MINISTERE DE L'EQUIPEMENT, DES TRANSPORTS, DE L'AMENAGEMENT DU TERRITOIRE, DU LOGEMENT, DU TOURISME ET DE LA MER – BUREAU D'ENQUETES ET D'ANALYSES POUR LA SECURITE DE L'AVIATION CIVILE

BEA

Accident on 25 December 2003 at Cotonou Cadjèhoun aerodrome (Benin) to the Boeing 727-223 registered 3X-GDO operated by UTA (Union des Transports Africains)

REPORT TRANSLATION

3x-o031225a

F O R E W O R D

By application of Decree No 2003-563 of 26 December 2003, the government of the Republic of Benin set up a National Commission of Inquiry to shed light on the causes of the accident that occurred on 25 December 2003 at Cotonou Cadjèhoun. By Order No 3451/MDN/DC/SA of 30 December 2003, the President of this Commission delegated the technical investigation to the BEA (Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile), the French aircraft accident investigation bureau.

This report presents the technical conclusions reached by the BEA on the circumstances and causes of this accident. In accordance with Annex 13 of the Convention on International Civil aviation and with the legislation that regulates the BEA's activities (Book VII of the French Civil Aviation Code), the investigation into this accident is intended neither to apportion blame nor to assess individual or collective responsibility. The sole objective is to draw lessons from this occurrence which may help to prevent future accidents or incidents. Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous interpretations.

This investigation was greatly slowed down by the wide dispersion of those in positions of responsibility and the difficulties encountered by the investigators in obtaining precise information, usually gathered in the first few days, and regulatory documents relating to the airplane and the flight. This is in itself the first conclusion of the investigation.

The BEA thanks the Captain and the Chief Flight Attendant, whose help was invaluable. Their precise answers, which were strictly consistent with the two recordings and the findings, enabled the investigators to better understand the history of the flight and the crew's actions.

SPECIAL FOREWORD TO ENGLISH EDITION

This report has been translated and published by the BEA to make its reading easier for English-speaking people. As accurate as the translation may be, the original text in French should be considered as the work of reference.

Table of Contents

Glossary

AD	Airworthiness Directive
BEA	Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile
CAA	Civil Aviation Authority
CVR	Cockpit Voice Recorder
DGAC	French civil aviation directorate (Direction Générale de l'Aviation Civile)
DNAC	National civil aviation directorate (Direction Nationale de l'Aviation Civile)
FAA	Federal Aviation Administration
FAG	Financial Advisory Group
FDR	Flight Data Recorder
ft	Feet
JAR	Joint Airworthiness Requirements
kt	Knots
lb	Pounds
MEL	Minimum Equipment List
ICAO	International Civil Aviation Organisation
QNH	Altimeter setting to obtain aerodrome elevation when on the ground
SAMU	Emergency medical service
SARP	Standards And Recommended Practices
SOP	Standard Operating Procedure
TOW	Take-Off Weight
USOAP	Universal Safety Oversight Audit Program
UTA	Union des Transports Africains
UTC	Universal Time Coordinated

SYNOPSIS

Date and time
Thursday 25 December 2003
at 13 h 59 (1)

Aircraft
Boeing 727-223 registered 3X-GDO

Site of accident
Cotonou Cadjèhoun Aerodrome
(Republic of Benin)

Owner
Financial Advisory Group
Sharjah (United Arab Emirates)

Nature of flight
Public transport of passengers
Scheduled flight GIH 141
Conakry - Cotonou - Beirut - Dubai

Operator
Union des Transports Africains

Persons on board
Crew 10
Passengers 150*, including six babies

Summary

On 25 December 2003, arriving from Conakry (Guinea), the Boeing 727-223 registered 3X-GDO undertaking flight GIH 141 to Kufra (Libya) and Beirut (Lebanon) and Dubai (United Arab Emirates) stopped over at Cotonou. During takeoff the airplane, overloaded in an anarchic manner, was not able to climb at the usual rate and struck an airport building located a hundred and eighteen meters past the runway end on the extended runway centerline, crashed onto the beach and ended up in the ocean.

The government of the Republic of Benin set up a National Commission of Inquiry to shed light on the causes of the accident. The President of the Commission delegated the technical investigation to the BEA, the French aircraft accident investigation bureau, and invited the States involved (2) to nominate Accredited Representatives to participate in the investigation, in accordance with the provisions of Annex 13 to the Chicago Convention.

Casualties	Crew members	Passengers	Others
Fatal	5	133 *	3 *
Serious	5	17	1
Light/none	-	-	-

* Note: some doubts remain as to the total number of passengers.

(1) Except where otherwise noted, the times shown in this report are expressed in Universal Time Coordinated (UTC). One hour should be added to obtain the legal time applicable in Benin on the day of the accident.
(2) Guinea, United States, Lebanon.

1 - FACTUAL INFORMATION

1.1 History of the Flight

Note: the following description results from facts established at the accident site, readout of the flight recorders and the testimony gathered.

Flight GIH 141 was a weekly scheduled flight, performed by the Union des Transports Africains (UTA), between Conakry (Guinea), Cotonou (Benin), Beirut (Lebanon) and Dubai (United Arab Emirates). A stopover at Kufra (Libya) was planned between Cotonou and Beirut.

Having departed from Conakry at 10 h 07 with eighty-six passengers, including three babies, and ten crewmembers, the Boeing 727-223 registered 3X-GDO landed at Cotonou Cadjèhoun on 25 December 2003 at 12 h 25. Nine passengers disembarked.

Sixty-three persons, including two babies, checked in at the airport check-in desk. Ten others, including one baby, boarded from an aircraft that had arrived from Lomé (Togo). Passenger boarding and baggage loading took place in a climate of great confusion. The airplane was full. In the cockpit, two UTA executives were occupying the jump seats. Faced with the particularly large number and size of the hand baggage, the chief flight attendant informed the Captain of the situation.

The ground handling company's agents began loading the baggage in the aft hold when one of the operator's agents, who remains unidentified, asked them to continue loading in the forward hold, which already contained baggage. When the operation was finished, the hold was full.

During this time, the crew prepared the airplane for the second flight segment. The co-pilot was discussing his concerns with the UTA executives, reminding them of the importance of determining the precise weight of the loading of the airplane. The flight plan for Kufra, signed by the Captain, was filed with the ATC office but the meteorological dossier that had been prepared was not collected. Fuel was added to fill up the airplane's tanks (14,244 liters, or 11.4 metric tons). The accompanying mechanics added some oil. The Captain determined the limitations for the flight and selected the following configuration: flaps 25°, air conditioning units shut down.

At 13 h 47 min 55, the crew began the pre-flight checklist. Calm was restored in the cockpit. At 13 h 52 min 12, flight GIH 141 was cleared to roll. The co-pilot was pilot flying (PF). The elevator was set at 6 ¾, it was stated that the takeoff would be performed with full power applied with brakes on, followed by a climb at three degrees maximum to gain speed, with no turn after landing gear retraction.

As the roll was beginning, a flight attendant informed the cockpit that passengers who wanted to sit near their friends were still standing and did not want to sit down. The airline's Director General called the people in the cabin to order.

Take-off thrust was requested at 13 h 58 min 01, brake release was performed at 13 h 58 min 15. The airplane accelerated. In the tower, the assistant controller noted that the take-off roll was long, though he did not pay any particular attention to it. At 13 h 59, a speed of a hundred and thirty-seven knots was reached. The Captain called out V1 and Vr. The co-pilot pulled back on the control column. This action initially had no effect on the airplane's angle of attack. The Captain called « Rotate, rotate »; the co-pilot pulled back harder. The angle of attack only increased slowly. When the airplane had hardly left the ground, it struck the building containing the localizer on the extended runway centerline, at 13 h 59 min 11. The right main landing gear broke off and ripped off a part of the underwing flaps on the right wing. The airplane banked slightly to the right and crashed onto the beach. It broke into several pieces and ended up in the ocean.

The two controllers present in the tower heard the noise and, looking in the direction of the takeoff, saw the airplane plunge towards the ground. Immediately afterwards, a cloud of dust and sand prevented anything else being seen.

The fire brigade duty chief stated that the airplane seemed to have struck the localizer building. The firefighters went to the site and noticed the damage to the building and the presence of a casualty, a technician who was working there during the takeoff. Noticing some aircraft parts on the beach, they went there through a service gate beyond the installations. Some survivors were still in the wreckage, others were in the water or on the beach. Some inhabitants from the immediate vicinity crowded around, complicating the rescuers' task. The town fire brigade, the Red Cross and the Cotonou SAMU, along with some members of the police, arrived some minutes later.

1.2 Injuries to persons

To this day, given the difficulties encountered in finding and identifying the victims [(3),] due to the extent of the disaster and the imprecision of the information concerning the people on board, between a hundred and forty and a and hundred and forty-eight fatalities can be recorded. There were twenty-two survivors, including the Captain, the Flight Engineer and the Director General of the airline. The technician who was in the building struck by the airplane was also seriously injured.

Note: the number of victims and survivors exceeded the number of persons on board according to the manifests (see § 1.16.1.2). This is one of numerous inconsistencies brought to light in the course of this investigation. It is possible that there were some passengers on board who were not included on the manifests or that there were people on the beach at the time of the accident, even though the latter seems less plausible since no disappearances were notified. It is also likely that some errors were made in identifying the bodies: shortly before this report was written, two bodies were sent back from Bangladesh to Lebanon.

(3) One hundred and forty-one bodies were found, of which twelve have still not been identified, and there are seven missing persons whose DNA does not correspond to that of the bodies found but not identified.

1.3 Damage to Aircraft

The airplane was destroyed.

1.4 Other Damage

The localizer building was destroyed. The aerodrome perimeter wall was damaged.

1.5 Personnel Information

1.5.1 Flight Crew

Note: information regarding the Flight Crew was requested from UTA and from the Guinean and Libyan administrative authorities.

1.5.1.1 Captain

Male, aged 49.

Air Transport Pilot's License (ATPL) No 347 issued by Libya on 5 March 1988, valid until 9 January 2004, not validated by the Guinean DNAC.

Commercial Pilot's License (CPL) No 119847 issued by the United Kingdom on 30 August 1977, validation No 47/03 by the Guinean DNAC for a period of three months on 9 December 2003.

Instrument and international radiotelephony ratings also issued in the United Kingdom (August 1977).

Medical Air Operator Certificate valid until 15 January 2004.

Type rating on Boeing 727 obtained on 28 February 1980 in the United States.

Other type ratings: PA 28, PA 39, Fokker 27, Boeing 707.

Pilot Instructor from 1992 with Libyan Arab Airlines. CRM stage 1 training performed in 1994 with instructors from Royal Jordanian Airlines.

Professional experience:

- 11,000 flying hours in total including 5,000 as Captain;
- 8,000 flying hours on type including 5,000 as Captain;
- flying hours in the previous six months: *information not obtained*;
- flying hours in the previous three months: *information not obtained*;
- flying hours in the previous thirty days: *information not obtained*.

Note: the last entry on the pilot's log book was made on 2 July 2003.

Checks: *information not obtained*.

A Pilot for Libyan Arab Airlines, where he flew on Boeing 727's equipped with JT8-D15 engines, the Captain joined the FAG (Financial Advisory Group) on 11 March 2003, with availability until 10 March 2004. In this context, he had first worked for three months for Royal Jordanian Airlines then for six months for Trans Air Benin. During the latter period, he regularly landed a Boeing 727 at Pointe Noire and at Cotonou. On 8 December 2003, he had performed his first flight for UTA.

Over eighteen days, he had performed about sixty-seven flying hours. In fact, in the absence of any records of his activity as requested from the operator, the following flights were able to be traced: five trips from Dubai - Conakry or Conakry - Dubai, with corresponding durations, based on the flying times of GIH 141, of twelve hours and twelve hours twenty minutes with in-service times of fifteen hours and fifteen hours thirty minutes. On 24 December, one Conakry - Freetown - Banjul - Dakar - Freetown - Conakry rotation, that is to say more than four hours flying. On the morning of the 25th, the Conakry - Cotonou route, with a duration of two hours thirty minutes.

Note: the Accredited Representative of Guinea indicated that the national regulations recommend, for a flight with four legs and a crew of three, a limitation of nine hours flying time for the flight crew over a twenty-four hour service period. For cabin crew, the UTA operations manual sets a limit of eleven flying hours with in-service time of fourteen hours.

1.5.1.2 Co-pilot

Male, aged 49.

Air Transport Pilot's License (ATPL) No 347 issued by Libya on 1st March 2001, valid until 9 January 2004, not validated by the Guinean DNAC.

Commercial Pilot's License (CPL) No 119847 issued by the United Kingdom on 13 October 1979, validation No 47/03 by the Guinean DNAC for a period of three months on 9 December 2003.

Medical certificate valid until 14 January 2004.

Professional experience and checks: *information not obtained*.

The co-pilot had joined FAG on secondment from Libyan Arab Airlines. Like the Captain, he had performed his first flight for UTA on 8 December 2003 and had done exactly the same things since that date.

1.5.1.3 Flight Engineer

Male, aged 45.

Flight Engineer License No 120 issued by Libya on 19 February 2002, validation No 48/03 by the Guinean DNAC for three months on 9 December 2003.

Medical certificate valid until 30 April 2004.

Professional experience:

- 14,000 flying hours in total, all on 727-700;
- flying hours in the previous six months: *information not obtained*;
- flying hours in the previous three months: *information not obtained*;
- flying hours in the previous thirty days: *information not obtained*.

Checks: *information not obtained*.

The Flight Engineer had joined FAG on secondment from Libyan Arab Airlines. Like the Captain, he had performed his first flight for UTA on 8 December 2003 and had done exactly the same things since that date.

1.5.2 Cabin Crew

Note: after 8 December 2003, the cabin crew performed the same flights as the Flight Crew. They had no written contract with the operator. The information relating to their training, experience and working hours was requested from the operator and the Guinean authorities.

1.5.2.1 Chief Flight Attendant

Female, aged 26.

License 37/DNAC/02 issued on 14 May 2002 by the Guinean DNAC, valid until 27 June 2004.

Ab initio training in Liberia then training course in safety and rescue in Conakry.

Flying hours: *information not obtained*.

The chief flight attendant did not know her total flying hours since the beginning of her work with UTA (about two years). She had been flying on Boeing 727 since July 2003. It was however possible to reconstitute her work time since 25 September 2003, with, in total, two hundred and sixty hours.

1.5.2.2 Flight Attendants

- Female, aged 22.
  License 73/DNAC/03 issued on 15 September 2003 by the Guinean DNAC, valid until 29 October 2004.
  Flying hours*: information not obtained*.

- Female, aged 22.
  License 74/DNAC/03 issued on 21 November 2003 by the Guinean DNAC, valid until 2 December 2004.
  Flying hours: *information not obtained*.

- Female, aged 22.
  License 66/DNAC/03 issued on 1st April 2003 by the Guinean DNAC, valid until 26 March 2004.
  Flying hours: *information not obtained*.

1.5.3 Other crew members

Three persons accompanied the airplane on all of its flights, two ground mechanics and a transporter, an agent of the airline. The operator considered them as members of the crew.

The two ground mechanics were recruited by FAG and were paid by UTA. They were responsible for the daily maintenance of the airplane. One of them was authorized to sign off the airplane for return to service. They shared avionic specialties, engines and structure.

The mechanic who survived was able to give details of his professional experience: fifteen years in the Peruvian Air Force, six years in civil aviation including one year with Air Peru, two years in a maintenance workshop and three in a company undertaking Boeing 727 maintenance. He had worked for FAG for seven months and on the route for two months. He was an engine specialist.

According to information supplied by the manager of UTA, the transporter was responsible for paying the expenses incurred at each stopover (refueling and assistance). He said that he had stayed in the airplane during the stopover in Cotonou on 25 December.

1.5.4 ATC Personnel

The air traffic controller on duty on the day of the accident had been trained at the African Meteorological and Civil aviation School in Niamey. He was qualified to undertake the functions of tower controller. He had an assistant, a controller in training in the tower. The latter was handling the radio communications, under the Duty Controller’s responsibility.

1.6 Aircraft Information

Note: the information in this chapter, along with that in 1.17 on the operation of the airplane in 2003, was obtained from a highly incomplete set of disparate documents that were gathered with great difficulty during the course of the investigation.

1.6.1 Airplane

Manufacturer	Boeing Aircraft Corporation
Type	Boeing 727-223
Serial number	21370
Registration	3X-GDO
Date of construction	June 1977
Airworthiness Certificate	03/014/CN issued 15 October 2003, valid until 14 April 2004
Utilization to 25 December 2003	67,186 flying hours; 40,452 cycles (source Guinea CAA (DNAC)
Utilization since last C-check	1,076 cycles

At the time of the accident the airplane was configured with twelve first class, a hundred and twenty-eight economy class seats, along with and six seats reserved for airline personnel. There were also five seats in the cockpit and four cabin crew jump seats

1.6.2 Engines

	Engine No 1	**Engine No 2**	**Engine No 3**
Manufacturer	Pratt & Whitney	Pratt & Whitney	Pratt & Whitney
Type	JT8D-9A	JT8D-9A	JT8D-9A
Serial number - according to DNAC * document (30 December 2003) - according to ARIANA (10 February 2003) - noted at the site	665193 665189 ** **	654780 654780 654780 654780	665341 665880 665880 665880
Installation date	***	***	***
Total flying hours	77,924	81,485	66,503
Flying hours since installation	***	***	***
Cycles since installation	***	***	***

* Source Pegasus Aviation Group, 11 July 2002.
** Engine No 1 could not be brought to dry land. Its serial number could not be checked.
*** Information not obtained.

1.6.3 History

The Boeing 727-223 serial number 21370 was registered N865AA from June 1977 to January 2003. It was operated by American Airlines before being stored on 18 October 2001, through the Pegasus Aviation Group, in the Mojave Desert in California. It was not possible to obtain the number of flying hours it had performed up to then. On 20 February 2002, it became the property of Wells Fargo Bank Northwest.

In January 2003, the airplane was sold to the Financial Advisory Group whose headquarters was in Miami (Florida). This company owns transport category aircraft that it leases to various operators. It is apparently currently based in the Virgin Islands, according to information provided by its office in Sharjah (United Arab Emirates), an office that appears to have managed the airplane from the time of its purchase and was the only interlocutor for its successive operators.

On 15 January 2003, an FAA authorization allowed the new operator, Ariana Afghan Airlines, to undertake a ferry flight to Afghanistan under the YA-FAK registration. This authorization was subject to the obligation to perform the flight with a crew designated by the FAA and, before any new period of operation, to applying the conditional Airworthiness Directives to the airplane.

From 23 June 2003, the airplane was operated by Alpha Omega Airways in Swaziland under the 3D-FAK registration. On 8 July, this operator, presenting itself as the owner of the airplane, leased it with a crew (ACMI [(4)] contract) for thirty days to UTA, which operated it from 9 July 2003 onwards. On 13 October, UTA signed a second lease for the same airplane, this time with FAG (note that it was the same person, the Director General of FAG, who signed both contracts). This contract came into effect on the 15th for a period of six months. Its main clauses were as follows:

- FAG had to make the airplane available to UTA in Conakry, in good condition for operations and in accordance with the AD's;
- FAG had to make a qualified crew available to UTA;
- FAG had to take care of base maintenance for the airplane;
- UTA had to take care of line maintenance of the airplane, this to be undertaken by personnel recruited by FAG and approved by both parties. UTA had to update the airplane's flight and maintenance documents. These documents had to be in accordance with the regulations;
- UTA was responsible for all of the direct operating costs, including the salaries and insurance for the aircrew and maintenance personnel recruited by FAG;
- the airplane was leased on the basis of eighty hours use per month.

Also on 15 October 2003, the Guinean DNAC (Direction Nationale de l'Aviation Civile) registered the airplane under the registration 3X-GDO and, while waiting for UTA to write its own documentation, approved the Flight Manual for three months that had originally been approved by the FAA, along with the Minimum Equipment List (MEL) and the maintenance manual issued by American Airlines.

(4) Aircraft Crew Maintenance Insurance

The documents presented at that time were the Certificate of cancellation from Swaziland and the airplane leasing contract.

On 14 November 2003, the DNAC approved the MEL of the Boeing 727 3X-GDO and the revised Operations Manual.

At the same time as its successive registrations in Afghanistan, Swaziland and Guinea, the airplane received three Airworthiness Certificates without special restrictions. Its three operators were successively registered as being its owner. A table showing the history of the airplane is included in the appendices.

1.6.4 Maintenance

The last major overhaul (C check) was carried out at 64,975 flying hours on 19 January 2001 by American Airlines at Tulsa (United States).

During the airplane's period of storage, some maintenance actions were undertaken by Pegasus Aviation Group. Thus, on 11 July 2002, engines 1 and 3 were replaced by engines from the Boeing 727-223 registered N862AA (serial number 21089). Following these operations the serial numbers of engines were as follows:

- engine number 1: 665193;
- engine number 2: 654780;
- engine number 3: 665341.

