SOUTH AFRICAN CIVIL AVIATION AUTHORITY

*Section/division* **Occurrence Investigation** Form Number: CA 12-12a

# AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Reference: | CA18/2/3/9156 | | |
| **Aircraft Registration** | **ZS-HSR** | **Date of Accident** | 23 March 2013 | | **Time of Accident** | 12:25 | |
| **Type of Aircraft** | Bell 206B | | **Type of Operation** | | Commercial | | |
| **Pilot-in-command Licence Type** | CPL | | **Age** | 33 | **Licence Valid** | Yes | |
| **Pilot-in-command Flying Experience** | Total Flying Hours | | 1052,3 | | Hours on Type | 11,2 | |
| **Last point of departure** | Pietermaritzburg airfield FAPM – KwaZulu-Natal | | | | | | |
| **Next point of intended landing** | Pietermaritzburg Botanical Gardens (PBG) | | | | | | |
| **Location of the accident site with reference to easily defined geographical points (GPS readings if possible)** | | | | | | | |
| Between Botanical Gardens boundary and Zwartkop Street, about 3,75 nm from FAPM (S 29°36' 30" E 30°20' 44") | | | | | | | |
| **Meteorological Information** | FAPM METAR at 10:00z.Surface wind 160°at 18 knots; temperature 28℃; dew point 19℃; ceiling and visib ility okay; QNH 1013 no significant weather reported. | | | | | | |
| **Number of people on board** | 1+4 | **No. of people injured** | 1+4 | **No. of people killed** | **0** | | |

## Synopsis

A chartered aircraft relocated from Virginia Airport to Pietermaritzburg Airport to flying four passengers (04) passengers to an ad hoc helicopter landing site near the Pietermaritzburg Botanical Gardens (PBG) for a wedding that was to take place that day. PBG is approximately 3.71 nm from RWY 16 threshold, within 5 nm radius of the FAPM control zone (CTR).

The pilot received FAPM weather and then contacted the tower for clearance. Tower cleared the flight to 500 feet AGL with direct routing to the landing site. The departure and climb to a height of 500 feet were uneventful. On initial approach the pilot decided to descend in a right-hand pattern, but as he continued to circle, the aircraft suddenly lost about 50 feet in height. The aircraft continued losing height rapidly and yawing to the right became tighter and tighter. The pilot tried to recover by reducing power and lowering the nose. All his efforts were futile as the rate of descent was too high and they were close to the ground. The aircraft impacted the ground and suffered substantial damage.

## Probable Cause

Loss of control during approach

**Contributing factor**: Poor in-flight planning

| | | | |
|---|---|---|---|
| IARC Date | | Release Date | |

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

*Section/division* **Occurrence Investigation**
*Telephone number:* **011-545-1000**
*E-mail address of originator:* **thwalag@caa.co.za**

Form Number: CA 12-12a

# AIRCRAFT ACCIDENT REPORT

**Name of Owner/Operator** : King Shaka Aviation
**Manufacturer** : Bell Helicopter Textron
**Model** : Bell 206B
**Nationality** : South African
**Registration Marks** : ZS-HSR
**Place** : Pietermaritzburg Botanical Gardens (PBG)
**Date** : 23 March 2013
**Time** : 12:25

*All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.*

**Purpose of the Investigation:**

*In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997) this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation incidents or accidents and* ***not to establish legal liability****.*

**Disclaimer:**

*This report is given without prejudice to the rights of the CAA, which are reserved.*

## 1. FACTUAL INFORMATION

### 1.1 History of Flight

1.1.1 On the 23 March 2013 at 10:00B a domestic charter flight relocated from Virginia Airfield (FAVG), its base, to Pietermaritzburg Airfield (FAPM) for the purpose of ferrying clients to a wedding later that day. The 40-minute flight was uneventful. The charter flight was from FAPM to the Pietermaritzburg Botanical Garden (GPS S29° 36' 30.8" E030° 26' 45"). PBG is within the FA PM Control Zone (CTR). It is approximately 3.71 nm, bearing 311°, from RWY 16 th reshold. The CTR boundary extends to 5 nm around the airport.

