
1. FACTUAL INFORMATION

1.1 *History of the flight*

On 2nd June, 2012 at 1828hrs Allied Air Ltd Flight DHV 111, a Boeing 727-221 Cargo aircraft, Registration: 5N-BJN, departed Murtala Muhammed International Airport, Ikeja, Lagos-Nigeria to Kotoka International Airport, estimating Accra, Ghana at 1904hrs, en-route to Abidjan. While taxiing for take-off, the Flight Engineer observed that the CSD amber light (caution) had illuminated on the panel. With the Captain's permission, it was disconnected.

The flight was cleared Flight Level 240 and to maintain by Accra Area Control on 130.9MHz. The Flight was operating under Instrument Flight Rules (IFR) conditions and the flight was turbulent, the aircraft was cruising at a speed of 280kts which is the recommended turbulence speed. On the descent into Accra, the aircraft was cleared by Accra Approach on 119.5MHz initially to Flight Level 50 and later cleared to 2000ft. It was again instructed to climb to 3000ft due to high ground. On arrival at Accra, the Captain flew an Instrument Landing System (ILS) coupled approach, until he saw the runway. He then disconnected the autopilot at 500ft and manually flew the aircraft. After disconnecting the auto-pilot, he came into heavy IMC conditions in rain. The aircraft experienced an unstable approach at a high speed of 167kts and landed with a wind of 050/15kts at 154kts and about 5807ft from Runway 21 in nil visibility. The crew deployed thrust reversers and applied the normal brakes as well as the emergency pneumatic brakes but these actions were ineffective to stop the aircraft. Normally deploying the thrust reversers or applying the brakes would bring the nose wheel down. However, the nose gear was kept up. The speed brakes were not deployed. The crew reported seeing red lights rushing towards them soon after the main wheels touched the ground for the landing run. The aircraft nose gear never touched the ground until the aircraft went over the fence wall.

A Lufthansa Flight DLH 566 operated on behalf of Lufthansa (LH) by Private Air which had landed earlier at 1902hrs reported a wind of 050/15kts and visibility of 3800m in rain. From the 2nd intersection where DLH 566 had stopped, ready to backtrack Runway 21, the crew observed Allied Air appeared to have landed at very high speed when the aircraft went past and could not determine whether the aircraft was taking off. A Lufthansa ground engineer who was waiting at the intersection to receive DLH 566 indicated the approximate touchdown point of DHV 111.

Both the controller at the Tower and the Marshaller in the "follow me" vehicle waiting at the 1st Intersection saw Allied Air land between the 1st and 2nd intersections. The FDR indicated that the aircraft landed 4000ft to the end of Runway 21.

The full length of Runway 21 is 3403m (11,162ft for take-off) but available for landing is 2990m (9,807ft). The FDR readout showed that the aircraft landed at 150kts, and at 1.6G, 5807ft from the beginning of Runway 21 and 4000ft from the threshold of the Runway 03.

The runway surface condition for braking as described by DLH crew was good. Shortly after Turkish Airline (THY 629) had landed, DLH 566 also landed followed by DHV 111.

The aircraft over-ran the runway and destroyed the Threshold Lights and the Approach lights on Runway 03. It knocked out the ILS Localizer transmitter structure and mounts, broke through the airport perimeter wall. The aircraft crossed Giffard Road, collided with a passenger mini bus killing all ten (10) persons on board. It uprooted a tree by the road side before finally coming to a stop at an open space near El-Wak Sport Stadium. The Emergency Locator Transmitter (ELT) was triggered by the impact.

The right side of a taxi cab on the road was grazed by flying debris from the localizer transmitter structures carried along by the right wing of the aircraft. The leading edge of the wing was extensively damaged.

The aircraft came to a rest outside the airport perimeter wall 1171ft (350m) from the Threshold of Runway 03, heading 215° southwest, coordinates 05 35 13.67N 000° 10 29.20W.

The four (4) crew members sustained minor injuries. The aircraft and the mini bus were all destroyed.

At 1910hrs, RFFS was alerted by the Tower Controller through the crash alarm bell. It took 9 minutes for the firemen to get to the crash site.

The Airport was closed for 45minutes during which runway inspection was carried out. No pool of water was found anywhere on the runway.

Approximately one hour after the aircraft had over-ran the runway, the Airport was re-opened to traffic. Other airlines including KLM and British Airways, landed.

Even though the Technical Log Book had no records of deferred defect, the Captain in an interview said the windshield wipers were switched on during the landing phase but were unable to clear the rain. It was observed during the investigation that the windshield wipers were rather $\frac{3}{4}$ switched on.



Figure 1 Photograph of the accident aircraft in the rest position.

Figure 2 Accra (KIA) airport layout plan with surrounding street and properties



Figure 3 Photograph of the crashed minibus within the accident vicinity.



Photograph of the crashed minibus within the accident vicinity.

