AIRCRAFT ACCIDENT REPORT

ASSOC/2011/07/10/F

Accident Investigation Bureau

Report on the Serious Incident involving HS-125-700A aircraft operated by Associated Aviation Limited with nationality and registration marks 5N-BEX which occurred at Benin Airport, Edo state, Nigeria On 10th July, 2011

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

AD	Airworthiness Directives
AFM	Aircraft Flight Manual
AGL	Above Ground Level
AIB	Accident Investigation Bureau
AMSL	Above Mean Sea Level
APU	Auxiliary Power Unit
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATPL (A)	Airline Transport Pilot License (Aeroplane)
BKN	Broken
CB	Circuit Breaker
Cb	Cumulonimbus
CFIT	Controlled Flight Into Terrain
CPL (A)	Commercial Pilot License (Aeroplane)
CRM	Crew Resource Management
CSN	Cycle Since New
CVR	Cockpit Voice Recorder
^{o}C	Degree Celcius
DME	Distance Measuring Equipment

DNBE	ICAO Location indicator for Benin Airport
EPR	Engine Pressure Ratio
FAAN	Federal Airports Authority of Nigerian
FCOM	Flight Crew Operations manual
FDR	Flight Data Recorder
FL	Flight Level
FMS	Flight Management System
ft	Feet
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
hPa	Hectopascal
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Condition
IR	Instrument Ratings
km	Kilometre
kt	Knots
lbs	Pounds
LOFT	Line Oriented Flight Training

MDA	Minimum Descent Altitude
MFL	Minimum Friction Level
MPL	Maintenance Planning Level
NCAA	Nigerian Civil Aviation Authority
Nig.CARs	Nigeria Civil Aviation Regulations
NiMET	Nigerian Meteorological Agency
NOTAM	Notices to Air Men
NTSB	National Transportation Safety Board
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
QNH	Altimeter Pressure Setting above mean sea level
RWY	Runway
S	Serviceable
SARPs	Standard and Recommended Practices
SB	Service Bulletins
SOP	Standard Operating Procedures
SSFDR	Solid State Flight Data Recorder
Temp.	Temperature
TCAS	Traffic Collision Avoidance System

TSH	Threshold Crossing Height
TSN	Time Since New
TSRA	Thunderstorm and Rain
TWR	Tower
US	Unserviceable
UK	United Kingdom
UTC	Coordinated Universal Time
V_{APP}	Target Approach Speed
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Condition
VOR	Very High Frequency Omnidirectional Radio Range
V_{REF}	Reference landing speed

Aircraft accident report number:	ASSOC/2011/07/10/F
Registered operator:	Associated Aviation Limited
Registered owner:	Seaside View Management
Manufacturer:	Hawker Siddeley Aviation Limited, UK
Model:	HS-125-700A
Nationality and registration marks:	5N-BEX
Location:	Runway 05, Benin Airport
Date and time:	10th July, 2011 at about 11:50 h *(All times in this report are local time (UTC+1, unless otherwise stated)*

SYNOPSIS

Accident Investigation Bureau, Nigeria (AIB-N) was notified on 10th July, 2011 of this serious incident by the Airspace Manager of Benin Airport, and investigators were dispatched same day. All appropriate stakeholders were notified accordingly.

On the 10th of July, 2011 at 09:50 h, a HS-125 aircraft with nationality and registration marks 5N-BEX belonging to Associated Aviation Ltd. departed Nnamdi Azikiwe International Airport for Benin Airport as a positioning flight, with two crew members and a staff passenger who doubled as cabin crew on this flight. It was a charter flight to convey a VIP passenger back to Abuja. The Pilot was the Pilot Flying (PF) and the Co-pilot was the Pilot Monitoring (PM). The flight operated on an Instrument Flight Rules (IFR) flight plan.

Station, destination and alternate weather information was passed to the crew before departure. The aircraft was cleared to FL180 which was accordingly maintained towards Benin. It remained under the control of Lagos Approach before being transferred to Benin Tower.

At 65NM to Benin, the aircraft was cleared by Benin ATC to descend to FL120, subsequently to 3,500 ft, and afterwards to 2,200 ft; to commence straight in approach on runway 23 as requested by the crew and to report runway in sight.

The current weather report in Benin was also passed to the crew, which showed a deterioration of the weather since departure from Abuja.

The crew executed two missed approaches on runway 23 and requested to shoot an approach on runway 05. Benin ATC advised the crew of the unserviceability of the approach lights on runway 05, which the crew acknowledged.

Two landing attempts were made on runway 05. On the second attempt, the aircraft touched down past the mid-point of the wet runway, overran the runway and came to a stop on the marshy grass verge at about 450 ft beyond the end of runway 05. The engines were shut down and the three persons on board disembarked without injuries, through the passenger exit door.

The aircraft was slightly damaged with no indication of serious impact or fire damage.

This incident occurred at about 11:50 h in daylight.

The investigation identified the following:

Causal factor

The final approach was not stable; the aircraft crossed the threshold at 395 ft AGL with airspeed of 212 kt while the V_{ref} for landing was 122 kt.

Contributory factor

1. The aircraft touched down beyond the runway midpoint into the wet runway.
2. The decision to continue the approach despite marginal weather at destination.
3. The approved company's Standard Operating Procedure (SOP) was inadequate.
4. The Crew Resource Management (CRM) in the flight deck was poor which resulted in non-standard call-outs by the pilot monitoring (PM).

No Safety Recommendations were made.

1.0 FACTUAL INFORMATION

1.1 History of the flight

On 10th July 2011 at 09:50 h, an HS-125-700A aircraft with nationality and registration marks 5N-BEX, operated by Associated Aviation Limited departed Nnamdi Azikiwe International Airport, Abuja (DNAA) to Benin Airport (DNBE) as a positioning flight for a charter on an Instrument Flight Rules (IFR) flight plan. On board were two flight crew and a cabin crew. The Pilot was the Pilot Flying (PF) and the Co-pilot was the Pilot Monitoring (PM).

The crew had reported for duty at the Operational Control Centre, received the Dispatch Release, Met Folder from the dispatcher which contained Meteorological Information appropriate for departure (Abuja), destination (Benin) and alternate (Lagos) airports.

The take-off, climb and cruise were normal.

At 65 nautical miles to Benin, the crew requested for descent clearance from Benin Air Traffic Control (ATC). The aircraft was cleared to descend to FL120 initially. Benin weather was passed to the crew as: surface wind 300^{o}/06 kt, visibility 2000 m in rain, cloud BKN at 270 m, QNH 1016, temperature 24^{o}C with runway surface wet. When the crew reported 51 DME, 5N-BEX was cleared to descend to 3,500 ft on QNH 1016 and to position for a straight-in approach runway 23. At 20 DME, 5N-BEX was further cleared to descend to 2,200 ft and to report runway in sight.

Following the normal procedures for straight-in approach, the crew reported to have descended to 'minimum altitude' in the final approach, they sighted the runway overhead threshold of runway 23, in rain, and a go-around was initiated successfully. The crew shot a second approach on runway 23 which also ended in a go around. At this point, the crew requested a higher level and FL100 was approved by the ATC.

Information obtained from the CVR transcript indicated that the crew also considered the option of diverting to Lagos. The Controller advised the crew to establish contact with Lagos for a higher flight level since Benin had no jurisdiction above FL100. However, the flight crew decided to shoot an approach for runway 05, although the Controller suggested that runway 23 looked better for approach since it had serviceable runway approach lights.

The crew shot an approach on runway 05 which also ended in a go-around and the crew repositioned for another approach on runway 05. At this point, the Controller requested the crew to report position and intention as the go-around was not reported.

At 11:14 h, the crew reported finals runway 05. The ATC then cleared 5N-BEX to land runway 05 with a caution that runway surface is wet. According to the CVR transcript, at about 11:16 h the aircraft touched down beyond the mid-point of the runway 05, and overran the end of the runway by about 450 ft into a marshy grass verge. The three persons on board disembarked normally through the passenger exit door, without injuries.

