



# AIRCRAFT ACCIDENT REPORT

CAL/2010/08/20/F

---

**Accident Investigation Bureau**

---

**Report on the Serious Incident involving a B737-200  
aircraft with nationality and registration marks  
5N-BIF owned and operated by Chanchangi Airlines  
which occurred at Kaduna Airport, Runway 05,  
Kaduna State, Nigeria  
On 20th of August, 2010**

This report is produced by the Accident Investigation Bureau (AIB), Nnamdi Azikiwe International Airport, Abuja.

The report is based upon the investigation carried out by Accident Investigation Bureau, in accordance with Annex 13 to the Convention on International Civil Aviation, Nigerian Civil Aviation Act 2006, and Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2019.

In accordance with Annex 13 to the Convention on International Civil Aviation, it is not the purpose of aircraft accident/serious incident investigations to apportion blame or liability.

Readers are advised that Accident Investigation Bureau investigates for the sole purpose of enhancing aviation safety. Consequently, AIB reports are confined to matters of safety significance and should not be used for any other purpose.

Accident Investigation Bureau believes that safety information is of great value if it is passed on for the use of others. Hence, readers are encouraged to copy or reprint for further distribution, acknowledging the Accident Investigation Bureau as the source.

Safety Recommendations in this report are addressed to the Regulatory Authority of the State (NCAA) as well as other stakeholders, as appropriate. The Regulatory Authority is the authority that ensures implementation and enforcement.

**©Accident Investigation Bureau, Nigeria 2021.**



## TABLE OF CONTENTS

<b>TABLE OF CONTENTS</b> .....	<b>i</b>
<b>TABLE OF FIGURES</b> .....	<b>iii</b>
<b>GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT</b> .....	<b>iv</b>
<b>SYNOPSIS</b> .....	<b>1</b>
<b>1.0 FACTUAL INFORMATION</b> .....	<b>3</b>
1.1 History of the flight .....	3
1.2 Injuries to persons .....	4
1.3 Damage to aircraft .....	5
1.4 Other damage .....	5
1.5 Personnel information .....	5
1.5.1 Captain .....	5
1.5.2 First Officer .....	6
1.6 Aircraft information .....	7
1.6.1 General information .....	7
1.6.2 Powerplant .....	7
1.6.3 General maintenance records .....	7
1.6.4 Technical log book entries/maintenance history of engine .....	8
1.7 Meteorological information .....	9
1.7.1 Meteorological conditions .....	9
1.7.2 Satellite weather imagery .....	10
1.8 Aids to navigation .....	10
1.9 Communications .....	10
1.10 Aerodrome information.....	11



---

1.11	Flight recorders.....	11
1.12	Wreckage and impact information.....	14
1.13	Medical and pathological information.....	14
1.14	Fire .....	14
1.15	Survival aspects .....	14
1.16	Test and research .....	15
1.17	Organizational and management information .....	15
1.17.1	Chanchangi organizational chart .....	16
1.17.2	Nigerian Meteorological Agency (NiMet) .....	21
1.18	Additional information .....	24
1.19	Useful or effective investigation techniques .....	25
<b>2.0</b>	<b>ANALYSIS .....</b>	<b>26</b>
2.1	General .....	26
2.2	The approach phase.....	26
2.3	Wind shear .....	28
2.4	Cockpit Voice Recorder (CVR) .....	29
2.5	Non-reporting of the incident by the crew .....	30
<b>3.0</b>	<b>CONCLUSION .....</b>	<b>31</b>
3.1	Findings .....	31
3.2	Causal factor .....	32
3.3	Contributory factor .....	32
<b>4.0</b>	<b>SAFETY RECOMMENDATIONS .....</b>	<b>33</b>
	<b>APPENDICES .....</b>	<b>34</b>
	Appendix A: Tape transcript on NCH334 of 20th August, 2010 .....	34
	Appendix B: Satellite weather imagery .....	37



## TABLE OF FIGURES

Figure 1: Flight Data Recorder plot of the whole journey .....	12
Figure 2: FDR plot of the last 3 minutes of the flight .....	13

## **GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT**

AIB	Accident Investigation Bureau
AEP	Aerodrome Emergency Plan
AGL	Above Ground Level
AMEL	Aircraft Maintenance Engineer License
AMSL	Above Mean Sea Level
APP	Approach
ARFFS	Aerodrome Rescue and Fire Fighting Service
ATC	Air Traffic Control
ATPL	Airline Transport Pilot License
CB	Cumulonimbus Cloud
C of A	Certificate of Airworthiness
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
°C	Degree Celcius
DATCO	Duty Air Traffic Controller
DME	Distance Measuring Equipment
DNAA	ICAO Location Indicator for Abuja Airport
EPR	Engine Pressure Ratio

°F	Degree Fahrenheit
FDR	Flight Data Recorder
FL	Flight Level
ft	Feet
fpm	Feet per minute
h	hour
hPa	Hectopascal
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
KIAS	Indicated Airspeed calibrated in Knots
kt	Knot
km	Kilometre
LDG	Landing
LOTSO	A reporting point
m	Metre
NAMA	Nigerian Airspace Management Agency
NCAA	Nigerian Civil Aviation Authority
NDB	Non-Directional Beacon
NIMET	Nigerian Meteorological Agency

Nig.CARs	Nigeria Civil Aviation Regulations
NM	Nautical Mile
NOTAM	Notices to Airmen
QNH	Altimeter Setting above mean sea level
RNAV	Area Navigation
SCT	Scattered Clouds
SOP	Standard Operating Procedures
SW-SE	South-West/South-East
UTC	Universal Co-ordinated Time
V <sub>ref</sub>	Reference speed for landing
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Radio Range



**Aircraft accident report number:** CAL/2010/08/20/F

**Registered owner and operator:** Chanchangi Airlines Nig. Ltd

**Aircraft type and model:** B737-200

**Manufacturer:** Boeing Aircraft Company, USA

**Date of manufacture:** 1983

**Nationality and registration marks:** 5N-BIF

**Serial number:** 23043

**Location:** Kaduna Airport, Runway 05, Kaduna State, Nigeria.

10°41'45" N 07°19'12" E

**Date and time:** 20th August, 2010 at 20:41 h

*All times in this report are local time (equivalent to UTC +1) unless otherwise stated.*

## SYNOPSIS

The Accident Investigation Bureau, Nigeria (AIB-N) was notified of the occurrence late on the 20th August, 2010 and investigators arrived Kaduna the following day. All relevant stakeholders were also notified.

