AIRCRAFT ACCIDENT REPORT

2/2009 (BLV 2005/10/22/F)

Accident Investigation Bureau

Report on the Accident involving Bellview Airlines Ltd B737-200 Reg. 5N-BFN at Lisa Village, Ogun State, Nigeria On 22 October 2005

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 decide what action is taken.

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GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

ACC	**-**	Area Control Centre
AIB	**-**	Accident Investigation Bureau
AMO	**-**	Approved maintenance Organization
ANR	**-**	Air Navigation Regulation
AOC	-	Air Operator Certificate
APU	-	Auxiliary Power Unit
ATC	-	Air Traffic Control
ATPL	-	Airline Transport Pilot Licence
BAL	-	Bellview Airlines Limited
BEB	-	Boeing Reference
CRM	-	Crew Resource Management
CT	-	Computer Tomography
CVR	-	Cockpit Voice Recorder
DME	-	Distance Measuring equipment
ELT	-	Emergency Locator Transmitter
EQS	-	Engineering Quality Services
FBI	-	Federal Bureau of Intelligence
FDR	-	Flight Data recorder
FH	-	Flight Hour

FL	-	Flight Level
HIL	-	Hold Item List
ICAO	-	International Civil Aviation Organization
IFR	-	Instrument Flying Rules
JAA	-	Joint Aviation Authority
LAE	-	Licenced Aircraft Engineer
LOFT	-	Line-oriented Flight Training
MEL	-	Minimum Equipment List
Mhz	-	Mega hertz
MMA	-	Murtala Muhammed Airport
MSL	-	Mean Sea Level
NAMA	-	Nigerian Airspace Management Agency
NCAA	-	Nigerian Civil Aviation Authority
NCAR	-	Nigerian Civil Aviation Regulation
NEMA	-	National Emergency Management Agency
NIMET	-	Nigerian Meteorological Agency
NM	-	Nautical Mile
NPF	-	Nigerian Police Force
NTSB	-	National Transportation Safety Board
OM	-	Operations Manual

PCU	-	Power Control Unit
PF	-	Pilot Flying
PIC	-	Pilot –In-Command
PNF	-	Pilot Not Flying
QAP	-	Quality Assurance Programme
RADAR	-	Radio Detection and Ranging
SSS	-	State Security Service
T/S	-	Trouble Shoot
TR	-	Trust Reverser
UTC	-	Universal Time Control
VHF	-	Very High Frequency
VOR	-	VHF Omnidirectoral Range

Aircraft Accident Report No:	**(BLV/2005/10 /22/F)**
Registered Owner and Operator:	Bellview Airlines Limited
Aircraft Type:	Boeing 737 – 200
Nationality:	Nigerian
Registration:	5N – BFN
Location of Accident:	Lisa Village, Ogun State. 14 NM North of Murtala Muhammed Airport, Ikeja Co-ordinates: N6° 48'43" and E3° 18' 19"
Date and Time:	22nd October, 2005 at 2040hrs *All times in this report are local (UTC+1)*

Synopsis

The accident was reported by the Nigerian Airspace Management Agency (NAMA) to the erstwhile Accident Investigation and Prevention Bureau (AIPB) now Accident Investigation Bureau (AIB) on Saturday 22nd of October, 2005 at 2153 hrs. The state of manufacture was notified and Accredited Representative participated in the investigation.

Bellview flight 210 was on a scheduled passenger flight from Murtala Muhammed Airport (MMA), Lagos for Nnamdi Azikiwe International Airport, Abuja. The aircraft was operated on an Instrument Flight Rule (IFR) plan and departed MMA at 2035 hrs with 117 persons on board. The Tower observed the aircraft execute a right-hand turn and instructed the crew to contact Approach Control. The Control instructed the crew to report passing FL130 (13,000ft) or when crossing LAG located at 6nm from the threshold 18L. The last contact with BLV210 by Approach Control was at 2036 hrs.

Approach Control made attempt to call at 20:46:46 hrs but there was no response, which meant that the aircraft might have crashed between 20:35:35 hrs and 20:46:46 hrs.

The wreckage site was located about 10:00 hrs on Sunday, 23rd October, 2005 at Lisa village, Ogun state. The accident occured at coordinates $N6^0 48'43''$, $E3^0 18'19''$.

It is worthwhile to mention that neither the flight data recorder (FDR) nor cockpit voice recorder (CVR) was recovered from the wreckage.

All the 117 persons on board were fatally injured and the aircraft was destroyed.

The investigation identified the following:

Causal Factor

The AIB, after an extensive investigation, could not identify conclusive evidence to explain the cause of the accident involving Bellview Flight 210.

The investigation considered several factors that could explain the accident. They include the PIC training of the Captain before taking Command on the B737 aircraft which was inadequate, the cumulative flight hours of the pilot in the days before the accident which was indicative of excessive workload that could lead to fatigue.

Furthermore, the investigation revealed that the airplane had technical defects. The airplane should not have been dispatched for either the accident flight or earlier flights.

The absence of forensic evidence prevented the determination of the captain's medical condition at the time of the accident. The missing flight recorders to reconstruct the flight also precluded the determination of his performance during the flight. Due to lack of evidence, the investigation could not determine the effect, if any, of the atmospheric disturbances on the airplane or the flight crew's ability to maintain continued flight.

The operator could not maintain the continuing airworthiness of its aircraft, in ensuring compliance of its flight and maintenance personnel with the regulatory requirements. The Civil Aviation Authority's safety oversight of the operator's procedures and operations was inadequate.

Four Safety Recommendations have been made.

1.0 Factual Information.

1.1 History of the flight

The accident was reported to erstwhile Accident Investigation and Prevention Bureau (AIPB) now Accident Investigation Bureau (AIB) on Saturday 22nd of October, 2005. The site of the wreckage was located on the 23rd of October, 2005 and investigation began the same day.

On October 22, 2005, at 2040 hrs, Bellview Airlines (BLV) Flight 210, a Boeing B737-200, 5N-BFN, crashed while climbing to cruise altitude shortly after take-off from Murtala Muhammed Airport, Lagos (LOS). The flight was operating under the provisions of the Nigerian Civil Aviation Authority (NCAA) Air Navigation Regulations (ANRs) as a scheduled domestic passenger flight from LOS to Abuja International Airport (ABV). The flight departed LOS for ABV at 2035 hrs, with 2 pilots, 1 licensed engineer, 3 flight attendants, and 111 passengers on board. The airplane entered a descent and impacted open terrain at Lisa Village, Ogun State. All 117 persons were killed and the airplane was destroyed by impact forces and fire. Instrument meteorological conditions prevailed. The airplane was operated on an Instrument Flight Rule (IFR) plan.

The accident occurred on the final leg of a one-day round trip from Abuja to Abidjan with intermediate stops at Lagos and Accra for both the outbound and inbound segments.

The trip through the second stop at Accra (the fourth leg) was reported without incident. On the fifth leg, during the taxi for takeoff at Accra, the pilot and the engineer discussed the low pressure reading of 650 psi in the brake accumulator system according to the pilot that flew the aircraft from Accra to Lagos. Normal accumulator brake pressure is 1000 psi.

The captain continued the flight to the destination, LOS, without incident, where the discrepancy was logged.

The engineer briefed the maintenance crew about the low pressure reading. The crew consisted of two Licensed Aircraft Engineers (LAEs) and the outbound engineer for Flight 210. LAEs and engineer on riding coverage worked together to troubleshoot the brake system, which included verifying the pressure reading with the pressure gauge from another Boeing 737 (5N-BFM) in the fleet. It was determined that the source of the low pressure was due to a faulty brake accumulator. On checking the Minimum Equipment List (MEL), the maintenance engineers decided that the aircraft could be released for operation with the fault.

Before Flight 210 departed, the captain discussed en-route weather with another pilot who had just completed a flight from Port Harcourt to Lagos. The other pilot informed the accident captain of a squall line in the vicinity of Benin. The accident captain indicated that he experienced the same weather condition on his previous flight from Abuja to Lagos.

The chronology of the flight was determined from the transcript of the recorded radio communications between Air Traffic Control and Flight 210 and post accident interviews of air traffic personnel.

According to the transcript, the pilot of Flight 210 contacted the tower at 1917:02 UTC and requested for startup and clearance was given. The controller gave him the temperature and QNH, which were 27 degrees Centigrade and 1010 millibars respectively. At 1924:08 UTC, the Pilot requested and got approval for taxi to Runway 18L. At 1927 UTC, the tower requested for Persons on Board (POB), endurance and registration. In response, the pilot indicated the number of persons on board as 114 minus 6 crew, fuel endurance as 3 hours and 50 minutes and registration 5N-BFN. The tower acknowledged the information and issued the route clearance via Airway UR778, Flight Level 250, with a right turn-out on course. The pilot read back the clearance and the controller acknowledged and instructed the pilot to report when ready for takeoff.

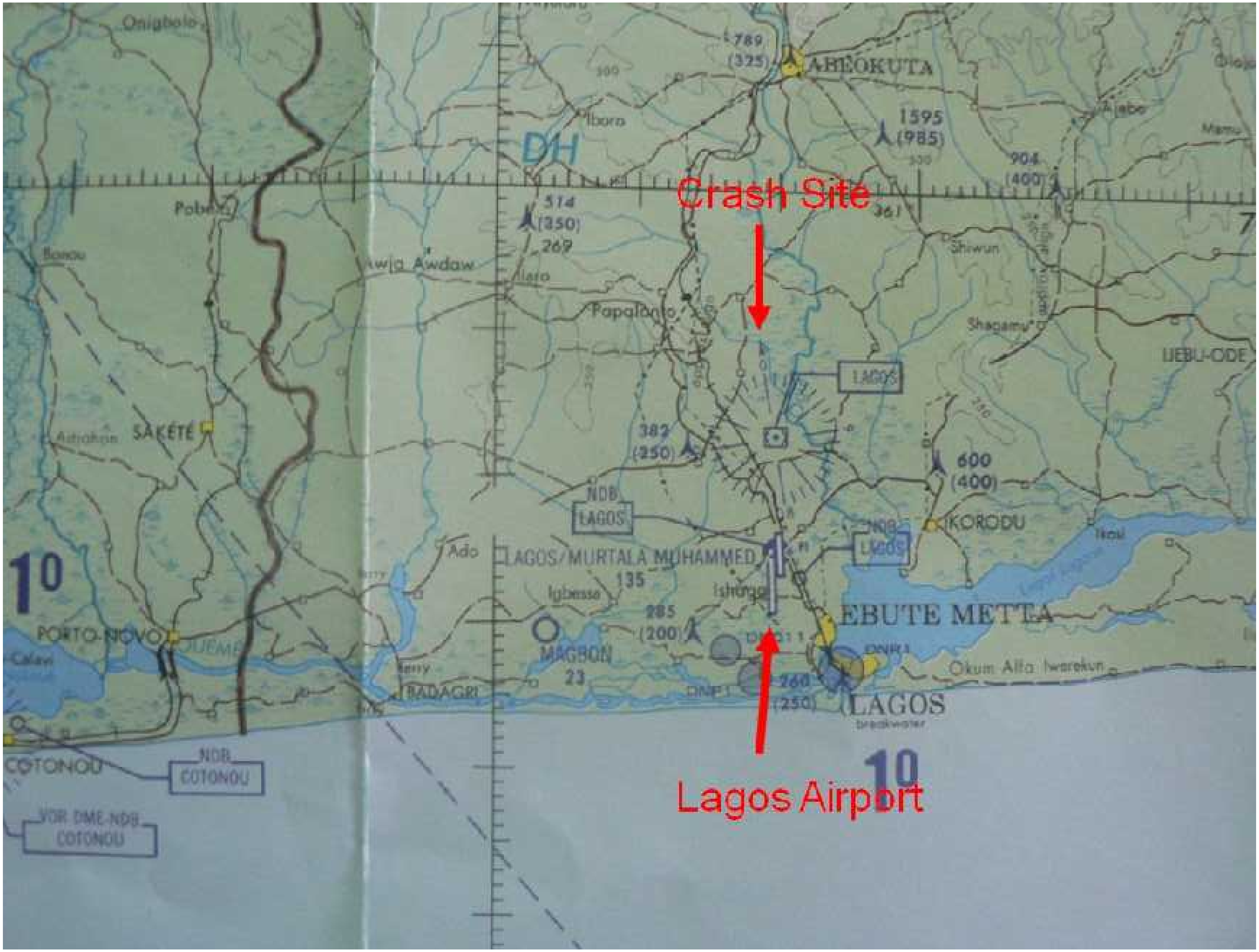
At 1927:55 UTC, the pilot requested “can we have a left turn out please?” and soon afterwards his request was granted by the controller. At 1928:08 UTC, the tower cleared BLV 210 as follows: "BLV 210 RUNWAY HEADING 3500FT LEFT TURN ON COURSE" At 1928;12 UTC, BLV 210 replied "3500FT LEFT TURN ON COURSE 210". 1928:47 UTC, the pilot reported ready for takeoff, and after given the wind condition as 270 degrees at 7 knots the controller cleared Flight 210 for departure at 1928:50 UTC. The pilot acknowledged the clearance, and at 1929:14 UTC requested “And correction, Bellview 210, please we will take a right turn out. We just had a sweep around the weather and right turn out will be okay for us.”

The controller responded “right turn after departure, right turn on course” and the pilot acknowledged.

According to the transcript, at 1931:52 UTC, the controller reported Flight 210 as airborne and instructed the pilot to contact LOS Approach Control. During the post-crash interview, the controller indicated he saw the airplane turn right, but was unable to determine its attitude due to darkness. He indicated the airplane sounded and appeared normal. At 1932:22 UTC, the pilot made initial contact with Approach Control and reported “Approach, Bellview 210 is with you on a right turn coming out of 1600 (feet)”. The Approach Control replied “report again passing one three zero.” The pilot acknowledged at 1932:35 UTC, and that was the last known transmission from the flight. According to the transcript, the controller attempted to regain contact with the flight at 19:43:46 UTC. Repeated attempts were unsuccessful.

Emergency alert was then sent out to relevant agencies including the National Emergency Management Agency (NEMA) for search and rescue operations to commence.

The airplane struck the ground on flat terrain in a relatively open and wooded area, 14NM north of the airport (N6˚ 48’43”and E3˚ 18’ 19”) See below the crash site map.



CRASH SITE LISA VILLAGE

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	6	111	0
Serious	0	0	0
Minor/None	0	0	

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other damage

The vegetations and cash crops at the crash site were destroyed. The impact crater covered a large area and measured 57 feet by 54 feet and 30 feet deep.

1.5 Personnel Information

1.5.1 Captain

Nationality	-	Nigerian
Date of Birth	-	8th December, 1956
Licence No.	-	ATPL 3132
Validity	-	31st December, 2005
Aircraft Ratings	-	Falcon-20, BAC-1-11, B-707, B-737
Total Flying Time	-	13429:25 hours as at 28th June, 2005
Total on type	-	153:45 hours
Total last 90days	-	296:45 hours
Total last 28days	-	91:45 hours
Total last 24 hours	-	2:30 hours

Before the captain joined Bellview Airlines in October, 2004, he had worked for Imani Aviation, Okada Air, Gas Air and Kabo Airlines. He was out of active flying for 12years, between 1992 and 2004.

In August, 2004, he went for B-737 pilot – in – command (PIC) training at Aero Services Aviation Centre, Florida, USA and obtained a Certificate of Completion on the 28th of August, 2004. He then joined Bellview Airlines on the 11th of October, 2004 as a captain under training.

He was released as a line captain to take command on the B-737 aircraft on the 9th of November, 2004. His employment occurred 9 months after he had suffered serious injuries in which he was a victim of a criminal attack. He had his last simulator training at United Flight Training Services, Denver, USA on the 28th of May, 2005. At the end of the simulator training, the captain returned to Nigeria and submitted his simulator evaluation results to the Regulatory Authority.

AIB obtained the training results directly from the institution for comparison with what was submitted to the Regulatory Authority. The comparison of the two results showed a lot of inconsistencies (See Appendices B and C).

The captain had 1053 hrs of total time as a Boeing 737 Pilot-In-Command and there were no reports of his involvement in previous incidents and accidents. Interview with company pilots who had flown with the captain indicated his performance was satisfactory.

Records to determine the captain's actual crew flight, duty, and rest times were not available. According to the company crew roster, the captain was on the fifth of six consecutive days of scheduled crew assignments.

On the first and third day, he was scheduled for two flights each day with scheduled flight times of two hours each. According to the roster, he was scheduled for one flight on each of the second and fourth day with scheduled flight times of two hours. There was no medical evidence that any long term effects from or continuous medication needed because of the injuries that the captain suffered from the criminal attack that would have affected his flight performance.

1.5.2 **First Officer**

Nationality	-	Ghanaian
Date of Birth	-	3rd December, 1963
Licence No.	-	CPL 604307276 (NCAA validation on 21st November, 2004)
Validity	-	31st January, 2006
Aircraft Ratings	-	CESSNA 152/172, CESSNA 310Q, B737-200
Total Flying Time	-	762 hours
On type	-	451 hours
Total last 90days	-	248:15 hours
Total last 28days	-	84:30 hours
Total last 24 hrs	-	2:00 hours

He had his last simulator training at United Flight Training Services, Denver, USA on the 28th of May, 2005. There were some differences in the simulator report submitted by the co-pilot to NCAA compared with the one obtained directly from the institution (See Appendices D and E).

Records to determine the first officer's actual crew flight, duty and rest times were not available. However, evidence deduced from a letter he wrote to the company dated 26th September 2005 titled "payment of flight Allowance" he asserted the following: "I have been operating as two-man crew (First Officer with a Captain) since August 27, 2005 and have logged a total flight hours of 118:50 hrs as at 15th September 2005". According to the company's crew roster, the first officer had been off duty the day before the accident following five consecutive days of crew assignments. Apart from the fourth day, which he was scheduled for three flights, each of the duty days consisted of assignments of two flights.

1.5.3 Maintenance Engineer 4

Authorisation No. - 2006/03/06

Nationality - Ethiopian

Age - 57 years (28th June, 1948)

Scope of Authorisation - B737, B767

The engineer was responsible for the maintenance, release and dispatch of the aircraft on the eventful flight.

Obtained Diploma in Avionics from Ethiopian Airlines Technical School on 31st December, 1971.

Type Ratings held on Ethiopian AMEL

B 707	-	05 - 02 – 79
B 727 – 200	-	21 – 10 – 81
B 767 – 200	-	30 – 05 - 84
DHC – 6	-	05 – 05 – 86
B 757 – 200	-	30 – 11 – 91
L – 100	-	10 - 01 – 92
B 767 – 300	-	19 - 05 – 99

FAA A&P Certificate No. 2249749 -10–20–92 (Power Plant Airframe).
Attended B 737 Engine and Airframe Systems Course at SABENA Technical Training School - 10 -11 – 89.
Recruitment on B737 - 6/7/8 – 900 Airframe and Power Plant Systems Course at Ethiopian Airlines Technical School - January, 23 - 04.
NCAA Certificate of Validation
No. F – LMA000879 Issued 29/12/003
Ratings - B 737 – 200 (JT8D)
B 737 – 300/400/600 (CFM56)
B 767 – 200 CF – 6
Human Factor Training – Bellview Learning Centre 25 – 26 August, 2005.
He rectified the snag on low brake hydraulic pressure and signed off the Technical log sheet.

1.6 Aircraft Information

Type	-	B737-200	
Manufacturer	-	Boeing Commercial Airplane Company, USA	
Year of Manufacture	-	1981	
Serial No.	-	22734	
Registration	-	5N-BFN	
Operator	-	Bellview Airlines	
Airframe Time	-	55772:46 hours	
Cycles Since New	-	36266	
C of A Validity	-	31st October, 2005	
Engines			
Type	-	JT8D–17	
Manufacturer	-	Pratt & Whitney	
		No. 1	**No. 2**
Serial No.	-	P702979	P585505
TSN/CSN	-	57045 hours/ 44482 cycles	56211 hours/ 53163 cycles
TSO/CSO	-	1653 hours/ 1710 cycles	132 hours/ 133 cycles
Type of fuel Used	-	Jet A1	

Boeing 737-200, 5N-BFN

1.6.1 General Maintenance Records

The aircraft was manufactured in 1981 and entered the Nigerian Register on the 21st of March, 2003. With reference to 'C' check, the prescribed inspections were carried out in accordance with Approved Maintenance Programme at the facility of Royal Air Maroc, Morocco between 28th of December, 2004 and 12th of February, 2005.
The 'C' check was carried out on the aircraft at the airframe time of 54546 hours and total cycles of 35009 after which the Certificate of Release to Service (CRS) was duly issued.

The prescribed 'C' checks schedule for the aircraft type is at the airframe time interval of 3000 hours or calendar time of 18 months whichever occurs first. Therefore the next 'C'-check would have been due in August, 2006 going by the calendar time.

Royal Air Maroc is one of the Approved Maintenance Organizations (AMO) by the Nigerian Civil Aviation Authority (NCAA). As part of the oversight functions of NCAA, airworthiness surveyors usually visit AMOs to review the Service Bulletins (SB), Airworthiness Directives (AD) and the progress of entire work package before renewing Certificate of Airworthiness.

The last check (A-5) was performed on the aircraft by Bellview Airlines Engineers in Lagos at the airframe time of 55746:46 hours in October, 2005 and the CRS of the aircraft was issued on the 17th of October, 2005.