1.2 Injuries to persons

1.2.1 Table 1.

Injuries	Flight Crew	Passengers	Total in the Aircraft	others
Fatal	0	0	0	10
Serious	0	0	0	0
Minor	4	0	4	1
None	0	0	0	0
TOTAL	4	0	4	11

1.2.2 All the fatalities in the public transport mini bus were of Ghanaian Nationality.

1.3 Damage to aircraft

The aircraft was destroyed.

1.4 Other damage

The aircraft crashed through the threshold lights, Simple Approach Lighting System of Runway 03, the localizer antenna array, collapsed drainage slabs, broke through a fence wall and collided with the mini-bus. The aircraft then grazed the right side of a taxi cab on the main Giffard road and finally uprooted a tree by the road side before it came to a stop.

1.5 Personnel information

1.5.1 *The Captain (PIC)*

The Captain, a Nigerian age 61years obtained his UK CPL license No 121842 issued in 1979 and converted to NCAA License No 2466. He started his career with Nigeria Airways in August, 1979 flying on the F27 until 1981. He was upgraded to the B737 as a 1st Officer. In October 1985, he trained on the A310 at Airbus Industries in Toulouse, France and later transferred to a leased SAS B747-100 as a 1st Officer.

He was transferred to B737 as a commander in 1989 until 1999 when he resigned and migrated to the Caribbean (Trinidad & Tobago). Two years later he returned to Nigeria to fly with Bellview Airlines on the B737 until 2001.

Between 2001 and 2008, the Captain had flown with several Nigerian Airline operators i.e. EAS, Fresh Air and Afrijet, and finally joined Allied Air in November 2009. He was sent for his initial B727 training by Allied Air and started flying the B727 in the same year.

According to the Captain's Allied Air employment and flight records, he had flown a total of about 14,000hrs of which 1,464hrs were on B727 aircraft. He had flown 150.17hrs, 49.22hrs, 02.45hrs in 90 days, 28 days and 24 hrs respectively. Before the accident the company records showed that the Captain obtained an initial B727 type rating in 2009 and that his most recent Line Check, Proficiency Check and Recurrent Training were in May 2011. His Proficiency Check and Recurrent Training were on 14th January, 2012, Route Check on 9th March, 2012 and his Medical Examination was due on 15th August, 2012.

A search of his NCAA records revealed no recent history of enforcement action or pilot certificates & rating failure or retest history. He had NCAA Airman Medical Certificate class 1 with limitations of near vision.

The Pilot-in-Command had been on duty for 6hrs on Friday prior to the accident. He told investigators that he reported for duty 2hrs before commencement of the flight in a sound mind. The aircraft was released off chocks at 1820hrs for its departure to KIA, Accra.

During post-accident interview, the Captain stated that the weather on the night of the accident was partially unstable but he expected to be able to land safely.

1.5.2 ***The Co-pilot (PM)***

The Pilot Monitoring a Nigerian, age 59 years was employed by Allied Air on 17th February, 2012. He obtained his FAA pilot's License No 110-52-9268 in 1976 and converted it to NCAA Licence No 1790. He started his flying career with Nigeria Airways on 18th October 1977 and flew the F27 and F28 as first officer. On 18th January 1981, he was rated on the B707 aircraft.

He thereafter obtained an ATPL and flew the B737 as Captain in 1983. From 1989 he flew the B707 as Captain for various Airline Operators both in Europe and Nigeria. On 5th May 2000, the Pilot Monitoring joined Afrijet and flew F27 and later, the B727. From there, he joined TransSahara Air to fly the B727 in January 2002. He flew with Dasab Airlines from 1st January 2003 and commanded the B727. In 2010 the PM joined Associated Aviation, flying the B727 later as Captain.

Before engagement with Allied Air in February 2012, he was sent to Pan Am Air Training School, Miami, Florida, USA for Simulator session.

He holds ATPL with the B707 and B727 ratings. The PM holds a Class 1 NCAA Airman Medical Certificate valid till 4th June, 2012 with limitation that he must wear corrective glasses and have a spare.

According to Pilot Monitoring Allied Air employment and flight records, he had flown 22,463.24 hrs on all types and 13.915 as PIC and 4,180 hrs on the B727 aircraft. He had flown 126.18hrs, 58.06 hrs and zero hrs in the last 90days, 28days and 24hrs respectfully. He had not flown for the last 24 hrs before the accident flight. He was assigned to standby duties and was acting as Co-pilot (Pilot Monitoring) at the time of the accident.

During post-accident interview, the PM admitted that Crew Resource Management was very poor. He also revealed that the fateful flight was the first time he flew with the PIC. He further said his concentration was on tracking the center line because the weather was poor.

When asked whether he would have disengaged the autopilot at the altitude the Captain did, he replied; "I would have flown the aircraft coupled to the ILS to the ground". However it was placarded in the cockpit that flying the aircraft below CAT 1 conditions was prohibited.

1.5.3 ***The Flight Engineer***

The Flight Engineer, a Nigerian age 49years holds NCAA License no. 242. The License is valid until 11th February, 2013. His medical Class 1 certificate is valid until 2nd June, 2013.