After the arrival of the airplane in Afghanistan, between January and February 2003, maintenance was undertaken by Ariana Maintenance Hangar, a subsidiary of Ariana Afghan Airlines

- application of Airworthiness Directives 90-25-03 (anti-corrosion treatment) and 2001-22-12 (search for and identification of corrosion and of cracks on the horizontal stabilizer);
- B4 check;
- maintenance program as scheduled in the airplane's maintenance log.

The maintenance program was based on that of American Airlines:

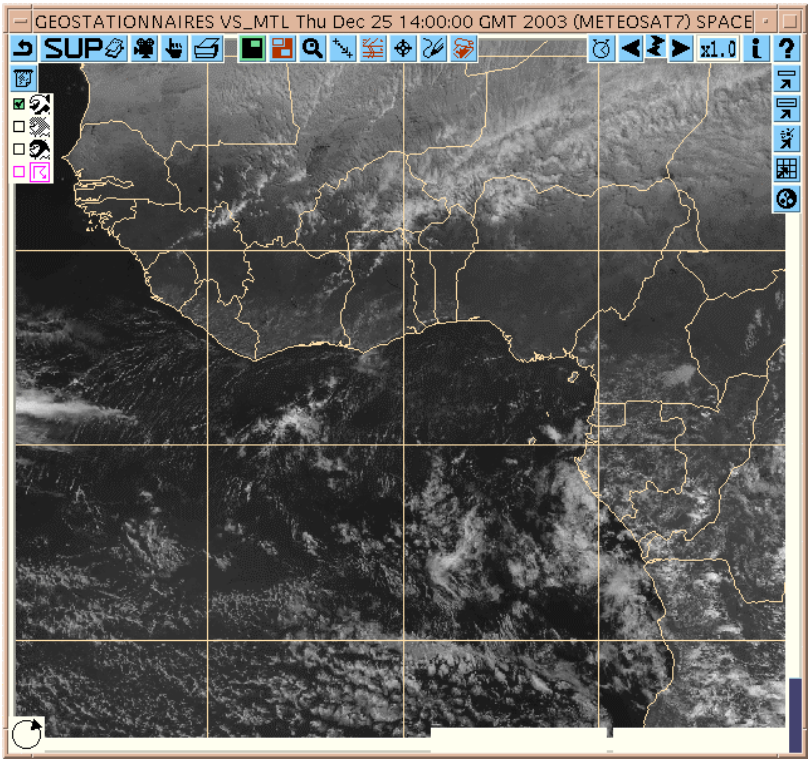
- check A: 65 flying hours;
- check B: 475 flying hours;
- check C (partial): 3,000 flying hours;
- check C (complete): 14,000 flying hours or 3,650 days.

The Director General of UTA stated that Ariana was still contracted to FAG for the airplane's maintenance For his part, the president of FAG stated that the maintenance contracts with Ariana were suspended. Despite repeated requests, no documents were supplied relating to the airplane's maintenance after its departure from the United States, in particular documents relating to the change of engine that was noted on the aircraft wreckage.

1.7 Meteorological Information

1.7.1 General situation

On 25 December, with winter established over western Africa, the intertropical convergence zone was broken up. The cirrus covering the Sahel indicated the subtropical jet stream and not the top of a line of cumulonimbus. Infrared and visible satellite images show that the situation was stable.



1.7.2 Situation and evolution at Cotonou on the day of the accident

In a dry and stable atmospheric environment, Cotonou, located on the coast, was subject to light breezes at night, with the formation of mist at dawn. At sunrise, the wind became variable, and while the temperature rose from 26 to 32 °C at 14 h 00, the sea breeze came up, variable from the south at 6 kt. The sky was covered with fine cirrus and some strato-cumulus at 1,500 feet. The visibility was no greater than eight kilometers with humidity at 75%. The QNH was 1009 hPa.

METAR DBBB 251400Z 17006KT 130V210 8000 FEW015 BKN250 32/27 Q1009 NOSIG=

TAF DBBB 250950Z 251212 20008KT 8000 SCT013 TEMPO1417 FEW013 FEW023CB BECMG 0305 VRB3KT 3000 BR BKN010=

1.8 Aids to navigation

Not applicable.

1.9 Communications

The ATC service's radio communications at Cotonou aerodrome were recorded. They include a time reference expressed in UTC. The transcript of the communications with flight GIH 141 is included in the appendices. It shows nothing abnormal.

1.10 Aerodrome information

1.10.1 Infrastructure

Cotonou Cadjèhoun is a civil aerodrome open to public air traffic. It has one runway 06/24, 2 400 x 45 m, made of tarred concrete; reference altitude is 17 ft, the altitude of the threshold of runway 06 (057°) is 16 ft, the altitude of the threshold of runway 24 (237°) is 15 ft. It is equipped with a category II ILS, a localizer and a VOR/DME. There is no radar at the aerodrome.

The localizer building, built more than thirty-five years ago, is 118 m from the end of runway 24. It was 2.45 m high.

Note: Annex 14 to the Chicago Convention requires (paragraph 8.7.2) that equipment or installations needed for navigation that have to be located on a safety area at the end of a runway must be frangible and be as low as possible. This regulation is to be put into effect before 1st January 2010 for aids to navigation already constructed. Although the standard specifies ninety meters, the Annex recommends, in paragraph 3.4.3, that the safety area at the end of the runway should extend from the end of the runway strip over a distance of at least two hundred and forty meters when the aerodrome reference code is 3 or 4, which is the case at Cotonou.

1.10.2 Departure procedures

There is only one taxiway to reach the runway from the aerodrome ramp. The airplane must thus taxi up the runway and turn around at the end on the turn-around area provided.

At the time of the accident, runway 24 was in service. In that direction, the take-off runway available (TORA) and distance available (TODA) was 2,400 m; the acceleration-stop distance available (ASDA) was 2,455 m, which corresponds to a stopway of fifty-five meters.

1.10.3 Rescue and fire fighting

The level of protection for the rescue and fire fighting services is 8, according to the ICAO classification. The personnel include forty firefighters (two teams of ten, two of nine and two supervisors). The team has one low-power vehicle, four medium power vehicles, one runway vehicle and one command vehicle.

1.11 Flight Recorders

1.11.1 Recovery of recorders

Two recorders were installed as per regulations on board 3X-GDO: one Cockpit Voice Recorder (CVR) and one Flight Data Recorder (FDR).

They were recovered on 27 December 2003 by a team of military divers from Benin, France and Lebanon. The aft part of the fuselage in which the two recorders were found immersed was resting on the sandy bottom between one and a half and five meters deep. The recorders were still attached to their connecters and each was in an oblong container. The CVR could be removed easily, but the FDR had to be removed with its container. Both were placed in fresh water and handed over to the Cotonou Gendarmerie. The CVR was only slightly damaged and the FDR had impact marks on one of its outer sides.

On 2 January 2004, in order to facilitate transport to the BEA, the CVR's protective casing was removed and the FDR was removed from its container, in the presence of an officer of the Judicial Police. The CVR's protective casing and the FDR were sealed for transportation to France.

1.11.2 Characteristics of recorders and readout operations

1.11.2.1 CVR

- Manufacturer: FAIRCHILD
- Type: A100
- Type number: 93-A100-80
- Serial number: 52232

The CVR records four parallel tracks with duration of thirty minutes on a magnetic tape loop. It was slightly damaged. The magnetic tape was wound back on a new reel after cleaning with alcohol and drying. It was then placed on an appropriate player and the readout speed was adjusted to the 400 Hz parasite signal broadcast by the on-board electrical system.

Since the crew were not using the headphones only track 2, which recorded the cockpit area microphone, contained exchanges in the cockpit in Arabic, English and French. The quality of the recording was poor. On the other tracks, the radio communications in French and English were found. These communications allowed a UTC reference time to be calculated, by comparison with the control tower recording. The effective length of the recording was thirty-one minutes and forty seconds. It began at 13 h 27 min 35 s and ended at 13 h 59 min 15 s.

1.11.2.2 FDR

- Manufacturer: ALLIED SIGNAL
- Type: 4120
- Type number: 980-4120-RXUS
- Serial number: 4421

The FDR was a static memory recorder with a recording duration of at least twenty-five hours. It was opened so as to access the protected module containing the memory. The outer connector was corroded and covered with grains of sand. It was thus necessary to replace it. The content of the memory was read out in the form of a binary file.

The conversion of this file into flight parameters expressed in physical units was carried out with the aid of a document supplied by American Airlines since the operator did not possess the conversion document. The correlation between the data concerning the control column and the elevator was checked with Boeing over the twenty-five hours of available recordings. This brought to light a systematic lag and the parameters were corrected as a result.

The following parameters were recorded:

Aileron controls	Autopilot (discrete)
Elevator control	Longitudinal acceleration
Rudder pedals *	Normal acceleration
Ailerons	Computed airspeed
Elevator	Pressure altitude
Rudder	Magnetic heading
Angle of attack	Engine 1 pressure report
Roll angle	Engine 2 pressure report
VHF (discrete)	Engine 3 pressure report

* The parameter representing the position of the rudder pedals was not valid throughout the recording.

The data was synchronized with the radio communications. The correspondence between the FDR time and UTC time was carried out by associating the transmit/receive signals recorded on the FDR with the time they were recorded on the tower tape.

Note: the recording frequency of the VHF parameter (one value per second) makes it impossible to obtain accuracy any greater than a second.

1.11.3 Analysis of data

Notes:

- In addition to the recorded parameters (see graphs in appendix 3), the ground speed of the airplane and the distance run after brake release were calculated by successive integration of horizontal acceleration data [(5)]. These are however of limited accuracy.
- Taking into account the poor quality of the recording and of the exchanges before the beginning of the take-off roll, identification of the voices (sometimes still uncertain), the transcription of the recording and its translation took an exceptionally long time.

There was a lot of noise during flight preparation. Most of the discussions were about the loading of the airplane and these exchanges were between the flight crew and various UTA representatives.

At 13 h 49 min 32 s, flight GIH 141 was cleared to start up.

At 13 h 52 min 12 s, it was cleared to taxi.

At 13 h 53 min 34 s, the Captain said « Make it one three seven, one four seven ». There was a discussion on the number of people on board then the Captain asked for silence for the pre-flight check-list.

At 13 h 56 min 28 s, the co-pilot stated the take-off conditions: « Under the brakes … maximum power »; « I will climb maximum three degrees nose up until I build up my speed ».

At 13 h 57 min 40 s, flight GIH 141 was cleared for take-off.

At 13 h 58 min 01 s, take-off thrust was called for and applied with the brakes on. The brakes were released at 13 h 58 min 15 s.

At 13 h 58 min 24 s, the Captain called for a « push »; this instruction was followed by a forward control column movement.

At 13 h 58 min 40 s, the Captain called out the speed of 80 kt, the calculations then show a roll distance of about 480 m since brake release.

At 13 h 59 min 00 s, the Captain called out « V1, VR ». The roll distance was about 1,620 m and the speed 137 kt. Simultaneously, the co-pilot made an elevator input [(6)] which passed from – 5.6° to + 10° in two seconds. The airplane's angle of attack remained constant and the speed continued to increase.

At 13 h 59 min 02 s, the speed was 140 kt, the roll distance calculated from brake release was about 1,780 m. A background noise appeared that only stopped after the impact with the localizer building. The Captain called out « Rotate, rotate » and

(5) Horizontal acceleration is the sum of the horizontal components of vertical and normal acceleration.

(6) Throughout the take-off, the control column inputs were perfectly correlated with the movement of the elevator.

the co-pilot pulled back harder. The value of the angle of attack began to vary from – 1.2° to a maximum of 9° at an angular speed of about one degree a second.

At 13 h 59 min 04 s, the elevator angle reached + 16°, the angle of attack 0.5° and the speed was then 145 kt.

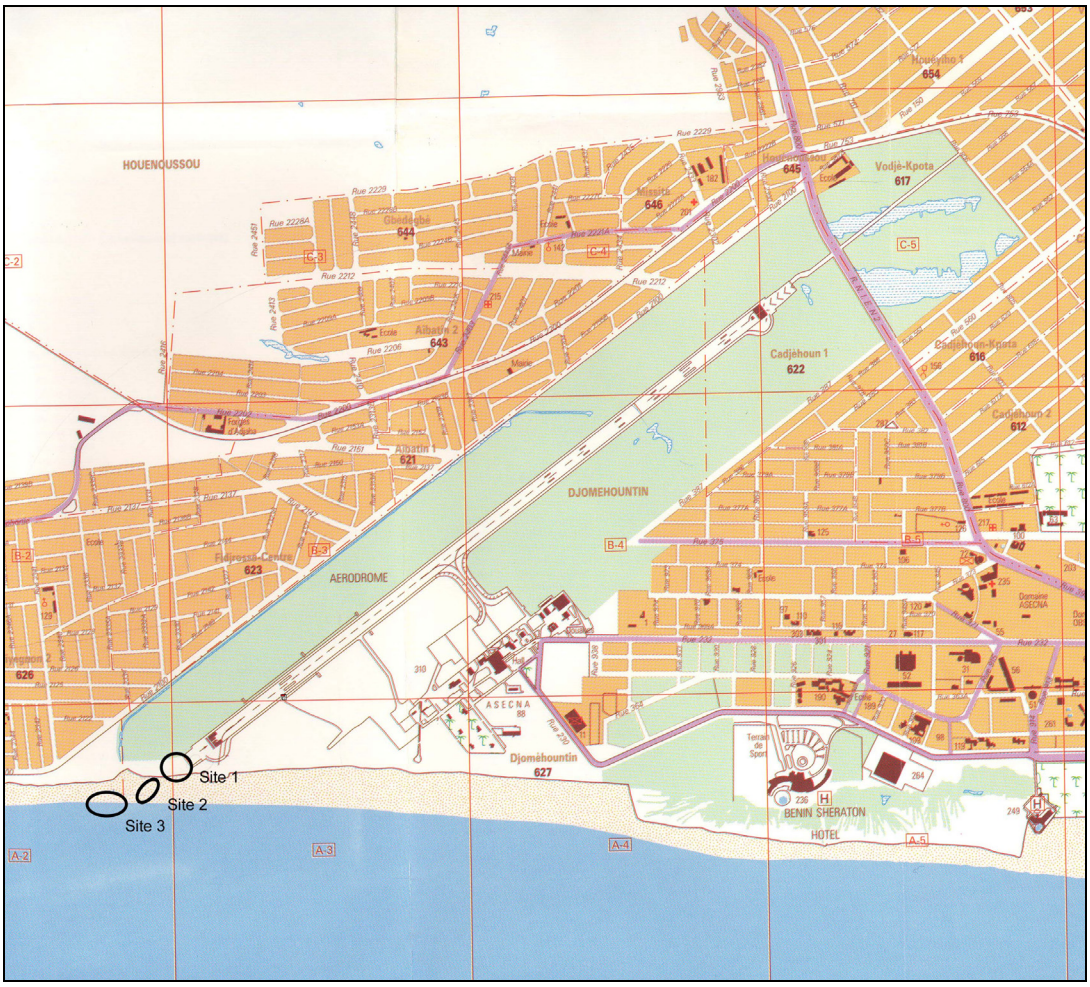
Lift off occurred at about 13 h 59 min 07 s, when the roll distance was about 2,100 m and the speed 148 kt.

At 13 h 59 min 09 s, the Captain said, urgently, « Pull, pull, pull … ».

At 13 h 59 min 11 s, as the speed of the airplane reached 155 kt, the sound of the first impact is heard. A sudden decrease in longitudinal acceleration and angle of attack correspond to this.

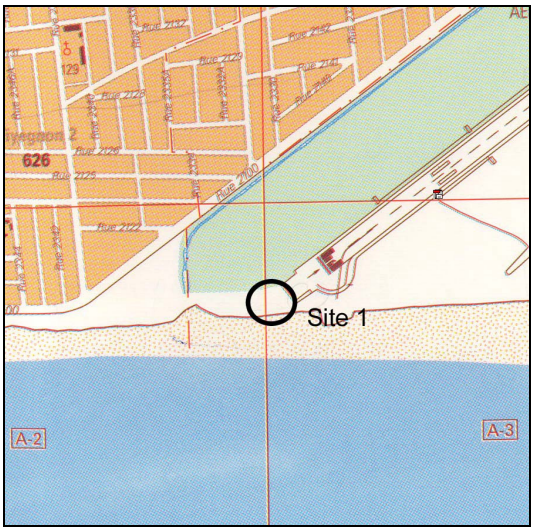
1.12 Wreckage and Impact Information

The airplane struck a technical building after the end of the runway (site 1), crashed onto the beach (site 2) and ended up in the ocean (site 3).

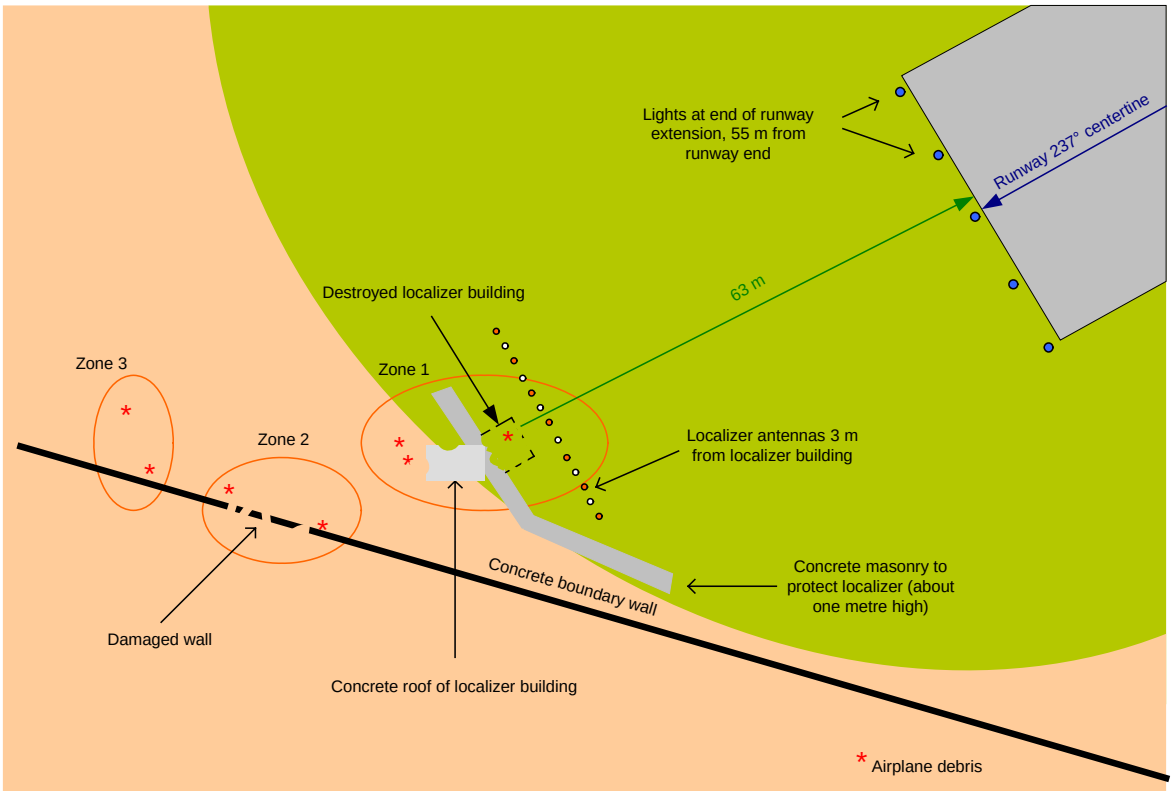


1.12.1 Within the aerodrome

Site 1



The illustration of site 1 (below) shows the distribution of the airplane debris in three distinct zones, with a total area of about 1,550 m².



Zone 1

The airplane damaged the localizer antennas, which were about a hundred and fifteen meters from the end of the runway, then destroyed the reinforced concrete building housing the electronic equipment bays.

The photo below shows the north wall of the building with a black mark on the right side caused by the right inner tire. This mark was one meter twenty from the ground.

On the east wall of the building, at a height of two meters ten, marks were found from a burst tire from the left main landing gear.

The roof of the building was torn off. It rotated 45° to the left and was thrown nine meters to the south.

Damage on the right was noted that was caused by the right main landing gear, on the central part marks were left by the lower part of the fuselage and on the left side there was damage caused by the left main landing gear.

A part of the airplane's tail and some steps from the retractable ventral stairs were also found among the debris inside the building. The right main landing gear and its outer right wheel were found fifteen and eighteen meters southwest of the building respectively. The rims showed marks of the wheels' collision with the building.

Zone 2

A part of the aerodrome boundary wall located on the runway extended centerline, at a distance of thirty-five meters from the localizer building, was damaged.