On the 20th August, 2010 5N-BIF, a Boeing 737-200, owned and operated by Chanchangi Airlines Ltd., operated a series of flights commencing from Lagos between 14:38 h and 18:27 h as NCH198 and landed in Abuja without any incident.

The same aircraft now operated as NCH334 to Kaduna at 20:18 h with a total of 45 persons on board inclusive of nine (9) crew members with fuel endurance of 2 hours 40 minutes. The flight was normal but became unstable during approach to landing on Runway 05. The aircraft descended in stormy weather, struck and uprooted the Non Directional Beacon (NDB) antenna 50 ft (15 m) high, some approach lights, and landed 240 meters short of the runway damaging three tyres: one on the nose wheel and one each on the main landing gear. The aircraft continued its movement into the runway, taxied to the ramp and parked. The three tyres were immediately replaced. This incident occurred at 20:41 h at night time. None of the flight crew and passengers sustained any injury.

The investigation identified the following:

### **Causal factor**

Loss of speed, altitude and situational awareness due to poor instruments' scanning on short finals Runway 05.

### **Contributory factor**

1. The airplane was flown at a high descent rate (825 fpm) when the aircraft was just 225 ft above runway during approach
2. Possible increase in crew workload due to thunderstorm activities in the vicinity of the airport.

**No Safety Recommendations were made.**

## **1.0 FACTUAL INFORMATION**

### **1.1 History of the flight**

On 20th August, 2010, a Boeing 737-200, with nationality and registration marks 5N-BIF owned and operated by Chanchangi Airlines Limited, operated a series of flights from Lagos between 14:38 h and 18:27 h as NCH198 and landed in Abuja without any incident.

At 20:18 h, 5N-BIF departed Abuja for Kaduna as NCH334 with 45 persons onboard inclusive of nine (9) crew and fuel endurance of 2 hours 40 minutes on an Instrument Flight Rules (IFR) flight plan.

At 20:21 h, NCH334 had contact with Kaduna (DNKA) Air Traffic Control (ATC) climbing out of FL90 to FL130, estimated position LOTSO 20:30 h and destination DNKA 20:40 h.

DNKA Approach (APP) cleared NCH334 to Kaduna VOR (KDA) to expect VOR/DME approach for Runway 05 and passed the 20:00 h weather report as: wind 260/07 kt, temperature 25°C in thunderstorms.

NCH334 then requested descent from FL130 after being released by Abuja (DNAA) and was cleared to 4000 ft on QNH 1016 hPa by DNKA. NCH334 was further cleared for straight-in approach runway 05. The aircraft reported established 4 Nautical Miles (nm) final, and cleared to land runway 05 with surface wind variable at 10 kt.

During approach to landing on runway 05, the aircraft became unstable in stormy weather on the approach path. The aircraft touched down 240 meters short of the runway impacted and damaged the Non-Directional Beacon (NDB) antennae 50 ft (15 m) high and some ground aids on the approach path, burst three tyres - the left nose wheel, number two and number four main wheels.

The aircraft continued its movement into the active runway and taxied to the ramp. Tyres of the aircraft were changed shortly after the incident before the AIB team arrived. Flight crew and passengers disembarked with no injury. The incident was not reported to the ATC and other appropriate authorities. This incident happened 20:41 h at night.

According to the Air Traffic Control (ATC), the crew did not report any abnormality with the landing and neither did the pilot report that he impacted objects on the final approach path. The ATC was not aware of the incident until notified by the NAMA duty engineer at 21:06 h.

The PIC, in his Mandatory Occurrence Reports (MOR) reported that “on approach to land Kaduna airport, was established on profile until 2,300 ft MSL when sudden loss of airspeed and height was noticed” which prompted him to add thrust. This added thrust raised the nose of the aircraft and immediately thereafter a loud, dull sound on the portside was heard followed by ground contact short of the runway, which the PIC attributed to wind shear.

## 1.2 Injuries to persons

<b>Injuries</b>	<b>Crew</b>	<b>Passengers</b>	<b>Total in the aircraft</b>	<b>Others</b>
<b>Fatal</b>	Nil	Nil	Nil	Nil
<b>Serious</b>	Nil	Nil	Nil	Nil
<b>Minor/None</b>	Nil	Nil	Nil	Nil
<b>None</b>	9	36	45	Nil

### **1.3 Damage to aircraft**

The aircraft was slightly damaged.

### **1.4 Other damage**

The following were damaged:

1. The Non-Directional Beacon (NDB) antennae (locator) was damaged.
2. Six (6) sodium approach fittings.
3. Eighteen (18) high intensity approach fittings.
4. Two (2) low intensity approach fittings.
5. One (1) isolating series transformer

### **1.5 Personnel information**

#### **1.5.1 Captain**

Nationality:	Nigerian
Age:	55 years
Licence:	Airline Transport Pilot Licence (Aeroplane)
Licence:	Valid till 29th September, 2010
Aircraft ratings:	Boeing 737-200
Medical certificate:	Valid till 29th September, 2010
Simulator:	Valid till 27th September, 2010

Total flying time:	8,750 h
Total on type:	850 h
Last 90 days:	140 h
Last 28 days:	60 h
Last 24 hours:	8 h

The Captain held a first-class NCAA airman medical certificate with limitations “valid only while wearing corrective spectacles with second pair available”.

### **1.5.2 First Officer**

Nationality:	Ghanaian
Age:	45 years
Licence:	Commercial Pilot Licence (Aeroplane)
Licence:	Valid till 10th November, 2010
Aircraft ratings:	Boeing 737-200
Medical certificate:	Valid till 10th November, 2010
Simulator:	Valid till 30th October, 2010
Total flying time:	2,136 h
Total on type:	1,300 h
Last 90 days:	119 h
Last 28 days:	73 h
Last 24 hours:	8 h

## 1.6 Aircraft information

### 1.6.1 General information

Aircraft type and model:	Boeing 737-200
Year of manufacture:	1983
Serial number:	23043
Nationality and registration marks:	5N-BIF
Airframe time:	53,837 h
Certificate of Airworthiness:	Valid till 5th January, 2011
Certificate of registration:	Issued 25th November, 2005

### 1.6.2 Powerplant

<b>Engines</b>	<b>No. 1</b>	<b>No. 2</b>
Engine Type:	JT8D – 17A	JT8D - 17A
Manufacturer:	Pratt & Whitney, USA	Pratt & Whitney, USA
Year of manufacture:	1979	1979
Serial Number:	P 689978	P 688172
Hours/Cycles:	53,446.50 / 31885	52,787.25 / 35390
Fuel Type used:	Jet A-1	

### 1.6.3 General maintenance records

The aircraft was manufactured in 1983 and entered the Nigerian Register on 25th November, 2005. A Check B2 maintenance inspection was completed on 25th – 26th

March, 2010 five months before the incident. The last C-check was carried out on the aircraft at the airframe time of 53,837:58 h and total cycles of 36,909 at the facility of Air Asia Company limited, Taiwan Airfield, Taiwan 70291, Taiwan, Republic of China on the 5th July, 2009 after which the Certificate of Release to Service (CRS) was issued. The next prescribed C- checks scheduled for the aircraft type will be at the airframe time interval of 3,000 h or a calendar time of 18 months whichever comes first. Therefore, the next C- check would have been due in December 2010 going by the calendar time.