1.1.2 Once all four passengers were on board the pilot requested departure clearance from FAPM ATC. The aircraft was cleared to climb to 500 feet AGL and to route direct to its destination. The flight was to be conducted under visual flight rules (VFR) At 11:54B the aircraft took off from FAPM to the botanical gardens and climbed as instructed. There was no traffic to affect, the sky was clear and the wind was from 160° at 18 knots, which makes it a ta il wind.

1.1.3 The pilot stated that on approach for landing the aircraft circled around the intended landing spot. Without warning the aircraft seemed to lose control and was descending at a higher rate than expected. It ended up crash landing, the first impact being on one side of Zwartkops Street and the resultant forces pushed the aircraft to the opposite side, between the street and the botanical gardens, where it finally came to rest.

1.1.4 The pilot and passengers suffered from minor to severe injuries in the accident and the aircraft was completely destroyed.

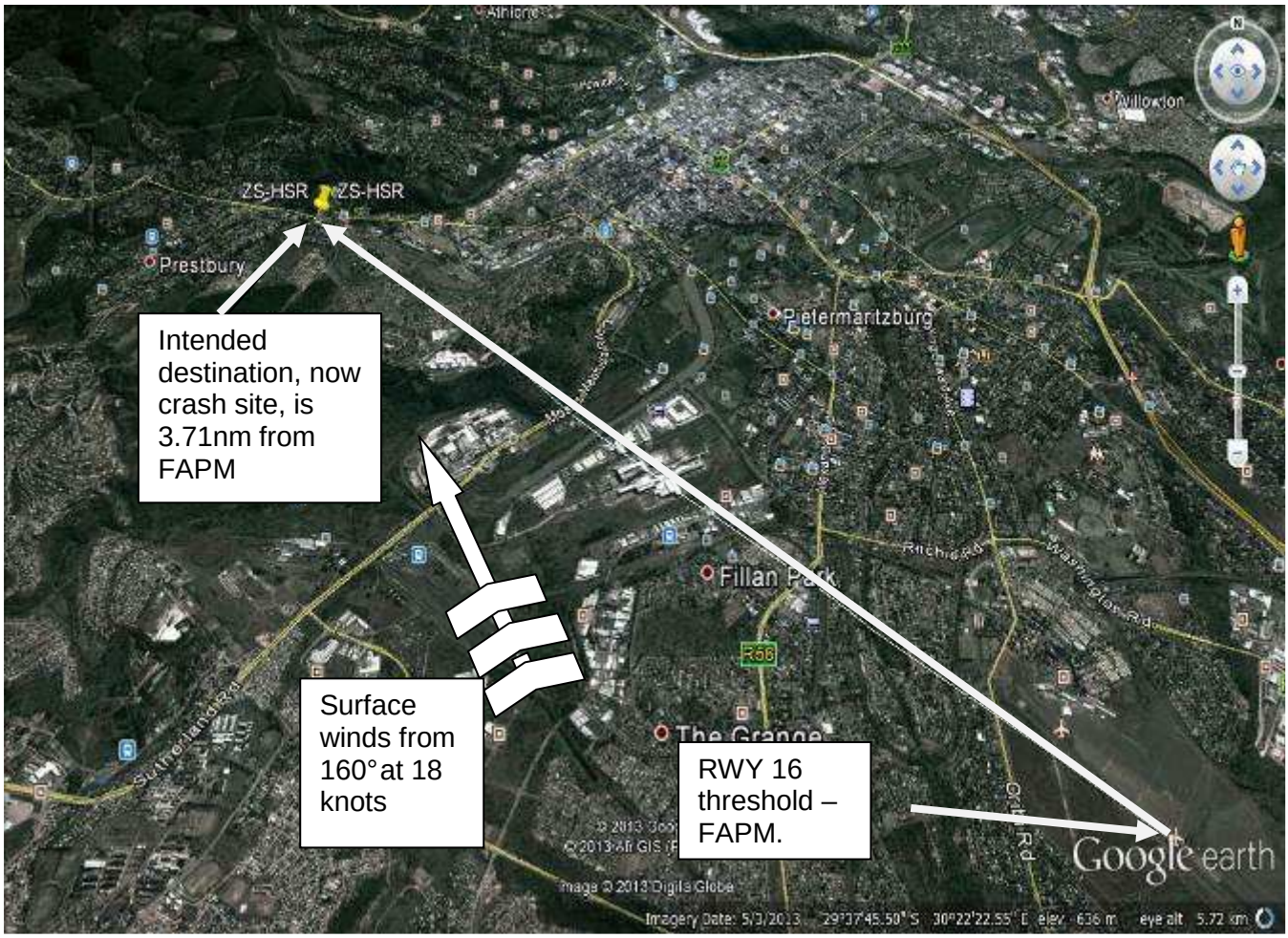



Figure 1: Flight to destination is 3.71 nm (6,91km) with a tail wind of 18 knots

## 1.2 Injuries to Persons

| Injuries | Pilot | Crew | Pass. | Other |
|---|---|---|---|---|
| Fatal | - | - | - | - |
| Serious | 1 | - | - | - |
| Minor | - | - | 4 | - |
| None | - | - | - | - |

## 1.3 Damage to Aircraft

1.3.1 The aircraft suffered substantial damage in the accident.


**Figure 2: S**everity of the accident

## 1.4 Other Damage

1.4.1 During the forced landing, the main rotor blades tore through and damaged approximately 10 m of the Botanical Gardens palisade fence and severed some tree branches and a 20 cm thick tree trunk nearby.

**Figure 3: D**amage to the fence and vegetation

## 1.5 Personnel Information

| | | | | | |
|---|---|---|---|---|---|
| Nationality | Swedish | Gender | Male | Age | 33 |
| Licence Number | 027 222 6929 | Licence Type | CPL | | |
| Licence valid | Yes | Type Endorsed | Yes | | |
| Ratings | Night flight, Instrument | | | | |
| Medical Expiry Date | 31 May 2013 | | | | |
| Restrictions | None | | | | |
| Previous Accidents | None | | | | |

Flying Experience:

| | |
|---|---|
| Total Hours | 1052.3 |
| Total Past 90 Days | 3.8 |
| Total on Type Past 90 Days | 1.9 |
| Total on Type | 11.2 |