The location of the occurrence has reference co-ordinates of N06°19'00" E005°37'00" with an elevation of 258 ft.

This incident occurred in daylight and Instrument Meteorological condition 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	2	1	3

1.3 Damage to aircraft

The aircraft was slightly damaged.

1.4 Other damage

Three approach light assemblies were destroyed and the attached electrical armored cables pulled out and damaged. There was fuel leakage from the right fuel tank that contaminated the grass area.

1.5 Personnel information

1.5.1 Pilot

Nationality:	American
Age:	49 years
Licence type:	Airline Transport Pilot Licence (Aeroplane)
Medical certificate:	Valid till 13th August, 2011
Simulator:	Valid till 7th September, 2011
Ratings:	Boeing 737, Beechcraft 300, Beechcraft 400, Hawker Siddeley 125, Mitsubishi 300, Gulfstream IV
Total flying hours:	15,000 h
Total on type:	5,000 h
Last 90 days:	Not available
Last 7 days:	Not available
Last 24 hours:	Nil

1.5.2 Co-pilot

Nationality:	Nigerian
Age:	37 years
Licence type:	Airline Transport Pilot Licence (Aeroplane)
Medical certificate:	Valid till 28th October, 2011
Simulator:	Valid till 17th October 2011
Ratings:	Cessna 441, Beechcraft-300, Hawker Siddeley 125/800XP
Total flying hours:	5,714 h
On type:	90 h
Last 90 days:	39.7 h
Last 7 days:	Not Available
Last 24 hours:	Not Available

1.6 Aircraft information

1.6.1 General information

Type:	Hawker Siddeley 125-700A
Serial Number:	257197
Manufacturer:	Hawker Siddeley Aviation Ltd UK
Year of Manufacture:	1983
Nationality:	Nigerian
Nationality and registration marks:	5N-BEX
Certificate of registration:	Issued 29th January 2008

Certificate of Airworthiness:	Valid till 20th January, 2012
Time since new (TSN):	12,678.3 h
Cycles since new (CSN):	10,394
Type of fuel:	Jet A1

The aircraft was equipped with Traffic Alert and Collision Avoidance System (TCAS) and Ground Proximity Warning System (GPWS), which were serviceable at the time of the incident. The maximum take-off weight was 25,500 lbs and the maximum landing weight was 22,000 lbs. There was no documented evidence of any deferred defects or outstanding Airworthiness Directives (ADs).

1.6.2 Powerplant

	No. 1 Engine	**No. 2 Engine**
Type	TPE 731-3-1H	TFE 731-3-1H
Serial No.	P-84420C	P-84473C
Hours	11,390.2 h	11,850.3 h
Cycles	9262	9567

Both engines were serviceable at the time of dispatch and there was no documented evidence of any system malfunction. Maintenance had been carried out according to the approved maintenance schedule.

Figure 1: The aircraft at its final position

1.7 Meteorological information

DNBE

Time:	**0700UTC**	**0800UTC**	**0900UTC**
Wind:	Calm	150°/07 kt	300°/06 kt
Visibility	6 km	10 km	2,000 m
Weather:	Mist	Mist	Rain
Cloud:	Broken 270 m	Broken 300 m	Broken 270 m
Temp/Dew Point:	23°C/23°C	24°C/23°C	24°C
QNH:	1015 hPa	1015 hPa	1016 hPa

The destination weather report was obtained on first contact with Benin Control Tower about 65 NM to Benin.

1.8 Aids to navigation

The Very High Frequency Omnidirectional Radio Range (VOR) and the Distance Measuring Equipment (DME) were serviceable at the time of the incident. The Instrument Landing System (ILS) on runway 05 was unserviceable and NOTAM had been published. The approach lights on runway 05, the edge lights of runway 05/23 and most taxi lights were unserviceable and NOTAM had been published.

The aircraft was equipped with an Auto Flight System: Flight Management System (FMS) and Global Positioning System (GPS), which were serviceable. Relevant maps, aeronautical charts and approach plates were also available on board the aircraft.

1.9 Communications

There was effective communication between the aircraft and the ATCs in Abuja, Lagos and Benin. Benin Air Traffic Control had difficulties establishing radio contact with Lagos Air Traffic Control.

1.10 Aerodrome information

Benin airport has its location indicator as DNBE, elevation of 258 ft and a geographical reference of N06°19'00" E005°37'00".

Benin airport has a bi-directional runway with a grooved asphalt surface, designated Runway 05/23. The runway has a length of 7,870 ft with a slope of +0.5.

The VOR is located offset of the runway centre line axis.

At the time of the occurrence, Benin airport operations had been restricted to sunrise-to-sunset.

Figure 2: Rubberized touchdown zone of runway 05

1.11 Flight recorders

The aircraft was fitted with a solid-state Cockpit Voice Recorder (CVR) of 30 minutes duration, and a 25-hour solid-state Flight Data Recorder (FDR). The CVR and FDR were recovered intact. Below are the particulars of the recorders.

1.11.1 Flight Data Recorder

Manufacturer:	Allied Signal, USA
Model:	SSUFDR

Part Number:	980-4120-Gxus
Serial Number:	20139

1.11.2 Cockpit Voice Recorder

Manufacturer:	Fairchild, USA
Model:	A-100A
Part Number:	93-A100-83
Serial Number:	55848

The Flight recorders were sent to the National Transportation Safety Board (NTSB), Washington D.C. for downloading and data were successfully extracted from the recorders.

Approximately 1 hour and 28 minutes of data was recovered from the FDR but due to the unavailability of the FDR data frame documentation which AIB was unable to obtain from the operator, NTSB relied on archived documentation from Allied Signal, the recorder manufacturer, to extract only 7 parameters. It was established that there were potentially more recorded information if proper documentation had been available.

1.11.3 FDR Plot

The diagrams in Figures 2, 3, and 4 are plots of the FDR data from the incident aircraft recorded during the event.

The FDR data indicated the following:

At 10.47.42, the recorded pressure altitude was 395 feet, and the computed airspeed was 212 kt with a magnetic heading of 45 degrees. This coincides with the time the aircraft crossed the threshold.

At 10.49.42, the acceleration data was consistent with touchdown, the computed airspeed was 212 kt and the magnetic heading was 51 degrees according to the FDR plot. The V_{ref} computed by the crew was 122 kt which represented about 90 kt below the computed airspeed provided by the FDR.