The Flight Engineer had both the B707 and B727 ratings. His recency on Simulator training on the B727 was valid till 11th February, 2013. His proficiency (operator check) was signed and dated 23rd February, 2012. His total flying time is 6309.28hrs and 6168.30hrs on types. For the last 90 days he has flown 140.58 hrs and 39.54hrs for the last 28 days and 01.45 hrs for the last 24 hrs. The Flight Engineer during the landing phase said he had his concentration on the center line of the runway.

1.5.4 ***Ground Engineer***

The Ground Engineer from DR Congo age 40years, had worked for Allied Air Ltd for one (1) year. He holds a valid AME License from DR Congo and has been validated by NCAA. He has ratings on the DC.9, DC.8, MD-80, B707 and B727 airplanes and JT8D-15/17 engines. He acted both as the Ground Engineer and Loadmaster for the flight. According to the Ground Engineer, he operated the main entrance door for the evacuation of the crew.

1.6 **Aircraft information**

1.6.1 ***General***

The Boeing 727-221 Cargo Aircraft, Serial Number 22540 was manufactured on 1st January, 1982 and was first owned and operated by Pan American World Airways Inc. as a passenger aircraft. On 22nd January 1993 the aircraft was sold to Express One International Inc. and modified as a cargo aircraft. The aircraft was later acquired by All Canada Express from 1997 to 2005 and placed on the Canadian Register. It went into storage from 2005 to 2007.

In 2007 the aircraft was sold to Allied Air Ltd of Nigeria and registered on 23rd April, 2007 as 5N-BJN with the Nigeria Civil Aviation Authority. It was issued with a Certificate of Registration (C of R) No. 1227 and Certificate of Airworthiness (C of A) No.1227 expiring on 2nd July 2012.

1.6.2 **Aircraft history**

As of 31st May, 2012, the Boeing 727-221 Cargo Aircraft has a total flying hours of 40251.40 hrs and 25380 cycles since New. Total Flying Hours since last major "C" Check was 1143.20hrs and total flying hours since last periodic inspection i.e. "A" Check was 46.40 hrs. The next Major "C" Check was scheduled for 1st July 2012. The aircraft crashed a month before this major Check.

The aircraft complied with all Airworthiness Directives (ADs) and Service Bulletins (SBs).

1.6.3 **Engines**

The Boeing 727-221 cargo aircraft is powered by three (3) Pratt & Whitney JT8D-15/-17 engines. The engines were serviceable and did not contribute to the accident.

Position	Serial No	Total Time	Total Cycle	Time Remains	Cycle Rem
1	687405	53,729	38,011	2,980	1,488
2	686351	30,196	37,210	12,379.91	2,594
3	688112	40,739	35,199	3,926	2,858

The aircraft was also equipped with an Auxiliary Power Unit; (APU) GTCP 85-98C with serial number P-36850 manufactured by Allied Signal in the USA. The APU was serviceable.

1.6.4	Landing gears	Current Overhaul Interval:	16,000 hr/10 years
	Nose Landing Gear	Serial No. 2042 UX 59	29 th October, 2018
	Left Main Landing Gear	" " 8B42	29 th October, 2018
	Right Main Landing Gear	" " 2A203	29 th October, 2018

1.6.5 ***Fuel***

Total fuel capacity of the aircraft is 52,000lbs and the type of fuel is JET-A1. The aircraft departed Lagos with 26,000lbs of fuel and landed in Accra with 18000lbs.

1.6.6 ***Aircraft maximum weights***

The Basic Operating Weight, (BOW) of the aircraft B727 Registration 5N-BJN is 119,212lbs. Maximum Takeoff Weight, (MTOW) is 180,500lbs and Maximum Allowed Payload, (MAP) is 54,788Ibs. The Maximum Zero Fuel Weight, (MZFW) is 143,000Ibs and the Maximum Landing Weight (MLW) is 160,000Ibs. The aircraft was loaded with 49,738Ibs of cargo and actual takeoff weight was 168,950Ibs. The maximum landing weight was 160,000lbs. It was expected to land with a weight of 158,950Ibs.

1.6.7 ***Certificates***

The aircraft certificates required by regulations to be carried on board i.e Certificate of Registration, (C of R), Certificate of Airworthiness, (C of A), Air Transport License (ATL), Noise Certificate, Aircraft Insurance, Radio License, Air Operator Certificate (AOC), Certificate of Release to Service, (CRS) and Certificate of Fumigation were found to be valid.

1.6.8 ***Authorisations***

Allied Air had NCAA Authorisation to perform both Checks "A" and "B" and it was valid till 14th January, 2013. Certificate of Release to Service was appropriately signed by the Ground Engineer.

Allied Air applied for the extension of the "C" Check due on 2nd May, 2012. However, due to unavailability of hangar space at the Aircraft Maintenance Organization (SAF AIR) in South Africa, the NCAA approved the application and extended the inspection to 1st July, 2012. SAF AIR has been approved by NCAA to carry out the "C" Checks for Allied Air B727.