## 1.6 Aircraft Information

1.6.1 The Bell 206B Jet Ranger is a two-blade single-engine helicopter that can carry a pilot and four passengers, one in front and three at the back. The engine is a turbine Rolls Royce Allison 250 C20J which uses JET A-1 fuel.

**Airframe:**

| | | |
|---|---|---|
| Type | Bell 206B | |
| Serial Number | 4002 | |
| Manufacturer | Bell Helicopter Textron | |
| Date of Manufacture | 1983 | |
| Total Airframe Hours (At time of Accident) | 2945.7 | |
| Last MPI (Date & Hours) | 07 February 2013 | 2889.7 |
| Hours since Last MPI | 56 | |
| C of A (Issue Date) | 11 April 1988 | |
| C of R (Issue Date) (Present owner) | 29 July 2010 | |
| Operating Categories | Part 127 | |

**Engine:**

| | |
|---|---|
| Type | Allison 250 – C20J |
| Serial Number | CEA 270382 |
| Hours since New | 2945.5 |
| Hours since Overhaul | 357.5 |

1.6.3 There were no engine or accessories defects recorded in the flight folio or relevant logbook prior to the accident.

## 1.7 Meteorological Information

1.7.1 Weather information for the day and time of accident was obtained from FAPM tower as observed on their METAR.

| | | | | | |
|---|---|---|---|---|---|
| Wind direction | 160° | Wind speed | 18 knots | Visibility | 10 km |
| Temperature | 28℃ | Cloud cover | Clear sky | Cloud base | nil |
| Dew point | 19℃ | | | | |

## 1.8 Aids to Navigation

1.8.1 The aircraft was fitted with standard navigational equipment as approved at the time of certification by the regulator. No defects were recorded or reported prior to or during the accident flight.

## 1.9 Communications

1.9.1 The aircraft was equipped with standard communication systems and none was reported unserviceable prior to the accident. The pilot maintained two-way communication with FAPM ATC.

## 1.10 Aerodrome Information

1.10.1 The accident happened away from an aerodrome. It took place near the Botanical Gardens, where a wedding was supposed to take place. The gardens are approximately 3.75nm from Pietermaritzburg Airport at an elevation of 2079ft. The application for an ad hoc helicopter landing was approved by SACAA on the 19 March 2013 (see appendix A). GPS position: S29°36’ 30” E30°20’ 44”.

## 1.11 Flight Recorders

1.12.1 The aircraft was not fitted with flight data recorders (FDR) or cockpit voice recorders (CVR), and none was required by the regulations.

