



PRELIMINARY REPORT

Accident Investigation Bureau

**Report on Serious Incident involving EMB-145LR
with nationality and registration marks 5N-BVD
operated by Air Peace Limited which occurred at
Kaduna airport, Kaduna on 14th January, 2021.**



5N-BVD

Registered owner/operator: Air Peace Limited
Aircraft type and model: EMB-145LR
Manufacturer: Empresa Brasileira DE Aeronautica SA
Year of manufacture: 1999
Nationality and registration marks: 5N-BVD
Serial number: 145199
Location: Runway 05, Kaduna airport (DNKA)
Date and time: 14th January, 2021 at 12:11 h
*(All time in this report are local time
(UTC +1) unless otherwise stated)*



INTRODUCTION

Accident Investigation Bureau (AIB-N) Nigeria was notified of the occurrence by the Nigerian Civil Aviation Authority (NCAA) on 14th January, 2021. Investigators were dispatched same day and commenced post occurrence assessments, under the provisions of Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2019 and ICAO Annex 13.

The purpose of this preliminary report is to provide details of the initial facts, discussions and findings surrounding the occurrence; it includes information gathered from witness statements, Cockpit Voice Recorder, ATC transcripts, preliminary inspection of the site and the aircraft.

The investigation is on-going.

1.0 FACTUAL INFORMATION

1.1 History of the flight

On 14th January, 2021, an Embraer EMB-145LR aircraft with nationality and registration marks 5N-BVD, operated by Air Peace Limited, was scheduled for normal passenger flight (four sectors); Lagos-Owerri-Lagos and Lagos-Kaduna-Lagos, with the same flight crew to operate the flights.

At 10:27 h, 5N-BVD departed Murtala Muhammed International Airport Lagos (DNMM) for Kaduna airport (DNKA) for the third sector as Flight APK7376 on an Instrument Flight Rules (IFR) flight plan with 53 persons on board (49 passengers and 4 crew) and fuel endurance of three hours. The Co-Pilot was the Pilot Flying (PF), while the Pilot was the Pilot Monitoring (PM).

According to the flight crew, as APK7376 was climbing out of Lagos, an advisory light Hydraulic 1 low quantity (HYD1 LO QTY) indication on the Engine Indicating and Crew Alert System (EICAS) came ON. The Co-pilot transferred control to the Pilot and read out the Quick Reference Handbook (QRH) section 10-7 (HYDRAULIC SYSTEM LOW QUANTITY), which advised the flight crew to monitor the affected system. The flight crew then monitored the hydraulic system 1 indication on the Multi-Function Display (MFD), which indicated low hydraulic quantity. At this time, the Co-Pilot took over control of the aircraft again and the crew continued to monitor the hydraulic system 1 until landing at the destination airport.

At 11:00 h, APK7376 contacted DNKA Air Traffic Control (ATC) and passed its traffic information as follows; *Lagos to your station FL290 estimating Kaduna 1029Z we have 53-4 crew, endurance is 0245 Echo Mike Bravo 145 5N-BVD*. Then ATC acknowledged and responded; *Roger APK7376 maintain FL290 as cleared by Kano to KDA VOR no delay expected for ILS approach Runway 05, QNH 1018 contact time 1000*.

At 11:01 h, APK7376 requested for weather information and ATC provided the weather information as follows; *wind is 080/06 KT CAVOK CAVOK, QNH 1018 TEMP 27° C*.

At 11:30 h, APK7376 was cleared to land RWY 05. APK7376 acknowledged.

At 11:32 h, APK7376 landed RWY 05 DNKA.

According to the Pilot, as the aircraft turned to exit the active runway, there was slight stiffness of the Nose Wheel Steering (NWS). The Pilot instructed the Co-pilot to move the hydraulic system 1 Electric Motor Driven Pump (EMDP 1) Switch from AUTO to ON position. After this, the Nose Wheel Steering became more effective.

At 11:33 h, ATC noticed slow movement of the aircraft as it was exiting RWY 05 to the apron and asked the Pilot if there was any problem and the crew replied negative.

The flight crew further stated that after the passengers had disembarked, the Pilot conducted a walk-around and upon his return to the cockpit, the Co-pilot also did same. Both reported no sign of fluid spillage around the aircraft. The aircraft was then refuelled and passengers were boarded for the return flight to Lagos.

At 12:00 h, 5N-BVD requested for start-up clearance from ATC for the fourth sector as Flight APK7377, intended destination Lagos, FL280 on an Instrument Flight Rules (IFR) flight plan with 53 persons on board (49 passengers and 4 crew) and fuel endurance of 3 hours 25 minutes.