#### **1.6.4 Technical log book entries/maintenance history of engine**

The aircraft Technical Logbook is a mandatory document that should be carried on board aircraft. Each airplane carries a Technical Logbook in which the engineering records, findings of the preflight, daily and transit checks are recorded. It also contains the crew's record of any defects during any phase of the flight and the rectification actions taken after the flight.

From the aircraft Technical Logbook, the No. 1 engine of the aircraft with serial No. 702735 was damaged due to turbine failure resulting in loud vibration. This was changed on 22nd February, 2010 to another engine with serial No. 702767 and certified to be satisfactory. However, this same changed engine No. 1 with serial No. 702767 also failed during take-off on 26th June, 2010 - four months after its replacement and was replaced again by another engine No. 689978 on 29th June, 2010. From the foregoing, it is important to note that 5N-BIF has a history of frequent engine changes. See the table below:



## Engine Change History on 5N-BIF

ITEM	Engine Change Date (dd/mm/yyyy)	Position: Left (No. 1)/Right (No. 2)	Engine S/N OFF	Engine S/N ON
1	22/2/10	#1	702735	702767
2	29/6/10	#1	702767	689978

## 1.7 Meteorological information

### 1.7.1 Meteorological conditions

The Meteorological conditions as obtained from Nigerian Meteorological Agency (NIMET) for Kaduna were as follows:

**Time:** 19:00 h

Wind: 260°/07 kt

Visibility: 10 km

Weather: Thunderstorms

Cloud: SCT 270 m Few CB 750 m

Temperature/Dew Point: 25°C/22°C

QNH: 1016 hPa

**Time:** 20:00 h

Wind: 360°/10 kt

Visibility: 6 km

Weather: Thunderstorms

Cloud: SCT 270 m FEW CB 750 m (SW –SE)  
Temperature/Dew Point: 22°C /21°C  
QNH: 1016 hPa

### **1.7.2 Satellite weather imagery**

The satellite weather imagery received from Nigerian Meteorological Agency (NIMET), showed clouds development at hourly intervals beginning from 1800 h to 2000 h when the serious incident occurred. It was apparent that the isolated convective cell developed sometime around 1800 h and grew rapidly with an estimated base of 2,500 ft. Given the intensity, vertical development and the movement of the cell over Kaduna, it produced rain, lightning activities, wind shear, downburst wind, and other adverse meteorological conditions which are the associated characteristics features of a typical thunderstorm Cumulonimbus (CB) cloud.

### **1.8 Aids to navigation**

The available navigational aids including Very High Frequency Omni-Directional Radio Range (VOR) and the Distance Measuring Equipment (DME) were serviceable at the time of the incident. The Instrument Landing System (ILS) and the glide slope were unserviceable while radar equipment was not in use.

### **1.9 Communications**

There was effective communication between the aircraft and the Control Tower throughout the duration of the flight.

### **1.10 Aerodrome information**

The Kaduna airport (DNKA) is a controlled airfield with operations from sunrise to sunset. The airport coordinates are 10°41'45" N, 007°19' 12" E. The runway is 9,843 ft (2,953 m) long and 197 ft (59 m) wide with an elevation of 2,073 ft (632 m). The airport has a single bi-directional runway with concrete and asphalt surface, designated RWY 05/23 and had no perimeter fence. The runway surface was wet as it was raining at the time of the incident.

### **1.11 Flight recorders**

The aircraft was equipped with both Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR). The recorders were recovered in good physical condition.

The CVR recordings of the flight was over-written.

The FDR was successfully downloaded and analyzed. The FDR contained 42.5 minutes (42 minutes 30 seconds) of recorded data of the event flight. Twelve parameters of the event flight were recorded. The aircraft maintained an average speed of 134 knots with a corresponding Engine Pressure Ratio (EPR) in the last three minutes of its landing, confirming adequate power from the engines according to the FDR plots.

The pitch, the roll attitudes and the heading were found to be unstable during the last segment of the flight. The Radio altitude was at zero (0) ft at 89,375 secs, that is, 34.4 minutes (34 minutes 24 seconds) of the total flight duration. (See FDR plot on the next page)