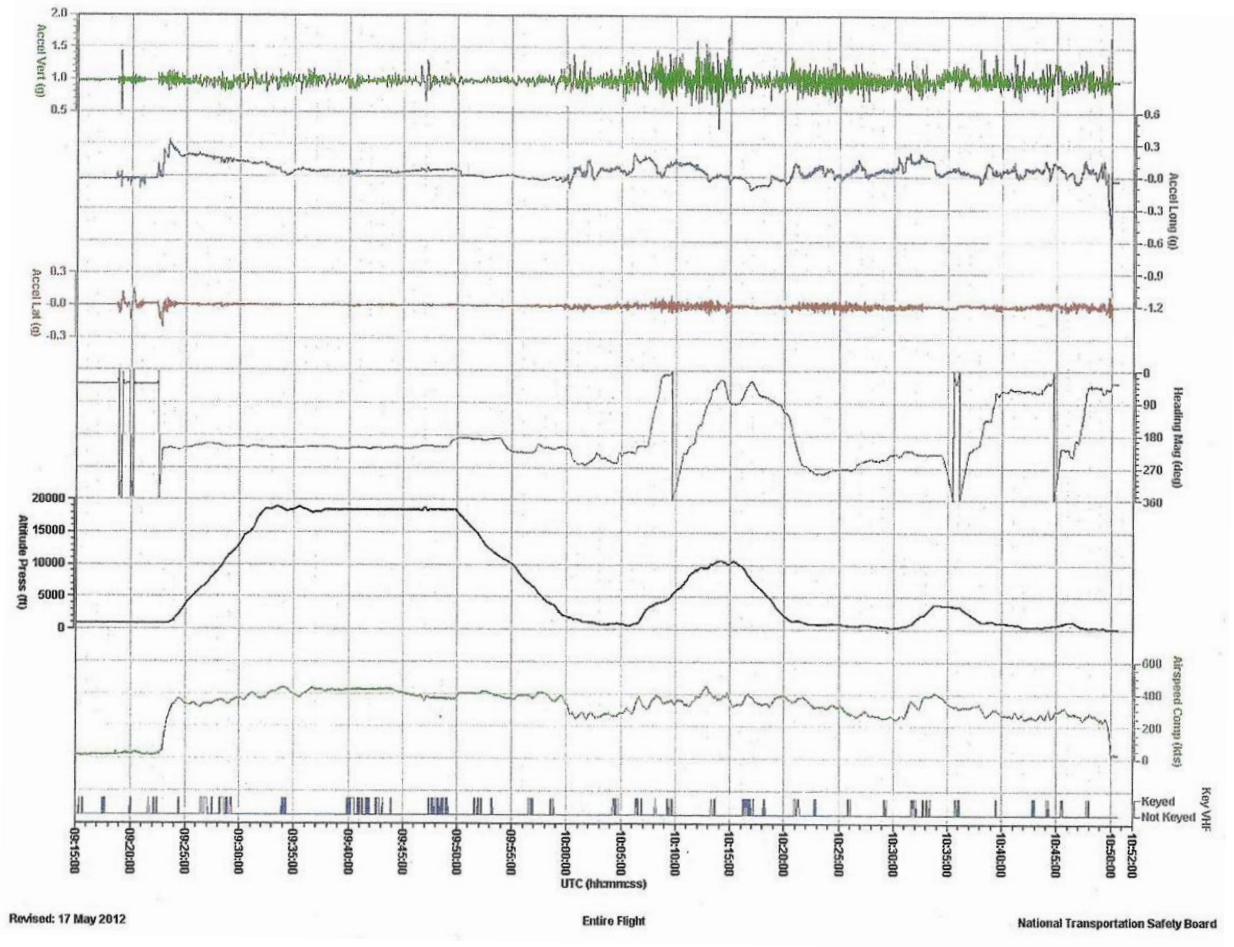

Figure 3: Plot of the entire flight from 09.15.00 to 10.50.38

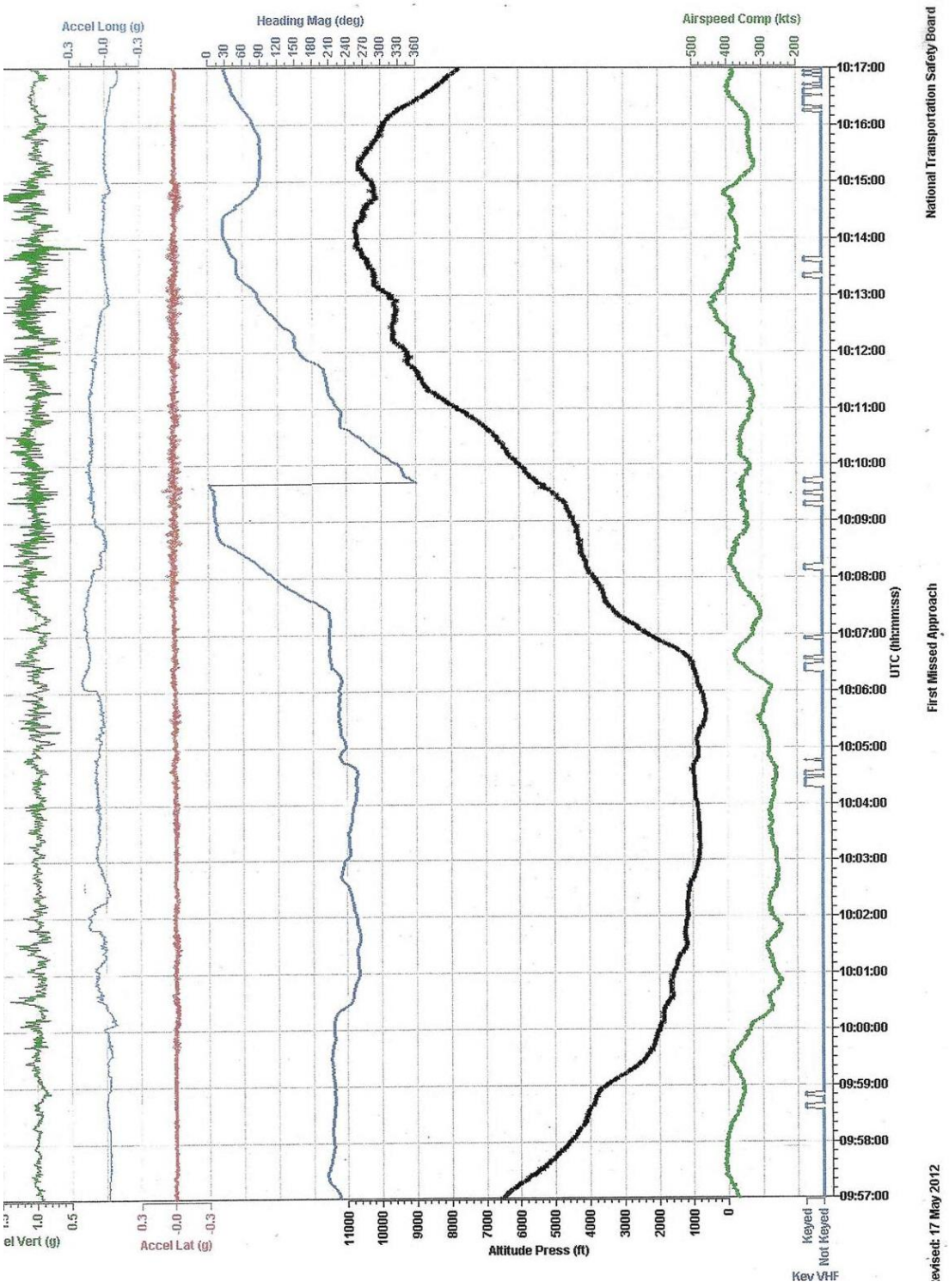

Figure 4: Plot of the first missed approach from 09.57.00 to 10.17.00

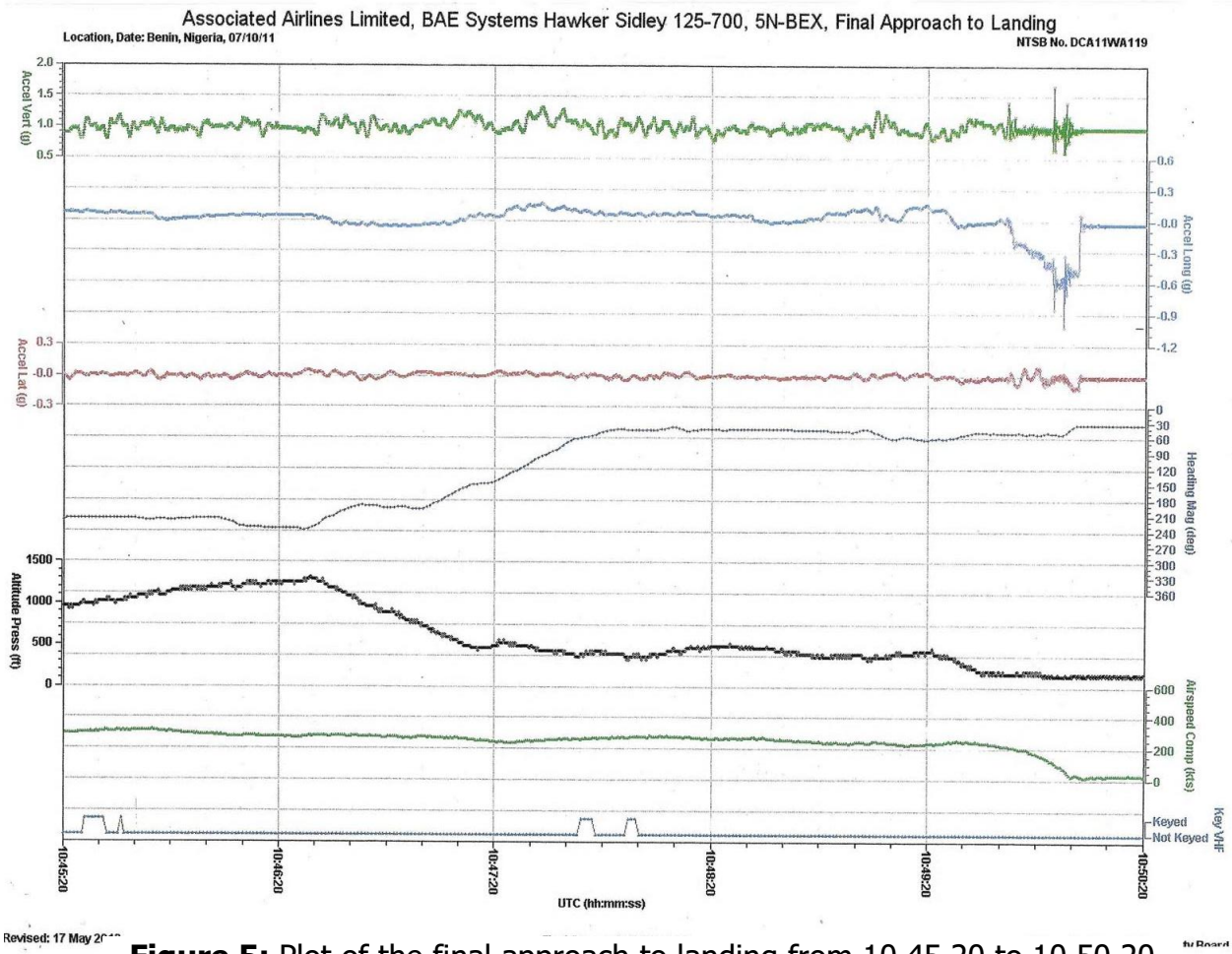

Figure 5: Plot of the final approach to landing from 10.45.20 to 10.50.20

1.11.4 CVR transcript

See Appendix.

1.12 Wreckage and impact information

The aircraft was intact as it came to rest at about 450 ft from the threshold of Runway 23. There was no wreckage trail. The terrain surrounding the incident site was contaminated with aviation fuel that leaked from the right-wing tank. Grass and mud were found in the engine air intakes and the APU nacelle. Both rear wheels were embedded in the muddy field. The damage to the aircraft was as a result of impact forces with the approach light mountings and cables.

Figure 6: Final position of aircraft 450 ft from the edge of runway 23

Figure 7: Right-wing leading edge damage

Figure 8: Damage to the right-wing leading edge at the wing root

Figure 9: Dent of the No. 1 engine exhaust with mud splatter on the empennage of the aircraft

Figure 10: Damage to the approach lights of runway 23

1.13 Medical and pathological information

No medical or toxicological tests were carried out on the crew.

1.14 Fire

There was no fire.

1.15 Survival aspect

The aircraft remained intact when it came to a complete stop without failure of any structures in the cabin such as seats, seat belts and overhead bins. There was thus, sufficient liveable volume. The Airport Rescue and Fire Fighting Service personnel arrived the site within 5 minutes of the incident according to the ATC and some interviewed witnesses. The Emergency Locator Transmitter Centre in Abuja confirmed that the incident activated an emergency signal.

Figure 11: The passenger cabin section of the aircraft after the incident

Figure 12: A cross-section of the cockpit instrument panel

1.16 Tests and research

Nil.

1.17 Organizational and management information

1.17.1 Associated Aviation Limited

Associated Aviation Ltd holds an Air Operator's Certificate, and was registered to operate a mixed fleet of aircraft on scheduled and charter services. The scheduled flights were authorized only within the territory of Nigeria and charter flights could extend to areas outside Nigeria. The operational base is at Ikeja, Lagos.

1.17.1.1 Management policies and practices

Co-pilots' responsibility as contained in the NCAA approved Associated Aviation Ltd Operations Manual ref. 1.5.1(b) (2) b: *a hazardous situation is developing, Captain to be informed by the co-pilot.*

Periodic checks:

Line check …NCAA approved Operations Manual ref. 5.2.6.2 *every flight crew member is to have been tested in flight to the satisfaction of his Chief Pilot as to his competence to perform the duties required of him in normal maneuvers and procedures, including the use of instruments and equipments installed in the aircraft type to be used on flights*