1.6.9 ***Aircraft status***

The aircraft was serviceable for the flight.

1.7 Meteorological information

1.7.1 *Kotoka International Airport Weather Information*

Half hourly and hourly MET reports Metars and SPECI are generated automatically by the Automated Weather Observation System (AWOS) and transmitted to the ATC and users.

At the time of the accident, numerous thunderstorms in the Accra Airport area were producing heavy to moderate rain showers and gusty surface wind. No wind shear in the Accra area was reported.

ATIS recording at 1700hrs

Wind 190 at 9kts
Visibility 10 kms or more
Cloud: Few 1,600ft
Few CB3000ft
Temperature 28° Dew Point 24 QNH 1011
Tempo Visibility 5 kilometers
Thunderstorm in Light Rain
Cloud Ceiling broken 1000ft
Cumulonimbus (CB) between Southwest and Northeast
KIA Romeo 1700hrs
Runway 21 in use expect ILS 21

ATIS recording at 1800hrs

Wind 180 at 05kts
Visibility 10 kms
Cloud: Few 1,600ft, SCT 3100ft
Few CB3000ft
Temperature 27° Dew Point 24 QNH 1013 HPA, QFE: 1005HPA
Trend: Tempo 5000 – TSRA BKN 1000FT

DHV 111 had copied the ATIS on first contact with Accra Control on frequency 130.9MHz at time 1856HRS ATC Approach Control on frequency 119.5 MHz made a general broadcast to all inbound aircraft i.e. THY 629, DLH 566, DHV 111 and Kenya 509 that it was raining over the field, surface wind 05/15 kts DHV 111 had copied and asked if it was raining and its intensity.

METAR: ***Report DGAA 021900Z***

Wind 040/15kts VRB
BTN 020 AND 080 VISIBILITY// 4300m
RVR // M //
CLOUD OVERCAST 900ft FEW 3000CB
TEMPERATURE 23°C Dew Point 21°C
QNH 1014HPA QFE 1007 HPA

1.7.2 ***Flight Crew Dispatch and In-flight information***

Lufthansa DLH566, a B737-800 aircraft which preceded the DHV111, landed at 1901hrs. During his approach to landing the weather was characterised by moderate rain, reduced visibility and tailwind. Radar picture showed scattered returns in the whole area. The visible cues were sufficient for landing.

Tailwind during the landing was assessed as more than 10kts, but less than 15kts.

1.8 **Aids to navigation**

Kotoka International Airport is equipped with the following navigational aids: VOR/DME, NDB, Locator Beacon, Runway Lights and ILS on Runway 21.

At the time of the accident the Approach Lights, Threshold lights and PAPI's were switched off on Runway 03. All the Runway lights were serviceable on Runway 21. The Approach Lights and Threshold lights on Runway 03 were completely destroyed during the accident.

The aircraft is equipped with the following equipment: ATC Transponder, Selcal, VOR/ILS Navigation. System, Marker Receiver, DME, ADF, Altitude Alert, Radio Altimeter, Weather Radar, TCAS, GPS, TAWS and Windshear. These equipment were found to be on board and serviceable before and during the accident.

Topographical maps, charts, approach plates were available onboard the aircraft and these were not relevant to the accident. All the NAV. equipment were functional during the flight.

1.9 Communications

The aircraft departed Lagos at 1828hrs and was on frequency of Lagos Control of 124.3MHz. The aircraft had contact with Accra Control at Cotonou on frequency 130.9MHz and was cleared to FL 240. At top of descent, the aircraft was cleared to FL 160 and transferred to Accra Approach on frequency 119.5 MHz. The aircraft remained on this frequency until it crashed. There was good communication between the aircraft and ATC.

1.10 Aerodrome information

- Name of Aerodrome: Kotoka International Airport
- Location Indicator: DGAA
- Aerodrome Reference Point (ARP): 05 36 15.89 N
000 10 03.16 W (WGS 84)
ELEVATION: 205 FT
- Runway Identification: 21/03
Runway Markings: Threshold, Centerline, Runway Designations, Taxi holding position stripes, Taxi way centerline, exit lines.
- Runway length: (Declared distances, Table 2.)

Runway Designation	TORA (m)	TODA(m)	ASDA(m)	LDA(m)	Remarks
1	2	3	4	5	6
03	3403	3403	3403	3403	Runway grooved
21	3403	3650	3510	2990	

Table 2

1.10.1 ***Runway conditions and pavement classification***

Pavement (PCN): 70 F / B / W / T

Rubber deposit : Identified Touchdown Zone (TDZ) R21

Presence of water: Grooving facilities enhance drainage of water from Runway

Friction Coefficients: Not determined

Braking Action: Not determined

1.10.2 ***Runway lighting***

Runway 03 Lighting: Threshold green, Edge white; last 600m alternating red and white and last 300m red

Approach lighting R03: Simple Approach

PAPI: Reported switched off

Runway 21 lighting: CAT II Runway Lighting system, Precision Approach CAT I Secondary Power with Minimum Switch-Over times. Threshold green, Touchdown Zone (TDZ) to 900m centre line white. The last 600m alternating red and white, last 300m red

Taxiway lighting: Green Centerline, Blue edge and, exit Lights.

