



FEDERAL REPUBLIC OF NIGERIA

Civil Aircraft Accident Report
No. CIA 122

FEDERAL MINISTRY OF TRANSPORT AND AVIATION

REPORT ON THE ACCIDENT

TO

BELL 206B JET RANGER III HELICOPTER REGISTERED 5N-AQC AT A LOCATION 7 NAUTICAL MILES N.N.W. OF KADUNA AIRPORT, NEAR THE VILLAGE OF IFIRA ON SATURDAY THE 26TH OF APRIL 1986.

AIR REGISTRATION BRANCH

21029

AIR SAFETY, LAGOS

1st July, 19

The Hon. Minister for Transport Et Aviation,
Federal Ministry of Transport Et Aviation,
Joseph Street,
Lagos.

Dear Sir,

Civil Aircraft Accident Report No. CIA 122

I have the honour to submit the report on the circumstances of the accident to the Bell 206B Jet Ranger III registered 5N-AQC which occurred ½ km north of Ifira village, Kaduna State on Saturday, the 26th of April, 1986.

Yours faithfully,

K. K. O. SAGOE
Chief Inspector of Accident

Aircraft Accident Investigation Civil
Aircraft Accident Report No. CIA 122

Aircraft: Bell 206B Jet Ranger III helicopter serial No, 2797

Registration: 5 N -AQC

Engine: Allison Model 250-C20B

Owner: Federal Ministry of Agriculture
Federal Dept. of Pest Control
Services P. M. B. 2005.
Kaduna,
Kaduna
State.

Operator: Capital Aviation Services Ltd.,
P.O. Box 8276,
Kaduna.

Crew: (1) Captain G. N. Igwebike,
Check Captain-killed.
(2) Captain J. Abdullah,

Captain on Check-seriously injured

Passengers: Nil.

Place of Accident: 7 Nautical Miles NNW of Kaduna Airport and ;km.
North of the village of IFIRA.

Kaduna Airport Co-ordinates and elevation: Lat. N10⁰ 41' , 42"
Long E007⁰ 19' - 10"
Elev.2073ft.

Date and Time: 26th April, 1986 at 12:08 UTC
i.e. 1:08 p.m. local time.

Synopsis:

The helicopter was being used to carry out a check-ride for one of the Captains employed by Capital Aviation Services Ltd. The Check-Captain was authorized by the Licensing Dept. of the Federal Ministry of Transport and Aviation to conduct the test in order that the Captain on check be issued the Bell 206B rating on his Licence as a pilot in command.

After several hovering exercises were carried out within the aerodrome circuit the aircraft proceeded north of the field for the remaining tests in the programme.

It was at the tail end of the tests that an engine failure was simulated by the check Captain, but the Captain on check hesitated in his reaction to the required procedure. The report concludes that the accident was probably caused by the failure of the Pilot on the controls to react instant to the engine flame-out by immediately putting the helicopter into auto-rotation.

FACTUAL INFORMATION

1.1 History of Flight:

The helicopter was on a check-ride flight around Kaduna Airport when the accident occurred.

The helicopter with two souls on board and an endurance of 02:00 hours lifted up at about 10:48 UTC, i.e. 11:48 a.m. local time and proceeded to the threshold of runway 05 for a hovering exercise. Later at 10:56 UTC a circuit was made into runway 23 and a landing was effected on the taxi-way. After an objection to landing on the taxi-way was raised by the Air Traffic Controller (ATC), a low pass was made towards the 05 threshold, but just before getting to the threshold the crew decided to proceed to an area north of the field at about 11:05 UTC to complete the check-ride programme. The helicopter had spent some 30 minutes by then on the ground manouvres. North of the field about 45 minutes were spent on aerial exercises before the exercise of landing in a confined space (Landing in a bush-clearing) was carried out.

The helicopter took off from the bush both accelerating and climbing attaining about 60 knots forward speed and a height of about 200ft when the check-Captain reached forward to operate a switch to the 'Off' position either to simulate a complete hydraulic failure or an engine flame-out.

During the ensuing period the main rotor of the helicopter went into an aerodynamic stall accompanied by heavy vibrations of the helicopter.

The Check-Captain immediately took over the controls of the helicopter from the left seat, attempted to re-start the engines by turning 'ON' the fuel valve and at the same time establish the helicopter into autorotation.