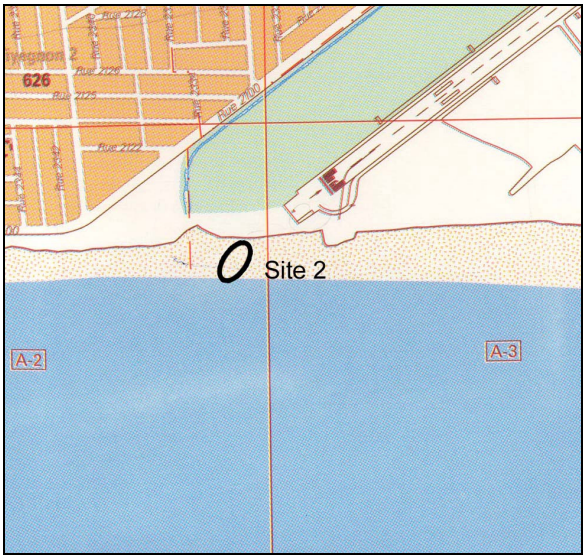
Direction of take-off

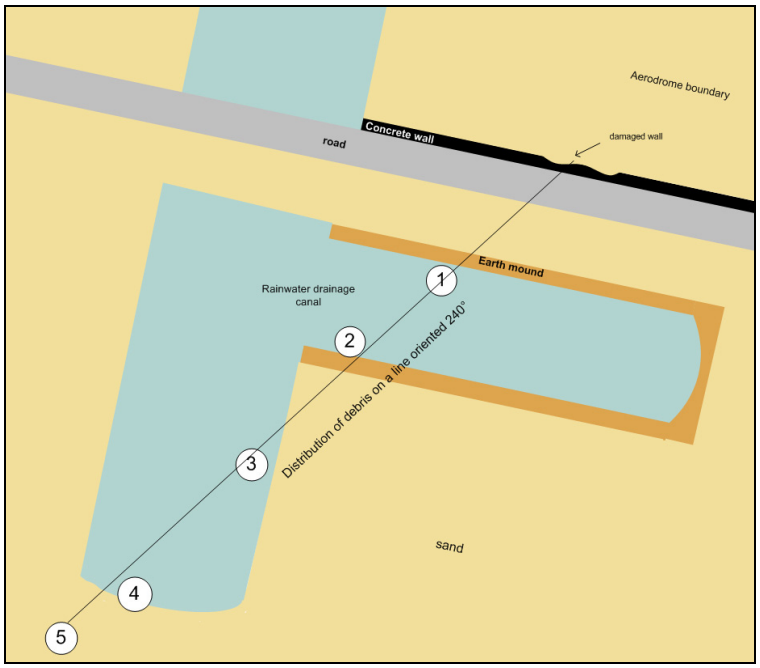
Some small debris from the lower part of the fuselage, a part of a flap and a landing gear door were also found near the damaged part of the wall.

Zone 3

Six meters to the west of the previously-mentioned parts, two parts of the right flap were found. Tire marks were found on the underside along with a circular-shaped puncture about two centimeters deep.

1.12.2 On the beach





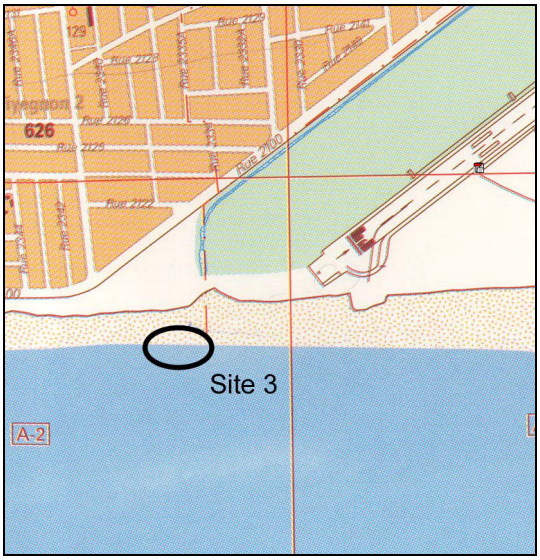
The plan of site 2 shows the position of the parts found in the rain drainage channel that crossed it. The heavy parts, numbered ① to ⑤ indicate the airplane's path after it passed over the aerodrome boundary wall.

The cylinder, the drag strut, the pivot link, parts of the side strut, the lock crank and the right ① main landing gear support beam ① were found in the canal, a hundred and fifty meters from the boundary.

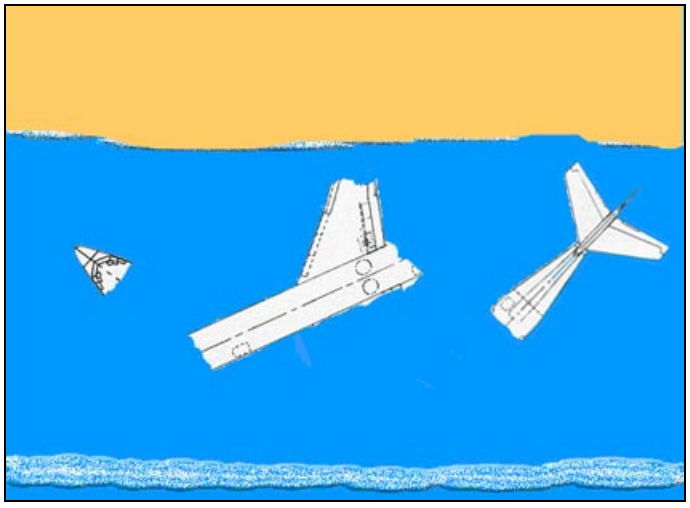
Beyond, near the opposite bank but in the water, a part of the right inner flap ②, with its screwjack and, a few meters away, a piece of the right wing with a part of the outer right aileron ③ were found.

On the left bank of the canal, a part of the skin of the right wing ④ was found, then, five meters away, another part of the right wing with a leading edge slat ⑤.

1.12.3 In the ocean



The main parts of the airplane were found in the ocean, in an area where the depth of water varied between three and ten meters. The waves that were breaking about fifty meters out kept the wreckage close to the shoreline.



The main part of the airplane had turned over and only the lower part of the fuselage and the underside of the left wing were visible. Both of the outer engines had separated from the tail.

The accessible elements were towed back to the beach with cables. They were only secured some hours after the accident. The parts that were recovered represented about a half of the airplane's overall structure, more than half the fuselage and the left engine were missing.

Undersea searches that were undertaken by divers from the French Navy and the BEA did not enable other significant parts of the aircraft to be identified, in particular the left engine, apparently displaced and covered in sand by the currents, which are particularly strong in that area.

1.12.4 Examination of wreckage

Left main landing gear

The rims of the inner wheels showed marks of the collision with the roof of the localizer building.

Right engine

The majority of engine 3 was intact. The thrust reverser was still attached to the engine, in the retracted position. No damage due to a fire or an uncontained burst was noted.

The visible part of the low pressure turbine did not show any signs of malfunction.

The nose cowl was crushed and twisted. The visible fan blades were intact, with the exception of a blade that had marks from an impact with a hard object on its leading edge. The visible main stage blades were severely damaged. One of them had broken off just above its base and the others were generally broken off about halfway up and bore impact marks on their leading edges.

Inside the engine, a part of the main stage was covered in sand in which blade fragments, a piece of honeycomb structure and a flattened oil tank were found.

Central engine

The visible parts of engine 2 showed no signs of damage due to a fire or an uncontained burst. The nose cowl was missing. The thrust reverser, in the retracted position, and the exhaust section were intact. The last stage low pressure turbine blades were intact, which indicated that the turbine assembly was intact. The nose dome was slightly dented and pushed in. The compressor blades were not all visible due to the damage to the air intake channel, and the visible main stage blades were relatively lightly damaged.

Tail

During recovery operations, the tail broke in two, the rudder and the central engine in one part and the stabilizer and the elevator in the other. The stabilizer jackscrew was intact; its drive cables were broken.

The position of the jackscrew did not make it possible to validate the position of the stabilizer, the cause and the sequence of the cable ruptures being undetermined.

Central section

The central part of the wreckage consisted of the center box and part of the left wing. On the section of the center box that corresponded to the right wing root, it was noted that the latter had separated from the fuselage with a forward to aft movement.

Cockpit

The cockpit was not very damaged, except for the Flight engineer's panel and a large part of the equipment. There was a strong compression mark on the floor and the skin of the partition and the outer right side of the fuselage. The nose gear had been ripped off.

Only a few indications could be noted. Taking into account the shocks resulting from the impact and the number of people that had been in direct contact with the wreckage, these values must be interpreted with caution.

On the Captain's instrument panel:

- airspeed indicator: 152 kt, index: 147 kt;
- altimeter: 20 ft; altimeter reference: 1010 hPa, 29,82 in Hg;
- HSI: heading 240°;
- time: 10 h 30 UTC.

On the co-pilot's panel:

- airspeed indicator: 151 kt, index 147 kt;
- altimeter: 250 ft; altimeter reference: 1015 hPa, 29,97 in Hg;
- HSI: heading 240;
- altitude alert selected on the barometer: 29.59 in Hg.

On the center panel and control panel:

- emergency airspeed indicator: 0 kt; index 148 kt;
- hydraulic brake pressure: 3,250 psi;
- pneumatic pressure: 1,200 psi;
- engines:

	No 1	**No 2**	**No 3**
EPR (needles)	< 1.00	1.05	1.32
EPR (index)	1.8	1.9	2.0
N1	0	0	0
EGT	600	0	500
N2	0	0	0
FF	1 700	2 650	750

- thrust levers useable;
- landing gear control lever in intermediate (OFF) position, between the UP and DOWN positions;
- outer flap indicator:
  - right: 35°,
  - left: 40°;
- inner flap indicator:
  - right: 5°,
  - left: 2°;
- STAB TRIM: 6 ¾.

1.13 Medical and Pathological Information

1.13.1 Casualties

Twenty-seven survivors were taken to Cotonou hospital by the emergency services. Five died of their injuries in the following hours.

1.13.2 Killed

The bodies of the victims were taken to various morgues in Cotonou and Abomey-Calavi.

1.13.3 Toxicological research

The examinations carried out on the flight crew brought to light no evidence of substances likely to affect performance.

1.14 Fire

There was no fire.

1.15 Survival Aspects

After the accident, several thousand people went to the site, which interfered with the rescue operations, especially as the fire service vehicles could not access the beach or became bogged down in the sand. There was no coordination between the staff of the various organizations concerned. The existing action plan was not put into effect. Since it had been written, no safety and rescue operations had been organized. Fisherman helped to recover some victims.

The survivors that the investigators were able to meet were all seated in the forward and aft parts of the airplane, near the fuselage areas that ruptured.

It was impossible to determine the exact positions of the passengers, since seats had not been allocated during check-in. One of the survivors, so as to stay near his friends, had sat on the back of one the flight attendant's seats. Another survivor, seated at the rear of the airplane, had seen people fly off their seats and, at the moment of impact, "fly around the cabin". According to the testimony gathered, some passengers had not attached their seatbelts.

In the cockpit, the co-pilot died as a result of injuries sustained from the impact on the right side of the airplane. The other four persons survived.

1.16 Tests and Research

1.16.1 Weight and balance

1.16.1.1 Context and documents available

Before any public transport flight, a weight and balance sheet must be made for the airplane, detailing its loading and weight distribution (ICAO - Annex 6, § 4.3.1) so as to allow the Captain to check that the weight limitations and the center of gravity are not exceeded. Two copies of the sheet are usually made, one to be kept on board and the other to be filed by the operator's local agent. Annex 6 specifies that the preparation sheets that must be completed by the operator before a flight must be kept by the operator for three months.

The weight and balance sheets for both flights on 25 December could not be provided to the investigators by the operator, or indeed any of the general documents on the weight of the airplane, or any loading plan for the departures from Conakry and Cotonou. In general, the operator was unable to supply any documents relating to the airplane's previous flights.

The handling services at the airport, for their part (see 1.17.3.2) stated that the operator did not ask them to supply such sheets before flights. However, the Lebanese Accredited Representative was able to supply six weight and balance sheets, including one with Alpha Omega Airlines (and not Airways!) headed paper and three weight and balance sheets, all on Alpha Omega Airlines headed paper, filled out during stops in Beirut.

The only documents available for the flights on 25 December were the manifests, that is to say the lists of passengers (with no mention of assigned seats) and of hold baggage, according to the origin and the destination. For flights departing from Cotonou, there were seven different more or less correctly filled out manifests.

These findings confirm the content of the interviews with the Captain and the recordings of conversations before take-off: a representative of UTA supplied the data for airplane loading to the crew and the latter determined the weight and balance of the airplane. The weight and balance sheet came from Alpha Omega Airways (a fragment of such a sheet was in fact found in the wreckage).

Note: there are significant differences between the airplane limitations on the weight and balance sheet used and those defined in the manufacturer's documentation. Thus, the maximum take-off weight authorized therein is 86.4 tons instead of 80.7 tons. The weight and balance sheets used correspond to another version of the Boeing 727.

1.16.1.2 Determination of airplane's weight

On departure from Cotonou, on the basis of indications received, the crew had estimated the airplane's take-off weight (TOW) at seventy-eight tons, which corresponded to the runway limitation on the day with flaps 25. In the absence of the weight and balance sheet, the investigators tried to reconstitute the values by taking into account the various elements available for the 25 December flights.

Note: the Operations Manual supplied by UTA contains no indication on the method to be used to complete the weight and balance sheet, in particular relating to an evaluation of the weight of the passengers. Verbally, the operator indicated that they used a figure of 75 kg per adult.

Basic operating weight

The basic operating weight, or corrected basic weight, is a characteristic of any airplane. It corresponds to the weight of the airplane with equipment but without fuel, to which are added the weight of the crew and the on-board documentation. This value, essential when calculating the airplane's take-off weight, must be included in the airplane's documentation. Nevertheless, it was not possible for the investigators to obtain this documentation, nor to identify clearly the place where it might be kept. Furthermore, several different values for the weight were given to the investigators. On 26 June 2001, according to a document from American Airlines supplied by the owner of the airplane, it was 44.8 tons. On a document dated 8 July 2003, also apparently supplied by the owner of the airplane, it was given as 47.04 tons, whereas on 9 August 2003, an empty weight of 43.5 tons, corresponding to the last C check in the United States, was provided by the operator to the Guinean DNAC. As to the weight and balance sheets filled out in Beirut, the one with Alpha Omega Airlines headed paper used a figure of 47.04 tons, while three others, filled out between 17 November and 5 December, gave a value of 47.17 tons and the last two, filled out on 15 and 19 December, gave a value of 46.2 tons. Finally, the Captain stated that he used a value of 46.3 tons.

The attributed values available thus vary significantly for the period of operation of the airplane by UTA, which is materially impossible. The operator did not specify completion of any modifications to the airplane's equipment or to the composition of the crew. The investigators noted that the commercial configuration of the airplane delivered on 8 July by Alpha Omega Airways was different from that of American Airlines and that the six airline personnel seats appeared on 22 October, though these changes do not explain the variations found between November and December.

For the purposes of calculation, a spread from 43.5 to 47.17 tons was used, although it is the upper end of the scale that is most likely.

Persons on board

Note: determining the number of persons on board was particularly difficult, in the absence of any general documentation and, as indicated in paragraph 1.2, there remains doubt as to the exact figure. However, this uncertainty does not significantly alter the results of the following calculations and the conclusions that it is possible to draw from them.

According to the manifests, on take-off from Conakry there were eighty-six passengers, including four children and three babies [7]. Forty-five persons from Freetown (Sierra Leone), including sixteen officers from Bangladesh on a UN mission, had boarded without any transit checks. In Cotonou, nine passengers disembarked, sixty-three persons, including three children and two babies, were checked in at the airport desk, and ten others, including one child and a baby, boarded directly from an airplane that had arrived from Lomé (Togo). This results in a total of one hundred and thirty-six adult passengers, eight children and six babies. This total is consistent with the number of seats available (see 1.6.1), babies not being counted as occupying a seat.

The real weight of the passengers is unknown, as is that of their baggage, although testimony indicates that there was a lot of large heavy baggage. In UTA's day-to-day operations, passengers arriving at the check-in desk were not limited to any specific weight or dimensions for their hand baggage.

Note: the investigation showed that it was possible for last-minute passengers to buy their boarding card from passengers that had already checked in. The names of passengers were not on the boarding cards.

The standard weight allowed per adult passenger, with hand baggage, varies according to the operator and the nature of the flight. UTA used a figure of 75 kg, although the weight and balance sheets on departure from Beirut show weight variations from 75 to 84 kg. In comparison, Air France counts 84 kg on a scheduled medium haul flight, as does the JAR-OPS 1 (1.620). The allowance for a child is generally 35 kg.

On this basis, a figure of between 10,480 and 11,704 kg for the passengers and the hand baggage is obtained [8].

Loading of the airplane

According to the documents and the testimony, the quantity of fuel carried was twenty-three tons. Three hundred kilos should be deducted for taxiing.

For the baggage checked in, an extra charge is made beyond the maximum noted on the flight ticket. For UTA, this weight was variable according to the coupons, between 30 and 50 kg per adult and 15 kg per child or baby. Other airlines allow lower weights and dimensions and apply higher rates for excess baggage.

The weight of the hold baggage that was checked in, according to the incomplete information on the manifests, was 4.675 kg. In addition, testimony corroborates that no cargo was loaded at Conakry and at Cotonou.

(7) The babies (children under the age of two) are not considered as passengers in the strict sense of the term. They are not taken into account in the load calculations.

(8) The crew is not taken into account in this calculation since it is normally included in the corrected basic weight, even if it is likely that the operator had not modified this weight to take account of the security escort and the two non-crew mechanics.

Note: the manifest relating to the nine passengers that disembarked at Cotonou does not show any baggage checked in. The baggage handlers claimed, however, that they unloaded about ten bags when the airplane arrived. This shows the limits in the accuracy of the preceding calculation.

Calculation of takeoff weight

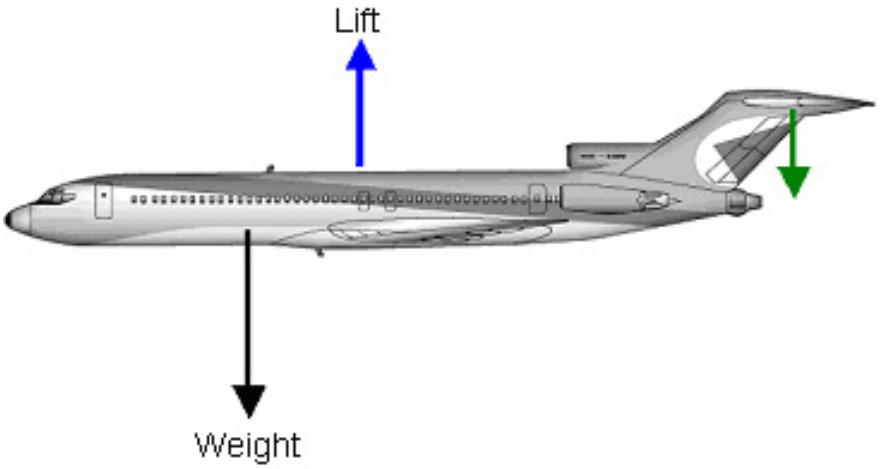
By taking the extremes of the various values in the preceding, and adding them together, the airplane's take-off weight at Cotonou was theoretically somewhere between 81.355 and 86.249 kg.

To obtain some precision for these values, calculations based on the airplane's performances were made (see 1.16.1.4). These calculations give a take-off weight for the airplane of 85.5 tons, with a variable of 500 kg.

1.16.1.3. Determination of airplane's weight and balance

The flap (25°) and stabilizer (6 ¾) settings chosen by the crew, which are confirmed both by the testimony and the observations made on the wreckage, as well as the declared weight of 78 tons, show that the center of gravity allowed for by the crew was 19%. This value is consistent with a normally balanced airplane.

Note: in very general terms, three forces contribute to the pitch balance of the Boeing 727 at the time of rotation. The aerodynamic forces on the wings, acting upwards; the aerodynamic forces on the stabilizer, acting downwards, which depend on its setting; and the weight of the airplane, acting downwards. As the airplane pivots around its main landing gear, the pitch-up or pitch-down effect of each of these forces will depend on its distance from the gear. The weight is applied at the center of gravity. The more the airplane is loaded forwards, the more its center of gravity moves forward and the greater the moment is. The pilot must thus adjust the stabilizer setting so that the airplane is practically balanced at the rotation speed and so that the pitch-up effect of the elevator allows for take-off. Respecting the balance limits is essential to the stability and maneuverability of the airplane. The value of the center of gravity, associated with the airplane's configuration, determines the correct adjustment of the stabilizer setting on take-off so as to ensure the effectiveness of the stabilizer.



In fact it is not known what the load distribution was in the holds, or even in the cabin, since no loading plan was made. The only thing that could be determined was that the forward hold was full of baggage. Equally, the airplane's dry operating index, that is to say its empty center of gravity, could not be identified. On the documents from Lebanon, two different indices (21.5 and 23.0) had been used. It was not therefore possible to reconstitute the airplane's center of gravity as it was on 25 December.

The graphs obtained from the recorded parameters (see appendix) show that, when the stick was pulled back, the elevator was immediately set in pitch-up position, but that the airplane's response time was very slow compared to the usual time, the nose lifting off late while the acceleration was continuing. Such a situation at the beginning of the climb-out indicates either a limitation in the elevator's operation or an airplane with a center of gravity that is too far forward.