PAPI : Available

1.10.3 ***Runway inspection programmes***

The Ramp Control unit is charged with the responsibility of conducting Aerodrome inspections. Scheduled inspections are conducted three (3) times a day (Morning, Afternoon and evening).

Additional inspections are conducted:

- Following construction works or activities
- After rain or bad weather
- Following accidents or incidents on the airside

Runway inspection was carried out in rain immediately after the accident and was found satisfactory.

1.11 Flight recorders

1.11.1 *Flight data recorders*

The accident aircraft was equipped with a Lockheed Aeronautical Systems model 209 (LAS 209) FDR serial number 645, that recorded flight data of altitude, airspeed, heading, elevator, aileron, flap and rudder positions. It also recorded engine pressure ratio, thrust reversers status and positions with speed attitude and brake status in ARINC 573 configuration data. There are six tracks of ¼-inch Mylar tape using analog signal for a total of 25 hours of recorded flight data.

The FDR was in good physical condition and the readout and evaluation results were found satisfactory. (See the Appendix "B" at page 37 to 48)

The following information were obtained:

- a) the main landing gear touched down at 4,000 feet to the end of Runway 21. At that time, the aircraft Indicated Airspeed (IAS) was 167 knots with aircraft heading of 208° and the nose gear was up. The vertical acceleration recorded was 1.6G.
- b) the speed brakes were fully deployed 3.5 seconds after touchdown and the vertical acceleration decreased to a value of 1.0G from 1.6G within 3.5seconds of touchdown.
- c) three seconds after departure from the paved surface, the No.3 engine pressure ratio (EPR) decreased from 1.5 to 1.2, whilst EPR 1 & 2 increased to 1.9 and 1.8 respectively.
- d) the first indication of thrust reverser activity was recorded on only engines 1 and 2 for 1 to 2 seconds respectively after touchdown, with full deployment in 5 to 6 seconds. Engine 3 thrust reverser remained inactive (locked) to the final stop.

- e) the landing gear departed the runway at an airspeed of 100 knots. The thrust reversers 1 and 2 were fully deployed. Thrust reverser 3 remained locked.
- f) the aircraft came to a stop 1,171ft beyond the end of the Runway 21 on a heading of 215° with the nose and main landing gear struts broken and detached.
- g) the elapse time between touchdown and departure from pave surface is approximately 16.5sec.

1.11.2 ***Cockpit voice recorder, (CVR)***

The aircraft is equipped with a Fairchild model A-100 CVR, serial number (S/N) 5930. The CVR showed no signs of physical damage but the playback was unsatisfactory.

The 30-minute recording consisted of four channels as indicated in the table below:

Channel Number	Content Source	Quality
1	Crew Member	Good
2	CAM	Unusable
3	Crew Member	Good
4	Crew Member	Good

Instead of recording four (4) good quality audio information, the CVR recorded only three. The recorded audio on channel 2, the Cockpit Area Microphone (CAM) was unintelligible and fragmented. This information could not be used.

Due to the limited content on the CVR, the specific crewmember source of channels 1, 3, and 4 could not be determined for analysis because they did not contain any intra-cockpit communications. They were limited to the recording of only radio communications.

The recordings started at 0:00:08.8 and continued uninterrupted until 0:31:51.6. However, interview with the crew indicated that there was cockpit interaction during the flight until the accident.

1.12 Wreckage and impact information

The aircraft departed Runway 03 and came to rest 1171ft (350m) southwest and heading 215°. The nose cone initially made contact with the localizer antenna and its structures. The cone together with the weather radar antenna housed therein, were smashed and the debris scattered on both sides of the aircraft path with some flying across the perimeter fence.

The aircraft nose gear which was still in the air missed the fence wall whilst the leading edge of both wings span cleared the top three layers of the block works (eight layers in height) of the perimeter wall. Whilst the aircraft was still on ground its weight was on the right main gear thereby breaking into pieces, the slabs on the drainage but the left main gear only displaced the slabs in its path.

Thereafter, the two main landing gears then broke through the fence wall. All the tyres were completely deflated.

The aircraft cockpit then sank into the road and the nose gear created a depression in the asphalt road, broke off and flew ahead of the aircraft with the portions of the struts scattered in its way. When the main landing gears went through the wall, the right gear struck and uprooted a tree, and broke away from the trunion. Part of the Localizer antenna got entangled with the leading edge of the right wing and were carried along by the aircraft to a stop.

The left landing gear and wing flattened the mini bus. In the process about $\frac{1}{3}$ of the wing housing the fuel, broke off with fuel in the tank dripping. The landing gear twisted to rest on top of the wing. The two mounts on which the inner flaps were supported together with the screw jacks were damaged from the impact. The outer wing flaps turned in the upwards direction of the wind flow. The No.3 outer flaps were detached and found close to the flattened mini bus.

