arrived at the accident site a short time later and initiated the investigation.

1. FACTUAL INFORMATION

1.1 *History of the flight*

On 25th November, at 21:05 hours¹, Learjet 35A C-GRFO was about to perform an ambulance flight from Lisbon Airport (Portugal) to Dorval Airport in Montreal (Quebec/Canada), with intermediate en-route stops at Santa Maria Airport (Azores/Portugal) and St. John's (Newfoundland/Canada).

The aircraft, with two pilots, three medical attendants and one patient on board, taxied out Delta Apron to the holding point for RWY 03. The wind was 310 at 6 kts and the runway was dry.

The take-off roll was initiated at 21:05 and according to the pilots everything was normal and the aircraft accelerated without any abnormalities.

When the aircraft reached the speed of approximately 125 kts, the Captain, who was the PF, heard something hitting underneath the fuselage and thought the aircraft run over FOD lying on the runway. Unbeknownst to the pilots, one of the two right-hand main gear tires had blown out.

Because the aircraft speed was below V_1 (take-off decision speed) the Captain decided to abort the take-off: he brought the thrust levers to idle, began braking and extended the spoilers. The aircraft's drag chute was not used.

During the abort, the other right-hand main gear tire also blew and the aircraft skidded along the runway on the right wheel rims.

The aircraft decelerated down the runway and stayed close to the centerline. At the end of the airstrip run, at a low speed, the aircraft veered to the left and departed the runway onto the grass, stopping at about 6 meters (approximately 20 feet) from the runway edge.



¹ The time in this report refers to UTC hours.

1.2 Injuries to persons

INJURIES	CREW	PASSENGERS	OTHERS	TOTAL
FATAL	-	-	-	-
SERIOUS	-	-	-	-
MINOR	-	-	-	-
NONE	5	1	-	6

1.3 Damage to the aircraft

Substantial damage, limited to the right-hand main landing gear:

- Both tires were completely destroyed;
- The wheel rims and brake assemblies were severely eroded;
- Hydraulic lines were destroyed and other components were also damaged.



The aircraft belly was also inspected and there was no evident damage.

1.4 Damage to third parties

None.

1.5 Personal Information

1.5.1 Pilot-in Command

License FAA ATP issued 8th October 2003.

Ratings Airplane MEL/SEL. LR35, LR36, MU2

Medical Certificate First Class, dated 28.07.2000.

Flying Experience 8500 hrs, 2500 on type

1.5.2 First Officer

License FAA ATP issued 10th November 2004.

Ratings Airplane MEL/SEL, C425, C500, LR 35, MU2, SW2

Medical Certificate First Class, dated 28.07.2000.

Flying Experience 5954 hrs, 155 on type.

1.6 Aircraft Information

1.6.1. Airframe

Manufacturer Gates Learjet Corp.

Model 35A

Serial Nr. 100

Year of Manufacture 1993

Registration C-GRFO

Year of Manufacture 1993

Manufacture Serial Nr 100

No / Type of Engines Two / Garrett TFE 731-2-2B. 3,500 lbs. thrust each.

Total time /landings 19,087.0 hours / 11,875 landings.

Registered owner Skyservice Lifeguard

Operator / User Skyservice Lifeguard

The aircraft had a valid Certificate of Airworthiness.

1.6.2 Skyservice Maintenance

The aircraft had been maintained by the owner's maintenance organization, which has maintained Skyservice's aircraft for more than 10 years. As a regular action, the

maintenance organization performs daily inspections (DI) and registers the aircraft's tire pressures and serviceability condition in the DI check sheet.

On C-GRFO, the tire pressures were checked on the day of departure and registered them on DI sheet as correct values.

1.7 Metrological information

Winds 310 degrees at 06 knots, sky clear, visibility more than 10 kilometres.

1.8 Aids to navigation

Not involved.

1.9 Communications

Not relevant to the investigation.

1.10 Airport Information

1.10.1 Lisbon International Airport

- a. RWY 03 (QFU 023°) is 3805 meters long and 45 meters wide. Take-off run available (TORA) is 3715 meters, take-off distance available (TODA) is 3815 meters and the accelerate-stop distance (ASDA) is 3715 meters. The runway threshold elevation is 331 feet (101 meters).
- b. The *Serviços de Operações Aeroportuárias*² (SOA) is in charge for foreign object (FOD) inspection of runways. According with Annex 14, the Lisbon Airport runways are subject to inspections for FOD.

Lisbon SOA carries out four scheduled inspections at sunrise, at 09:00 hrs, at 15:00 hrs and at sunset. Additional inspections are also carried out anytime that SOA considers them necessary.

The last runway inspection before the incident was a scheduled inspection carried out at 17:10 hrs (sunset).

² Airport Operation Services.

The runway was inspected following the incident. No FOD was found on the runway, other than the remains of the right-hand main landing gear tires, rim debris and brake-assembly pieces.