Checks on the wreckage did not reveal any evidence that would support the theory that there was a malfunction of the airplane's elevator system. The calculations made on the basis of airplane performance during take-off (see 1.16.1.4) gave a center of gravity value of 14%, that is to say a forward balance that would require a stabilizer setting of 7 ¾.

The eight previous take-offs were also analyzed (graphs in appendix). These show that during the previous take-off from Cotonou (flight No 8) the pitch-up control input had immediately been followed by an increase in the airplane's angle of attack. The previous day, on flight No 2, the rotation had been performed spontaneously at a speed of around one hundred knots, without any elevator input, and there had then been some stick push so as to control the rotation.

1.16.1.4 Performance calculations

It has been shown that the airplane's estimated take-off weight was greater, by several tons, than the maximum acceptable value under the conditions of the day of the accident. However such excess weight, though it lengthened the take-off run [(9)], which would have been about 1,300 meters with a weight of 78 tons, and though it increased the rotation speed (in the take-off conditions, Vr was 130 kt for a weight of 78 tons), does not explain the shape of the curves on the graphs, nor the airplane's problems in lifting off. From information supplied by the manufacturer, it seems that even a weight of 86 tons would still have allowed the airplane to clear the obstacle.

Given the absence of reliable data on airplane loading, the investigators looked for confirmation of the weight of the airplane, based on the recorded parameters. They also asked Boeing to reconstitute the values of the parameters determining the airplane's recorded performance on take-off. These calculations were based on take-offs from Conakry and Cotonou on the day of the accident and on the previous take-off from Cotonou. They confirmed the results of the calculations

(9) A higher weight would reduce the airplane's acceleration and it would take it longer and it would need a greater distance to reach the same speed.

made at the BEA on the distance rolled and the weight of the airplane and provided some indications as to the real balance of the airplane.

It was thus determined that the take-off from Cotonou was performed at a weight of 85.5 ± 0.5 tons, which corresponds to a theoretical take-off roll of about 1,650 meters, a Vr of 137 kt, and a center of gravity at 14%. The Boeing specialists confirmed that such a center of gravity, if it were not taken into account in the elevator setting, would make the rotation slow and difficult at the speed selected. They added that, on the basis of a simulation made based on the established weight and balance conditions, a rapid and vigorous input on the stick would nevertheless have allowed the airplane to take off more rapidly and thus pass over the obstacle.

Under the same conditions, the take-off from Conakry was performed at a weight of 81 ± 0.5 tons and center of gravity of 16%. However, by making a similar calculation to that in paragraph 1.16.1.2 for this take-off, a spread of between only 74 and 78 .3 tons results. It therefore seems that about three tons of undeclared airplane loading took place between Conakry and Cotonou.

Finally, the previous take-off from Cotonou had been performed at a weight of 79 ± 0.5 tons, with center of gravity at 18%.

Note: given the time scheduled for the flight, the high 32 °C temperature contributed to reducing the airplane's performance at the time of the acceleration. The figure supplied by the crew and taken into account by them was the temperature in the shade. The runway temperature, supposing that it was significantly higher, would have further diminished the airplane's performance at take-off. Comparisons between these two temperatures in the middle of the day were thus made during the work performed on the site; no significant difference was noted.

1.16.2 Takeoff noise

The noise that appeared at 13 h 59 min 02 s, immediately before the airplane's angle of attack began to increase, had a practically constant frequency of 0.035 Hz. The comparison with various noises recorded on a Boeing 727 on the ground showed only one frequency close to this value, that of one of two stick shakers with which the airplane is equipped.

The accident airplane was equipped with only one stick shaker motor, on the left side. The Captain who, in fact, described the majority of the established facts precisely, did not note any stick shaker activation. The Flight Engineer, for his part, did not remember any such warning. Furthermore, the speed range during which the noise is heard is at least ten knots higher than that of the stick shaker initiation speed, that is to say 129 kt for a weight of 85.5 tons and a center of gravity of 14%. This hypothesis was therefore eliminated since it implied an untimely initiation of the stick shaker that was unnoticed by two crew members. They described what they heard as being like the extension of the nose gear followed by some vibration from the same gear.

1.17 Organizational and Management Information

1.17.1 Obligations of States with Regard to Safety Oversight

1.17.1.1 The international context

The responsibilities and international obligations of States in relation to safety oversight are derived from the Convention of 7 December 1944 on Civil Aviation, known as the Chicago Convention, *in order that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically.*

The Convention recognizes (article one) that *each State has complete and exclusive sovereignty over airspace above its territory*.

Furthermore, it stipulates (article 12) that States ensure that any aircraft flying over its territory or maneuvering thereon, as well as any aircraft with its registration mark, wherever it may be found, should be in conformity with the rules and regulations applicable in the place where the flight or the maneuver is taking place.

The Convention also specifies (in articles 31 and 32) that States of Registry must issue Airworthiness Certificates to aircraft undertaking international flights and certificates and licenses to their crews. However, article 83 authorizes the partial or total transfer of these responsibilities, as well as those relating to article 12, to the State of Operator of the aircraft.

To ensure harmony between these various obligations, the Convention introduces, in article 12, an obligation for national regulations to be in conformity with the rules established pursuant to the Convention [(10)] and, in article 33, the international recognition of documents issued by the State of Registry in so far as they correspond to the standards.

This implies that each State adopts a law or a civil aviation code, completed by the necessary rules of application, to put into place and apply the international standards. This also implies that each State may ascertain that other States are satisfactorily undertaking their commitments. Specifically, if the rules adopted by other States are inferior to international standards, article 38 stipulates that these differences be notified to the Council.

Note: bilateral agreements often set out the conditions of application of international provisions.

[(10)] Article 37 stipulates the adoption of standards, recommended practices and international procedures. The eighteen Annexes to the Convention contain standards and recommended practices covering the entire field of civil aviation activities.

1.17.1.2 State of Registry

The obligations derived from articles 31 and 32 of the Chicago Convention are detailed in Annexes 1 « Personnel Licensing» and 8 « Airworthiness of Aircraft». Article 39 stipulates that certificates and licenses be annotated if they do not meet international standards.

Thus, the State that intends to register an aircraft must:

- determine that the aircraft meets the minimum established standards and issue an Airworthiness Certificate for it;
- ensure that the airworthiness of the aircraft is maintained, that is to say to ensure that it is overhauled and maintained in good condition for flight, wherever it may be used in the world;
- issue or validate as necessary licenses and ratings for flight crew;
- take the appropriate steps to remedy any reported failings in the maintenance of the aircraft and its use.

The methods to apply to meet these responsibilities may include the transfer of some tasks to private organizations or to other States. This transfer does not include a transfer of responsibility, except in cases specifically covered by article 38b where there is a transfer to the State of Operator.

1.17.1.3 State of Operator

Safety in air transport does not depend solely on the certification of the airplane but also on the conditions of its use. These obligations are the responsibility of the operator and are set out in Annex 6 «Technical Operation of Aircraft ».

Annex 6 specifies (section 4.2.1) that the State of Operator is responsible for issuing an Air Operator Certificate, or an air operations license, authorizing a company to undertake the commercial transport of passengers or of cargo. This State is obliged to ensure that any operator authorized by it has the organization and means available to guarantee the safety of operations, including a method for oversight of flights, a program of training for flight crew and satisfactory provisions in terms of maintenance, and that it diligently undertake any appropriate corrective measures, where necessary.

Some detailed information is given in Supplement F to the Annex and in the manual on inspection procedures, authorizations and continuous surveillance of operations (Doc 8335). It also states that continuous surveillance by the State of Operator is an essential element in the latter's responsibilities and that the inspection prior to certification of the operator should ensure that the latter has made adequate provision to ensure service at stopovers and to help the flight crew perform their duties at all of the aerodromes used.

The State of the Operator must check the Operations Manual (Annex 6 – 4.2.2) and approve the operator's Minimum Equipment List (Annex 6 – 6.1.2).

Note: the Air Operator Certificate is not covered by the Chicago Convention. It is thus not required on board aircraft in application of article 29 and, not being covered by article 39, does not need to be annotated. Nevertheless, in application of article 38, differences with standards laid out in Annex 6 must be notified.

1.17.1.4 States on the route

Article16 of the Convention gives the authorities of a State *the right, without unreasonable delay, to search aircraft of the other contracting States on landing or on departure and to inspect the certificates and other documents prescribed by the Convention*. This article forms the judicial basis of ground inspections or foreign transport aircraft.

Thus, a State may ensure that the aircraft that stop over on its territory are in good flying condition, at least with regard to the checks that it is possible to perform on the apron, that is to say without recourse to a workshop. The checks performed are necessarily superficial, except where a particularly suspect aircraft is immobilized for a long period, and relate to the documentation, the equipment carried and the accessible parts of the airplane. They do not make it possible to ensure the correct operation of the inner workings of the airplane, nor of correct use thereof nor of its crew's real skills.

In order that these inspections be as effective as possible, it is therefore important that the State of Operator, when duly informed, determine the cause of any inadequacies found and impose fundamental corrective measures on the airline, where required.

It should be noted that States where a stopover occurs have no responsibility in checking flight preparation or loading of the airplane, even though it is clear that they are the only ones able to really ensure these basic elements for the safety of the upcoming flight have been carried out correctly.

Note: on 1st June 2003, the Lebanese DNAC set up a program of technical inspections on airplanes on stopovers. For its part, the Beninese DNAC only carries out inspections of documents on the aircraft that land at Cotonou. It does not have the resources available to allow it to go further and carry out technical inspections.

1.17.1.5 Audits of safety oversight

The ICAO, during its 1995 Assembly, set up a program of audits of safety oversight. This program, through audits of States, is aimed at ensuring the States' capacity to fulfill their responsibilities for safety oversight, in particular through effective application of the standards and recommended practices in Annexes 1, 6 and 8.

Initially carried out on a voluntary basis, the program was modified in November 1998 to become systematic and regular. Since then it has been called the Universal Safety Oversight Audit Program (USOAP).

In context of the USOAP, audits and audit follow-up missions have been undertaken, among others, to Guinea from 16 to 22 January 2001 then from 26 to 29 January 2004, to Benin from 17 to 24 January 2000 then from 19 to 22 January 2004, to Lebanon from 3 to 10 April 2000 then from 27 June to 1st July 2002.

The audit reports are confidential and are handed over to the civil aviation authorities of the States concerned. The ICAO makes available report summaries for other States that show any difficulties in the area of safety oversight that a State may have experienced at the time of the audit, along with the planned corrective measures. However, it does not provide an updated list of States that continue to present shortcomings in their obligations in this area.

According to a note presented by the General Secretariat of the Organisation at the time of the 35th session of the Assembly (WP 63), an analysis of the 153 audit follow-up missions made up to 31 July 2004 shows that some States have not made satisfactory progress in resolving the shortcomings that were noted in terms of safety. Almost 30% of States audited had difficulty in putting into effect their plan of corrective action in relation to operational regulations, qualified technical staff and resolving safety problems. It should be added that eight States did not submit a plan for corrective action after their first audit and that twelve States, including Sierra Leone, could not be audited for various reasons.

1.17.2 Oversight

According to the indications supplied by the Guinean DNAC, national regulations are based on the provisions of the Annexes to the Chicago Convention. A ministerial decree established the reference and the use of the provisions of the Annexes and associated ICAO documents as the basis for regulations in all areas of civil aviation. Guinea did not notify any differences with regard to Annexes 1, 6 and 8.

The following details were given:

a) An Airworthiness Certificate is issued after a technical inspection of the aircraft and its documents.

b) An Air Operator Certificate is issued in accordance with the provisions of Chapter 4 of Annex 6. The main documents that must be supplied by the applicant for its issue are:

- the Operations Manual;
- the maintenance and inspection manual.

A check is also carried out on the appropriateness of the aircraft and the routes requested.

Note: during a seminar organized by the ICAO in Dakar in 2000, the Guinean authorities were advised to introduce Air Operator Certificates. Up to then, only the technical agreement of the Ministry of Transport was necessary to undertake commercial flights and the inspection of civil aviation concerned the airworthiness of aircraft, flight crew and maintenance personnel licensing.

Following that seminar, the DNAC created an Air Operator Certificate and encouraged operators (including UTA) to train their personnel in the contents of Annexes 1, 6 and 8.

The ICAO audit follow-up mission of January 2004, which took place after the accident, confirmed the absence of any system to nominate and delegate powers to DNAC inspectors that would allow them to carry out inspections on the safety of aircraft. Guinea still had not *« adopted technical regulations relating to the technical operation of aircraft »* nor *« established a system for issuing air operator certificates and the oversight of authorized air operators»*. The authorization that was issued to operators as well as its conditions of issue had not been revised at that time and were not in accordance with international standards. The issuing procedure and that for continuing authorization did not take into account the technical capacities of the applicants. Despite its plan of corrective action in 2001, Guinea had still not established a regulatory framework applicable to the leasing of aircraft that would allow the responsibility of Guinean and foreign operators to be established in the areas of personnel training and licensing, nor for technical operations, airworthiness and the maintenance of an acceptable level of safety oversight.

To summarize, at the time of the accident, Guinea had a civil aviation code and explicit references to international provisions but had not established the detailed regulations to put these into effect nor the necessary means and procedures [(11)].

1.17.3 The operator

1.17.3.1 The aircraft operator's responsibilities

The operator is responsible for the safe, regular and effective operation of flights, wherever they may be performed. The operator must respect the laws and regulations of the State wherever it is registered and in the States where the aircraft performs flights.

More precisely, the operator must both develop operational instructions necessary for the safety of flights in the context of the applicable laws and regulations and take the necessary steps to ensure continuing airworthiness of its aircraft.

The first means of issuing instructions on flight safety is via the Operations Manual (Annex 6 – 4.2.2), the manual that must normally be presented to the supervisory civil aviation authority before the Air Operator Certificate is issued. The Operations Manual is fundamental for safety and must be complete, precise and relevant [(12)].

Annex 6 lists the minimum requirements concerning the Operations Manual. It should, in particular, include provisions relating to training, work time for flight crew, instructions for the calculation of the weight and balance as well as for airplane handling on the ground, standard operating procedures (SOP) for each

(11) The Guinean Accredited Representative indicated that these regulations had now been adopted. The BEA was not able to obtain them.

(12) The manual on the preparation of an Operations Manual (doc 9376) gives detailed instructions on how to write it.

phase of flight, normal exceptional and emergency procedures and the associated check-lists and instructions relating to the routes and aerodromes used.

To guarantee the airworthiness of the aircraft it operates, an operator must establish a maintenance program (Annex 6 – 8.3) as well as a maintenance and inspection manual (Annex 6 – 8.2) describing, among other things, the maintenance procedures and the roles of the various participants. A copy of the maintenance and inspection manual must be filed with the State of Registry and the State of Operator. The operator must also preserve various data relating to the service life of the aircraft (Annex 6 – 8.4). In case of a change of operator, this data must be passed on to the new operator.

Annex 6 (§ 3.2.1) also stipulates that the operator must establish flight safety and accident prevention programs.

1.17.3.2 Organisation and management of UTA

a) On 15 September 1997, the Guinea Minister of Transport gave his technical approval for public air transport activities to be undertaken by the « Union des Transports Africains de Guinea SARL UTA ». The Air Operator Certificate was issued on 12 November 2001.

UTA is a private company under Guinean law based in Conakry. Before setting up in Guinea, the operator had been based in Sierra Leone, from 1995, under the name of West Coast.

b) Before 2003, UTA operated two low-capacity airplanes, an Antonov 24 registered in Sierra Leone (9L-LBQ) and a Let 410 (3X-GDE). The Antonov was used for public transport on regional routes in Wets Africa (Freetown, Banjul, Abidjan etc.), the Let 410 for flights for mining companies and as an air ambulance. These two airplanes belong to an individual who is also technical director of UTA. They are part of a leasing contract that includes the flight crew and maintenance.

On 16 June 2003, UTA leased the Boeing 727-223, serial number 21089, from Financial Advisory Group for a period of three months. On 27 June, the airplane was registered 3X-GDM for three months. On 28 June, it took off with passengers bound for Beirut. This airplane never returned to Conakry. It was flown on a ferry flight to Sharjah on 8 July 2003. On 9 July, it was replaced by 3D-FAK (see 1.6.3).

The operational specifications established by the DNAC specify, in the publication dated 25 July 2003, that UTA's fleet consisted of four airplanes (an Antonov 24 with a capacity of 48 passengers, a Let 410 with a capacity of 13 passengers, a Boeing 727-200 / 3X-GDM with a capacity of 140 passengers, a Boeing 727-200 / 3D-FAK with a capacity of 138 passengers) and that the airplanes' maintenance was to be undertaken in accordance with the maintenance program approved by the DNAC and the manufacturer's maintenance manual. The revised edition of this document dated 23 October 2003 reduced the number of airplanes on the fleet list

to three (3X-GDM was no longer included) but now indicated 140 passengers [13] for the second Boeing (3D-FAK), registered 3X-GDO in between times.

Note: it was not possible for the Guinean authorities to obtain the coordinates of the approved workshop during the eleven days the airplane registered 3X-GDM was operated. For 3X-GDO, a maintenance workshop visit was planned in Kabul for January 2004.

c) UTA had only one flight crew to operate the Boeing 727. During the six months of operation of the airplane, three different crews had been employed by UTA in succession.

d) The feasibility study of the Conakry - Cotonou - Beirut - Dubai route is supposed to have been carried out by a company called Gatwick Aviation whose headquarters are reputedly in Dubai. This feasibility study was not passed on to the investigators.

e) The majority of management posts at UTA, including that of Director General, were filled by members of the same family of Lebanese origin, none of whom possessed any technical knowledge relating to air transport. Non-family members included the technical director, also responsible for training, and the chief pilot, who was responsible for quality control. The investigation revealed, however, that the latter's area of competence was limited to the two low-capacity airplanes.

Note: the Chief Pilot was not rated on Boeing 727.

f) UTA had an office in Conakry, this office being located in the offices of a travel agency belonging to the Director General of UTA.

UTA rented a check-in desk from the Conakry airport management company (SOGEAC). In addition it had two containers located a few dozen meters from the main airport building. The first one was used to stock the printed paperwork needed for operations and bottles of mineral water. The second, located at the end of a hangar, was used to stock spare parts.

In Conakry, UTA used the SOGEAC's assistance services but there was no written contract between the two companies. SOGEAC rented UTA check-in desks, various handling equipment and personnel for loading and unloading operations. Those with authority in the company stated that they systematically supplied the passenger and baggage manifests but that they filled out the weight and balance sheet only if the operator requested it, which was not the case for UTA.

In Cotonou, assistance for checking in passengers and their baggage and hold loading and unloading operations was supplied by COGAA (Comité de gestion de l'assistance en escale des avions), a company supervised by the Minister responsible for civil aviation, created after the bankruptcy of the airline Air Afrique. At the time of the accident, there was no written contract with UTA, the services being supplied on demand. The person responsible at COGAA stated that he did not know who was in charge of preparing the weight and balance sheet for UTA and that he did not supply the passenger and baggage manifests.

[13] This concerns seats that can be sold.

UTA's agents, who supplied the information relating to the loading of the airplane to the crew of the B 727 (see. 1.16.1.1), had received no specific training.

UTA had no installations, operations room, briefing room, flight safety or stopover services. There was a flagrant lack of structures and of trained personnel to operate a large transport airplane or to organize and supervise aviation activity on stopovers on the Conakry – Dubai route.

1.17.3.3 UTA's documentation

a) According to the testimony gathered and the documents supplied to the investigators, the crew of 3X-GDO had the airline's Operations Manual, the airplane's flight manual and the Minimum Equipment List at their disposal.

b) The Minimum Equipment List, originally established by American Airlines, had only been provisionally approved on 23 July 2003 by Swaziland, State of supervision of Alpha Omega Airways, when the airplane was already operated by UTA. The Guinean DNAC approved the MEL of the Boeing 727-200, registered 3X-GDO, on 14 November 2003. This approval is included as a preamble to the Operations Manual.

Note: in this Operations Manual there was a chapter entitled Boeing 727 MEL. It contained no items relevant to an MEL.

c) The maintenance and inspection manual could not be provided to the investigators.

d) The Operations Manual, in English, was only provided to the investigators two months after the accident. It had been approved by the Guinean DNAC on 14 November 2003, thus after the opening of the route.

Numerous errors, omissions and inconsistencies appear on first reading of this document, clearly assembled from clumsy copying from one or more operations manuals from foreign airlines, and obviously only destined to fulfill the regulatory obligation. The wording of some chapters, for example, corresponds to activities based in Jordan or in Gaza.

Of note are the absence of any work time limits for the flight crew, the absence of details relating to loading, weight and balance (weight allowance, calculation method for weight and balance, dry operating index and corrected basic weight, etc.), the absence of a list of documents that should be kept by the operator, etc. As was shown in paragraph 1.16.1.1, the document that came from Alpha Omega Airways and was used to establish the center of gravity did not correspond to the airplane type.

