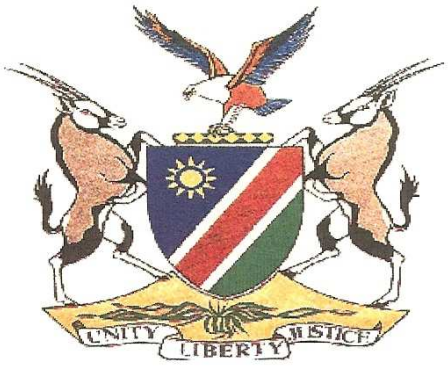

REPUBLIC OF NAMIBIA

MINISTRY OF WORKS AND TRANSPORT

DIRECTORATE OF AIRCRAFT ACCIDENT INVESTIGATIONS

CIVIL AIRCRAFT ACCIDENT REPORT

ACCID/111509/01-06

OPERATION	**:**	**COMMERCIAL**
AIRCRAFT	**:**	**ZS-OTU**
LOCATION	**:**	**PROSPERITA AREA**
DATE	**:**	**15 NOVEMBER 2009**

TABLE OF CONTENTS **PAGE**

FOREWORD

This report presents the factual information, data analysis, conclusions, and safety recommendations reached during the investigation. The purpose of the investigation was to establish the circumstances surrounding this accident.

In accordance with the provisions of Annex 13 to the contention on International Civil Aviation Organization, the accident's analysis, conclusions, and safety recommendations contained therein are intended neither to apportion blame nor to single out any individual or group of individuals. The main objective was to identify the systematic deficiencies and draw lessons, from the occurrence, which might help to prevent accidents and incidents in the future. To this end, many a time, the reader may be interested in whether or not an issue was a direct cause of the accident (that has already taken place), whereas the investigator is mainly concerned with the prevention of future accidents/incidents.

As a result, usage of this report for any purpose other than (the latter and spirit of Annex 13 and other relevant statutes) prevention of similar occurrences in the future might lead to erroneous interpretations and applications.

ABBREVIATIION

AD	-	Air Worthiness Directives
ADF	-	Automatic Directional Finder
AGL	-	Above Ground Level
AME	-	Aircraft Maintenance Engineer
AMO	-	Aircraft Maintenance Organization
ATC	-	Air Traffic Control
°C	-	Degrees Celsius
CVR	-	Cock pit Voice Recorder
CAA	-	Civil Aviation Authority
DCA	-	Director of Civil Aviation
DME	-	Distance Measuring Equipment
ELT	-	Emergency Locator Transmitter
ETM	-	Engine Trend Monitor
FDR	-	Flight Data Recorder
GPS	-	Global Positioning System
ICAO	-	International Civil Aviation Organization
ILS	-	Instrument Landing System
KG	-	Kilogram
SB	-	Service Bulletins
SACAA	-	South African Civil Aviation Authority
SACAR	-	South Africa Civil Aircraft Register
MHZ	-	Megahertz
NDB	-	Non-Directional Radio-Beacon
AOC	-	Air Operator Certificate
POH	-	Pilot Operating Handbook
VOR	-	Very high Frequency omni-directional radio range
UTC	-	Universal Time Co-ordinated

REPUBLIC OF NAMIBIA

MINISTRY OF WORKS AND TRANSPORT
DIRECTORATE OF AIRCRAFT ACCIDENT INVESTIGATIONS

Tel : (264) (61)208-8411
Fax : (264) (61)208-8495
Telex: (05-908) 811
E-mail: enengola@mwtc.gov.na

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AIRCRAFT ACCIDENT INVESTIGATIONS
Private Bag 12042
Ausspannplatz
Windhoek
NAMIBIA

Enquiries: E. M. Nengola **Our Ref: 3/48** **Date: 7 April 2010**

To : **Minister of Works and Transport**
Deputy Minister of Works and Transport
PS: Ministry of Works and Transport

RE: AIRCRAFT ACCIDENT REPORT

Please find attached the final report on the above subject accident. In accordance with the International Civil Aviation Organization Annex 13 – Aircraft Accident and Incident Investigation – Standard 6.13, final reports shall be published as soon as possible in the interest of accident prevention.