Next day, at sunrise time, the inspection included the areas adjacent to the runway edges. No foreign objects were found.

1.10.2 *The Anti-Skid System*

According to the flight crew the anti-skid system was tested before take-off and functioned normally.

The sensors were inspected later on by the maintenance crew repairing the aircraft and were found to be functioning normally.

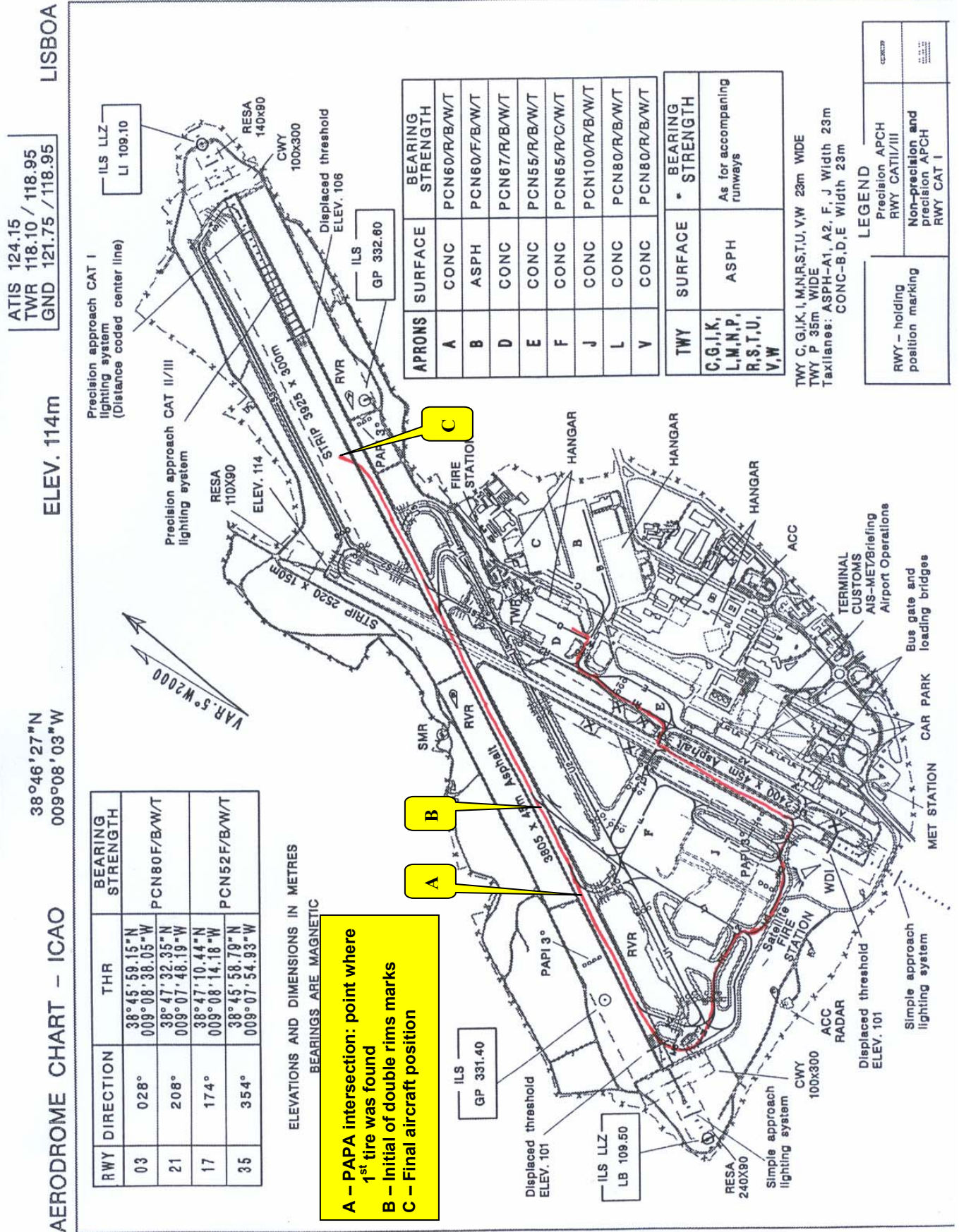
1.11 **Flight recorders**

Not analyzed.

1.12 **Information on the local of the incident**

1.12.1 *Tire Remains and Runway Traces*

The distance between the points where the blown tire was found and where the rims marks began to be visible on runway surface was 330 feet. From this point on, a large amount of small tire rubber and metal debris was found along the runway. The distance, between the point where the rims marks began and the position where the aircraft came to a complete stop, was about 4800 feet.



1.13 Medical and pathological information

Both pilots possessed valid medicals and indicated no restrictions on their capabilities.

There were no personal injuries to all aircraft occupants.

1.14 Fire

No fire broke out as a result of the incident.

1.15 Survival aspects

The airport firefighters responded immediately and the patient was quickly evacuated to the hospital.