## 1.12 Wreckage and Impact Information

1.12.1 The first impact was on one side of Zwartkops Street, and the resultant forces pushed the aircraft to the opposite side between the street and the botanical gardens, where it finally came to rest.

1.12.2 The accident site, Zwartkop Street, runs between the boundary of the gardens and the ad hoc landing site, with vegetation and tall trees. The main rotor was sheared off the mast and ended approximately 2 m from the wreckage. All the debris from the aircraft was found approximately 100 m from the wreckage.

**Figure 4:** The main rotor that was sheared off the mast

1.12.3 Its landing skids were bent and they tore through floor into the fuselage. The transmission system was dislodged out of place by resultant forces from the collective control system in the landing sequence. The tail boom outer metal skin was ripped open by the main rotor from front to back on the right-hand side.

1.12.4 The doors, windshield and passenger windows were broken and chair mountings were dislodged. The main rotor broke off the vertical shaft and landed about 3m from the aircraft. A rotor blade piece that broke off (approximately 1 m long) was found 120m from the crash site.

## 1.13 Medical and Pathological Information

1.13.1 The aircraft's resultant forces caused the injuries to the persons on board. The pilot's major injury was spinal. He needed two operations to his spine and a month in hospital to recover from the injury he suffered during the accident.

1.13.2 The four passengers suffered minor injuries in various places. They were treated and discharged on the day of the accident.

## 1.14 Fire

1.14.1 There was no pre or post-impact fire.

## 1.15 Survival Aspects

1.15.1 The accident was survivable with limitations, because the accident sequence resulted in injuries of differing severity to all on board. All occupants were strapped in their seats by the safety harnesses, which also showed signs of extreme tension even though they did not break.

## 1.16 Tests and Research

1.16.1 Two engineers, one from Rolls Royce and the other from Bell Helicopters,

inspected the engine and the airframe for any pre-existing defects. The engineers examined electrical wiring and all external fuel, oil and air lines for signs of looseness or fatigue and found damage attributed to the accident. We are awaiting their report and findings on the accident.

## 1.17 Organisational and Management Information

1.17.1 The aircraft had a current maintenance release, issued on the 17 August 2012. Examination of the aircraft's maintenance records revealed nothing that would have contributed to the accident.

1.17.2

## 1.18 Additional Information

1.18.1 Conditions under which LTE may occur:

Any manoeuvre which requires the pilot to operate in a high-power, low-airspeed environment with a **left crosswind or tailwind** creates an environment where unanticipated right yaw may occur.

There is greater susceptibility to Loss of Tail Rotor Effect (LTE) in right turns. This is especially true during flight at low airspeed, since the pilot may not be able to stop rotation. The helicopter will attempt to yaw to the right. Correct and timely pilot response to an uncommanded right yaw is critical. The yaw is usually correctable if additional left pedal is applied immediately. If the response is incorrect or slow, the yaw rate may rapidly increase to a point where recovery is not possible.