Review of the engine records showed that engine no.1 was last overhauled in August, 2004 and installed on the aircraft in October, 2004 while engine no.2 was last overhauled in May, 2005 and installed on the 13th of September, 2005.

1.6.2 Technical Logbook Records and Management of Deferred Defects

The technical logbook is a mandatory document to be carried onboard an aircraft. Each airplane carries a technical logbook in which the engineering findings of the preflight, daily and transit checks are recorded. The logbook also contains the crew's record of any defects during any phase of the flight and the rectification actions taken after the flight. AIB examined the contents of the technical logbook from the period the airplane came back from the 'C' check. The examination revealed multiple defects on the airplane that were not properly attended to. The technical logbook did not provide information concerning the effectiveness of each action taken against the associated defects.

DEFECTS

DATE	SNAG	RECTIFICATION ACTION	TECH LOG PAGE
06/04/05	No. 2 Fuel flow indicator inop	Noted	014054
21/04/05	No. 2 Fuel flow indicator U/S	Noted	014084
21/04/05	Eng. No. 2 T/R unlock Light ON after shutdown	T/R central lock mechanism verified o.k. Electrical signal suspected, Trouble shooting commenced	014084
26/09/05	All other snags on previous page 014310	Please be specific on item No. 3 and refer to Mel.	014311

	Remain the same	Open – No. 14310 item 1 & 4	
29/09/05	Controls Heavy & stiff with Auto pilot Elevator Channel Engaged	Pitch Servo motor in case noted	014316
05/10/05	(1) Centre fuel pump® U/S will not transfer fuel (2) No. 2 T/R will not deploy (3) No. 2 T/R unserviceable (4) Compressor surge on No. 2 Engine on take off	Cleaned and secured centre boost pump connector operation check o.k. - - -	014329 014330
06/10/05	No. 2 T/R unserviceable	(Ref 0014330) Recycle CB lubed T/R mechanism operation checked o.k.	014331
09/10/05	Bird strike on Engine No. 2 during Roll in P/H	Inspection carried out shingled blade on state 1 compressor	014334
10/10/05	HIL No. 14332 APU INOP	*APU Generator Replaced *APU mount replaced after APU was removed & reinstalled *APU FCU replaced *Load control thermostat replaced	014336
13/10/05	HIL No. 14310 LDG Edge Flap light INOP	After trouble shooting Proximity switch in cause proximity in order HIL closed	014337
14/10/05	Fuel flow No. 1 & 2 unserviceable	Noted	014341
14/10/05	No. 1 Reverser unlock light flickers on in flight.	Proximity switch cleaned test carried out.	014342
16/10/05	MACH Trim INOP at Mach 0.75	Replace Mach-Trim coupler	014347

		"Swapped with ……..".	
16/10/05	Autopilot engaged too much force required to make pitch changes	Required longer ground time to T/S. Pls operate per MEL 21-1 item. Transferred to HIL No. 43	014347
17/10/05	A5-checked Required - Task cards on CNK_A5 by maintenance planner.	A5-carried out as per BAL work package FN/CHK/A5/02	014350
19/10/05	No. 2 Reverser unlock light.	Proximity Switch cleaned Test o.k.	013509
20/10/05	Crack on Engine No.2 Reverser.	Crack drilled stopped fairing to be replaced on receipt from overseas.	013506
		Noted. Stopped drilled (No.2 Engine T/R upper fairing).	013507
21/10/05	No. 1 Thrust Reverser unlock light come on in flight.	T/R Proximity switch is being looked into	013509

1.6.3 General Hydraulic System Description of Boeing 737-200

The B737 series airplane incorporates three functionally independent hydraulic systems, which operate at approximately 3000 psi (Pound Per Square Inch) Pressure. The systems are designated as System "A", System "B" and the "Standby" System. Each system has its own independent reservoir.

Although Systems "A" and "B" normally provide dual hydraulic power for flight controls, either system alone will power the flight controls. The Ailerons and Elevators can also be operated manually, without hydraulic power. The Rudder also may be operated with the "Standby" hydraulic system. Systems "A" and "B" hydraulics have two pumps each. The capacities of the hydraulic pumps in the system are sized so that the operation of any one of the pumps is capable of full flight control authority for its respective system operation.

The "A" hydraulic System, which is powered by two engine-driven hydraulic pumps (one driven by each engine), provides power for flight controls, landing gear operation and nose wheel steering, inboard-brakes, inboard flight spoilers, engine thrust reversers, and ground spoilers.

The "B" hydraulic system, which is powered by two electric motor-driven hydraulic pumps, provides power for flight controls, outboard brakes, autopilot, auto-brakes and outboard flight spoilers.

The "Standby" hydraulic system is powered by an electric pump and is activated by arming ALTERNATE FLAPS or selecting STANDBY RUDDER A or B on the pilot overhead panel in the cockpit. This system powers the rudder control system, provides an alternate source of power for both thrust reversers and extend the leading-edge flaps and slats in the alternate mode. Normal operation of the airplane is with the "A" and "B" Hydraulic System Switch to ON and the ALTERNATE FLAPS switch OFF.

1.6.4 Maintenance checks, Schedules and Intervals

Bellview conducts line maintenance (preflight, daily and transit), 'A' and 'B' checks, while 'C' checks and heavy structural inspections (D checks) are contracted out. All checks are completed as per B737 – 200 maintenance schedule dated July 2002 as approved by the NCAA in November 2003.

Check schedule was as follows:

Pre-flight – prior to first flight of the day.

Transit checks – as required per flight

Daily check – Completed after the last flight of the day

'A' checks (A1 – A6), A5 & A6 constituting a 'B' check – 125 Flight hrs (FH)/30 days.
'C' checks – 3000 FH or 18 months whichever comes first
'D' checks (structural inspection check) – 20, 000 FH / 8 years

Last 'A' check

A5 – CHECK was the last 'A' check on 5N – BFN carried out as per BAL work package FN/CHK/A5/02 on the 17th October, 2005. It was conducted in Lagos by BEB personnel and inclusive of B check items.

1.6.5 Maintenance Culture

In course of this investigation, it was discovered at the time of the accident that the technical logbook entries were improperly made, rectification action were ignored, improperly carried out or placed in Hold Item List (HIL) as deferred defects without the authority of the minimum equipment list (MEL). The quality system is to monitor the procedures for maintenance of continuous airworthiness requirements for all aircraft. Approved and standard maintenance procedures were outlined in maintenance schedules.

1.6.6 Weight and Balance

The aircraft was properly certificated in accordance with ANRs and was within weight and center of gravity limits.

The weight and balance information (Load Sheet) was prepared by Bellview Airlines staff. The input in the load sheet included aircraft, baggage, passenger and fuel weight. The flight departed with a gross weight of 50145Kgs.

1.6.7 Application of MEL Items/ Repair Intervals

The followings are Bellview Airlines approved MEL procedures:

When an engineer considers that the application of an MEL item is required to meet a scheduled departure of a transit aircraft the engineer shall where practicable, first make contact with the chief engineer/fleet engineer either by direct telephone or telex or e-mail and advise the following: station, aircraft registration, MEL reference number and MEL chapter name.

All users of an approved MEL must effect repairs of inoperative systems or components deferred in accordance with MEL, at or prior to the repair time interval established by the following letter designators.

- *CATEGORY A – Item in this category shall be repaired within the time interval specified in the remarks column of the operator's approved MEL.*

- *CATEGORY B – Items in this category shall be repaired within three (3) consecutive calendar days (72) hours excluding the day the malfunction was recorded in the aircraft maintenance record/logbook.*

- *CATEGORY C – Items in this category shall be repaired within ten (10) consecutive calendar days (240 hrs) excluding the day the malfunction was recorded in the aircraft maintenance record/logbook.*

- *CATEGORY D – Items in this category shall be repaired within one hundred and twenty (120) consecutive calendar days (2880 hrs) excluding the day the malfunction was recorded in the aircraft maintenance log book.*

Any relief other than that granted by an approved document is sought for as an administrative control item, a request must be submitted to the Regulatory Authority.

1.6.7.1 MEL Certification and Recording

Having completed any necessary maintenance action associated with the particular item as indicated by the designator, the engineer shall then

- Certify the tech log, all maintenance action associated with the MEL;
- Record MEL reference and any limitation on the tech log;
- Make a statement that the MEL has been transferred to the actual HIL quoting HIL reference;
- In HIL, reference tech log serial number to MEL item;
- Complete the HIL;
- Certify the HIL entry;
- Ensure that the affected or associated indicators, controls or switches on the flight deck are placarded and isolated as required by the MEL;
- Provide notices to the crew, stating any operational reduction.

1.6.8 Quality Assurance

The overall management of the engineering quality assurance programme (QAP) is the responsibility of the engineering quality services (EQS) department. The monitoring of quality with the maintenance organization is achieved through the following activities:

- Compliance audit
- Task audits
- Product sampling

1.6.9 Bellview Quality Assurance Programmes

"Quality Assurance includes all those systematic measures needed to ensure that a company is well planned, organized, operated, maintained, developed and supported in accordance with Authority regulations and the operator's own additional standards.

It is fundamental to flight safety, and a primary concern of the Quality Assurance Programme, that each company employee is motivated to do his work in a professional manner and in accordance with the standards which have been set". (OM part A 3.2.2)

1.7 Meteorological Information

1.7.1 Aviation routine weather report (METAR) for MMA on the day of the accident was as follows:

Time:		**1900 UTC**
Wind	-	250 /09kts
Visibility	-	10km
Weather	-	Lightning to NE

Cloud	-	Few 300m, Few 600m CB (N-E) BKN 9000m
Temperature	-	27^0 C
QNH	-	1010 hpa
Time:		**1930 UTC**
Wind	-	230/08kts
Visibility	-	10km
Weather	-	Lightning to NE
Cloud	-	Few 300m, Few 600m CB (N-E) BKN 9000m
Temperature	-	27^0 C
QNH	-	1011hpa
Time:		**2000 UTC**
Wind	-	240/09kts
Visibility	-	10km
Weather	-	Lightning to NE
Cloud	-	Few 300m, few 600m CB (NW-E) BKN 9000m
Temperature	-	27^0 C
QNH	-	1011 hpa

The crash site was located at the Northeast of the Airport and the weather reported between 1930hrs UTC and 2000hrs UTC was also CB N-E.

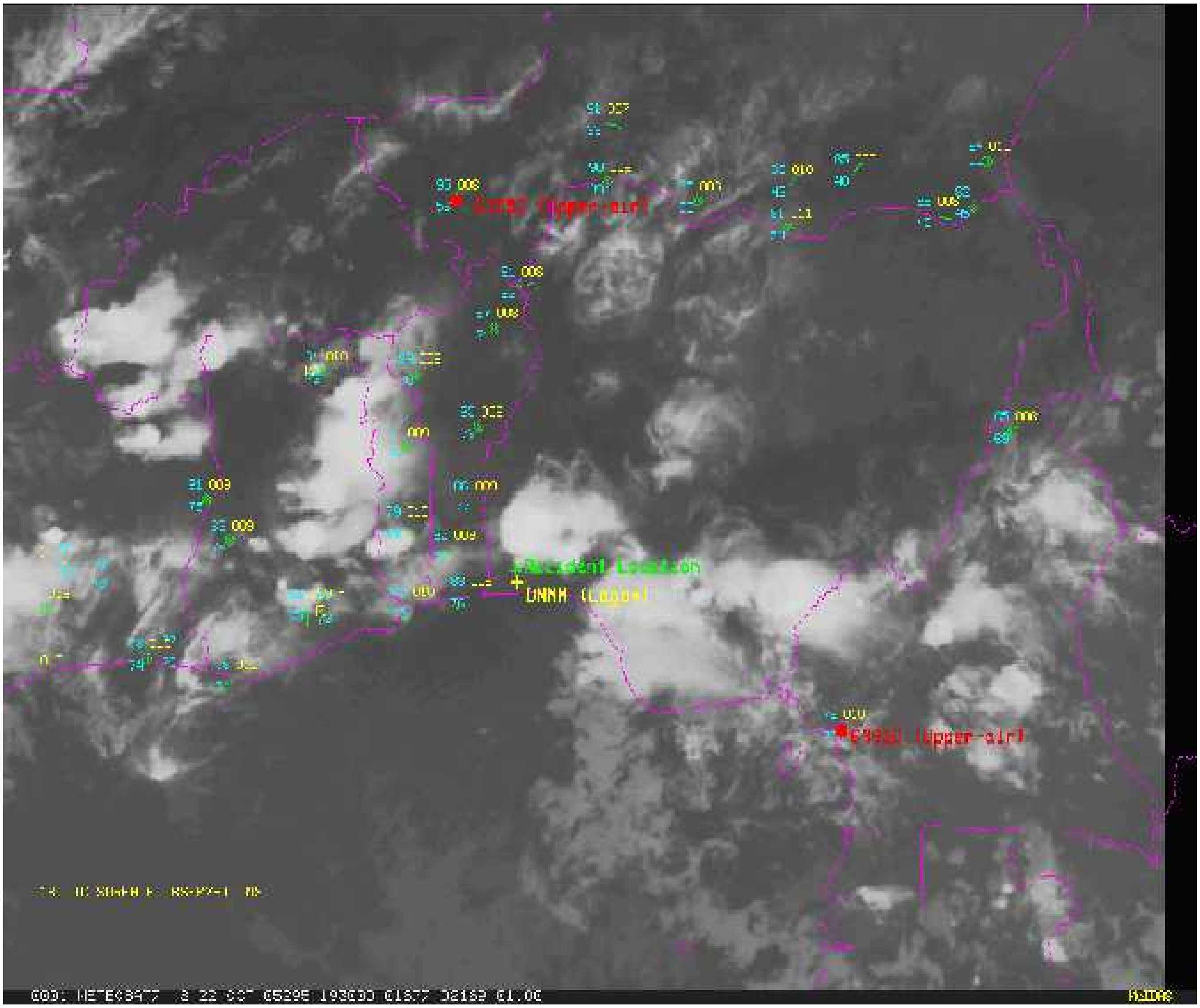
1.7.2 Satellite Imagery Report

Apart from the above METAR for MMA, AIB also requested for the satellite imagery of the Lagos area on the day of the accident from the Nigerian Meteorological Agency (NIMET). The report of the satellite imagery showed that both Infrared and water vapor images revealed the presence of large circular shaped clouds in couplet, especially over the south western portion including Lagos and also over the coastal part of south-south of the country at about 1800hrs. The couplet cells appeared to remain stationary or slow moving while intensifying and eventually merging to become a large cloud cell at 2400hrs over the south western part of the country; at the same time the cumulonimbus cloud over the coast of the south-south weakened and eventually dissipated.

There was also a satellite imagery report produced by Boeing Aircraft Company over Lagos and its environs. The report indicated strong convective storm activity near the accident site at the time of the accident and that the freezing level was likely between 14500ft and 15000ft.

The report also stated that windshear and or heavy rain and or hail are associated with strong convection. Icing might have been a factor but only above Flight Level 150.

Boeing Satellite Imagery Report



18:00hrs surface observations over plotted on the 19:30 hrs IR satellite image. The locations of the two upper-air sites nearest to the accident site are plotted in red. There were no surface data available from Nigeria. There are numerous airports reporting data east of the accident site including two in eastern Ghana reporting thunderstorms, but there were no airports reporting data near the accident location.

The Meteorological report issued by the agency on the day of the accident at 1100 UTC over Ikeja airport, continued till 1800 UTC when lightning was reported to the NE. The lightning prevailed and by 2140 UTC thunderstorm without rain was reported and this continued into the next day.

The accident occurred at 2040 hrs. It was night and dark at the time.

1.8 Aids to Navigation

All the available navigational aids were serviceable, except the Radar which was switched off for routine weekend maintenance. (NOTAMED 0525 dated 13th February, 2002)

1.9 Communications

There was communication between the aircraft, the Lagos Control Tower and Approach Control until contact was lost with the aircraft.

1.10 Aerodrome Information

Lagos has an elevation of 135ft above sea level and the runways are 18L/36R and 18R/36L. The runways are also equipped with Precision Approach Path Indicator (PAPI), runway and approach lights. The length of runway 18L/36R is 2745m while that of 18R/36L is 3900m. Runway 18R and 18L were equipped with Instrument Landing System (ILS).

1.11 Flight Recorders

The aircraft was equipped with both FDR and CVR. According to maintenance record, the Flight Data Recorder (FDR) P/N 980-4100-GQUN, S/N 5281 and Cockpit Voice Recorder (CVR) P/N 93A100-80, S/N 15038 were installed.
The CVR is located near the door in the aft lower cargo compartment of the aircraft. The FDR is located above the ceiling in the aft passenger cabin and is reached by lowering the ceiling panel. However, both recorders were not found.

1.12 Wreckage and Impact Information

The crash site was located at 14 NM north of MMA with co-ordinates: N6^{0} 48^{I} 43^{II} and E3^{0} 18^{I} 19^{II}. The accident occurred on a cocoa and kolanut plantation at Lisa Village in Ogun State. The aircraft impacted the ground at steep attitude and high speed penetrating the ground to a depth of over 30ft (10m) and disintegrated in the process. A plan view of the impact zone was prepared showing size and dimensions of the crater made by the crash and locations of components and parts at several points.

Fig 1.12c: Crater in the Forest

Fig 1.12d Smoke from the crater

Crash site showed one engine imprint on the ground at the edge of the main aircraft impact generated crater. The engine imprint appeared to be adjacent to a wing imprint.

Although it was almost vertical to the ground, the engine entry path to the ground appeared to be at an angle smaller than 90 degrees. The North direction was designated as 12 O'clock position of the main crater. The engine imprint was between 10 and 11 O'clock positions. (See fig 1.12a)

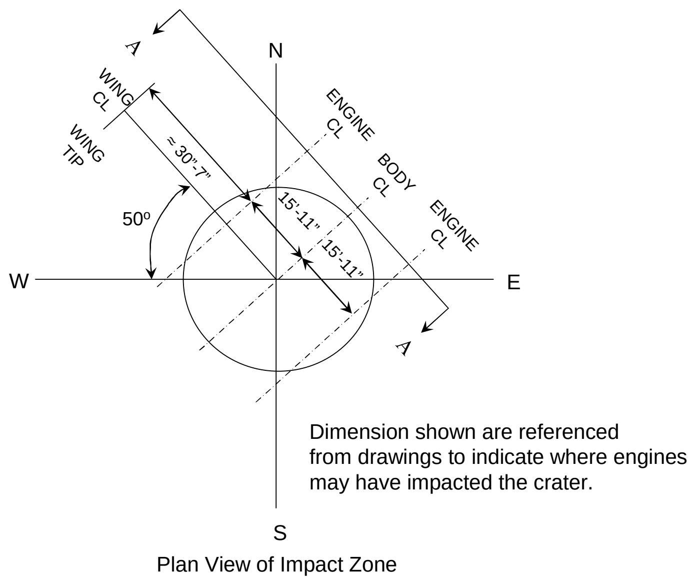
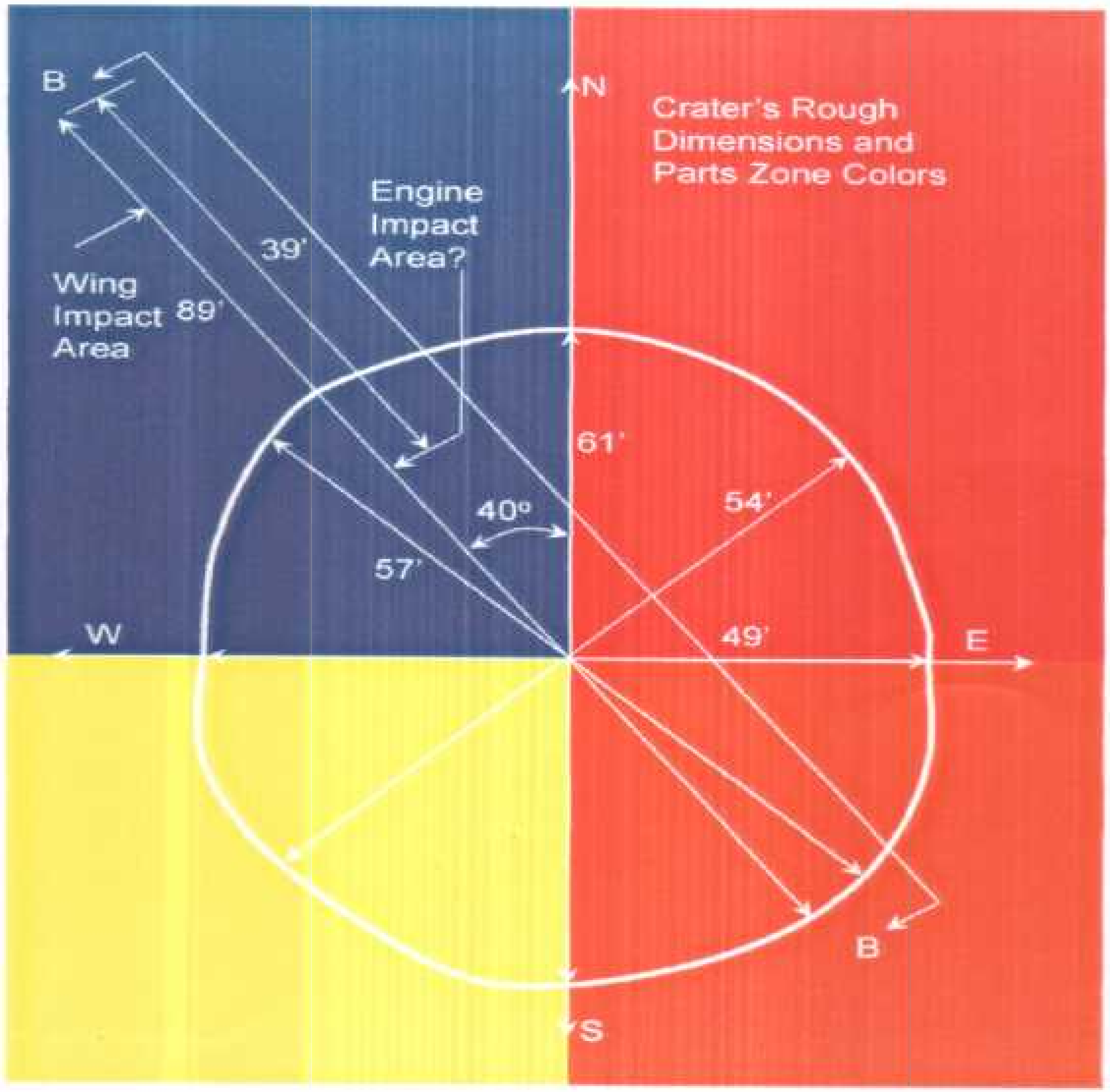


Fig 1.12a Plan view of the impact crater



Plan view of the impact crater

Fragments of engine parts were recovered in the area outside the crater between 3 and 6 O'clock positions, including one fractured fan blade, oil cooler, fuel de-icing heater, low compressor blades, stator vanes, fan case, intermediate case and turbine case.