The aircraft crashed to the ground with an appreciable forward speed and a yaw to the right.

The tail boom made the first impact with a six-inch diameter tree trunk after which the boom was sheared off and the helicopter rolled over on the ground coming to a final halt in an inverted position. There was no outbreak of fire.

The accident location was 7 nautical miles N.N.W. of Latitude 10^o 41'42" Longitude 7^o 19' 10" E.

The accident occurred in bright sun-shine at day-time.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
-			
Fatal	1	-	-
Serious	1	-	-
Minor	-	-	-

1.3 Damage to aircraft:

The helicopter was totally destroyed.

1.4 Other Damage:

There was no damage around the farm-land that would warrant a financial compensation.

1.6 Personnel Information: Check-Captain: Male, aged 32 years. Licence: Airline Transport Pilot's Licence No. 1877 (Helicopters) which would expire on the 17th of June, 1986.

TypeRating: Bell 47-G2 Bell
212 Bell 206

Flying Experience: Total Hours 4,500 hours

Total hours on type: 149hrs. 25mins.

Medicals: Next medicals due on the 30th of June, 1986 and the ECG expires on the 30th of December, 1987.

The last flight entry in the personal flying Log book was a flight of 3hrs. 35minutes on the 1 st of April, 1986 in a Bell 206.

Captain on Check: Male, aged 28 years.

Licence: Commercial Pilot's Licence No. 2817 (Helicopters) which would expire on the 4th of June, 1986.

Type Ratings: Alouette II Alouette III Dauphin SA 365 AS 355 Ecureuil 2.
Bell 47

Flying Experience: Total Hours: 1,550hrs. 59 minutes. Total Hours on type:

7hrs. 30minutes. Flying hours last 84 days. 3hrs. Flying hours last 28 days. 3 hrs. Flying hours last 7 days. 3 hrs.

He flew about 4 hours 30 minutes on the Bell 206 in December, 1985 and then 3 hrs. four months later in April prior to the check-ride. Rest period prior to the accident was over 20 hours.

Medicals: Next due on the 4th of June, 1986 and the E.C.G. is valid until the 4th of December, 1987.

Air Traffic Controller: The Air Traffic Controller was Mr. A. Adedara aged 36 yrs. a holder of a current A.T.C. Licence No. 63 endorsed with following ratings; aerodrome, approach and radar. The Licence and accompanying medicals would expire on the 23rd of July, 1986.

Aircraft Maintenance Personnel: The Engineer in charge of the aircraft was Mr. P. M. Ranicar, holder of a Nigerian Aircraft Maintenance licence No. 1172 which was valid until the 13th of February, 1987.

His type ratings are as follows;

Category 'A'..... Agusta/Bell 206 Helicopters

Category 'C'..... Allison 250 Engines in Agusta/Bell 206 Helicopters.

He was therefore considered qualified for the functions he was performing.

Conversion Training Captains:

The conversion training of Captain Junald Abdullah was carried out by Captain J. R. Ridings, the Chief Pilot of Capital Aviation Services Ltd. and Captain S. M.

Captain J. R. Ridings did not possess any Nigerian Licence at the time he was in command as Instructor on 5N-AQC. His licence coverage then was from the United Kingdom.

Captain S. M. Watila was in possession of a current Commercial Pilot's Licence No. 2018 (Helicopters). The Bell 206 endorsement was not included in his licence.

1.6 **Aircraft Information:**

The Bell 2068 Jet Ranger III was manufactured on the 14th of September 1979 and carried a Certificate of Airworthiness No. 497 which was valid in the aerial work category until the 31st of December 1986. The helicopter was not insured.

The aircraft must have been on the ground between the 3rd of October 1983 and the 1st of January 1986 at a period when it was denied a Certificate of Airworthiness.

The total aircraft flying hours were 483 hours 54 minutes. The last inspection was a 50 hour check which was carried out at 479 hours 6 minutes on the 12th of March 1986 and all mandatory inspections and directives were complied with.

There were no defects on the helicopter which could have contributed to the accident.

With the weight report of the aircraft, weight of the two crew members and weight of fuel on board at the time of accident, it was verified that the Centre of Gravity of the helicopter was within the prescribed limits at the time of crash.

A maintenance agreement exists between the Owners of the aircraft, Federal Department of Pest Control Services and Capital Aviation Services Limited, Kaduna, but the owners categorically denied that any person from Capital Aviation Services Ltd. was ever authorized to operate the helicopter on the date it crashed.

