



AIRCRAFT ACCIDENT REPORT

BH 2011/07/14/F

Accident Investigation Bureau

Report on the Accident Involving
Bristow Helicopters, Registration 5N-BMM
at Port Harcourt International Airport,
River State. Nigeria
On 14th July 2011

This report was produced by the Accident Investigation Bureau (AIB), Murtala Muhammed Airport, Ikeja, Lagos.

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.

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

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

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

Recommendations in this report are addressed to the regulatory Authorities of the state (NCAA). It is for this authority to ensure enforcement.

Contents

Glossary of abbreviations used in this report.....	vi
Synopsis.....	2
1.0 Factual Information.....	4
1.1 History of the Flight.....	4
1.2 Injuries to Persons.....	5
1.3 Damage to Aircraft.....	6
1.4 Other Damage.....	9
1.5 Personnel Information.....	9
1.5.1 Captain.....	9
1.5.2 Co-Pilot.....	10
1.6 Aircraft Information.....	10
1.6.1 General Information.....	10
1.6.2 Power Plant.....	11
1.7 Meteorological Information.....	12
1.8 Aids to Navigation.....	12
1.9 Communications.....	12
1.10 Aerodrome Information.....	12

1.11	Flight Recorders.....	13
1.11.1	Flight Data Recorder.....	13
1.11.2	Cockpit Voice Recorder.....	13
1.12	Wreckage and Impact Information.....	23
1.13	Medical and Pathological Information.....	25
1.14	Fire.....	25
1.15	Survival Aspect.....	25
1.16	Test and Research.....	26
1.17	Organization and Management Information.....	27
1.17.1	Organizational Chart.....	27
1.17.1.2	The Pilot.....	27
1.17.1.3	Pairing (Crew Roster).....	28
1.17.1.4	Cabin Attendant (Bristow Ops Man.5.5).....	28
1.17.1.5	Pilot's Age and Licence Limitations(B.O.M.5.12).....	30
1.17.1.6	Medical Restrictions to Pilot's Licences(BOM 5.13).....	31

1.17.1.7	Flying after an Accident (BOM11.11)	31
1.17.1.8	Monitoring Procedures (BOM 8.3.4)	32
1.17.1.9	Windshield Defog	33
1.17.1.10	Emergency Evacuation	33
1.17.2	Nigeria Civil Aviation Authority(NCAA)	34
1.17.3	Federal Airport Authority of Nigeria (FAAN)	38
1.18	Additional Information	38
1.19	Useful or Effective Investigation Techniques	38
2.0	Analysis	39
2.1	Flight Phase	39
2.2	The Pilots	40
2.3	The Cabin Attendant	43
2.4	Monitoring, Procedures, Simulator	43
2.5	Decision Height (DH)	44
2.6	Defogging and Blurred Windshield	44
2.7	Emergency Evacuation	45
2.8	Operations Manual Part A and C	46

2.9	Flight Data Recorder.....	46
3.0	Conclusions.....	48
3.1	Findings.....	48
3.2	Causal Factor.....	49
3.3	Contributing Factors.....	49
4.0	Safety Recommendations.....	50

GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

AIB	-	Accident Investigation Bureau
AC	-	Alternating Current
ATC	-	Air Traffic Controller
APU	-	Auxiliary Power Unit
AOC	-	Air Operators Certificate
ATPL	-	Airline Transport Pilot Licence
BATT	-	Battery
BOM	-	Bristow Operations Manual
CPL	-	Commercial Pilot Licence
CVR	-	Cockpit Voice Recorder
CRM	-	Crew Resource Management
CSO	-	Cycle Since Overhaul

DH	-	Decision Height
DME	-	Distance Measuring Equipment
FAAN	-	Federal Airport Authority of Nigeria
FDR	-	Flight Data Recorder
FL	-	Flight Level
HF	-	High Frequency
HPA	-	Hecto Pascal
ICAO	-	International Civil Aviation Organization
IFR	-	Instrument Flight Rules
ILS	-	Instrument Landing System
L/H	-	Left Hand
MDA	-	Minima Decision Altitude
MDH	-	Minima Decision Height
NCAA	-	Nigerian Civil Aviation Authority
NCARS	-	Nigeria Civil Aviation Regulation
NTSB	-	National Transport Safety Board, U.S.A.
NIMET	-	Nigerian Meteorological Agency
NM	-	Nautical Mile
POT VOR	-	Port Harcourt VOR
POI	-	Principal Operations Inspector

- PF - Pilot Flying
- PM - Pilot Monitoring
- PNF - Pilot Not Flying
- QNH - The Atmospheric Pressure at Mean Sea Level
- R/H - Right Hand

- SSFDR - Solid State Flight Data Recorder
- TSO - Time Since Overhaul
- UTC - Universal Time Coordinated
- VHF - Very High Frequency
- VOR - Very High Frequency Omni-directional Radio Range

Aircraft Accident Report No: BH 2011/07/14/F

Registered Owner and Operator: Bristow Helicopters (Nig.) Ltd

Aircraft Type and Model: Cessna Citation 560XLS

Nationality: Nigerian

Registration: 5N-BMM

Location: Port Harcourt International Airport Nigeria

Date and Time: 14TH July 2011 at 1953 hrs.
(All times in this report are local times equivalent to UTC+1, unless otherwise stated)

Synopsis

The Accident Investigation Bureau (AIB) was notified of the accident in the evening of 14th July 2011, investigators were dispatched and arrived at the site in the morning of the 15th July 2011. All the relevant authorities were informed, but no accredited representative participated in the investigation. The investigation was conducted by the Bureau in accordance with the provisions of the Civil Aviation Act 2006 and ICAO Annex 13.

5N-BMM departed Lagos at 1856 hrs for Port Harcourt on an Instrument Flight Rules (IFR) and estimated Port Harcourt at 1940 hrs. The aircraft was cleared to maintain FL 330.

The aircraft made first contact with Port Harcourt at 1914hrs. The pilot reported maintaining FL330 with six souls onboard, four hours fuel endurance and estimating POT VOR at 1940hrs.

At 1921hrs the pilot reported 100 NM to POT and requested for descent. The aircraft was cleared for descent through different levels and finally cleared for the straight-in ILS Approach Runway 21 and to report on the localizer.

On final approach the crew were no longer visual but continued the approach, crash landed and exited the runway.

The investigation identified the following:

Causal Factor: The Decision of the pilot to continue the approach without the required visual references.

Contributory Factors:

- 1) Poor crew co-ordination. (CRM)
- 2) Pairing two captains together.
- 3) The weather was marginal.

Six safety recommendations have been made.

1.0 FACTUAL INFORMATION

1.1 HISTORY OF FLIGHT

5N-BMM departed Lagos at 1856hrs for Port Harcourt on an Instrument Flight Rules (IFR) and estimated Port Harcourt at 1940 hrs. The aircraft was cleared to maintain FL 330.

The aircraft's first contact with Port Harcourt was at 1914hrs. The pilot reported maintaining FL330 with six souls onboard, four hours fuel endurance and estimating POT VOR at 1940hrs. The aircraft was cleared to POT, to maintain FL330 with no delay expected for ILS Approach Runway 21, QNH 1011 and to report when released by Lagos. At 1921 hrs the pilot reported 100 NM to POT and requested for descent.

The aircraft was cleared to descend to FL150. At 1927hrs the pilot requested for further descent and was cleared to 3,300ft on QNH. 1011 but the pilot acknowledged 3500ft. At 1931hrs the aircraft was re-cleared to FL 090 initially due to departing traffic on Runway 03. At 1934hrs 5N-BMM reported maintaining FL090 and was re-cleared to FL050. The aircraft was re-cleared to 2000ft on QNH 1011 at 1936hrs and cleared for the straight-in ILS Approach Runway 21 and to report on the localizer. At 1947hrs the pilot reported final for Runway 21 and was asked to contact Tower on 119.2 and the Tower asked 5N-BMM to report on glide slope Runway 21. At 1950hrs the Tower asked 5N-BMM to confirm on the glide slope and the crew confirmed "Charlie, we have three miles to run". The Tower cleared 5N-BMM to land with surface wind calm but to exercise caution since the Runway surface was wet and 5N-BMM responded "wind calm". At 1952:26hrs the auto voice callout "minimums minimums" alerted the crew. At 1952:40hrs the pilot flying (PF) said "I am not on the centerline". At 1952:48hrs he said "I can't see down". At 1952:55hrs the pilot monitoring (PM) said to the pilot flying; " I am telling you to go down" and the pilot flying said " I will go down", five seconds

later the aircraft crashed. The crew exited the aircraft without accomplishing the Emergency Evacuation Checklist and therefore left the right engine running for about 28 minutes after the crash. The Fire Service eventually used their water hose to shutdown the running engine.