After excavation, at the engine imprint location between 10 and 11 O'clock position of the main crater, heavily damaged engine components were recovered, including 1st and 2nd stage compressor (Low Pressure Compressor (LPC)), High Pressure Compressor (HPC) and turbine rotors. All compressor blades were corn-cobbed, except one 1st stage fan blade. The cases of the engine were compressed axially.

Heavily damaged components from the other engine were recovered at approximately 3 O'clock position of the crater, including one HPC and turbine disks. Several 1st stage turbine blades fractured inboard of tip shroud, and all other blades were corn-cobbed.

The characteristics of the damage on both engines appear consistent with a high speed impact with engines rotating and producing power (See fig 1.12b).

Fig 1.12b An impact damaged engine

Different metal pieces were found scattered all over the wreckage site, some trees were trimmed while few were uprooted by the aircraft pre-crash impact. Smoke emanated profusely from the crater while the excavation was on-going (See fig 1.12c-d).

2-Dimensional wreckage layout

2-Dimensional Wreckage Layout

2-Dimensional Wreckage layout

A two dimensional layout or reconstruction of the wreckage was performed to permit a detailed examination of the various wreckage pieces and an analysis of the various components of the aircraft. A reconstruction is an assemblage of the various pieces of the wreckage in their relative positions before failure.

The reconstruction revealed that about 60% of the aircraft wreckage was recovered and the structure sustained high impact damage. Localized fire damage was also discovered during the examination.

1.13 Medical and Pathological Information

The human remains recovered from the scene were all mangled. No single whole body was recovered. Forensic pathologists were engaged to search and recover human remains within the perimeter of the crash site and did the same while excavation of the crater was on. All recovered human remains in form of tissue pieces of varying sizes, shapes and textures (bony or soft tissue) and in varying stages of decomposition were gathered and transported to the storage facilities of Omega Mortuaries in Ojodu, Ogun State, at the end of each day.

Post mortem examination determined the cause of death for all victims on board the flight was due to multiple injuries associated with the accident. There were insufficient specimens for toxicological testing.

1.14 Fire

There was post-impact fire. The aircraft sustained localized fire damage. The fire had self-extinguished before the accident site was located by search/fire-fighting personnel, but the site continued to smoulder for several days.

1.15 Survival Aspects

The accident was not survivable.

1.15.1 Search and Rescue

The crash site was not located until the following day. Search and rescue was unable to locate the crash site due to misinformation and lack of correct equipment. The search and rescue agency did not pick up signal from Emergency Locator Transmitter (ELT) of this aircraft to enable it locate the crash site.

However, an eyewitness in Lisa village claimed that the villagers had been to the crash site early the following morning (23^{rd} October, 2005). Later, at about 0900 hrs the police arrived at the village and went straight to the crash site without asking the villagers any question. Before the arrival of the police, the accident had been reported to their public relations officer (PRO) at Sango, Ogun state.

1.16 Tests and Research

1.16.1 Burnt Fuselage Section

Burnt fuselage parts of the left side of the underbelly of the aircraft near the cargo hold area were recovered from the wreckage. These pieces were found approximately 100 feet away from the crater created by the impact of the aircraft with the ground. The burnt parts contained a portion of the registration number and another section of the skin with the other part of the registration number. The two pieces matched and were suspected to emanate from the left side of the fuselage. The nature of fire damage to this section raised the suspicion of an explosion. The Nigerian State Security Services (SSS) and the United States of America Federal Bureau of Investigation (FBI) were invited to examine the burnt parts. The US FBI took a piece of the burnt part, swabs from the inner and outer surface of the burnt piece and an electronic part found within the folded section of the piece of interest, back to their facilities for laboratory analysis and screened for presence of explosive residue. The results of the tests were negative i.e. no explosion.

Summary of FBI Explosive Test Report

Physical examination of the wreckage and explosive residue testing showed no evidence of high explosives. There was clear evidence of fire but no conclusion could be reached as to whether the fire occurred prior to the crash or only as a result of the crash.

Fig.1.6.1 Two piece match from the left side of the fuselage.

1.16.2 Thrust Reversers

All the four thrust reverser mechanisms were recovered from the wreckage and separated. Thrust Reversers are installed on engines, which are deployed when the aircraft touches down to slow the aircraft down through a reverse airflow. Each engine is installed with two mechanisms that are identical. Based on fracture patterns, both pairs of mechanisms were matched up. Engine identification could not be made and each mechanism was arbitrarily labeled as 1, 2, 3 and 4. The thrust reversers when recovered showed some discrepancies which raised some suspicions as to its pre-impact conditions. The discrepancies are as follows:

No 1 Actuator - fully stowed

No 2 Actuator - Deployed

No 3 Actuator - fully stowed but guide rod fractured

No 4 Actuator - partially deployed

Also, there were a lot of snags on the thrust reversers as recorded in the technical logbook, which most times were not properly recorded or that the snags were not properly attended to as required for continued safe operation of the aircraft. Some of the snags were left open and not cleared as required by ANR.

Rudder Power Control Unit (PCU) Examination

The PCU, which had part number 65C37053-9 and serial number 1665ASSC was manufactured by Parker Hannifin in Irving, California, USA. The examination of the PCU was carried out at two locations in the USA. The first location was at the Equipment Quality Analysis of Boeing Aircraft Company in Seattle while the second location was at the facilities of Parker Hannifin in Irving, California.

Due to the non-availability of special tools to tear down the equipment at Boeing facilities in Seattle, the equipment was only examined for external anomalies and then X-rayed including Computer Tomography (CT). At this location, the equipment was also partially disassembled for inspection of internal parts.

At the facilities of Parker Hannifin in California, a complete disassembly of the mechanical linkages of the primary/secondary input cranks and the walking beam assembly was carried out. The following were the results of the examination carried out at the two locations:

All the physical anomalies on the equipment were consistent with damage due to impact.

The interior when X-rayed showed the piston was jammed and bent consistent with impact damage.

Examination of the central cavities after the partial disassembly of the PCU showed that all parts were intact and properly connected. Observed movement of the lever appears consistent with normal operations.

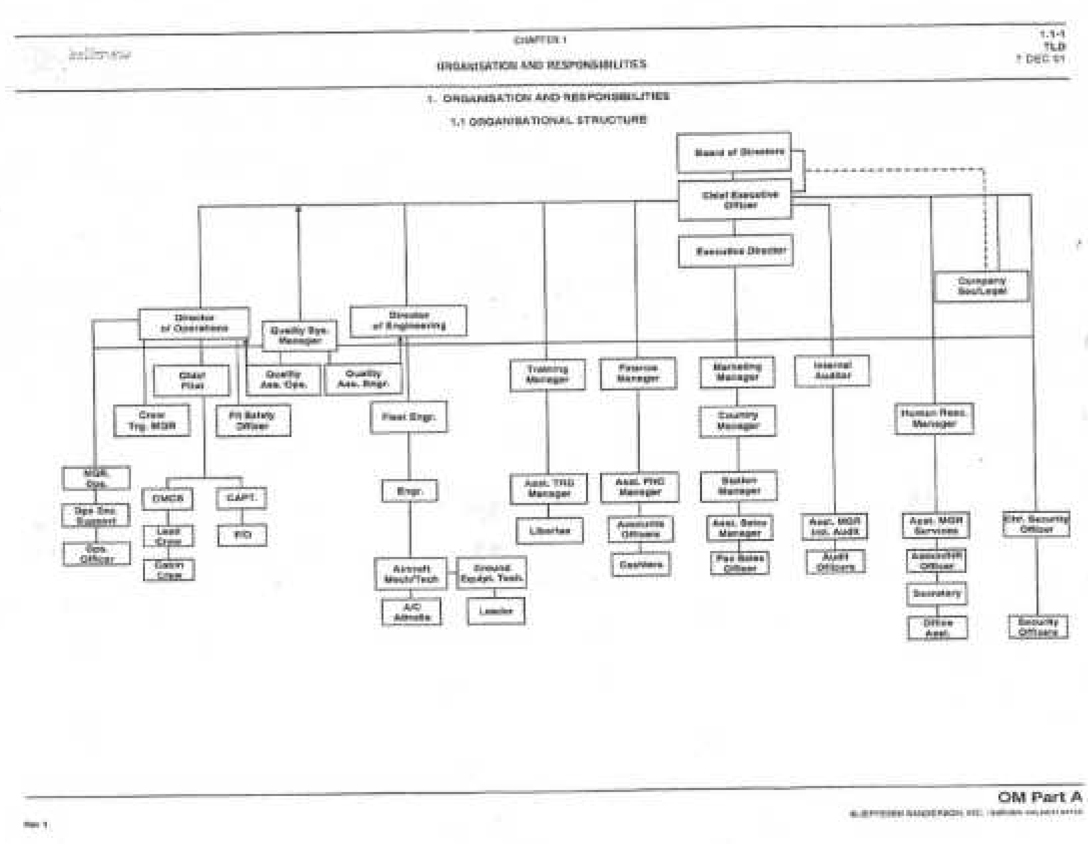
Examination of both the primary and secondary slides of the dual servo showed wear pattern which, were consistent with what obtains during normal operations.

The pre impact position of the PCU was not determined during the tear down and examination.

1.17 Organizational and Management Information

Bellview Airlines is an Air Operator's Certificate (AOC) holder, a privately owned company, headed by a chief executive officer. Bellview started as an IATA approved travel agency in Lagos, Nigeria in 1989. The Airline commenced operations in 1992 as a charter operator. In 1993 Bellview Airlines commenced scheduled passenger services within Nigeria, using a DC-9-32 series aircraft leased directly from the McDonnell Douglas Corporation. The workforce comprises over 500 local and international personnel.

BELLVIEW ORGANIZATIONAL STRUCTURE



1.17.1 Operations Manual

Bellview Airlines Operations Manual has been prepared in accordance with the condition contained in the Air Operator's Certificate (AOC) with the applicable national rules and regulations.

1.17.1.1 Flight Operations Manager

The Flight Operations Manager is or has been an active line pilot with the status of commander. He or his deputy should hold a valid ATPL issued by JAA Authority. The Flight Operations Manager is accepted by the authority. He is appointed by and reports to the accountable manager. To ensure the functioning of the quality system within the Flight Operations Department, his functions, duties and responsibilities are:

- To coordinate and supervise the chief pilot, the departments *"crew training"*, *"cabin crew and flight operations support"*.

- To determine all flight operations standards and practices, and to ensure their compliance with all relevant national and international regulations and with the provisions of the AOC.

- To call and chair hearings in case of accident and incidents or, wherever he deems it necessary, in case of irregularities or at violations of legal provisions or internal directives.

- To organize inspection of flights, to check the professional standard of the company's flight crew, and to establish improvements in standards, procedures and training.

1.17.1.2 Crew Training Department

The Nominated post holder of the Crew Training department should have thorough knowledge of the Crew Training Concept for Flight Crew as well as for Cabin Crew Training. He or his Deputy should be current Type Rating Instructors on aeroplanes operated under the operator's AOC. Furthermore, he is accepted by the Authority.

He shall normally be an active line pilot (commander) appointed to this position by the Accountable Manager with the consent of the Flight Operations Manager. He is responsible for Flight Crew and cabin Crew training.

To ensure the functioning of the Quality system within the Crew Training Department, his functions, duties and responsibilities are:

- to coordinate all questions and matters relating to flight operational standards, regulations/provisions and **training.**
- to establish training syllabi and check forms for all required training and checks, in cooperation with the Flight Operations Manager,
- to establish the professional prerequisites concerning employment/training/upgrading of flight and cabin crew members, in cooperation with the Flight Operations Manager and with the Section Chief pilot/ Cabin Crew Manager(see chapter5)
- to hold editorial responsibility for OM part D,
- to coordinate with the other post holders the contents of the OM part D and the training relevant subjects of OM part B 10 and 11 (editorial responsibility for the OM part B rests with Flight Operations Support).

1.17.1.3 Flight Crew Department(s)

The section chief pilot, responsible for a fleet of aeroplanes of a defined type, shall be an active line pilot (commander) and hold a license on that type. He shall be appointed to this position by the Flight Operations Manager. His functions, duties and responsibilities are:

- to supervise the flight operations of his fleet
- to closely cooperate with the Flight Operations Manager, with other section chief pilots and all relevant departments in standardizing and optimizing standards and procedures,
- to establish fleet – specific procedures and regulations; where necessary, in cooperation with the Ground operations Department,
- to cooperate with the Crew Training Department in establishing the requirements flight crews have to meet, and in establishing check and training syllabi and procedures,
- to conduct inspection flights, to check the professional standard and development of his personnel, to prescribe additional training,
- to ensure, in cooperation with the Crew Training Department, that checks of his personnel are being conducted in due time,
- to ensure the exchange of information and experience within his fleet and with interfacing departments,
- to discuss fleet-relevant maintenance subjects and problems with the Maintenance Department in order to ensure the airworthiness of his fleet's aeroplanes,

- to ensure and improve the cooperation between pilots and system panel operators ("flight engineers")

1.17.1.4 Safety Officer

The Safety Officer promotes and supervises operational safety as a representative of the Flight Operations Manager for all safety related matters. He shall regularly report about his functions to Flight Operations Manager and to the Authority to guarantee the maintenance of flight operational safety.

1.17.1.5 Command Course

The command course includes at least:

- Training in a flight simulator (including LOFT) and /or flying training including familiarization with left pilot seat operation and a proficiency check operating as commander.
- Instruction in operator command responsibilities.
- Line training in command under supervision with a minimum of 10 sectors required for pilots already qualified on the aeroplane type (additional sectors will be required for a pilot converting onto a new type of aeroplane).
- Completion of a commander's line check and route competency qualification, and
- Crew resource management training (for initial upgrading to commander).

1.17.1.6 Records

A training summary for each flight crew member and all records of training, checking and qualification undertaken by him will be maintained by the company as described in chapter 2.1.6. records will be made available to crew members upon request.

Document Storage Periods:

<u>Reports</u>

- Accident report (to be retained by Director of Operations) indefinitely. (operation manual chapter 2.1.6.4).
- <u>Records</u> (flight crew records 2.1.6.5)
- Flight, Duty and Rest Time - 15 Months
- Licence - As long as the crew is exercising the privileges of licence for the Operator
- Conversion training/checking - 3 Years
- Command course - 3 Years
- Recurrent training/checking - 3 Years
- Training and checking to operate in either pilot seat - 3 Years

1.17.1.7 Minimum Qualification Requirements

The minimum qualification requirements for a flight crew member to act as commander of a commercial air transport flight are:

- Successful completion of the command course as specified in the OM part D 9TM), if conducting multi-crew operations.
- An airline transport pilot licence with appropriate type rating.
- Valid Instrument rating when operating under IFR.
- Completion of operator's crew resource management training.
- Line training in command under supervision.
- An operator proficiency check operating as commander.
- Recency of experience according to 5.2.6
- Route and aerodrome competency according to 5.4.1.4 and
- Three thousand five hundred hours total, including two thousand on jet and five hundred on type.

1.17.1.8 Recency of Experience

A pilot must not operate an aeroplane as commander unless he has carried out, within the preceding 90 days, at least three take-offs and three landings as pilot flying in an aeroplane of the same type/class, or a Flight Simulator of the aeroplane type to be used. The Flight simulator must be acceptable to the Authority for take – offs and landings.

1.17.1.9 Route and Aerodrome Competence Qualification

Route competence training will include knowledge of:

- terrain and minimum safe altitudes;
- seasonal meteorological, communication and air traffic facilities, services and procedures;
- search and rescue procedures;
- navigational facilities associated with the route along which the flight is to take place;

Depending on the complexity of the route, the following methods of familiarization will be used:

- for less complex routes, familiarization by self – briefing with route documentation, or by means of programmed instruction;
- for more complex routes, in addition to the items above,
  - in – flight familiarization as co – pilot , observer or commander under supervision, or
  - familiarization in an approved flight simulator using an appropriate route data base.

Aerodrome competence qualification includes knowledge of obstructions, physical layout, lighting, approach aids and arrival, departure, holding and instrument approach procedures and applicable operating minima.

Aerodromes are specified in three categories. The least demanding aerodromes are category A. Category B and C are applied to progressively more demanding aerodromes.

Prior to operating to a category B aerodrome, the commander should be briefed, or self – briefed, by means of programmed instructions, on the category B aerodrome concerned and should certify that he has carried out these instructions.

1.17.2 Nigerian Civil Aviation Authority (NCAA)

"NCAA was established by decree 49 of 1999, with among others, the statutory responsibilities of ensuring regulating, monitoring and promotion of the safety, security, economic and reliability of air navigation oversight in line with International Civil Aviation Organisation (ICAO) standard and recommended practices (SARPs). The Authority effectively commenced operations on 1st January, 2000".

1.17.2.1 Civil Aviation Air Navigation Regulation (ANR) Part2.1.2.7 (h&i)

(f) Except as provided in paragraph (i) of this subsection, no person may act as PIC of a complex aeroplane, high-performance aero plane or a pressurized aircraft capable of flight above 25,000 feet MSL, or an aircraft that the authority has determined requires aircraft type – specific training unless the person has:

(1) received and logged ground and flight training from an authorized instructor in the applicable aeroplane type, or in an approved synthetic training device that is representative of that aeroplane, and has been found proficient in the operation and systems of the aeroplane; and
(2) Received a one-time endorsement in the pilot's logbook from an authorized instructor who certifies the person is proficient to operate that aircraft

(i) The training and endorsement required by paragraph (h) of this subsection is not required if the person has flight time as PIC of that type of aircraft, or in an approved synthetic training device that is representative of such an aircraft, prior to 1st November, 2000.

1.17.2.2 Records of Training Time 2.1.4.7 (ANR)

(a) Each person shall document and record the following time in a manner acceptable to the Authority:

(1) Training and aeronautical experience used to meet the requirements for a licence, rating, qualification, authorization, or flight review of this part.

(2) The aeronautical experience required to show recent flight experience requirements of these regulations.

1.17.2.3 Initial Crew Resource Management 8.10.12 (ANR)

No person may serve nor may any AOC holder use a person as a crew member or flight operations officer unless that person has completed the initial CRM curriculum approved by the Authority.

1.17.2.4 Human Factor

There are noticeable human factors issues in this accident as revealed by the investigation such as: personnel training, maintenance culture, crew rest periods, work overload and fatigue, etc.

1.18 Additional information

Response/Comments from operator

Bellview Airlines felt strongly that there was a probability of an unlawful interference (Explosive), which may have affected or be responsible for the accident. Bellview's comments are attached. (See appendix H)

Missing Flight Recorders

There were several correspondences between AIB and the Nigerian Police Force on the sighting, handling and possession of the flight recorders. AIB did not at anytime sight, handle or possess the flight recorders.

The Pilot

For ten years (1992 – 2002) out of the twelve years he was out of flying, he was engaged by Fan Milk Plc, Ibadan as senior logistics controller. Between 2002 and 2004 he left Fan Milk and became the Managing Director, Ultimate Drink Nig. Ltd., Benin City, Nigeria.

On the 30th January, 2004, the pilot was a victim of criminal attack during which he was shot. He was thereafter treated at the University of Benin Teaching Hospital and a private hospital. Due to facial injuries resulting from the attack, he underwent plastic surgery in the hands of Maxillo-Facial Specialist surgeon in Kaduna. In June, 2004, he decided to return to active flying having undergone medical examination which certified him fit to fly.