It is recommended that copies of these final reports be made available to the public and other interested parties upon request. Your approval is therefore sought to release the said report.

T. Shuungula 07-04-2010
Titus Shuungula
Ag.DIRECTOR: AIRCRAFT ACCIDENT INVESTIGATIONS

ACCID/111509/01-06

MINISTRY OF WORKS AND TRANSPORT
ACCIDENT REPORT – EXECUTIVE SUMMARY

Aircraft Registration	**ZS - OTU**	**Date of Accident**	15 November 2009	**Time of Accident**	04:58Z
Type of Aircraft	CESSNA - 208B		**Type of Operation**	Commercial	
Pilot-In-Command Licence Type	Commercial	**Age**	42	**Licence Valid**	Yes
Pilot In-Command Flying Experience	Total Flying Hours	671.2		Hours on Type	206.3
Last point of departure	Eros Airport (Windhoek, Namibia) (FYWE)				
Next point of intended landing	Ondjiva Aerodrome, Angola (FNGI)				
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)					
1.2nm SSW of Eros airport (Position; South 22°37.958' East 017°04.418' elevation 5686 feet AMSL)					
Meteorological Information	Surface Wind: 180°/8 knots, Temperature: 19.3°C, Visibility; +10km; Cloud cover Nil, Cloud base: Nil, Dew point: Unknown				
Number of people on board	1+ 3	**No. of people injured**	1	**No. of people killed**	3

Synopsis

On 15 November 2009, at about 04:58Z, an aircraft a Cessna Caravan 208B, with a pilot and three passengers on board took – off from Eros airport for a flight to Ondjiva, Lubango and Luanda. On board the aircraft were a substantial amount of cargo, which include building materials, meat, paints, bottles of wine etc. which was placed between and on top of the seats as well as in the cargo –pod. The cargo inside the cabin area was not secured. Shortly after take off from runway 19 the aircraft turned to the right and then pitched nose up. According to the passenger who survived, the aircraft entered into a left spin shortly after the nose pitched up and second later impacted with terrain, coming to rest facing the direction it took off from.
The pilot and two passengers were fatally injured during the accident. One of the passengers survived the accident and was admitted to a local hospital with a spinal injury. The Pilot in Command was a holder of a Commercial pilot license. His medical certificate was valid with restrictions (to wear corrective lenses).

Fine weather was reported during the time of the accident with surface wind of 180° at 8 knots.
The last Annual Inspection prior to the accident was carried out on the 14 November 2009, at 12469.6 airframe hours at Eros airport in Namibia by the maintenance personnel from a South African based Aircraft Maintenance Organization (AMO) assisted by the aircraft maintenance engineer from Namibian based AMO.
The aircraft had flown a further 1.6 hours (hobbs meter reading) since the last Inspection was carried out.
The aircraft was bought from Namibia by a Company called Aviation @ Work based in Pretoria, South Africa and deleted from the Namibian Civil Register of Aircraft on 11 April 2005.
All Airworthiness Directives and Service Bulletins were complied with as certified in the last Inspection dated 14 November 2009.

Probable Cause

The investigations revealed that during these operations the take-off weight of the aircraft was exceeded by 629 pounds. The aircraft failed to maintained flying speed and stalled shortly after take –off, rendering ground impact inevitable.

Contributing factor

The pilot made one fundamental error in his weight calculation that he used the incorrect aircraft empty weight.
This was the pilot's first flight from Eros airport therefore being unfamiliar with the airport and the environmental phenomena's associated with it (especially taking off from Runway 19.
The cargo that was in the cabin was packed between and underneath and on top of the seats and not secured.

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator	**: Sun Road Trading 10CC**
Manufacturer	**: Cessna Aircraft Company**
Model	**: 208B**
Nationality	**: South African**
Registration Marks	**: ZS-OTU**
Place	**: 1.2 nm SSW of Eros Aerodrome, Namibia**
Date	**:15 November 2009**

All times given in this report are Co-ordinated Universal Time (UTC).