There was no management structure for Boeing 727 operations. According to the operations department's organization chart, the director of operations and the chief pilot managed a fleet of Lockheed 1011's, whereas UTA did not operate this type of airplane. Chapters relating to the operation of other types of airplanes are also found (L1011, B707, F50, DHC8) and elements relating to B727 training in 2002!

Finally, several departments listed in the Operations Manual simply did not exist (flight support manager, section dispatch manager, navigation and « Jeppesen » section, systems, procedures and publication section, crew scheduling and record section).

The following declaration is also of note (Part A, section 05-01): *safety is the most important rule for all airlines. This is an essential ingredient for any evaluation of success. This is the responsibility of all. Our objective is the effective mastery of disaster with zero accidents. The mastery of disasters means the prevention of injuries or accidents to persons or goods. With UTA, safety is the priority. Try to make it your attitude and rule of life.*

e) UTA was not able to produce the slightest data on the flights that had been performed, flying hours and periods of service of the crew members and airplane maintenance personnel. Nor was it able to supply any documents at all relating to the weight and balance calculation for any previous flight. It was incapable of indicating who was in reality responsible for supervising the loading of the holds and what such a persons instructions or training might be.

1.17.4 The Conakry - Cotonou - Beirut - Dubai Route

1.17.4.1 Certification

On 7 April 2003, UTA applied for approval to operate the « Conakry - Abidjan - Cotonou - Beirut and return» route. The same day, the national Director of civil aviation in Guinea informed the Benin and Lebanon DGAC's that UTA was designated to exploit traffic rights on this route and asked for the granting of associated traffic rights.

a) On 18 April 2003, the Director General of civil aviation in Benin indicated that he had no objection to his country being served by UTA. He asked the Guinean administration to notify access to these traffic rights by diplomatic means and to forward the following documents to him:

- the airline's statutes;
- the certificate of air transport and its approval;
- the technical documents of the aircraft scheduled for operations;
- the insurance contracts for these aircraft;
- the schedule and the tariffs.

On 9 July, he recommended consultation between UTA and the national airline already operating the route Abidjan with third and fourth freedoms and asked the Guinean DNAC for a consultation on the rights to Beirut.

On 11 July 2003, the latter replied that it was favorable to organizing consultation to discuss the problems relating to the application of the requested agreement and asked for a temporary authorization for UTA to operate charter flights on the route requested.

On 23 July, the Benin DGAC indicated its desire to reach an agreement to apply the bilateral agreement between the two countries and granted UTA temporary authorization to operate charter flights on the Conakry - Cotonou - Beirut - Cotonou – Conakry route, with one round trip a week.

b) On 24 June 2003, the Director General of civil aviation in Lebanon requested the documents concerning the airline UTA, specifying that the fifth freedom right was not in the agreement on air transport between Lebanon and Guinea but that this request could be approved temporarily on condition that the agreement be subsequently modified.

1.17.4.2 Flights

Note: flights initially had the status of charter flights. The airplanes stayed for several days in Beirut waiting for their passengers for the return flight. It was during this period that the Lebanese DGAC was able to plan inspections in the presence of the crew and the accompanying mechanics.

3X-GDM, from Conakry, arrived in Beirut on 28 June 2003 to stay until 8 July 2003. On this occasion, the Lebanese DGAC carried out a technical inspection. Due to the findings from the inspection, the airplane was obliged to leave empty, on a ferry flight, to Sharjah where the Financial Advisory Group, its owner, had an office.

UTA then replaced it with 3D-FAK, which arrived in Beirut on 9 July, from Sharjah, and left again on 10 July with passengers bound for Conakry. The airplane returned to Beirut on 11 July.

From this date on, the Lebanese DGAC carried out systematic checks on the condition of the airplane through inspections and imposed stopover assistance from a company based in Beirut.

On 21 July, the DGAC inspected 3D-FAK and made eighteen observations:

- MEL belonging to American Airlines;
- Insurance relating to another airplane;
- Air Operator Certificate issued to Alpha Omega Airways;
- No leasing contract;
- Equipment checklists from Ariana Afghan Airlines;
- Torch in cockpit inoperative;
- Extinguisher bottles in engines No 1 and 3 requiring weighing;
- Flight recorder emergency pingers inoperative;
- Illuminated emergency exit path inoperative in economy;
- Passenger instruction signs inoperative;
- Compensation of backup compass not performed since January 1997;
- Absence of emergency locator beacon;
- Tire on wheel No 3 beyond wear limits;
- Missing emergency equipment signs;
- VHF antenna No 2 cracked;
- Right static port sign to be remade;

- Oil leak on engine No 2;
- Tire rubber on wheel No 4 in bad condition.

On 23 July, the airplane took off bound for Cotonou with twenty-eight passengers after eight items required for further operations were corrected. It stayed in Conakry for a month so that the remaining items noted could be brought into compliance with the regulations.

On 30 July, the Lebanese DGAC, following the inspection of the 21st, sent a letter to the civil aviation authorities of Swaziland and Guinea. This letter mentioned the items that were problematic in terms of safety and asked that the points identified be brought into compliance with the regulations. During this period, airplanes not in compliance with airworthiness rules could only leave Lebanon on ferry flights at the expense of the owner.

The points noted in the letter of 30 July were as follows:

- Engine extinguishers out of date;
- Excessive tire wear on wheels 3 and 4;
- Absence of emergency locator beacon;
- MEL not approved by Swaziland;
- Equipment logbook belonging to Ariana Afghan Airlines;
- Illuminated emergency exit path and emergency signs inoperative;
- Compensation of backup compass out of date;
- Equipment signs absent.

On 9 August, the DNAC inspected the airplane and confirmed the anomalies noted by the Lebanese inspection. On 12 August, the national Director of civil aviation indicated to his Lebanese counterpart the work undertaken on the airplane:

- corrective action had been taken on five of the eight non-standard items;
- two maintenance items requiring work in an approved workshop that could, subject to authorization by the Lebanese DGAC, be performed in Beirut;
- Alpha Omega Airways was responsible for getting the MEL approved by the State of registration (sic), that is to say Swaziland.

Note: these letters and corrective actions show the ambiguity that existed on the operational status of 3D-FAK. The leasing contract is an ACMI type contract, that is to say that the lessor supplies the airplane with crew, insurance and maintenance. The airplane must then normally be operated within the framework of the Air Operator Certificate and in accordance with the Operations Manual of the lessor and not the lessee. The operator would thus be Alpha Omega, on behalf of UTA, which had the approval to operate the route. However, it was UTA that carried out the required modifications, and it was Guinea, which had registered the airplane in the list of the UTA fleet, that answered Lebanon and the response concerning the MEL refers to the registration and not to operations.

3D-FAK obtained authorization to land at Beirut on 22 August. It was accompanied by a representative of the Guinean DNAC tasked with establishing links between the two administrations. The latter, in order to ensure effective oversight, recommended that the airplane be registered in Guinea.

On 25 August, the airplane was inspected at Beirut by the DGAC inspectors and the DNAC representative. The DGAC requested that it be noted that the MEL on board was that which had been approved provisionally by Swaziland on 23 July 2003, and that the letter of approval should be included in the airplane's documents.

Two new inspections took place, on 20 September and on 11 October. The inspection of 20 September brought to light the following points: life rafts out of date since July 2002; cockpit oxygen bottles out of date, pressure normal; airplane Flight Manual and MEL approved provisionally. The inspection of 11 October showed that the items identified as non-standard on 20 September had been corrected by 22 September.

The following table summarizes the airplane's visits to Beirut:

Date of arrival	Date of departure
1st September 2003	3 September 2003
7 September 2003	10 September 2003
18 September 2003	22 September 2003
25 September 2003	29 September 2003
2 October 2003	6 October 2003
9 October 2003	13 October 2003
15 October 2003: change of registration to 3X-GDO	
16 October 2003	20 October 2003
23 October 2003	27 October 2003
30 October 2003	3 November 2003
6 November 2003	10 November 2003
13 November 2003	17 November 2003
20 November 2003	24 November 2003
27 November 2003	27 November 2003, to Dubai

From 27 November, the route of the UTA Boeing 727 was extended to Dubai. It then stopped over at Beirut for two to three hours, during the night, on the following dates:

Date	From	Bound for
1st December 2003	Dubai	Cotonou
4 December 2003	Cotonou	Dubai
8 December 2003	Dubai	Cotonou
11 December 2003	Cotonou	Dubai
15 December 2003	Dubai	Cotonou
18 December 2003	Cotonou	Dubai
22 December 2003	Dubai	Cotonou

Note: the BEA would like to stress the significant role played by the Lebanese civil aviation authorities in furthering the interests of safety. This applies both to the time before the accident, through the checks and the subsequent upgrading requirements imposed, and during the investigation, through the information supplied, especially that related to this chapter.

2 - ANALYSIS

2.1 History of the Route

The setting up of the Conakry-Beirut route was a response to the economic needs of Guinea and its neighboring countries. The disappearance of Air Afrique in effect interrupted most of the air routes that existed between the countries of West Africa, reinforcing the isolation of some of them and imposing long expensive trips by air between places that are geographically quite close to each other. For example, to travel from Cotonou to Conakry meant passing through Paris. Only the development of small airlines allowed this situation to improve, but this development took place in a regulatory context that was inadequate. Safety breaches were thus allowed to accumulate.

The Conakry-Beirut route also answered the need for a route to Beirut for the large Lebanese communities in West Africa. The passengers came not only from Guinea and Benin but also from Sierra Leone and Togo. MEA, the main Lebanese airline, no longer serves the region either.

Finally, the use of this route for transporting UN soldiers returning from Sierra Leone confirms both the lack of air routes between West Africa and Asia and the difficulty for those needing to travel to appreciate the level of safety on offer.

The route was thus opened by UTA, a company that was already carrying out local flights with low capacity aircraft. The absence of aeronautical knowledge and lack of experience of those responsible in management meant that they did not realize the extent of the leap forward in terms of means and organization that this development represented. The quality of a route study, which those responsible said was carried out, is also questionable. Thus, the choice of schedule, with a stopover in Cotonou in the middle of the day, at the hottest time, bearing in mind the length of runway available and the performance of the chosen aircraft, would only have permitted a load that was much lower than the capacity available.

It is also questionable how realistic it was to organize a regular route with just one aircraft and one crew, with no real technical support at the stopovers.

The extension of the route to Dubai, apparently for reasons of profitability, was also done without analysis of the new operational implications of the decision. For example, it led the flight crew to systematically exceed the number of flying hours recommended by Guinea or set by the operator.

To operate this route, UTA called on a company whose real role could only be touched upon in the course of this investigation. Based in fact in Sharjah, but having its official headquarters successively in Miami and then the Virgin Islands, this company popped up on several occasions during the setting up of the route. It was the owner of the two airplanes operated successively by UTA. It, or at least its owner, apparently set up on behalf of Ariana a maintenance workshop in Kabul on behalf of Ariana Afghan Airlines and in effect undertook the maintenance of the aircraft (Ariana’s failure to reply to questions posed during the investigation made

it impossible to clarify this point). It, or at least its owner, was behind the operator Alpha Omega Airways that was based in Swaziland. It also supplied UTA with the three flight crews that succeeded each other at the controls of the airplane as well as the two ramp mechanics who accompanied the airplane to undertake line maintenance. Finally, it held a part of the airplane's documentation and undertook the airplane's maintenance in a specialized maintenance workshop not defined in the contract that linked it with UTA. No information on the activity of this maintenance workshop could be obtained during the investigation. This attribution of roles and responsibilities between the owner and the operator of the airplane tended to dilute both and complicated the oversight of operations.

Operations to Beirut started up with charter flights, with a first airplane registered in Guinea as 3X-GDM, but the irregularities noted by the Lebanese civil aviation administration obliged the owner and the operator to replace the airplane, which returned to Sharjah to be lost without trace from that time on as far as the investigation was concerned. The Lebanese administration is to be congratulated for having decided on this inspection the first time the airplane passed through Beirut.

The replacement of that aircraft was first accomplished through a leasing arrangement with crew from Alpha Omega. The technical operation of the new airplane was thus initially carried out by this second airline, within the framework of its air operator certificate and registration issued by Swaziland. The Lebanese inspections immediately showed the safety level of this airplane was also inadequate and that its reference documentation was not in accordance with the regulatory requirements.

This situation led to an agreement between the Lebanese and Guinean civil aviation authorities, which required the deficiencies that had been noted to be rectified. In addition, both administrations considered that the airplane being registered in Guinea would enable better control of the situation. This change of registry, and thus in fact of operator, was carried out without either of the operators raising any objections.

In the meantime, the airplane continued operations on the route, which had progressively become a scheduled route, between Conakry and Beirut, and was then extended to Dubai from 27 November onwards. In parallel, on the technical side, the successive inspections made in Beirut progressively ensured compliance with airworthiness requirements, within the limitations of the technical possibilities offered by inspections.

2.2 Accident Scenario

The preparation of the flight from Cotonou seems to have been carried out as usual, the UTA personnel providing the flight crew with information on the load and the latter preparing their flight without any external assistance. In particular, the inadequacy of the manifests and the absence of precise data on the center of gravity were not unique to this flight. On the other hand, the airplane was full, at least one passenger had even bought his boarding cards from a person that had already checked in, and the passengers were perhaps more heavily laden than

usual. Boarding was disorderly, there was too much hand baggage, some passengers remained standing until the last moment and a call to order was required.

Although the crew did not receive precise information on the weight of the baggage, they knew that the airplane was heavily loaded. The animated discussion that they had with the airline executives confirmed this. However, there were still three more legs and nearly ten hours of flying to perform. The agitated state of the passengers and their short employment experience in the airline did not encourage them to extend the stopover. In addition, their experience suggested that "it always made it" and their documentation led them to believe, erroneously, that they had a structural margin five tons higher than that which they really had.

The crew prepared for the take-off in this stressful atmosphere. They determined a configuration appropriate to the conditions on the day, allowing for correct load distribution, in accordance with their general instructions, and planning for an engine power-up with the brakes on so as to reduce the length of the take-off roll. Logically, they took into account a high load (the choice of a rotation speed of 137 kt [(14)], which corresponds to a weight of 85 rather than 78 tons shows that they had allowed a high margin) though correctly distributed, in accordance with the general instructions, which meant that the stabilizer was set at 6 ¾. The building on the runway extended centerline was not supposed to pose any problems since it did not impinge on the airplane's climb out-slope, even with one engine out. It should be noted that the other members of the flight crew made no objections or expressed any doubts whatsoever as to the feasibility of the take-off.

The roll and take-off were performed in accordance with what had been planned and it was only at the moment of rotation that the effect of the forward center of gravity was felt. The co-pilot, at the controls, did not feel the expected reaction from the aircraft when he pulled back on the control column. He then apparently hesitated for a moment before increasing his inputs on the column. The end of the runway was approaching and it was then too late to change strategy and the only option available was to continue while hoping that the airplane would finally take off. This is what happened, but too far down the runway and with a climb angle that was too low to avoid the roof of the building and the accident.

Analyses carried out by the manufacturer suggested that, even loaded at 85 tons, the airplane would have taken off and passed over the obstacle. They also suggested that balanced as it was, it could even have taken off if the control column inputs had been full and vigorous straight away. However, it should be remembered that the existence of safety margins is a condition for safety in aviation and not an encouragement to exceed the established limits. A flight is not a game of chance, luck should not play a part in it and all of the calculations show that the take-off should never have been attempted.

(14) The Vr callout was made at this speed. In addition, the callout made at 13 h 53 min 34 s appears to correspond to the V1 and Vr bugs. This would confirm the choice.

It has been shown that the decision to refuse to depart was, nonetheless, not an easy one to take. There were both commercial and operational pressures with a full airplane and a flight to undertake, the company's manager was present on board along with his family, there were apparently guarantees provided by the people who had supervised the loading and there was a lack of knowledge of how far forward the center of gravity was.

Today, safety cannot depend solely on the Captain, especially when he has imprecise information on the condition of his airplane. It depends on the existence of an organized structure where each participant has the skills necessary to carry out a well-defined role, where systematic checks are made on the validity of the information supplied and of the reference documentation, and where airplane operations are managed and feedback on them truly exists.

The investigation showed that none of these basic conditions for safety were in place.

2.3 Structural Analysis

2.3.1 The operator

Previously based in Sierra Leone, the operator had relocated its activities in Guinea. It has been shown that the company's structure really corresponded to the superimposition of an essentially commercial family structure onto a technical operations structure with two low capacity airplanes. Nothing was changed in this organization when UTA decided to open the route to Beirut and the operation of the Boeing 727 was set up without any functional changes, with no specialized management and without carrying out the required procedures. It is possible that the fact that the route was supposed to be operated in an African and Arab environment well known to the owners of UTA reassured them as to their ability to face the challenges to a company that they only perceived as an extension of a known existing activity.

The operator did not complete the requirements concerning mandatory documentation that would have allowed the airplane's operation to be organized. The uncertainties surrounding the maintenance of the two successive Boeing 727's have been shown and, more prosaically, the absence of any checks on their condition when they entered service. The serious deficiencies and errors in the Operations Manual, leading to disorganized operations with no checks, have also been shown. The lack of any follow-up in training and recurrent training for the crew, the absence of any follow-up of their work activities, the absence of any flight safety structure that would have allowed any drift or potential inadequacies to be corrected are all points that have been brought to light.

The investigation also showed the absence of any technical means or premises for technical operations, the absence of any technical assistance at the stopovers, except in Beirut where the authorities imposed it, the absence of any formalities in the management of relations with outside partners (absence of contracts, payments made in cash).

In this situation, could the UTA management team have called on skills from outside the company? The findings of the Lebanese authorities on the two airplanes put into service one after the other show that this was possible neither through FAG nor through Alpha Omega.

The crew was thus alone and everything depended on them, with no competent operational framework and no precise documentation. Nonetheless, three complete flight crews manned the aircraft in just a few months. It is not possible to see how they could have assumed the technical management function, even supposing that their flights left them the time.

To summarize, it can perhaps be said based on the preceding that, as far as the Boeing 727 was concerned, as an airline operator UTA possessed only the title and the authorizations.

2.3.2 Oversight

One safety net remained, the necessity for an operator to be authorized then inspected by the State responsible for oversight. Unfortunately, the investigation showed that the Guinean civil aviation administration had not been able to complete its mission with regard to UTA. It supported and immediately passed on the request to open the route, whose importance to the country has been seen, without obliging the operator to set up the structure and generate the documentation required for these operations. Nor did it, via inspections and oversight of operations, ensure that UTA respected the limits on flying hours, follow up the documentation on the flight crew, the airplane and the flights. Furthermore, it is clear that the same failings applied to the role of the Swaziland administration.

It was not at first a simple question of training and resources, even if improvements in these two areas would clearly have led to an improvement in safety. In fact, the inadequacies and errors in the UTA documentation are obvious at first glance, and the condition of the two successive airplanes was noticed by the Lebanese inspector during a simple ramp inspection. The Guinean personnel are competent and available, as was shown during the investigation. Further, it should be noted that those responsible for these tasks in Lebanon or in many other countries are neither overabundant nor over-equipped.

Failings in oversight, also recorded during ICAO audits, initially come from an unfavorable environment: inadequate regulations and enforcement documentation and an absence of a voluntary and organized approach to safety. The clear pre-eminence of economic considerations unrelated to safety make inspections and any possible requirements appear to be unjust penalties on the economic activity. These factors appear to endanger employment and compromise air links that are necessary for a variety of reasons (the same considerations can be observed during an investigation). Furthermore, this is not specific to Guinea or Swaziland and very often the strict application of safety rules creates the risk of the loss of jobs or an interruption in a vital link.

It is, however, necessary to take a relative view of the impact of safety requirements, this accident being a good example. The request to open a route dated from April 2003. More than two months passed before the effective start of operations. The time taken over the negotiations for authorizations to serve various destinations could have been used to prepare the documentation and organize the operational environment of the airplane. Similarly, after the Lebanese inspections, operations on the route had to be arranged so as to allow for compliance, and the time and money were found to do that. It seems clear that the disturbance in the company's activity would have been less significant if it had proceeded with ensuring compliance before the route was opened. Finally, unfortunately, it should be noted that the Conakry- Cotonou-Beirut route no longer exists in any event, that there has been a negative economic impact and that this has been amplified by the human and economic consequences of the accident itself.

As regards the inspection of the condition of airplanes by the Guinean administration, two observations can be made. The airplane registered 3X-GDM had previously been registered in the United States and it is understandable that a small country's administrative services did not believe it necessary to carry out an extensive inspection of this airplane with a view to a temporary registration. As to the airplane registered 3X-GDO, observations on it were made by the Lebanese authorities when it was under the Swaziland registry. At the time of its registration in Guinea, its condition was considered as being satisfactory.