2.0 Analysis

2.1 Human Factor in this accident

It is important to mention the role of human factor in this accident; it is also believed that human error had assumed a very high percentage in all accidents recorded worldwide. Seldom, if ever, is an accident the result of a single cause. Accidents are typically a combination of several different causes. When each such cause is viewed alone, it may often appear insignificant, but in combination with other causes it can complete a sequence of seemingly unrelated events that result in an accident. The strongest evidence of a serious breach of a system's safety is an accident. Every accident is a chain of events that must be completed.

Analysis of accident data all too often reveals that the situation prior to the accident was *"ripe for an accident"*; one with safety consciousness may have been saying that it was just a matter of time before these circumstances led to an accident.

Pilots, engineers, technicians, managers, etc may have committed these errors or unsafe practices many times before without adverse consequences. In addition, some of the unsafe conditions in which they were operating may have been present for years, again without causing an accident. In other words, an element of chance was present.

With respect to Bellview 210 mishap, the following factors may have directly or indirectly contributed to the accident: Organisation and maintenance cultures, flight crew training and competence, flight coordination in adverse weather and inadequate oversight functions.

The human element is the most flexible and adaptable part of the aviation system, but it is also the most vulnerable to influences that can adversely affect its performance. With the majority of accidents resulting from less than optimum human performance, there has been a tendency to merely attribute them to human error. *Human error is a symptom of system failure, not the cause*

(Dan Maurio). An error attributed to humans may have been design – induced or stimulated by inadequate equipment or training, badly designed procedures or a poor layout of checklist or manuals. Bellview 210 was characterized with several human factor issues i.e. crew training / competence and engineering practices.

The following maintenance actions are indications of human factor performance errors:

- Non entries of defects in Tech Log;
- Inadequate and incorrect entries;
- Nil and insufficient responses to defects;
- Non transference of uncleared defects into hold item list;
- Release of aircraft with several uncleared defects;
- Escalations of repair time intervals MEL deferred defect items without due approvals from appropriate regulatory authority.

Some were situational violations which were due to particular factors that existed at the time, such as time pressure or high workload. At times, it is organization – induced violations – pressure imposed by the organization regarding delivery of service. In spite of the knowledge that a violation is being committed, goal orientation and mission achievement lead people to deviate from norms in the belief that the deviation does not bear adverse consequences.

2.1.1 Fatigue and Stress

Fatigue is a threat to aviation safety because of the impairments in alertness and performance it creates. "Fatigue is defined as "a non – pathologic state resulting in a decreased ability to maintain function or workload due to mental or physical stress." The term used to describe a range of experiences from sleepy, or tired, exhausted. There are two major physiological phenomena that have been demonstrated to create fatigue: sleep loss and circadian rhythm disruption. Fatigue is a normal response to many conditions common to flight operations because of sleep loss, shift work, and long duty cycles. It has significant physiological and performance *consequences because it is essential that all flight crew members remain alert and contribute to flight safety by their actions, observations and communications. The only effective treatment for fatigue is adequate sleep. – Dr. Samuel Strauss.*

The investigation revealed that the captain logged 1053 hours on type (B737-200) within one year of his employment with Bellview Airlines.

Fatigue cannot be ruled out as it relates to the Bellview 210 accident since the trend of the pilot hour log showed considerable work overload. For instance, from 27th December, 2004 to 4th July, 2005 a period of 6 months and 8 days, the pilot logged 1,568 hours. The last 90 days before the accident submitted by the Airline showed total flight hours of 296:45 hrs. Cumulatively, the pilot's total flight hour in ten months was 1,864:45 hrs in gross violation of 1,000 flight hours in twelve calendar months. (ANR Schedule 11 – 3 table 1).

Bellview Airlines confirmed the total hours flown by the Captain to be 1,053:45 hrs throughout his employment with the Airlines. It is worthy of note that the submission of the airline is at variance with what the Captain submitted to the Regulatory Authority for his licence renewal. The total flight hours submitted to the Bureau by Bellview indicated that the Captain's total flight hour was 11,053:45. However, records obtained from NCAA showed that the total flight hours of the Captain as at 4th July, 2005 was 13,429:15. Below is an extract from NCAA personnel licence file.

11/08/88	7040.26 - (1869.74 hrs) in 6½ month which means 287.65 hrs per month, 9.59 hrs per day.
01/02/91	9728.30 - (871 hrs) in 6 months = 161.8 hrs per month.
27/12/04	11,861.15] - (1, 568 hrs) in 6 months and 8 days
04/07/05	13,429.15] =261.3 hrs per month

Evidence deduced from a letter the First Officer wrote to the company dated 26th September 2005 titled "payment of flight Allowance", he asserted the following: "I have been operating as two-man crew (First Officer with a Captain) since August 27, 2005 and have logged a total flight hours of 118:50 hrs as at 15th September 2005". From the above, it could be seen that the First Officer flew 118:50 hours within a period of 19 days. This is in contravention of ANR Schedule 11-3 table 1 which stipulates a maximum flight hours of 100 hours in 30 consecutive days. This could be an indication that the First Officer was over worked and possibly fatigued during this period.

2.2 Conduct of Maintenance Procedures (Defects Entries and Rectification Actions)

The licenced aircraft engineers and technicians involved in performing and/ or certifying line maintenance tasks on the aircraft did not often carry out the work as per the approved maintenance programme. The certifying responsibility for ensuring compliance with the required airworthiness standard was not adhered to.

With reference to the list of defects in 1.6.2,

(a) On the 6th of April, 2005, *"No.2 Fuel flow indicator inoperative"*. Rectification Action: *"Noted"*

On the 21st April 2005, *"No.2 Fuel flow indicator U/S"* Rectification Action: "Noted".

This defect was disregarded and not properly attended to and was carried on Hold Item List (HIL) as a deferred defect for 5 months when the repair interval category (C) stipulated 10 consecutive calendar days (240 hrs). The indicator was finally replaced on the 13th Oct 2005 as HIL item 42. Contrary to the MEL 73 – 1 item 5.

(b) On the 14th October, 2005, "both No.1 and No.2 fuel flow indicators unserviceable".

Rectification Action: *"Noted"* ref. Tech log 014341

- The MEL did not give relief for operation of the aircraft with both fuel flow indicators unserviceable.
- The defect was not rectified, and not properly entered into the aircraft technical log book. The aircraft was supposed to be grounded until at least one indicator was replaced.
- On the 17th October, 2005, A5 check was performed on the aircraft. This was an opportunity to rectify all deferred defects, but the aircraft was returned to service when it was technically unserviceable.

(c) On the 29th September, 2005 ref. Tech log 014316.

"Controls heavy and stiff with Auto Pilot Elev. Channel engaged"

Rectification Action *"Pitch Servo Motor in case noted"* The defect was not rectified nor deferred but simply "noted".

The same defect was reported on the technical logbook on the 16th October, 2005. *"With Autopilot engaged too much force required to make pitch changes"*

Rectification Action: *"Requires longer ground time to T/S (troubleshoot). Please operate per MEL 21 – 1 item1. "Transferred to HIL No.43"*.

Note – The MEL reference was wrongly quoted (see below *)

On the 17th October, 2005, A5 check was performed on the aircraft. This provided the ground time needed to troubleshoot and rectify the defect. The opportunity was ignored as the defect remained with the aircraft till it crashed on the 22nd October, 2005.

*MEL Requirements of Defect: MEL 22-1 item 1 are as follows:

Autopilot systems (B, C) may be inoperative provided

(a) Approach minimums do not require their use;
(b) Enroute operations do not require autopilot use and;
(c) Number of flight segments and segment duration is acceptable to the flight crew.

NOTE: 1 Operator should make every effort to repair the auto pilot early in the repair interval as provided by this relief statement, in consideration of such factors as weather, traffic density and the effect of other inoperative systems.

NOTE: 2 Any mode which functions normally may be used.

The repair interval for one system or both unserviceable is B, C respectively i.e. 3 consecutive calendar days (72 hrs) and 10 consecutive calendar days (240 hrs) respectively.

The defect was first reported on the 29th September, 2005 remained unattended to till it was re – reported on the 16th of October (17 days repair interval exceeding the MEL relief timeframe and a missed opportunity provided by the A5 check on the 17th October, 2005 to redress the situation). The MEL highlighted the concomitant effect of operating an aircraft with multiple inoperative systems.

(d) On the 5th of October, 2005 ref. Tech log sheet 014330

Defect – *"Compressor surge No.2 Engine on take-off"*

Rectification Action: No rectification action was taken in the tech log book.

The maintenance actions required for this defect is stated in the appropriate section of the maintenance manual.

In summary, the airplane should not have been dispatched for either the accident flight or earlier flights. However, the investigation has not proved that any of the MEL items had either singularly or collectively caused the accident.

(e) Engine Thrust Reversers (T/R)

There were several thrust reverser defects in the aircraft involving both engines. Significantly, thrust reverser defect recorded in the tech log on the 14th October, 2005.
Defect: *"No. 1 Reverser unlock light flickers on in flight".*

Rectification Action: *"Proximity switch cleaned test carried out"*
On the 21st October, 2005 the defect was repeated in the log book entry.

Defect: *"No.1 Thrust Reverser unlock light comes on in flight"*

Rectification Action: *"T/R proximity switch is being looked into"*

The MEL called for a maintenance action which reads *"one may be inoperative provided the reverser is locked in the closed (forward thrust) position"*. There was no evidence to show that the LAE took the positive maintenance action in accordance with the MEL. There was detailed examination of the thrust reverser assemblies by the National Transportation Safety Board (NTSB). The thrust reversers were not causal to the accident.

2.3 Main Rudder power control unit (PCU)

The PCU was manufactured by Parker Hannifin to Boeing engineering drawings. The analysis was conducted at Boeing, equipment quality analysis facilities in Seattle Washington. The physical anomalies with the subject PCU were consistent with damage due to impact. The unit was not directly causal to the accident.

2.4 Lower Aft Cargo Hold Burnt Section

The section was a piece of interest to this investigation. It was found 100 feet away from the crater formed by the impact of the aircraft with the ground. Swabs of this section tested negative for explosive residue. The examination was carried out and confirmed by the explosive unit of the Federal Bureau of Investigation (FBI), USA.

2.5 Bellview Airlines Organizational Behaviour

The air transport industry has recognized the value inherent in the concept of organizational behavior or culture in safety matters. Pilots, Engineers and managers are in the best position to effect accident prevention by avoiding unacceptable risks and breakdown of safety policies, and introduce changes that will enhance its structure, policies, corporate culture and procedures.

The Flight Operations Manager and the flight training department were responsible for flight training of crew members both in content, value and practical flight training of pilot in command, captain upgrade, and newly employed captains. The airline clearly stated this in their operations manual.

The pilot was employed as a captain for the B737-200, twelve months before the accident. He was checked out as a pilot-in-command on type, one month after his employment. His employment occurred 9 months after he suffered serious injuries as a result of the attack where he sustained injuries. However, the pilot was able to satisfy the NCAA medical requirement by the submission of a Class 1 medical certificate. There was no medical evidence that any long term effects from or continuous medication needed because of the injuries that the captain suffered from the criminal attack that would have affected his flight performance.

The captain of the flight had a special case. On the 15th of February, 1986 he obtained his first ATPL Temporary Airman Certificate Number 2314353. He used this licence to operate a BAC 1-11 before leaving active flying in 1992 to engage in non – aviation related businesses. In 2004, twelve years later, he returned to active flying.

On the 3rd of June 2004, he reported the ATPL stolen. Thereafter, he travelled to the United States of America and requested for a re-issuance of his lost ATPL after completion of an initial B-737 PIC course in Aero Services, Miami, USA.

Investigation by AIB discovered that the trainings acquired by the pilot were inadequate to perform as PIC on B-737. Records showed that he accumulated only 47 hours (line training) which might have been adequate requirement but only for a pilot in active flying, transiting from one aircraft to another. However, for a pilot out of active flying for a period of twelve years, a more comprehensive training that includes B-737 full Ground School, CPT if necessary, simulator, aircraft and line trainings should have been more appropriate.

The pilot claimed to have acquired 80 flight hours on B-737 as at 17th September, 2004 when he applied for the inclusion of a B-737 rating on his ATPL, but these hours could not be verified because as at this time he was yet to join any airline. He joined Bellview on 4th October, 2004. In the course of investigation, it was discovered that this application did not pass through the due process that is, from the Director General to the GM and then DGM, Personnel Licensing and Training of the Regulatory Authority for verification before going to the desk officer. In so doing, the anomaly in the licence application was not detected.

The investigation established that the pilot was checked out by Bellview airlines in line with its approved operations manual. It was discovered that:

- The pilot claimed to have acquired 80 flight hours on B-737 as at 17th September, 2004 when he applied for inclusion of a rating on his licence from NCAA. However, it is worthy to note that the Captain had a B -737 PIC training course at Aero Services Miami.

  This course included 80 hours of ground school and 15 hours simulator as Pilot Flying (PF) and 10 hours as Pilot Non- Flying (PNF) training completed on 28th August, 2004 but had no aircraft training. In this investigation, AIB could not confirm the 80 hours of flight training claimed by the pilot before his employment.

- The Captain completed his line release check on 9th November, 2004 and therefore was authorized to fly as PIC on B-737 operated by Bellview airlines. Nevertheless, what was quoted as minimum qualification requirements in the company's Operations Manual Section 5.2.1.2 is at variance with the training the captain had as at the time of his release. For instance, "three thousand five hundred hours total, including two thousand on Jet and five hundred on type". The Captain did not meet the five hundred hours on type as at the time of his release.

- The pilot's CRM course was done from 21st to 23rd of March, 2005 after he had been released as Captain on B-737. This course was a prerequisite for his release as PIC as contained in the company's Operations Manual section 5.2.1.2. Rather, the course was done four months after he had taken command.

2.6 Inconsistencies of Document

During the course of investigation, AIB obtained simulator report from United Flight Training Services, USA the organization charged with Bellview Airlines simulator training. Comparative analysis of the two reports were made and found to be different from the report available to NCAA.

However, the captain did not undergo any aircraft training, except the aircraft line training in Bellview airlines before he was given command on B-737. Some of the exercises claimed to have been done by the captain were not actually done and the instructor's signature on the two reports were different. The report submitted by the captain was supposed to be a true copy of the original but this was not the case.
These inconsistencies were also applicable to the first officer.

From the aforementioned evidences discovered from the pilot's training documents, ANR section 1.2.5 stated as follows:

"1. No person may make or cause to be made concerning any licence, certificate, rating, qualification, or authorization, issued under these regulations application for or duplicate thereof.

(a) Any fraudulent or intentionally false statement;
(b) Any fraudulent or intentionally false entry in any logbook, record, or report that these Regulations require, or used to show compliance with any requirement of these Regulations;
(c) Any reproduction for fraudulent purpose; or
(d) Any alteration

2. Any person who commits any act prohibited under paragraph (a) may have his or her airman licence, rating, certificate, qualification, or authorization revoked or suspended".

These anomalies were neither discovered by the Airline nor the Civil Aviation Authority up till the time of this accident.

2.7 Captain's Hour Log Records

There were ambiguities in the hour log given to AIB by Bellview airlines and those contained in NCAA Personnel file of the captain.

Bellview gave a total flying hours of 11,053 hrs, while records from NCAA personnel file indicated 13,429.15 hrs as at 28/06/05.

AIB investigation revealed that the inconsistencies were obvious in a lot of areas. At a point the hour started decreasing instead of increasing see asterisk on the hour log. Between 28/01/88 to 11/08/88 which was 6½ months, he flew 1869.74 hrs equivalents to 287.65 hrs per month, which amount to 9.59 hrs per day.

The hour log from 1982 – 2005 was as follows:

Date	**Cumulative hours**
05/11/82	339.00
08/06/83	636.00
26/10/83	1030.15
12/04/84	1272.00
05/11/84	1500.00

08/05/85	1746.00
16/10/85	2996.00
14/07/86	3810.00
29/01/87	3424.00 *
13/07/87	4165.00 - (741 hrs) in 6 months
28/01/88	5170.00 - (1005 hrs) in 6 months
11/08/88	7040.26 - (1869.74 hrs) in 6½ month which means 287.65 hrs per month, 9.59 hrs per day.
28/02/90	7362.41 - (322.15 hrs) in 6 months
09/08/89	7613.59
09/02/90	8221.14 - (607.55 hrs) in 6 months
13/08/90	8757.30
01/02/91	9728.30 - (871 hrs) in 6 months = 161.8 hrs per month.
21/08/91	10,428 - (699.7 hrs) in 6 months = 116.6 per month.
06/02/92	11,098
25/08/92	11,636.09
27/12/04	**11,861.15] - (1, 568 hrs) in 6 months, 8 days**
04/07/05	**13,429.15] =261.3 hrs per month**

Note:
* *Point when the hour started decreasing instead of increasing or stagnant.*

The hours in bracket are in contravention of the ANR schedule 11.

2.8 Analysis of the crash time

The aircraft was airborne at 1935 UTC which was read to the aircraft at the time when the ATC voice recorder indicated 19:31:52 UTC. with 3mins difference. NAMA explained that there are 2 clocks being used in the system; Digital (master) stationed at ACC and control tower while analog clock was connected to ATC voice recorder which can not be connected to digital (master) clock. This explained the difference in time of tape transcript and tower log. Any time there was power surge on tape recorder, it affected the time sequence. The time difference was usually between 2-3 minutes.

With the foregoing in mind, the aircraft contacted approach control at 19:35:22 UTC and finished transmission with approach at 19:35:35 UTC. Approach control requested the aircraft to report passing FL130 at LAG, but did not call back. Approach control made attempt to call at 19:46:46 UTC but there was no response, which meant that the aircraft might have crashed between 19:35:35 UTC and 19:46:46 UTC.

Same clearance given to similar aircraft to make a right turn to Abuja usually takes about 3mins to LAG. Further 7nm north which was the crash site will take an additional 2mins at an assumed speed of 240kts, adding the calculated 5mins to departure time at 1935 UTC will take the crash time to 1940 UTC. This was corroborated with the time on the wrist watch found at the wreckage site which stopped at 2040 hrs (1940 UTC) (See fig 2.10).

Fig 2.10 wrist watch recovered from the wreckage site

2.9 Weather Conditions

Apart from the METAR report, there was also a satellite imagery report prepared by the Boeing Aircraft Company. Visibility at the time of the accident was 10km at Lagos station with the presence of thunderstorm, and lightning to the Northeast–East of the airport.

The thunderstorm was an obvious hazard to any pilot and safety precaution should be taken to avoid flying through the storm. Spatial disorientation may have enhanced the severity of the weather impact on the pilot at the time of the accident. Spatial disorientation is a situation when a pilot loses orientation of his position and loses situation awareness, which is caused by poor visibility and or unusual attitude, resulting in the pilot not knowing the attitude of the aircraft.

The attitude of an aircraft is generally determined by reference to the natural horizon or other visual references with the surface. If neither horizon nor surface references exist, the attitude of an aircraft must be determined by artificial means from the flight instruments. Sight supported by other senses allows the pilot to maintain orientation. However, during period of low visibility, the supporting senses sometimes conflict with what is seen. When this happens, a pilot is particularly vulnerable to disorientation particularly at night. The degree of disorientation may vary considerably with individual pilot. Spatial disorientation to a pilot means simply the inability to tell which way is up.

However, due to the lack of sufficient information that could have been ascertained from flight data recorder, ATC radar data, or relevant radio transmission from the accident flight, it was not determined if or to what extent the weather and/or spatial disorientation affected the accident flight. The crash site was located at the Northeast of the Airport and the weather reported between 1930hrs UTC and 2000hrs UTC was also CB (N-E). Therefore, it is inconclusive if the adverse weather conditions were a factor in this accident.

2.10 Flight Recorders

The recorders were not recovered from the crash site. The absence of the recorders made the investigation very difficult. Flight Recorders are the only means available to account for aircraft maneuvers and flight crew actions critical to finding the probable cause(s) of incidents/accidents, including data analysis that could prevent future incidents or accidents. The flight recorders could have provided the investigators with valuable information about the lateral, horizontal and longitudinal control of the aircraft, the speed, and the discussion among the crew, between the pilots, the Control Tower and ambient sounds.

There were several correspondences between AIB and the Nigerian Police Force on the sighting, handling and possession of the flight recorders. AIB did not at anytime sight, handle or possess the flight recorders.

2.11 Analysis of the Burnt Section of the fuselage

The burnt parts contained a portion of the registration number and another section of the skin with the other part of the registration number. The two pieces matched and were suspected to emanate from the left side of the fuselage. The nature of fire damage to this section raised the suspicion of an explosion. The Nigerian State Security Services (SSS) and the United States of America Federal Bureau of Investigation (FBI) were invited to examine the burnt parts. The US FBI took a piece of the burnt part, swabs from the inner and outer surface of the burnt piece and an electronic part found within the folded section of the piece of interest, back to their facilities for laboratory analysis and screened for presence of explosive residue. The results of the tests were negative i.e. no explosion.

Bellview Airlines inferred that there was a possibility of a low level explosion which resulted in bringing down the aircraft, considering the sudden descent of the aircraft and absence of MAYDAY call from the crew. However, the operator did not provide any evidence to support this assertion.

2.12 Nigerian Civil Aviation Authority (NCAA)

The document submitted by the captain for inclusion of a B-737 type rating on his Licence was not properly scrutinized as AIB investigation revealed that the 80 hours flying experience the pilot claimed was not aircraft actual flight time but ground school time.