At 19:54hrs the Tower called 5N-BMM to pass on the landing time as 19:53hrs, but no response from 5N-BMM. There was no indication that the aircraft was taxiing on the Runway because it was dark and no light was visible hence the need to alert the Fire personnel. The watch room was asked to give the Tower information, which they could not give since they do not have a two – way contact with the Fire trucks.

The Tower could not raise the Fire truck since there was no two - way communication between them; however, the Fire truck was later cleared to proceed to the Runway as the Tower could not ascertain the position of the aircraft.

The aircraft was actually turned 90° because of the big culvert that held the right wing and made the aircraft spin and turned 90° facing the runway, two meters from the active runway, the culvert was uprooted due to the aircraft impact forces. The wheel broke off because of the gully that runs parallel to the runway.

1.2 INJURIES TO PERSONS

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	NIL	NIL	NIL
SERIOUS	NIL	NIL	NIL
MINOR/NONE	2	4	NIL

1.3 DAMAGE TO AIRCRAFT

The aircraft was substantially damaged; see fig 1.3a-c below.



Fig 1.3a Damaged Aircraft



Fig 1.3b Damaged E and E Compartment



Fig 1.3c The damaged nose wheel and the Radome area

1.4 OTHER DAMAGE

One Runway light was broken.

1.5 PERSONNEL INFORMATION

1.5.1 CAPTAIN

Nationality:	-	Nigerian
Age:	-	56 yrs
Gender:	-	Male
Licence No.	-	ATPL 2191
Aircraft Rating:	-	CE-560XL
Instrument Rating:	-	16 th Dec. 2011
Proficiency Check:	-	17 th June 2011
Simulator Expires	-	14 th June 2011
Medical:	-	28 th July 2011
Total Flying Experience:-		11,751 hrs
On Type:	-	684 hrs
Last 90 days:	-	55 hrs
Last 28 days:	-	2:12 hrs
Last 24 hrs:	-	NIL

Simulator Training was performed at Business Aviation Training CAE.

1.5.2 CO - PILOT

Nationality:	-	Nigerian
Age	-	60 yrs
Gender:	-	Male
Licence No.	-	ATPL 2969
Aircraft Rating:	-	CE-560XL, C-501,DASH-6
Instrument Rating:	-	28 th April 2012
Proficiency Check:	-	27 th April 2011
Medical:	-	15 th August 2011
Total Flying Experience:	-	13,302 hrs
On Type:	-	612 hrs
Last 90 days:	-	67 hrs
Last 28 days:	-	40 hrs
Last 24 hrs:	-	1:20 hrs

1.6 AIRCRAFT INFORMATION

1.6.1 GENERAL INFORMATION

Aircraft Type:	-	CESSNA CITATION 560XLS
Year of Manufacture:	-	2008
Serial Number:	-	560-5830
Registration:	-	5N-BMM
Total Airframe time:	-	982:09 Hrs

Certificate of Airworthiness

Validity:	-	25 th June, 2011 to 24 th Sept., 2011
Category:	-	Transport
Certificate of Registration:	-	23 rd June 2009
Operator:	-	Bristow Helicopter (NIG) Ltd
Insurance Validity:	-	1 st April 2011 to 1 st April 2012

1.6.2 POWER PLANT

Manufacturer: Pratt & Whitney

Engine No. 1

Engine Type: PW 545 B
Total Time since new: 957:16hrs as @24/06/2011
Cycles: 1089

Engine No. 2

Engine Type: PW 545 B
Total Time since new: 957:16hrs as @24/06/2011
Cycles: 1087

Type of Fuel used: Jet A1

1.7 METEOROLOGICAL INFORMATION

Time : 1830 UTC
Wind : 300/02
Visibility : 6 km
Weather : Drizzle
Cloud : BKN 210m
FEW 600m CB(SD)
QNH : 1011 hPa
Temp. : 24⁰ C / 22⁰ C

1.8 AIDS TO NAVIGATION

The Instrument Landing System (ILS) was serviceable at the time of the accident. The VOR and DME were also serviceable.

1.9 COMMUNICATIONS

There was good communication between the aircraft and the Control Tower. However, there was no two-way communication between the Control Tower and the Watch room and also between the Tower and the Fire Service.

1.10 AERODROME INFORMATION

Port Harcourt International Airport is one of the major airports in Nigeria and is located in the South-South region of the Country. It has VOR/DME and ILS installed. It's an important gateway out of Nigeria. The runway length is 9,843ft or 3000metres, elevation of 87ft from RWY. 21 and 82ft from RWY 03. There are Licensed Air Traffic

Controllers (ATC) to provide Air Traffic Control Services and Meteorological services provided by NIMET. The airport is fully covered by Fire Services. Since the airport is an international airport, all requirements to sustain this category are available or present at the airport. Approach and Aerial charts by Jeppesen are in use at the airport.

1.11 FLIGHT RECORDERS

FLIGHT DATA RECORDER (FDR)

Part Number	:	980-4700-025
S/N	:	SSFDR-16438
Date Code	:	062008
Manufacturer	:	Honeywell

COCKPIT VOICE RECORDER (CVR)

Part Number	:	2100-1020-02
S/N	:	000532508
Date Code	:	032008
Manufacturer	:	Honeywell

The Flight Recorders are located at the rear of the aircraft. The Recorders were removed after the crash and were in good condition. They were sent to NTSB for readout. Attached below is the detailed readout of the recorders.



NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

May 18, 2012

Flight Data Recorder - 10

Specialist's Factual Report
By Erin Gormley

1. EVENT SUMMARY

Location: Port Harcourt, Nigeria
Date: July 14, 2011
Aircraft: Cessna 560XL
Registration: 5N-BMM
Operator: Bristow Helicopters
NTSB Number: DCA11WA120

On July 14, 2011, a Cessna 560XLS, 5N-BMM, operated by Bristow Helicopters Limited, was substantially damaged while landing at Port Harcourt International Airport, Nigeria. The investigation is being conducted by the Nigerian Accident Investigation Bureau (AIB).

2. DETAILS OF FLIGHT DATA RECORDER INVESTIGATION

The flight data recorder (FDR) was escorted to the NTSB Vehicle Recorders laboratory by Director of Engineering, Chukwama Diala, Nigerian AIB, on May 15, 2012, in Washington, DC for readout.

The following FDR was received:

Recorder Manufacturer/Model: **Honeywell SSFDR 980-4700-025, 64 wps**
Recorder Serial Number: **16438**

2.1. Honeywell SSFDR Description

The Honeywell Solid State Flight Data Recorder (SSFDR) records airplane flight information in a digital format using solid-state flash memory as the recording medium. The SSFDR can receive data in the ARINC 573/717/747 configurations and can record a minimum of 25 hours of flight data. It is configured to record 64 12-bit words of digital information every second. Each grouping of 64 words (each second) is called a subframe. Each subframe has a unique 12-bit synchronization (sync) word identifying it as either subframe 1, 2, 3, or 4. The sync word is the first word in each subframe. The data stream is "in sync" when successive sync words appear at proper 64-word intervals. Each data parameter (e.g. altitude, heading, airspeed) has a specifically assigned word number within the subframe. The SSFDR is designed to meet the crash-survivability requirements of TSO-C124.

DCA11WA120
FDR Factual Report, page 10-1

2.1.1. Recorder Condition

Figure 1 shows the SSFDR was in good condition and the data were extracted normally from the recorder.

Figure 1. Exterior of flight recorder



2.1.2. Recording Description

The FDR recording contained approximately 30 hours of data. Timing of the FDR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The event flight was the last flight of the recording and its duration from takeoff was approximately 57 minutes.

2.1.3. Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on documentation from the aircraft manufacturer. Where applicable, the conversions have been changed to ensure that the parameters conform to the NTSB's standard sign convention that climbing right turns are positive (CRT=+).¹

2.2. Time Correlation

An accident time of 18:53 GMT was provided by the Nigerian AIB representative. A point of significant acceleration values (SRN 107289) was identified as this time and used to correlate the FDR data from SRN to GMT². Common events on the FDR and CVR were used to correlate the two recordings.