Disclaimer:

The report is given without prejudice to the rights of the Directorate of Aircraft Accident Investigations, which are reserved.

Purpose of the Investigations :

In terms of ICAO Annex 13, this report was compiled in the interest of the promotion of aviation safety and the reduction of risk of aviation accident or incidents and **not to establish legal liability.**

This report contains fact relating to aircraft accidents or incidents which have been determined at the time of issue. **The report may therefore be revised should new and substantive facts be made available to the investigator (s).**

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 On 15 November 2009, at about 04:58 UTC, an aircraft a Caravan 208B, with a pilot and three passengers on board took – off from Eros airport for a flight to Luanda via Ondjiva and Lumbango.

1.1.2 The aircraft was loaded with non perishable cargo, which was destined for two separate locations within Angola. The cargo consisted mainly of building material, several containers of paint, boat spares, toolboxes, liquid beverages and frozen meat.

1.1.3 A certain amount of the cargo was weighed by a handling company at Eros airport during the afternoon of 14 November 2009. The weight of the cargo amount to

810.7kg. The handling agent provided two people that assisted in loading the aircraft under the supervision of the pilot and a security guard. They were also assisted by a person from a local operator based at Eros airport.

1.1.4 On 15 November 2009, prior to departure additional cargo arrived and were loaded into the cargo-pod, consisting mainly of frozen meat and beverages and this was not weighed by the handling agent. The suitcase of the three passengers and the pilot were also not weighed and were loaded inside the cabin towards the back. The cargo inside the cabin was not secured and was placed between and on top of the seats all the way to the roof (all the seats were installed in the aircraft at the time).

1.1.5 The three passengers that were onboard the aircraft were destined to perform maintenance work at a private lodge in Angola. The surviving passenger was trained as a builder and the other two passengers were to service several boats utilized by the lodge during fishing excursions.

1.1.6 The aircraft was scheduled to depart from Eros airport at 04:00 UTC, on 15 November 2009, but was delayed for approximately one hour due to a logistical problem at the airport. This was the pilot's first flight from Eros airport. The aircraft was cleared for take-off by Air Traffic Controller (ATC) for runway 19 and the wind on take-off was 180° at 8 knots according to Air Traffic Control (ATC) information.

1.1.7 On 11 November 2009, the aircraft landed at Eros airport en-route from Luanda in Angola. The aircraft was scheduled for a Phase 2 maintenance inspection, which was conducted at Eros airport by maintenance personnel from South Africa and Namibia. The Inspection was conducted over a period of three days and was completed on Saturday afternoon, 14 November 2009.

1.1.8 On the 12 November 2009, the pilot of the accident flight was flown from Wonderboom airport to Eros airport on a non scheduled flight. His contract arrangements were to conduct a tour of between six to ten weeks in Angola with the aircraft ZS-OTU. The aircraft were to return to Luanda in Angola where it was utilized in a non-scheduled domestic operation, transporting passengers between Luanda and Soyo in Northern Angola under a Validation Certificate that was issued by the Angolan Authorities.

1.1.9 According to the passengers who survived the accident as well as several eyewitness, the aircraft roll pass the main apron and rotated lifting the nose wheel off the runway surface but the main wheels remained on the runway. The aircraft become airborne pass the intersection of Runway 09/27, clearing the aerodrome boundary fence by about 10 feet. It then climbed to a height of approximately 300 feet above ground level (AGL) and then sank back to about 200 feet above ground level (AGL). The aircraft then turned right in a westerly direction and entered into a high nose-up attitude.

1.1.10 The surviving passengers further stated that shortly after take off the nose of the aircraft pitched up and the left wing dropped and the aircraft started to spin/spiral towards the left. Shortly there after the aircraft impacted with flat bush type of terrain and skidded along the ground, coming to rest about 150m from the point of impact, facing the approaching direction (towards the aerodrome).