The Captain's licence personnel file obtained from NCAA revealed that during the period between 27th December, 2004 and 4th July, 2005 (six months and eight days), the pilot logged 1,568 flight hours. This is at variance with ANR schedule 11-3 table 1.

The functions of the Principal Maintenance Inspector (PMI) include monitoring and safety surveillance of the airworthiness activities of the airline on the aircraft it operates. These activities include maintenance checks (routine and non – routine including compliance with Service Bulletins (SB) and Airworthiness Directives (AD) applicable to the aircraft), repairs and clearing of defects entered in the aircraft's technical log book. In the course of investigation AIB discovered that there were some deferred defects that exceeded the MEL repair intervals. For instance, during the A5 checks on 17th October 2005, an Auto Pilot pitch control snag which was earlier deferred was carried forward after such significant check without concession from the Regulatory Authority.

Ramp inspection is a random activity carried out by Aviation Safety Inspectors (ASIs) on aircraft on the tarmac prepared for service without notice. These inspections should have detected the deferred defects and the catalogue of MEL items that were not resolved within the specified repair intervals.

2.13 Bellview Airlines Quality Assurance Programmes

There is no evidence to show that the airline's quality assurance department performed adequate monitoring and implementation of the quality assurance in the maintenance organization in accordance with NCAR 145. The failure to comply with the applicable procedures or requirements constituted a non – conformance which required appropriate corrective action to be taken by the senior manager of the department concerned.

- A culture existed within the airline's maintenance organizations, in which LAE's and technicians deviated from approved maintenance instruction and company procedures without being aware of the airworthiness implication and without approval for concession from the Regulatory Authority.

- Ineffective supervision of maintenance staff had allowed some working practices to develop, that had compromised airworthiness control.

- There is no consistent policy in the maintenance organization's approach to human factor issues and its conduct of maintenance error investigation.

- The quality assurance programme was not effective in highlighting unsatisfactory practices in maintenance organization.

- The airline flight crew training department did not properly evaluate the captain's training requirement. The department should have taken his twelve years absence from flying into consideration in prescribing additional training rather than the PIC course he did at Aero Services USA. The line training provided by the airline was inadequate. The captain needed a complete training which is an ab-initio PIC training on type (ground school, full simulator and aircraft training before embarking on line training) considering the fact that he had never flown a B-737 aircraft before.

3.0 Conclusions

3.1 Findings

3.1.1 The aircraft was dispatched and operated with several deferred defects in the tech log without considering the concomitant effect of other inoperative systems.

3.1.2 The Captain's trainings as PIC on B-737 were inadequate.

3.1.3 Fuel flow indicators No1 and No2 were unserviceable from 14th October, 2005 till the time of accident; MEL did not give relief for operation of the aircraft with both indicators unserviceable.

3.1.4 There were evidences of discrepancies in the B-737 simulator reports submitted by both flight crew.

3.1.5 The captain was out of flying for 12 years.

3.1.6 The captain returned to flying with the following PIC Simulator training records to fly B737:

(a) 15 hours of pilot flying (PF)
(b) 10 hours of pilot not flying (PNF)
(C) 8 days of ground school training

3.1.7 Defects were not properly entered and rectification were either ignored or not properly carried out in aircraft tech log.

3.1.8 Deferred defects were not placed in Hold Item List in accordance with the airline's maintenance procedures.

3.1.9 The airline did not take advantage of the last A5 check performed on the 17th October, 2005 to rectify all outstanding defects along side with complaints that have been beyond repair interval of the MEL.

3.1.10 The Bellview Airlines Quality Assurance oversight was inadequate considering the number of outstanding aircraft defects and the inclusive entries in the tech log.

3.1.11 The prevailing weather at departure showed thunderstorm and lightning activities N-E of the airport.

3.1.12 The aircraft had Certificate of Airworthiness.

3.1.13 There was no evidence that any pre – existing medical condition affected the flight crew performance.

3.1.14 The CRM training was carried out four months after the Captain had been checked out.

3.1.15 There were inconsistencies in the logging of the Captain's flight hours.

3.1.16 NCAA safety oversight functions with respect to personnel licensing, surveillance and enforcement on the airline were inadequate.

3.1.17 NCAA did not apply appropriate sanctions as at when due to the airline for routine violations of MEL repair intervals.

3.1.18 The captain did not meet minimum requirement on type experience required by the company to fly as pilot in command.

3.1.19 The total flight hours submitted to AIB by Bellview Airlines indicated that the pilot had flown for 11, 053:46 while records from NCAA showed a total flight hours of 13, 429:15 hours as at 4th July, 2005.

3.1.20 AIB discovered that the Captain was subjected to excessive work load with attendant danger of fatigue. He flew 1,586 hours in six months and eight days.

3.1.21 The 80 hours the captain submitted as flying experience could not be verified.

3.1.22 The Investigation was unable to establish the pilot flying as at the time of the accident.

3.1.23 The characteristics of the damage on both engines was consistent with a high speed impact with engines rotating. Both engines were producing power at the point of impact.

3.1.24 The Flight Recorders were not recovered.

3.1.25 The examination at NTSB headquarters revealed that the thrust reverser actuators and rudder PCU were not contributory to the accident.

3.1.26 Test and research conducted by FBI on the burnt portion of the fuselage did not confirm the presence of any explosive residue.

3.1.27 The ATC radar that would have facilitated the Search and Rescue activities was switched off for routine maintenance on the day of the accident.

3.1.28 About 60% of the aircraft was recovered at the crash site due to impact forces.

3.1.29 There was no distress call from the crew of Bellview Flight 210.

3.1.30 The Company required 500 hours of flight time on type to serve as PIC, the captain had only accrued 47 hours of flight time when he was assigned to the B737-200.

3.1.31 The airplane should not have been dispatched for either the accident flight or earlier flights.

3.1.32 The Airline Flight crew training department did not properly evaluate the Captain's training requirements having left flying for twelve years.

3.2 Causal Factor

The AIB, after an extensive investigation, could not identify conclusive evidence to explain the cause of the accident involving Bellview Flight 210.

The investigation considered several factors that could explain the accident. They include the PIC training of the Captain before taking Command on the B737 aircraft which was inadequate, the cumulative flight hours of the pilot in the days before the accident which was indicative of excessive workload that could lead to fatigue.

Furthermore, the investigation revealed that the airplane had technical defects. The airplane should not have been dispatched for either the accident flight or earlier flights.

The absence of forensic evidence prevented the determination of the captain’s medical condition at the time of the accident. The missing flight recorders to reconstruct the flight also precluded the determination of his performance during the flight. Due to lack of evidence, the investigation could not determine the effect, if any, of the atmospheric disturbances on the airplane or the flight crew’s ability to maintain continued flight.

The operator could not maintain the continuing airworthiness of its aircraft, in ensuring compliance of its flight and maintenance personnel with the regulatory requirements. The Civil Aviation Authority’s safety oversight of the operator’s procedures and operations was inadequate.

4.0 Safety Recommendations

4.1 Safety Recommendations 2010 - 001

NCAA should ensure that its safety oversight functions on airlines are such that they;

(a) Increase the effectiveness of the surveillance on airline operations to promptly identify and respond to potential safety problems.

(b) Effectively implement the airlines procedures for training and licensing of flight and maintenance crew.

4.2 Safety Recommendations 2010 - 002

NAMA should expedite action on the provision of radar coverage of Nigeria airspace to enhance effective Air Traffic Services (ATS) and Search And Rescue (SAR) operations.

4.3 Safety Recommendations 2010 - 003

Bellview Airlines should ensure that;

(a) Maintenance tasks are certified in a sequential and timely manner;

(b) Deferred defects are properly placed in Hold Item List (HIL);

(c) Repair intervals are not exceeded beyond the relief provided by Minimum Equipment List (MEL);

(d) Suitable actions are taken to sensitize maintenance staff of their professional responsibilities, the limit of their authorization and that approval from appropriate authority is required when it becomes necessary to deviate from approved instruction and procedures.

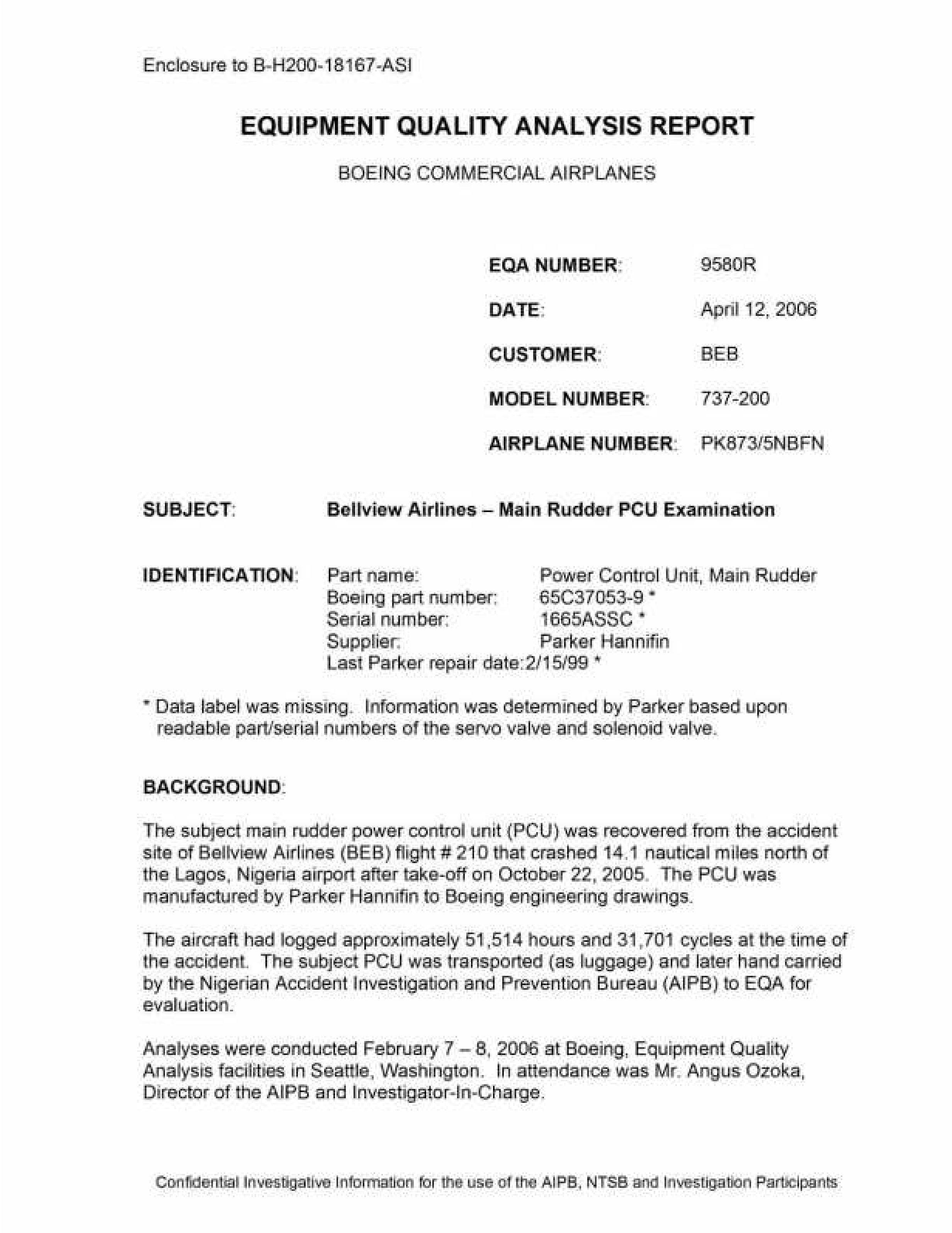
4.4 Safety Recommendations 2010 – 004

Bellview airlines should review its safety and quality control to ensure the following;

(a) Maintenance activities are carried out in accordance with approved maintenance program and established engineering best practices.

(b) Standardization and control of flight crew training (base, conversion to type, LOFT and currency) are fully implemented.

APPENDIX A



Enclosure to B-H200-18167-ASI

EQUIPMENT QUALITY ANALYSIS REPORT

BOEING COMMERCIAL AIRPLANES

EQA NUMBER:	9580R
DATE:	April 12, 2006
CUSTOMER:	BEB
MODEL NUMBER:	737-200
AIRPLANE NUMBER:	PK873/5NBFN

SUBJECT: **Bellview Airlines – Main Rudder PCU Examination**

IDENTIFICATION:

Part name:	Power Control Unit, Main Rudder
Boeing part number:	65C37053-9 *
Serial number:	1665ASSC *
Supplier:	Parker Hannifin
Last Parker repair date:	2/15/99 *

* Data label was missing. Information was determined by Parker based upon readable part/serial numbers of the servo valve and solenoid valve.

BACKGROUND:

The subject main rudder power control unit (PCU) was recovered from the accident site of Bellview Airlines (BEB) flight # 210 that crashed 14.1 nautical miles north of the Lagos, Nigeria airport after take-off on October 22, 2005. The PCU was manufactured by Parker Hannifin to Boeing engineering drawings.

The aircraft had logged approximately 51,514 hours and 31,701 cycles at the time of the accident. The subject PCU was transported (as luggage) and later hand carried by the Nigerian Accident Investigation and Prevention Bureau (AIPB) to EQA for evaluation.

Analyses were conducted February 7 – 8, 2006 at Boeing, Equipment Quality Analysis facilities in Seattle, Washington. In attendance was Mr. Angus Ozoka, Director of the AIPB and Investigator-In-Charge.

Confidential Investigative Information for the use of the AIPB, NTSB and Investigation Participants assembly, the bent, redundant piston rod extended with the rod end still attached to a segment of the aircraft rudder structure. All of the mechanical linkages that should have been attached to the aft piston rod were missing. Figure 2 documents the "as-received" condition. Figures 3 - 9 show overall photographs of the aft manifold assembly. Note that the location descriptions reference the as-installed orientation of the PCU in the aircraft.

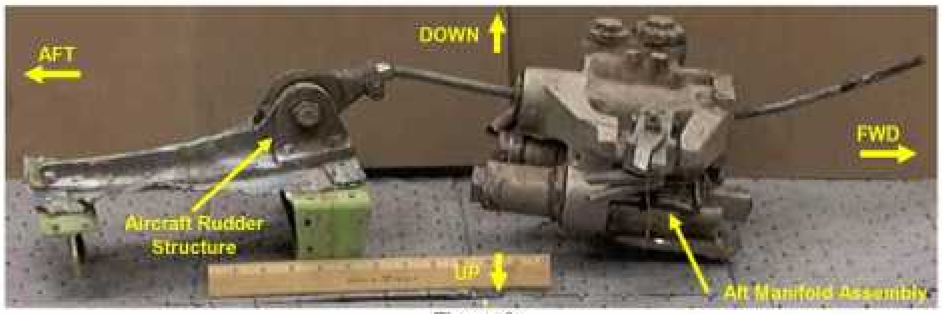


Figure 2

Figure 3. Left side view showing bent, redundant piston rod

Figure 4. Aft end view

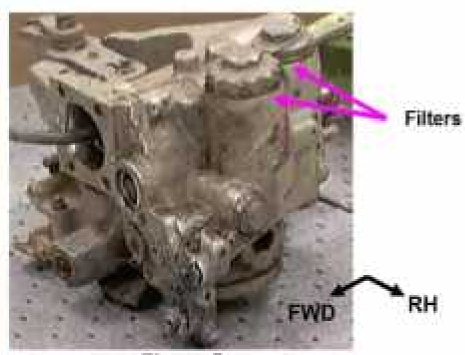


Figure 5

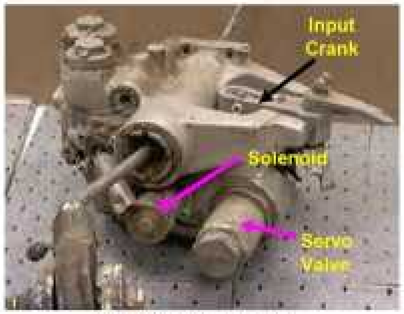


Figure 6. Aft end view

Figure 7. Forward end view

Figure 8. Left side view

Figure 9. Right side view

Figures 10 – 16 document the anomalous features of the piston rod at the **AFT** end of the subject PCU. Note that the bend and fracture (cup/cone tensile type) are at the attachment point. Note also in Figures 14 and 15 that the mating surface of the fracture shown in Figures 12 and 13 appears to be recessed in the (gland) nut.

Figure 10

Figure 11

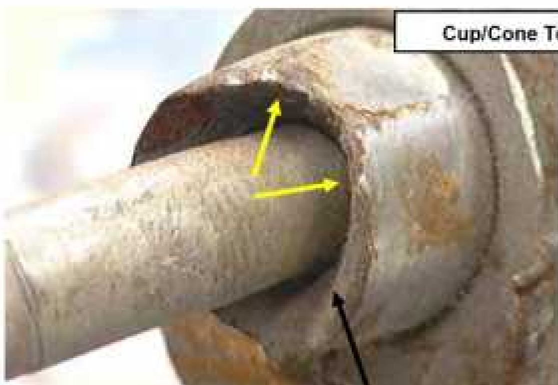


Figure 12

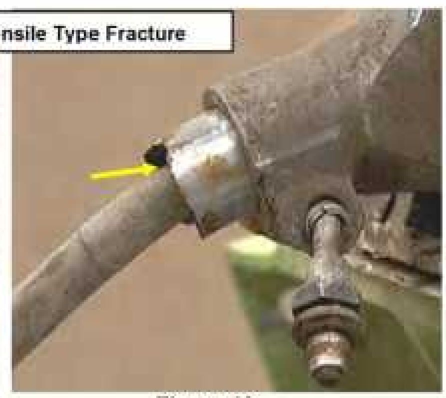
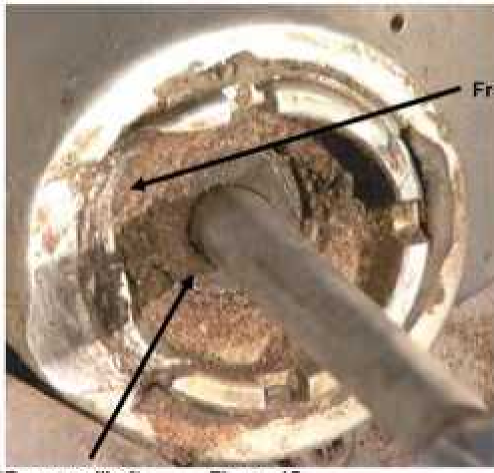


Figure 13

Figure 14



"Recessed" aft piston rod

Figure 15

Figure 16

Figures 17 – 21 document the anomalous features of the piston rod at the **FWD** end of the subject PCU. Note the narrowed condition of the rod in Figure 19.

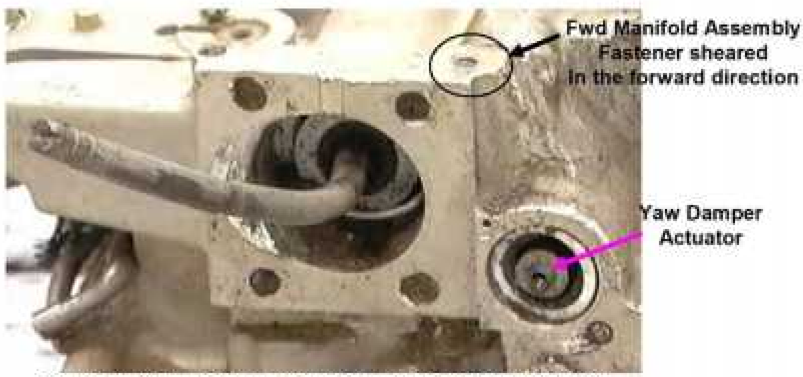


Figure 17. View of bent, redundant piston rod at FWD end

Figure 18

Figure 19

As shown on Figures 20 and 21, the aft piston had over-traveled in the retract direction. Over-travel is defined as the distance from the top of the piston surface to the edge surface of the bore. The distances were measured on each side of the bore (0.327 & 0.306 inch). Figure 20 documents the measurements. Note also the extruded back-up ring in Figure 21.

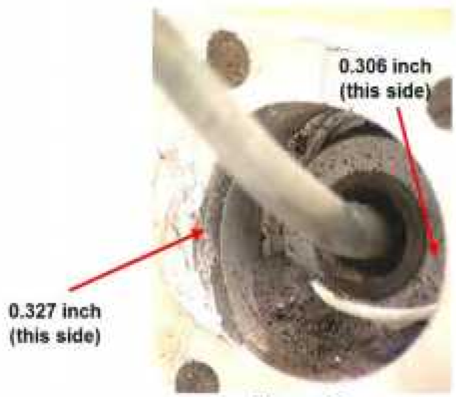


Figure 20

Figure 21

Figures 22 – 25 show the fractured input levers, which were characterized, predominantly as tensile failures.