A section behind the left wing fitted to the fuselage was ripped off exposing fuel, pneumatic and hydraulic lines and flight control cables.

The No. 1 and No.3 engines sucked in pieces of metal tubes from the localizer transmitter fittings as well as branches of the tree. The no. 2 engine was free from any obstacles. The empennage collapsed causing the entire section to rest on the ground on the port side of the elevator.

The left nose landing gear door was found located close to the aircraft forward main door whereas the right landing gear door was found intact but stuck under the fuselage.

A section of the uprooted tree was found embedded midway on the port side under the fuselage. The main fuselage showed some signs of breakage from the right wing root to the top of the fuselage. The right wing leading edge slats were badly damaged

1.13 Medical and pathological information

From the Medical reports, the Captain suffered from contusion to the left leg with swelling of the anterior with multiple excoriations on the same leg. He had inflamed left index finger. His blood pressure was 170/130. The Captain was visibly traumatized.

The Pilot Monitoring did not complain of any pain but medical examination report revealed that he suffered contusion to the left lower limb with excoriations and swelling. His blood pressure was 180/120 and was also visibly traumatized.

Medical reports revealed that the Ground Engineer had a mild contusion to the lower left leg and had a sorrowful look.

A medical report showed that the Flight Engineer had some pain in the left lower limb but was relatively well composed.

Pathological reports for all ten (10) fatalities were the same. They suffered crushed head, neck, chest and had facial injuries.

The taxi cab driver's medical report showed contusion to the shoulder but no obvious laceration. He was mildly traumatized.

1.14 Fire

There was no fire outbreak.

1.15 Survival aspects

At 1910hrs Tower knew DHV111 had crashed-landed and therefore activated the crash bell. Tower told RFFS watch room on Channel 2 (Ground Communication Channel) to proceed to end of Runway 21 immediately to confirm the situation because an aircraft had landed and run-off the runway.

Tower saw the three (3) Fire Tenders moving in the opposite direction (i.e towards the threshold of Runway 21) and re-directed them. At the same time, the Ramp Manager informed Tower that he was proceeding to Runway 03 to also confirm the situation.

A few minutes later, the Fire Tenders reported to Tower that there was no aircraft seen on Runway 03 and that they were returning to base. Seconds later, the Ramp Manager made a broadcast on the handset that he had seen the aircraft and it had crashed through the perimeter wall at Runway 03. He then instructed the RFFS to return and use Gate 26 to reach the aircraft.

At 1919hrs Approach Control attempted to contact DVH 111 but this proved futile. At the same time, the Captain of DHV 111 reported to Tower on 118.6MHz that they had overran the runway. He said it twice and went off the air. Tower responded to DHV 111 that "Emergency Procedures were in progress". However, there was no response from DHV 111.

Later at 1921hrs, Ramp Manager confirmed the exact position of the crashed aircraft with its crew. At 1925hrs the runway was closed to traffic.

At 1930hrs Tower requested Ramp Manager to inspect the runway. He reported back that there was no debris on the runway.

At 1952hrs Tower instructed the Ramp Manager to conduct a full inspection of the runway. This was carried out and there was no debris of any sort or pool of water. The runway was re-opened to full traffic at 2010hrs.

1.15.1 ***Search and rescue***

Rescue and Fire Fighting Service and Aviation Security both under GACL, the Ghana Armed Forces, Ghana National Fire Service, National Security, NADMO, Ghana Police Service and the National Ambulance Service were quickly deployed to the scene of the accident.

The RFFS took nine (9) minutes to reach the aircraft from the time it was told at 1919 hours of the crash because:

1. They misunderstood the ATC instructions and went in the wrong direction towards the threshold of Runway 21.
2. The construction works at the southern side of the airport and the taxi way had adversely affected their movement to the crash site.
3. The access gate (Gate 26) is normally locked to prevent access from outside to the airside. The key to the gate is kept at the Aviation Security Office and so the lock had to be broken down with an axe in this emergency situation.
4. The heavy Fire Tenders could not access the crashed aircraft through the broken fence wall.
5. The Lufthansa (LH) aircraft was backtracking so access to the crash site through the runway was impossible.

Command at the Forward Control Post (FCP) was established and the site was cordoned off by the security personnel. The main road i.e the Giffard Road was closed to traffic. Traffic was reopened 48hrs later. The combined team further established ambulance holding area.

Four (4) mobile floodlights powered by generators were deployed from the Ghana Armed Forces and PW Ghana Ltd, a Construction Company, to provide adequate lighting and security for the crash site and other exhibits of evidence.

The cockpit area was intact on impact and there was more livable volume. The crew members' seats and seat belts were all intact. With difficulty, the Ground Engineer also doubling as the Load Master, managed to open the main entrance door for evacuation.

The Firemen evacuated the crew from the aircraft since the Crews' attempt to use the escape ropes to go through the Direct Vision (DV) windows failed. All the emergency equipment in the cockpit were found on board and in serviceable condition. The cargo on board was found intact.