1.1.11 The surviving passenger was seated behind the co-pilot seat and vacated the wreckage unassisted. He walked several meters from the wreckages into the field and then fainted. He was attended to by emergency personnel after they arrived on the

scene and was admitted to a local hospital, suffering from a spinal injury. The pilot and the passengers that were seated next to him passed away in hospital shortly after they were admitted. The passenger that was seated behind the pilot passed away on the scene.

1.1.12 The flight plan was filed for the sector to be flown; Eros – Ondjiva – Huambo and Luanda.

1.1.13 Two fuel uplift invoices were recovered from the accident site. They indicated that the aircraft was refuelled twice on 14 November 2009. The first invoice No.39675 indicated that 472 litres of Jet A1 was uplifted and the second invoice No.39676 indicated a 100 litres.

1.1.14 Both fuel attendants were interviewed at Eros airport and they indicated that the tanks were not filled to capacity. The pilot was present on both occasions watching fuel status inside the cockpit and told them to stop. Thirty six pounds of fuel was subtracted for start-up and taxi, which accommodate a six minute time frame period on an average fuel consumption of 400 pounds per hour.

1.1.15 All the passengers were issued with flight tickets by a local operator based at Eros airport, tickets No. 30226, 30227 and 30228, route Eros – Huambo – Luanda. The tickets were issued on the 15 November 2009, and date of departure was supposed to be the 16 November 2009.

1.1.16 During the onsite investigation it was found out that the wing leading edges of the aircraft was spray painted with a harsh anti erosion type paint. This type of paint results in a rough texture which can therefore affect the stalling characteristics of the wing. Verification with the aircraft manufacture confirmed that this did not meet the original airworthiness certification requirements and was in contradiction of the aircraft manufacture minimum continuous airworthiness standard.

1.1.17 According to the Air Traffic Controller who was on duty on the morning of 15 November 2009, aircraft ZS-OTU, C208 took off from runway 19 for FNGI in Angola. The pilot was given a choice between using runway 19 and 01, because the wind was 180/08 knots. The pilot insisted on using runway 19. After struggling to get the aircraft in the air (airborne) the aircraft lifted of abeam the control tower. According to our observation (ATC) the aircraft was too heavy it couldn't get height and it went down south west of Prosperita Industrial area.

1.1.18 Another witness stated that Sunday morning at Eros airport, I was on departure duty of Air Namibia, Flight SW 164 which departs 07:00. ZS-OTU started in front of Aviation Centre, I heard the Caravan had to use high power in order to taxi. As the Beechcraft started at 06:55, I looked in a westerly direction from the apron. I could see the runway clearly. I saw ZS-OTU passing on take-off run in southerly direction. At intersection "Delta" ZS-OTU rotated, but only the nose-wheel lifted off the ground. At intersection "Charlie" the caravan was still not airborne. The cargo pod was almost scratching on the runway. The caravan eventually took off close to the cross runway "27 and 09". ZS-OTU did not gain much height, but was still climbing slowly. At a point started to descent, possible that the pilot selected flaps "UP". While descending the pilot turned the aircraft to the right. While turning the aircraft descended quickly until it crashed into the ground.

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	1	-	2	-
Serious	-	-	1	-
Minor	-	-	-	-
None	-	-	-	-

1.3 Damage to Aircraft

1.3.1 The aircraft was destroyed during the impact sequence.

Figure 3: Aircraft wreckage facing the approach direction and part of the cargos could be seen scattered around.

1.4 Other Damage

1.4.1 Minor damage was caused to vegetation during the impact.

1.5 Personnel Information

Nationality		South African			
Licence No	0270420607	Gender	Male	Age	42
Licence valid		Yes	Type Endorsed	Yes	
Ratings		Night Flight and Instrument rating			
Medical Expiry Date		31 January 2010			
Restrictions		To wear corrective lenses			
Previous Accidents		None			

Flying Experience :

Total Hours	671.2
Total Past 90 Days	19.7
Total on Type Past 90 Days	11.5
Total on Type	206.3

1.5.1 The pilot started working for the company on 1 November 2009 and had conducted one flight from Wonderboom to Port Elizabeth and back to Wonderboom on a C208B with a company check pilot on 2 November 2009.

