AIRCRAFT ACCIDENT REPORT

AIRPEACE/2019/06/22/F

Accident Investigation Bureau

Report on the Serious Incident involving a B737-500 aircraft operated by Air Peace Limited with nationality and registration marks 5N-BRN which occurred at Port Harcourt Airport, Omagwa, Rivers State On 22nd June, 2019

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.

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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.

Printed in Nigeria for the Accident Investigation Bureau (AIB)

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GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

AFE	Above Field Elevation
AFM	Airplane Flight Manual
AGL	Above Ground Level
AIB-N	Accident Investigation Bureau, Nigeria
AMSL	Above Mean Sea Level
APP	Approach unit of Air Traffic Control
ATC	Air Traffic Control
ATCOs	Air Traffic Controllers
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot Licence
ATR	Aerei da Transporto Regionale
ATS	Air Traffic Service
BKN	Broken
C of A	Certificate of Airworthiness
CB	Cumulonimbus
CLD	Cloud
CPL	Commercial Pilot Licence
CRM	Crew Resource Management
CVR	Cockpit Voice Recorder

DA	Diamond
DME	Distance Measuring Equipment
DNPO	Location identifier for Port Harcourt International Airport
EMB	Embraer
FAA	Federal Aviation Administration
FAAN	Federal Airport Authority of Nigeria
FAR	Federal Aviation Regulations
FDR	Flight Data Recorder
FL	Flight Level
FMC	Flight Management Computer
ft	Feet
GPWS	Ground Proximity Warning System
HAT	Height Above Terrain
hPa	Hectopascal
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
kt	Knots
km	Kilometre

LLWAS	Low Level Wind Shear Alert System
LOS	IATA code for Lagos
METAR	Meteorological Aerodrome Report
NAMA	Nigerian Airspace Management Agency
NCAA	Nigerian Civil Aviation Authority
NiMet	Nigerian Meteorological Agency
NM	Nautical Miles
NOSIG	No Significant Change
NW	Northwest
OM	Operations Manual
Ops	Operations
PALS	Precision Approach Lighting System
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PHC	IATA Code for Port Harcourt
PM	Pilot Monitoring
POT	Port Harcourt VOR
QNH	Altimeter setting above mean sea level
SE	Southeast
S-N	South to North
SPECI	Aviation selected special weather report

SSCVR	Solid State Cockpit Voice Recorder
SSFDR	Solid State Flight Data Recorder
SW	Southwest
TDWR	Terminal Doppler Weather Radar
TDZ	Touchdown Zone
TEMP	Temperature
TEMPO	Temporary
TOC	Top of Climb
TOD	Top of Decent
TS	Thunderstorm
-TSRA	Thunderstorm in light Rain
+TSRA	Thunderstorm in heavy Rain
TWR	Control Tower
UTC	Coordinated Universal Time
V_{REF}	Reference landing approach speed
VHF	Very High Frequency
VIS	Visibility
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Radio Range
Wx	Weather

Aircraft accident report number:	AIRPEACE/2019/06/22/F
Registered owner and operator:	Air Peace Limited
Manufacturer:	The Boeing Company, USA
Year of manufacture:	1993
Aircraft type and model:	B737-500
Serial number:	25234
Nationality and registration marks:	5N-BRN
Location:	Runway 21, Port Harcourt Airport 05°00'56"N, 006°56'58"E
Date and Time:	22nd of June, 2019 at 14:57 h *(All times in this report are local time, equivalent to UTC+1 unless otherwise stated)*

SYNOPSIS

On 22nd June 2019, at about 14:05 h, a Boeing 737-500 aircraft with nationality and registration marks 5N-BRN operated by Air Peace Limited scheduled as APK7291 departed Nnamdi Azikiwe International Airport, Abuja (DNAA) for Port Harcourt International Airport (DNPO) on an Instrument Flight Rules (IFR) flight plan. On-board were 94 persons inclusive of 6 crew members with fuel endurance of 02:30 h. The First Officer was the Pilot Flying (PF) while the Captain was the Pilot Monitoring (PM).

At 14:32 h, APK7291 established contact with Port Harcourt Air Traffic Control (ATC) Approach (App) unit, relayed flight information with estimates into Port Harcourt airport VOR (POT) for 14:59 h. Port Harcourt Approach replied with this inbound clearance; "APK7291 cleared to Papa Oscar Tango (POT), FL300 no delay expected

for ILS approach runway 21, QNH 1011, time 1333Z. Standby for Port Harcourt METAR."

The Port Harcourt weather information for 1330Z (14:30 h) was: Surface Wind 190°/05 kt, Visibility 10 km in thunderstorm, Cloud Broken 330 m, Few Cumulonimbus S-N of the airfield 600 m, QNH 1011, Temperature 30℃, thunderstorm to the N/W of the airfield. Approach unit also advised APK7291 to report released by Lagos Area Control and the crew acknowledged.

Landing clearance was given to the crew and the aircraft touched down on runway 21 and subsequently veered off the runway, left of the centreline into the grass verge at about 1,260 m from the threshold.

It continued its movement on the grass and stopped parallel to the runway at about 1,620 m from the threshold with the right wing-tip at the edge of the runway shoulder at approximately 37 m from the runway centreline and came to a stop with the wheels stuck in the mud.

Passengers disembarked in rain without injury using the forward service door R1 and a moveable passenger stair.

The investigation identified the following:

Causal factor

Excessive and inconsistent rudder inputs after touchdown.

Contributory factor

1. The decision to continue the approach rather than to execute a go-around in an adverse weather condition.
2. Non-adherence to procedures in terms of callouts and go-around as contained in the company's operations manual.

Three Safety Recommendations were made.

1.0 FACTUAL INFORMATION

1.1 History of the flight

On 22nd June 2019, at about 14:05 h, a Boeing 737-500 aircraft with nationality and registration marks 5N-BRN operated by Air Peace Limited as scheduled passenger flight APK7291 departed Nnamdi Azikiwe International Airport, Abuja (DNAA) for Port Harcourt International Airport (DNPO) on an Instrument Flight Rules (IFR) flight plan. On-board were 94 persons inclusive of 6 crew members with fuel endurance of 02:30 h. The First Officer was the Pilot Flying (PF) while the Captain was the Pilot Monitoring (PM).

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At 14:38 h, APK7291 contacted Port Harcourt Approach after being released by Lagos Area Control descending FL220. At 14:39 h, Port Harcourt Approach later cleared APK7291 to; "descend FL120, report distance and inbound radial 'POT'."

At 14:40 h, APK7291 acknowledged clearance, reported on radial 006 "POT" and 92 DME (Distance Measuring Equipment). Approach requested APK7291 to report 80 Nautical Miles (NM) "POT" for further descent. Shortly after, APK7291 reported 82 NM and Approach re-cleared APK7291 to descend FL080 and to report 50 NM. At 14:45

h, APK7291 reported 50 NM and was cleared by Approach to descend FL070 and to report 28 NM POT for further descent.

At 14:49 h, APK7291 at 29 NM was cleared by Approach to descend 2,400 ft on QNH 1011, and was cleared straight-in ILS approach runway 21 to report established, which the crew acknowledged. At this point, the crew enquired from Approach if it was raining over the station. About a minute later, Approach responded, "negative rain overhead the station".

At 14:54 h, APK7291 reported established on ILS 8 NM and the Approach transferred APK7291 to DNPO Tower (TWR) for final landing clearance.

At 14:55 h, APK7291 contacted DNPO TWR on frequency 119.2 MHz and subsequently cleared APK7291, "there is rain at the approach path, with the runway in sight check gears down and locked, wind is 070 at 03 knots, exercise caution on landing, runway surface wet, cleared to land runway 21", and the crew acknowledged "cleared to land runway 21 APK7291, copied the caution…"

The Cockpit Voice Recorder (CVR) revealed that, below 1,000 ft, a sound similar to the movement of wipers was heard continuously till the end of the flight. The PM asked "how many hours do you have?" and the PF answered "300". Shortly before 500 ft, PF announced "autopilot disengaged". The crew reported to have experienced cross winds of 100^{o}/12 kt on descent at about 500 ft Above Ground Level (AGL) on final approach runway 21. At about 300 ft, the crew announced, "minimums, checked landing". At this point, PM announced "I have controls".

The crew stated that, on short finals after obtaining landing clearance, it started drizzling but the runway lights were visible, the runway markings were identifiable and the ILS was functional. After touchdown on runway 21, the intensity of rain increased in strong winds, visibility reduced causing them to experience loss of directional control of the aircraft. The crew also stated that, due to wet runway, the aircraft skidded to the left of the runway centerline uncontrollably even with the application of brakes, rudder and ailerons.

The aircraft touched down and veered off the runway, left of the centreline into the grass verge at about 1,260 m from the threshold. It continued its movement on the grass and stopped parallel to the runway at about 1,620 m from the threshold with the right wing-tip at the edge of the runway shoulder at approximately 37 m from the runway centreline and came to a stop with the wheels stuck in the mud.

At 14:58 h, DNPO TWR called "APK7291 I can see your light on the ground ahh time now 1358Z, confirm ops normal". The crew then reported runway excursion and requested to disembark the passengers where the aircraft stopped. At 15:07 h, APK7291 confirmed the arrival of the movable passenger stairs which was positioned at the forward service door (R1) of the aircraft where all the passengers and crew disembarked in rain, without injury.

The incident occurred in daylight and Instrument Meteorological Conditions (IMC) prevailed.

1.2 Injuries to persons

Injuries	**Crew**	**Passengers**	**Total in the aircraft**
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor	Nil	Nil	Nil
None	6	88	94
TOTAL	6	88	94

1.3 Damage to aircraft

The aircraft was substantially damaged.

1.4 Other damage

Nil.