1.16 Tests and research

1.16.1 Investigation of the aircraft tires

- I. The main landing gear tires were manufactured by Goodyear Tire & Rubber Co., Danville, USA. The type was Goodyear Flight Eagle P/N 178K23-5 (12 ply), size 17.5x5.75-8.
- II. In 2001, FAA issued an Airworthiness Directive applicable to all Learjet Model 23, 24, 25, 28, 29, 31, 35, 36, and 55 series airplanes.

This AD directed an inspection of all main gear tires of these models in order to find out if there were any of the following kinds of tires installed and to replace them: Goodyear Flight Eagle, with the part number 178K23-5 within the serial number range of 0148xxxx through 0152xxxx.

Due to faults in manufacturing, separations of tire tread from the main landing gear tires could happen during take-offs and landings.

- III. The tire remains were sent to Goodyear to be analyzed.

1.17 Organizational and management information

Not considered relevant to the investigation.

1.18 Additional information

Not applicable.

1.19 Useful or effective investigation techniques

None.

2. ANALYSIS

2.1 *Investigation of the aircraft tires remains*

Evidence revealed that one of the right-hand main gear tires blew out immediately after the PAPA intersection, where two pieces of same tire were found. That was the point where the first tire thread separated.



A

Part **B** fits perfectly inside of Part **A**.



B

It is assumed that one or both of those tire pieces hit the bottom of the aircraft and that this was the sound that the captain heard.

A few seconds and 330 feet later (where rims marks began), the second tire blew out, as the brakes were applied.

From this point on, for about 4800 feet, both right main gear rims skidded along the runway, leaving traces on the asphalt, until the aircraft had the runway excursion.



2.2 *Goodyear Aviation analyses*

Based on inspection of tires remains, Goodyear Aviation observed:

- a. Evidence of excessive heating such as bluing of the rubber, reverted rubber and charred nylon;
- b. Presence of liner wrinkles on sidewall and shoulder regions;
- c. X-break appearance on both tire remains.

3. CONCLUSIONS

3.1 Findings

- 3.1.1. The Investigation Commission determined that the first tire thread separated, hit underneath the aircraft fuselage, and then the tire blew out;
- 3.1.2. Some seconds later, the second tire also blew out, as the brakes were applied, due to supplementary loads and the brakes overheating;
- 3.1.3. Goodyear Aviation concluded that *“it might have excessive sidewall flexing and heat generation in tires from running underinflated, which probably led to ply cords breaking and the tires weakening until the blowouts occurred”*;
- 3.1.4. In the before flight exterior inspection, the crew checked visually the tires and found them with normal pressure;
- 3.1.5. Goodyear Aviation also concluded that *“the #4 (and possibly #3 tire as well) suffered impact damage, as shown by the x-break. It cannot be confirmed whether the impact occurred before or after the blowouts. It is quite possible that the impact initiated the blowouts on the already weakened tires”*;
- 3.1.6. The SOA carried out the last runway scheduled inspection at 17:10 hrs (sunset);
- 3.1.7. No FOD was found on the runway surface (inspected immediately after the incident and on the annexed areas to the runway edges the day after) that could support a hypothesis of the first tire having impacted a foreign object;
- 3.1.8. The aircraft anti-skid system was operational and functioned normally;
- 3.1.9. The use of the drag chute would have assisted in slowing down the aircraft, and could have probably helped to minimize the damage to the right gear;

3.1.10. In 2001, Goodyear Flight Eagle tires, - the same P/N 178K23-5 (12 ply) - had manufacture problems that lead to several blowout tire episodes during landing and take-off phases, leading to an Airworthiness Directive;

3.1.11. The Investigation Commission finds the Goodyear hypothesis unlikely, specifically that both C-GRFO tires could have been under-inflated at same time and be unperceived to the crew during the exterior before flight inspection.

3.2 Causes

The incident was due to a blown tire immediately before V_1 , which led to a rejected take-off. The second tire also blew out as brakes were applied because of heat generated and tire supplementary loads during the rejected take-off.

The primary cause of the tire failure is not known.

4. SAFETY ACTION

Actions Taken by Skyservice:

- a. As a precautionary measure and to minimize the risk of operating their aircrafts fleet with under-inflated tires, Skyservice immediately issued a Maintenance TIB (Technical Information Bulletin), to be followed in addition to manufacturer's recommendations), where some rules have been implemented to the technicians:
 1. *Do not check/record tire pressures soon after landing.*
 2. *Always use a calibrated pressure gauge.*
 3. *Always record the pre-service pressure, and then if required, service the tire(s).*
 4. *If a slow leak is suspected, advise the applicable coordinator to insure proper monitoring.*

- b. Also to improve safety and minimize damages during a high speed rejected takeoff, Skyservice will:
 1. Remind their pilots about the importance of the use of the drag chute and
 2. Ensure this procedure to be trained in the simulator's checks.

The Investigator-in-charge



Artur A. Pereira

Lisboa, 16th May 2005.