On the other hand Capital Aviation Services Ltd. did present documents at the time of investigation which indicate that proposals were still going on to engage the services of Capital Aviation Services Ltd. on contract basis for the training of Pilots engaged by the Federal Department of Pest Control Services in the operation of the aircraft for crop spraying manouvres.

The type of fuel used was Jet A-1.

1.7 **Meteorological Information:**

Time: 12:00 UTC
Wind: From 240 degrees at 9 knots.
Temperature: 31 oC
Dew Point: 22°C Visibility 30km.
Cloud: 2 oktas Cu at 600 metres.
7 oktas CS at 9000 metres. Q. F. E. 941
m13 Q.N.H. 1016mB

The natural light condition was a bright sunlight.

This weather condition is considered good for the operations and therefore bears no relevance to the accident.

1.8 AIDS TO NAVIGATION

The flight was purely visual.

1.9 Communications:

Communications between the control tower and the aircraft were on 122.3 MHz. (See Appendix 1). The communications between the helicopter and the control tower appeared normal while the aircraft was on its ground manoeuvre exercises near the runway.

However, the following entries in the Aerodrome Watch-Log indicated that there were problems of transmission and reception of radio signals at Kaduna on the day of the accident.

The following were recorded;

Time: 0603 UTC - 9495 MHz tested, nil contact with any station.

12:47UTC - - Kano informed of the crash through WT 509.

12:48UTC - Finding it difficult to read other stations on 122.3 MHz - Signals men working on the set. Through WT 509, ambulance relayed that they are almost at the crash site.

12:55UTC - Unable to read any station now except WT 509.

13:20UTC - Only 122.3 MHz standby working off and on. Mains completely U/S. Tower moved to Kano aircraft on ground Kaduna since I cannot read any station anymore on our standby set.

15:23UTC - Again unable to read any station even the WT 502 LOS - KAD. ETA 1537 comes ON and OFF.

The crew of 5N-AOC did not report the time when they were established in the training/Exercise area even though the Controller requested them to do so.

The Controller did not inquire on the progress of the local flight thirty minutes after the last contact was established with the aircraft.

1.10 Aerodrome Information:

The aerodrome elevation was 2073ft but the other field data are irrelevant to this accident.

1.11 Flight Recorders:

Not installed or required by law.

1.12 Wreckage and Impact Information:

See wreckage distribution chart Appendix II.

The tail boom of the helicopter made the first impact with a six inch diameter trunk of a tree after which the boom was sheared off. The helicopter made a heavy impact with the ground, rolled over its right side and ended up in an inverted position on top of a mound of pebbles.

1.13 Medical and Pathological Information:

The Check Captain died immediately from head injuries.

The Captain on Check suffered severe multiple injuries and a compound fracture on the right elbow.

1.14 Fire:

There was no fire outbreak.

1.15 Survival Aspects:

The first indication of the crash was reported by a villager who reported to the Control Tower 1 hr, 32 minutes after departure of the aircraft to the practice area.

The Airport Fire Services and rescue crew probably arrived at the crash site about 45 minutes after the crash.

The Captain on check climbed out of the helicopter and was aided by the villagers who arrived at the site about ten minutes after the crash.

The rescue team from the airport conveyed the corpse and the injured Pilot to the Armed Forces Hospital located about 37 kilometres from the crash site.

1.16 Tests and Research: Nil.

1.17 Additional Information:

The fuel cork actuator switch and the hydraulic switch on this helicopter are located on the instrument panel below the main flight instruments and in line with the right hand seat pilot's cyclic control column. The separation of the switches is about six inches.

1.18 New Investigation Technique: Nil.

2. Analysis:

The surviving crew member, the Captain on check, was interviewed and it was fully established that the helicopter was climbing out after the crew had landed in a bush clearing.

The Captain on check recollected vividly that the Check Captain reached forward to operate a switch. From the placement of the Check-Captain's hand, he could have been going for either the hydraulic switch, in order to simulate a hydraulic failure, or the fuel cork actuator switch, in order to simulate an engine flame-out.

A significant start to the accident sequence was the fact that the Captain on check, and also on the controls tried to anticipate what the Check-Captain was going to do. As it happened in this case, the Captain on Check guessed that the

was going to be a hydraulic failure simulation. Up till the time of interview, he maintained that his guess was right and the Check Captain in fact made a mistake by **switching off the fuel** cork actuator. In paragraph 1.17, the position of the two switches had been fully described.