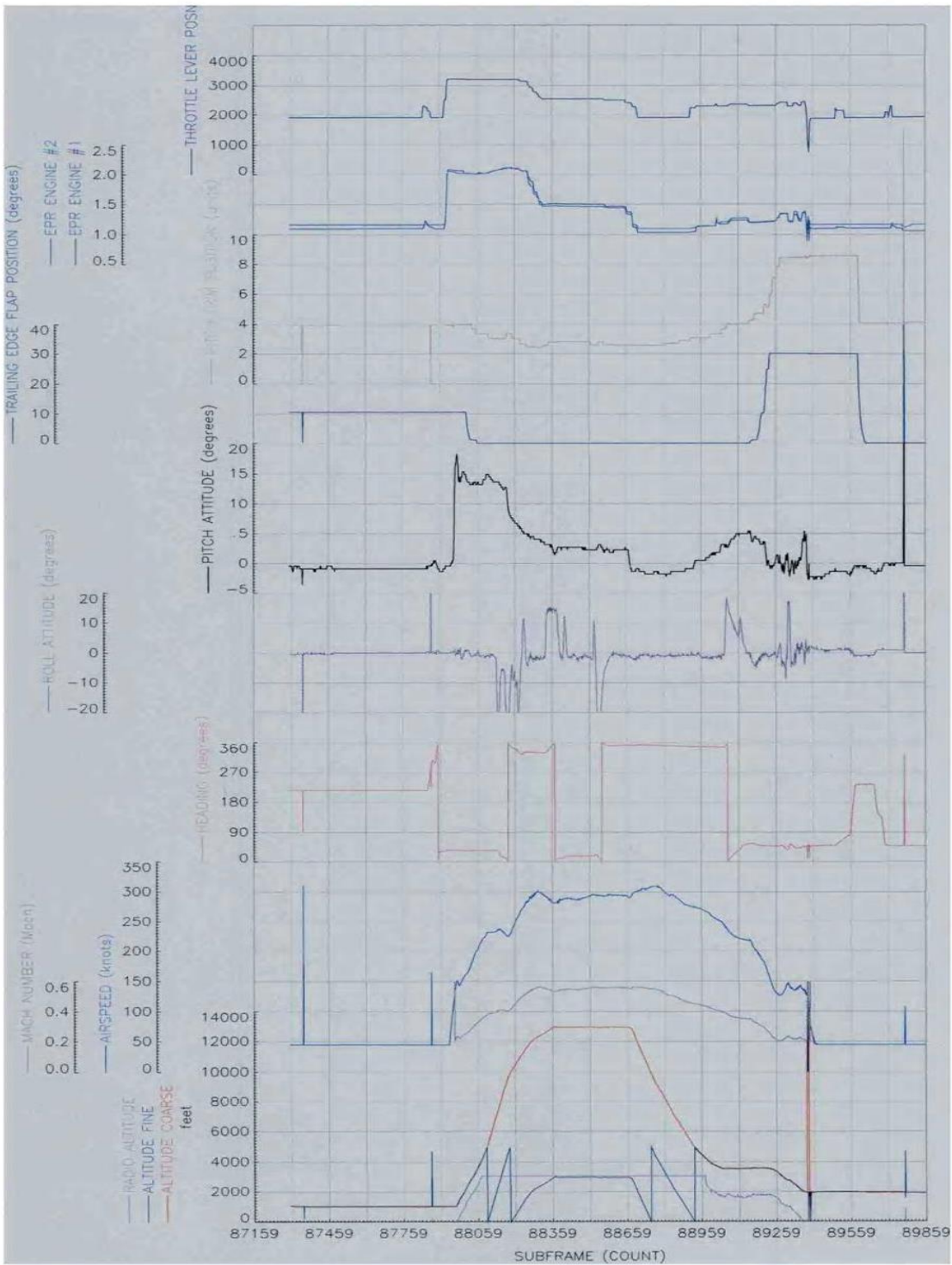


Figure 1: Flight Data Recorder plot of the whole journey



5N-BIF

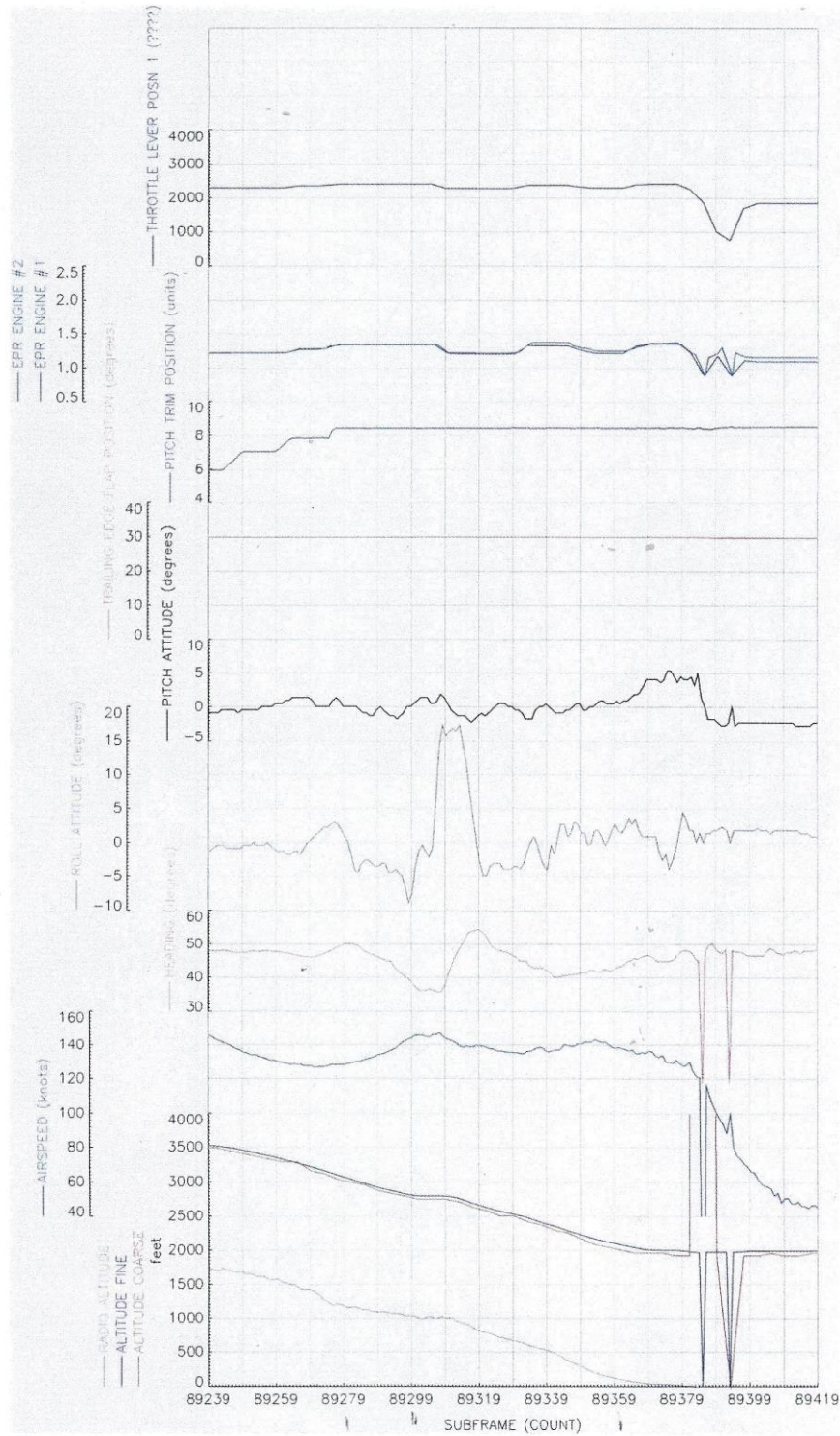


Figure 2: FDR plot of the last 3 minutes of the flight

### **1.12 Wreckage and impact information**

The aircraft touched down at about 240 meters short of the runway 05 threshold. The aircraft impacted and damaged the Non-Directional Beacon (NDB) antennae which was 50 ft (15 m) high and some ground aids on the approach path. Number one engine was damaged and dents were found under the fuselage and anti-skid flexible hose. The Left nose wheel, number two and number four main wheels were also damaged.