Proficiency check: ref. 5.2.6.3…*every pilot is to have been tested to the satisfaction of the Chief Pilot as to his competence to perform the duties required of him while executing normal and emergency maneuvers and procedures in flight, including the use of instrument approach-to-land systems of the type in use on the route to be flown either:*

(1) In flight in the aircraft type to be used, in IMC or IMC simulated by a means approved by NCAA; or,

(2) In a simulator approved by the NCAA, under the supervision of an approved person.

- **Recency requirements:** Ref. 5.2.7.1…Captains. *Before operating in command on a public transport flight, a Captain is to have carried out as Pilot in command not less than 3 take-offs and 3 landings in an aircraft of the type used on the flight within the preceding 3 months. One take-off and one landing is to have been made within the preceding 28 days***.**

Co-pilots: *Before operating as Pilot in the right hand seat during take-off and landing on a public transport flight, a Pilot is to have carried out either as Pilot in command or as Co-pilot not less than 3 take-offs and 3 landings in an aircraft of the type to be used on the flight within the preceding 3 months. In addition, Associated Aviation requires a Co-*

pilot to operate on the aircraft type concerned at least once in any 28day period. Ref. 5.2.7.2

System of amendment and revision. Ref.0.2.2. amendment procedures: *All revisions will be in the form of a complete change or addition. No open and ink changes are to be made. Upon receipt of a change or addition, the holder of the manual shall simply follow the page control chart issued with the change, and remove and insert new pages as instructed. The Chief Pilot or his designee is responsible for the amendment, compiling and disseminating the changes.*

En-route weather monitoring: NCAA approved Associated Aviation Ltd Operations Manual ref. 2.4.4.5. *Flight crew to maintain a continuous monitoring of destination weather while en-route.*

CRM requirement: Nig.CARs 8.10.1.12(a) *No person may serve nor may any AOC holder use a person as a flight-dispatcher or crewmember unless that person has completed the initial CRM curriculum approved by the Authority.*

Flight crewmember use of seat belts: Nig.CARs 8.5.1.6(a) *Each flight crewmember shall have his or her seat belts fastened during takeoff and landing and all other times when seated at his or her station.*

1.17.2 Federal Airports Authority of Nigeria (FAAN)

FAAN manages the airports and provides the needed infrastructure, security, fire services and any other service that enhances safety at the airport, for example marshallers, and FOLLOW-ME trucks, airport markings, parking airport lighting, authority and passes for airside operators.