In finding out the cause of this accident analysis must clearly show whether the Check Captain did make a mistake in operating a switch unintentionally or the Captain in Check made the wrong guess in anticipation of the following sequence of events thereby unnecessarily delaying his reaction to what actually followed.

Firstly, the hand movement of the Check Captain could have resulted in either switching off the fuel cork actuator or the hydraulic switch.

Secondly, was the helicopter at a phase of flight where either tests could have been safely carried out? The answer to this question is crucial. The main rotor blades would have been set at the maximum pitch angle by the collective pitch lever as the helicopter was just climbing out. To lose the assistance of the hydraulic system at this phase of flight would have subjected the Pilot in Control to the maximum manual load. However such tests form part of the certification criteria for the helicopter and it must have been amply demonstrated by the manufacturers that the helicopter was still controllable.

Thirdly, was it permitted to simulate an engine flame-out at that point in time where the helicopter was maneuvering? The answer to this would be found in the Height Velocity Diagram (see Appendix III). This diagram is usually called the "Avoid Curve".

The Height- Velocity diagram defines the conditions from which a safe landing can be made on a smooth, level, firm surface following an engine failure. The procedure is to immediately put the helicopter into autorotation and effect a landing. The criterion is that auto-rotation would be possible provided the height and indicated airspeed of the helicopter are not in the shaded area of the diagram. From the evidence of the Captain in Check i.e. Pilot in the controls, the indicated speed of the helicopter was 60 knots and the height was 200ft. (This point has been marked on the diagram). The helicopter was definitely not inside the shaded area, therefore it would have been possible to go into an auto-rotation and effect a safe landing.

From the balance of evidence, it can be deduced that, at the time in question the Check-Captain, technically was allowed to simulate either a complete loss of hydraulics or an engine failure.

It is therefore very significant that the first event in the series of events that led to the accident is the fact that the Captain in Check tried to pre-empt the Check Captain's intentions, but as it turned out his guess was wrong.

In fact the Captain in Check's reaction was the opposite of what was required of him in that a hydraulic failure would require him to pull harder at the pitch lever to maintain the high main rotor pitch whereas an engine failure would require him to quickly lower the pitch lever in order to maintain a high main rotor speed for auto-rotation.

In a real life situation, a Pilot in Control would detect either a hydraulic failure or an engine failure principally from the feel of the controls and a few instrument indications. The accident would not have taken place had the Pilot in Control not tried to anticipate the next event in his test programme. The feel of the controls and instrument indications would have guided him into the correct response which in this case was to put the helicopter into auto-rotation and effect a landing.

The sequence of events can thus be built up as follows;

- (a) Check Captain simulated an engine flame-out.
- (b) Captain on check was expecting a hydraulic failure.
- (c) Captain on check maintained the main rotor pitch angle.
- (d) Main rotors set at high pitch angle induced a high aerodynamic drag which resulted in a drastic loss in rotor speed and later rotor stall.
- (e) Check Captain realized the error, took over controls and tried to restart engines and regain controls.
- (f) Engines could not be re-started as the main rotor speed had decayed rapidly.
- (g) Helicopter was doomed to crash to the ground with stalled rotors and no sources of lift to bear its weight.

The records of the conversion training of the Captain on check revealed that the training was carried out by two Captains who were not in possession of the appropriate Licences which would qualify them as instructors on a Nigerian registered aircraft. Secondly, the training was not carried out in a coercive and comprehensive manner in that the first 4.5 hrs. were flown in December 1985 after which the next 3hrs. were flown after a period of 4 months just 48 hours before the check-ride. These facts are rather indicative of an unprofessional and careless attitude of the employers of the Captain on check, Capital Aviation Services Ltd. It probably explained why the Captain on check would not fully rely on the feel of the aircraft and was thus forced to rely on his guess of the next move. The conversion training should have been carried out in one continuous training by qualified personnel.

Search and rescue could have been alerted earlier had the Air Traffic Controller on duty kept a peg on the helicopter under his control by requesting a feed-back on the progress of the flight every 30 minutes as required by A.T.C. practice. A direct recommendation as sequel to this is that ATC personnel should be made to carryout recurrent checks especially on those practices which are normally not the routine.