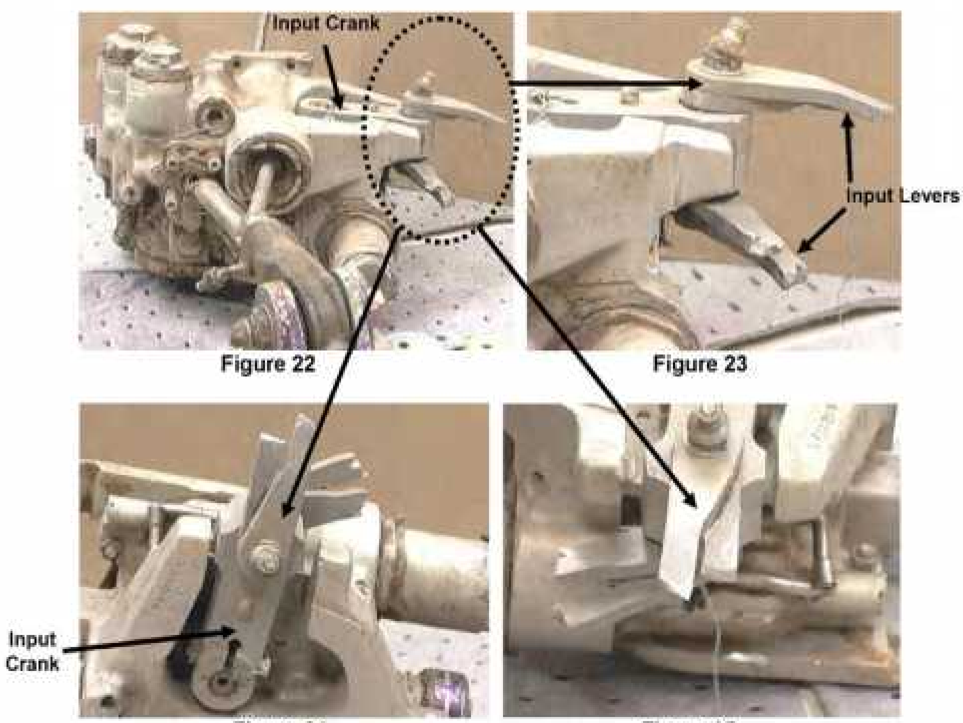


Figure 22 Figure 23 Figure 24 Figure 25

Confidential Investigative Information for the use of the AIPB, NTSB and Investigation Participants

A digital force gauge was utilized to measure the force required to move the input crank. Initially, the force was applied in the **AFT** direction (actuator rod would retract). The following three measurements (in pounds force) were recorded: 11.0, 11.5 – 12.0 & 25.0. During the measurement activity, the walking beam levers and the yaw damper actuator moved, suggesting that these parts were still internally connected. After each measurement, the input crank appeared to be biased back to its original (neutral, mid-point) position. After reinstalling the walking beam cap, it required 20 pounds of force to move the input crank.

Then, the force required to move the input crank in the **FWD** direction (actuator rod would extend) was measured. A force of three to four pounds was recorded. At this point, based upon the relatively free movement of the input crank, the investigation group surmised that the servo valve was capable of movement and was not jammed.

Figures 26 - 31 show the location and external condition of the solenoid valve and servo valve.

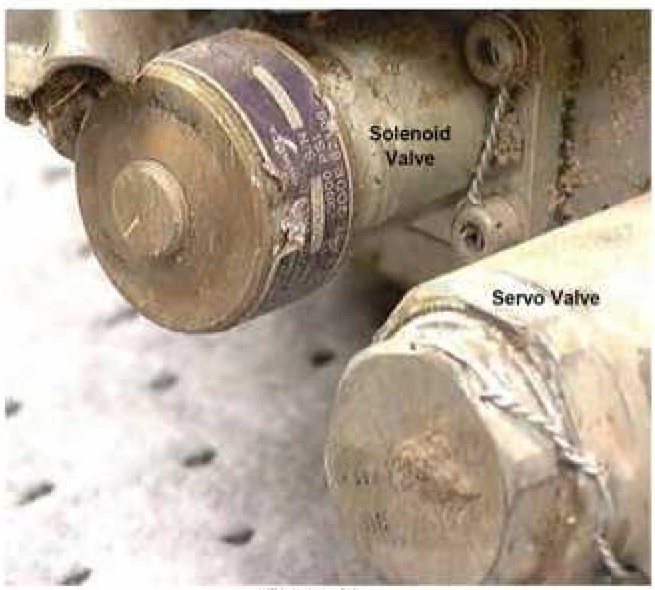


Figure 26

Figure 27

Figure 28

Figure 29

Figure 30

Figure 31

The subject PCU was then transported to the Boeing Non-Destructive Test (NDT) facility for x-ray imaging, including computed tomography (CT). Prior to transport, the aircraft rudder structure attached to the rod eye (at the **AFT** end) was removed. X-ray images were taken that revealed a bowed redundant piston rod, which extended throughout the entire body of the PCU. Additionally, the over-travel of the aft piston was quite visible. Figure 32 shows a representative image and points out both of these features.

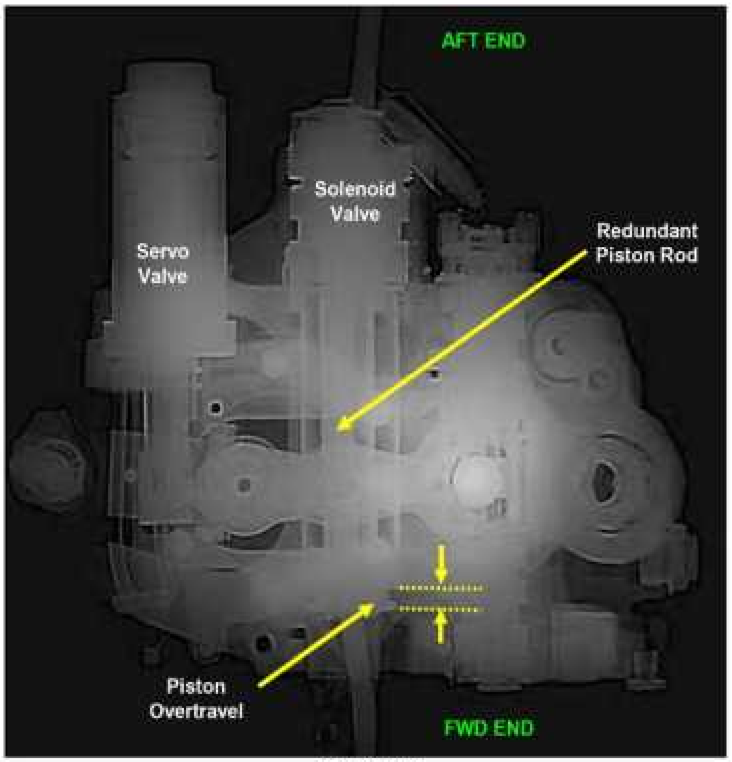


Figure 32

Following the x-ray activity, a Parker representative noted that the input crank had moved from its position observed during the initial photo-documentation. The Boeing accident investigator also stated that the input crank had moved from its position noted at the crash site.

DISASSEMBLY OBSERVATIONS:

The subject PCU (aft manifold assembly) was partially disassembled. The first item removed was the cover assembly (See Figure 8). In the cavities beneath the plate were the mechanical linkages of both the primary/secondary input cranks and the walking beam assembly. Figures 33, 34 and 35 show the cavities displaying these parts.

Figure 33

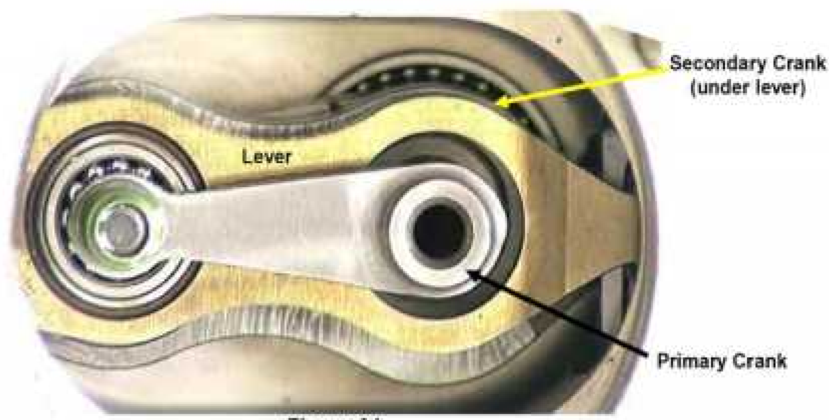


Figure 34

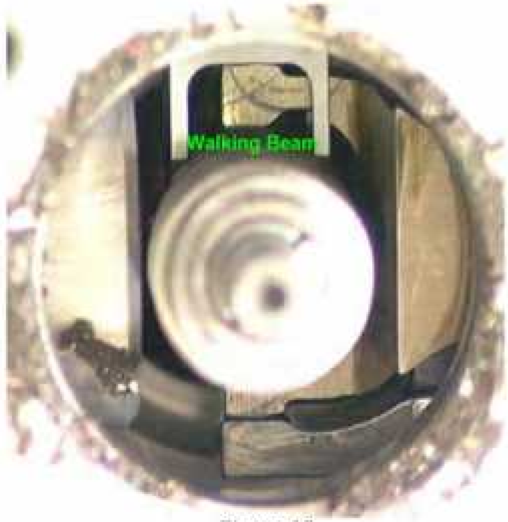


Figure 35

No further disassembly of the linkages was conducted. The investigation group determined that the most prudent course of action would be to have the proper disassembly "tool" first before attempting to disassemble further.

The input crank was then removed, revealing the splined ends of both the primary and secondary cranks. Figure 36 shows the ends of both cranks.

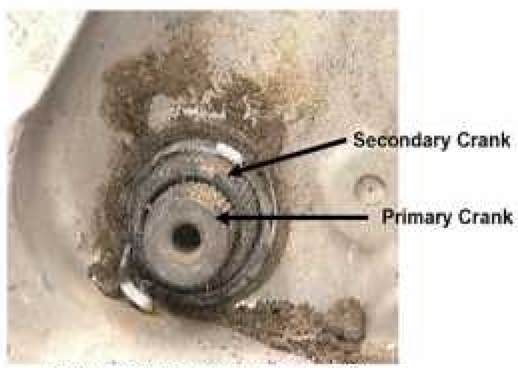


Figure 36. Input crank removed

Next, the cap of the servo valve was removed, revealing both the primary and secondary slides. Two springs along with the spring guides (single & double) were removed. During this disassembly, it was noted that the spring keeper pin was broken. Figures 37 – 40 document this activity.

Figure 37

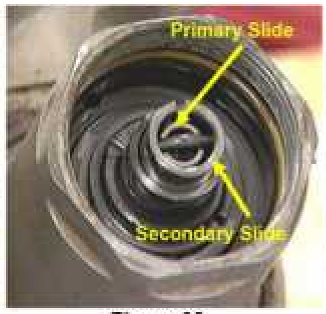


Figure 38

Figure 39

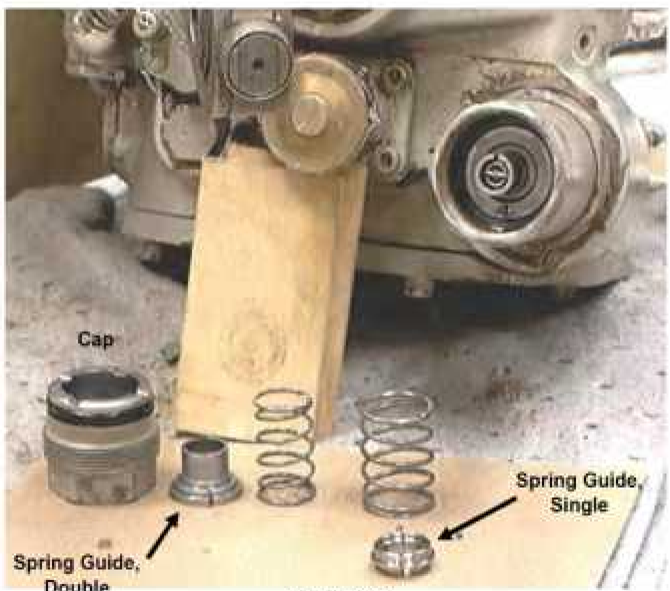


Figure 40

Figures 41, 42 and 43 show the single spring guide and the two end pieces of the fractured spring keeper pin.

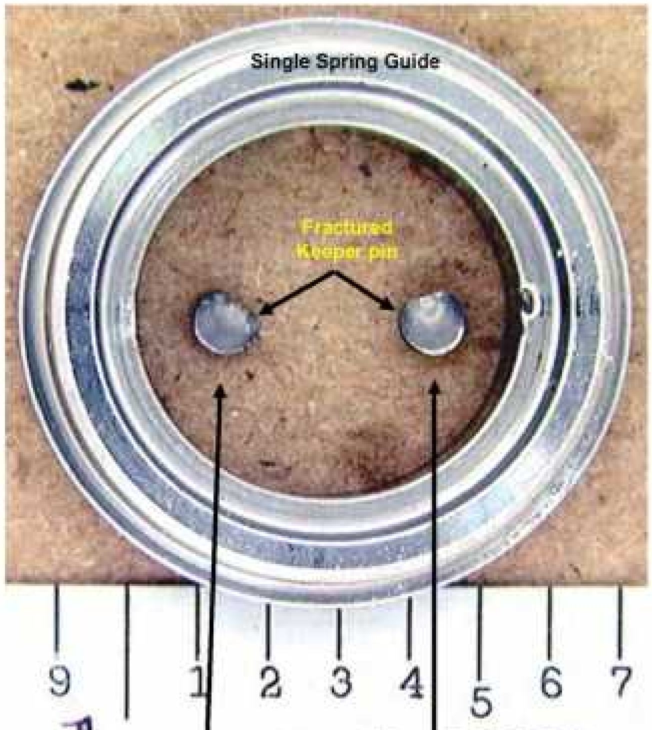


Figure 41

Figure 42

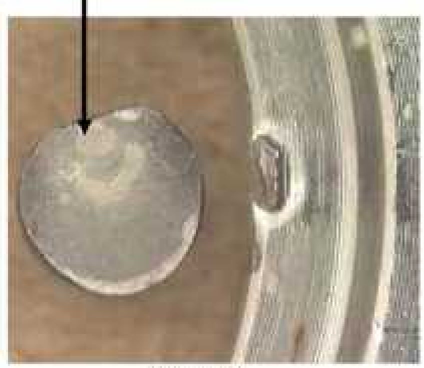


Figure 43

At this stage of disassembly, the investigation group chose to conclude this examination.

APPENDIX B

TRAINING

REPORT OBTAINED FROM THE INSTITUTION

212

UNITED SERVICES

FLIGHT TRAINING SERVICES

RECURRENT TRAINING / CHECKING

X PIC ☐ SIC ☐ FE

STUDENT'S NAME: Print

W362A05/28/05 ID #

B737-200 A/C Type

GROUND TRAINING: Aircraft Systems

Instructor Name / File# (Print & Sign) Date

Doors and Equipment Req'd.? Yes ☐ No ☐

Instructor Name / File# (Print & Sign) Date

PILOT PROFICIENCY

LINE		TRAINING			Eval.
	DATE	5/27			5/28
	GROUND OPERATIONS				
1	Preflight Inspections	S			S
2	Taxing 1	S			S
3	Power Checks 1 & 2	S			S
4	TAKEOFFS				
5	Normal (No malfunctions)	S			S
6	Instrument (100' ceiling)	S			S
7	Crosswind	S			S
8	Powerplant Failure (>V1 <V2)	S			S
9	Rejected Takeoff 3	S			S
10	INSTRUMENT PROCEDURES				
11	Area Departure	S			S
1	Area Arrivals				
13	Holding				S
14	Normal ILS Approach 9	S			S
15	Engine-out ILS Approach 3	S			S
16	Non-precision Approach	S			S
17	2nd Non-Precision Approach4				S
18	Missed Approach From ILS	S			S
19	Eng-Out Missed Approach (PIC)	S			S
20	Circling Approach 6				S
21	IN-FLIGHT MANEUVERS				
22	Steep Turns (PIC)	S			S
20	Specific Flight Characteristics	S			S
23	Approach To Stalls 5	S			S
24	Powerplant Failure 7	S			S
25	2-Engine Inop Approach 8				
26	LANDINGS				
27	Normal	S			S
28	From an ILS	S			S
29	Crosswind	S			S
30	Engine Out	S			S
31	2-Engine Out 8				
3	Rejected Landing	S			S
33	Abnormal Flap				
34	From Circling Approach 5				
35	PROCEDURES				
36	Normal and Abnormal	S			S
37	Emergency Procedures	S			S
38	Judgment	S			S
39	FMS Proficiency				
	TOTAL SIM TIME - PAC	2:00			2:00

FE PROFICIENCY

	TRAINING			Eval.
DATE				
NORMAL PROCEDURES				
Exterior Preflight				
Interior Preflight				
Panel Set-up				
Fuel Load				
Engine Start				
Taxi & Before Takeoff				
Takeoff and Climb				
Pressurization				
Cruise and Fuel Management				
Descent and Approach				
After Landing				
Securing				
Crew Coord. & Monitoring				
Computations				
Anti-ice, De-ice				
NON-NORMAL AND EMERGENCY PROCEDURES				
Trouble Shooting				
Knowledge of Procedures				
Ability to Perform Procedures				
Crew Coordination				
MEL and CDL				
TOTAL FE PANEL TIME				

Grade Legend: S = Satisfactory U = Unsat. I = Incomplete

Notes for Proficiency Check Airman:

1 PIC and SIC may both simultaneously take credit for this event
2 As appropriate for type of aircraft
3 Engine failure before FAF, manually flown
4 Use different letdown for other non-precision
5 Normally will be checked; if not, initial below:

CIRCLING NOT CHECKED: 121 only ________

6 Landing, takeoff, clean configuration
7 Inflight engine shut down required and relight optional
8 3 and 4 engine aircraft only
9 Approach Minimum - CAT I, II, III (CIRCLE ONE)

REMARKS

W. H. Baker — Print Instructor Name

C-74704 — UAL File No.

Instructor Signature

FAA PHYSICAL Class: ______ Dated: ______ FAA CERTIFICATE CHECKED: ☐

Oral Grade: S SIM Ck Grade: S

J.T. McDOUGLE C74701 — Evaluator Name / File# (Print & Sign)

Student Signature Date: 5-28-05 FTS REVIEW (Date) 06/06/05

Check / Training Observed for (Check one) ☐ Pilot or ☐ FE

Check / Training Observed by (Circle one) FAA / TCQA Name: Date: 5-28-05

PILOT AND FE RECURRENT DENUS 22APR04

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APPENDIX C

67

UNITED
FLIGHT TRAINING SERVICES

RECURRENT TRAINING / CHECKING

X PIC ☐ SIC ☐ FE

STUDENT'S NAME ______ Print

W362A05/28/05 — ID #
B737-200 — A/C Type

GROUND TRAINING: Aircraft Systems
Instructor Name / File# (Print & Sign) — Date

Doors and Equipment — Req'd.? Yes ☐ No ☐
Instructor Name / File# (Print & Sign) — Date

PILOT PROFICIENCY

	TRAINING			Eval
DATE	[illegible]			[illegible]
GROUND OPERATIONS				
Preflight Inspection	S			S
Taxiing 1	S			S
Power Checks 1 & 2	S			S
TAKEOFFS				
Normal (No malfunctions)	S			S
Instrument (100' ceiling)	S			S
Crosswind	S			S
Powerplant Failure (>V1<V2)	S			S
Rejected Takeoff 3	S			S
INSTRUMENT PROCEDURES				
Area Departure	S			S
Area Arrivals	S			S
Holding	S			S
Normal ILS Approach 4	S			S
Engine-out ILS Approach 3	S			S
Non-precision Approach	S			S
2nd Non-Precision Approach 4	S			S
Missed Approach From ILS	S			S
Eng-Out Missed Approach (PIC)	S			S
Circling Approach 5				S
IN-FLIGHT MANEUVERS				
Steep Turns (PIC)	S			S
Specific Flight Characteristics	S			S
Approach To Stalls 6	S			S
Powerplant Failure 7	S			S
2-Engine Inop Approach 8				
LANDINGS				
Normal	S			S
From an ILS	S			S
Crosswind	S			I
Engine Out	S			S
2-Engine Out 8				S
Rejected Landing	S			S
Abnormal Flap				S
From Circling Approach 5				S
[illegible]EDURES				
Normal and Abnormal	S			S
Emergency Procedures	S			S
Judgment	S			S
FMS Proficiency				
TOTAL SIM TIME - PAC	2 [illegible]			3 [illegible]

FE PROFICIENCY

	TRAINING			Eval.
DATE				
NORMAL PROCEDURES				
Exterior Preflight				
Interior Preflight				
Panel Set-up				
Fuel Load				
Engine Start				
Taxi & Before Takeoff				
Takeoff and Climb				
Pressurization				
Cruise and Fuel Management				
Descent and Approach				
After Landing				
Securing				
Crew Coord. & Monitoring				
Computations				
Anti-ice, De-ice				
NON-NORMAL AND EMERGENCY PROCEDURES				
Trouble Shooting				
Knowledge of Procedures				
Ability to Perform Procedures				
Crew Coordination				
MEL and CDL				
TOTAL FE PANEL TIME				

Grade Legend: S = Satisfactory U = Unsat. I = Incomplete

Notes for Proficiency Check Airman:

1. PIC and SIC may both simultaneously take credit for this event
2. As appropriate for type of aircraft
3. Engine failure before FAF, manually flown
4. Use different letdown for other non-precision
5. Normally will be checked; if not, initial below:

CIRCLING NOT CHECKED: 121 only ______

6. Landing, takeoff, clean configuration
7. Inflight engine shut down required and relight optional
8. 3 and 4 engine aircraft only
9. Approach Minimum – CAT I, II, III (CIRCLE ONE)