Could Lebanon have gone further and banned or suspended operations on the route? Without going back over the economic and human problems that such a decision would inevitably lead to, it should be noted that Lebanon ensured compliance through its inspections of the airplane but that it could not check the competence of the operator's staff and the operating conditions of the airplane outside of Lebanese territory. That would have necessitated a complete audit of the company's activities, which is a difficult procedure, expensive both for the State and for the operator, and which is normally carried out by the administration responsible for oversight at the time the operations permit is issued. Under the terms of the Chicago Convention, States recognize approvals and certificates issued by other States, except where the latter do not respect international provisions. To refuse access to the national territory to a duly authorized foreign operator, to call into question the relevance of the inspections carried out by the State responsible for oversight, without any other evidence than presumptions, is a very serious procedure. Unfortunately, the deficiencies that are regularly noted around the world oblige States to take such steps. It appears that international civil aviation is at a crossroads. Either States protect each other by increasing their reciprocal oversight, which can go as far as a systematic audit of foreign operators and systematic ramp inspections for all foreign airplanes, leading to the effective death of the Chicago Convention and the appearance of a world with a two-speed safety system, or each State strengthens its internal oversight and States that have difficulties in doing that are clearly identified and assisted.

2.3.3 The international context

The preceding analysis shows that, beyond the fundamental role of the States for safety oversight of their operators, a re-definition of the role of other States appears to be desirable. Such a re-definition can only be conceived of within an international context, under the auspices of the ICAO. Reference was made to this in the report to the 35th session of the ICAO Assembly and in working paper 63. The entire investigation and the analysis of the facts carried out by the BEA show the relevance of WP 63 and the importance of the voluntary application of its recommendations by the international community.

The following extracts are illustrative:

…
The audits have also revealed organization-related problems, arising mainly from a lack of commitment by certain Governments to adequately support their civil aviation authorities. Where such problems exist, the consequences include incorrect and insufficient safety oversight, and subsequent safety deficiencies.
…
The Convention on International Civil Aviation and its Annexes provide the legal recognition and operational framework for Contracting States to build a civil aviation safety system based on mutual trust and recognition. For example, Article 33 of the Convention requires Contracting States to recognize as valid certificates of airworthiness and personnel licenses issued by another Contracting State, provided that the requirements under which such documents were issued are equal to or above the minimum Standards established under the Convention. This implies, prior to any recognition, that States be satisfied with other States' level of adherence to ICAO provisions and safety oversight provided. This can either be performed directly through bilateral contacts or by analyzing the ICAO safety oversight audit results for the States concerned. These results are available to all Contracting States in the form of audit summary reports. These reports provide information to identify those States having difficulties in maintaining their safety oversight capability and performance. Contracting States have a responsibility to assist in the global safety oversight effort by increasing vigilance and taking appropriate action.
…
However, it has become evident that additional safety-related information, e.g. ramp checks, non-ICAO audit programs, incident and accident reports, would also be useful to States. On the basis of such information, as well as that provided through the ICAO audit reports, civil aviation authorities may identify safety deficiencies and take appropriate measures affecting specific foreign air operators, e.g. placing additional conditions on these operators when they access their airspace.
…
States are responsible for taking measures, including the imposition of additional conditions to ensure that safety deficiencies are addressed. Transparency is a key element to enable flight safety to be maintained worldwide. Information related to safety deficiencies and subsequent additional conditions imposed on operators should be made available to all Contracting States.
…

The Chicago Convention which, with its annexes, regulates international civil aviation is based on trust and mutual recognition between States. Each State must establish its own means for safety oversight. The ICAO, through its evaluations, checks their conformity with the rules dictated by the Chicago Convention. It therefore seems necessary, in order to avoid the development of non-law areas, that all violation of these rules, especially the absence of corrective actions, should be easily identifiable and available for the States. A resolution to this effect was adopted by the 35th session of the Assembly. This increased transparency should allow all States to better respect the basic rules on safety oversight.

To facilitate the application of the provisions that are desirable in terms of safety oversight, the following thoughts are offered up: a clear elucidation of the role of the State of the Operator at the highest level of international regulations, that is to say in the Convention itself, would be desirable so as to complete the steps taken when article 83 b was adopted. Equally, a clarification of the requirements for non-scheduled flights would be desirable. In fact, as has been seen, these two points are clear in practice but the existence of apparently contradictory provisions complicates a rapid understanding of what air transport safety implies. Finally, those who are at the top of political or administrative hierarchies may not, paradoxically, possess clear structured information about what is expected of their administration, though any initial impetus should naturally come from them. A written guide with this aim in mind should facilitate their task.

3 - CONCLUSIONS

3.1 Findings

3.1.1 Personnel

- Both pilots possessed Air Transport Pilot Licenses (ATPL) issued by Libya, not validated by Guinea.
- Both pilots possessed Commercial Pilot licenses (CPL) issued by the United Kingdom and validated by Guinea.
- The Flight Engineer possessed a license issued by Libya and validated by Guinea.
- The flight crew had been recruited by the owner of the airplane; they were paid by the operator.
- The flight crew exceeded, on each rotation, the flying time limits recommended by the State of Operator.
- The cabin crew possessed valid licenses. They did not have a written contract with the operator.
- The cabin crew exceeded, on each rotation, the flying time limits and the flight service periods defined by the operator.
- The controller on duty in the Cotonou tower possessed the necessary qualifications. A controller who was being trained assisted him.
- The operator had only one crew to operate the B727.
- All of the flights took place with the participation of two on-board mechanics and a security escort.

3.1.2 Operations

- The airplane had replaced another Boeing 727, registered 3X-GDM, which had been forced to leave empty, on a ferry flight, after a technical inspection carried out at the time of its first flight to Beirut.
- The airplane was leased. Its owner had purchased it in January 2003. At that time it was in storage in the Mojave Desert in the USA.
- After the purchase, the airplane underwent some work, in particular engine changes, about which no information has been obtained.
- No maintenance documents subsequent to the purchase of the aircraft, including for the period of operation by UTA, could be provided.

- The airplane was operated successively by three operators under the remit of Afghanistan, Swaziland and Guinea respectively.

- The airplane was registered successively in Afghanistan, Swaziland and Guinea. Each of these countries issued a Certificate of Airworthiness for it with no restrictions on its validity. Each of the three successive Certificates of Registration mentioned the operator as the owner of the aircraft.

- During stopovers in Lebanon, the airplane was subject to technical inspections that brought to light failures to comply with regulations relating to documentation and equipment. At the time of those findings, the airplane was registered in Swaziland. The points raised were corrected before the airplane was registered by Guinea.

- The Guinean DNAC applied the technical procedures defined by ICAO, though it had neither regulations for detailed application nor the means to inspect the application thereof.

- According to the lease, maintenance of the airplane was the responsibility of the owner and the updating of its maintenance documents was up to the operator.

- The operator had neither the material infrastructure nor the skills required to operate a large transport airplane.

- The revised Operations Manual had been approved by the Guinean civil aviation authority several months after the beginning of operations.

- The Operations Manual was incomplete, contained numerous inconsistencies and was unsuitable for the needs of operations with the Boeing 727.

- The Operations Manual did not have a chapter on the loading and balance of the airplane.

- The corrected basic weight and the corrected dry operating index were not included in the available documentation. The operator was not able to provide them to the investigators.

- The crew did not have the appropriate documents to prepare the flight. The document used to establish the center of gravity, drawn up by the previous operator, showed limits that exceeded the airplane's performance capacities.

- The Operations Manual did not define the limitations on flying time and work periods for the flight crew.

- The service companies at Conakry and Cotonou had no written contracts with the operator that defined the services to be provided.

- Seats were not attributed during check-in and the boarding cards were not nominative.

3.1.3 The flight

- 3X-GDO was supposed to carry out the flight from Cotonou to Beirut, with a stopover at Kufra. It was the second stop on the scheduled weekly flight GIH 141 from Conakry to Dubai.

- On 25 December 2003, the meteorological conditions were compatible with the operation of the planned flight.

- The co-pilot was Pilot Flying.

- Passenger boarding and airplane loading were performed without any overall supervision and with a complete lack of rigor.

- The airplane was full and there was a large quantity of large hand baggage. The forward hold was full.

- No overall document relating to boarding and loading (passengers, baggage) could be supplied. There were seven different manifests, all badly completed.

- Calculations showed that an undeclared load of around three tons was probably on board during the flight from Conakry to Cotonou.

- The flight crew knew that the airplane was heavily loaded. They did not know the distribution of the load in the airplane's holds.

- On the basis of these indications and of their experience, the flight crew decided on a configuration and a take-off technique.

- They decided on a take-off weight of seventy-eight tons, which was compatible with the runway limitation, and a center of gravity of 19% that corresponded to a correctly distributed load.

- In fact, the airplane weight was about eighty-five and a half tons and the center of gravity 14%, that is to say much further forward.

- Forty-five seconds after brake release, the Captain ordered the rotation, which the co-pilot immediately carried out.

- The real rotation only occurred two seconds later, when the co-pilot increased his control column input. Five seconds later, the wheels left the ground.

- Fifty-six seconds after brake release, the airplane struck a building made of reinforced concrete, two meters forty-five high, located one hundred and eighteen meters from the end of the runway.

- The recorded number of victims and survivors exceeds the number of people who were presumed to be on board, whether according to the manifests or based on the number of seats available.

3.2 Causes

The accident resulted from a direct cause:

- The difficulty that the flight crew encountered in performing the rotation with an overloaded airplane whose forward center of gravity was unknown to them;

and two structural causes:

- The operator's serious lack of competence, organization and regulatory documentation, which made it impossible for it both to organize the operation of the route correctly and to check the loading of the airplane;

- The inadequacy of the supervision exercised by the Guinean civil aviation authorities and, previously, by the authorities in Swaziland, in the context of safety oversight.

The following factors could have contributed to the accident:

- The need for air links with Beirut for the large communities of Lebanese origin in West Africa;

- The dispersal of effective responsibility between the various actors, in particular the role played by the owner of the airplane, which made supervision complicated;

- The failure by the operator, at Conakry and Cotonou, to call on service companies to supply information on the airplane's loading;

- The Captain's agreement to undertake the take-off with an airplane for which he had not been able to establish the weight;

- The short length of the runway at Cotonou;

- The time of day chosen for the departure of the flight, when it was particularly hot;

- The very wide margins, in particular in relation to the airplane's weight, which appeared to exist, due to the use of an inappropriate document to establish the airplane's weight and balance sheet;

- The existence of a non-frangible building one hundred and eighteen meters after the runway threshold.

4 - RECOMMENDATIONS

4.1 Approval and oversight of operators

The investigation showed the importance for safety of both good organization by operators and, further, of supervision exercised by national authorities before and after the approval of an operator. This necessarily implies the drawing up and approval of complete written documentation, as well as the time to do this. Furthermore, whatever the quality or training of the inspectors may be, it is difficult to undertake such oversight in a rigorous and objective manner in the absence of any precise regulations. The BEA thus recommends that:

- **Guinea and all States that wish to issue Air Operator Certificates urgently draw up complete regulations in accordance with the recommended standards and practices relating to safety in aviation and ensure that they possess the structures and means necessary to enforce these regulations;**

- **this complete set of national regulations require the precise identification of the owner of aircraft operated and of the companies responsible for their maintenance as well as the effective setting up of a flight safety program;**

- **this complete set of national regulations include a minimum time period for the examination of the statutory documents and ensure that no provisional approval can be given, whether at the start of operations or when a new aircraft type enters service, if these documents are not complete and satisfactory from the point of view of operational safety;**

- **the national civil aviation authorities undertake a new and complete examination of the structures and capacities of a carrier each time that there is a significant change in its activity;**

- **the national civil aviation authorities undertake regular inspections of the various companies involved in the operation of an aircraft in commercial service;**

- **the national civil aviation authorities ensure that their aerodromes check the loading of aircraft and that a copy of the weight and balance sheet is filed with them;**

- **the national civil aviation authorities ensure that boarding cards are nominative and that they are checked on boarding.**

4.2 International Organization

The investigation showed that weakness in regulatory structures and in the means for oversight of safety in certain States made it impossible to guarantee an appropriate level of safety for passengers and people on the ground, including on other States' territory. These weaknesses are the result of several factors, including the priority often given to economic considerations and the belief that safety largely depends on the decisions taken in real time by the front line actors, in particular the Captain. This situation tends to call into question the international organization of air transport, based as it is on confidence and the recognition by each State of the approvals and certificates issued by other States. This leads to multiple checks and direct inspections, with all of the negative consequences that this has on the direct and indirect costs of air transport, and poses the risk of the appearance of a two-speed world safety system.

The BEA notes the initiatives taken by the ICAO on the occasion of the 35th session of the Assembly (September-October 2004), in particular the findings and proposals in WP 63. The investigation shows the relevance and urgency of the measures proposed. Consequently, the BEA recommends that:

- **the ICAO Council vigorously follow up the actions to be taken as a result of the resolutions that the Assembly adopted in the area of safety by affirming its role as the lead actor and conductor where safety is concerned and by endeavoring to ensure, where necessary, that States be made aware of their responsibilities in this area;**

- **the ICAO Council examine all of the provisions relating to safety oversight that are contained in the Chicago Convention and its various Annexes, so as to identify any updates required, in particular in relation to the role of the State of Operator and to the deletion of the distinctions made between scheduled flights and charter flights;**

- **the ICAO Council endeavor to clarify the notion of operator, given the various forms of aircraft leasing and agreements between carriers, in order to avoid the dispersal of responsibilities;**

- **the ICAO Council, noting the inevitable complexity in regulations and documentation relating to safety oversight, study the development of a guide, intended for those responsible at a national level for safety matters, that informs them in a structured manner of their responsibilities relating to safety and of the provisions for which they are responsible for ensuring compliance;**

- **States that have a tradition of technical assistance, given the means at their disposal and their long and confident relations with other States, in particular France, study the relevance of their current technical assistance programs in the realm of safety and, where appropriate, re-organize them to support and complete ICAO's actions.**

4.3 Autonomous systems for measuring weight and balance

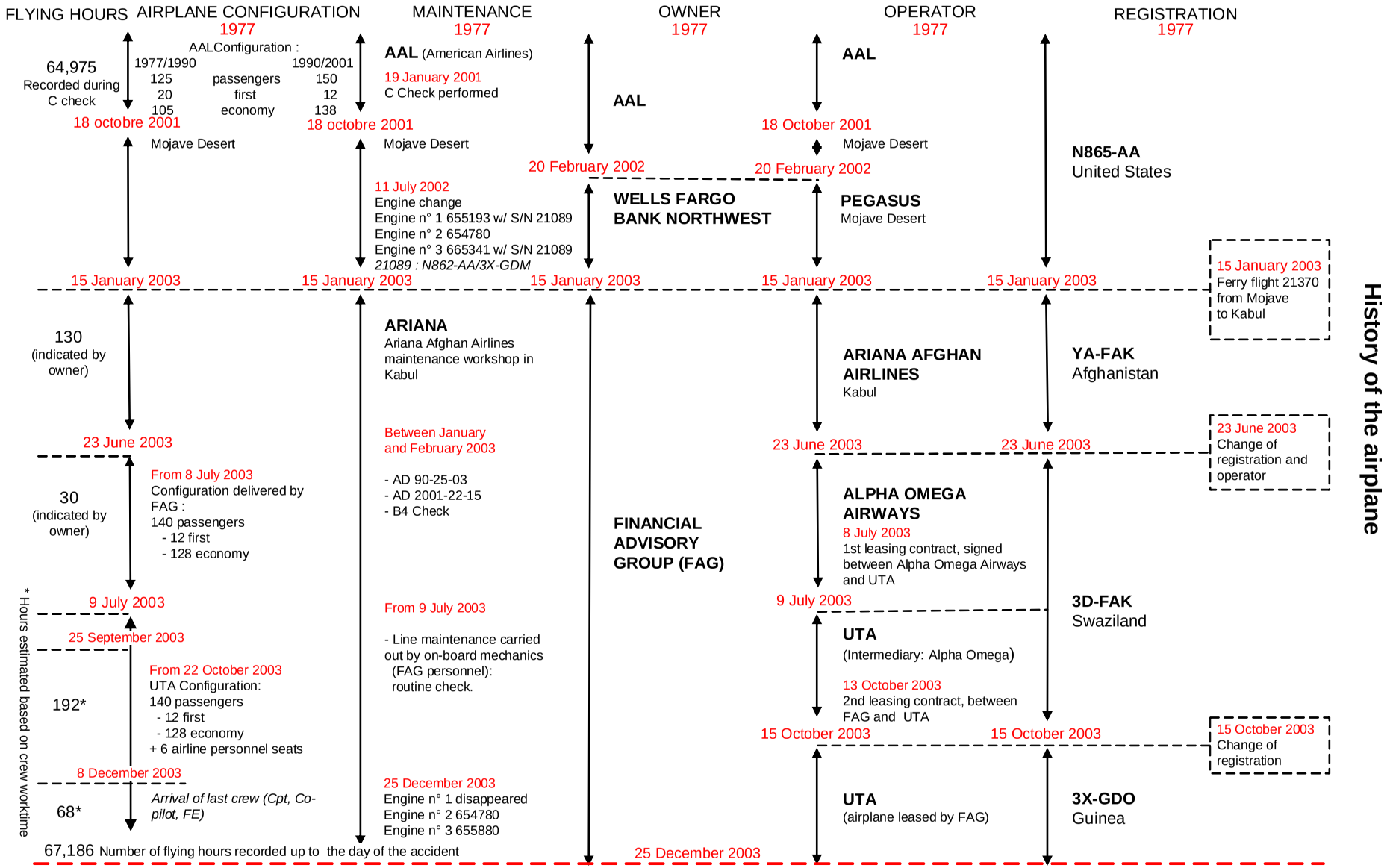
Knowing the true weight and balance of the airplane would most likely have enabled the crew to avoid the accident. In addition, erroneous estimates of these parameters are quite likely during operations. Onboard autonomous systems are, however, available and they give an indication of the airplane's weight and balance that is sufficient to attract the crew's attention in case of an abnormal situation. Consequently, the BEA recommends that:

- **the civil aviation authorities, in particular the FAA in the United States and the EASA in Europe, modify the certification requirements so as to ensure the presence, on new generation airplanes to be used for commercial flights, of on-board systems to determine weight and balance, as well as recording of the parameters supplied by these systems;**

- **the civil aviation authorities put in place the necessary regulatory measures to require, where technically possible, retrofitting on airplanes used for commercial flights of such systems and the recording of the parameters supplied.**

List of Appendices

HISTORY OF THE BOEING 727-223 / SERIAL N°: 21370



Administrative History

HISTORY OF ADMINISTRATIVE STEPS FOR OPERATION OF THE CKY-COO-BEY-DBX ROUTE BY UTA

OPERATOR

1995

WEST COAST AIRLINES based in Sierra Leone

15 September 1997: Technical approval accorded for air transport operations to by the Guinean Ministry of Transport to SARL **UTA** « Union des Transports Africains de Guinée, », a private company under Guinean law based in Conakry.

12 November 2001 : Air Operator Certificate issued (fleet consisted of 1 Antonov 24 and 1 Let 410).

7 April 2003

UTA applied to the Guinean CAA (DNAC) to obtain the rights to operate the CKY-ABJ-COO-BEY round trip route with a Boeing 737-800.

14 June 2003

UTA asked the Guinean CAA (DNAC) to register the Boeing 727-223 (S/N 21089), previously registered N862-AA.

16 June 2003

Leasing contract for Boeing 727-223 (S/N 21089) between FAG and UTA.

27 June 2003

The Boeing 727-223 (S/N 21089) was registered 3X-GDM in Guinea. The operations specifications recorded by the Guinean CAA (DNAC) indicate that the airline fleet consisted of :

- 1 Let 410 : 13 passengers,
- 1 Antonov 24 : 48 passengers,
- 1 B727, 3X-GDM (S/N 21089) : 140 passengers,
- 1 B727, 3D-FAK (S/N 21370) : 138 passengers.

28 June 2003

Take off from Conakry of 3X-GDM with passengers bound for Beirut via Cotonou.

8 July 2003

First leasing contract between FAG, Alpha Omega Airways and UTA for the Boeing 727-223 registered 3D-FAK (S/N 21370).

13 October 2003

Second leasing contract between FAG and UTA for the Boeing 727-223 (S/N 21370)

Guinean CAA (DNAC)

7 April 2003

The Guinean CAA (DNAC) informed the Beninese and Lebanese CAA's that UTA, with the ICAO call sign GIH was designated to operate the CKY-ABJ-COO-BEY round trip route as an airline with a Boeing 737-800 and requested 4th and 5th freedom rights on the route.

10 July 2003

Arrival of 3D-FAK at Conakry from Beirut.

11 July 2003

The DNAC asked the Beninese Administration for a temporary authorisation for UTA to operate charter flights on the route requested and departure of 3D-FAK to Beirut with passengers.

23 July 2003

3D-FAK arrived at Conakry from Beirut for the airplane to be brought up to standard following an technical inspection performed by the Lebanese CAA. It remained in Conakry for 31 days.

9 August 2003

Inspection and confirmation by the DNAC of the anomalies identified.

12 August 2003

Corrective action taken at Conakry on a part of the non-standard items. The DNAC asked for authorisation to perform maintenance operations in an approved workshop in Beirut for the outstanding non-standard items.