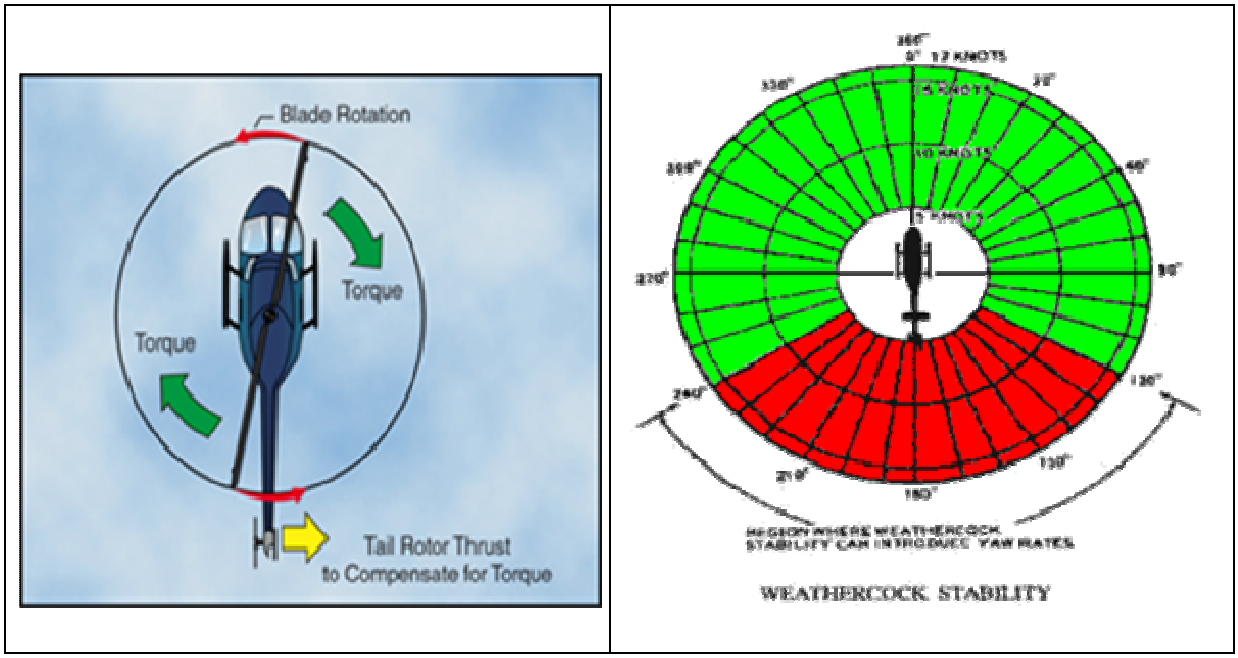



**Figure 5:** *Left: hand picture Shows forces produced by the main and tail rotor which are directly proportional to the speed of the aircraft. The right hand picture. Wind coming from green area good. Wind coming from red area (tailwind) bad.* ***The wind in this accident was 160°at 18 knots.***

Computer simulation has shown that if the pilot delays reversing the pedal control position when proceeding from a left crosswind situation (where a lot of right pedal is required due to the sideslip) to downwind, control would be lost, and the aircraft would rotate more than 360° before stopping.

The pilot must anticipate these variations, concentrate on flying the aircraft, and not allow a yaw rate to build. Caution should be exercised when executing right turns under conditions conducive to LTE.

1.18.2 Weathercock stability (120° to 240°):

Tailwinds from 120° to 240°, like left cross winds, will cause a high pilot workload. The most significant characteristic of tailwinds is that they are a yaw rate accelerator. Winds within this region will attempt to weathervane the nose of the aircraft into the relative wind. This characteristic comes from the fuselage and vertical fin.

The helicopter will make a slow uncommanded turn either to the right or left depending upon the exact wind direction unless a resisting pedal input is made. If a yaw rate has been established in either direction, it will be accelerated in the same direction when the relative winds enter the 120° to 240° area unless c orrective pedal action is made.

*If the pilot allows a right yaw rate to develop and the tail of the helicopter moves into this region, the yaw rate can accelerate rapidly. It is imperative that the pilot maintain positive control of the yaw rate and devote full attention to flying the aircraft when operating in a downwind condition.*

The helicopter can be operated safely in the above relative wind regions if proper attention is given to maintaining control. If the pilot is inattentive for some reason and a right yaw rate is initiated in one of the above relative wind regions, the yaw rate may increase.

1.18.3 Pilot's *Description of Events as contained in response to The Pilot's questionnaire e-mailed to him*

"At a height of 500ft. during a confined area landing preparation and orbiting to the right, wind shear resulted in a 50ft sudden drop in altitude when pulling power to arrest the descent and pushing left pedal there was no immediate effect of anti-torque and the aircraft continued yawing right.

When initiating recovery procedures the yawing to the right was at an increasing rate and recovery procedures were futile and there was insufficient height for recovery.

Recovery procedures included reduction of power and lowering of the nose to increase airspeed but adversely this procedure will reduce height even more."

1.18.4 Civil Aviation Regulation **127.07.19** states:

(1) Before take-off and landing and whenever deemed necessary in the interests of aviation safety, the pilot-in-command of a commercial air transport helicopter shall ensure that –
(a) all equipment, baggage and loose articles in the cabin of the helicopter, including passenger service items and flight crew members' and passengers' personal effects, are properly secured and stowed so as to avoid the possibility of injury to persons or damage to such helicopter through the movement of such

articles caused by in-flight turbulence or by unusual accelerations or manoeuvres; and
(b) All aisles, passage ways, exits and escape paths are kept clear of obstructions.