Communications between the Kaduna tower and aircraft in the vicinity was rather difficult on the day of accident. The H.F. communication was not in contact with any station and the V. H.F. at a stage was not oval table both on the main system and emergency. A.T.C was forced to move into a private aircraft on the ground.

The perennial problems with communication equipment is again evidenced.

The positioning of the fuel valve activation switch and the hydraulic switch is such that it could be possible to activate the wrong switch unintentionally. A separation of 6 inches for vital switches placed in the same area could lead to an error. It is therefore highly recommended that some additional safeguard be placed on the fuel valve switch by way of a wire-lock or a guard flap to ensure that the activation of the fuel valve switch is always a deliberate action.

3. Conclusions

3(a) Findings:

- I The Check Captain was properly licensed and authorized by the Civil Aviation Department for the flight.
- II The helicopter was properly maintained and a valid certificate of Airworthiness was in force, but the helicopter was never insured.

- III Examination of the helicopter revealed no evidence of a malfunction or unserviceability that could have contributed to the accident.
- IV The helicopter's weight and centre of gravity were within the prescribed limits for the phase of operation.
- v The operator of the helicopter, Capital Aviation Services Ltd. was not authorized to fly the helicopter by the owners, Federal Ministry of Agriculture.
- VI The Conversion training Captains for the Captain on check were not qualified as instructors on any Nigerian registered aircraft.
- VII The conversion training programme was not carried out in a coercive and professional manner.
- vi II The Air Traffic Controller failed to monitor the progress of the aircraft while it was in the test zone.
- Ix The perennial problem with communication equipment was manifest on the day of the accident.
- x The position of the hydraulic switch and the fuel valve activation switch was such that a mistake in actuating one for the other is possible.
- xI The Check-Captain was allowed at that precise phase of flight to simulate an engine flame-out in order to test reaction to putting the helicopter into auto-rotation.
- xII The Captain on check was in anticipation of a hydraulic failure simulation rather than an engine failure simulation.
- x111 The Captain on check's hesitation obliterated the possibility of getting the helicopter into auto-rotation.
- xIV There was no briefing by the Check-Captain before the engine flame-out was simulated.

3(b) Probable Cause:

The accident was probably caused by the failure of the Pilot on the Controls (Captain on check) to react instantly to the engine flame-out by immediately putting the helicopter into auto-rotation.

A contributory factor is the wrong anticipation on the part of the Captain on check of a hydraulic failure simulation.

4. Safety Recommendations:

- (a) Such Tests which are difficult, or marginal in effecting recovery at any phase of flight are best carried out in a simulator. Should it be absolutely necessary to carry out such tests on a live aircraft, adequate briefings should be given by the testing officer.
- (b) An additional safe-guard should be placed on the fuel valve switch of this helicopter to prevent unintentional operation of the switch.

- (c) The perennial communications problem at Kaduna Airport should be given an adequate attention.
- (d) Federal Government Ministries and Parastatals should seek the official assistance of the Ministry of Transport and Aviation in going into aviation ventures.
- (e) ATC personnel should be made to carry out recurrent checks more especially on those practices which are normally not the routine.

The Nigerian Airports Authority must ascertain that at all airports, there is a positive means of contact between the fire stations and the Control Tower on the emergency frequency i.e. 121.7MHz.

All ATC recorders in operation shall be fitted with time injectors so as to record the times of each communication.

APPENDIX I

**TAPE TRANSCRIPT ON 5NAQC, HELICOPTER,
CRASH AT KADUNA NEW AIRPORT ON THE
26TH APRIL, 1986.**

5NAQC KADUNA, KADUNA, FROM 5QC, GOOD MORNING.
TOWER 5QC. GOOD MORNING. GO AHEAD
5QC 5QC FROM CAPITAL AVIATION, REQUEST LIFT UP FOR
FLIGHT PERMISSION TO R23 FOR 15 MINUTE AREA OPERA
TIONS, POB 2 FUEL 0200.

TOWER WILL YOU SAY AGAIN AREA OF OPERATIONS?
5QC EH. GO AHEAD
TOWER SAY AGAIN AREA OF OPERATIONS, SAY AGAIN AREA OF OPE
RATIONS
5QC O.K. SIR, WE WILL LIKE TO OPERATE ON THRESHOLD R23
15 MINUTES THEN MOVE TO THE NORTH OF THE STATION.