1.5 Personnel information

1.5.1 Captain

Nationality:	Zimbabwean
Age:	42 years
Licence type:	Airline Transport Pilot Licence (Aeroplane)
Licence:	Valid till 14th September, 2019
Aircraft ratings:	Cessna 172, Xian MA60, Boeing 737-200/500
Medical certificate:	Valid till 6th February, 2020
Simulator:	Valid till 3rd August, 2019
Proficiency check:	21st December, 2018
Route/Line check:	12th September, 2018
Total flying time:	9,200 h
Total on type:	2,010 h
Total on type (PIC):	1,727 h
Last 90 days:	212:37 h
Last 28 days:	72:23 h
Last 24 hours:	06:00 h

1.5.2 First Officer

Nationality:	Nigerian
Age:	32 years
Licence type:	Commercial Pilot Licence (Aeroplane)
Licence:	Valid till 21st April, 2021
Aircraft ratings:	Diamond DA-42, Boeing 737-300/500, Boeing 737-NG,
Medical certificate:	Valid till 4th July, 2019
Simulator:	Valid till 23rd September, 2019
Proficiency check:	27th September, 2018
Route/Line check:	23rd April, 2019
Total flying time:	533:59 h
Total on type:	347 h
Last 90 days:	174:45 h
Last 28 days:	72:07 h
Last 24 hours:	04:40 h

1.5.3 Purser

Nationality:	Nigerian
Age:	37 years
Licence type:	Cabin Crew Licence
Licence:	Valid till 14th February, 2020
Ratings:	Boeing 737-300/500, Boeing 747-300/400, Boeing 767-300, Boeing 777-200/300, ATR42, Embraer-135/145

Medical certificate:	Valid till 3rd February, 2021

1.6 Aircraft information

1.6.1 General information

Manufacturer:	The Boeing Company, USA
Model:	Boeing 737-500
Serial number:	25234
Year of manufacture:	1993
Registered owner/operator:	Air Peace Limited
Nationality and registration marks:	5N-BRN
Certificate of Airworthiness:	Valid till 17th July, 2019
Certificate of Insurance:	Valid till 30th June,2019
Total airframe hours:	44,651 h
Total cycles since new:	34,612

1.6.2 Powerplant

	Engine No. 1	**Engine No. 2**
Manufacturer:	CFM International, USA	CFM International, USA
Engine type:	CFM 56-3C1	CFM 56-3C1
Year of manufacture:	1992	1992
Serial number:	857205	860262
Total time since new:	54,178.14 h	22,529.58 h
Cycles:	37,859	17,965

1.7 Meteorological information

The following weather information at Port Harcourt Airport:

Time:	**1230UTC**
Wind:	200°/10 kt
Visibility:	10 km
Weather:	Nil
Cloud:	Broken 011, Few 020CB
Temp/Dew point:	31°C/25°C
QNH:	1013 hPa
Trend:	Tempo Thunderstorm

Time:	**1300UTC**
Wind:	260°/05 kt
Visibility:	10 km
Weather:	Nil
Cloud:	Broken 330 m Few 600 m CB
Temp/Dew point:	31°C/25°C
QNH:	1012 hPa
Trend:	Tempo Thunderstorm

Time:	**1330UTC**
Wind:	240°/06 kt
Visibility:	10 km
Weather:	Nil

Cloud:	Broken 330 m Few 600 m CB
Temp/Dew point:	31°C/25°C
QNH:	1012 hPa
Trend:	Tempo 5000 TSRA

Time:	**1400UTC**
Wind:	320°/08 kt
Visibility:	4 km
Weather:	+TSRA
Cloud:	Broken 270 m, Few 600 m CB
Temp/Dew:	30°C/25°C
QNH:	1011 hPa
Trend:	Tempo 3000 m

Time:	**1430UTC**
Wind:	230°/12 kt
Visibility:	600 m
Weather:	+TSRA
Cloud:	Broken 270 m, Few 600 m CB
Temp/Dew:	25 °C /25°C
QNH:	1012 hPa
Trend:	NOSIG

1.7.1 Dispatch weather information

Prior to departure, Nnamdi Azikiwe International Airport, Abuja the crew obtained the following weather information:

	ABV	**PHC**	**LOS**
	DEP. STN – WX & Time	**DESTINATION – WX & Time**	**ALTERNATE – WX & Time**
	1230Z	**1230Z**	**1230Z**
S/W	310/07 kt	200/10 kt	220/09 kt
VIS	7 km	10 km	10 km
WX	Nil	Nil	Nil
CLD	SCT 240 m FEW 540 m CB	BKN 330 m, Few 600 m CB	BKN 390 m, Few 600 CB
QNH	1015	1013	1015
TEMP	21°C	31 °C	29 °C
DEW PT	19 °C	25 °C	25 °C
TREND	NOSIG	TEMPO Thunderstorm	TEMPO 5000 TSRA

1.7.2 Extract from ATC transcript on station weather

TIME (UTC)	**STATION**	**TRANSMISSION**
1333	APP	APK7291 Port Harcourt METAR 1330Z, Surface Wind 190/05kts, Visibility 10km in thunderstorm, Cloud BKN 330, Few CB South-North of the airfield 600m, QNH 1011, Temperature 30°C thunderstorm to the North-West of the airfield.
1350	APK7291	Port Harcourt APP, from APK7291, is it raining over the station
	APP	Standby
1351	APP	APK7291 negative rain overhead the station
1355	TWR	APK7291 there is rain at the approach path, with the runway in sight, check gears down and locked, Wind is 07/03kts, exercise caution on landing runway surface wet, cleared to land runway 21.

1.7.3 Meteorological Aerodrome Report (METAR) from 1230 UTC to 1401 UTC

At 1230 UTC: the surface wind 200 at 10knots, visibility 9999 BKN 011 Few 020CB, Temperature 31°C Dew point 25°C, QNH 1013, Tempo TS (Temporary thunderstorm)

At 1300 UTC: the surface wind 260 at 05 knots, visibility 9999 BKN 011 Few 020CB, Temperature 31°C Dew point 25 °C, QNH 1012, Tempo TS (Temporary thunderstorm)

At 1330 UTC: the surface wind 240 at 06 knots, visibility 9999 BKN 011 Few 020CB, Temperature 31°C Dew point 25°C, QNH 1012, Tempo 5000 –TSRA (Temporary visibility 5000, thunderstorm in light rain)

At 1332 UTC: SPECI (Special Meteorological Information) surface wind 190 at 05 knots, visibility 9999 thunderstorm BKN 011 Few 020CB, Temperature 31°C Dew point 25°C, QNH 1011, Tempo 5000 –TSRA (Temporary visibility 5000, thunderstorm in light rain)

At 1346 UTC: SPECI (Special Meteorological Information) surface wind 240 at 05 knots, visibility 5000, -TSRA (thunderstorm in light rain), BKN 009 Few 020CB, Temperature 31°C Dew Point 25°C, QNH 1011, Tempo 3000 (Temporary visibility 3000)

At 1400 UTC: surface wind 320 at 08 knots, visibility 4000, -TSRA (Thunderstorm in light rain), BKN 009 Few 020CB, Temperature 30°C Dew point 25°C, QNH 1011, Tempo 3000 (Temporary visibility 3000)

At 1401 UTC: SPECI (Special Meteorological Information) surface wind 300 at 10 knots, visibility 3000, -TSRA (Thunderstorm in light rain) BKN 009 Few 020CB, Temperature 30°C Dew point 25°C, QNH 1011, Tempo 1500 TSRA (Temporary visibility 1500 Thunderstorm in heavy rain).