(2) All solid articles shall be placed in approved stowage areas in the helicopter, at all times whenever the seat belt lights are illuminated or when so directed by the pilot-in-command of such helicopter.

(3) For the purposes of sub-regulation (2), "approved stowage area" means –
(a) The area under a passenger seat; or
(b) a locker, overhead or other, in accordance with the placard mass limitation of the locker.

(4) No take-off or landing shall be commenced by the pilot-in-command of the helicopter, unless he or she has been informed of the safe condition of the cabin.

1.18.5 The groom's party of four arrived ready for the wedding without luggage. As soon as the passengers were on board the aircraft, the PIC followed Civil Aviation Regulation CAR 127.07.02 and advised them of procedures to follow should the aircraft be involved in an emergency. The passengers were also instructed to wear their seat belts at all times.

1.18.6 On the 19 March 2013 the South African Civil Aviation Authority (SACAA), following Civil Aviation Regulations (CAR) 91.07.4, approved an application for an ad hoc helicopter landing by King Shaka Aviation. The landing site was near Pietermaritzburg Botanical Gardens (PBG), where a wedding was to be held a few days later.

## 2. ANALYSIS

### 2.1 General

2.1.1 On 23 March 2013 four passengers, including the groom, chartered a Bell 206 Jet Ranger to be ferried from Pietermaritzburg Airport (FAPM) to the Pietermaritzburg Botanical Gardens (PBG) to the wedding that was to take place later that day.

2.1.2 The aircraft relocated from Virginia (FAVG) at 08:00Z, where it was based, for a 40 minute flight to FAPM. No unusual events were reported on that leg. The intended ferry flight was supposed to be short, as the destination was within the FAPM Control Zone (CTR). The location was at 3.71 nm, bearing 311°, from the RWY 16 threshold.

2.1.3 The pilot received the weather information for that hour from FAPM Meteorological Terminal Report (METAR), which indicated that the wind was from 160° at 18kt, visibility was greater than 10 km, temperature 28° Celsius, dew point 19° Celsius and no significant weather was reported.

2.1.4 The FAPM ATC advised the pilot that there was no reported traffic. The ATC then cleared him to climb to and maintain 500 feet AGL up to the ad hoc landing site and to report reaching the destination. The climb to 500 feet AGL and routing to the PBG was uneventful until reaching the top of descent abeam the ad hoc site.

2.2 **Aircraft:**

2.2.1 The pilot stated that wind shear affected his descent rate by losing approximately 50 feet and the aircraft was banking more to the right. At this stage the pilot decided to increase the power and push in left pedal to counter the yaw.

2.2.2 The pilot's recovery procedures, i.e. reduce power and lowering of the nose to increase airspeed with little height to spare, achieved the opposite. The rate of yawing to the right became even more pronounced and all efforts and inputs from the pilot were futile in arresting the impending spin and high rate of descent.

2.2.3 The pilot and his passengers were unsure of the number of spins that the aircraft did before impact. The aircraft's natural tendency to yaw to the right and the fact that there was a tail wind simply made the situation worse. The quotation under 1.18.2 above states that: *If the pilot allows a right yaw rate to develop and the tail of the helicopter moves into this region, the yaw rate can accelerate rapidly. It is imperative that the pilot maintain positive control of the yaw rate and devote full attention to flying the aircraft when operating in a downwind condition.*

2.2.4 After the aircraft's spin and high rate of descent, the aircraft's first impact and resultant forces pushed it back into the air for a further 12.5m from one side of the street to the other, where it finally came to rest.

# 3. CONCLUSION

3.1 **Findings**

3.1.1 The ad hoc landing site was approved by SACAA before the flight, therefore the flight was legal.

3.1.2 The pilot was medically fit and properly qualified to command the flight and the aircraft maintenance records were up to date.

3.1.3 The passengers were issued with tickets for the trip.

3.1.4 Turning right during an approach orbit at low airspeed (about 30kt) contributed to loss of tail rotor effect (LTE), which resulted in the aircraft spinning and losing height at a high rate.

3.1.5 The following damage to aircraft was consistent with the engine operating at the time of the accident:

- The transmission system was dislodged by resultant forces from the collective control system pushing it out of place during the impact sequence.