Accordingly, the time offset for the event flight data from SRN to GMT is the following: GMT = SRN - 39309. Therefore, for the rest of this report, all times are referenced as GMT not SRN.

¹ CRT=+ means that for any parameter recorded that indicates a climb or a right turn, the sign for that value is positive. Also, for any parameter recorded that indicates an action or deflection, if it induces a climb or right turn, the value is positive. Examples: Right Roll = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +.

² GMT is Greenwich Mean Time which is also known as Coordinated Universal Time (UTC).

2.3. FDR Plots and Corresponding Tabular Data

The following figures contain FDR data recorded during the event landing on July 14, 2011. These plots are configured such that right turns are indicated by the trace moving toward the bottom of the page, left turns towards the top of the page, and nose up attitudes towards the top of the page. Figure 2 shows select parameters during the entire flight. Figures 3 and 4 expand the time period around landing. Figure 5 shows some discrete parameters during landing. The corresponding tabular data used to create these plots are provided in electronic (*.csv³) format as Attachment 1 to this report.

The FDR data indicates that the aircraft took off about 17:56 GMT. The aircraft cruised at an altitude of 33,000 feet before beginning to descend at about 18:24. Around 18:49:50, the aircraft begins the final descent and the flaps transition to 35 degrees. The AP parameter transitions from engaged to not engaged at 18:52:14.

After 18:52:56, there is a vertical acceleration spike of +2.43 g's, a lateral acceleration of +.46 g's, and a sharp decrease in recorded pitch angle from 5 degrees to -1 degree. This point most likely indicates aircraft initial touchdown. The recorded heading at this time was 215 degrees and the airspeed was 97 knots. The longitudinal acceleration values began to significantly decrease and the magnetic heading values indicated a left directional change. Four seconds later, a maximum vertical acceleration value of 2.58 g's and a maximum longitudinal acceleration value of -1.08 g's were recorded and the heading captured was 201 degrees. Following this point, the recorded values for most of the parameters on the SSFDR become suspect. There is a subsequent loss of recorded data for undetermined period of time. The SSFDR begins recording again for approximately 25 minutes. The data are consistent with the recorder being powered but not receiving valid systems input. Due to the nature of the impact and resulting damage, data recorded after 18:53 until the end of recording should be considered suspect and may not be representative of actual aircraft information.

³ Comma Separated Value format.

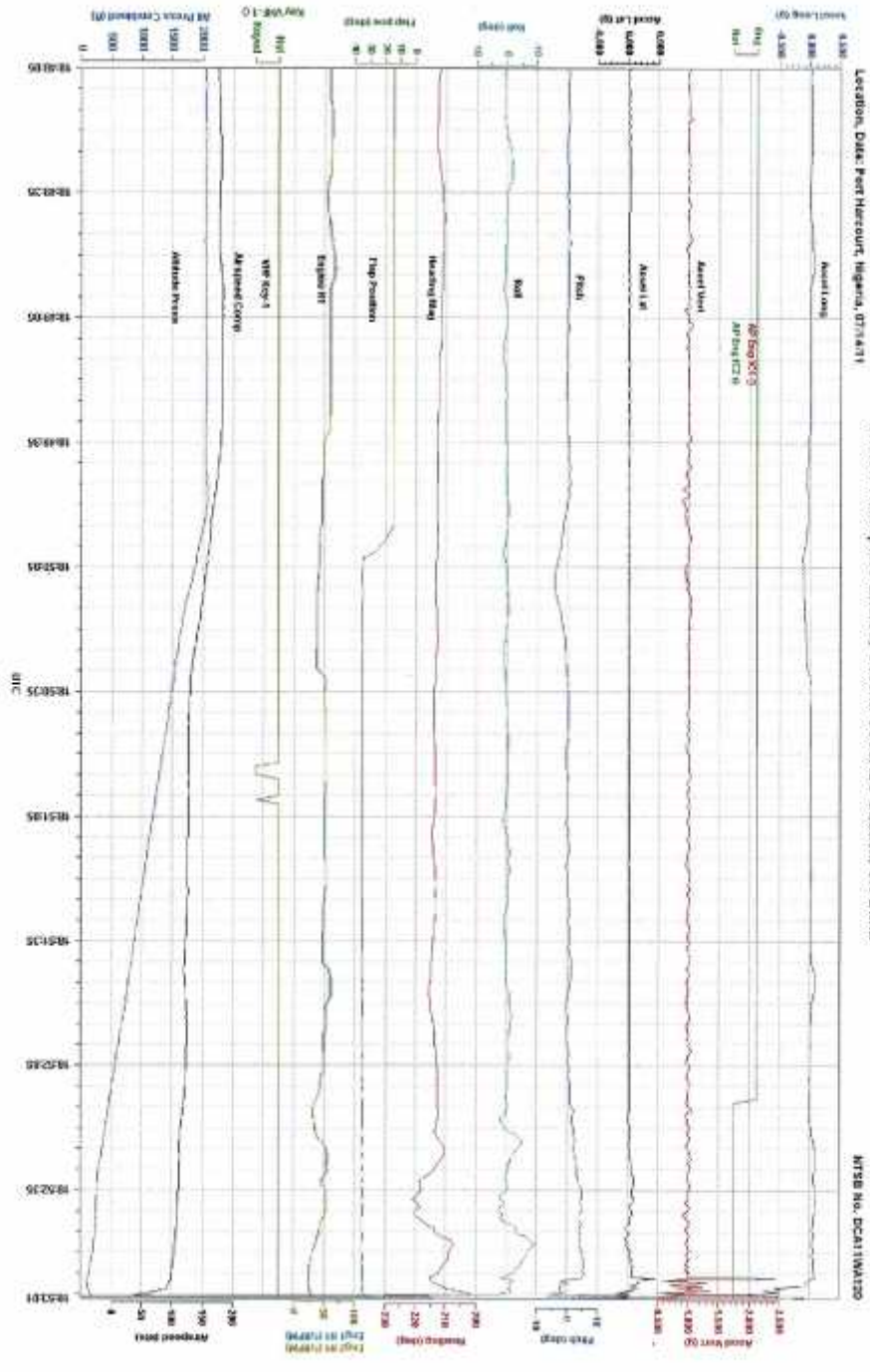


Figure 2. Basic parameters during approach and landing
 Bristow Helicopters Limited, Cessna C560XLs Gatton, SN-BMIM

Figure 3. Basic parameters during landing
 Bristow Helicopters Limited, Cessna C560XLS Citation, 5N-BMM