1.18 Additional information

1.18.1 Evaluation of runway friction level

Normally assessment review of the runway friction level is performed on annual basis and where appropriate take the following actions;

- *If the friction level is below the Maintenance Planning Level (MPL), maintenance should be arranged to restore the friction level ideally to a value equal to or greater than the Design Objective Level (DOL).*
- *If the friction level is below the Minimum Friction Level (MFL), maintenance should be arranged urgently in order to restore the friction level and in accordance with ICAO Annex 14 Vol. I Paragraph 2.9.5, a NOTAM shall be issued advising that the runway may be slippery when wet.*
- *If the friction level is significantly below the MFL, the aerodrome operator should consider withdrawing the runway from use for takeoff and/or landing when wet.*

1.18.2 Line Oriented Flight Training

Line Oriented Flight Training (LOFT) is the execution of flight crew training in a flight simulator for airline pilot trainees, as refresher course or recertification for flight crew with existing airline ratings. It allows flight crew to train under realistic environments but at the same time, emphasizes on the occurrence of typical scenarios which require good decision making, intercommunication and leadership capabilities. It is therefore often used in conjunction with the Crew Resource Management (CRM) training programme. In order to have an accurate understanding of how well the flight crew react to the anomalies, the abnormal situations that the flight crew would face, would not be briefed to them beforehand.

1.18.3 Notes on the operations of Associated Aviation

The company's designated dispatcher was not licenced and had no initial CRM training.

The Engineer who carried out maintenance, authorized inspections and signed off the mandatory aircraft release documents did not have the aircraft type on licence to perform such duties.

Amendments and updates in the Operations Manual were effected in pencil.

Neither the flight crew nor the dispatcher had any knowledge of the maximum take-off and landing weights of the aircraft.

1.19 Useful or effective investigation techniques

Nil.

2.0 ANALYSIS

2.1 Conduct of the flight

The pilots were certified and medically fit to conduct the flight. There was no evidence of flight crew fatigue, considering the crew duty period on this flight before the incident. The aircraft had a valid Certificate of Airworthiness.

Considering the Captain's decision to continue the approach in a known bad weather condition during the approach phase of the flight into Benin, it can be deduced that the Captain had situational stress. This could also account for his apparently erratic decisions to divert to Lagos and the sudden change of mind to make another approach on runway 05 despite the odds against the use of this runway at the time.

Research has confirmed that stress can degrade an individual's decision-making performance and consequently, ability to assess the current situation and need for an alternate course of action. Despite the numerous cues during the approach indicating weather at the airport had significantly deteriorated, the flight crew continued with their original plan to land the aircraft instead of conducting a go-around and entering a holding pattern to wait for improvement in the weather, or diverting to an alternate airport, i.e *'press-on-itis'*. This is a term which is used to describe the decision by flight crew to continue with their original landing plan, even though prevailing weather, runway, or other operational conditions suggest that another course of action would be more appropriate, (deciding to "go" in a "no go" situation).

According to the CVR transcript, in the fourth approach that resulted in the overrun of the runway, the crew missed the runway but decided to execute a loop and reposition for finals. This contributed to an increase in the aircraft's altitude and the misalignment of the aircraft to the left of runway centre line only, compounded by the offset location of the VOR. These were all evidenced by the tyre marks to the left of the runway centreline. A missed approach would have been more appropriate in this circumstance as

the crew did not recognize and maintain stabilized approach criteria early in the approach to landing.

Accident investigations (runway excursion in particular) conducted by most national aviation investigating bodies, have identified that unstabilised approaches are precursors for runway overrun, veer-off and controlled flight into terrain (CFIT). Unstabilised approaches end up in long and fast landings, worse still when conducted on wet runways followed by delayed and inappropriate flight crew actions after touchdown. The chance of a long landing may also be influenced by the type of approach procedure used, (precision or non-precision approach). Data indicates that airports can significantly minimize runway overrun risks with precision approach and landing guidance facilities.

In 2005, Van Es of the Dutch National Aerospace Laboratory established that the mean distance from the runway threshold to the touchdown point was about 30 percent longer during a non-precision instrument landing than a precision approach. Properly executed precision approaches result in a five-fold risk advantage over non-precision approaches.

Following a non-precision VOR approach on runway 05, the aircraft approached unstabilised, touched down in poor environmental conditions, failed to stop and subsequently ran off the end of the runway into a marshy grass verge, coming to a final stop some 450 ft beyond the runway 23 end. In most instances, a runway excursion is not a total surprise to the flight crew. If one lands long and fast, with a tailwind, or on a contaminated runway, the consequences are predictable. The flight crew exhibited a total lack of knowledge of the existing circumstance. Closely related to this fact was the lack of awareness and compliance with a well developed operator's SOP which is an important preventative risk control to mitigate runway excursions.

Also contributing significantly was that Associated Aviation SOP was inadequate in terms of providing guidance to the flight crew for safe approach and landing techniques in typical weather, runway and operational conditions. SOPs should be designed to focus on the end users – the flight crew. The crew exhibited poor professional judgment and

airmanship coupled with flight crew omissions and inappropriate actions as a result of inadequate systems knowledge.

The Captain made all the decisions and flew the aircraft at the same time. The Co-pilot with few hours on type, rarely challenged some of the Captain's flawed decisions, as captured in the CVR transcript. The co-pilot did not inform the Captain of any deviations from normal as stipulated in the NCAA approved Associated Aviation Ltd Operations Manual ref. 1.5.1(b)(2)9b): *Copilot is to bring to the Captain's immediate attention any instance where he considers a hazardous situation was developing.*

2.2 The non-adherence to Standard Operating Procedure

The crew on approaching Benin discovered that the weather conditions had deteriorated to a level that would normally require an ILS approach. The ILS on runway 05 was unserviceable and NOTAM was promulgated to that effect. The crew did not monitor the destination weather while en-route in accordance with the requirements of NCAA approved Associated Aviation Ltd Operations Manual Ref. 2.4.4.5 on En-route Weather Monitoring.

The investigation believes that the fact that this was a positioning flight to pick a VIP passenger must have added some pressure on the crew to embark on this 'must-land' operations. An inappropriate decision was taken to continue the flight which resulted in three missed approaches. On the fourth approach, the aircraft touched down at a point more than halfway the runway length, at a speed in excess of the recommended reference speed (V_{ref}) on wet runway. All these contributed to the overrun. There were no records to show that neither the crew nor the AOC holder, complied with the NCAA training and checks requirements as there were no evidence of Route checks, Route Familiarization and Proficiency checks as stipulated in the approved company Operations Manual Sections 5.2.6 and 5.2.7.

Crew Resource Management (CRM) training is intended to reinforce the fact that both pilots should be closely involved with the conduct of a flight, regardless of rank and who is the Pilot Flying (PF). CRM training focuses on the appropriate use of non-technical skills like workload management, unusual circumstances and reinforces the appropriate existence of, and adherence to Standard Operating Procedures (SOPs). The actions of the crew on this incident flight were characterized by both inadequate SOP guidance and CRM training.

The dispatcher's non-CRM compliance was contrary to NCAR 8.10.1.12(a) on CRM requirement for an AOC holder.

Evidence available to the Bureau showed that the aircraft was not properly dispatched as the Dispatch Release Form only indicated limitations on take-off and landing weights as against the actual take-off and landing weights of the aircraft.

It was also discovered that the aircraft had been operating without any load sheet or Bug cards prepared for the flights operated while Associated Airlines Ltd was an AOC Operator.

2.3 Crew actions in marginal weather

Non-adherence to procedure coupled with the deteriorated weather conditions contributed immensely to this serious incident.

There was a significant deterioration in Benin weather from the time of departure out of Abuja till arrival in Benin. The forecast visibility in Benin before departing Abuja was 10 km with no rain and consequently, did not report a wet runway surface. But the weather report on arrival Benin was 2,000 m in rain and runway surface reported wet. This might have contributed to the crew's workload with the attendant flawed decisions. The crew neither recognized nor considered this deteriorating weather and also did not consider that there was no reported trend of improvement in the actual weather. Such marginal

weather could be attempted with a precision instrument approach such as an ILS but the ILS in Benin was unserviceable and NOTAM was in force. The crew chose to use the runway 05 although the approach lights on runway 05 were unserviceable.

The crew's actions that contributed to this incident were either inappropriate or were not in compliance with existing standard operating procedures. Non-compliance with procedures, whether inadvertent or deliberate, could be difficult to prevent and can only be addressed by effective training and maintaining a culture of adherence to SOPs within an organization. Loss of situation awareness or deviation from SOPs often contribute to unstabilised approaches, long and fast landings, delayed and inappropriate crew actions after touchdown.