At 12:01 h, start-up request was approved by ATC with the following information: QNH 1017, temperature 29°C, and departure RWY 05.

According to the Pilot, he asked the Co-Pilot to switch the EMDP 1 to ON position as a precaution.

At 12:02 h, APK7377 requested for taxi and was cleared to holding position RWY 05 for departure. The crew acknowledged the clearance. According to the Lead Cabin Crew, during taxi a hissing sound was heard from the cabin over-head the wing section all the way to the aft of the aircraft, which he reported to the flight crew. The flight crew acknowledged this information.



At 12:06 h, APK7377 was cleared to Lagos via airway UV377, to climb and maintain FL280 and also to squawk A0612. The instruction was acknowledged. The flight crew enquired to know if there was any smell, or if the noise was as a result of cabin pressure leakage.

At 12:07 h, ATC called APK7377 to confirm if ready for departure and APK7377 responded, negative, stand-by.

At 12:09 h, APK7377 informed the ATC that it was ready for departure and ATC issued clearance as follows; *wind 090°/06 kt, after departure left turn, clear to take-off RWY 05*. The flight crew acknowledged.

According to the flight crew, after lining up for take-off, engine parameters were checked and found to be within limit. The Co-pilot was the Pilot Flying (PF) while the Pilot was the Pilot Monitoring (PM).

The flight crew stated that during the take-off roll, as the aircraft attained 110 KIAS, the crew experienced heavy vibrations and shaking of the control column. The Pilot (PM) then took over control of the aircraft and performed a rejected take-off by applying foot brakes and thrust reversers to bring the aircraft to a stop. The Number 1 Thrust Reverser did not deploy. The aircraft came to a stop 284 metres short of the end of runway 05 and four metres left of the centreline.

At 12:11 h, ATC informed the Aerodrome Rescue and Fire Fighting Services (ARFFS). According to the CVR recordings, the ARFFS arrived 4 minutes 11 seconds after they were informed by the ATC. Upon arrival, the ARFFS conducted inspection on the aircraft, after which it found the number 1 and number 2 main wheel tyres burst and reported same to the flight crew. The Pilot briefed the passengers of the situation via the Public Address (PA) system, thereafter passengers disembarked normally.

The incident occurred at 12:11 h daytime in Visual Meteorological Conditions (VMC).

1.2 Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	Nil	Nil	Nil	Nil
Serious	Nil	Nil	Nil	Nil
Minor	Nil	Nil	Nil	Nil
None	4	49	53	Nil
Total	4	49	53	Nil

1.3 Damage to aircraft

The aircraft was slightly damaged.

1.4 Other damage

Nil

1.5 Personnel information

1.5.1 Pilot

Nationality:	British
Age:	64 years
Licence type:	Airline Transport Pilot Licence (Aeroplane)
Licence:	valid till 5th May, 2021
Aircraft ratings:	Piper Aztec-23, BAC 1-11, Boeing 737-300, DC-9, Airbus 330-200, Embraer-145, MD-80, Boeing 737-NG, Airbus 330, Airbus 300-600, FALCON-20
Medical:	valid till 31st July, 2021

5N-BVD

Simulator:	valid till 31st March, 2021 (NCAA Covid-19 dispensation)
Total flying time:	14,210:30 h
Total on type:	1,200 h
Total on type (PIC):	939:16 h
Last 90 days:	144:05 h
Last 28 days:	81 h
Last 7 days:	21:45 h
Last 24 hours:	3 h

1.5.2 Co-pilot

Nationality:	Nigerian
Age:	23 years
Licence type:	Commercial Pilot Licence (Aeroplane)
Licence:	valid till 13th July, 2021
Aircraft ratings:	Embraer 135/145
Medical:	valid till 13th July, 2021
Simulator:	valid till 31st January, 2021
Total flying time:	1,116:05 h
Total on type:	960 h
Last 90 days:	152:30 h
Last 28 days:	90:55 h
Last 7 days:	13:15 h
Last 24 hours:	3 h

1.5.3 Lead Cabin Crew

Nationality:	Nigerian
Age:	38 years
Licence type:	Cabin Crew Licence
Licence:	valid till 3rd February, 2021
Aircraft ratings:	Boeing 767-300, Boeing 737-300/500, Boeing 777-200/300, ATR42, Embraer 135/145, Boeing 747-300/400
Medical:	valid till 6th February, 2022