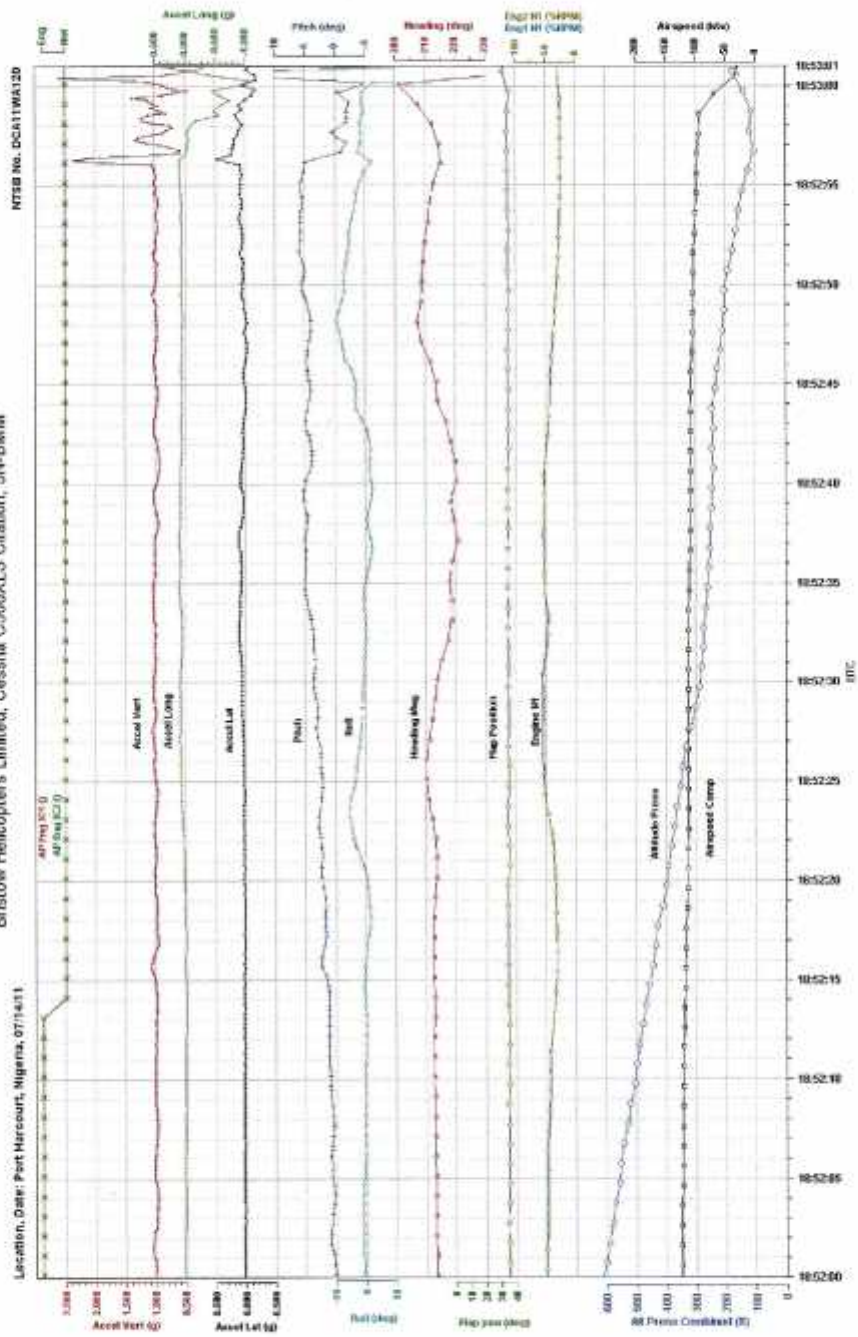
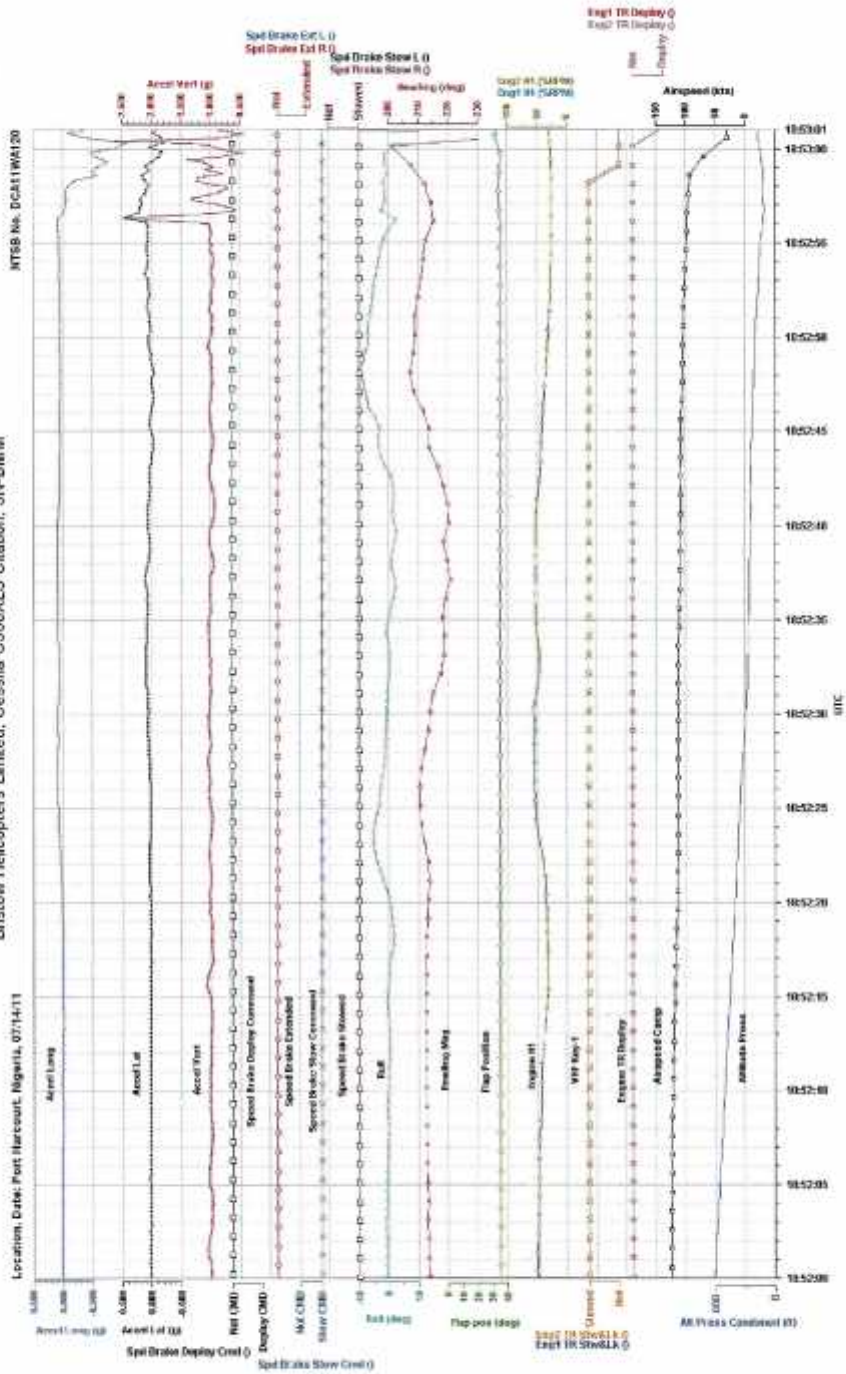


Figure 4. Discrete parameters during landing
Bristow Helicopters Limited, Cessna C560XLS Citation, 5N-BMM





NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

May 18, 2012

Cockpit Voice Recorder

Specialist's Factual Report By Bill Tuccio

A. EVENT

Location: Port Harcourt, Nigeria
Date: July 14, 2011, 1853 Universal Coordinated Time (UTC)
Aircraft: Cessna 560XL, 5N-BMM
Operator: Bristow Helicopters
NTSB Number: DCA11WA120

C. SUMMARY

On July 14, 2011, a Cessna 560XLS, 5N-BMM, operated by Bristow Helicopters Limited, was substantially damaged while landing at Port Harcourt International Airport, Nigeria. The investigation is being conducted by the Nigerian Accident Investigation Bureau (AIB).

D. DETAILS OF INVESTIGATION

On May 16, 2012, Engineer Chuckwuma Diala of the AIB, hand carried the following CVR to the NTSB Vehicle Recorder Division's Audio Laboratory:

Recorder Manufacturer/Model: **L-3 FA2100-1020**
Recorder Serial Number: **532508**

Recorder Description

This model CVR, the L-3/Fairchild FA2100-1020, is a solid-state CVR that records 2 hours of digital cockpit audio. The recorded audio data is separated by the Honeywell download software into a 4-channel recording containing the last 2 hours of recorded events. The recording contains 4 channels of audio data; one channel for each flight crew and one channel for the CAM audio information.

Recorder Damage

Upon arrival at the audio laboratory, it was evident that the CVR had not sustained any heat or structural damage and the audio information was extracted from the recorder normally, without difficulty. Digital photos of the extraction process were provided to the AIB.

Audio Recording Description

The 2-hour recording consisted of four channels of audio information. Each channel's audio quality* is indicated in the table. The filenames of the audio provided to the AIB on compact disk are also noted. Due to the poor and unusable quality of the recordings, the source of the content could not be determined; however the audio on channel 4 was very likely that of the CAM. Three versions of the channel 4 file were provided: "w120_h4.wav" is the 16kHz file as extracted by the L-3 software; "W120_H4_8k.wav" is the audio resampled to 8kHz; and "W120_H4_8k_with350ishFilterApplied.wav" is the 8kHz file with an audio filter applied to remove a background tone of about 350hz that persisted throughout the recording.

Channel Number	Content/Source	Quality	File Name
1	Unknown	Unusable	w120_h1.wav
2	Unknown	Unusable	w120_h2.wav
3	Unknown	Poor	w120_h3.wav
4	Unknown	Poor	w120_h4.wav

Timing and Correlation

The times used in this report are expressed as Universal Coordinated Time (UTC). Timing of the transcript was accomplished by aligning the local accident time as provided by the AIB Nigerian Official. The provided time of 1853:00.0 UTC was associated with a "sound of loud thunk" after touchdown at 0135:17.1 CVR Elapsed Time.