TOWER O.K. QNH 1017.
5QC ONH 1017.
TOWER CLEARED TO LIFT.
5QC KADUNA, THE 5QC ESTABLISHED ON THRESHOLD R23, COULD
YOU ADVISE OF TFC SITUATION
TOWER OC, YOU ARE GOING TO R05. IF YOU HAVE TO OPERATE R23
YOU HAVE TO TURN RIGHT TO R23. YOU ARE GOING TO R05.
5QC O.K. TO TURN RIGHT R23
TOWER WHAT TYPE OF OPERATIONS ARE YOU GOING TO CARRY OUT
ON R23.
5QC AH, AM
5QC KADUNA. 5QC
TOWER GO AHEAD
5QC OH. SIR, CAN WE USE THE THRESHOLD OF R05 FOR OUR
HOVERING EXERCISE?
TOWER I UNDERSTAND HOVERING EXERCISE?
5QC AFFIRMATIVE SIR, REQUEST R05.
TOWER CONTINUE YOUR EXERCISE ADVISE WHEN YOU ARE READY
TO RETURN TO THE APRON.
5QC O.K., 5QC
5QC KADUNA, 5QC 15 ESTABLISHED ON THE THRESHOLD OF R05.
COULD YOU PLEASE ADVISE OF TRAFFIC.
TOWER O.K. TRAFFIC IS CESSNA CITATION INBOUND FROM LAGOS.
WILL BE USING R23, AND WILL ADVISE YOU TO KEEP LEFT ON
FTNAI .
5QC O.K., 5QC, COPIED.
TOWER QC. KEEP CLEAR NOW, TRAFFIC IS TURNING FINAL, IT'S
CESSNA CITATION
5QC KADUNA, QC COULD YOU ADVISE IF THE AIRCRAFT IS
THE RUNWAY. STR
TOWER IF CLEAR THE RUNWAY I WILL ADVISE YOU
5QC THANK YOU
5QC CLEARED THE RUNWAY

TOWER : ROGGER
TOWER : O.K. THE 5QC AIRCRAFT IS CLEARED THE RUNWAY, QC, DO YOU COPY?

5QC : I UNDERSTAND THE AIRCRAFT IS CLEAR OF THE RUNWAY, SIR
TOWER : AFFIRMATIVE
5QC : O.K. SIR, WE ARE ON THE THRESHOLD OF RUNWAY 05 THIS TIME

5QC : KAD, 5QC WE REQUEST RIGHT HAND CIRCUIT FOR R05
TOWER : ROGGER, YOU ARE CLEAR
TOWER : TIME NOW 1103 (TO OTHER AIRCRAFT)
5QC : KADUNA, 5QC, IS RIGHT BASE FOR R23
TOWER : REPORT RUNNING FINAL
5QC :
TOWER : WILL YOU BE MAKING A TOUCH AND GO, OR YOU ARE RETURNING DIRECTLY ON APRON?
5QC : KADUNA, QC, LANDING DIRECTLY ON THE APRON.

TOWER : ROGGER, YOU CLEARED TO LAND DIRECTLY ON THE APRON. WIND IS 240 AT 10
5QC : 5QC
TOWER : TIME NOW 1105 (TO OTHER AIRCRAFT)
TOWER : QC, YOUR INTENTION?
5QC : WE WANT TO PRACTISE QUICK STOP ON THE TAXIWAY. WILL CALL YOU LATER