The aircraft left leading edge devices and the left wing were damaged with a big hole on the left wing.

The runway touch-down zone up to the end of the runway 05 was littered with pieces of burst tyres and several pieces of broken approach lights that were also damaged but the aircraft was intact.

### **1.13 Medical and pathological information**

No medical or toxicological tests were conducted.

### **1.14 Fire**

There was no fire.

### **1.15 Survival aspects**

The occurrence was survivable as there was livable volume for the persons on board.

### **1.16 Test and research**

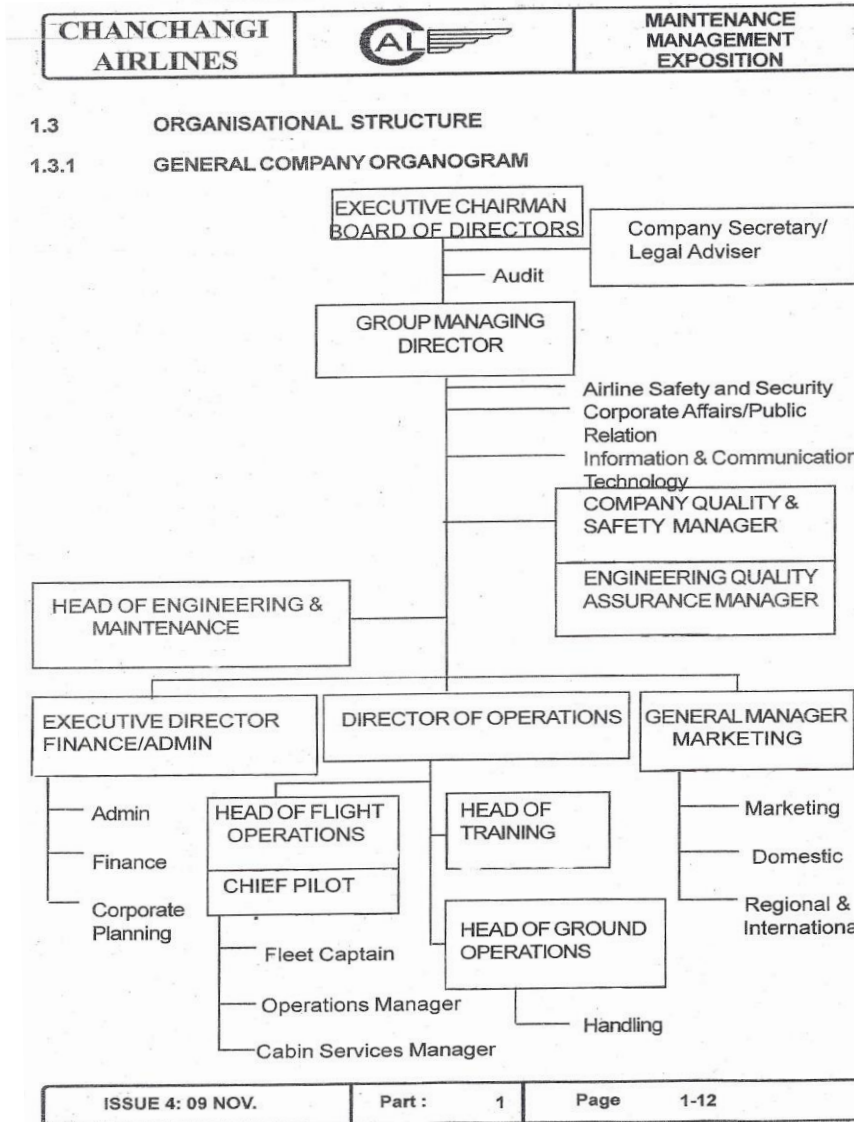
Nil.

### **1.17 Organizational and management information**

Chanchangi Airlines Limited was incorporated in January 1994 and started operations in April 1997 on a wet lease agreement with Aviogenex of Yugoslavia as a domestic carrier in Nigeria. The Airlines operate a fleet of Boeing 727 -200 and 737-200 aircraft and had its administrative headquarters in Kaduna while its operational base was in Lagos. At the time of the incident, the airlines operated scheduled daily domestic flights to several destinations in the country.



### 1.17.1 Chanchangi organizational chart



#### 1.17.1.1 Chanchangi policy on weather avoidance

Chanchangi Airlines in its Standard Operating Procedures (SOPs) stated clearly the procedures to adopt in order to avoid weather. The extracts are stated below:



## **Avoiding Weather (CHAN SOP 28.1)**

- *Avoid individual cells by use of radar, visual or other means. Remember that vivid and frequent lightning also indicates a severe storm.*
- *Never regard thunderstorms as light even when radar returns are of light intensity.*
- *Plan a deviation path early; skirting red or magenta portions of a cell is not enough.*
- *Avoid all weather echoes that appear beyond 100 NM as these will be quite dense.*
- *Avoid intense echoes by 20NM.*
- *Do not avoid downwind unless absolutely necessary, this is especially true under the anvil of a large CB. Hail may be several miles from the cloud and turbulence may extend as much as 20NM, this is greatly reduced on the upwind side of the storm.*
- *Thunderstorms develop and dissipate rapidly; therefore one must not plan a course above or between closely spaced echoes.*
- *Do not fly between intense echoes that are only 40NM apart especially when these cover 6/10 or more of the display.*
- *Do not fly over the top of intense echoes with less than 10,000ft vertical separation. Any requirement for an immediate descent may make it impossible to avoid the weather below.*
- *Do not fly under thunderstorms even if you can see through the other side. Turbulence under storm can be severe.*

*NOTE: With weather radar inoperative, do not fly in to clouds especially if this contains scattered or embedded CBs.*

### **1.17.1.3 Chanchangi policy on windshear**

#### **Extracts from CHAN SOPs 23.3 (Recovery/Escape Manoeuvre from Windshear)**

*The following action should be taken when preventive action is not successful, or whenever flight path control becomes marginal below 500 feet above the ground on take-off or landing. The flight crew must make the determination of marginal flight path control using all the information available in the cockpit.*