This supplied time resulted in the relationship, UTC = CVR Elapsed Time (adjusted recording) + 1717:42.920.

Description of Audio Events

With assistance from NTSB staff, a summary of the recording was produced by the Nigerian Official. The CVR recording began with the landing of a prior flight, followed by power interruptions to the CVR. Due to the power interruptions, the time period prior to 1740:04.1 UTC on the CVR summary is not known; these times are highlighted in red in the electronic Excel file and the corresponding printed version provided to the Nigerian Official. Word and Acrobat documents containing this report, a copy of the raw and adjusted audio, and an Excel document of the summarized recording were provided to the Nigerian Official.

* See attached CVR Quality Rating Scale.

CVR Quality Rating Scale

The levels of recording quality are characterized by the following traits of the cockpit voice recorder information:

Excellent Quality	Virtually all of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate only one or two words that were not intelligible. Any loss in the transcript is usually attributed to simultaneous cockpit/radio transmissions that obscure each other.
Good Quality	Most of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate several words or phrases that were not intelligible. Any loss in the transcript can be attributed to minor technical deficiencies or momentary dropouts in the recording system or to a large number of simultaneous cockpit/radio transmissions that obscure each other.
Fair Quality	The majority of the crew conversations were intelligible. The transcript that was developed may indicate passages where conversations were unintelligible or fragmented. This type of recording is usually caused by cockpit noise that obscures portions of the voice signals or by a minor electrical or mechanical failure of the CVR system that distorts or obscures the audio information.
Poor Quality	Extraordinary means had to be used to make some of the crew conversations intelligible. The transcript that was developed may indicate fragmented phrases and conversations and may indicate extensive passages where conversations were missing or unintelligible. This type of recording is usually caused by a combination of a high cockpit noise level with a low voice signal (poor signal-to-noise ratio) or by a mechanical or electrical failure of the CVR system that severely distorts or obscures the audio information.
Unusable	Crew conversations may be discerned, but neither ordinary nor extraordinary means made it possible to develop a meaningful transcript of the conversations. This type of recording is usually caused by an almost total mechanical or electrical failure of the CVR system.

The aircraft was intact except for the right wheel assembly that sheared-off, the wheel was found about ten feet from where the aircraft came to rest. See fig 1.12a-b.



Fig 1.12a The wreckage of the Aircraft



Fig. 1.12b The wreckage showing damaged Radome and Nose section

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

The crew were tested for drug and alcohol abuse. The sample was sent to SOS International in Port Harcourt for analysis, their urine samples were also taken. The drug analysis was negative, while alcohol test result was still pending. The test was performed on the 14th of July 2011 and the Chief Medical Officer signed the result.

1.14 FIRE

There was no fire outbreak.

1.15 SURVIVAL ASPECTS

The Tower could not raise the Fire truck since there was no two - way communication between the Tower and the Fire truck. The Fire truck was cleared to proceed to the Runway as the Tower could not ascertain the position of the aircraft.

On reaching the Runway it was observed that the aircraft had crashed and was by link 2 facing the active Runway about 2 meters from the active Runway. It was night and in darkness.

The aircraft was intact though it was substantially damaged. One of the main landing gears detached from the wheel assembly and was found about 10 feet away. The crash was survivable because there was livable volume.

According to the crew, they wanted to exit through the main exit door but realized that the door was jammed. They finally disembarked through the emergency exit close to the starboard

engine that was left running. Two of the passengers sustained minor injuries. The normal evacuation procedures were not carried out. The crew and passengers all walked away from the aircraft towards link 2, thereafter they were taken to the airport clinic.

The Airport Fire Service was prompt at the crash site to help rescue the crew and passengers. The Fire Services tried to break into the aircraft with their axe (See fig 1.15a). One of the engines was still running while the fire services attempted to shut-down the running engine to prevent fire outbreak. The Fire Services finally stopped the engine with high pressure foam water.



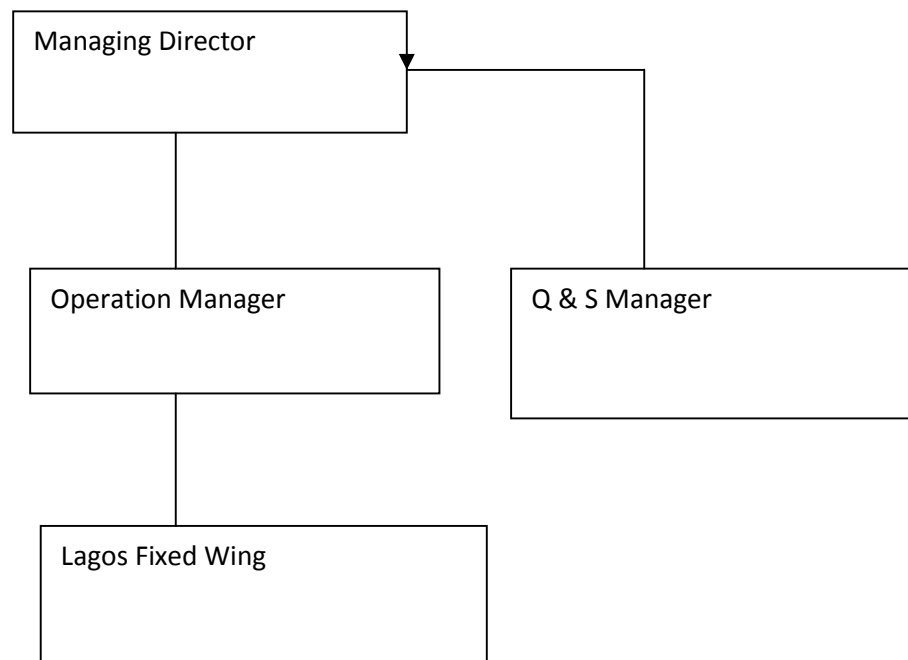
Fig 1.15a Rescue team/ Fire Services tried to break into the Aircraft to rescue passengers.

1.16 TEST AND RESEARCH

Nil.

1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION

1.17.1 ORGANIZATIONAL CHART



The company will conduct all operations in accordance with the approved NCAA Air Operators Certificate (AOC). Operations Manual is constructed primarily to govern operations taking place over and within the territory of Nigeria.

1.17.1.2 THE PILOTS

The two pilots are relatively new on the aircraft, with the PF and PM having total hours on type of 684 and 612 respectively. Fixed wing operations is new in Bristow Helicopters Nigeria. The PF and PM were aged 56 and 60 years respectively; their last CRM was on the 28th July 2009. They have total flying hours of 11,751 and 13,302

respectively. They both have limitations on their Licencies which states:

" SHALL HAVE AVAILABLE CORRECTIVE SPECTACLES FOR NEAR VISION AND CARRY A SPARE SET OF SPECTACLES" and "SHALL WEAR MULTIFOCAL LENSES AND CARRY A SPARE SET OF SPECTACLES"

1.17.1.3 Pairing (Crew Roster)

Bristow does not have a policy on pairing or crew roaster, however two pilots of same age bracket 56 and 60 years were paired/rostered.

1.17.1.4 Cabin Attendant (Bristow Ops Man.5.5)

"A person employed to facilitate the safety of passengers, whose duties are detailed by the Company or the aircraft commander. Such persons will not act as a member of the flight crew".

The Duties and Responsibilities of the Cabin Crew Members:-
(Bristow Ops Manual 1.6)

The Cabin Attendants are responsible as follows:

To the Chief Pilot on all administrative matters concerning their employment with the Company.

To the Chief Pilot for ensuring that the catering and bar uplift are ordered for any flight to which they are allocated.

To the Commander of any aircraft to which they are allocated for ensuring that:

- a. All passengers are briefed before take-off on the position of emergency exits and lifejackets, the use of safety belts and emergency oxygen equipment and on the restrictions on smoking.
- b. All passengers are properly seated, with safety belts fastened for take-off, landing and at other times in flight when so instructed by the Commander.
- c. All catering stores and equipment in their charge are on board before flight and are correctly used and stowed.
- d. Gangways and emergency exits are kept clear of obstructions during takeoffs and landing.
- e. Within the limits of the aircraft stores, proper cabin service is extended to the passengers.
- f. Any unusual occurrence is reported immediately to the Commander.
- g. They are seated, with safety belt fastened in one of the passenger seats, or in the jump seat, for take-off and landing. In an emergency the cabin attendant is to assist the flight crew in carrying out their duties.