The investigation deduced that there was a "steep cockpit gradient" between the PF and PM in terms of flight experience, having logged 15,000 h and 5,714 h flight hours respectively. This could be responsible for PM being passive when he ought to be assertive.

The crew did not divert to the alternate airport after several attempts to land on both ends of the runway. Aviation Safety bodies have often reinforced the message that stabilized approach criteria are as much a critical part of approach and landing safety, as 'no blame' go-around policies. A no-blame go-around policy means that flight crew will never be penalized for conducting go-around for safety reasons, (for example, due to an unstabilised approach). No-blame go-around polices lead to safer operations as flight crew can confidently make safety decisions ahead of concerns about profitability, operator polices, or scheduling pressures without fear of reprimand. Generally, flight crew regard go-around as a simulator event meant only to be conducted during simulator training. Lastly, the flight crew's readiness to commence an approach is crucial. Rushed approaches and *press-on-itis* elevate the likelihood of an unstabilized approach.

2.4 Crew Resource Management (CRM)

As best practice and good airmanship would demand in aviation, for safe and efficient operations, all crewmembers need to act together and the key component to achieve this is a high level of group situational awareness. Situational awareness is knowing what is going on around the crew, it is the big picture and is fundamental to correct decision making and action. It refers to one's ability to accurately perceive what is going on in the cockpit and outside the aircraft. The success of the entire crew therefore depends not only on each crew member maintaining his own individual situational awareness as it relates to each crewmember's defined responsibility, for example, the pilot flying the aircraft (PF) and the pilot coordinating the checklist, making radio calls and monitoring systems (PM). At the same time, each crewmember should ensure that the other crewmembers are building the same picture. There will be responsibilities that will overlap, for example, both pilots should maintain an active look-out for other aircraft.

According to the CVR transcript, the crew on most occasions were unclear about their individual roles as Pilot Flying and Pilot Monitoring. This actually resulted in not understanding one another well which ended up in a lot of *'say again'* in the crew communication.

2.5 Prevention of overrun incident

Runway excursions involve aircraft running off the end of the runway (overrun) or exiting the side of the runway (veer-off) during an aircraft's landing or take-off roll. Preventive risk controls are the most important way to reduce the likelihood and consequences of runway excursions. These include reinforcement of safe approach techniques, pre-landing risk assessments, line-oriented flight training and clear polices on go-around.

Runway overrun prevention provides pilots and operators with a 'rule of thumb' for calculating landing distances but has always been unpredictable for unstabilized

approaches. Other associated factors could roughly be worked out which include normal speed with delayed touchdown, i.e extended flare (floating), wet or dry runway, excessive threshold crossing height (TCH) and delayed braking actions. There are calculated penalties for these other factors. To avoid landing overruns, the following steps must be well managed: stabilized approach which provides appropriate threshold crossing height, accurate approach speed to touchdown at the appropriate touchdown zone without excessive flare (floating) and rebound of the aircraft at touchdown.

The crew on this incident flight did not maintain the appropriate approach profile as evident from the FDR. 5N-BEX was in an unstabilized approach, and thus crossed the threshold high at 395 ft AGL rather than the expected 50 ft, at a speed of about 90 kts in excess of the V_{ref} of 122 kt and touched down long and fast into a wet runway.

Line Oriented Flight Training (LOFT) and adherence to Standard Operating Procedures (SOPs) should reinforce the importance of flying safe, stabilized approaches. Flight crew need to be aware that unstabilized approaches increase the likelihood of approach and landing incidents such as runway excursions and controlled flight into terrain (CFIT). 'Long' landing or extended flare coupled with a reported 'fast' landing account for runway overrun or veer-off and/or a loss of control after touchdown due to excessive airspeed. To achieve stabilized approach with consistency in various conditions of wind and weather requires timely deceleration to final approach speed matched with configuration change so that the landing configuration is achieved at 500 ft above airfield level (AAL) in VMC and 1,000 ft (AAL) in IMC. If the aircraft is not stabilized at these heights, a go-around/missed approach becomes mandatory and shall be initiated and conducted in accordance with the Operator's approved procedures.

2.6 Factors affecting overall landing distance

As a tyre rolls along a wet runway, it is constantly squeezing the water from the tread. This squeezing action generates water pressures which can lift portions of the tyre off the runway and reduces the amount of friction the tyre can develop. This action is called hydroplaning.

Aquaplaning, also known as hydroplaning, is a condition in which standing water, slush or snow, causes the moving wheel of an aircraft to lose contact with the load bearing surface on which it is rolling with the result that braking action on the wheel is not effective in reducing the ground speed of the aircraft.

According to the crew and the Air Traffic Controller reports, 5N-BEX touched down well beyond the mid-point of the runway.

Preparation for a normal stop begins during the approach. A well planned and properly executed approach, flare and touchdown maximizes the runway available for stopping. Excess approach speed is a contributory factor in almost every overrun. Excess speed increases the tendency of the airplane to float during the flare and to rebound during touchdown, which increases the stopping distance required on the runway. If the touchdown is delayed while 10 kt of speed are bled off in flare, the total distance will increase by about 1,400 – 2,000 feet for all jet airplanes, on dry runways. On wet runways the actual landing distance is further increased by as much as 600 - 900 feet.

The normal rate of descent during approach is 500 - 800 feet-per-minute. An extended flare as a result of higher rate of descent will bring the airplane's touchdown point far into the runway which in turn increases the landing distance that could result in an overrun.

All the above factors, wet runway surface, higher than normal approach speed and profile which induced a high rate of descent, greatly increased the actual landing distance which

in turn contributed to the runway overrun of 5N-BEX during the fourth approach and landing.

2.7 CVR download

For all the approach attempts, the First Officer was always in the lead and constantly called out *"Don't descend"* and there were series of automatic altitude alert warnings like *"Don't descend, Flaps", 'Too low, Flaps'.*

Both pilots exhibited some degree of lack of CRM knowledge. The use of the wiper was always requested by the First Officer even though he was not the Pilot Flying. This occasionally resulted in some argument between the two pilots. Whenever they were established on finals for landing, the First Officer (PM) would request the Captain (PF) to look out for the field as compared with the normal procedure where the Pilot Flying concentrates on flying the aircraft (instrument flying) while the pilot monitoring looks out for the runway.

From the CVR transcript, on crossing the Missed Approach Point (MAP), the First Officer requested the Captain to climb instead of the appropriate phraseology of "Go Around". The Captain persistently went below the minimum by descending to 700 feet instead of 800 feet and both pilots agreed that 700 feet was good enough. The Captain at this point requested the First Officer to confirm the Minimum Descent Altitude (MDA) from the approach chart when they were in the middle of an Instrument Approach procedure. This, investigation believed, was an indication that the crew did not perform the appropriate approach briefing before initiating the approach procedure as this was not captured in the CVR transcript.

In all instances when the First Officer advised the Captain of any deviation from normal; the Captain acknowledged and responded, *"I know"* instead of the standard phraseology followed by necessary corrective action which connotes poor airmanship.

On two occasions, the First Officer called out *"Fasten Seat Belt"* when he was not reading any checklist item and there was no response from the Captain. There was an AUTOVOICE call out of *"Five Hundred Feet"* which represented an indication from the Radio Altimeter of the height above ground level. The field elevation at Benin airport is 257 feet. This in addition to the 500 feet from the call out, equals 757 feet; another indication of exceeding the MDA of 800 feet.

After the second approach, both pilots mooted an intention to divert to Lagos but suddenly changed mind to hold for some minutes for an improvement in the weather. This was another sign of situational stress. According to the CVR transcript, in the fourth approach the crew saw the runway late and instead of a normal missed approach procedure they embarked in an unusual procedure to realign with the runway by making a loop and suddenly touched down on the runway as the Captain was requesting the First Officer to help *'push, push,* which finally resulted in the overrun.