REMARKS

W H Burger — Print Instructor Name
C74704 — UAL File No.
[signature] — Instructor Signature

PHYSICAL Class ______ Dated: ______ FAA CERTIFICATE CHECKED: ☐
Oral Grade: S   SIM Ck Grade: S
J T McDowell [signature] C74701 — Evaluator Name / File# (Print & Sign)
Student Signature [signature] Date: 5-25-05   FTS REVIEW (Date) ______

Check / Training Observed for (Check one) ☐ Pilot or ☐ FE
Check / Training Observed by (Circle one) FAA / TCQA   Name: ______ Date: ______

PILOT AND FE RECURRENT   DENUS 22APR04
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APPENDIX D

UNITED SERVICES
FLIGHT TRAINING SERVICES

215

RECURRENT TRAINING / CHECKING

STUDENT'S NAME: ______________ Print   W362A05/28/05 ID #   PIC X SIC FE   B737-200 A/C Type

GROUND TRAINING: Aircraft Systems
Instructor Name / File# (Print & Sign) Date

Doors and Equipment Req'd.? Yes ☐ No ☐
Instructor Name / File# (Print & Sign) Date

PILOT PROFICIENCY

INE		TRAINING			Eval.
	DATE	5/27			5/28
	GROUND OPERATIONS				
1	Preflight Inspections	S			S
2	Taxing 1	S			S
3	Power Checks 1 & 2	S			S
4	TAKEOFFS				
5	Normal (No malfunctions)	S			S
6	Instrument (100' ceiling)	S			S
7	Crosswind				S
8	Powerplant Failure (>V1 <V2)	S			S
9	Rejected Takeoff 1				
10	INSTRUMENT PROCEDURES				
11	Area Departure	S			S
	Area Arrivals				S
	Holding				
14	Normal ILS Approach 8	S			S
15	Engine-out ILS Approach 3	S			S
16	Non-precision Approach	S			S
17	2nd Non-Precision Approach 4				S
18	Missed Approach From ILS	S			S
19	Eng-Out Missed Approach (PIC)	S			
20	Circling Approach 5				
21	IN-FLIGHT MANEUVERS				
22	Steep Turns (PIC)	S			S
	Specific Flight Characteristics	S			S
23	Approach To Stalls 6	S			S
24	Powerplant Failure 7	S			S
25	2-Engine Inop Approach 8				—
26	LANDINGS				
27	Normal	S			S
28	From an ILS	S			S
29	Crosswind				S
30	Engine Out	S			S
31	2-Engine Out 8				—
	Rejected Landing				
	Abnormal Flap				—
	From Circling Approach 5				—
	PROCEDURES				
	Normal and Abnormal	S			S
	Emergency Procedures	S			S
	Judgment	S			S
	FMS Proficiency				
	TOTAL SIM TIME / PAC	2:00			2:00

FE PROFICIENCY

	TRAINING			Eval.
DATE				
NORMAL PROCEDURES				
Exterior Preflight				
Interior Preflight				
Panel Set-up				
Fuel Load				
Engine Start				
Taxi & Before Takeoff				
Takeoff and Climb				
Pressurization				
Cruise and Fuel Management				
Descent and Approach				
After Landing				
Securing				
Crew Coord. & Monitoring				
Computations				
Anti-ice, De-ice				
NON-NORMAL AND EMERGENCY PROCEDURES				
Trouble Shooting				
Knowledge of Procedures				
Ability to Perform Procedures				
Crew Coordination				
MEL and CDL				
TOTAL FE PANEL TIME				

Grade Legend: S = Satisfactory U = Unsat. I = Incomplete

Notes for Proficiency Check Airman:

1 PIC and SIC may both simultaneously take credit for this event
2 As appropriate for type of aircraft
3 Engine failure before FAF, manually flown
4 Use different letdown for other non-precision
5 Normally will be checked; if not, initial below:
CIRCLING NOT CHECKED: 121 only ________
6 Landing, takeoff, clean configuration
7 Inflight engine shut down required and relight optional
8 3 and 4 engine aircraft only
9 Approach Minimum - CAT I, II, III (CIRCLE ONE)

REMARKS

W.H. Bulger   C-74709
Print Instructor Name   UAL File No.   Instructor Signature

PHYSICAL:Class: ____ Dated: ____ FAA CERTIFICATE CHECKED: ☐
Oral Grade: S   SIM Ck Grade: S   J.T. McDougle   C74701
Evaluator Name / File# (Print & Sign)

nt Signature ______   Date: 5-28-05   FTS REVIEW (Date) 06/6/05

Check / Training Observed for (Check one) ☐ Pilot or ☐ FE
Check / Training Observed by (Circle one) FAA / TCQA Name: ______ Date: ______

PILOT AND FE RECURRENT   DENUS 22APR04
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APPENDIXE

Bellview Airlines 737-200 5N-BFN
Examination Observations
12-17 December 2005
Lagos, Nigeria

ummary

The purpose of this document is to record observations made during a visual examination of the recovered wreckage of the airplane. A separate document records the observations made of the maintenance records.

A 2-demensional, full scale layout of the outline of the 737-200 was laid out on the hanger floor. The overall dimensions of the airplane are approximately 100' in length and 100' wingspan. All of the recovered wreckage was examined and, when possible, placed in the approximate proper location on the layout. Major sections of examined wreckage included the fuselage, wings, empennage, engines, and flight controls. See figures 1 and 2 (note that these pictures were taken in November, 2005).

In summary, it is estimated that, overall by weight, approximately 45 to 55 percent of the airplane was recovered to the hanger at Lagos International Airport. A rough breakdown by airplane section is:

Section	% Recovered
FWD Fuselage (sections 41 & 43)	< 5
Wings	55
AFT Fuselage (section 46)	25
Empennage (section 48)	65
Primary Flight Controls	< 10
Secondary Flight Controls/Systems	35
Landing Gear	60
Engines	85
Interior Structure/ Equipment/ Furnishings	< 1

45

UNITED SERVICES

FLIGHT TRAINING SERVICES

RECURRENT TRAINING / CHECKING

PIC ☐ X SIC ☐ FE

STUDENT'S NAME: **Ernest Eshun** (Print) — W362A05/28/05 (ID #) — B737-200 (A/C Type)

GROU[N]D TRAINING: Aircraft Systems — Instructor Name / File# (Print & Sign) — Date

Doors and Equipment — Req'd.? Yes ☐ No ☐ — Instructor Name / File# (Print & Sign) — Date

PILOT PROFICIENCY

LINE		TRAINING			Eval.
	DATE	5/22			5/28
	GROUND OPERATIONS				
1	Preflight Inspections	S			S
2	Taxiing 3	S			S
3	Power Checks 1 & 2	S			S
4	TAKEOFFS				
5	Normal (No malfunctions)	S			S
6	Instrument (100' ceiling)	S			S
7	Crosswind				S
[illegible]	Powerplant Failure (>V1 <V2)	S			S
[illegible]	Rejected Takeoff 1				S
10	[IN]STRUMENT PROCEDURES				
11	Area Departure	S			S
12	Area Arrivals				S
13	Holding				
14	Normal ILS Approach 4	S			S
15	Engine-out ILS Approach 3	S			S
16	Non-precision Approach	S			S
17	2nd Non-Precision Approach 4				S
18	Missed Approach From ILS	S			S
19	Eng-Out Missed Approach (PIC)	S			
20	Circling Approach 3				
21	IN-FLIGHT MANEUVERS				
22	Steep Turns (PIC)	S			S
20	Specific Flight Characteristics	S			S
23	Approach To Stalls 8	S			S
24	Powerplant Failure 7	S			S
25	2-Engine Inop Approach 8				
26	LANDINGS				
27	Normal	S			S
[illegible]	From an ILS	S			S
[illegible]	Crosswind				S
30	Engine Out	S			S
31	2-Engine Out 8				
32	Rejected Landing				
33	Abnormal Flap				
34	From Circling Approach 2				
35	PROCEDURES				
36	Normal and Abnormal	S			S
37	Emergency Procedures	S			S
38	Judgment	S			S
39	FMS Proficiency				
	TOTAL SIM TIME - PAC				

FE PROFICIENCY

	TRAINING			Eval.
DATE				
NORMAL PROCEDURES				
Exterior Preflight				
Interior Preflight				
Panel Set-up				
Fuel Load				
Engine Start				
Taxi & Before Takeoff				
Takeoff and Climb				
Pressurization				
Cruise and Fuel Management				
Descent and Approach				
After Landing				
Securing				
Crew Coord. & Monitoring				
Computations				
Anti-ice, De-ice				
NON-NORMAL AND EMERGENCY PROCEDURES				
Trouble Shooting				
Knowledge of Procedures				
Ability to Perform Procedures				
Crew Coordination				
MEL and CDL				
TOTAL FE PANEL TIME				

Grade Legend: S = Satisfactory U = Unsat. I = Incomplete

Notes for Proficiency Check Airman:

1. PIC and SIC may both simultaneously take credit for this event
2. As appropriate for type of aircraft
3. Engine failure before FAF, manually flown
4. Use different letdown for other non-precision
5. Normally will be checked; if not, initial below:

CIRCLING NOT CHECKED: 121 only ______

6. Landing, takeoff, clean configuration
7. Inflight engine shut down required and relight optional
8. 3 and 4 engine aircraft only
9. Approach Minimums – CAT I, II, III (CIRCLE ONE)

REMARKS

W.H. Burger — Print Instructor Name

674704 — UAL File No.

[signature] — Instructor Signature

[F]A PHYSICAL Class: ______ Dated: ______ FAA CERTIFICATE CHECKED: ☐

Oral Grade: S SIM Ck Grade: S

J.H. McDougle [signature] 674707 — Evaluator Name / File# (Print & Sign)

[Stud]ent Signature [signature] Date: 5-28-05 FTS REVIEW (Date) ______

Check / Training Observed for (Check one) ☐ Pilot or ☐ FE

Check / Training Observed by (Circle one) FAA / TCQA Name: ______ Date: ______

PILOT AND FE RECURRENT DENUS 22APR04

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APPENDIXF

Bellview Airlines 737-200 5N-BFN
Examination Observations
12-17 December 2005
Lagos, Nigeria

Overview & Summary

The purpose of this document is to record observations made during a visual examination of the recovered wreckage of the airplane. A separate document records the observations made of the maintenance records.

A 2-demensional, full scale layout of the outline of the 737-200 was laid out on the hanger floor. The overall dimensions of the airplane are approximately 100' in length and 100' wingspan. All of the recovered wreckage was examined and, when possible, placed in the approximate proper location on the layout. Major sections of examined wreckage included the fuselage, wings, empennage, engines, and flight controls. See figures 1 and 2 (note that these pictures were taken in November, 2005).

In summary, it is estimated that, overall by weight, approximately 45 to 55 percent of the airplane was recovered to the hanger at Lagos International Airport. A rough breakdown by airplane section is:

Section	% Recovered
FWD Fuselage (sections 41 & 43)	< 5
Wings	55
AFT Fuselage (section 46)	25
Empennage (section 48)	65
Primary Flight Controls	< 10
Secondary Flight Controls/Systems	35
Landing Gear	60
Engines	85
Interior Structure/ Equipment/ Furnishings	< 1

FIG 1 – Aft Fuselage & Empennage Layout

FIG 2 – Forward Fuselage, Wing, and Engine Layout

Fuselage

Nearly the airplane's fuselage was fractured in very small pieces (consistent with high- speed impact). It appears that the left hand side of the fuselage is where a majority of the pieces recovered from the accident site came from. This would also be consistent with high-speed impact where the right wing was down.

Overall, only about 3% of the fuselage structure in front of the wings was recovered. Approximately 25% of the structure aft of the wings was recovered. Only very small pieces of floor beam were recovered.

The largest examined section encompasses the crown skin from approximately BS 830 back to 950. In addition, the portion of skin that contains the left hand registration number (located above stringer 14 between BS 827 and 887), plus a portion of the aft entry and galley door cutout skin and the aft edge frame of the entry door cutout was recovered.


FIG 3 - Aft Crown Skin and Registry Number

A portion of the BS 1016 aft pressure bulkhead was found, three pieces of the outer Y-chord with stringers and small section of web attached. The largest piece was the lowest portion of the bulkhead, which includes section of web where the control cables penetrate, including intercostal just aft of bulkhead.


FIG 4 – Aft Pressure Bulkhead Lowest Portion

Going forward a portion of the left skin containing "Bellview" was recovered. This is between BS 440 and about 580 above stringer 10 on both sides of the airplane.

FIG 5 – Skin Pieces That Include Part of Bellview's Name
(This shows the portion with "bel")

The next significant skin section is located at the BS 360 splice. There are portions from stringer 6L to 10L (aft of 360), 12L to 15L (aft of 360), 16L to 18L (fwd of 360) including the aft lower corner of the entry door cutout, and 17L to 19L (aft of 360).

FIG 6 – Left Skin at BS 360 Splice

The only other left hand skin with distinctive markings is that section marked "cut here" (so marked for emergency crews as an acceptable location to cut through the structure for access) in the forward crown area. There are three pieces that make-up a portion of this area.

FIG 7 – Forward Upper Skin Marked "Cut Here"

The only major section from the right hand side is the forward cargo door cutout. This piece is crumbled into a ball as seen in figure 8 and was found in bottom of the impact crater.

FIG 8 – Fwd Cargo Door Cutout Lower Sill Area

A number of skin pieces remained unidentified as to their location. A large example of one of these is shown in figures 9 and 10.

FIG 9 – Example of large, unidentified piece of skin

FIG 10 – Miscellaneous Fuselage Parts

There were a few pieces from either the BS 540 or BS 727 butt splice, but no obvious details that indicate positive identity.

FIG 11 – BS 540 or 727 Butt Splice (shown at BS 727)

Much of the recovered fuselage structure consists of the outside skin of the airplane. To provide structural support, there are fuselage stringers running longitudinal for the entire length of the fuselage (with 10" spacing). There are circumferential frames located approximately every 20". Only a few small pieces of the frames and stringers have been recovered. There are major frame and stringer pieces are attached to the aft crown skin mentioned above. None of the structure for the four upper lobe passenger doors and two lower lobe cargo doors has been recovered. This includes the door mechanisms inside the doors. There were no obvious signs of any of the flat pressure bulkheads (BS 178 and 727) or the wing center section front or rear spar webs. The nose wheel well dog house was likewise not identified in the recovered wreckage.

The floorbeams the width of the fuselage and provide support to both the cabin floor as well as the pressure loads induced into the frames. Like the frames, the floorbeams are spaces approximately every 20" throughout the length of the fuselage. An examination of the wreckage located only one short section of floorbeam.

FIG 12 – Typical Floorbeam

The last major area lacking is over the wing center section and that over the wheel well. None of the pressure deck or the major beams in this area was found.

Fire Damage

During the examination of the impact site, a number of parts were noted to have evidence of burn damage (actual heat and sooting). A section of recovered fuselage skin from approximately body station 940 to 980, left side (below the windows and on the backside of the body registration number appeared to display an unusual burn/sooting pattern. As noted on the accident site, the part was folded twice, the outside against outside and inside against inside. The burn/sooting pattern appears to stop along the fold line. The level of expertise available at the site could not make a determination of pre- or post- impact fire damage.

FIG 13 – Burned Skin Part at Site

FIG 13A – Burned Part at Site – Opposite Side

FIG 13B – Burned Part Looking at Inside Fold.
Note fire/soot damage stopping within the fold

FIG 13C – Burned Part Unfolded at Hanger (airplane exterior)

FIG 13D – Burned Part Unfolded at Hanger (cabin side)

Flight Controls/ Systems

Recovered primary flight control actuators include:

- Rudder System (Main Rudder Power Control Unit (PCU))
  This unit, shown in figure 14 (as documented in the field), is missing the front portion of the attach arms which provide support to the vertical stabilizer rear spar. The inner portion of the concentric dual piston remains attached to the rod end; this, in turn, remained attached to a portion of the rudder front spar. Figure 15 shows the unit in the hanger with a recovered portion of the attach arms.

FIG 14 – Main Rudder PCU (at impact site)

FIG 15 – Main Rudder PCU (in hanger with recovered forward support arm)

The exposed piston measures 10.5" in length. It is jammed in position. The input lever can be moved.

Other recovered rudder system components include a portion of one flight deck rudder pedal (grooved round section where heel is placed during use). In addition, a portion of the rudder trim cable drum was recovered with a short (6") length of cable attached.

- Lateral Control System

No identifiable components of the aileron control or actuation system were recovered. Small portions of the aileron surface were recovered. Portions of the spoiler panel structure and skin were also recovered. One spoiler actuator was recovered as seen below in figure 16.

FIG 16 – Spoiler Actuator

- Elevator Control System

Small portions of the STA 1156 elevator control and actuation system were recovered as shown in figures 17 and 18 below. Figure 19 shows the normal relationship on these components and their location in the airplane. The main elevator drive torque tube is largely intact (and bent); the elevator connecting rods are fractured.

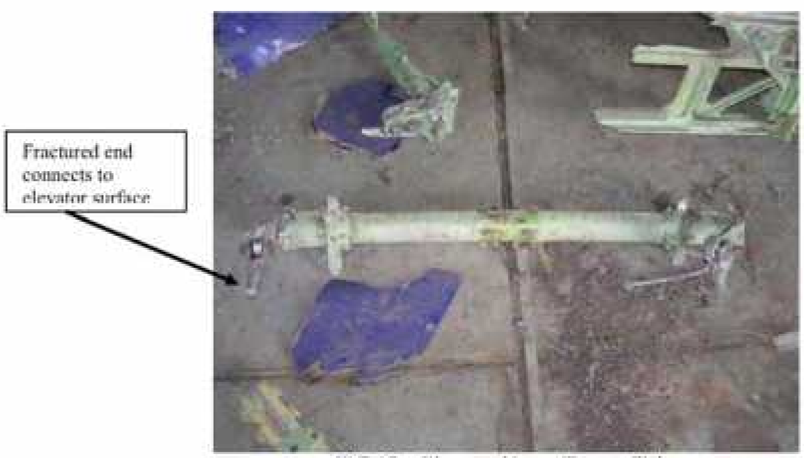

FIG 17 – Elevator Upper Torque Tube

As well, a small portion of one side of the elevator input torque tube was recovered. This portion still has the rod end of the elevator Power Control Unit attached to it. See figure 18.

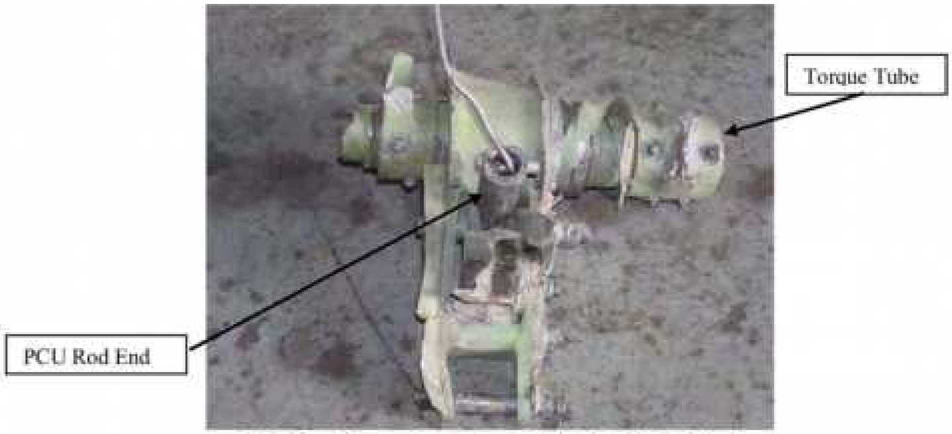

FIG 18 – Elevator Input Torque Tube & PCU Rod End

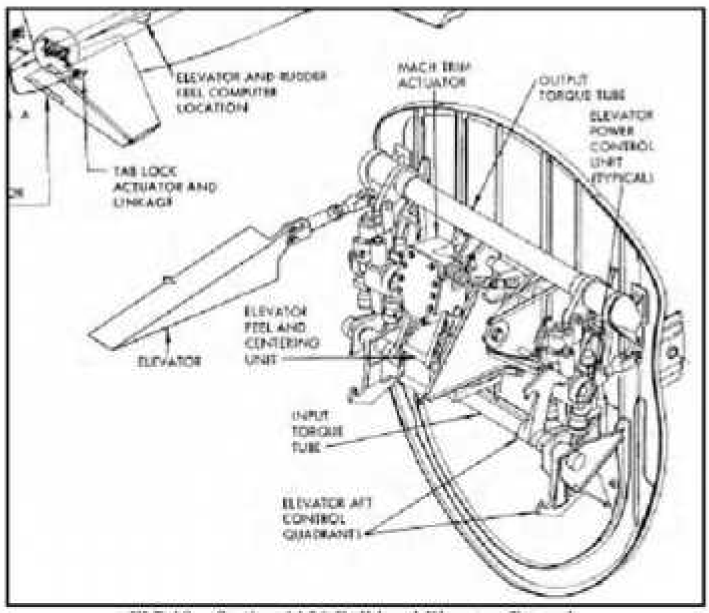

FIG 19 – Station 1156 Bulkhead Elevator Controls

In addition, the Feel Computer and one (of two) elevator tab lock mechanisms were found. The feel computer is largely intact and is fractured from its mounting hardware; the tab lock mechanism has the actuator and the moving arms but is missing the springs and the actual tab rods which connect to and drive the tab during airplane manual reversion. Figures 20A and 20B show these two components, respectively.