Figure 1: Satellite image of Port Harcourt International Airport Runway 21

1.7.4 Satellite imagery of Weather at Port Harcourt

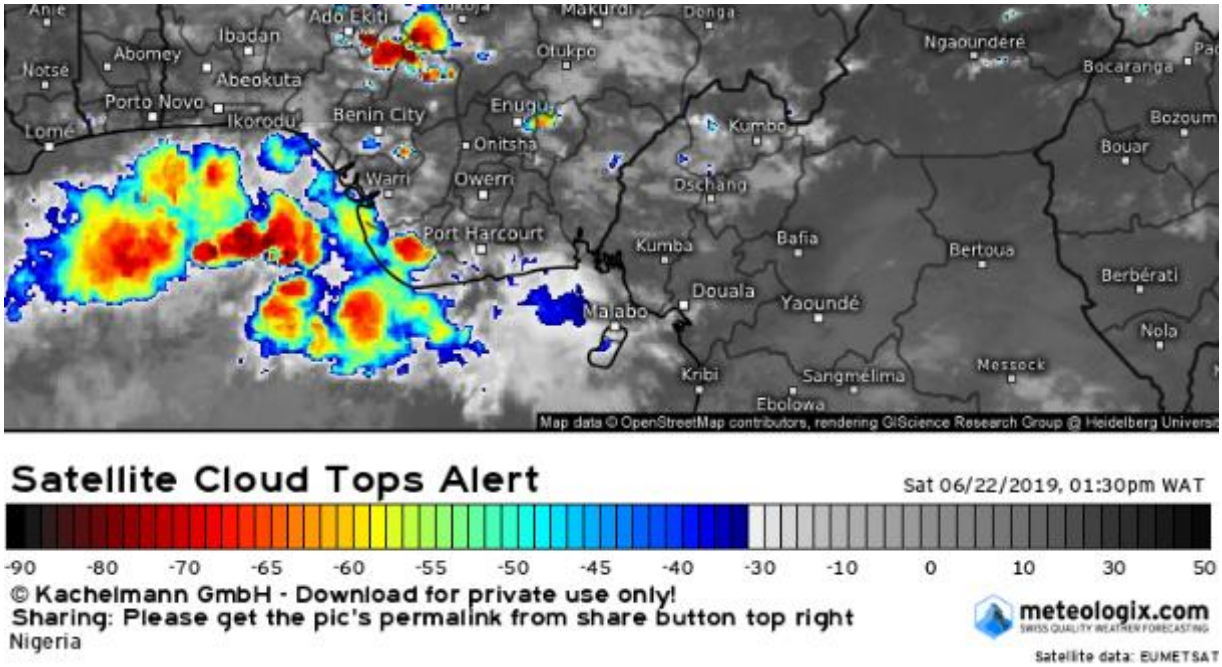


Figure 2: Satellite imagery at 1230 UTC

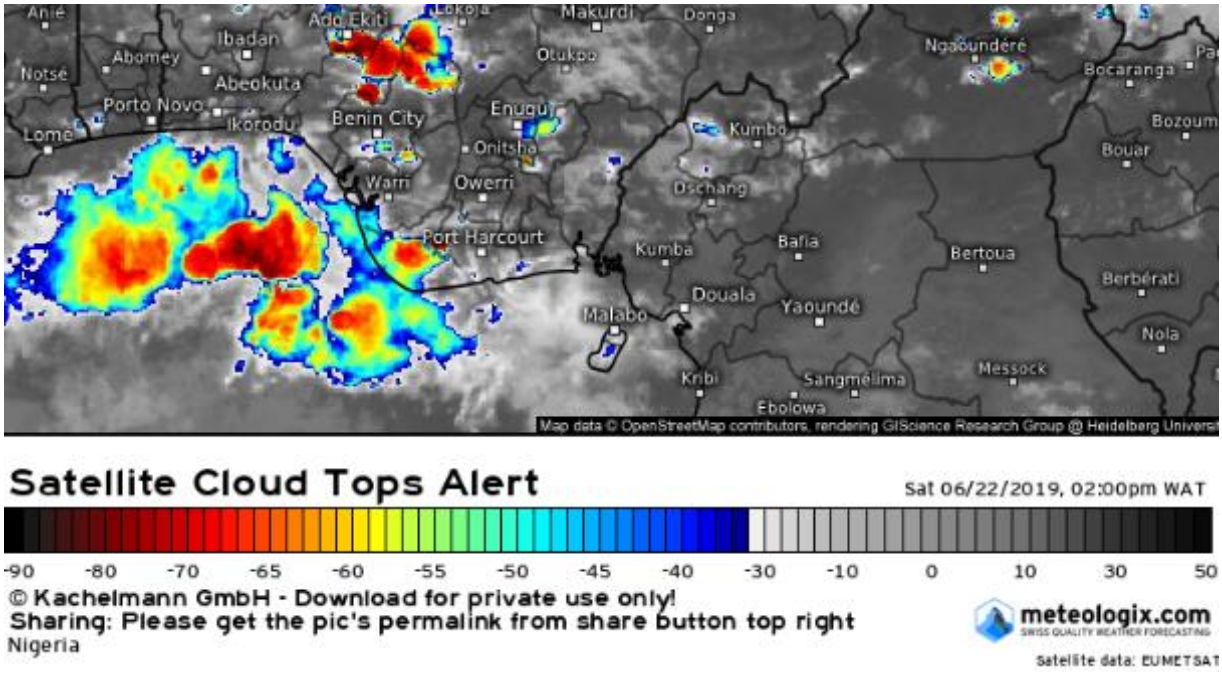


Figure 3: Satellite imagery at 1300 UTC

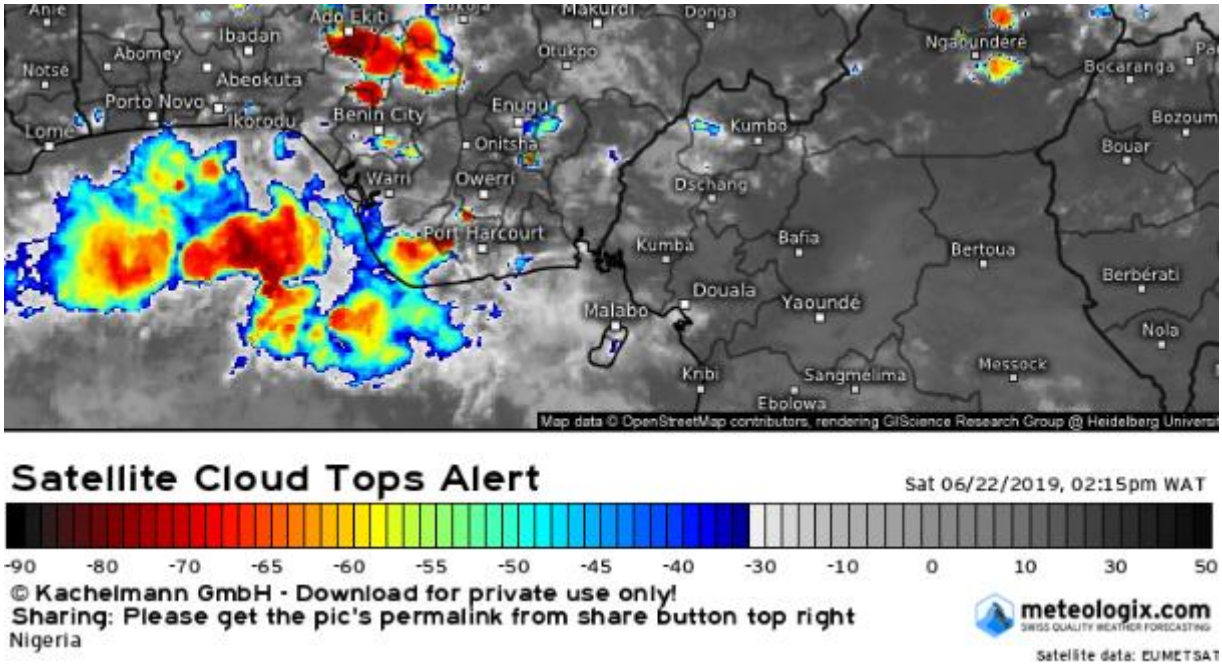


Figure 4: Satellite imagery at 1315 UTC

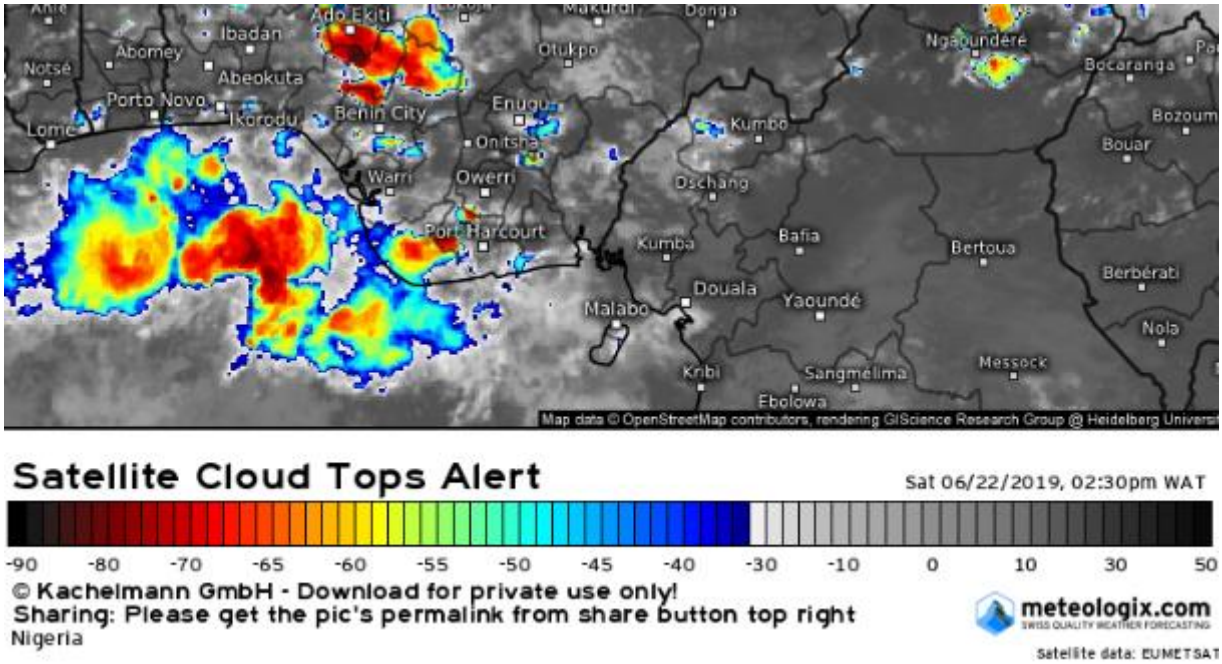


Figure 5: Satellite imagery at 1330 UTC

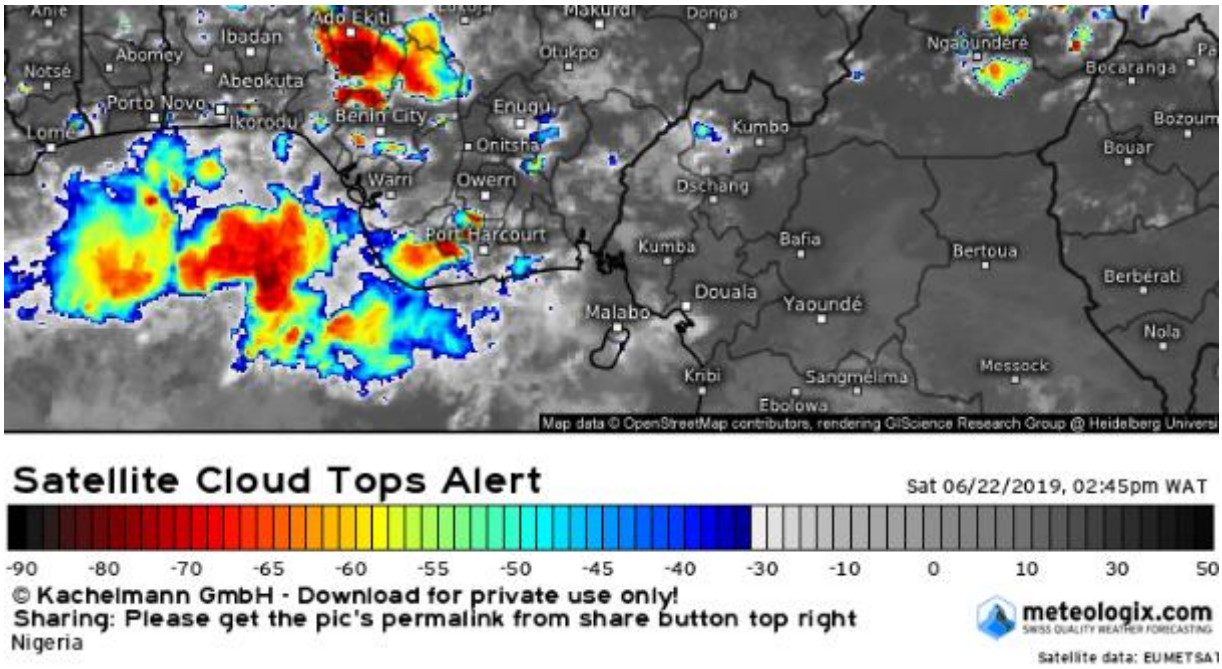


Figure 6: Satellite imagery at 1345 UTC

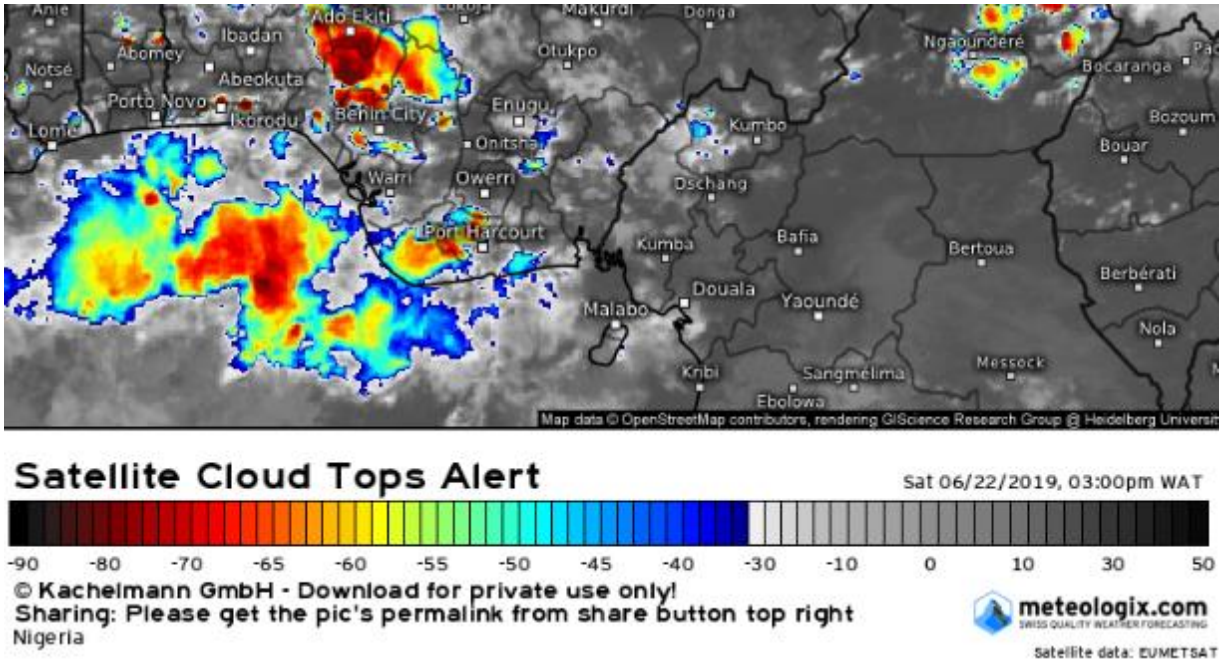


Figure 7: Satellite imagery at 1400 UTC

1.8 Aids to navigation

The conditions of the navigational aids at Port Harcourt International Airport on the day of the occurrence were as follows:

VHF 119.2 MHz (TWR MAIN)	-Serviceable-
VHF 118.6 MHz (TWR SEC)	-Serviceable-
VHF 124.9 MHz (APP)	-Serviceable-
VHF 121.7 MHz (DOMESTIC)	-Serviceable-
VHF 121.5 MHz (EMERGENCY)	-Serviceable-
VHF 122.3 MHz (ATIS)	-Unserviceable-
'POT' 113.5 MHz VOR/DME (FAILED CAL)	-Unserviceable-
'IPC' 110.3 MHz ILS/DME	-Serviceable-

VSAT/SATCOM/GSM PHONES	-Serviceable-
JOTRON STANDBY RADIO	-Serviceable-
FREQUENCY SMART STRIP	-Serviceable-
AUTOMATED WEATHER OBSERVING SYSTEM (AWOS)	-Serviceable-
LOW LEVEL WINDSHEAR ALERT SYSTEM (LLWAS)	-Unserviceable-
RADAR MONITOR	-Serviceable-
DIGITAL ANENOMETER	-Serviceable-
ALDIS LAMP	-Serviceable-
BINOCULARS	-Serviceable-
TOWER – APP DIRECT LINK	-Serviceable-
NIMET WEATHER REPORT MONITOR	-Serviceable-
ATM MANUAL OF Ops	-Serviceable-

1.9 Communications

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

1.10 Aerodrome information

Port Harcourt International Airport (DNPO) Aerodrome Reference Point is 05°00'56"N, 006°56'58"E and has an elevation of 27 m (87 ft). The aerodrome has two runways with orientation of 03 and 21. The length and width of the runway are 3,000 m (9,843 ft) and 60 m (197 ft) respectively with an asphalt/concrete surface

and a blast pad of 120 m (393.7 ft) at both ends. Both runways have Precision Approach Lighting System (PALS) and Runway 21 has Precision Approach Path Indicator (PAPI). Runway 21 was used for the landing.

1.11 Flight recorders

The aircraft is fitted with Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR). The recorders, whose particulars are given below were retrieved and taken to the Accident Investigation Bureau's Flight Safety Laboratory in Abuja for download and analysis.

	Cockpit Voice Recorder	**Flight Data Recorder**
Model	SSCVR	SSFDR
Part Number	980-6022-001	980-4700-001
Serial Number	0705	0373
Manufacturer	Allied Signal	Honeywell International

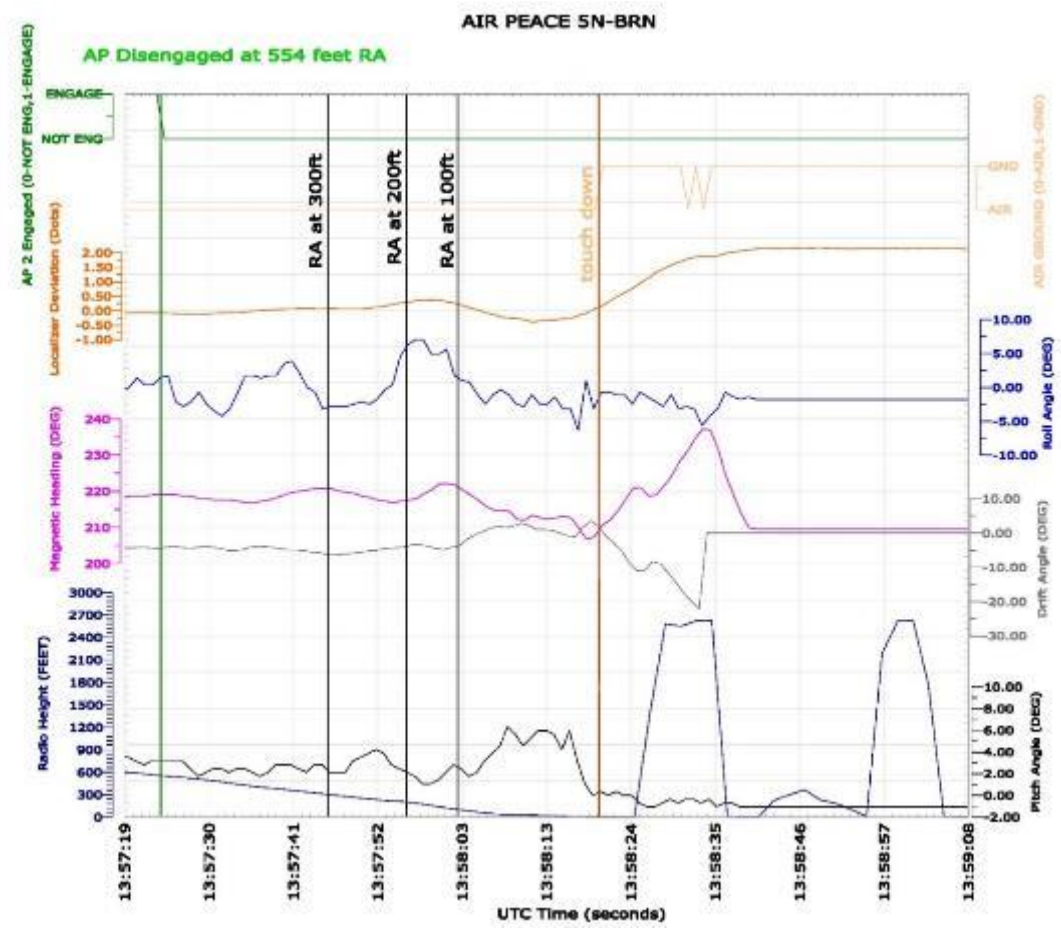


Figure 8: Final approach and landing

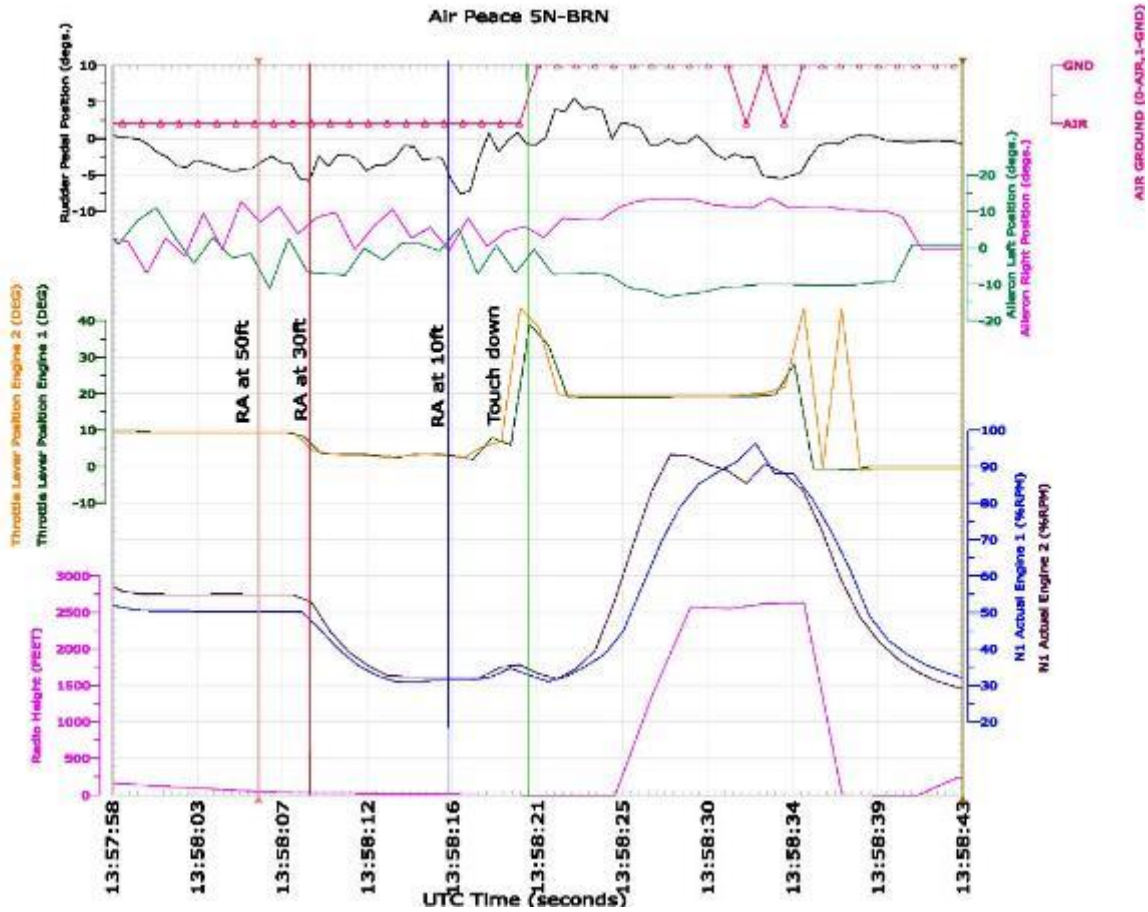


Figure 9: Final approach and landing

Extract from CVR transcript on weather from 12,000 feet to touchdown

Altitude	SPEAKER	CONTENT
	P1	our alternate is going to be Owerri depending on the weather. On ground we are going to have five point eight tones left, so we have about ten minutes if we have to hold
2600ft	P2	I like to go a little bit to the right
	P1	look at your weather radar and see where you want to go
2400ft	P1	we're below the clouds, we're landing in rain

		cabin crew advised, missed approach altitude two thousand five hundred set, landing checks complete
1000ft	P1	the rain is straight ahead, if we've to go-around straight ahead
	P2	Alright
	P1	Maintain straight ahead
	P2	Alright sir
600ft	A/C	*Continuous wiper sound*
500ft	P1	checks, right crosswind twelve knots
	A/C	Continuous wiper sound to touchdown

1.12 Wreckage and impact information

The aircraft veered off the runway, left of the centreline at about 1,260 m from the threshold into the grass verge. It continued its movement on the grass and stopped parallel to the runway at about 1,620 m from the threshold with the right wing-tip at the edge of the runway shoulder at approximately 37 m from the centreline and the landing gears stuck in the mud.

The aircraft was recovered at about 15:10 h on 23rd June, 2019 by Federal Airports Authority of Nigeria (FAAN) in collaboration with other agencies.