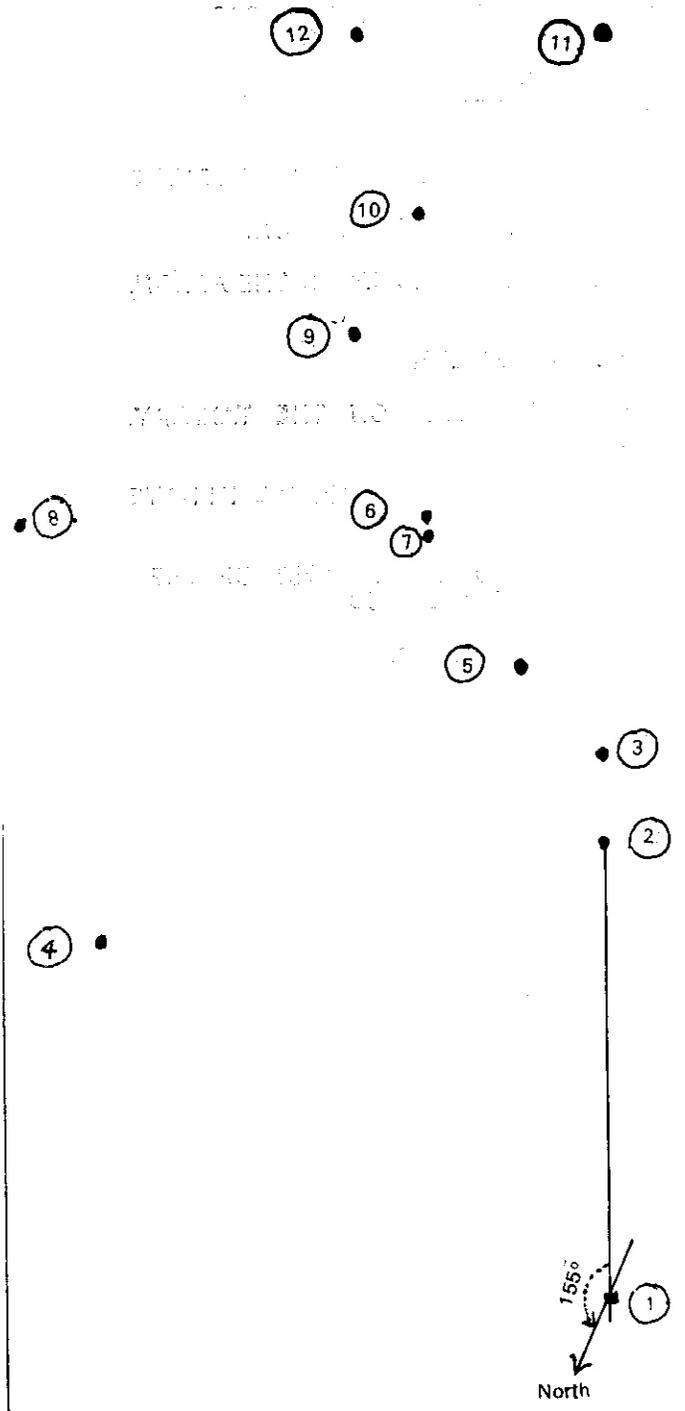
TOWER : YOU CAN'T PARK ON THE TAXIWAY, WHAT HAPPENS IF I HAVE TRAFFIC GOING OUT?

5QC : KADUNA, 5QC,TO NORTH WEST OF THE STATION. WILL CALL YOU ESTABLISHED

TOWER : ROGGER, CALL ME WHEN ESTABLISHED.

APPENDIX II

Wreckage Distribution



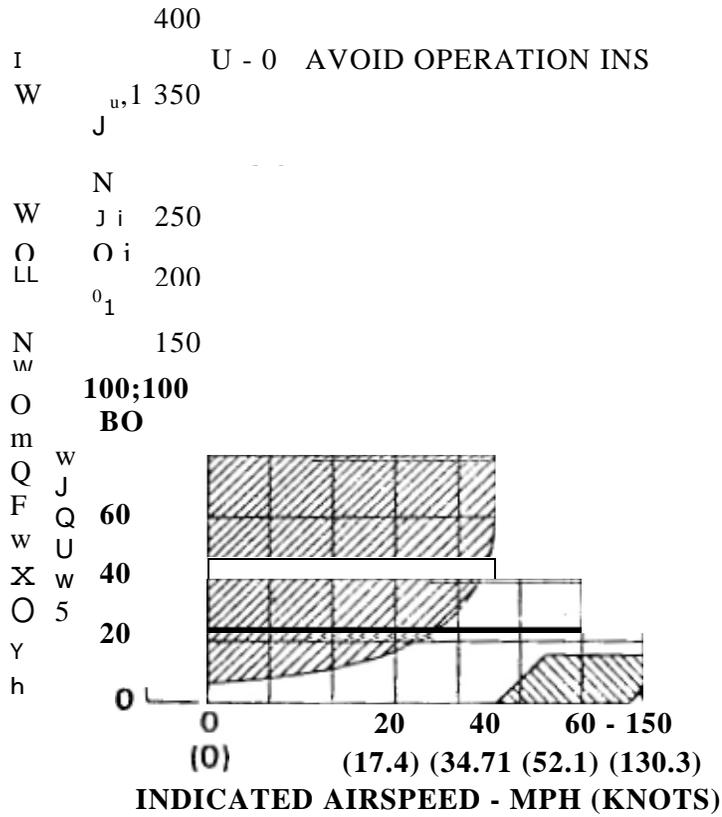
Scale 1cm = 1 meter	
Index	
1.	Tail boom 8ft. long with tail rotor intact
2.	Fuel Tank
3.	Baggage Compartment door
4.	Rear left hand skid (1ft. long)
5.	Float gauge
6.	Rear door
7.	Part of skid 4' long
8.	Skid 2' long
9.	Side Window
10.	Skid 6' long
11.	Main Wreckage
	(a) Main Fuselage
	(b) Doors
	(c) Main rotors both bent at right angles 3' from root
12.	Port front door
13.	Skid 8' long