FIG 20A – Elevator Feel Computer

FIG 20B – Tab Lock Mechanism

Recovered secondary flight controls include:

- High Lift System

The high lift system consists of the wing leading edge and trailing edge devices. Wing leading edge devices consist of 6 slat actuators and 4 kruger flap actuators. There are 12 leading edge support tracks. Wing trailing edge devices consist of 8 flap transmissions and tracks. As noted in figures 21A, recovered high lift components include 2 LE slat actuators, 1 kruger flap actuator, and 5 LE slat tracks.

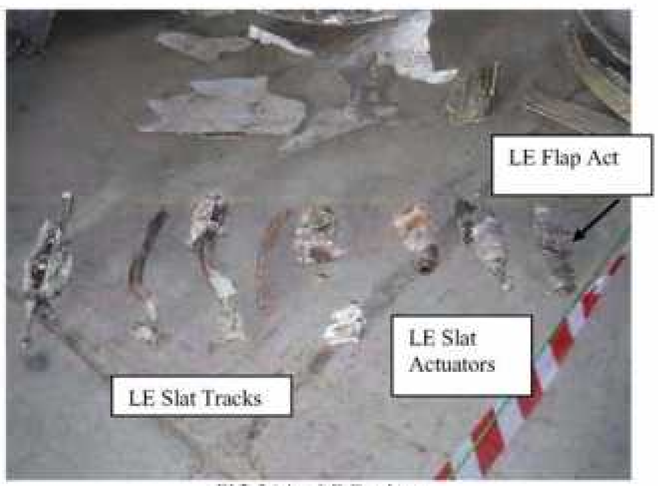

FIG 2A1 – LE Devices

Figure 21B shows the 5 recovered TE flap transmissions. Examination notes that transmissions #1 and #8 (outboard flap, outboard transmission), #3 and #6 (inboard flap, outboard transmission), and either #2 or #7 (outboard flap, inboard transmission) were recovered. Both #4 and #5 (inboard flap, inboard transmission) were not recovered.

FIG 21B – TE Flap Transmissions

Only one section of trailing edge ballscrew was recovered. This unit, identified by fracture face matching, is from the #1 (left outboard flap, outboard ballscrew) position. A measurement of the portion of the screw between the ballnut and the end stop indicates that the flap was in the fully retracted position. Likewise, one of the LE slat actuators was recovered intact with both the housing and the piston rod end. Its recovered position is consistent with the slats retracted position.

- Stabilizer Trim System

The main system component normally consists of a large transmission with primary and secondary brake, two motors, and a cable drum. A 4' long ballscrew extends from the transmission housing and rotates causing the horizontal stabilizer to move to the commanded position. The only component recovered is the ball screw and primary brake assembly as shown in figure 22

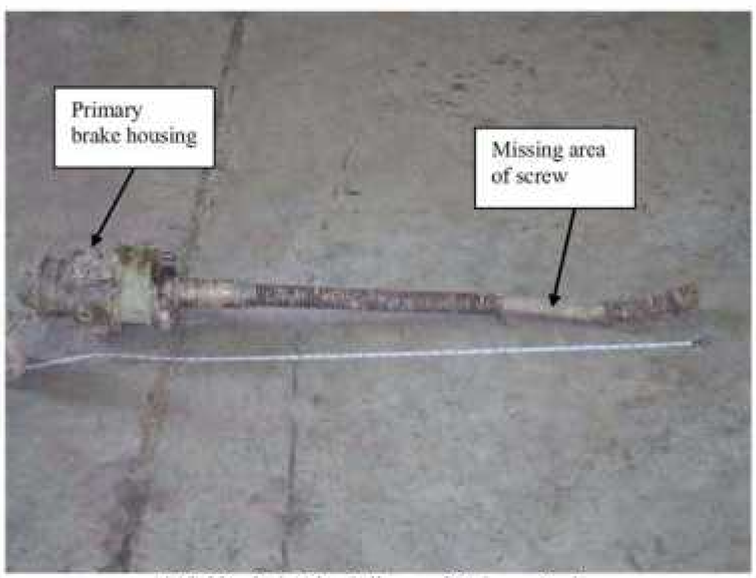

FIG 22 – Stab Trim Ballscrew & Primary Brake

The screw assembly normally consists of the ballscrew and an inner safety rod. Figure 22 notes an 8" section of the outer ballscrew missing. This is also a fracture point for the inner safety rod. This missing area is consistent with the size of the stabilizer ballnut. This indicates that, based on a measurement of the screw length between the lower surface of the upper stop and the point of fracture for the screw that the stab trim held a position of 4.2 units (1.2° LE down).

- Miscellaneous Systems

Only small portions of the remaining flight and landing systems were recovered. One main landing gear retract actuator was recovered. The piston was extended, bent, and exhibited a large dent along its surface. This is consistent with the landing gear in the retracted position.

A number of electronic aviation boxes were also recovered. They were damaged to a degree that it is not possible to identify them. See figure 23.

FIG 23 – Electronic Boxes

Powerplants

- Engines

Both JT8D engines were recovered from the impact crater. The number 1, or left, engine was found on the east side of the crater whilst engine number 2, or right, was found on the west side. Both were severely damaged by the forces of impact making identification difficult. Details of the engine examination are available from the engine manufacturer (Pratt & Whitney).

- Thrust Reversers

The JT8D thrust reverser system consists of two clamshell type doors which are used to redirect the engine exhaust thrust. Each door has a separate lock and actuation system. The main actuation mechanism for both door-pairs were recovered as was one lock actuator and two lock latches (there are normally 4 lock systems). Figure 24 below shows the reverser mechanism.

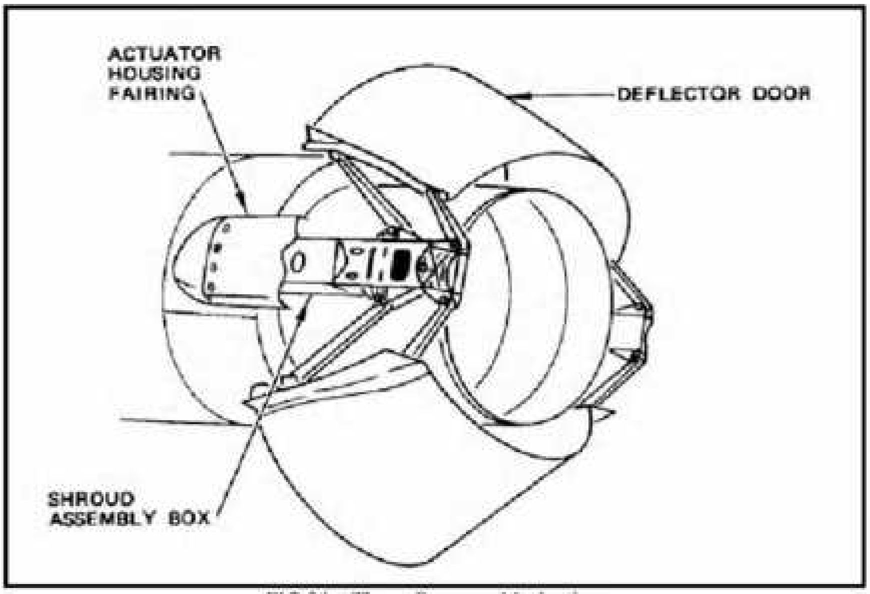

FIG 24 – Thrust Reverser Mechanism

Portions of all four actuation mechanisms were recovered. These portions consist mainly of the links and driver assembly. One partial cylinder (of 4) hydraulic actuators was found.


FIG 25 – One of four recovered TR actuation mechanisms

Two of the four mechanisms were noted to be in a deployed or partially deployed position. Further examination resulted in locating each pair of mechanisms. Of each pair, one mechanism was found in the stowed position whilst the other is noted to be in the deployed or partially deployed position. Further examination is necessary.

Empennage

Recovered parts includes large section of R/H horizontal stabilizer, left hand horizontal stabilizer outboard section, upper section of vertical stabilizer, both R/H and L/H outboard section of elevators, part of horizontal stabilizer center section rear spar, rudder Power Control Unit (PCU), PCU attach fittings, elevator upper torque tube, large number of small skin sections and hinge fittings.

Parts not recovered were R/H and L/H elevator tabs, inboard section of R/H and L/H elevators, inboard section of L/H horizontal stabilizer, lower section of vertical stabilizer, rudder, and most of the horizontal stabilizer center section.

FIG 26 Empennage parts

Horizontal Stabilizer R/H:

Approximately 75 percent of right hand horizontal stabilizer has been recovered. Stabilizer is in two large and two small assemblies and number of small pieces.

FIG 27 R/H Stabilizer with Elevator

FIG 27A Inboard view of R/H Stabilizer

Upper Skin R/H:

FIG 28 Upper Skin

FIG 28A Upper Skin

Upper skin is in two large pieces and two small pieces with some missing section. There are number of tears in the skin.

First tear is from aft end at SSta 120.30 (outboard of rib) going fwd-outboard through rib at SSta 129.5 to front spar at approximate SSta 135.

Second tear is at outboard of SSta 147.90 going fwd-outboard to SSta 164.

Leading edge is in three sections as follows:

FIG 29 Leading Edge

FIG 29A Inboard View of Leading Edge

Inboard to LESta 142.45
LESta 142.45 to LESta 176
Section from LESta 176 to LESta 193 is missing

Note: Leading edges were attached to the stabilizer.

<u>Lower Skin R/H:</u>

Lower skin is in four pieces as follow:

Tear from SSta 131 going fwd-outboard to SSta 142
Tear from SSta 171 going fwd and midway going outboard and turning inboard ending at SSta 175
Tear is at SSta 230

<u>Ribs R/H:</u>

All ribs are attached to the skins except ribs at SSta 139.70, 147.90, 157.10, 166.30, 175.50, and 184.70. Rib at SSta 129.30 is cut aft 2/3 section of it is separated. All the ribs are found.

<u>Trailing edge box R/H:</u>

Section of trailing edge box from SSta 193.90 to inboard is missing. There are three pieces of 2 to 2.5 feet section of lower aft hat section were found. Majority of inboard section is missing.

<u>Stabilizer Spars R/H:</u>

Aft spar from inboard to SSta 193.90 is missing. Front spar was attached to the leading edge however, broken in pieces.

FIG 30 Aft View of Stabilizer

Elevator R/H:

Two large pieces of elevators were recovered. The inboard section from outboard tab cutout location to inboard section of elevator is missing. All attachments of elevator to stabilizer were broken.

FIG 31 Elevator

FIG 31A Edge of elevator at the tab cutout

Elevator Tab R/H:

Missing

Horizontal Stabilizer L/H:

Approximately 35 percent of left hand horizontal stabilizer has been recovered. Stabilizer is in three large assemblies and number of pieces.

FIG 32 Stabilizer

FIG 32A Stabilizer

FIG 32B Stabilizer

Recovered sections are:

From SSta 120.30 to SSta 147.90
From SSta 147.90 to SSta 222
From SSta 222 to outboard

The inboard section of the stabilizer is missing (approximately 1/3 of stabilizer). The mid section crushed and tangled.


FIG 32C Stabilizer

Upper and Lower Skin L/H:

Upper and lower skin has a number of cracks and tears with ribs attached to them.


FIG 33 Upper Skin

Some upper/lower inboard skins were recovered.


FIG 33A Stabilizer Upper/Lower Skin Pieces

Ribs L/H:

Ribs at the 2/3 outboard section of horizontal stabilizer were damaged and within the stabilizer box.


FIG 34 Inboard View of Damaged Stabilizer

Trailing edge box L/H:

Most of trailing edge box was missing.


FIG 35 Aft End of Horizontal Stabilizer

Elevator L/H:

One large piece of elevator is recovered (1/3 outboard section).


FIG 36 Elevator

Elevator Tab L/H:

Missing

Other Horizontal stabilizer parts L/H and R/H:

FIG 37 Elevator to Stabilizer Fittings and Balance Weight

FIG 37A Rear Spar Box Hat Sections and Hinge fittings

Horizontal Stabilizer Center Section

Very small parts of center section rear spar were discovered. The sections found were both right hand and left hand section with part of inboard section of horizontal stabilizer rear spar attached together. Left hand side was in three pieces. All bolts (6) were in place and tight.

FIG 38 Left Hand Side

FIG 38A Left Hand Side

FIG 38B Right Hand Side

FIG 38C Right Hand Side

Vertical Stabilizer

Upper 1/6 section of upper vertical stabilizer section plus some of the lower section skin were recovered. No major lower sections were recovered.

FIG 39 Upper Vertical Stabilizer

FIG 39A Lower Vertical Stabilizer Skin Sections

Vertical Attachment Fitting

The left hand aft upper attachment fitting was recovered.

FIG 40 Upper L/H Aft Attached Fitting

FIG 40A Upper L/H Aft Attached Fitting

FIG 40B Lower Section of Aft L/H Spar

Rudder

Some skin panels were recovered plus upper rudder balance weight and rudder PCU attached fittings

FIG 41 Upper Rudder Balance weight

FIG 42 Rudder PCU Attached Fittings with PCU

Other rudder to vertical stabilizer attachment fittings

FIG 43 Rudder to Vertical Stabilizer fitting

FIG 43A Rudder to Vertical Stabilizer fitting

Wing and Landing Gear

Nearly all the airplane's recovered wing parts were fractured in small pieces. Pieces were found from LH wing tip to RH wing tip. Local fire and/or smoke damage RH WBL 415.93 trailing edge rib, and trailing edge structure at various locations. No melted aluminum found.

FIG 44 General overview of a 2D layout of the RH wing looking inboard from the wing tip.

- 1 of 8 (total per airplane) fixed trailing edge aileron hinge fittings (ref D6-15897 pg 54). With partial aileron attached.

FIG 45 Side View of 1 fixed trailing edge aileron hinge fitting. (WBL location unknown) (ref D6-15897 pg 54). Hinge rib and portion of the wing rear spar is shown. Portion of the aileron is shown on the right side.

FIG 45A Plan View of the hinge shown in Fig. 2.
Fixed trailing edge aileron hinge fitting. (ref D6-15897 pg 54).

- RH aileron partial - containing tab push rods and tab mast fitting.

FIG 46 Plan View RH aileron partial - containing tab push rods and tab mast fitting.

FIG 46A Bottom View RH aileron partial - containing tab push rods and tab mast fitting.

FIG 46B Aux View RH aileron (partial) - containing tab push rods at forward end.

- LH and RH wing tip structure - RH with Devore logo light fairing. (ref D6-15897 pg 57) shown without logo light fairing (variable installation).

FIG 47 Left Hand View RH logo light fairing.

FIG 47A Folded out View LH logo light fairing missing.

FIG 47B Plan View LH wing tip lower skin with rear spar lower chord horizontal flange shown on the left.

- LH and RH wing box structure from tip to side of body - partial with front and rear spars - partial and upper and lower wing skin assys (ref D6-15897 pg 44 – 44.3).

FIG 48 Pieces of outboard wing box.

FIG 48A Pieces of outboard wing box.

FIG 48B Pieces of outboard wing box.

FIG 48C Pieces of LH outboard wing box lower skin at WBL 103 and rear spar. View looking down and forward.

- LH and RH side of body splice - partial lower splice including some stringer end fittings. (ref BBL 70.85).


FIG 49 RBL 70.85 lower splice looking down and forward


FIG 49A LBL 70.85 lower splice looking down and forward

FIG 49B LBL 70.85 lower rear spar chord splice looking down and forward

- Center wing box upper and lower skins and stringers partial (ref D6-15897 pg 52.1).

NO PICTURE

- Fixed trailing edge flap tracks 5 out of 8 were found (1, 2, 3, 6, 7 or 8).

FIG 50 Track no. 7 or 8

FIG 50A Track no. 3 or 6

FIG 50B Track no. 3 or 6

FIG 50C Track no. 1 or 2

FIG 50D Track no.1 or 2

- Fixed trailing edge panels partial LH or RH between WBL 415.93 and WBL 560. (ref D6-15897 pg 56).

FIG 51 upper trailing edge panels.

- Trailing edge ribs at WBL 415.93 (ref D6-15897 pg 56).

FIG 51A trailing edge rib at LH WBL 415.93.

FIG 51B trailing edge rib at RH WBL 415.93.

- Inboard and Outboard flap assemblies partial and spoiler assemblies partial

FIG 52 Ship set of the 4 outbd flap - track fairing support fittings broken as shown

FIG 52A Inboard flap torque tubes


FIG 52B RH inbd midflap inbd end


FIG 52C Flap and Spoiler components


FIG 52D Flap and Spoiler components

FIG 52E Flap and Spoiler components

- Small pieces of leading edge, slats, and K-flaps (ref D6-15897 pg 49-52).

FIG 53 Slat tracks and fixed leading edge roller ribs

FIG 53A Slat components

FIG 53B Krueger flap partial


FIG 54 - 65-49541 Wing Leading Edge Access Panel at the Nacelle. (Upper Leading Edge).


FIG 55 - 65-71926 Flipper Flap Assy – Inbd Trailing Edge Flap

FIG 56 - 65-46995-15 Aileron Bus Quadrant Wing Sta 518.86

FIG 57 - 65-45437 series tension beam brackets on wing center section spanwise beam instl

Significant Parts Not Found-

- 7 of 8 fixed trailing edge aileron hinge fittings (ref D6-15897 pg 54).
- LH aileron and (no components or partial components).
- LH without Devore logo light fairing at the wing tip. (ref D6-15897 pg 57 shown without Devore logo light fairing. (This is a variable configuration).
- LH and RH side-of-body upper rib chords and upper skin and stringer end fittings.
- LH and RH side-of-body spar chord splice joints except LH lower was found as shown above.
- Center wing box spanwise beams (ref D6-15897 pg 58).
- LH and RH Center wing lower beams at BL 40.875 (ref D6-15897 pg 58.2).
- Wing center section longitudinal floor beams (ref D6-15897 pg 45.2).

- Wheel Well pressure deck (no components of partial components) (ref D6-15897 pg 42.4).
- Wing center section front and rear spar (ref D6-15897 pg 59).
- Fixed trailing edge flap tracks 3 out of 8 (4, 5, 7 or 8) (ref D6-15897 pg 53 and 54).

Main and Nose Landing Gear and Support Joints

The entire left main landing gear was recovered. Local fire damage near the LH main gear. Tire fire. LH tires were burnt complete. Fire and/or smoke damage to the outbd end of the RH main landing gear support beam. No melted aluminum found.

FIG 58 LH lower main landing gear assy shows evidence that the tires, wheels, and struts were subjected to fire

FIG 59A LH upper main landing gear assy

- LH and RH main landing gear support beam assys LH complete RH partial (outbd half) (ref D6-15897 pg 53).

FIG 60 LH main landing gear support beam aft half – split on bond line. Bearing bore shown.

FIG 60A LH main landing gear support beam inbd end – split on bond line. Shown attached to the swing link and body frame.

FIG 60B LH main landing gear support beam outbd end – split on bond line.

FIG 60C RH main landing gear support beam outbd end.
Smoke and/or heat damage on the outbd end.

- Nose Landing Gear

Nose gear assy broken in several places.

NO PICTURE

Significant Parts Not Found-

- RH main landing gear beam inbd half (ref D6-15897 pg 53).
- RH main gear assy (no components or partial components found). RH wheels and tires.
- Nose gear wheels and tires.

APPENDIX G

Captain's Profile

Date	Action
1981	Received Commercial Pilot License with Single/Multi-engine/Instrument Ratings @ Airline Training Institute
1983 to 1986	First Officer/Captain on DA-20 @ Imani Aviation
1986	Received DA-20 Conversion Training @ Flight Safety Intl., Moonachie, NJ
1986	Received BAC 1-11 Conversion Training
1986 to 1988	Deputy Director, Flight Ops @ Okada Airline
1988	B707 Conversion Training
1988 to 1990	Captain/Training Captain/Examiner on BAC 1-11 & B707 @ GAS Airline
1990 to 1992	Captain/Training Captain on BAC 1-11
1992 to 2004	Senior Logistic Controller @ Fan Milk (**Inactive from flying**)
June 3, 2004	ATP Certificate stolen @ LOS
June 15, 2004	Applies/Receives replacement ATP(valid June 23, 2004 to December 31, 2004)
June 16, 2004	Medical Certificate Received (Valid June 23 to December 31, 2004)
August 28, 2004	Completes B737 PIC Training Course @ Aero Services Aviation Center, Florida
October 21 to 30, 2004	Bellview Captain Phase 1 (Captain Under Training) (Start 32.0 Cum Hrs; End 68.1 hrs = 36.1 Cum Hrs)
November 4 to 9, 2004	Bellview Captain Phase 2 (Captain Under Supervision) (Start 90.0 Cum Hrs; End 101 Cum Hrs = 11.0 Cum Hrs)
November 9, 2004	Approved for Release as Line Captain
January 10 to 12, 2005	Dangerous Goods Training @ Bellview Learning Center
February 6, 2005	Recurrency Training @ United Flight Training Services, Denver, CO (Completion Certificate in File)
March 21 to 23, 2005	CRM Course @ Bellview Learning Center
May 28, 2005	Recurrency Training @ United Flight Training, Denver, CO (No Completion Certificate in file)