1.17.1.5 Pilot's Age and Licence Limitations(B.O.M.5.12)

The normal retirement age for pilots shall be on their 58th birthday. No consideration of a pilot's employment beyond the normal retirement age shall be considered as a waiver of the general application of the Company's retirement policy. The Company may, at its sole discretion and with its specific written authority, permit pilots to continue in employment with the Company beyond that date, subject to such conditions as the Company may see fit. The following being the minimum criteria:

- a. The pilot satisfactorily completes Operator Proficiency, Line and Emergency and Safety checks (including Wet Dinghy Drill if applicable), plus any relevant special task checks such as instructor's rating, IRE and THE renewal, CFS and Company standardisation checks and continues to demonstrate his ability to maintain the standard of competency required by the Company.
- b. The pilot satisfactorily completes an appropriate aircrew medical examination. Every alternate examination to be conducted by the Company's medical department at Gatwick or by a Company nominated doctor.
- c. The pilot shall not carry out single pilot commercial air transport flights after he attains the age of 60 years.
- d. No additional qualification training, such as Instrument Rating training, shall be given to pilots beyond the age of 55 years.

e. Conversions onto other multi-engine aircraft types shall not normally be given to pilots beyond their 55th birthday.

1.17.1.6 Medical Restrictions to Pilot's Licences (BOM5.13)

Where a pilot has a restriction on his medical certificate "As or with Co-pilot" he shall not fly as Pilot or Co-pilot on commercial air transport flights with another pilot with the same restriction, or with a pilot who is beyond his 60th birthday.

1.17.1.7 Flying after an Accident (BOM11.11)

After being involved in an accident as defined at the beginning of this paragraph, the crew shall not carry out further flying duties. Crew members shall remain on site, unless to undergo medical treatment or examination, and may not be scheduled for flying duties until authorised by the appropriate Head of Flight Operations after the preliminary findings of the investigation are known or apparent.

In order to expedite a crew member's return to normal flying duties, the Chief Pilot or similarly authorised person may, as a result of the preliminary investigation, recommend to the relevant Head of Flight Operations that, in his own carefully considered judgement, the actions of the crew member were in no way a contributory cause of the accident, nor, commensurate with the average ability of an alert, well-trained crew member, contributed to any subsequent damage.

1.17.1.8 Monitoring Procedures (BOM 8.3.4)

The efficiency with which the PNF completes the task is dependent on clear communication between the pilots. To promote this, standard phrases are to be used whenever possible and the voice pitched so as to be heard above noise of other radio/intercom traffic. At times unambiguous hand signal may supplement a call.

The PNF will adopt the following procedures and any additional calls required by the PF/Commander:

Emergency	Call
In the event of a malfunction, even if not accompanied by a warning light	MASTER CAUTION
The nature of the malfunction will be advised as soon as practicable	ENGINE FIRE No... HYDRAULIC FAILURE No..
If accompanied by fire	FIRE IN.....
If no fire	NO SIGNS OF FIRE
General	
If any parameter is incorrect for any stage of flight	AIRSPEED HIGH/LOW
If rate of descent is excessive	RATE OF DESCENT
If the PNF considers it imperative to discontinue an approach	GO AROUND

This last call is an order and is to be obeyed immediately.

Should the PF fail to acknowledge any of these calls they should be repeated immediately. If the PF still does not respond, he should be considered as incapacitated and the PNF is to take control.

These are standard operating procedures to be followed during normal operation. Non-standard operations may require a change in procedure which will be decided by the Commander.

1.17.1.9 Windshield Defog

Windshield defog is accomplished by electric windshields power by engine driven AC alternator. The windshield heat should be turned on prior to descent from altitude to provide adequate clearing for descent into high humidity conditions. The window vent control must be positioned to the closed position for descent to prevent internal side window defogging. If the outside windshield fogs over after landing the electric windshield anti-ice system may be turned to the O'RIDE position. (Flight Manual Section iii- Operating Procedures Page 3-143)

1.17.1.10 Emergency Evacuation (FAA APPROVED AIRPLANE FLIGHT MANUAL CITATION XLS)

1. PARK SET -- SET

2. Throttles -- BOTH CUT OFF.
3. LH/RH ENGINE FIRE Switches -- BOTH PRESS.
4. LH/RH Fire Bottle Armed Switches--BOTH PRESS(if fire suspected).
5. APU MASTER Switch -- OFF.
6. BATT Switch -- OFF.

7. Emergency Locator Transmitter(ELT)-- ENSURE ACTIVATED (if required for search and rescue services).

8. Airplane and Immediate Area--CHECK for BEST ESCAPE ROUTE.

- IF THRU CABIN DOOR

9. Cabin Door -- OPEN

10. Move away from airplane

Procedure completed

- IF THRU EMERGENCY EXIT

9. Emergency Exit -- REMOVE and THROW OUT of airplane.

10. Move away from airplane

Procedure completed.

1.17.2 Nigeria Civil Aviation Authority (NCAA)

NCAA is the organization charged with the responsibility of Regulation in Nigeria.

1.17.2.1 NCARs IS:8.10.1.12--(a) Each AOC holder shall ensure that the flight dispatcher and all aircraft crew members have CRM training as part of their initial and recurrent training requirements.

1.17.2.2 Age limitation

NCARs 8.10.1.1.--(a) No person may serve nor may any AOC holder use a person as a required PIC in a single pilot operation on aircraft engaged in commercial air transportation operations if that person has reached his or her 60th birthday.

(b) For aircraft engaged in commercial air transport operations requiring more than one pilot as flight crewmembers, the AOC holder may use one pilot up to age 65 provided that the other pilot is less than age 60.

(c) Check airmen who have reached their 65th birthday or who do not hold an appropriate medical certificate may continue their check airman functions, but may not serve as or occupy the position of a required pilot flight crewmember on an aeroplane engaged in international commercial air transport operations unless the other pilot is less than age 60.

1.17.2.3 Emergency Evacuation Demo. (NCARs) IS 9.2.3.5

Each AOC holder shall conduct a partial emergency evacuation and ditching evacuation, observed by the Authority, which demonstrates the effectiveness of its crew members emergency training and evacuation procedures.

1.17.2.4 Bristow Ops Manual Part A & C

NCAA, after a closer look at the content and the structure of Bristow Operations Manual rejected it and demanded for a review and subsequent resubmit. The letter to Bristow Helicopters Nig. Ltd was dated 27th January 2010, the compliance period was six (6) months. Below is the copy of the original letter written to Bristow.



NIGERIAN CIVIL AVIATION

AVIATION HOUSE

P.M.B. 21029, 21038 IKEJA-LAGO:
Tel (Fax: 01-49300;

NCAA/DOT/BHNL/Vol.

1/00710 27th January, 2010

The Managing Director
Bristow Helicopters Nig,
Ltd. G. A. T.
M. M. Local Airport
Ikeja, Lagos

RE: OPERATIONS MANUALS PART A AND PART C

After a closer look at contents and structure of your Operations Manual, it is clear that the Manuals are not in accordance with the rules and regulations of the Authority,

The Manuals cannot be accepted or approved in the current form, you are hereby referred to Nigeria CARs Part 9.3.1.2 and IS 9.3.1.2 and Advisory Circulars (AC) NCAA-AC-OPS001 paragraph 7.0, NCAA-AC_ OPS027 paragraph 3.0(Special Flight and Duty Time Scheme) in accordance with Nig. CAR 8.11.1.6., and the NCAA Order number NCAA-0-OPS001 paragraph 10.3 which deals with references of the Nigeria CARs to be complied with as applicable to the applicants Operation (See paragraph 10.3.2).

Please be guided by the provisions of Nigeria CAR Part 9.3.1.2 and IS 9.3.1.2 in the preparation of your company Manuals.

You are hereby requested to comply with the regulatory requirements and resubmit to the Authority Operations Manuals together with statement of Compliance within six (6) months for further evaluation for acceptance and approval.

A handwritten signature in black ink, appearing to read 'J. T. Paase', is located below the main text.