- The main rotor continued rotation against a jammed transmission system and simply sheared it off the rotor mast. The shear marks on the mast do not resemble pre-existing metal fatigue. The whole surface was shiny, consistent

with failure/shearing that occurred as a result of an accident.

- The skids were bent beyond their elastic limit and they tore through the floor into the fuselage.

3.1.6 Examination of wiring and all external fuel, oil and air lines for signs of looseness revealed no abnormalities existing before the accident.

3.1.7 All control surfaces were accounted for, and all damage to the aircraft was attributable to the severe impact forces.

### 3.2 Probable Cause/s

3.2.1 Loss of control during approach.

3.2.2 Poor in flight planning.

## 4. SAFETY RECOMMENDATIONS

4.1 None

## 5. APPENDICES

CERTIFICATE OF REGISTRATION

CAR47B

SOUTH AFRICAN CIVIL AVIATION AUTHORITY
REPUBLIC OF SOUTH AFRICA

CERTIFICATE OF REGISTRATION — CERTIFICATE NUMBER: 4841/ZS-HSR/3

| 1 Nationality and registration marks | 2 Manufacturer and manufacturer's designation of aircraft | 3 Aircraft serial number |
|---|---|---|
| ZS-HSR | BELL HELICOPTER TEXTRON 206B | 4002 |

4 Name of owner: KING AIR SERVICES PARTNERSHIP

5 Address of owner: PO BOX 29044
SELAVILLE
2109

6 It is hereby certified that the aircraft described above has been duly entered in the South African Civil Aircraft Register in accordance with the Convention on International Civil Aviation dated 7 December 1944 and with the Civil Aviation Regulations, 1997, as amended.

7 NO ENDORSEMENTS

Date of issue: 2010/07/29

17598

FOR DIRECTOR OF CIVIL AVIATION

CERTIFICATE OF AIRWORTHINESS

SOUTH AFRICAN CIVIL AVIATION AUTHORITY
REPUBLIC OF SOUTH AFRICA

AW 31305
CAR24E

CERTIFICATE OF AIRWORTHINESS — CERTIFICATE NO: 4841/ZS-HSR/10

| 1 Nationality and registration marks | 2 Manufacturer and manufacturer's designation of aircraft | 3 Aircraft serial number |
|---|---|---|
| ZS-HSR | BELL HELICOPTER TEXTRON 206B | 4002 |

4 Categories: STANDARD Part 127

5 This certificate of airworthiness is issued, pursuant to the Convention on International Civil Aviation, dated 7 December 1944 and the Aviation Act, 1962 (Act 74 of 1962), as amended, and the Civil Aviation Regulations, 1997 as amended, in respect of the above-mentioned aircraft which is considered to be airworthy when maintained and operated in accordance with the foregoing and the pertinent operating limitations.