1.16 Test and research

NIL

1.17 Organizational and management information

The founder and CEO of Allied Air Ltd is an airline Captain with 15yrs of airline experience. The airline was formed in 1998 and over the years, the company has seen steady strategic growth in air cargo operations in Nigeria and on West African markets. The airline operates a fleet of four (4) B727-221s and holds a Nigeria Air Operator Certificate. Other aircraft e.g DC 10-30, B747-200 and Illusion Il76 are leased as required, to meet demands. The company's operations are based on compliance with Nigeria Civil Aviation Authority (NCAA) regulations. This is its first accident.

The role of the crew is stipulated in the company's Operations Manual approved by the NCAA. It is placarded in red in the Cockpit that CAT II operations and below are forbidden.

1.18 Additional information

1.18.1 There are major construction works currently going on at the southern side at KIA, to construct eight (8) additional parking bays. These bays would connect the underground fuelling system for Large (Code E) aircraft. This work is obstructing the view of the RFFS from landing aircraft and has affected the vehicular movement within the apron area.

The construction works also include the widening of the taxiway which has necessitated the backtracking of arriving aircraft to the existing parking bays.

1.19 Useful or effective investigation techniques

NIL

2. ANALYSIS**2.1 *General***

A four (4) man crew operating Allied Air Boeing 727-221, registration number 5N-BJN departed Mutarla Mohammed Airport Ikeja, Lagos on the 2nd of June, 2012 at 1828hrs. According to the load sheet the aircraft was laden with 22,548 Kgs of cargo and 26,000lbs of JET-A1 fuel. Flight DHV 111 was estimated to arrive at Kotoka International Airport at 1904hrs, but the aircraft overrun the runway at 1910hrs and was destroyed.

2.2 *Pilot decision to land and action*

At 1834hrs, Arik Air flight 075 from Lagos after being briefed by ATC about the prevailing Meteorological condition, decided to hold over Accra for weather improvement. At 1836hrs wind speed was given as 050/17kts and Arik Air flight 075 decided to return to Lagos since the wind had turned into a tailwind. This necessitated using Runway 03. Also there were no Approach lights, ILS and PAPI on Runway 03 as advised through NOTAM.

At 1856hrs, all the inbound flights i.e Turkish THY 629 Airbus 320 (ETA 1843), Lufthansa DLH 566, B737-800 (ETA 1857) and Allied Air DHV 111, B727 (ETA 1904) were advised raining over the airfield and surface wind 040/15kts. DHV 111 copied and asked about intensity but there was no response from ATC. The Captain did not ask ATC again.

As DHV 111 got near to Accra, it avoided weather. When he reported clear of weather, Approach Control took him through the Localizer because of his heading which would have taken him to 6miles final.

DHV 111 was therefore given vectors 360^o, 120^o and then 170^o to position him 11miles final at 2000ft then cleared for ILS approach Runway 21 to report established. When established on the final approach, the Pilot was instructed to continue approach and was informed repeatedly of the surface wind.

The aircraft appeared to be on a 3 degree approach path and at the same time pitching from -2 to +3 degrees at a high speed of 167kts. The maximum approach speed for a maximum landing weight of a B727 is 137kts.

Between the beacon "AA" and the VOR "ACC", the Captain disconnected the autopilot at 500ft for a manual approach.

He later flew into heavy rain and could not see the runway. This placed him in CAT II conditions. It is placarded in red in the Cockpit that below CAT I operations are forbidden. He should have carried out a missed approach procedure. The pilot's decision at the critical landing phase was inappropriate.

The Captain eventually made a heavy landing at 1.6G in nil visibility. The crew stated that all of them were watching the tracking on the Localizer and paid little attention to threshold and runway edge lights. The Co-pilot (PM) in his statement stated that he didn't know where they landed and when asked further whether he knew his position on landing, he replied; "I didn't know where the aircraft touched down".

The Flight Engineer also said he could not see the actual point where they landed because the rain intensified. He did not monitor the rate of descent.

2.3 ***Other observation on landing***

After touchdown, the crew said they saw red lights flashing past and they knew they were getting close to end of Runway 21.

The Ramp Controller in the "Follow Me" vehicle waiting at the first turnoff stated that he saw the aircraft land between the 1st and 2nd turnoff which was confirmed by the Air Traffic Controller.

The crew of DLH 566 who were waiting at the 2nd turnoff said they saw the aircraft go past them very fast as if it was taking off.

The Flight Data Recorder readout at NTSB, Washington, USA showed that the aircraft:

- touched down at 154kts,

- touched down on the main landing gear 4000ft from the end of Runway 21
- landed at 1.6G. The Captain deployed speed brakes, selected thrust reversers and applied foot brakes. The ELT warning system was triggered by the impact.
- the elapsed time between touchdown and the end of the paved surface is approximately 16.5secs: and

The FDR indicated that by the time the aircraft got to the threshold of Runway 03 the touchdown speed of 154kts had decreased to 100kts. This showed that the aircraft was decelerating almost normally.