22 August 2003

3D-FAK was authorised to land at Beirut via Cotonou with passengers including a representative of the DNAC to validate the upgrading of the airplane in Beirut and to establish links between the two administrations.

26 August 2003

3D-FAK landed with passengers at Conakry from Beirut via Cotonou.

15 October 2003

Change in registration of the Boeing 727-223 (S/N 21370) from 3D-FAK (Swaziland) to 3X-GDO (Guinea), after inspection by the DNAC.

14 November 2003

Guinea approved the revised Operations Manual and MEL for the Boeing 727 registered 3X-GDO.

Beninese CAA (DNAC)

18 April 2003

The Director General of Civil Aviation indicated that he had no objection to his country being served by the route and asked the Guinean administration to notify him of the concession of traffic rights through diplomatic channels and supply the documents relating to the airline UTA, including the AOC statutes, aircraft's technical documentation, insurance contract, schedule program and rates.

9 Julv 2003

The DGAC noted the requests from the DNAC for 3rd and 4th freedom rights between Cotonou and Conakry as well as 5th freedom rights for Abidjan and Beyrouth for operation of the route by UTA. He recommended advance coordination between UTA and the national airlines at Abidjan and asked the Director of the Guinean CAA (DNAC) for consultations between Benin and Guinea for the rights to Beirut.

23 July 2003

The DGAC informed the Guinean administration of its desire to apply a trilateral agreement between Guinea, Benin and Lebanon. It accorded a temporary operations autorisation to UTA for charter flights on the CKY-COO-BEY-COO-CKY route at a rhythm of one flight a week.

On 1, 7 18, 25 September 2003
On 2. 9. 16. 23. 30 October 2003
On 6, 13, 20, 27 November 2003
On 4, 11, 18 December 2003

The Boeing 727-223 (S/N 21370) landed with passengers at Cotonou from Conakry bound for Beirut, from where it departed on the following dates :

3, 10, 22, 29 September 2003
6, 13, 20, 27 October 2003
3, 10, 17, 24, November 2003

Lebanese CAA (DGAC)

26 May 2000

Agreement on air transport signed between the governments of the Republic of Lebanon and the Republic of Guinea.

1er June 2003

The Director General of Civil Aviation set up a program of inspections to be performed by inspectors carrying out technical checks on aircraft.

24 June 2003

The Lebanese CAA noted the request from the Guinean authorities fro 4th and 5th freedom rights on the CKY-ABJ-COO-BEY round trip route with a 737/800 and also requested the documentation relating to UTA.
The CAA noted that 5th freedom rights was not included in the agreement on air transport between Lebanon and Guinea.
The request could be approved temporarily subject to modifications to this agreement.

28 June 2003

3X-GDM arrived at Beyrouth from Cotonou and stayed for 11 days.
During this period, a technical inspection was performed. The airplane was obliged to leave empty (ferry flight) for Sharjah (United Arab Emirates).

8 July 2003

Departure of 3X-GDM (S/N 21089) on ferry flight for Sharjah.

9 July 2003

Arrival of 3D-FAK (S/N 21370) in Beirut on ferry flight from Sharjah.

10 July 2003

Departure of 3D-FAK for Cotonou and Conakry with passengers.

11 July 2003

Arrival of 3D-FAK in Beirut from Conakry, 13-day stay.

21 July 2003

Inspection by Lebanese CAA and identification of 18 non-standard items on 3D-FAK.

23 July 2003

The airplane took off with passengers from Beirut bound for Cotonou and Conakry after upgrading of 8 items required to continue operations.

30 July 2003

Following the inspection on 21 July, the Lebanese CAA sent a letter to the Swaziland and Guinean CAA's mentioning the items relating to safety problems.

22 August 2003

3D-FAK landed in Beirut from Conakry. Having received no response from Swaziland (State of registry of the airplane) the Lebanese CAA and the representative of the DNAC asked the operator to register the airplane in Guinea so as to ensure effective oversight of operations.

25 August 2003

Inspection of 3D-FAK in Beirut.

20 September 2003 et 11 October 2003

Inspections on 3D-FAK in Beirut.

27 November 2003

Beginning of flight with passengers by 3X-GDO to Dubai (DXB), where it remained for 5 days.

1, 8, 15, 22 December 2003

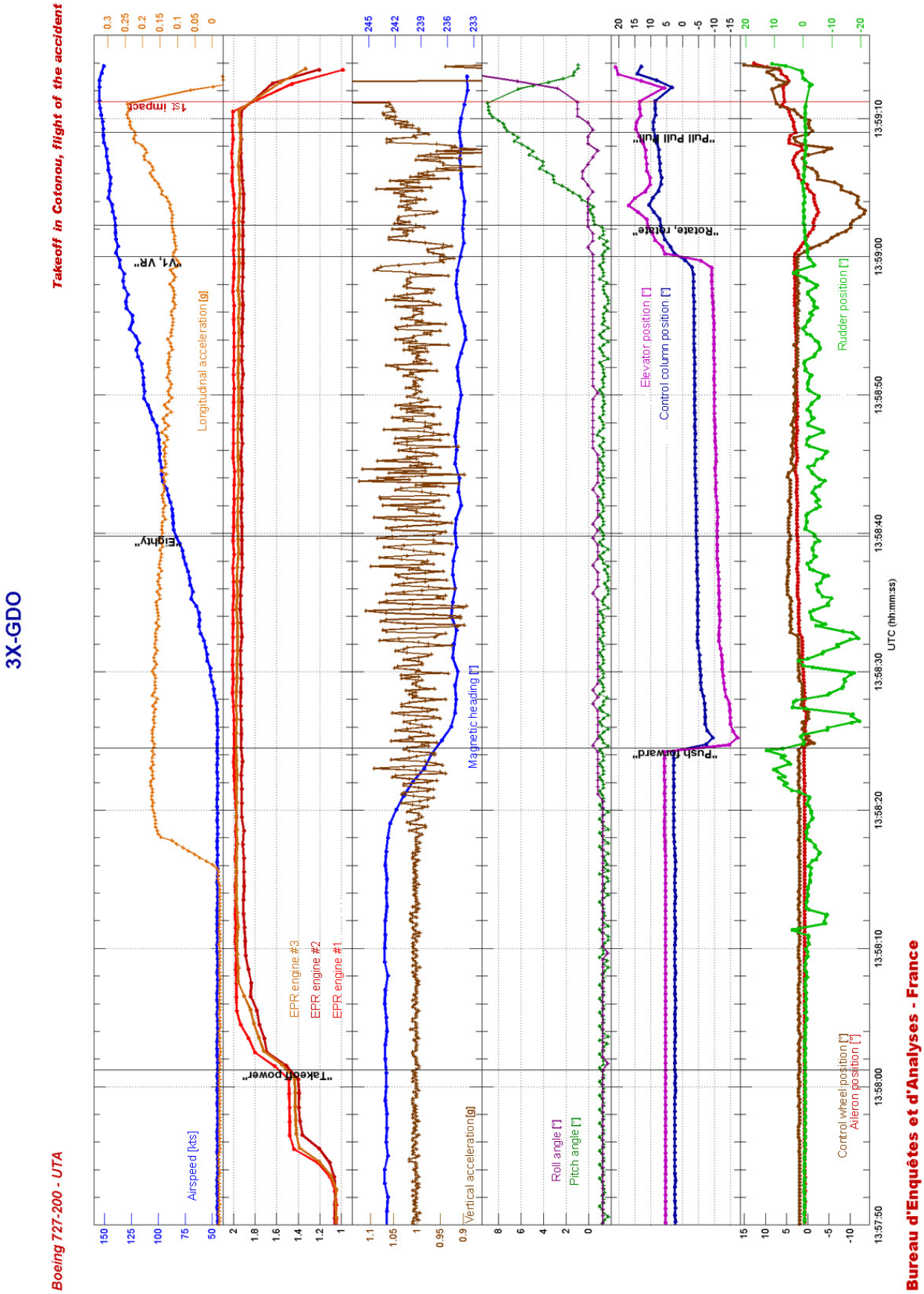
3X-GDO landed with passengers (except for the flight on 01.12.03) in Beirut, coming from Dubai, and took off again bound for Conakry on the same day.

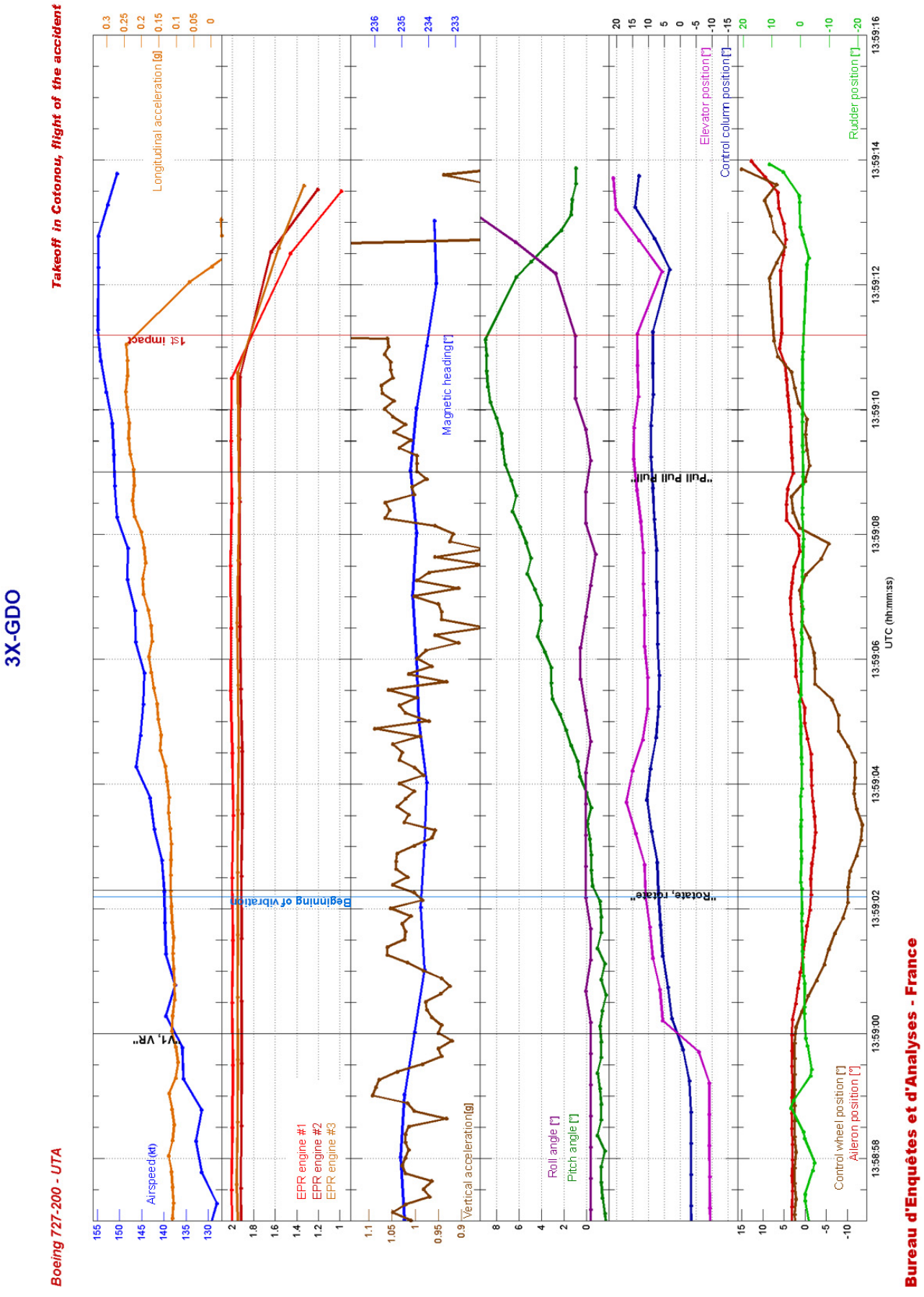
June 2003

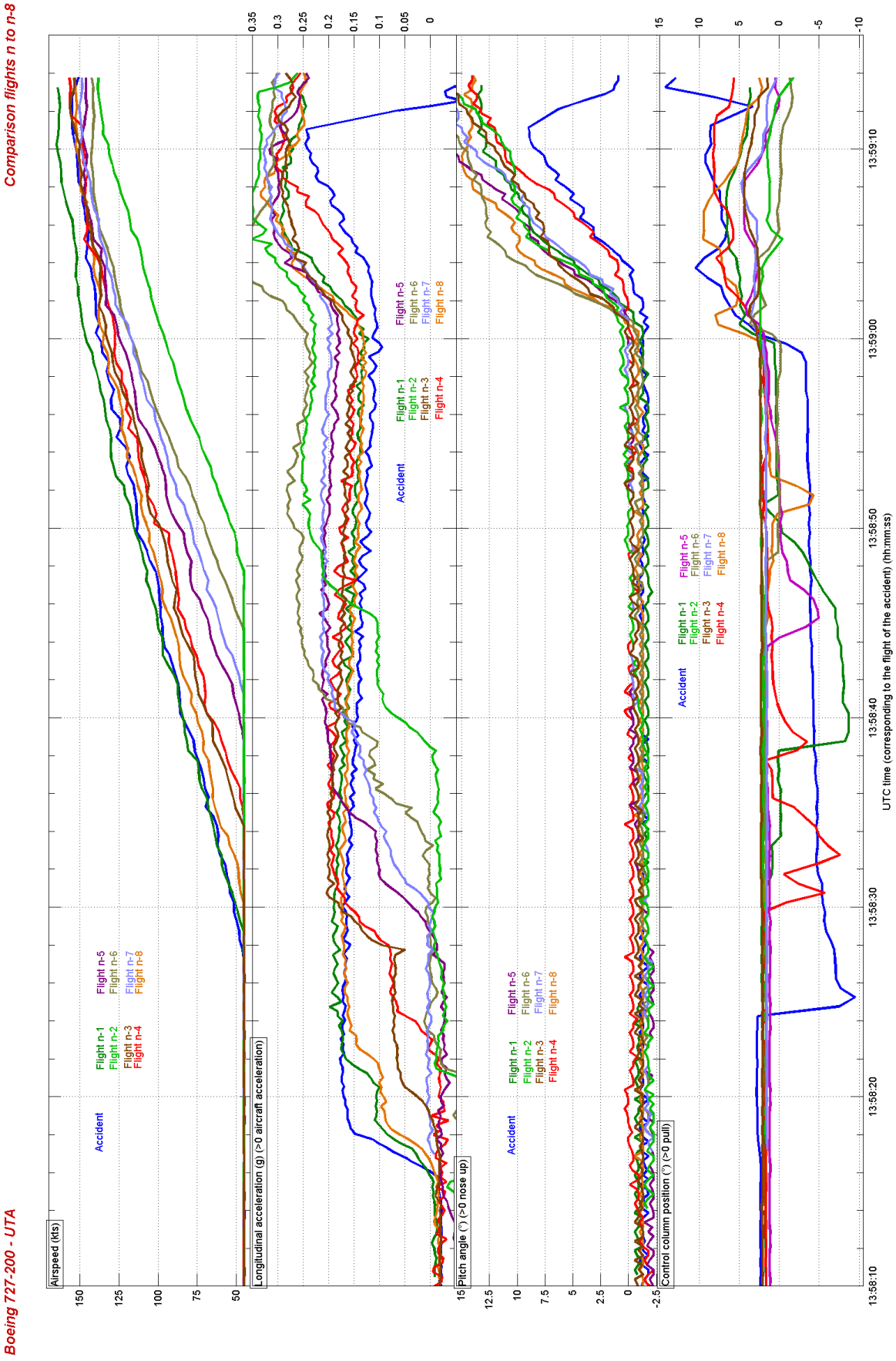
July 2003

August 2003

DFDR Graphs


3X-GDO
Takeoff in Cotonou, flight of the accident
Boeing 727-200 - UTA
Bureau d'Enquêtes et d'Analyses - France
1st impact
"V1, VR"
"Eighty"
"Takeoff power"
"Push forward"
"Rotate, rotate"
"Pull Pull Pull"
Airspeed [kts]
Longitudinal acceleration [g]
EPR engine #3
EPR engine #2
EPR engine #1
Magnetic heading [°]
Vertical acceleration [g]
Roll angle [°]
Pitch angle [°]
Elevator position [°]
Control column position [°]
Rudder position [°]
Control wheel position [°]
Aileron position [°]
UTC (hh:mm:ss)
13:57:50
13:58:00
13:58:10
13:58:20
13:58:30
13:58:40
13:58:50
13:59:00
13:59:10


3X-GDO
Takeoff in Cotonou, flight of the accident
Boeing 727-200 - UTA
Bureau d'Enquêtes et d'Analyses - France
Airspeed(kt)
Longitudinal acceleration [g]
EPR engine #1
EPR engine #2
EPR engine #3
Vertical acceleration[g]
Magnetic heading[°]
Roll angle [°]
Pitch angle [°]
Elevator position [°]
Control column position [°]
Control wheel position [°]
Aileron position [°]
Rudder position [°]
1st impact
"V1, VR"
Beginning of vibration
"Rotate, rotate"
"Pull Pull Pull"
UTC (hh:mm:ss)
13:58:58
13:59:00
13:59:02
13:59:04
13:59:06
13:59:08
13:59:10
13:59:12
13:59:14
13:59:16


3X-GDO
Comparison flights n to n-8
Boeing 727-200 - UTA
Airspeed (kts)
Longitudinal acceleration (g) (>0 aircraft acceleration)
Pitch angle (°) (>0 nose up)
Control column position (°) (>0 pull)
Accident
Flight n-1
Flight n-2
Flight n-3
Flight n-4
Flight n-5
Flight n-6
Flight n-7
Flight n-8
UTC time (corresponding to the flight of the accident) (hh:mm:ss)
Bureau d'Enquêtes et d'Analyses - France

CVR TRANSCRIPT

FOREWORD

The following is a transcript of the elements which were comprehensible at the time of the readout of the cockpit voice recorder from the Boeing 727-223 registered 3X-GDO involved in the accident at Cotonou (Benin) on 25 December 2003. This transcript contains conversations between crew members, radiotelephonic messages and various noises corresponding, for example, to the movement of selectors or to alarms.

The reader's attention is drawn to the fact that the recording and transcript of the CVR are only a partial reflection of events and of the atmosphere in a cockpit. Consequently, the utmost care is required in the interpretation of this document.

The voices of crew members are heard via the cockpit area microphone (CAM). They are placed in separate columns for reasons of clarity. One column is reserved for the voices of others, noises and alarms, also heard via the CAM. It also includes the transcript of remarks made by people other than the crew.

The radio communications not heard by the crew in the cockpit are not transcribed.