2.8 Navigational aids at Benin

The singular responsibility of installation and maintenance of the airport facilities rests with FAAN. During the investigation it was discovered that almost all the approach lights, runway edge lights and the ILS had been left unattended to and the runway surface left to deteriorate to an unsafe condition.

The location of the VOR is not in line with the extended runway centre line axis which accounts for a heading change whenever the field/runway comes in sight during an instrument approach.

3.0 CONCLUSIONS

3.1 Findings

1. The aircraft had a valid Certificate of Airworthiness at the time of occurrence.
2. All control surfaces were accounted for, and all damage to the aircraft were attributable to the impact forces.
3. The flight crew were qualified and certified to conduct the flight.
4. The flight crew were in compliance with flight and duty time regulations.
5. There was a significant change of weather from departure out of Abuja to arrival in Benin which was known to the crew.
6. Benin airport had only VOR/DME serviceable at the time of the incident.
7. The crew executed a non-precision approach in poor weather conditions.
8. The aircraft crossed the threshold high at about 395 ft AGL at a speed of about 90 kt above the V_{ref} of 122 kt and touched down long and fast into the wet runway.
9. The First Officer had only 90 h on type when the incident occurred.
10. Three missed approaches were executed and the fourth approach resulted in the runway overrun.
11. The continuation of the landing with airspeed above the target threshold Speed (V_{ref}) and high on the final approach profile resulted in the touchdown far beyond the normal touchdown point.
12. The company's designated dispatcher was not licensed and had no initial CRM training.
13. The Engineer who carried out maintenance, authorized inspections, and signed off the mandatory aircraft release documents did not have the aircraft type on license to perform such duties.
14. Amendments and updates in the Operations Manual were effected in pencil.
15. Benin airport operations had been restricted to sunrise to sunset and NOTAM in force.

16. The approach lights on runway 05, the edge lights on runway 05/23 and most taxi lights were all unserviceable and NOTAM promulgated.
17. ICAO Radio Phraseology was not adhered to in the conduct of the flight.
18. Neither the flight crew nor the dispatcher had any knowledge of the maximum take-off and landing weights of the aircraft.
19. Benin Air Traffic Control had difficulties establishing radio contact with Lagos Air Traffic Control.
20. It was also discovered that the aircraft had been operating without any load sheet.

3.2 Causal factor

The final approach was not stable; the aircraft crossed the threshold at 395 ft AGL with airspeed of 212 k t while the V_{ref} for landing was 122 kt.

3.3 Contributory factor

1. The aircraft touched down beyond the runway midpoint into the wet runway.
2. The decision to continue the approach despite marginal weather at destination.
3. The approved company's Standard Operating Procedure (SOP) was inadequate.
4. The Crew Resource Management (CRM) in the flight deck was poor which resulted in non-standard call-outs by the pilot monitoring (PM).

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 were made.

APPENDIX

Appendix A: CVR Transcript

UTC Start	UTC End	Source	Text
10:23:14.5			[START OF RECORDING]
10:23:19.7	10:23:53.9	INT	[first officer confirmed speed is good and flaps 15]
10:24:00.2	10:24:03.2	INT	[first officer says 18 miles from the VOR]
10:24:30.9	10:24:31.6	CAM	[sound of change in noise, similar to gear down]
10:25:26.3	10:25:28.7	AUTOVOICE	five hundred
10:25:53.9	10:26:18.0	RDO	[first officer discusses rain over field with tower]
10:27:00.5	10:27:02.9	INT	[flaps 25]
10:27:55.9	10:28:00.3	INT	[first officer calls out and captain clarifies 10 miles to "run"]
10:28:23.0	10:28:36.0	INT	[first officer confirms altitude and suggests wiper]
10:28:46.6	10:28:56.8	INT	[wiper turned on]
10:28:58.2	10:29:10.7	INT	[captain asks for wiper off. wiper turned off]
10:29:13.8	10:29:19.6	RDO	[reports 5 mile final 23 to tower]
10:29:33.9	10:30:06.8	INT	[first officer calls don't descend, repeating multiple times]
10:30:07.2	10:30:20.8	INT	[wiper turned on again by first officer]
10:30:22.0	10:30:28.8	INT	[captain asks for wiper off. wiper turned off.]
10:30:29.7	10:30:32.5	INT	[first officer repeats, don't descend]
10:31:05.6	10:31:19.1	INT	[missed approach, as runway not in sight]
10:31:19.8	10:31:28.4	INT	[captain says they will go to Lagos. Then says will hold and try again.]
10:31:43.0	10:32:11.3	RDO	[first officer reports missed. advises they will hold for 10 minutes to wait for weather. tower assigns 5,000 feet.]
10:32:40.5	10:33:43.0	RDO	[first officer asks tower if runway 05 weather is better than 23. tower provides 1000 UTC weather of visibility 2,000 meters; slight rain, broken clouds 270 meters, charlie bravo several directions 600 meters. (wind was not reported)]
10:34:17.1	10:34:25.5	TWR	[tower provides 1000 UTC weather to another aircraft on the frequency, advising winds 210 degrees at 5 knots; altimeter QNH 1016; temperature 23 degrees Celsius.]
10:34:45.0	10:35:43.5	INT	[crew discusses what approach and runway to use, deciding on runway 05; further discusses no approach lights on runway 5.]
10:35:44.8	10:36:15.2	RDO	[crew requests runway 5 and is cleared for approach to runway 5 by the tower.]
10:36:23.0	10:37:10.6	INT	[crew briefed and discussed the approach.]
10:37:41.2	10:37:45.9	INT	[coming up on 2,200 feet]
10:37:46.8	10:37:52.2	INT	[flaps 15]
10:38:22.5	10:38:28.3	INT	[first officer notes they need to climb back up to 2,000 feet]
10:38:37.8	10:38:43.2	INT	[crew notes they have enough fuel to get back to Abuja]
10:38:57.5	10:39:00.4	INT	[crew notes just about 1,800 feet and next steps in approach]
10:39:15.0	10:39:18.7	INT	[first officer notes when on course, until 4.5 miles from the VOR before step down]

UTC Start	UTC End	Source	Text
10:39:27.1	10:39:32.9	RDO	[tower asks for position report. first officer reports just about turning final for runway 5 and will call established.]
10:39:48.5	10:39:49.1	CAM	[gear down]
10:39:53.9	10:40:06.3	INT	[first officer notes "remain here" until 4.5 miles from VOR, then step down to 800 feet. captain asks first officer to set 800 feet. first officer sets 800 feet.]
10:40:08.9	10:40:13.4	INT	[first officer verifies QNH 1016]
10:40:18.4	10:40:24.4	INT	[first officer notes nav lights on "vref"]
10:40:52.2	10:40:55.0	INT	[first officer notes speed 122]
10:40:57.8	10:41:06.5	INT	[crew discusses distances of 10 miles and 6 miles. agrees to a 6 miles value on DME.]
10:41:13.2	10:41:17.4	INT	[first officer says "6 miles". captain asks for flaps 25]
10:41:23.6	10:41:38.6	INT	[first officer confirms 800 feet is set, flaps 25, and advises they want to descend to 800 feet.]
10:41:44.0	10:41:46.0	INT	[first officer confirms vref is 122.]
10:41:47.5	10:41:52.4	INT	[first officer advises maintain 800 and says they are below 800. captain provides an unintelligible acknowledgement.]
10:42:05.5	10:42:07.1	INT	[first officer says syncronizer going off.]
10:42:07.3	10:42:12.4	INT	[captain asks first officer to look out for runway; first officer acknowledges.]
10:42:14.5	10:42:28.1	INT	[captain asks what altitude they can descend to. first officer says 800 feet then says keep it at 700 feet that will be okay.]
10:42:41.9	10:42:46.7	INT-FO	[2 miles from the VOR. If we don't see the runway we can execute the missed approach.]
10:42:48.9	10:42:53.0	RDO-FO	[reports final on runway 5]
10:42:54.3	10:42:57.9	TWR	[acknowledges and tells aircraft to report runway in sight.]
10:42:57.4	10:42:57.9	CAM	[sound of wiper.]
10:42:58.6	10:43:01.9	RDO-FO	[confirms with tower they will call runway in sight.]
10:43:19.5	10:43:24.5	INT	[first officer says he is looking out for runway and they are at the VOR. captain acknowledges.]
10:43:49.5	10:43:51.8	INT	[captain says runway is not in sight followed by "fuckin' runway" followed by unintelligible expression.]
10:43:56.9	10:43:59.5	INT	[first officer notes aircraft is climbing. captain acknowledged.]
10:44:03.1	10:44:04.7	INT	[first officer asks if captain sees the runway. captain says no.]
10:44:06.0	10:44:08.6	RDO-FO	[reports short final to the tower.]
10:44:10.6	10:44:15.1	TWR	[tower acknowledges. and clears aircraft to land with runway in sight.]
10:44:16.3	10:44:19.1	RDO-FO	[acknowledges landing clearance]
10:44:19.1	10:44:23.4	INT	[first officer tells captain runway is over there. captain acknowledges.]