1.6 Aircraft information

Type:	Embraer-145LR
Manufacturer:	Empresa Brasileira DE Aeronautica SA
Year of manufacture:	1999
Serial number:	145199
Certificate of Airworthiness:	valid till 6th December, 2021
Certificate of Insurance:	valid till 8th April, 2021
Certificate of Registration:	issued on 15th July, 2019
Noise Certificate:	issued on 25th October, 2017
Total airframe time:	41,786:36 h
Total landing cycles:	36,054

The EMB-145LR aircraft is equipped with two independent hydraulic systems, hydraulic system 1 and hydraulic system 2. The two systems are identical except for the services they provide. Each hydraulic system is powered by one Engine Driven Pump (EDP) and one back-up Electric Motor Driven Pump (EMDP). Both systems provide constant pressure of 3000 psi. The working fluid of the hydraulic system is Skydrol LD4.

Indications of the hydraulic systems parameters are on the Engine Indication and Crew Alerting System (EICAS) and Multi-Function Display (MFD) and control is provided from hydraulic control panel installed on the overhead panel.

Hydraulic System 1 controls the following systems

1. Rudder
2. Left and right aileron
3. Landing gear
4. Nose Wheel Steering
5. Inboard spoilers
6. Outboard brakes
7. Main entrance door
8. Left thrust reverser

Hydraulic System 2 controls the following systems

1. Rudder
2. Left and right aileron
3. Right thrust reverser
4. Outboard spoiler
5. Inboard brakes
6. Emergency/park brake system



Figure 1: EMB-145 LR with registration marks 5N-BVD

The maintenance job card JC NO.: E145001APL-EMB for the aircraft showed that the night before the incident (13th January 2021), a routine post-flight inspection was carried out on 5N-BVD and the hydraulic system 1 and 2 reservoir fluid levels were checked and refilled with five (5) quarts of Skydrol LD4 fire resistant hydraulic fluid.

1.6.2 Power plant

Engine	Number 1	Number 2
Manufacturer	Rolls Royce, UK	Rolls Royce, UK
Type/Model	AE30071AP	AE30071AP
Date of Manufacture	23th October, 1999	18th November, 2001
Serial number	CAE311281	CAE312086
Time since new	36469:21	31793:01
Cycles since new	31891	25392

Fuel Used: Jet A1

1.6.4 Post occurrence inspection of hydraulic system

Post-occurrence assessment by the maintenance team of Air Peace Limited under the supervision of the AIB-N Investigation team showed the following:

1. Hydraulic fluid level indicator of the Hydraulic System 1 Reservoir was at Position 1.
2. Hydraulic fluid spillage was observed underneath the left main landing gear.
3. A hydraulic brake hose coupling underneath the number 1 main landing gear was found loose and dripping hydraulic fluid intermittently. Upon tightening the connecting pipe, the leakage stopped.
4. The electrical connector on the Pressure Switch from the number 1 Engine Driven Pump was found loose. The electrical connector was tightened, tested and pressure indicated 3000 psi.

1.7 Meteorological information

DNKA	1100 Z
Wind:	080°/11 kt
Visibility:	10 km
Weather:	Nil
Cloud:	NOSIG
Temp/Dew:	29°C/10°C
QNH:	1017 hPa

1.8 Aids to navigation

The conditions of the navigational aids at Kaduna airport on the day of the occurrence were as follows:

'KDA' VOR/DME 115.3 MHz	Serviceable
'KUA' VOR 114.7 MHz	Serviceable
'IKA' ILS	Serviceable
Localiser 110.1 MHz	Serviceable
Glideslope 334.4 MHz	Serviceable
Wind Velocity Indicator	Unserviceable
Digital Anemometer	Serviceable
Digital Clock	Serviceable
Binocular	Serviceable
Aldis Lamp	Serviceable
Low Level Windshear Alert System	Unserviceable

1.9 Communications

There was effective communication between the ATC and the flight crew.

Very High Frequency (VHF) 118.8 MHz	Serviceable
VHF 121.7 MHz	Serviceable
Intercom Phone	Serviceable

A Notice to Airmen (NOTAM) for the closure of runway 05/23 was promulgated after the occurrence.

1.10 Aerodrome information

Kaduna airport (DNKA) is located 29 km North-West of Kaduna with coordinates 10°41'39.4"N 7°19'06.0"E and an elevation of 632 m. The aerodrome has a single runway of an asphalt/concrete surface with orientation of 05/23. The length and width of the runway are 3000 m and 60 m respectively.