*The determination is subjective and based on the pilot's judgment of the situation. As a guideline, marginal flight path control may be indicated by uncontrolled changes from normal steady state flight conditions in excess of:*

- *15kts indicated airspeed*
- *500 feet per minute vertical speed*
- *5° displacement from the glide slope*

*Whenever flight path control becomes marginal below 500 feet above the ground, simultaneously: Disengage the auto throttle (if applicable) and aggressively position thrust levers forward to ensure maximum thrust is attained, rotate smoothly and at a normal rate towards an initial pitch attitude of 15°. Pitch attitude of 15° may be required to avoid terrain. Stop rotation immediately if stick shaker or buffet occurs. Stick shaker may occur at pitch attitude below 15° if very severe wind shear is encountered.*

*Do not follow flight director commands. When possible, without interfering with other tasks of monitoring the vertical flight path, the flight director should be turned off to eliminate continuous display of inappropriate commands.*

*NOTE: Flight Director Operation in auto throttle FMS equipped is different.*

*Monitor vertical speed and altitude. If the airplane is descending, increase the pitch attitude smoothly and in small increments to stop the descent. Stick shakers must be respected at all times. If the stick shaker activates, reduce the pitch attitude just enough to silence the shaker, Flight at intermittent stick shaker may be required to obtain a positive rate of climb.*

*Smooth, steady pitch attitude control is very important during the recovery, especially if pitch attitude close to stick shaker or buffet margins. Smooth, steady control of pitch attitude will ensure that high pitch rates do not develop and will avoid an overshoot of the pitch attitude at which stall warning is initiated.*

*Respecting the stick shaker or buffet will ensure that appropriate manoeuvre and stall margins are maintained.*

*Do not attempt to regain lost airspeed until terrain contact is no longer a factor. Also, do not change gear or flap confirmation until the vertical flight path is under control.*

#### **1.17.1.4 Chanchangi policy on elements of stabilized approach (CHAN SOP 24.10)**

*All flights must be stabilized by **1000 feet** above airport level in Instrument Meteorological Conditions (**IMC**) and by **500 feet** above airport elevation in Visual Meteorological Conditions (**VMC**). An approach is stabilized when all the following criteria are met:*

- 1. The aircraft is on the correct flight path.*
- 2. Only small changes in heading/pitch are required to maintain correct flight path.*
- 3. The aircraft speed is not more than  $V_{ref} + 20$  knots indicated airspeed and not less than  $V_{ref}$ .*

4. *The aircraft is in the correct landing configuration.*
5. *Sink rate is no greater than 1000ft per minute; if any approach requires a sink rate greater than 1000ft per minute, a special briefing should be conducted.*
6. *Power setting is appropriate for the aircraft configuration and is not below the minimum power for approach as defined by the aircraft operational manual.*
7. *All briefings and checklists have been conducted.*
8. *ILS approach must be flown within one dot of localizer and glide slope; during a circling approach, wings should be level on final when the aircraft reaches 300ft above airport elevation.*
9. *Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach requires a special briefing.*
10. *An approach that becomes un-stabilized below **1000ft** above airport elevation in **IMC** or below **500ft** above airport elevation in **VMC** requires an immediate go-around.*

#### **1.17.1.5 Chanchangi approach gate (CHAN SOP 24.11)**

*A missed approach is required to be conducted once the approach gate has been missed.*

**The Flight Safety Foundation defines Approach Gate as** "a point in space (1000ft above airport elevation in IMC or 500ft above airport elevation in VMC) at which a go-around is required if the aircraft does not meet defined stabilized approach criteria".

### **1.17.2 Nigerian Meteorological Agency (NiMet)**

Nigerian Meteorological Agency (NiMet) was established by an Act No. 9 of 2003 and charged, among others, with the responsibilities of issuing weather forecasts for the safe operation of aircrafts, ocean going vessels and oil rigs and providing water and climate information for socio-economic development of Nigeria.

#### **1.17.2.1 Sources of Low Level Wind shear**

*There are four common sources of low level wind shear listed as follows:*

- i. Frontal Windshear:*
  - a. If the temperature difference across the fronts at the surface is 10° F (-12.2° C) or more; and*
  - b. If the front is moving at a speed of at least 30 knots. The presence of these two factors, especially during weather briefing, could indicate the possibility of frontal wind shear.*

- ii. Temperature Inversion:*

*Temperature Inversion is a condition in which the temperature of the atmosphere increases with altitude in contrast to the normal decrease with altitude.*

*At three hundred feet above the ground, coupled with high winds from what is known as the low level jet, can produce significant wind shears close to the ground. One aspect of temperature inversion shears is that, as the inversion dissipates, the shear plane and gusty winds move closer to the ground.*

*iii. Surface Obstructions:*

*The sudden change in wind velocity can seriously affect a landing due to construction of large hangars or other building near the runway. Some airfields are close to mountain ranges, and there are mountain passes close to the final approach paths. Strong surface winds blowing through these passes can cause serious localized wind shears during the approach. The real problem with such shear is that, it is almost totally unpredictable in terms of magnitude of severity. A pilot can expect such shears whenever strong surface winds are present.*

*iv. Thunderstorm:*

*The gusty winds are associated with mature thunderstorms and they result in downdrafts striking the ground and spreading out horizontally. These winds can change direction by as much as 180° and reach velocities of 100 knots as far as 10 miles ahead of the storm. The gust wind speed may increase as much as 50% between the surface and 1,500 feet, with most of the increase occurring in the first 150 feet.*

*While the other wind problems "the downburst" is also downdraft related, it is an extremely intense localized downdraft from a thunderstorm. This downdraft can exceed 720 feet per minute (fpm) with vertical velocity of 300 ft/m Above Ground Level (AGL). The power of the downburst can actually exceed aircraft climb capabilities, not only those of light aircraft but even with a high performance Air Force jet.*

### **1.17.3 The Nigerian Civil Aviation Authority (NCAA)**

The Nigerian Civil Aviation Authority (NCAA) was established by an Act of 2006 and charged with the responsibilities of regulating the Aviation sector.