APPENDIX III

206B FLIGHT MANUAL I-AA APPHO)VEII
250-C20B/C20J ENGINE

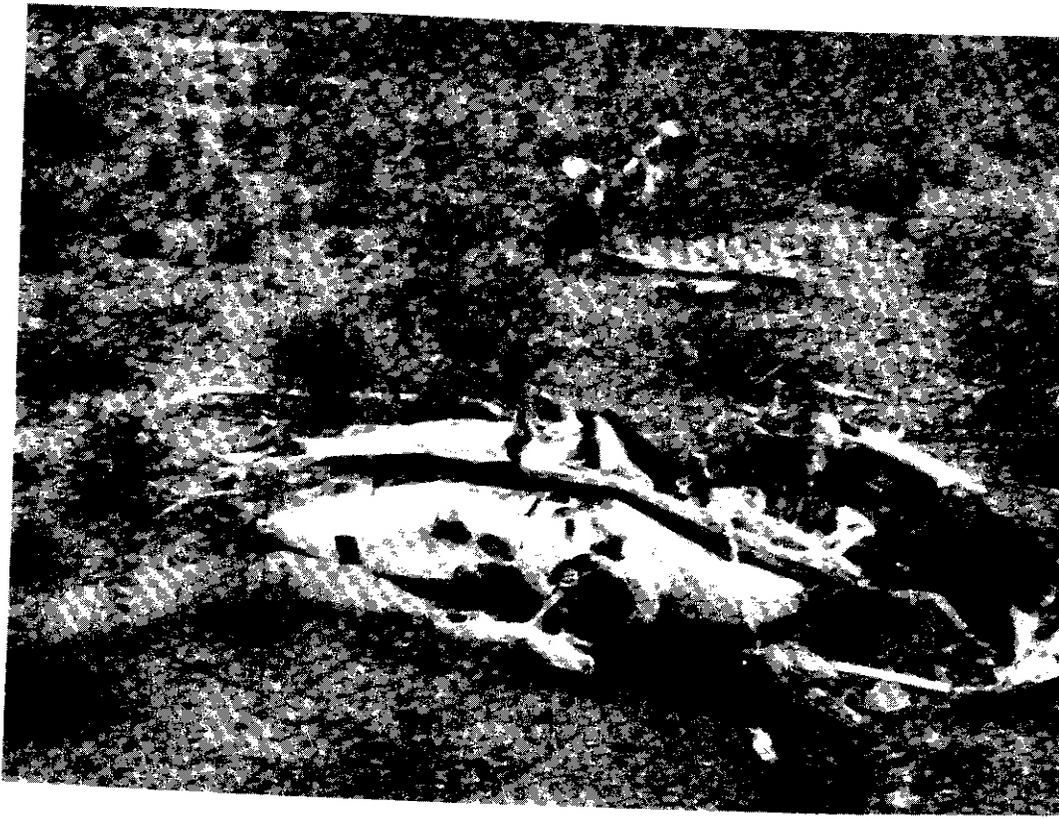
HEIGHT VELOCITY
D I A G R A M

The Height-Velocity Diagram defines the condition= from which a safe landing can be made on a smooth, level, firm surface following an engine failure. The Height Velocity Diagram is valid only when the helicopter gross weight does not exceed the limits of the Altitude Versus Gross Weight Limit for Height-Velocity Diagram.



Position of
helicopter
at the point of
flame-out

**HEIGHT - VELOCITY DIAGRAM FOR
SMOOTH, LEVEL, FIRM SURFACES**
206900-256



18

17