Lufthansa reported good braking action after landing at 1901hrs.

The GACL emphasized that shortly after the accident they inspected the runway and found no standing water on it.

The runway has grooves that drains water from its surface and is cambered to help water drain off easily after heavy rainfall. British Airways, KLM and Kenya Airways landed after Allied Air.

2.4 ***Flight control positions/ indications***

The FDR readout indicated that the flaps/slats were selected normal. However, flap 1, flap 2 and flap 4 on the left wing changed positions on impact. These were in disagreement with the settings as observed in the cockpit after the accident. This suggests that the controls were possibly tampered with when the aircraft came to a rest.

2.5 ***Windshield wiper system***

The wind shield wipers could not cope with the volume of water on the windshield. This was as a result of the setting. The Captain called for full wiper but the Flight Engineer selected the 3/4 position thereby reducing the effectiveness of the wiper. This according to the Captain visibility through the windshield was nil.

3. CONCLUSIONS

3.1 Findings

1. From the departure airport (Lagos) the No. 3 CSD was disconnected but was not logged in the Technical Log Book.
2. The weather was very poor with reduced visibility at KIA.
3. The 15kts tail wind was in excess of the allowable maximum of 10kts for a B727 aircraft.
4. The Pilot decided to land in poor visibility well below CAT 1 minima.
5. Crew co-ordination was almost non-existent among the crew on the accident flight. The Captain did not check how far he had gone on the runway with the help of the VOR/DME. The Co-pilot and the Flight Engineer suffered from fixation.
6. The crew were licensed to operate the aircraft type. However their exhibition of Crew Resource Management application was well below Standard.
7. The PM, himself a training Captain on the type was not co-operative.
8. The aircraft landed deep into the runway 4000ft from the threshold of Runway 03 and was unable to stop within the available stopping distance despite application of brakes. The nose gear was fully above the ground. He made a soft Landing instead of a positive Landing in heavy rain.
9. With the aircraft departure from the paved surface and travelling at almost 100kts, it smashed the Localizer transmitter and broke through the fence wall. It consequently left a trail of broken and detached aircraft parts. The aircraft smashed into a minibus and killed all ten (10) occupants.
10. No evidence of standing water on the runway.
11. The Cockpit Voice Recorder was of no help as the intra-cockpit communications were unintelligible.

12. The RFFS did not follow the controller's directives as all the three fire tenders headed to the threshold of Runway 21 when directed to proceed to Runway 03.
13. Runway 03 is not often used for landing in the night. The Approach and PAPI lights are switched off.
14. All mandatory documents to be carried on the aircraft were found to be valid.
15. The aircraft was properly maintained in accordance with a Maintenance Programme approved by NCAA.
16. There were no major repairs since the last "C" Check on 4th November, 2010.
17. The aircraft was due for a "C" Check in May 2012 but this was deferred to 2nd July, 2012.
18. Applicable Airworthiness Directives and Service Bulletins have been complied with.
19. Authorizations/Approvals required for the operation of the aircraft were found to be satisfactory.
20. The aircraft centre of gravity was within limits.
21. The Captain did not brief the crew on their individual responsibilities for the landing.

3.2 Probable cause/s

The probable causes of the accident were:

The decision of the Captain to continue with the landing instead of aborting at the missed approach point especially when he could hardly see through the windshield and when he did not know how far he had gone down the runway because of the rain and the tail wind components.

Contributory factors:

- a. the Captain disconnected the auto-pilot and flew the aircraft manually in an unstable approach.
- b. the Captain landed the aircraft at 4000ft to the threshold of Runway 03, 6060ft from Runway 21. He could not stop within the available distance.
- c. the Captain chose to land with a tailwind of 050/15Kts in excess of maximum allowable tailwind of 10Kts.
- d. the crew concentrated on tracking the Localizer rather than watching for threshold and runway edge lights. They suffered from fixation.
- e. the Captain did not deploy speed brakes on landing.

4. SAFETY RECOMMENDATIONS

- 4.1 GACL should ensure that the spare keys to each access gate on the airside is kept on each Fire Tender.
- 4.2 Allied Air should review the pairing of two (2) Captains both at or near 60 years.
- 4.3 Allied Air should ensure that all CVRs/FDRs on its B727 fleet be tested for serviceability on all channels in accordance with the laid down procedures.
- 4.4 Recurrent Crew Resources Management training for the crew should be carried out by Allied Air and enforced by NCAA every 12 months.
- 4.5 The GACL RFFS Department should move as a matter of urgency to the new site so that they will at all times have the whole runway in view.
- 4.6 GACL should ensure that Fire men are trained to be conversant with KIA Grid Map.
- 4.7 To prevent aircraft from breaking through the perimeter fence wall and crossing the Giffard Road and beyond, GACL should establish Runway End Safety Area (RESA) in accordance with ICAO Annex 14 .3.5.

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