### **1.17.3.1 The Nigerian Civil Aviation Regulations (Nig.CARs)**

The Nigerian Civil Aviation Regulations (Nig.CARs) stipulates the duties and responsibilities of crew members which include the authority and responsibility of the Pilot-In-Command (PIC). The extracts from (Nig.CARs) are as follows:

#### ***CREW MEMBER DUTIES AND RESPONSIBILITIES (see Nig.CARs 8.5)***

- a. Each crewmember shall report, without delay, any inadequacy or irregularity of a facility or navigational aid observed, in the course of operations, to the person responsible for that facility or navigational aid. (see Nig.CARs 8.5.1.20a)*
- b. The PIC shall report to the appropriate ATC facility without delay and with enough detail to be pertinent to the safety of other aircraft, any hazardous flight conditions encountered en route, including those associated with meteorological conditions. (see Nig.CARs 8.5.1.21a)*
- c. The PIC shall notify the nearest appropriate authority, by the quickest available means, of any accident involving his or her aircraft that results in serious injury or death of any person, or substantial damage to the aircraft or property. (see Nig. CARs 8.5.1.23a)*
- d. The PIC shall submit a report within 3 days to the authority of any accident which occurred while he or she was responsible for the flight. (See Nig.CARs 8.5.1.23b)*

### ***Operation of Cockpit Voice and Flight Data Recorders (Nig.CARs 8.5.1.24)***

*(a) The PIC shall ensure that whenever an aircraft has flight recorders installed, those recorders are operationally checked and operated continuously from the instant:-*

- 1) For a flight data recorder, the aircraft begins its take off roll until it has completed the landing roll, and*
- 2) For a cockpit voice recorder, the initiation of the pre-start check list until the end of the securing aircraft check list.*

*(b) The PIC may not permit a flight data recorder or cockpit voice recorder to be disabled, switched off or erased during flight, unless necessary to preserve the data for an accident or serious incident investigation.*

*(c) In event of an accident or serious incident, the PIC shall act to preserve the recorded data for subsequent investigation upon completion of flight.*

- 1) The flight recorders shall be deactivated upon completion of flight time following an accident or serious incident.*
- 2) The flight recorder shall not be reactivated before the Accident Investigation Bureau determines its disposition.*

### **1.18 Additional information**

There is no adequate fire coverage of the airport. The Fire personnel at the airport are inadequate as a requirement of category 8 airport.

Kaduna Airport Ambulance was not serviceable at the time of incident.





Records available to the investigation showed that the last test-run of the existing Kaduna Airport Emergency Plan (AEP) was in 2004.

### **1.19 Useful or effective investigation techniques**

Nil.

## 2.0 ANALYSIS

### 2.1 General

The pilots were properly certified and qualified to conduct the flight under the Nigerian Civil Aviation Regulations (Nig.CARs) 2009. No evidence indicated any medical or otherwise conditions that might have adversely affected their performance during the incident flight.

The incident aircraft had a valid Certificate of Airworthiness and was dispatched in accordance with the existing regulations. No evidence indicated any failure of the airplane's power plants, structures, systems that would have affected the airplane performance during the incident landing.

The crew received adequate weather information. They obtained weather updates while en-route Kaduna from Abuja. The incident runway was wet and the prevailing weather was thunderstorm.

The Tower frequency was serviceable and there was good communication between the aircraft and the Control Tower throughout the duration of the flight.

This analysis will discuss the flight crew decisions and actions, the company's policies and guidance, the approach phase, wind shear weather and flight data recorders.

### 2.2 The approach phase

According to CHAN SOPs 24.10, "All flights must be stabilized by **1000 feet** above airport elevation in Instrument Meteorological Conditions (IMC) and by **500 feet** above airport elevation in Visual Meteorological Conditions (VMC)". "An approach that becomes un-

stabilized below **1000ft** above airport elevation in **IMC** or below **500ft** above airport elevation in **VMC** requires an immediate go-around.”

Also, CHAN SOPs 24.11 states that “A missed approach is required to be conducted once the Approach Gate has been missed.”

The Flight Safety Foundation defines **Approach Gate** as “a point in space (**1000ft above airport elevation in IMC or 500ft above airport elevation in VMC**) at which a go-around is required if the aircraft does not meet defined stabilized approach criteria”.

NCH334 requested for descent from FL130 and was cleared to 4,000 ft on QNH 1016 hPa and further cleared for straight-in approach runway 05. The aircraft reported established 4 NM final, and cleared to land runway 05 with surface wind variable at 10 kt.

At 20:41 h, NCH334 landed about 240 m (800 ft) short of the runway 05 and impacted a Non-Directional Beacon antenna and some runway approach lights, burst three tyres; one on the nose wheel and one on each of the main landing gears.

The PIC reported in the Mandatory Occurrence Report (MOR) that “on approach to land Kaduna airport, was established on profile until 2,300 ft MSL when sudden loss of airspeed and height was noticed” which prompted him to add thrust. This added thrust by the PIC should have arrested the situation if it was applied on time.

The analysis of the FDR revealed that at 2,300 ft, there was sudden change in speed, pitch attitude and airspeed coupled with loss of altitude which led to the aircraft impacting the NDB equipment along the runway landing path. At this point, the aircraft showed a descent rate of 825 ft per minute at 225 ft above the aerodrome elevation. This situation may have been caused by poor instruments’ scanning from the pilot flying and lack of situation awareness.

The large changes in the heading/pitch were evaluated in the plot against small changes that were required to maintain the correct flight path. (See 1.17.1.4 Criteria of

Chanchangi Stabilized Approach). The heading was found to fluctuate between 36 and 55 degrees while the Pitch attitude fluctuated between -02 and +05 degrees.

These are large changes in the heading/pitch that were indications of the unstable approach.

### **2.3 Wind shear**

Wind shear is a rapid change in wind speed and direction, including updrafts and downdrafts. An aircraft may experience a significant deterioration in flight performance when exposed to wind shear of sufficient intensity or duration.

The PIC reported in the Mandatory Occurrence Report (MOR) that the crew encountered wind shear and this was said to have been responsible for landing short of the runway. The authenticity of this claim was investigated from the analysis of FDR plots and available weather report.

From the FDR plot, no evidence was found to show any sudden/excessive sink rate of the aircraft to corroborate "the sudden loss in height and speed" due to wind shear.

The investigation revealed that the sink rate was found to be 825 fpm (between 750 fpm and 900 fpm) on the average and this value was found to be normal and in accordance with Chanchangi SOPs.

There was no evidence that any of the four major causes of wind shear: frontal wind shear, temperature inversion, surface obstructions/topography and thunderstorm - that have long been recognized as serious hazards, at low altitude to airplanes during take-off, approach and landing; resulted in wind shear on the day of the incident.