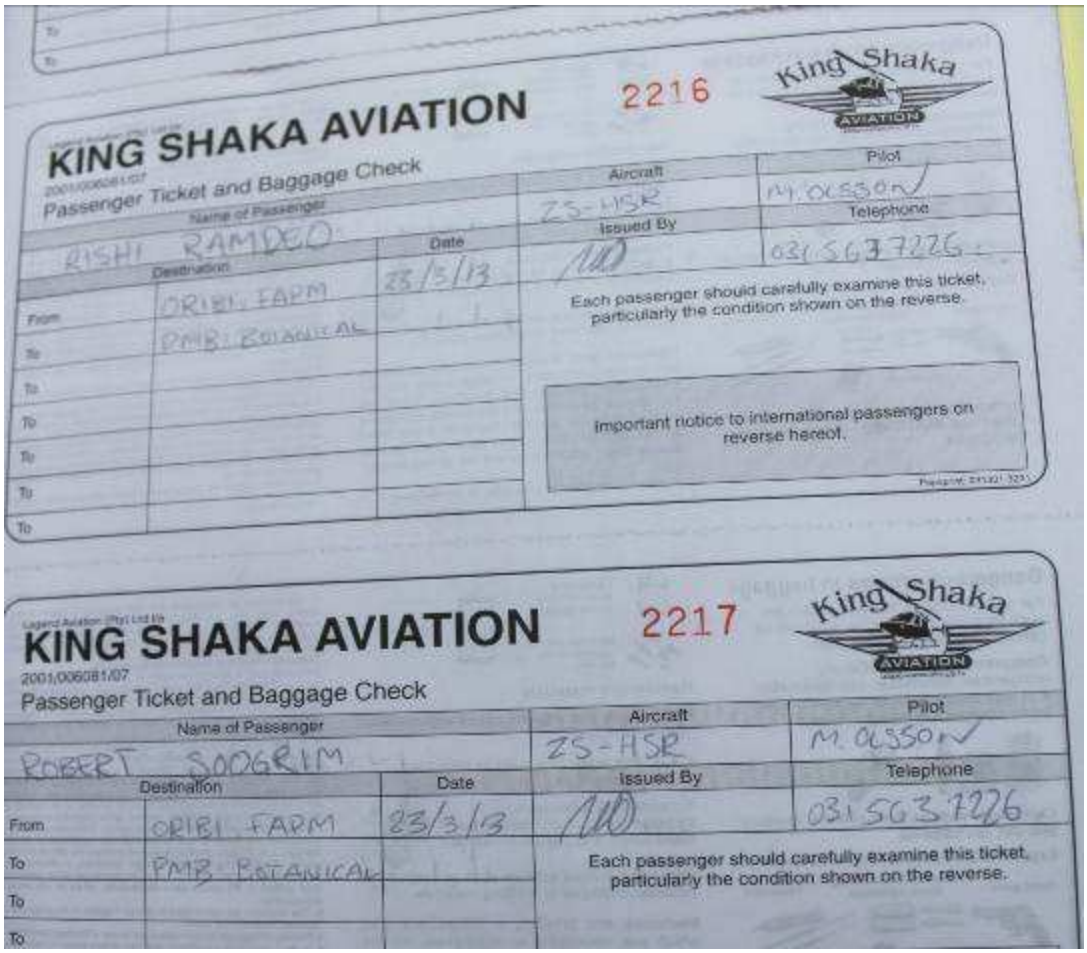
6 Special conditions: None

7 Original date of issue: 1988/04/11

8 Expiry date: 2013/04/10

FOR DIRECTOR OF CIVIL AVIATION
DIRECTOR OF CIVIL AVIATION

CERTIFICATE OF AIRWORTHINESS



KING SHAKA AVIATION

2216

Passenger Ticket and Baggage Check

| Name of Passenger | Aircraft | Pilot |
|---|---|---|
| RISHI RAMDEO | ZS-HSR | M. OLSSON |
| Destination | Date | Issued By / Telephone |
| From ORIBI FARM | 23/3/13 | 031 563 7226 |
| To PMB BOTANICAL | | |

Each passenger should carefully examine this ticket, particularly the condition shown on the reverse.

Important notice to international passengers on reverse hereof.

KING SHAKA AVIATION

2217

2001/006081/07

Passenger Ticket and Baggage Check

| Name of Passenger | Aircraft | Pilot |
|---|---|---|
| ROBERT SOOGRIM | ZS-HSR | M. OLSSON |
| Destination | Date | Issued By / Telephone |
| From ORIBI FARM | 23/3/13 | 031 563 7226 |
| To PMB BOTANICAL | | |

Each passenger should carefully examine this ticket, particularly the condition shown on the reverse.

KING SHAKA AVIATION 2218

Passenger Ticket and Baggage Check

| Name of Passenger | | Aircraft | Pilot |
|---|---|---|---|
| DOY RAMDEO | | ZS-HSR | M OLSSen |
| Destination | Date | Issued By | Telephone |
| From FAPM | 23/3/13 | [illegible] | 031 563 7 |
| To PMB BOTANICAL | | | |
| To | | | |
| To | | | |
| To | | | |
| To | | | |
| To | | | |

Each passenger should carefully examine this ... particularly the condition shown on the reve...

Important notice to international passenger ... reverse hereof.

KING SHAKA AVIATION 2219

2001/006081/07

Passenger Ticket and Baggage Check

| Name of Passenger | | Aircraft | Pilot |
|---|---|---|---|
| VEJAI RAMDEO | | ZS-HSR | M. OLSS |
| Destination | Date | Issued By | Teleph |
| From FAPM | 23/3/13 | [illegible] | 031 563 |
| To PMB BOTANICAL | | | |
| To | | | |
| To | | | |
| To | | | |
| To | | | |
| To | | | |

Each passenger should carefully examine ... particularly the condition shown on the

Important notice to international passe... reverse hereof.