The post recovery inspection of the aircraft revealed damage to the following components:

- Lower VHF antenna
- Lower anti-collision light
- Mud and foliage ingestion in the left and right trailing edge flap fairings
- Damage to No. 2 engine fan blades
- Main wheels and brake assemblies
- Nose wheels

Figure 10: Aerial view of the aircraft at its final position

Figure 11: The aircraft wheels stuck in mud

Figure 12: Tracks of the main wheels leading into the grass verge

Figure 13: The aircraft at its final position

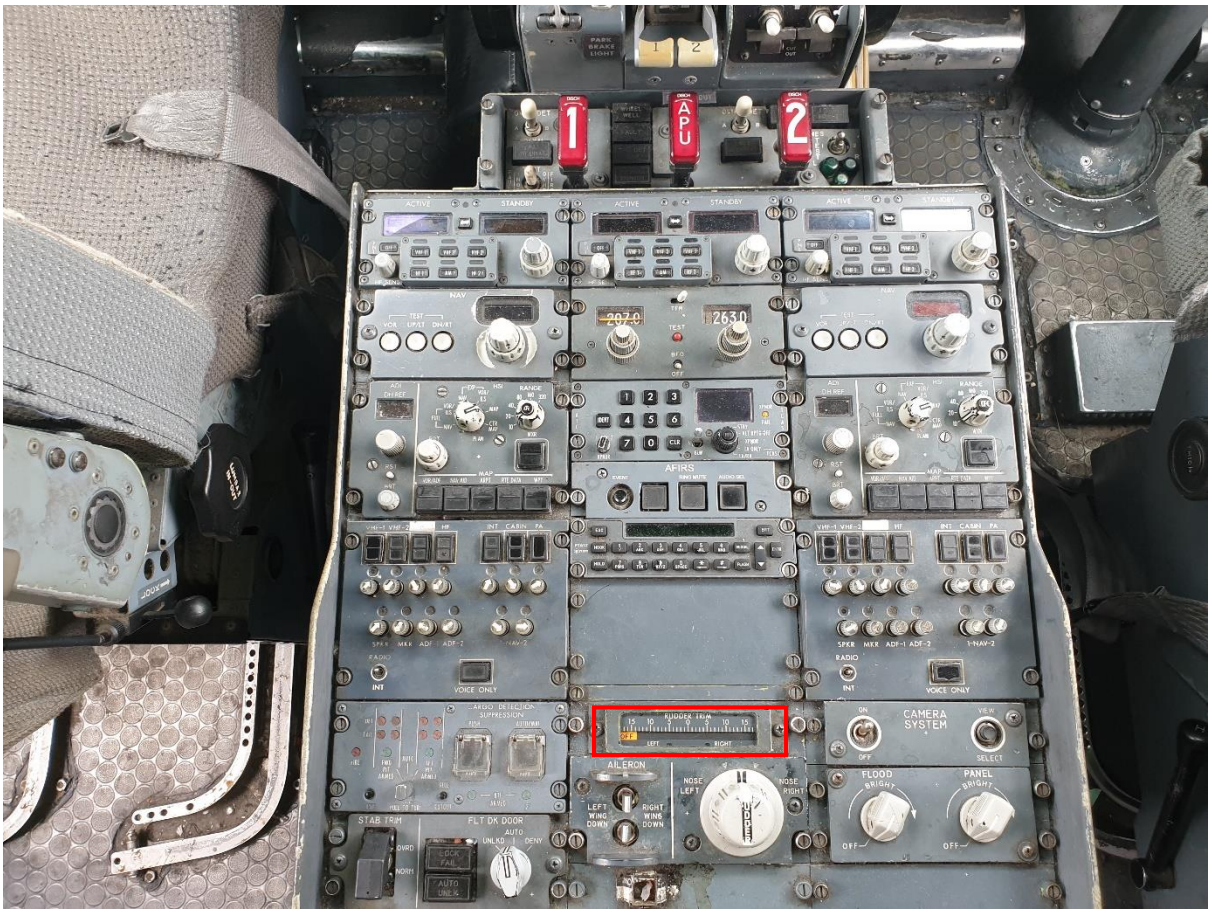


Figure 14: Highlighted photo of rudder trim panel on the pedestal

1.13 Medical and pathological information

Toxicology examination was carried out on the crew after the occurrence. The result of the examination was negative for alcohol and drugs.

1.14 Fire

There was no fire outbreak.

1.15 Survival aspects

There was liveable volume for the passengers and crew because the aircraft structure was intact after the occurrence. The seats and the restraint system were also found intact.

All persons on board disembarked the aircraft through the forward service door (R1) using the moveable passenger stairs and there were no injuries.

1.16 Test and research

Not Applicable.

1.17 Organizational and management information

1.17.1 Air Peace Limited

Air Peace is a private Nigeria airline founded in 2013 with its head office in Lagos State, Nigeria. Its operating Base is Murtala Muhammed International Airport. Air Peace, which provides passenger and charter services, serves the major cities of Nigeria and flies to 20 destinations including West Africa and the Middle East. The airline also established a subsidiary- Air Peace Hopper in 2018. Air Peace Limited holds an approved Air Operator Certificate (AOC) issued on the 8th of September, 2018 Number; APL/AOC/09-14/01, valid till 7th September, 2020.

Air Peace Limited has a total of 25 aircraft in her fleet; 16 Boeings (13 B737 and 3 B777), 1 Dornier Do-328JET, and 8 Embraer ERJ-145.

Air Peace designations are; P4 (IATA), APK (ICAO) and PEACE BIRD (Call sign).

1.17.1.1 Operations Manual Part B OPS/Standard Operating Procedures SOP

This manual also known as Standard Operating Procedure Manual (SOP) is prepared as a guide for all Air Peace crew for safe operations of our Boeing 737-500 aircraft. Majority of its contents especially those relating to certification limitations are propriety in nature and have therefore been copied as is from the Airplane Flight Manual (AFM).

Team work is the key concept to an understanding of the SOP. As a pilot, you are an integral part of a coordinated operation. The SOP explains not only your duties but also the duties of other crew members. Knowing what to expect from the other pilots aids in standardization and is an important factor in cockpit resource management. This knowledge enables the crew member to detect and correct errors or omissions.

The captain has the authority to deviate from the SOP, but only when unusual circumstances require him to do so in the interest of safety.

Airplane General (OM Part B 2.1)

Operational Limitations

Maximum Take-off and landing tailwind component-------- 10 knots

Maximum operating altitude---------- 37,000 feet pressure altitude

Maximum take-off and landing altitude---------- 8,400 feet pressure altitude

…

Crew Duties (OM Part B 3.0.2)

Preflight and post flight crew duties are divided between the captain and first officer. Phase of flight duties are divided between the pilot flying (PF) and the Pilot Monitoring (PM). Each crew member is responsible for moving the controls and switches in their area of responsibility.

The general Pilot Flying phase of flight responsibilities are:

- *Taxiing*
- *Flight path and airspeed control*
- *Airplane configuration*
- *Navigation*

The general Pilot Monitoring phase of flight responsibilities are:

- *Checklist reading*
- *Communications*
- *Tasks asked for by Pilot Flying*
- *Monitoring taxiing, flight path, airspeed, airplane configuration and navigation.*

PF and PM duties may change during a flight. For example the captain could be the PF during taxi but be the PM during takeoff through landing.

Do not be distracted from primary task of safely taxiing the aircraft.

Ensure that all crew members are aware of airplane attitude, position and instrument indications. Casual and non-essential conversation can be distracting, and may interfere with normal communications and is prohibited when below 10,000 feet AMSL.

Recommended sterile cockpit from the Before Start Checklist to TOC and TOD to shut down engines, unnecessary conversation reduces crew efficiency and alertness to the problem at hand, e.g approach and landing.

A Stabilized Approach Recommendations (OM Part B 3.23)

Maintaining a stable speed, descent rate, and vertical/lateral flight path in landing configuration is commonly referred to as the stabilized approach concept.

Any significant deviation from planned flight, airspeed, or descent rate should be announced. The deviation to execute a go-around is no indication of poor performance.

Note: Do not attempt to land from an unstable approach.

Recommended Elements of a Stabilized Approach

The following recommendations are consistent with criteria developed by the Flight Safety Foundation.

All approaches should be stabilized by 1,000 feet above airport elevation in instrument meteorological conditions (IMC) and by 500 feet above airport elevation in visual meteorological conditions (VMC). An approach is considered stabilized when all of the following criteria are met:

- *the airplane is the correct flight path*
- *only small changes in heading/pitch are required to maintain the correct flight path*
- *the airplane speed is not more than VREF + 20 knots indicated airspeed and not less than VREF*
- *the airplane is in the correct landing configuration*
- *sink rate is no greater than 1,000 fpm; if an approach requires a sink rate greater than1,000 fpm, a special briefing should be conducted*
- *power setting is appropriate for the airplane configuration*
- *all briefings and checklists have been conducted.*

Specific types of approaches are stabilized if they also fulfil the following:

- *ILS approaches should be flown within one dot of the glide slope and localizer, or within the expanded localizer scale (as installed)*
- *During a circling approach, wings should be level on final when the airplane reaches 300 feet above airport elevation.*

Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing.

Note: An approach that becomes unstabilized below 1,000 feet above airport elevation in IMC or below 500 feet above airport elevation in VMC requires an immediate go-around.

These conditions should be maintained throughout the rest of the approach for it to be considered a stabilized approach. If the above criteria cannot be established and maintained at and below 500 feet AFE, initiate a go-around.

At 100 feet HAT for all visual approaches, the airplane should be positioned so the flight deck is within, and tracking to remain within, the lateral confines of the runway edges extended.

As the airplane crosses the runway threshold it should be:

- *Stabilized on target airspeed to within + 10 knots until arresting descent rate at flare*
- *On a stabilized flight path using normal maneuvering*
- *Positioned to make a normal landing in the touchdown zone (the first 3,000 feet or first third of the runway, whichever is less).*

Initiate a go-around if the above criteria cannot be maintained

Callouts (OM Part B 3.33)

The PNF will accomplish the appropriate callout based on instrument indications or observations for the flight conditions. The PF will verify the condition/location from his instruments and acknowledge. If the PNF does not make the required callout, the PF should make it.

Standard Call-Outs (OM Part B 3.33.1)

In order to standardize the aircraft operation and to ensure the highest level of flight safety, standard-callouts will be used in normal, abnormal and emergency situations. Call-outs must be in a loud and clear voice.

Boeing 737 Flight Crew Operations Manual (Normal Checklists)

DESCENT

CPCS airplane

Pressurization……CAB ALT__, LAND ALT___

DCPCS airplane

Pressurization……LAND ALT_____

Recall……..Checked

Autobrake……_____

Landing data……VREF___, Minimums_____

Approach briefing……..Completed

APPROACH

Altimeters……_____

LANDING

Engine start switches……CONT

Speedbrake……ARMED

Landing gear……Down

Flaps……____, Green light

1.17.1.2 Airplane Flight Manual

An Airplane Flight Manual (AFM) is a document developed by the airplane manufacturer and approved by the regulatory authority (FAA, NCAA etc). It is specific to a particular make and model airplane by serial number and it contains operating procedures and limitations which meet the requirement of FAR 21.5 (for Boeing).