UTC Start	UTC End	Source	Text
10:44:24.6	10:44:26.3	INT	[first officer tells captain to make a loop. captain acknowledges.]
10:44:28.3	10:44:32.3	INT	[first officer repeats, let's make a loop to the other side, maintain 1,000. captain acknowledges.]
10:44:34.7	10:44:35.1	CAM	[sound of wiper stops.]
10:44:34.9	10:44:39.5	INT	[captain asks for heading bug, first officer acknowledges.]
10:44:41.5	10:44:44.3	INT	[first officer tells captain don't descend, maintain 1,000. captain acknowledges.]
10:44:48.2	10:44:55.2	INT	[first officer repeats maintain 1,000. tells captain he is descending. captain disagrees and says he is maintaining 1,000.]
10:44:55.8	10:44:58.3		[captain asks first officer to bring "me around all the way."]
10:45:01.2	10:45:02.2	INT	[sound of mid-level tone, similar to altitude alert.]
10:45:03.1	10:45:04.3	INT	[first officer says "because of the masts" (referring to altitude??? maybe)]
10:45:11.3	10:45:14.5	INT-FO	okay let's keep this heading two three zero.
10:45:23.7	10:45:32.3	RDO	[tower asks if aircraft is missed approach. First officer says negative, they are visual.]
10:45:33.1	10:45:39.0	RDO	[tower asks if they just want to realign. first officer confirms.]
10:45:48.5	10:45:51.3	INT	[first officer asks captain to maintain 235 degrees.]
10:46:03.1	10:46:06.0	INT	[captain confirms 235. first officer confirms 235.]
10:46:23.3	10:46:24.5	INT-FO	okay we can turn in.
10:46:25.0	10:46:26.5	INT-CA	we are four miles.
10:46:28.3	10:46:31.2	INT	[captain asks f/o if he can descend to 800. f/o confirms, 800.]
10:46:36.5	10:46:39.7	INT-FO	descend in the clear. we can just maintain this heading.
10:46:56.8	10:47:03.2	INT	[first officer says they can turn 140. maintain 800.]
10:47:12.5	10:47:22.6	INT	[first officer says maintain 800. start turning in.]
10:47:29.6	10:47:31.1	INT-FO	maintain eight hundred.
10:47:39.5	10:47:41.5	INT-FO	maintain zero five five.
10:47:43.9	10:47:48.1	RDO-FO	[reports final for runway 05]
10:47:44.7	10:47:45.0	CAM	[SPLICE IN TAPE]
10:47:48.9	10:47:56.6	TWR	[clears aircraft to land. advises runway surface is wet.]
10:47:52.9	10:47:54.9	INT-FO	don't descend. don't descend.
10:47:57.5	10:47:59.5	RDO-FO	[acknowledges cleared to land runway 05]
10:48:06.2	10:48:09.4	INT	[first officer points out the VOR is over there. just maintain "this". captain acknowledges.]
10:48:12.6	10:48:20.3	INT	[first officer tells captain not to turn; points out VOR is off to left. captain acknowledges.]
10:48:27.5	10:48:29.4	CAM	[sound of wiper begins]
10:48:45.3	10:48:46.3	INT-FO	see the runway?

UTC Start	UTC End	Source	Text
10:48:46.3	10:48:46.7	INT-CA	no.
10:48:49.4	10:48:51.1	INT-FO	don't descend. don't descend.
10:48:56.3	10:48:58.0	INT-CA	call the runway when you got it. okay.
10:48:58.1	10:48:58.8	INT-FO	don't descend.
10:48:59.0	10:48:59.4	INT-CA	I know.
10:49:03.1	10:49:04.9	INT	[first officer tells the captain runway is to the right. "go."]
10:49:05.9	10:49:06.7	INT	[first officer confirms that's the runway.]
10:49:07.8	10:49:08.6	INT-FO	speed.
10:49:08.9	10:49:10.4	INT-CA	no no no. don't do nothin'.
10:49:11.0	10:49:11.5	INT-FO	you want?
10:49:11.7	10:49:12.4	INT-CA	don't do nothing.
10:49:20.7	10:49:21.1	CAM	[sound of wiper stops.]
10:49:21.8	10:49:23.3	INT-CA	I can't even get this shit.
10:49:28.6	10:49:29.2	INT-FO	[first officer either says "you want to land?" or "you are on the line?" (unsure)]
10:49:29.2	10:49:30.9	INT-CA	[said "yeh a minute" or "I'm gonna" (unsure)] try to -- [sound of mid-level tone, similar to altitude alert]
10:49:33.8	10:49:34.5	INT-FO	no no.
10:49:35.6	10:49:36.1	INT-FO	not that.
10:49:40.5	10:49:41.1	INT	[sound of two clicks]
10:49:43.7	10:49:43.9	INT-FO	okay.
10:49:43.8	10:49:44.1	CAM	[sound of increased noise, similar to wheels on hard surface]
10:49:44.8	10:49:46.7	INT-CA	okay...hold em'...you push push push.
10:49:46.0	10:49:46.7	INT-FO	oh..yep.
10:49:47.4	10:49:49.4	INT-CA	oh shit. I'm gonna fuckin' run off the runway.
10:49:52.0	10:49:53.7	CAM	[sound of increased engine noise]
10:49:54.3	10:49:55.1	CAM	[sound of rumbling]
10:50:00.0	10:50:00.9	CAM	[sound like plates breaking] [this is 10:50:00.000UTC]
10:50:03.3	10:50:03.8	INT	[captain or first officer says "get off"]
10:50:03.7	10:50:06.6	INT-FA	come this way. (it's safe **or** come this way).
10:50:03.9	10:50:05.4	CAM	[sound of increased air noise] (possibly door opening????)
10:50:14.2	10:50:15.3	CAM	[decrease in engine sound]
10:50:26.1	10:50:27.2	INT-FO	shut down everything down.
10:50:28.4	10:50:29.6	INT-CA	hang on a minute. hang on a minute.
10:50:33.1	10:50:33.4	CAM	[sound of switch]
10:50:33.6	10:50:37.0	CAM	[sound of decreasing noise, similar to engine shutdown]

UTC Start	UTC End	Source	Text
10:50:37.9	10:50:40.5	CAM	[sound of multiple switches]
10:50:50.6	10:51:07.9	CAM	[male voice, distant, repeating "get out get out get out you"]
10:53:32.6	10:53:32.7	CAM	[end of recording]
10:53:32.7	10:53:39.2		[audio from beginning of flight resulting from location of cut of original CVR tape]
10:53:39.2			[end of tape]