Capt. J, T. Paase
Principal Operations Inspector
For: Director-General/CEO

1.17.2.5 Decision Height (DH or MDA)

NCAR 8.8.4.15 (a)--Where a DH or MDA is applicable, no pilot may operate a civil aircraft at any aerodrome or heliport below the authorised MDA, or continue an approach below the authorised DH unless-

(1) The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal manoeuvres;

(2) For commercial air transport operations, the descent rate will allow touchdown zone of the runway of intended landing;

(3) The reported flight visibility is not less than the visibility prescribed in the standard instrument approach being used or the controlling RVR is above the specified minimum; and

(4) At least one of the following visual reference for the intended runway is distinctly visible and identifiable to the pilot--

(i) The approach light system, except that the pilot may not descend below 100ft above the touchdown zone elevation using the approach lights as a reference unless the red terminating bars or the red side row bar are also distinctly visible and identifiable.

(ii) The threshold;

(iii) The threshold markings;

(iv) Threshold lights;

(v) The runway end identifier lights;

(vi) The visual approach slope indicator;

(vii) The touchdown zone or touchdown zone markings;

- (viii) The touchdown zone lights;
- (ix) The runway or runway markings; or
- (x) The runway lights.

1.17.3 Federal Airports Authority of Nigeria (FAAN)

FAAN has the mandate to provide maintenance, security, Fire coverage, communications and any other services that will enhance safety in all the airports it owns or controls in Nigeria.

1.18 Additional Information

During the interview with crew of the accident flight the pilots claimed that on the final approach, just before touchdown that the windshield became blurred. The PF in his statement stated that "Crossing the threshold, we had light rain and the windshield became blurry, at this time we were unable to carry out a GO-AROUND (Missed Approach) as we were already fully configured for landing and too close to the ground". While the PM stated that; "At 8 miles the aircraft was fully established but in and out of rain. At this time the windshield became blurred. At below D.H. of 310 feet we encountered another rain and the Captain-in-Command decided to land the aircraft".

The ATC transcript is available to the investigators.

Cabin Attendant was not on board the accident flight. Bristow has a policy of carrying at least one cabin attendant but only when an aircraft carries nineteen or more passengers.

The crew of the accident aircraft were not the rostered flight crew for that flight. They were persuaded to take the flight. The crew felt they were not properly treated as regards giving them the flight.

1.19 Useful or Effective Investigation Techniques Nil.

2.0 ANALYSIS

2.1 Flight Phase

The aircraft first contact with Port Harcourt was at 1914 hrs. The pilot reported maintaining FL330 with six souls onboard, four hours fuel endurance and estimating POT at 1940 hrs. The aircraft was cleared to POT VOR, to maintain FL330 with no delay expected for ILS Approach Runway 21, QNH 1011 and to report when released by Lagos. At 1921 hrs the pilot reported 100 NM to POT and requested for descent. The aircraft was cleared to descend to FL150. At 1927 hrs the pilot requested for further descent and was cleared to 3,300ft on QNH. 1011 but the pilot acknowledged 3500ft. At 1931 hrs the aircraft was re-cleared to FL 090 initially due to departing traffic on Runway 03. At 1934 hrs 5N-BMM reported maintaining FL090 and was re-cleared FL050. The aircraft was further cleared to 2000ft on QNH 1011 for a straight-in ILS Approach Runway 21 and to report on the localizer. At 1947 hrs the pilot reported final for Runway 21 and was asked to contact Tower on 119.2 and the Tower asked 5N-BMM to report on glide slope Runway 21. At 1950 hrs the Tower asked 5N-BMM to confirm on the glide slope and the crew confirmed "Charlie, we have three miles to run". The Tower cleared 5N-BMM to land with surface wind calm but to exercise caution since the Runway surface was wet and 5N-BMM responded "wind calm".

At 1954 hrs the Tower called 5N-BMM to pass on the landing time as 1953 hrs, but no response from 5N-BMM. There was no indication that the aircraft was taxiing on the Runway. It was dark and no light was visible, hence the need to raise the Fire truck. The watch room was asked to give the Tower information, which they could not give since they do not have a two – way contact with the Fire trucks.

The Fire truck was cleared to proceed to the Runway as the Tower could not ascertain the position of the aircraft.

The aircraft was actually turned 90° because of the big culvert that held the right wing and made the aircraft spin and turned 90° facing the runway, two meters from the active runway, the culvert was uprooted due to the aircraft impact forces.

The wheel broke off because of the gully that runs parallel to the runway.

Analyzing the statement of the two pilots in chapter 1.18, it will be correct to say that the pilots had enough time to carry out a missed approach and had enough time to find out what caused the blurred windshield. There was no record of any discussions about the problems on the ATC transcript neither was there any callout. The only thing evident on the CVR was when the pilot flying at minimums, asserted that he could not see the ground and was not aligned with the centerline. There was no mention of the windshield being blurred on the CVR.

The PM was not assertive in his callout. Section 1.17.1.8 of this report clearly outlined the procedure the PM should adopt in cases of an unusual parameter/situations as contained in Bristow Operations Manuals 8.3.4.

2.2 The Pilots

The two pilots were rated to fly the Cessna 560XLS aircraft. The total hours on type of the PF was 684 hrs while the PM was 612 hrs. Both had limitations in their Licences to wear corrective spectacles and multifocal Lenses and also carry a spare set of spectacles. During their last simulator, which was done in CAE Burgess Hill on the 15th June 2011, the PF had one day ground school and two hours PF, two hours PM, which totaled four (4) hours for the simulator section. The PM also had the same time in the simulator. This meant that they both had one session of simulator each of two hours hands-on in one calendar year. NCAR 8.10.1.33.--(a) No person may serve nor may

any AOC holder use a person as a flight crewmember unless within the preceding 12 calendar months that person has completed the recurrent ground and flight training curricula approved by the Authority. See-IS:8.10.1.33 for detailed curriculum.

The last CRM attended by both pilots was in 2009. NCAA regulation stipulates a 12 calendar months for recurrent training. However, at the time of the accident their CRM had expired. NCAR 8.10.1.33.--

(a) No person may serve nor may any AOC holder use a person as a flight crewmember unless within the preceding 12 calendar months that person has completed the recurrent ground and flight training curricula approved by the Authority

(b) The recurrent ground training shall include training on-- (3) Crew Resource Management.

NCARs: 8.10.1.12--(a) No person may serve nor may any AOC holder use a person as a flight dispatcher or crew member unless that person has completed the initial CRM curriculum approved by the Authority.

During the approach, at minimums the PF said " I can't see" and "I am not aligned" and yet the PM commanded the PF "go down, I say go down" few seconds later the aircraft crashed. The normal procedure at minimums, requires the PM to make the standard call-out (field-in-sight or field-not-insight) for the PF to initiate the appropriate action.

The non-compliance to the regulation was evident in the management of the situation and their non-adherence to normal procedure.

The crew of the accident aircraft were not the rostered flight crew for this flight. They were persuaded to take the flight. The crew felt they were not properly treated as regards giving them the flight.

This was evident in the CVR, as they discussed and deliberated at length during the flight, it was evident that they were not happy taking the flight. The discussion started while on ground and continued until the crash.

The PF was a Training Captain in Bristow Helicopters. The pairing of two captains with similar experience on the accident aircraft, even though one of them was certified as a co-pilot. However, the one certified as a co-pilot on the Cessna Citation 560xls was a certified captain on two aircraft. The co-pilot had a full complement of a captain (He wore four bars meant for captains), as at the time of the accident. It would have been difficult for anybody to identify any of them as a co-pilot. One operating as the co-pilot and the other as the captain in command cannot be overlooked. It was the captain flying as co-pilot that gave the command to the captain flying to go down, even when he complained that he could not see and that he was not aligned. It is believed that a regular first officer will not give a command like that to his captain. In pairing, necessary consideration should be made to avoid personality clashes, ego and unnecessary supremacy based on cultural and age differences which might jeopardize safety in operation of aircraft.

After the crash, the crew did not carry out the Emergency Evacuation, rather they left their positions, without shutting down all the engines as stipulated in the emergency checklist. The crew left the cock-pit for the main passengers exit door with an engine still running. Following the lack of proper emergency procedures, which led to some utterances in the cabin such as: "This door should open in Jesus name, open in Jesus name" (CVR) The door was jammed due to the severity of the impact. However, they eventually de-planed through the right rear emergency exit with the starboard engine still running. The Airport Fire Service came and shut down the engine with their high pressure water hoses.