The airplane manual is subdivided into 10 sections viz

- General (section 1)
- Limitations (section 2)
- Emergency procedures (section 3)
- Normal procedures (section 4)
- Performance (section 5)
- Weight and balance (section 6)
- Description and operation of the airplane and its systems (section 7)
- Airplane handling, servicing and maintenance (section 8)
- Supplements (section 9)
- Operating tips (section 10)

It is important to know and possess the required documents for the aircraft flown by operators**.**

Airplane Flight Manual (AFM) Section 1: 09-23-04

A u t o p i l o t (A/ P)/ F l i g h t D i r e c t o r (F/D) S y s t e m

- *Do not engage the autopilot for take-off below 1000 feet AGL*
- *For single channel operation during approach, the autopilot shall not remain engaged below 50 ft AGL.*

…

Maximum Crosswind (Boeing Airplane Flight Manual Section 4.1 page 8)

The maximum demonstrated crosswind component for take-off and landing is 35 knots reported wind at 10 metre height. This component is not considered to be limiting on a dry runway with all engines operating.

1.17.2 Federal Airport Authority of Nigeria (FAAN)

Federal Airports Authority of Nigeria (FAAN) is a service organization statutorily charged to manage all Commercial Airports in Nigeria and provide service to both passenger and cargo airlines.

FAAN performs its statutory duties, according to the policy guidelines provided by the Federal government of Nigeria, through the Federal Ministry of Aviation and is guided by these in all of its business dealings and agreements with contractors and various third parties with which it does business.

Duties/Functions FAAN

FAAN is entrusted with the following functions:

- To develop, provide and maintain airports, necessary services and facilities for safe, orderly, expeditious and economic operation of Air Transport.
- To provide adequate conditions under which passengers and goods may be carried by air and under which aircraft may be used for other gainful purpose and prohibiting the carriage by air goods of such classes as may be prescribed.
- To charge for services provided by the authority at airports.
- To provide accommodation and other facilities for the effective handling of passengers and freight.
- To develop and provide facilities for surface transportation within airport.
- To carry out at the airports (either by itself or by an agent or in partnership with any other person) economic activities that are relevant to airport.

- To carry out at the airports (either by itself, its agents or in partnership with any other person) such other commercial activities which are not relevant to air transport.
- To carry out at the airports (either by itself, its agents or in partnership with any other person) such other commercial activities which are not relevant to air transport.
- To provide adequate facilities and personnel for effective security at all airport.

Generally, to create conditions for the development in the most economic and efficient manner of air transport and the services connected with it.

1.17.2.1 Surface Friction Assessment and Derubberization Exercise Reports

Federal Airport Authority of Nigeria carried out a Surface Friction Measurements on runway 21/03 Port Harcourt International Airport on the 16th of March, 2019. This was conducted in accordance with Nigerian Civil Aviation Regulations (Nig.CARs Part 12.6.4e), Airport Standards Manual and ICAO Annex 14. **See Appendix A.**

FAAN also carried out a Derubberization Exercise on runway 21/03 Port Harcourt International Airport on the 9th and 10th of March, 2019. The second quarter derubberization exercise was conducted on 15th and 16th of June, 2019. **See Appendix B.**

1.17.3 Nigerian Airspace Management Agency (NAMA)

The Nigerian Airspace Management Agency (NAMA) was established by act of parliament to carry out the following functions among others:

- Provide air traffic services in Nigeria, including air traffic control, visual and non-visual aids, aeronautical communications services and electricity supplies

relating thereto, to enable public transport, private, business and military fly, as far as practicable and as safely as possible.

- Provide aerodromes at all the major airports, the navigation services necessary for the operation of aircraft taking off and landing and integrate them into the overall air traffic within the Nigeria airspace.
- Minimize or prevent interference with the use or effectiveness of all apparatus used in connection with air navigation and for prohibiting or regulating the use of such apparatus and display of signs and lights liable to endanger aircraft and endanger the use of Nigerian airspace.
- Require persons engaged in or employed in or in connection with air navigation, to supply meteorological information for the purpose of air navigation, as may be deemed appropriate from time to time.

1.17.3.1 Excerpt from ICAO Annex 11 Chapter 4

ATIS

Voice-Automatic Terminal Information Service (Voice-ATIS) broadcasts ***4.3.4***

4.3.4.1 *Voice-automatic terminal information service (Voice-ATIS) broadcasts shall be provided at aerodromes where there is a requirement to reduce the communication load on the ATS VHF air-ground communication channels. When provided, they shall comprise:*

a) One broadcast serving arriving aircraft; or

b) one broadcast serving departing aircraft; or

4.3.8 *ATIS for arriving aircraft*

ATIS messages containing arriving information only shall contain the following elements of information in the order listed:

…

s) any available information on significant meteorological phenomena in the approach area including wind shear, and information on recent weather of operational significance;

t) trend forecast, when available; and

u) specific ATIS instructions.

1.17.4 Nigerian Meteorological Agency (NiMet)

Nigerian Meteorological Agency (NiMet) was established by an act of parliament, NiMet (Establishment) Act of 2003.

It is the federal government agency charged with the responsibility to advise the federal government on all aspect of meteorology; prepare and interpret government policy in the field of meteorology, and also issue weather (and climate) forecasts for the safe operations of aircrafts, ocean going vessels and oil rigs.

It is also the responsibility of the agency to observe, collate, collect, process and disseminate cell meteorological data and information within and outside; co-ordinate research activities among staff, publish scientific papers in the various branch of meteorology in support of sustainable socio-economic activities in Nigeria.

The mandate of the agency in summary is; observing, analyzing, timely and accurate reporting of weather and climate information for socio-economic development and safety of lives and property.

1.17.4.1 Excerpt from ICAO Annex 3 Chapter 6

6. Specifications related to wind shear warnings

6.1 Detection of wind shear

Recommendation. — Evidence of the existence of wind shear should be derived from:
a) ground-based wind shear remote-sensing equipment, for example, Doppler radar;
b) ground-based wind shear detection equipment, for example, a system of surface wind and/or pressure sensors located in an array monitoring a specific runway or runways and associated approach and departure paths;

c) aircraft observations during the climb-out or approach phases of flight to be made in accordance with Chapter 5; or

d) other meteorological information, for example, from appropriate sensors located on existing masts or towers in the vicinity of the aerodrome or nearby areas of high ground.

Note. — Wind shear conditions are normally associated with the following phenomena: — thunderstorms, microbursts, funnel cloud (tornado or waterspout), and gust fronts

…

6.2 Format and dissemination of wind shear warnings

Note. — Information on wind shear is also to be included as supplementary information in local routine and special reports and METAR and SPECI in accordance with the templates in Tables A3-1 and A3-2.

6.2.1 The wind shear warnings shall be prepared in abbreviated plain language in accordance with the template in Table A6-3 and disseminated for aerodromes where wind shear is considered a factor in accordance with local arrangements with the appropriate ATS authority and operators concerned and by the meteorological office designated to provide service for the aerodrome or disseminated directly from

automated ground-based wind shear remote-sensing or detection equipment referred to in 6.1 a) and b).

…

1.18 Additional Information

1.18.1 Low Level Windshear Alert System (LLWAS)

A Low Level Wind Shear Alert System (LLWAS) is a ground based system used to detect windshear and associated weather phenomena such as microburst, close to an airport: especially along the runway corridors. A low level windshear is defined as a sudden change in wind velocity (speed) and or direction in either vertical or horizontal planes. At low level, when aircraft are departing from or landing at an aerodrome, wind shear can present a severe risk to flight safety. Therefore, timely warnings are essential to help flight crew respond appropriately.

1.18.1.1 Low Level Windshear Alert System Anemometers

An LLWAS consists of a number of anemometers strategically placed around, and within an aerodrome. Older systems used a minimum of 6 anemometers (one central and five perimeter) all within the aerodrome boundaries, whereas up-to-date systems can have over 30, with some placed up to 3 nautical miles (NM) along approach and departure paths.

Predominantly, only horizontal wind shear is measured, that is, all the anemometers are placed at similar height above the aerodrome reference. However, at some aerodromes remote sensing anemometers are placed on existing television masts and towers located in the vicinity of the aerodrome and even on surrounding hills where known problems exists (e.g. Hong Kong), in order to observe and measure wind shear in the vertical axis.

Aerodromes can be prevented from placing anemometers at preferred sites due to land ownership and access issues. Furthermore, to prevent interference with anemometer readings from local building development and terrain, some anemometers have to be sited at less than ideal locations.

1.18.1.2 Low Level Windshear Alert System Processing System

The aim of the system is to provide visual and audio alert to ATC so that they can pass on information and warnings about wind shear and microburst to flight crew and other aerodrome services and users.

The system processor continually monitors and compares the vector difference between and center field surface wind observations. The perimeter sensors (anemometers) are sampled regularly by the central control unit for every ten seconds for instance. The center field sensor produces a trio-minute running mean surface wind which is displayed in the ATC Tower Log with any detected gusts. If the vector difference between the center field and a perimeter sensor is more than 15 knots, the relevant perimeter wind is also displayed and an audio-visual alarm is triggered. Microburst conditions are detected by different algorithms, as a microburst can easily occur between two perimeter sensors without affecting any of them. In the latest LLWAS, variations in speed and direction are compared between sensors along a runway approach corridor; these variations can provide timely and accurate notice of a microburst.

1.18.1.3 Development

Although LLWAS manufacturers claim detection reliabilities and accuracies above 90 percent, there is still room for improvement in accuracy and reliability of LLWAS. False alarm can be caused by gusty wind conditions, by less than ideal anemometer siting e.g. shielding by obstructions, and by anemometer under/over reading. It is even possible that unserviceable anemometers can still feed erroneous data into the

system. New technology such as sonic anemometers can replace the mechanical vane anemometers. Being solid state instruments, these new sensors have a much better reliability and maintainability. Sensor information from LLWAS can also be integrated with data from Terminal Doppler Weather Radar (TDWR). Where this is installed, the outputs from the two systems will be integrated for issuance of warnings.

1.18.1.4 Air Traffic Control

Air Traffic Controllers (ATCOs) relays alert to all pilots on the relevant frequencies (Ground, Departure, Tower, Approach etc.) until such a time as the warnings are recorded on the Automatic Terminal Information Service (ATIS) and pilots have acknowledged the appropriate ATIS code letter as received. General warnings may be first issued e.g.

(a) low level wind shear/microburst advisories in effect
(b) caution, microburst minus 30 knots on final approach
(c) caution, wind shear plus 25 knots on departure

Some warnings may contain the centerfield wind followed by the relevant perimeter/runway wind.

1.18.2 Terminal Doppler Weather Radar (TDWR)

A Terminal Doppler Weather Radar (TDWR) system detects and reports hazardous weather in and around airport terminal approach and departure zones. The TDWR identifies and warns Air Traffic Controllers (ATCOs) of low altitude wind shear hazards caused by microbursts and gusts fronts, in addition to reporting on precipitation intensities and providing advanced warning of wind shifts.