1.11 Flight recorders

The aircraft is equipped with a Flight Data Recorder (FDR) and a Cockpit Voice Recorder (CVR). The FDR was downloaded in-situ and the CVR was downloaded at the Accident Investigation Bureau (AIB-N) Safety Laboratory, Abuja.

The Flight Recorders have the following particulars:

Recorders	Flight Data Recorder	Cockpit Voice Recorder
Manufacturer	Honeywell International Inc., USA	Honeywell International Inc., USA
Model	Solid State Flight Data Recorder	Solid State Memory Cockpit Voice Recorder
Part Number	980-4700-042	980-6022-001
Serial Number	SSFDR-09677	CVR120-06507

1.11.2 Deductions from Flight Data Recorder (FDR) Plots

The FDR showed that the take-off was rejected at a computed airspeed of 119 kt. The Number 1 Thrust Reverser did not deploy, and hydraulic fluid pressure for Number 1 system was low. Brake pressure was applied to bring the aircraft to a stop.

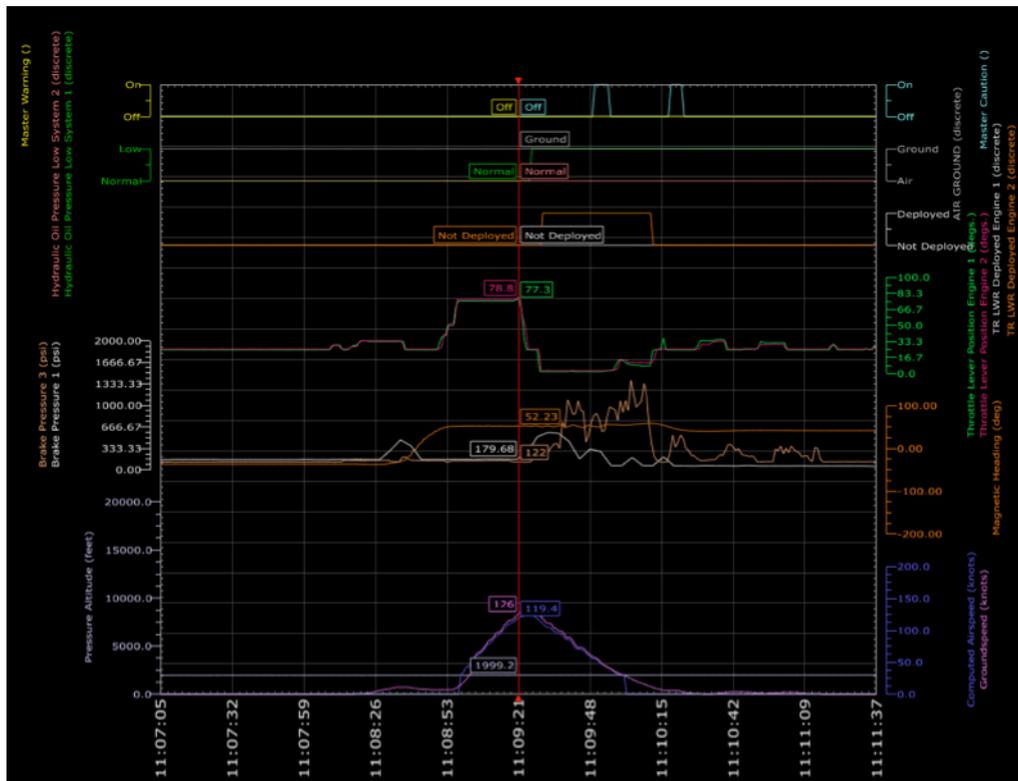


Figure 2: Relevant flight parameters at point of initiation of the rejected take-off¹

1.11.2 Cockpit Voice Recorder (CVR)

After the rejected take-off, the engines were shut down but the APU was left running and the CVR was not deactivated. Some portions of the recordings relevant to the occurrence were overwritten.

1.12 Wreckage and impact information

During the take-off roll, at about 756 m from the threshold of RWY 05, the number 2 main wheel tyre (inboard left main wheel) burst and the aircraft continued for a distance of about 1300 m when the number 1 left main wheel tyre (outboard left main wheel) burst. The aircraft continued for another 200 m where runway to metal contact started. The aircraft thereafter, moved in a ground loop pattern for 460 m.

¹ Time on the plot is UTC

The aircraft stopped at a distance of 1960 m from the point of first tyre burst, 284 m to the end of runway 05 on a magnetic heading of 031°, four meters left of the runway centreline with the aircraft rested on the left main landing gear hubs.