GLOSSARY

ATC time	ATC time obtained from the tower recordings
↓	Communication with ATC, the ground or the cabin crew
Cpt	Captain
FE	Flight Engineer
CP	Co-pilot
DG UTA	Director General of UTA
TS	Technical Service
example	*The words or groups of words in italics are translated from Arabic*
( )	Words or groups of words in parentheses are doubtful
(*)	Words or groups of words not understood
(?)	Speaker unknown or unidentified

ATC time	Cpt	FE	CP	ATC	Others
13 h 27min 35s	**START OF RECORDING**				
13 h 30 min 48 s to 13 h 39 min 46 s					Numerous distant conversations that are incomprehensible apart from a few words or isolated phrases
13 h 35 min 05 s	*This machine shouldn't… the total… where is the total (*) What what where… Why, why ? Each passenger has… Nothing (*)*				
13 h 35 min 14 s	*Each passenger has ninety kilos (*)*				
13 h 35 min 18 s	*(?) Each passenger has seven pieces two hundred kilos… seven pieces (*) passengers… where are they?*				
13 h 36 min 15 s		*That's it we've finished we have no more space* already *(*)*			
13 h 36 min 40 s	(?): (*)				
13 h 36 min 44 s	*(?): (Good because you) (*) hide*				
13 h 36 min 45 s	(?): (My brother) (*) give me (*) passengers the weight and how many bags				
13 h 36 min 51 s	(?): (*) Baggage hold				
13 h 36 min 53 s	(?): Yes, passengers… how many do you get?				
13 h 36 min 55 s	(?): (*) So I know (*) I want to know for this (computer)				
13 h 37 min 31 s	(?): We have one here				
13 h 37 min 32 s	(?): OK there's one				
13 h 37 min 33 s	(*) Only one?				
13 h 37 min 34 s	(?): (*) We have one here we have one here				
13 h 37 min 38 s			*The sheets they gave us don't have the* load. *What is that? Come on come on (…)*		
13 h 37 min 45 s			*The sheets they gave us don't have the* weight, only passengers		
13 h 37 min 47 s		(?): Don't worry			
13 h 37 min 48 s	*We have the* passengers manifest, without weight				

ATC time	Cpt	FE	CP	ATC	Others
13 h 37 min 51 s				Roger thanks for transmitting the request	
13 h 38 min 05 s		(?): (*)			
13 h 38 min 28 s		(?) (Thirty- five)			
13 h 38 min 30 s		(?): (*) *That's the* total (*) seven bags			
13 h 38 min 35 s					Incomprehensible speech by Captain on total baggage
13 h 39 min 04 s		(?): How many passengers on board?			
13 h 39 min 28 s		(?) Do you know how many passengers we (*) (*)			(*) Distant continuous conversations
13 h 39 min 40 s	*They didn't give us anything… fifty-five (*)*				
13 h 39 min 43 s		(?): sixty-five… *(*) (Comrade)*			
13 h 40 min 01 s	*How many (*)*				
13 h 40 min 02 s		*Fourteen*			
13 h 40 min 17 s		*Up to us now to complete (*)*			
13 h 40 min 30 s			*But but but… that each of them is bringing on board the airplane a two hundred kilo suitcase two hundred kilos (that's not possible) get them to unload them and weigh them, then we will know,* then there is no problem, then we can know where we are (*)		
13 h 40 min 40 s		(?) From Cotonou only sixty-three plus ten from Lome make them seventy-three total (*)			
13 h 40 min 51 s		(?) That's OK			
13 h 40 min 52 s		(?) Seventy-three plus (*)			
13 h 40 min 53 s				(Alpha)Juliet Cotonou take-off forty err call (backtrack)	
		(?): Seventy-three (*) more work			
13 h 40 min 57 s		(?): Nine tons of (*)		**(TYAAJ):** Err I will call back err (*)	
13 h 41 min 07 s		(?): (*) Tell me one thing (*)			
13 h 41 min 25 s		(?): (*) Everything below than ten kilos you put it			

ATC time	Cpt	FE	CP	ATC	Others
	down (*). More than ten kilos (*)				
13 h 41 min 30 s	(*) Two hundred kilos *found here*				Incomprehensible conversations
13 h 41 min 58 s		(?): (*) Thirty-five (*)			
13 h 42 min 05 s	You have to understand from here, *when we read (it) (*) it means normal*				
13 h 42 min 24 s	*(*)*				
13 h 42 min 46 s	*Put the bags (the weight of bags) who knows at least, everyone who has a bag (*)*				
13 h 43 min 45 s	*When the airplane is climbing (*) It's easy (*)*				
13 h 44 min 48 s	*Forty-seven (*) the temperature*				
13 h 44 min 51 s	*(…) we (said) that a hundred times we want (*)*				
13 h 45 min 42 s	*(…)*				
13 h 45 min 58 s	(?): *Finished, finished, close the door*				
13 h 46 min 14 s	*(?) We have five tons for take-off* (take off)				
13 h 46 min 15 s	*We have five tons for sure*				
13 h 46 min 17 s		*We have the temperature and the runway at two thousand four hundred…*			
	No, let him come (*) and we'll see the airplane				
	(?) You'll see (on this side) by the window				(3rd voice): *You will see when it takes off*
	(?) We will see when the airplane takes off if we take off				(3e voice): *You will see like that*
			If we manage to take off... the people … I tell you It will be quite a performance if we manage to take off today, you will see if we manage to take off today,		Anger and discontent from Co-pilot
					(3e voice): *because (he'll come)?*

ATC time	Cpt	FE	CP	ATC	Others
			because at least let them put the exact weight so that we know it, let them put the exact weight so that we can calculate it		
13 h 46 min 44 s					DG UTA: *But the weight is indicated here*
13 h 46 min 45 s			*There is no weight… each*		
13 h 46 min 48 s			*passenger came on board with a twenty kilo bag. It's impossible you have an airplane with a hundred passengers if this airplane takes off today you will see if this airplane takes off (otherwise) we're going to … we're going to drop into the sea*		DG UTA: *Yes, that's true*
13 h 46 min 50 s			*You have one forty (*). You will see when the aircraft will take off or we will crash on the sea*		
13 h 46 min 55 s					DG UTA: *I am (*) as soon as we arrive in Beirut I'm going to tell him off… what can I do what can I do… and on the return (*).* I cannot do anything, I came I made this problem I cannot return (*)
13 h 47 min 08 s			*No, don't send the passengers*		Exasperated

ATC time	Cpt	FE	CP	ATC	Others
			back but the baggage must stay here		
13 h 47 min 12 s					DG UTA: I will send six messages that more *thirty* kilos hand luggage and hand baggage is not allowed
13 h 47 min 20 s	(?) Checklist checklist				
13 h 47 min 22 s	(?) Checklist close door				
13 h 47 min 26 s	(?) *Bissmillah el Rahman el Rahim*				
13 h 47 min 31 s			(?) Before take off check list		
13 h 47 min 32 s	(?) First close the hatch and make sure (*)… *Yes*				
13 h 47 min 35 s	(?) (Make sure) (*)				
13 h 47 min 45 s	(?) *Bissmillah el Rahman el Rahim*				
13 h 47 min 50 s		(?) (*)			
13 h 47 min 54 s				TS: The tower the maintenance radio	
13 h 47 min 55 s	Cockpit left				
13 h 47 min 56 s			Cockpit right		
13 h 47 min 56 s		Compression (*) my side (*)			
13 h 47 min 58 s	(*)			(*) The tower (transmit)	
13 h 47 min 59 s		Stall warning?			
13 h 48 min 00 s			Checked	TS: Yes good day the tower it's (…) here to go from the ramp to the Loc	
13 h 48 min 00 s		Emergency lights?			
13 h 48 min 01 s			Armed		
13 h 48 min 01 s		Passenger signs?			
13 h 48 min 02 s			Well, ON		
13 h 48 min 02 s		(*)			
13 h 48 min 03 s			Three ON		
13 h 48 min 04 s		Anti-ice?			
13 h 48 min 04 s			Closed		
13 h 48 min 06 s				Approved call back when clear	
13 h 48 min 08 s	Flight instruments			TS: OK	
13 h 48 min 09 s		Flight instruments flight data I believe (*)			
13 h 48 min11 s	(?) Set and cross checked				
13 h 48 min 12 s	Take care (*) two seven nine				

ATC time	Cpt	FE	CP	ATC	Others
13 h 48 min 15 s		(?) Three times			
13 h 48 min 16 s	(*) Board?				
13 h 48 min 17 s	Checked				
13 h 48 min 17 s	Radio Nav transponder				
13 h 48 min 19 s	Stand by stand by				
13 h 48 min 19 s		Start levers?			
13 h 48 min 20 s			Cut off		
13 h 48 min 21 s		(?) Altimeter			
13 h 48 min 21 s		(?) (*)			
13 h 48 min 22 s		(?) Aileron trim?			
13 h 48 min 22 s		(?) (*) zero			
13 h 48 min 23 s		Oxygen ON			
13 h 48 min 24 s		(?) (Take off) (*)			
13 h 48 min 30 s	(*) Twenty-three (*) five hundred full stop (*) if we continue (*) if no more travel (*)				
13 h 48 min 38 s	Thank you very much… Start up				
13 h 48 min 58 s	↓ (?) Tower err good evening (Golf India) one four one				
13 h 49 min 04 s				Station calling change frequency one two five (*)	
13 h 49 min 19 s	Seven three				
13 h 49 min 21 s	↓ (?)Tower good evening Golf India Hotel one four one				
13 h 49 min 25 s				Golf India Hotel one four one Cotonou (*) right	
13 h 49 min 30 s					DG UTA: I'm coming please I'm coming… I will (*)
13 h 49 min 32 s				Golf India Hotel one four one start (*) runway two four the wind one six zero (zero) seven knots temperature three two dew point two seven Q N H one zero zero nine time take four nine call for starting	

ATC time	Cpt	FE	CP	ATC	Others
13 h 49 min 46 s	↓ (?) OK clear for take off runway two four				
13 h 49 min 53 s	OK please for start beacon				
13 h 49 min 55 s	ON				
13 h 49 min 56 s	OK deliver (*)				
13 h 50 min 12 s	Pressurize				
13 h 50 min 20 s	N1				
13 h 50 min 26 s	Two				
13 h 50 min 27 s			Two		
13 h 50 min 41 s	Two… engaged				
13 h 51 min 15 s		(?) N three			
13 h 51 min 17 s		(?) Valves open			
13 h 51 min 24 s	(Pressurize) (*)				
13 h 51 min 25 s	(*) Number one				
13 h 51 min 37 s		E G T right			
13 h 51 min 46 s	Five zero				
13 h 52 min 06 s	↓ (?) Golf India Hotel one four one taxi (*)				
13 h 52 min 12 s				India Hotel one four one Cotonou taxi in (*) backtrack runway two four	
13 h 52 min 16 s	↓ (*) Backtrack runway two four Golf India Hotel one four one				
13 h 52 min 20 s	After start check list				
13 h 52 min 26 s				Golf India Hotel one four one report (*)	
13 h 52 min 28 s	Five zero				
13 h 52 min 30 s	*Give us* total estimate				
13 h 52 min 38 s	Number two to take off (*)		↓ One four one ready to copy (*)		
13 h 52 min 42 s				India Hotel one four one Cotonou cleared Cotonou Kufra airport (*) limit initial level one one zero after airborne right turn contact Lagos on one two four seven for higher	
13 h 52 min 57 s			↓ (*) Clear		

ATC time	Cpt	FE	CP	ATC	Others
			destination Kufra (*) One one zero right turn after take off on target Lagos on one two four decimal seven		
13 h 53 min 05 s				(*) Hotel one four one clearance correct next call when ready to take off	
13 h 53 min 08 s	↓ Call you back ready				
13 h 53 min 23 s	(*) One point five				
13 h 53 min 26 s	(Negative flaps Twenty-five)				
13 h 53 min 27 s			(Ah Airport)		
13 h 53 min 31 s	(*) Thirty-six				
13 h 53 min 32 s			Here are flaps twenty-five		
13 h 53 min 34 s	(*) Make it one three seven one four seven				
13 h 53 min 39 s	(*) On board *or no*				
13 h 53 min 40 s		*(?) No, no*			
13 h 53 min 56 s	One three… (*) six				
13 h 54 min 00 s	One five (thirty-eight) one four two or one four three and… we have one four six… one four six				DG UTA: We have one four… one four err… five
13 h 54 min 09 s	One four five huh?				
13 h 54 min 10 s					DG UTA: Yes (*) That includes infants. We have one four two adults and we have three infants
13 h 54 min 12 s	OK (*) one four five				
13 h 54 min 14 s	One four two (*)				
13 h 54 min 17 s	(*) One four five (*)				
13 h 54 min 22 s	One (five) five (*)				

ATC time	Cpt	FE	CP	ATC	Others
13 h 54 min 46 s	(*) Flaps twenty-five				
13 h 54 min 57 s	*He tried to force it*				
13 h 55 min 03 s	(Aileron) left				
13 h 55 min 04 s	(*)				
13 h 55 min 06 s	Right… Rudder pull				
13 h 55 min 10 s	(*) Left				
13 h 55 min 12 s	(*)		Right		
13 h 55 min 14 s	Checklist				
13 h 55 min 19 s	We talk we talk… Checklist and then we talk				
13 h 55 min 24 s	Before (take off check list)			(OBK4001): Err Lagos control Oscar Bravo… Kilo four zero zero one	
13 h 55 min 25 s		(?) (*)			
13 h 55 min 26 s			All lights is out		
13 h 55 min 29 s			Set for departure on runway two four		
13 h 55 min 31 s		(?) (*) Six (*) three no light			
13 h 55 min 33 s				(OBK4001): we are approaching level one two zero and request to (maintain) level one three zero due to pressurization problem	
13 h 55 min 34 s		(?) (*)			
13 h 55 min 35 s		(?) (*)			
13 h 55 min 36 s		Set the trim six and three quarters			
13 h 55 min 39 s	Six and three quarters is on my side				
13 h 55 min 42 s		(?) (*)			
13 h 55 min 43 s		Flaps… twenty-five twenty-five green			
13 h 55 min 45 s	Twenty-five twenty-five green			(OBK4001): One two seven three good day	
13 h 55 min 50 s		(*) OFF for the time being (*)			

ATC time	Cpt	FE	CP	ATC	Others
13 h 56 min 00 s	(Try the ground switch to ground for the time being)				
13 h 56 min 05 s	Four packs ON… They will be OFF (when we line up)				
13 h 56 min 09 s		(?) (*)			
13 h 56 min 12 s	Two hundred and one nine six one nine six one three six one four six one five six (*) Omega				
13 h 56 min 18 s	(*) Very critical and in case something goes wrong I cannot (*) say whatever				
13 h 56 min 28 s	Go ahead (*) standard briefing		Normal took out will be take off (under the brakes… less than twenty-five maximum power)		
13 h 56 min 35 s		Pack less take off			
13 h 56 min 36 s			There will be (*) in cockpit one one five. I will climb maximum three degrees, nose up until I build up my speed. I give the flaps and then I clear up the airplane to go up to higher altimeter (*)		
13 h 56 min 49 s			OK I (land) as soon as possible		
13 h 56 min 52 s			*When something happen I'll give you (*)* turn off		
13 h 56 min 54 s	This is the				

ATC time	Cpt	FE	CP	ATC	Others
	procedure after the gears are up				
13 h 56 min 56 s	(?) I will not start initiate my clearance right (runway heading)				
13 h 56 min 58 s				(?): The Tower	
13 h 57 min 00 s	No turn… No turn … Don't make any turn, go to the sea no turn				
13 h 57 min 04 s				Maintenance radio the Tower	
13 h 57 min 04 s				(?): (*)	
13 h 57 min 05 s					DG UTA: *I want to talk to you for a bit*
13 h 57 min 14 s	He will check for you take off power on the brakes. Be careful *that's disturbing for the passengers* when you release. In other words he will put the full power for you. Don't release the brakes *you put your feet on the brakes* slowly, release, release, *then what's happening* easy, very easy on the brakes *because that's disturbing for the passengers*				
13 h 57 min 16 s				(*) The Tower	
13 h 57 min 35 s					Prayer in Arabic
13 h 57 min 37 s	↓ (?) Golf India Hotel one four one ready for departure				
13 h 57 min 40 s	(?) *OK lala OK lala*			India Hotel one four one Cotonou cleared for take off runway two four wind one seven zero	

ATC time	Cpt	FE	CP	ATC	Others
				(degrees) seven knots	
13 h 57 min 46 s	↓ (?) Cleared for take off Golf India Hotel one four one				
13 h 57 min 57 s	Easy easy on the brakes, very easy				
13 h 57 min 59 s	(*)				
13 h 58 min 01 s	Take off thrust				
13 h 58 min 07 s	*Go gently* you have the brakes				
13 h 58 min 09 s			Yes		
13 h 58 min 11 s	*Easy easy* gently, eh ?				
13 h 58 min 16 s	Release… release… *Easy release, easy release*				
13 h 58 min 18 s	*Let it off as if (*)* take off your feet				
13 h 58 min 20 s	Take off your feet				
13 h 58 min 21 s	OK (*)				
13 h 58 min 23 s	*Bissmillah el Rahman el Rahim*				
13 h 58 min 24 s	(*) Push (forward)				
13 h 58 min 26 s	*Power set*				
13 h 58 min 28 s	*Don't matter with the wind it's only seven knots*				
13 h 58 min 35 s	(Fifty knots)				
13 h 58 min 36 s	(*)				
13 h 58 min 40 s	Eighty				
13 h 59 min 00 s	V one V R				
13 h 59 min 02 s	(Rotate Rotate)				Noise followed by vibrations until impact
13 h 59 min 03 s	Rotate				
13 h 59 min 06 s	More, more, more				
13 h 59 min 09 s	Pull pull pull pull pull pull pull				
13 h 59 min 11 s	Pull pull pull pull				Noise of impact
13 h 59 min 14 s	**END OF RECORDING**				

Transcript of radio communications

GLOSSARY

ATC time	ATC time obtained from the tower recordings
( )	Words or groups of words in parentheses are doubtful
(*)	Words or groups of words not understood
(?)	Speaker unknown or not identified

ATC Time	Transmitting Station	Message
13 h 27 min 35 s		**START OF TRANSCRIPT**
13 h 34 min 39 s	**TYAAJ**	Cotonou, Cotonou Tango Yankee Alpha Alpha Juliet good day
13 h 34 min 50 s	**TWR**	Yankee Alpha Alpha Juliet Cotonou yes transmit
13 h 34 min 53 s	**TYAAJ**	Start up for… err… dropping Father Christmas at the Sheraton number of persons on board four Captain's name (…) autonomy one hour forty (four)
13 h 35 min 16 s	**TWR**	Confirm err… taxi for (tower) above the Sheraton
13 h 35 min 22 s	**TYAAJ**	Yes it's to drop Father Christmas by helicopter at the Sheraton … marina hotel
13 h 35 min 31 s	**TWR**	Roger cleared for start up runway two four wind one six zero temperature three two dewpoint two seven Q N H one zero zero nine time exact (thirty five) call back to taxi
13 h 35 min 45 s	**TYAAJ**	I will call you back to taxi. Do you have a lot of people with you?
13 h 35 min 53 s	**TWR**	No (*) you received me anyway
13 h 35 min 55 s	**TYAAJ**	Yes with everything that's going on around
13 h 36 min 24 s	**TWR**	Alpha Juliet (control)
13 h 36 min 25 s	**TYAAJ**	Yes I'm listening
13 h 36 min 28 s	**TWR**	I know that Father Christmas will also come down to the tower
13 h 36 min 31 s	**TYAAJ**	Err err I will ask him
13 h 36 min 35 s	**TWR**	Roger
13 h 37 min 46 s	**TYAAJ**	Well err he says that he will pass by to say hello to you
13 h 37 min 51 s	**TWR**	Roger thanks for transmitting the message
13 h 38 min 35 s	**TYAAJ**	Alpha Juliet to taxi
13 h 38 min 38 s	**TWR**	(*) Cotonou taxi (PA 2) taxi up runway two four call back in IFR for take-off
13 h 39 min 53 s	**TYAAJ**	Alpha Juliet for take-off
13 h 39 min 55 s	**TWR**	Alpha Juliet Cotonou you can take off from runway two four wind two hundred degrees zero five knots
13 h 40 min 00 s	**TYAAJ**	(*)
13 h 40 min 53 s	**TWR**	(Alpha)Juliet Cotonou take-off forty err call (half-tower)
13 h 40 min 57 s	**TYAAJ**	err I will call back err (*)
13 h 47 min 54 s	**S**ervice **T**echnique	The tower the maintenance radio
13 h 47 min 58 s	**TWR**	(*) The tower (transmit)
13 h 48 min 00 s	**TS**	Yes good day the tower is (…) here to taxi from the ramp to Loc
13 h 48 min 06 s	**TWR**	Approved call back when clear
13 h 48 min 08 s	**TS**	OK

ATC Time	Transmitting Station	Message
13 h 49 min 04s	**TWR**	Station calling change frequency one two five (*)
13 h 49 min 21s	**GIH141**	Tower good evening Gulf India Hotel one four one
13 h 49 min 25s	**TWR**	Gulf India Hotel one four one Cotonou (*) right
13 h 49 min 32 s	**TWR**	Gulf India Hotel one four one start (*) runway two four the wind one six zero (zero) seven knots temperature three two dew point two seven Q N H one zero zero nine time take four nine call for starting
13 h 49 min 46 s	**GIH141**	OK clear for take off runway two four
13 h 52 min 06 s	**GIH141**	Gulf India Hotel one four one taxi (*)
13 h 52 min 12 s	**TWR**	India Hotel one four one Cotonou taxi in (*) backtrack runway two four
13 h 52 min 16 s	**GIH141**	Backtrack runway two four Gulf India Hotel one four one
13 h 52 min 26 s	**TWR**	Gulf India Hotel one four one report (*)
13 h 52 min 38 s	**GIH141**	One four one ready to (copy (*))
13 h 52 min 42 s	**TWR**	India Hotel one four one Cotonou cleared Cotonou Kofra airport (*) limit initial level one one zero after airborne right turn contact Lagos on one two four seven for higher
13 h 52 min 57 s	**GIH141**	Clear destination Kofra (*) one one zero right turn after take off on target Lagos on one two four decimal seven
13 h 53 min 05 s	**TWR**	(*) Hotel one four one clearance correct next call when (*) to take off
13 h 53 min 08 s	**GIH141**	Call you back ready
13 h 55 min 24 s	**OBK4001**	Err Lagos control Oscar Bravo… Kilo four zero zero one
13 h 55 min 33 s	**OBK4001**	We are approaching level one two zero and request to (maintain) level one three zero due to pressurization problem
13 h 55 min 45 s	**OBK4001**	One two seven three good day
13 h 56 min 58 s	**(?)**	The Tower
13 h 57 min 04 s	**TWR**	Maintenance radio the Tower
13 h 57 min 04 s	**(?)**	(*)
13 h 57 min 16 s	**TWR**	(*) the Tower
13 h 57 min 37 s	**GIH141**	Gulf India Hotel one four one ready for departure
13 h 57 min 40 s	**TWR**	India Hotel one four one Cotonou cleared for take off runway two four wind one seven zero (degrees) seven knots
13 h 57 min 46 s	**GIH141**	Cleared for take off Gulf India Hotel one four one
13 h 59 min 15 s	**END OF TRANSCRIPT**	

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