TDWR antenna are located near but not on a primary airport site. The radar is specially designed to operate in a highly clustered environment usually present in the airport vicinity. It makes use of a variety of methods to minimize cluster and eliminate the

influence of such moving targets as birds, aircraft and even automobiles. In this way, the TDWR can accurately measure the radial wind speed and its fluctuations from which low level windshear can be computed.

The ATCOs use the TDWR reports to warn pilots who are potentially affected by the hazardous weather patterns.

1.18.3 Crew Resource Management

Crew Resource Management (CRM) is a methodology in which resources of equipment, procedures and people are collectively utilized as needed to safely complete every flight task. The individual components of CRM resources are communication, situation awareness, problem solving, decision making and team work. Crew resource management can also be said to be the effective use of all available resources for flight crew personnel to ensure a safe and efficient aircraft operation, reading error, avoiding stress and increasing efficiency.

The goal of Crew Resource Management is to reduce accidents or occurrences due to pilot error. It encourages first officers and other crew members to respectfully question the captain. It also encourages flight crews to work as a team rather than separate units with one decisive leader.

The following are crew resource management skills flight crews should possess.

- Communication and interpersonal skills
- Situation awareness
- Problem solving, decision making and judgment
- Leadership and followership
- Stress management
- Critique and self-critique.

CRM teaches pilots to act calmly and appropriately instead of out of fear or impulsiveness when decisions need to be made. Pilots should recognize their peculiar hazardous attitude that might interfere with good decision making and manage risk

appropriately. Pilots are now being taught that the only way to mitigate risks associated with flight operations is to manage them appropriately. This involves knowing the associated risk to start with. Flight crew manage risks by knowing that there are environmental risks such as weather or operational policies. These are also performance risks based on how heavy the aircraft is loaded, if the runway is wet, etc.

1.18.4 Witness report

According to the Captain, "as we descended, at about 12 NM, we saw the cloud under us and we called the Approach Tower to ask, if there is rain at the station and they said standby. Shortly after that, when they find out, they came back and said negative. We configured for the approach, about a 1000 ft, we could see the runway approach lights and PAPIs even though it was a bit misty. My First Officer was flying through all this time, then I ask him how many hours he has on the aircraft, He said 300 and something. Then I look at the FMC 2 for the wind. Initially there was 10 kts cross wind and about 4 kts head wind, then the wind started turning, becoming a tail wind. Also it started drizzling, we increase our auto break from 2 to 3, selected our wipers to low and then I told the First Officer I have control and we landed. As soon as we landed the mist still came and turned into a huge thunderstorm, I never have that experience. We struggled to control the aircraft on the runway. There was strong wind, a lot of water, visibility dropped, I put full controls because from my side I started seeing the runway edge light approaching. I put full rudder, brakes and aileron because I was trying to keep the wing down as the aircraft tends to tip up. The aircraft was uncontrollable, it skidded off and continued, we applied full braking until we managed to stop the aircraft".

According to the First Officer "as we descend into Port Harcourt, we can see weather building up over head. Once, Port Harcourt Approach handed us over to the Tower, I can remember the captain calling to ask Tower if it is raining over the station. The lady responded after a while that it was not raining. So we continue and we intercepted the localizer and the glideslope and we were fully established. Then the

captain called the tower inform them that we are established and she cleared us to land and to exercise caution due wet runway. Then the captain instantly selected auto brakes 3 and we continued. I can remember the captain telling me the go-around drill in case we want to go-around and what to expect, then we continued. Few miles to touchdown, am not exactly sure how many miles it is and then it started drizzling, then the captain now put the wiper on and on low. Then I remembered the captain asking me how many hours did you have on this aircraft and I said about 300 hours. Few minute[s], maybe a minute or two after that, he took over control".

1.19 Useful or effective investigation techniques

Nil.

2.0 ANALYSIS

2.1 General

The flight crew were certified and qualified to conduct the flight in accordance with the provisions of the Nigeria Civil Aviation Regulations (Nig.CARs). There was no evidence of any pre-existing medical or physiological conditions that might have impaired the crew performance.

The aircraft had a valid Certificate of Airworthiness (C of A) at the time of this occurrence, the weight and balance were within specification. There was no evidence of mechanical malfunctions, structural failures, flight controls limitations or powerplant failure that could have affected the aircraft performance.

Based on available evidence, the analysis of this occurrence will focus on the following: conduct of the flight, meteorological, other factors and crew resource management.

2.2 Conduct of the flight

At 14:32 h, APK7291 established contact with Port Harcourt Air Traffic Control (ATC) Approach (APP) unit, relayed flight information with estimates into Port Harcourt airport VOR (POT) for 14:59 h. Port Harcourt Approach replied with this inbound clearance; "APK7291 cleared to Papa Oscar Tango (POT) FL300, no delay expected for ILS approach runway 21, QNH 1011, time 1333Z.

From the FDR and CVR evidence available to the bureau, the operation of the flight was normal and stabilized until about 30 feet to touchdown. At this height, there was a positive drift angle of about 6 degrees and a negative rudder input of about 7 degrees. This shows that the aircraft was drifting to the right and the PF corrected for the drift with rudder input to the left. Also, at 30 ft RadAlt height, the throttles on both engines were retarded to idle which caused the aircraft to lose momentum for better

low level manoeuvre on landing. At 20 feet to touchdown, a rudder input of about 3 degrees to the right was applied.

From the FDR plot at touchdown, with a possible cross wind factor from the right at 100^{O}/12 knots involved, the aircraft started drifting to the left of the runway. The rudder input at this point was zero and increased to the right on the landing roll to 4 degrees and further to 7 degrees. This could be as a result of the flight crew realizing that the aircraft had drifted and touched down left of the runway centreline and tried to correct for this. This is corroborated by the magnetic heading of 212 degrees. During the landing roll, the magnetic heading started increasing to the right then suddenly started decreasing.

The flight crew on realizing excessive rudder input to the right in trying to correct for landing left of the runway centreline decided to also correct for this by commanding left rudder input of 3 to 4 and then further to 6 degrees. The crew were unable to stop the drift with these inconsistent rudder inputs. These rudder inputs were excessive causing the aircraft to veer off the runway into the grass verge, continuing in its movement parallel to the runway centreline and coming to a stop with the wheels stuck in the mud.

2.3 Meteorological and other factors

The crew reported to have experienced cross winds of 100^{o}/12 kt on descent at about 500 ft Above Ground Level (AGL) on final approach runway 21.

At 1330UTC, Port Harcourt Approach (APP) provided APK7291 with the following weather information: "Surface wind 190 at 05 knots, Visibility 9999 thunderstorm BKN 011 Few 020 CB, Temperature 31^{o}C Dew point 25 ^{o}C, QNH 1011, Tempo 5000 –TSRA (Temporary visibility 5000, thunderstorm in light rain)".

The above information correlates with the SPECIAL MET Report update issued by Port-Harcourt Met Office for 1332UTC.

Port-Harcourt ATC cleared APK7291 for landing on runway 21 at 1355UTC and provided wind information of 070°/3 kt, advising the flight crew to exercise caution during landing due wet runway surface.

NiMet had issued Meteorological and Special (SPECI) reports from 1230UTC indicating a thunderstorm cell within the vicinity of the Aerodrome in the North-South quadrant.

2.3.1 Review of the weather at DNPO

The latest weather at the time of the occurrence (1400UTC) as reported and issued by the MET Office was: Thunderstorm with light rain (-TSRA) with 10 minutes average wind given at Northwest as 8 kt (320/8 kt). A TREND FORECAST in expectation of decreasing horizontal visibility from 4000 to 3000 meters was included for the same report. It should be noted that the weather report for 1400UTC was issued at 1350UTC.

The wind direction for the past two hours had consistently varied from Southerly to North-Westerly in the general direction of a developing and advancing thunderstorm cell from the Southeast-Northwest direction as can be seen from the reports issued by the MET Office with a TREND forecast anticipating thunderstorm activity.

Archival footage of satellite imagery showed the development, intensification and propagation of a cluster of thunderstorm cells from the Southeast-North direction with significant activity to the Northwest direction.

From review of both Satellite Imageries and Met Reports issued within the period in consideration, the wind direction gradually began to change from Southerly (200/10 kt) at 1230UTC to north-westerly (320/8 kt) at 1400UTC in the general direction of the advancing storm cell which was more intense towards the north-westerly direction.

The advancing storm cells altered the wind direction which may have led to a significant increase in wind speed at the time of landing.

The weather was fast deteriorating and the crew were discussing a possible go-around in the event of not being able to land, with the visibility reducing from 4,000 meters to 3,000 meters then to 1,500 meters in thunderstorm with heavy rain over the station.

Evidence available indicates that the aircraft had an endurance of 02:30 h at departure from Abuja. Having flown an estimated flight time of 45 minutes, it had enough endurance with which the flight crew could have executed a go-around or divert to alternate.

2.3.2 Review of DNPO runway condition

The flight crew asserted that: "there was strong wind, a lot of water, visibility dropped, I put full controls because from my side I started seeing the runway edge light approaching. I put full rudder, brakes and aileron because I was trying to keep the wing down as the aircraft tends to tip up. The aircraft was uncontrollable, it skidded off and continued, we applied full braking until we managed to stop the aircraft".

Evidence available to the Bureau does not corroborate the above assertion by the flight crew.

The Federal Airport Authority of Nigeria (FAAN) carried out derubberization and Runway Frictional tests on runway 21/03 Port Harcourt International Airport prior to the date of the occurrence and the results as contained in the report was within the specified limits. There was also no evidence of water logging or rubber deposit on the runway that could have caused the aircraft to skid off.

Investigation also revealed that the Automatic Terminal Information Services (ATIS) was not operational at the time of the occurrence. This would have provided additional near real-time information from the MET Office to be transmitted to the flight crew.

The LLWAS was also not serviceable on the day of the occurrence.

2.4 Crew Resource Management

The goal of Crew Resource Management is to reduce accidents or occurrences due to pilot error. It encourages first officers and other crew members to respectfully question the captain. It also encourages flight crews to work as a team rather than separate units with one decisive leader.

The use of checklist during this flight was inconsistent. The descent and approach checks were carried out but not acknowledged as completed, only the landing checklists were completed and acknowledged. This is contrary to the provisions of the company's Operations Manual/Standard Operating Procedures (SOP).

According to company's Operations Manual/SOP, casual and non-essential conversation can be distracting, and may interfere with normal communications and is prohibited when below 10,000 feet AMSL. Sterile cockpit is recommended from the Before Start Checklist to TOC, and from TOD to engines shut down, unnecessary conversation reduces crew efficiency and alertness to the task at hand, e.g approach and landing.

On final approach inbound on the POT ILS, the captain suddenly wanted to know the first officer's total experience on type. The first officer confirmed he had 300 hours. At this time, considering the phase of flight, the captain should have concentrated on flying the aircraft properly and avoid casual conversations.

As the approach continued, wipers were heard confirming presence of rain in the approach path and at 400 ft AGL, wipers were switched to HIGH mode confirming more volume of rain water at short finals to runway 21. At 300 ft AGL, the Captain announced taking over control from the First Officer and continued the approach in heavy rain.