The following damage were observed:

1. The plies of the Number 1 tyre were shredded and the beads remained on the flange.
2. Portions of the plies of the number 2 tyre were shredded and flat spot was found on the remaining; the beads were not detached from the flanges.
3. The flanges of the two left main wheel hubs were abraded.
4. Left main landing gear door was damaged.
5. There was hydraulic fluid spillage underneath the left Main Landing Gear.



Figure 3: Damaged number 1 and number 2 main wheel tyres



Figure 4: Torn left main landing gear door fairing



Figure 5: Abraded number 1 left main wheel hub



Figure 6: Spillage of hydraulic fluid observed underneath the left main landing gear

1.13 Medical and pathological information

No medical or toxicological test was carried out.

1.14 Fire

There was no fire.

1.15 Survival aspect

The incident was survivable as the passenger cabin and cockpit were intact. There was no evacuation.

INITIAL FINDINGS

1. The flight crew were certified to conduct the flight.
2. The aircraft had a valid Certificate of Airworthiness.
3. After the last flight on the 13th January 2021, the hydraulic system 1 and 2 reservoirs were refilled.
4. The HYD1 LO QTY (blue advisory light) indication on the Engine Indicating and Crew Alerting System (EICAS) was observed by the flight crew during climb out of Lagos.
5. The flight crew consulted Section 10-7 (HYDRAULIC SYSTEM LOW QUANTITY) of the EMB145 Quick Reference Handbook (QRH) during the climb out of Lagos, which advised the flight crew to monitor the affected system.
6. The flight crew monitored the hydraulic system 1 quantity on the Multi-Function Display (MFD), which indicated low hydraulic quantity.
7. After landing in Kaduna, the Pilot noticed slight stiffness on the Nose Wheel Steering (NWS) while exiting the active runway to the ramp.
8. The Pilot instructed the Co-pilot to put the hydraulic system 1 Electric Motor Driven Pump switch from AUTO to ON position. Thereafter, the Nose Wheel Steering became more effective.
9. On ground Kaduna, the flight crew individually conducted a walk-around and reported no sign of hydraulic fluid leakage around the aircraft.
10. On ground Kaduna, the HYD1 LO QTY blue advisory indication was not reported to the Air Peace Maintenance Control Centre for technical advice.
11. There was no technical logbook entry on the HYD1 LO QTY.
12. Before taxi out from Kaduna apron, the Pilot instructed that the hydraulic system 1 Electric Motor Driven Pump switch be selected to ON position from AUTO.
13. The Lead Cabin Crew informed the Pilot via the intercom that he heard noise from the rear of the aircraft.
14. After line-up, the flight crew checked the engine parameters and noticed that there was no abnormal indication.

15. During the take-off roll, the flight crew experienced heavy vibrations and shaking of the control column as the speed of the aircraft reached 110 KIAS.
16. The Pilot took over the control of the aircraft and performed a rejected take-off.
17. The Pilot applied both foot brakes and thrust reversers, and the aircraft came to a stop at about 284 m to the end of the runway.
18. The Number 1 Thrust Reverser did not deploy, the aircraft drifted about 4 m left of the runway centreline.
19. The ARFFS arrived 4 minutes 11 seconds after they were informed by the ATC.
20. After the rejected take-off, the engines were shut down but the APU was left running and the CVR was not deactivated. Some portions of the CVR recordings relevant to this occurrence were overwritten.
21. Hydraulic fluid level indicator for System 1 Reservoir showed fluid quantity to be on position 1.
22. Hydraulic fluid spillage was observed underneath the left main landing gear during post occurrence inspection.
23. A loose coupling of a hydraulic brake hose underneath the number 1 main landing gear was observed with hydraulic fluid dripping intermittently.

IMMEDIATE SAFETY RECOMMENDATIONS

1. Air Peace Limited should ensure that flight crew report malfunctions and technical fault(s) experienced during flight to the Maintenance Control Centre (MCC) while out of base at stations where the company has not stationed maintenance personnel.
2. NCAA should ensure that operators comply strictly to the requirements of Nig. CARs section 7.8.1.3 (b) and the Nigerian Civil Aviation Authority (NCAA) All Operators Letter (AOL) dated 31st July, 2019 with reference Number: NCAA/DG/AIB/9/16/080 titled RE: CONTINUOUS OVERWRITTEN OF COCKPIT VOICE RECORDER (CVR) INFORMATION.

Outstanding investigation

1. Analyses of the Flight Recorders.
2. Additional witness interviews and statements.
3. Possible examination of certain hydraulic system components.