The surface winds passed to the crew at approach and when cleared to land were 260/07 kt and variable/10 kt respectively with the prevailing weather as thunderstorm. It could

also be stated that there was no gust in the wind velocity or indicated airspeed variations in excess of 15 kt as to suspect wind shear condition. The wind variations were 07 kt and 10 kt respectively and these were found to be normal wind speeds passed to the crew.

The investigation could not ascertain the authenticity of the statement from the points of FDR analysis and the surface winds passed to the crew on approach.

However, thunderstorm activities around the airport could increase the crew workload and the stability of the approach, which would require careful monitoring of the instrument panel during landing.

#### **2.4 Cockpit Voice Recorder (CVR)**

The result of the CVR download showed that the tape was overwritten. Therefore, useful information could not be derived from it that would have assisted the investigation.

The overwriting of important information contained in Cockpit Voice Recorder (CVR) could have been avoided if the crew had taken care to pull the CVR circuit breaker to remove power from the equipment after the occurrence and preserve the data.

The Nig.CARs 8.5.1.24 b, c (2009) stipulates that in the event of accident/serious incident, the PIC shall act to preserve the recorded data by de-activating the flight recorders upon completion of flight and shall not re-activate them before the appropriate authorities determine its disposition.

The lack of a CVR recording covering the period of the incident prevented some details of the events from being resolved.

## **2.5 Non-reporting of the incident by the crew**

The Nigerian Civil Aviation Regulations Nig.CARs 8.5.1.23c (2009) on crew member's responsibilities and duties stipulates as follows: the PIC shall notify the nearest appropriate authority, by the quickest available means, of any accident involving his or her aircraft that results in serious injury or death of any person, or substantial damage to the aircraft or property.

The debris deposited on the runway by the aircraft constitutes debris-ingestion hazard to subsequent landing aircraft.

However, the crew did not immediately report the occurrence to the appropriate authorities. The NAMA duty Engineer on routine shut-down-of-equipment at 21:00 h, drew the attention of ATC to the incident. It is noteworthy to state that the threshold of runway 05 was not visible to the Tower position at night due to darkness and the distance from the Control Tower building.

## **3.0 CONCLUSION**

### **3.1 Findings**

1. The aircraft had a valid Certificate of Airworthiness (C of A).
2. The aircraft was properly released for the flight.
3. The crew were properly licensed and medically fit to conduct the flight.
4. The crew conducted a non-precision approach into an area of intense convective activity of thunderstorm. The approach was however unstable.
5. The crew landed about 240 meters short of runway 05.
6. During the ground contact, the aircraft suffered damage to the No. 1 engine including dents under the fuselage and anti-skid flexible hose; Number one Nose wheel, number two and four Main wheels were also damaged.
7. The aircraft left leading edge devices and the left wing were damaged with a big hole on the left wing.
8. The incident was not immediately reported to the appropriate authorities.
9. Tyres of the aircraft were changed shortly after the incident before the AIB team arrived.
10. There was no evidence of windshear while the aircraft was on approach.
11. The FDR was successfully downloaded but the CVR recordings of the flight was over-written.
12. The Kaduna VOR/DME was serviceable at the time of the incident.

13. NOTAM had been issued on the unserviceability of the Kaduna ILS before the incident.
14. Kaduna airport fire coverage and the Fire personnel were inadequate considering the requirements of category 8 airport.
15. The existing Kaduna Airport Emergency Plan (AEP) was last test-run in 2004 by FAAN.
16. Kaduna Airport Ambulance was not serviceable.
17. Kaduna Airport had no perimeter fence.

### **3.2 Causal factor**

Loss of speed, altitude and situational awareness due to poor instruments' scanning on short finals runway 05.

### **3.3 Contributory factor**

1. The airplane was flown at a high descent rate (825 fpm) when the aircraft was just 225 ft above runway during approach.
2. Possible increase in crew workload due to thunderstorm activities in the vicinity of the airport.



## **4.0 SAFETY RECOMMENDATIONS**

In view of the issuance of the Nigeria CAR 2009 and the revision in 2015, which addressed the areas of shortcomings identified in this investigation, no safety recommendations are made.

## APPENDICES

### Appendix A: Tape transcript on NCH334 of 20th August, 2010

#### TAPE TRANSCRIPT ON NCH 334 OF 20<sup>th</sup> AUGUST, 2010

TIME	STATION	TRANSMISSIONS
1921	A/C ATC A/C	Kaduna – Kaduna - NCH334 go ahead. Good evening sir, NCH334 B737 Abuja to Kaduna climbing out of flight level 90 climbing flight 130 estimate lotso 1930 Kaduna 40, we have 45. Souls with 9 crew endurance 2 hours 40 BIF over.
	ATC	NCH334 cleared to "KDA" VOR No delay for VOR approach straight – in VOR approach Runway 05 QNH 1016 temp 28 time 1921 standby for weather.
	A/C	FL130 VOR IDME Runaway 05 temp. 28 QNH 1016,
	ATC	S/W 260-07KTS VIS. 10Km weather thunder storm cloud SCT. 270m FEW CB750M SW-E QNH 1016 temperature 25 o
1925	A/C ATC A/C A/C	OK copied 1012 if you can give me the wind direction and visibility all over again? Wind 270, 10KTS Vis . 10km . Ok copied we call you released by Abuja NCH334. Kaduna NCH334 we are 73 DME "KDA" released to you by Abuja FL 130, we call you next for decent.
1929	ATC ATC A/C ATC	Roger. NCH334 Kaduna go ahead The weather is thunder storm



5N-BIF

	AC	Thunder storm over head?
	ATC	Negative, is just approaching
	AC	Thunder storm approaching QNH1014
	ATC	1016
	AC	Thank you NCH334 confirm 05 for landing? I
	ATC	I confirm.
	AC	Ok, we call you established, call you ready for descent.
		Ok, 334 we are requesting descent , we are 47 DME KDA.
	ATC	Descend 4000 ft report final 05
	AC	4000 ft we call you established runway 05 NCH334.
1936	ATC	NCH334 Kaduna
	AC	Go ahead sir
	ATC	The wind is variable at 10 Kts
	AC	Say again sir
	ATC	Wind variable at 10 Kts
	AC	Variable at 10 Kts, we have the field in sight call you short final.
	ATC	Copied
1940	AC	NCH334 4milles to touch down runway 05
	ATC	Cleared to land S/W variable at 10Kts check green.
	AC	Cleared to land 05 334.



5N-BIF

---

1943	ATC ATC	NCH 334 on ground at 1941 next right 41 copied.
------	------------	--

**Appendix B: Satellite weather imagery**