Flight crew should possess the following crew resource management skills: communication and interpersonal skills, situation awareness, problem solving, decision

making and judgment, leadership and followership, stress management, critique and self-critique.

The decision of the crew to continue the flight rather than go-around was inadequate. From the training records available to the Bureau, the steep cockpit gradient in this flight might have influenced the level of coordination between the crew.

3.0 CONCLUSION

3.1 Findings

1. The aircraft had a valid Certificate of Airworthiness.
2. The aircraft veered off runway 21 left of the centreline into the grass verge at a distance of about 1,260 m from the runway threshold.
3. The aircraft came to a stop at a distance of 1,620 m from the threshold of runway 21 and the landing gears stuck in the mud.
4. The aircraft right wing tip at its final position was aligned with the edge of the runway shoulder approximately 37 m from the runway centreline.
5. The crew and passengers disembarked in rain without any injury through the forward service door (R1) using moveable passenger stairs.
6. The aircraft was recovered at about 15:10 h on 23rd June, 2019 by FAAN and other relevant agencies.
7. The Low Level Wind Shear Alert System (LLWAS) at Port Harcourt airport was unserviceable at the time of the occurrence.
8. The Automatic Terminal Information Service (ATIS) was unserviceable and NOTAM was issued to that effect.

3.2 Causal factor

Excessive and inconsistent rudder inputs after touchdown.

3.3 Contributory factor

1. The decision to continue the approach rather than to execute a go-around in an adverse weather condition.
2. Non-adherence to procedures in terms of callouts and go-around as contained in the company's operations manual.

4.0 SAFETY RECOMMENDATIONS

4.1 Safety Recommendation 2021-025

Nigerian Meteorological Agency (NiMet) should ensure serviceability of the Low Level Windshear Alerting System (LLWAS) at Port Harcourt International Airport.

4.2 Safety Recommendation 2021-026

Nigerian Airspace Management Agency (NAMA) should ensure the functionality of the Automatic Terminal Information System (ATIS) at Port Harcourt International Airport.

4.3 Safety Recommendation 2021-027

Air Peace Limited should ensure strict adherence to procedures by flight crew as contained in the approved company Operations Manual/Standard Operating Procedure (SOP).

APPENDIX

Appendix A: Runway friction test report

The Managing Director,
Federal Airport Authority of Nigeria,
Port Harcourt,
Nigeria.

Statement of compliance

Surface Friction Test was conducted in accordance with Nigerian Civil Aviation Regulation, NCAA Airport Standards Manual and ICAO Annex 14.

NOTES:

1. ***This report is to be read in conjunction with attached test computer generated documents.***
2. ***This report is non-transferable.***
3. ***The facility owner is responsible for ensuring that the runway surface friction is maintained in accordance with Nigerian Civil Aviation Regulation, NCAA Airport Standards Manual and ICAO Annex 14.***
4. ***Validity: The validity of this report based on NCAA/ICAO requirement/recommendations***

Inspector's Name:

Signature:

Date: 16/03/2019

Port Harcourt International Airport Runway Friction Test Report 1

The Managing Director,
Federal Airport Authority of Nigeria,
Port Harcourt,
Nigeria.

Test Equipment/Method

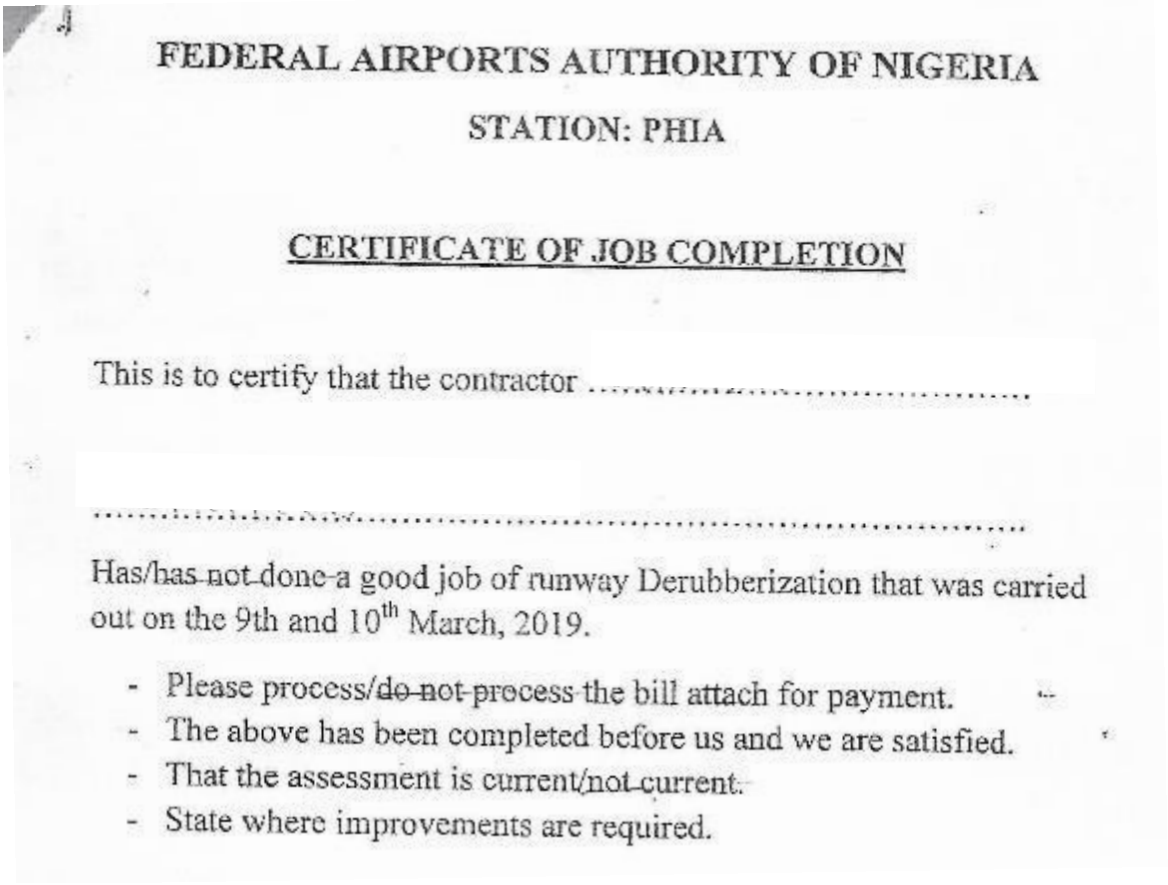
The SARSYS-ASFT T-5 Trailer continuous friction measuring equipment (CFME) with self-wetting capability was used for the test. The equipment operates on the skiddometer principle by applying a fixed longitudinal slip on the test wheel to enable continuous coefficient of friction measurement as required by NCAA and ICAO Annex 14.

RUNWAY 21/03
WIDTH 60m
LENGTH 3000m
SELF WET: ON

No of Runs	Runway Direction	Time (Local)	Dist. From C/L	Side from C/L	Average speed (km/h)	Surface condition	Average Friction Value
1	RWY 21	23:33:03	1.5m	Right	65	Good	0.55μ
1	RWY 03	23:33:03	1.5m	Right	65	Fair	0.54 μ
1	RWY 21	23:43:04	4m	Right	65	Fair	0.53 μ
1	RWY 03	23:43:04	4m	Right	65	Good	0.54 μ
1	RWY 21	00:04:25	7m	Right	65	Fair	0.53μ
1	RWY 03	00:04:25	7m	Right	65	Good	0.55μ
1	RWY 21	00:27:27	11m	Right	65	Fair	0.54μ
1	RWY 03	00:27:27	11m	Right	65	Good	0.54μ
1	RWY 21	00:37:26	17m	Right	64	Fair	0.54μ
1	RWY 03	00:37:26	17m	Right	64	Good	0.54μ
1	RWY 21	00:57:20	23m	Right	65	Fair	0.51μ
1	RWY 03	00:57:20	23m	Right	65	Fair	0.51μ
TOTAL AVERAGE FRICTION VALUE							**0.53μ**
CHECK1	21	00:20:16	--	Right	64		0.58μ
CHECK2	03	01:05:53	--	Right	65		0.56μ

Port Harcourt International Airport Runway Friction Test Report 2

Appendix B: The derubberisation exercise report



FEDERAL AIRPORTS AUTHORITY OF NIGERIA

STATION: PHIA

CERTIFICATE OF JOB COMPLETION

This is to certify that the contractor .....

.....

Has/~~has not~~ done a good job of runway Derubberization that was carried out on the 9th and 10th March, 2019.

- Please process/~~do not process~~ the bill attach for payment.
- The above has been completed before us and we are satisfied.
- That the assessment is current/~~not current~~.
- State where improvements are required.

FEDERAL AIRPORTS AUTHORITY OF NIGERIA

STATION: PHIA

OMAGWA

INTERNAL MEMO **18th June, 2019.**

TO: AM/RGM SS/SE

FROM: HOD ENVIRONMENT

SUBJECT: REPORT ON SECOND QUARTER DERUBBERIZATION 2019.

Above subject refers.

The second quarter derubberization was carried out on the 15th and 16th June, 2019 at 2200hrs- 0130hr each day.

The chemicals used for the exercise were Rubberaser and degreaser
The equipment used for the exercise – Motorized sweeper, pick up truck, Toyota (TUNDRA)truck and two (2) bucket sprinklers, four (4) buckets and PPEs (Nose mask, Safety boot / rain boot and coverall).
Their staff were kitted but wer observed to be without eye goggle and were supervised by Environment ,Safety and Operations department.
The exercise lasted for three hours and thirty minutes each day.

On the 15th of June, 2019 ATC granted clearance for the derubberization exercise at about 2203hrs. There was a total of four (4) drums used; Three (3) were rubberaser and one (1)degreaser.At about 2215hrs, the staff applied chemical (ruberaser) on the runway. At about 2248hrs the degreaser was applied over the chemical (rubberaser).The motorized sweeper commenced Scrubing at about 2248hrs the degreaser was applied over the chemical (rubbereraser).The motorized sweeper commenced scrubbing at about 2306hrs. At about 0051hrs. Flushing of the chemical (rubberaser) commenced. The exercise came to a close at about 0125hrs.

On the 16th of June, 2019 ATC granted clearance for the derubberization exercise at about 220hrs.There was a total of four (4) drums used; three (3) were rubberaser and one (1)degreaser. At about 2235hrs,the staff applied the chemical (rubberaser)on the runway.At about 2313hrs the degreaser was applied over the the chemical (rubberaser).The motorized sweeper commenced scrubbing at about 2329hrs. At about 0052hrs flushing of the chemical (rubberesaer)commenced . T he exercise came to close about 0127hrs.

Recommendation:

For more effective and efficient derubberization exercise in port Harcourt International Airport ,we suggest the use of water blasting machine to ensure safety compliance of personnel.

Thank you.

DGM/HOD Environment

PHIA.