2.3 The Cabin Attendant

Cabin Attendants are safety officers and their presence is necessary in every phase of flight. Their duties include enhancing safety in an emergency, briefing and helping the passengers and serving refreshments. However, the regulatory authority made it mandatory when an aircraft is carrying nineteen passengers or more. If there was a Cabin Attendant on board he or she would have enhanced the exit of the passengers and would have also reminded the pilots that the aircraft engine was still running at the time the pilots exited the airplane. Cabin Attendants should not be looked at as tea and coffee servers but as safety practitioners.

2.4 Monitoring, Procedures, Simulator

"The efficiency with which the PNF completes the task is dependent on clear communication between the pilots. To promote this, standard phrases are to be used whenever possible and the voice pitched so as to be heard above noise of other radio/intercom traffic. At times unambiguous hand signal may supplement a call". (BOM 8.3.4))

The pilot monitoring must be assertive, be sure of the correct indications, make meaningful call-out, monitor the pilot flying (PF), remind the pilot flying of any checklist that is due, look out while the PF flies the aircraft.

The pilot monitoring was not assertive and neither was he making any meaningful call-out nor was he helping the PF.

2.5 Decision Height (DH)

Nigeria Civil Aviation Regulation (NCAR) clearly states that "no pilot may operate a civil aircraft at any aerodrome or heliport below the authorised MDA, or continue an approach below the authorised DH unless--" NCARs 8.8.4.15 or see section 1.17.2.4 of this report.

The crew of 5N-BMM were carrying out an ILS approach and went below the Decision Height which was illegal. The PF asserted that he was not seeing and not aligned at minimum (DH) yet the PM commanded the PF to go down and few seconds later the aircraft crashed. The PF was the chief pilot and also the training captain. It is evident that he accepted to descend below DH without visual reference.

2.6 Defogging and Blurred Windshield

According to the statements of the pilots, the windshield became blurred and they were unable to see. The evidence available to AIB did not show any discussion between the pilots about the windshield being foggy or blurred, neither did they use the check list nor follow any known procedure to defog the windshield. The Bristow operations manual clearly outlined the procedure on how to defog the windshield. (Flight Manual Section iii - Operating Procedures Page 3-143)

There was no indication at this point, that any of the pilot made any remarks to each other about the windshield being blurred, except at minimums, when the PF said " I can't see" and "I am not aligned" while the PM commanded "go down".

"Windshield defog is accomplished by electric windshield powered by engine driven AC alternator. The windshield heat should be turned on prior to descent from altitude to provide adequate clearing for descent into high humidity conditions. The window vent control must be positioned in the closed position for descent to prevent internal side window defogging. If the outside windshield fogs over after landing, the electric windshield anti-ice system may be turned to the O'RIDE position".

2.7 Emergency Evacuation

There was no coordination among the crew, the two pilots exited the aircraft without carrying out the Evacuation checklist, which could have highlighted engine shutdown by the following methods:

1. PARK SET -- SET
2. Throttles -- BOTH CUT OFF.
3. LH/RH ENGINE FIRE Switches -- BOTH PRESS.
4. LH/RH Fire Bottle Armed Switches--BOTH PRESS (if fire suspected).
5. APU MASTER Switch -- OFF.
6. BATT Switch -- OFF.

After the crash, the crew did not call the Tower nor talk to the passengers about the emergency evacuation procedures. The crew instead attempted to open the main entrance door which was jammed due to the severity of the crash. They were there for some time making utterances. They later exited the aircraft using the emergency exit door/window while the starboard engine was still

running. The NCAA requires that all AOC holders should have an Emergency Evacuation program to demonstrate the effectiveness of their crew members' evacuation procedures. Accident Investigation Bureau does not have any evidence of any such Emergency Evacuation Demonstration Program.

Emergency Evacuation Demo.(NCARs) IS9.2.3.5 Each AOC holder shall conduct a partial emergency evacuation and ditching evacuation, observed by the Authority, which demonstrates the effectiveness of its crew members emergency training and evacuation procedures.

2.8 Operations Manual Part A and C

A letter was written by NCAA to Bristow Helicopters on the 27th January 2010, in which NCAA did not accept nor approve the above mentioned manuals in its present form:

"After a closer look at content and structure of your Operations Manual, it is clear that the manuals are not in accordance with the rules and regulations of the authority".

NCAA requested that the manuals be resubmitted after compliance. Up until the time of the accident these manuals are yet to be re-submitted for approval.

2.9 Flight Data Recorder

The FDR data indicates that the aircraft took off about 1856hrs. The aircraft cruised at an altitude of 33,000 feet before beginning to descend at about 1924hrs. Around 1949.50hrs, the aircraft began the final descent and the flaps transition to 35 degrees. The AP parameter transitioned from engaged to not engaged at 1952.14 hrs.

After 1952.56hrs, there was a vertical acceleration spike of +2.43g's, a lateral acceleration of +.46 g's, and a sharp decrease in recorded pitch angle from 5 degrees to -1 degree. This point most likely indicates aircraft initial touchdown. The recorded heading at this time was 215 degrees and airspeed was 97 knots. The longitudinal acceleration values began to significantly decrease and the magnetic heading values indicated a left directional change. Four seconds later, a maximum vertical acceleration value of 2.58 g's and a maximum longitudinal acceleration value of -1.08 g's were recorded and the heading captured was 201 degrees. Following this point, the recorded values for most of the parameters on the SSFDR become suspect. There is a subsequent loss of recorded data for undetermined period of time. The SSFDR begins recording again for approximately 25 minutes. The data are consistent with the recorder being powered but not receiving valid system input. Due to the nature of the impact and resulting damage, data recorded after 1953hrs until the end of recording should be considered suspect and may not be representative of actual aircraft information.

The above FDR analysis shows that the last few seconds before the crash, the aircraft was in an unstable approach situation and not aligned, this due to the magnetic heading values indicating a left directional change. This situation was confirmed by the PF in the CVR.

3.0 CONCLUSIONS

3.1 FINDINGS

- 3.1.1 The aircraft crashed in darkness (Night).
- 3.1.2 The Runway was wet.
- 3.1.3 The two pilots were captains.
- 3.1.4 Port Harcourt ILS, VOR, DME and Approach light were serviceable.
- 3.1.5 The aircraft departed the Runway at link one.
- 3.1.6 There was no two-way radio communication between the Tower and the Fire truck.
- 3.1.7 There was no two-way radio communication between the Watch room and Fire truck.
- 3.1.8 All the passengers and crew escaped with two passengers sustaining minor injuries.
- 3.1.9 All the passengers and crew evacuated the aircraft through the over wing exit.
- 3.1.10 The Fire Service tried to gain initial access into the aircraft by cutting the Emergency marked area on the aircraft.
- 3.1.11 The main entry door was jammed and was inaccessible.
- 3.1.12 The starboard wheel assembly sheared off.

- 3.1.13 There was no Ramp vehicle available to the Tower to access the crash site.
- 3.1.14 The starboard engine was running while the passenger evacuation was going on.
- 3.1.15 The Fire Services helped to shutdown the running engine.
- 3.1.16 There were concrete culverts running parallel and close to the runway.
- 3.1.17 There were gullies running parallel and close to the runway.
- 3.1.18 The last CRM the crew attended was in 2009.
- 3.1.19 Bristow Helicopters as at the time of the accident was operating with unapproved Operations Manuals Parts A and B.

3.2 Causal Factor

The Decision of the pilot to continue the approach without the required visual references.

3.3 Contributory Factors:

- 1) Poor crew co-ordination CRM.
- 2) Pairing two captains together.
- 3) The weather was marginal.

4.0 SAFETY RECOMMENDATIONS

- 4.1 NCAA should ensure that AOC holders do not pair two captains on a flight, provided the pilot on the right seat is right seat checked out.
- 4.2 NCAA POI attached to the Operator should in addition to their oversight functions, ensure that all Technical crew currency are up to date, e.g. CRM, Simulator recurrency, etc.
- 4.3 NCAA should ensure that Bristow Helicopters comply with the resubmission of their Operations Manual Part A and C
- 4.4 Bristow Helicopters should ensure compliance with 6 hour simulator session and one day ground school.
- 4.5 NCAA may wish to re-examine the policy of non-inclusion of cabin crew on flights with less than nineteen passengers.
- 4.6 NCAA should ensure that FAAN removes the concrete culvert running parallel to the runway.