1.5.2 He was flown to Eros airport from Wonderboom on 12 November 2009 with a Beech 36 (ZS-KAJ), owned by Aviation @ Work. The pilot's intended tour in Luanda would have been between 6 to10 weeks.

1.6 Aircraft Information

1.6.1 The accident aircraft ZS – OTU, Serial No. 208B-0513 was manufactured in the United of State of America in 1996 by Cessna Aircraft Manufacturing Company. The owner purchased the aircraft from Namibian in April 2005.

1.6.2 The aircraft with registration ZS – OTU was deleted from the South African Civil Aircraft Register (SACAR) as from the 2 August 2002 and brought to Namibia with the registration VR – CAR operated by a Local based Company COMAV.

1.6.3 On 26 January 2005, while the aircraft was in the Namibian registry application was submitted by a Local Company to the Regulatory Authority for the removal of Mac Cauley Propeller 3GFR24C703 and the installation of a Hartzell Propeller HC-B3TN-3AF Serial No.BUA29052 As per STC SA02181 AK by Hartzell propeller incorporation. The application was approved on 9 February 2005.The reason for modification was on the owner's request. Weight and moment change – None.

1.6.4 Another application was submitted by the same Local Company to the Regulatory Authority for the installation of King KRA – 10A wiring harness into the aircraft. The application was approved on 6 September 2005.The reason for modification was to upgrade the avionics on the customer's request. Weight and moment change 3.8lbs @1224.44 inch/lbs.

1.6.5 The aircraft was bought from Namibia by a Company called Aviation @ Work based in Pretoria, South Africa and deleted from the Namibian Civil Register of aircraft on 11 April 2005.

1.6.6 Certificate of release to service was issued on 23 June 2009, at 12268.4 airframe hours without any endorsements.

Airframe :

Type	Cessna 208B	
Serial No.	208B-0513	
Manufacture	Cessna Aircraft Company	
Year of Manufacture	1996	
Total Airframe Hours (At time of Accident)	12 469.6	
Last Phase Inspection(Date & Hours)	12 468.0	14 November 2009
Hours since Last Phase Inspection	1.6 (hobbs meter reading)	
C of A (Issue Date)	6 May 2005	
C of A (Expiry Date)	5 May 2010	
C of R (Issue Date) (Present owner)	9 October 2006	
Operating Categories	Normal	

NOTE: It was noted that the hobbs meter in the aircraft had accumulated 1.6 hours since the aircraft had landed at Eros aerodrome until the time of the accident. Apart from start, taxi, take-off and the accident flight, maintenance crew had performed a post maintenance ground run as well as a compressor wash.

Engine :

Type	Pratt & Whitney PT6A-114A
Serial No.	PCE 19238
Hours since New	15 109.6
Hours since Overhaul	3 395.6

Propeller:

Type	Hartzell HC-B3TN-3AF
Serial No.	BUA29052
Hours since New	3 190.6
Hours since Overhaul	299.6

1.6.7 Weight and Balance

Item	Weight (pounds)	Arm (inches)	Moment (Lbs-inches)
Aircraft empty weight	5174	189.9	982 424.1
Pilot (78kg)	172	135.5	23 306.0
Passenger (84kg)	185	135.5	25 067.5
Row 2 Passengers (69,67kg)	300	173.9	52 170.0
Row 3 cargo	710	210	149 100. 0
Row 4 cargo	814	246	200 244. 0
Row 5 cargo	318	282	87 420. 0
Cargo 2	300	296	89 676. 0
Pod Zone A (230 max)	60	132.4	7 944. 0
Pod Zone B (310 max)	60	182.1	10 926. 0
Pod Zone C (310 Max)	117	233	27 261. 0
Pod Zone D (280 Max)	117	288	33 696. 0
Fuel load	1 400	200	280 000. 0
Total Ramp Weight	**9 727**	**202.5**	**1 969 234. 6**
- Fuel for start, taxi	- 36	200	- 7 200. 0
Total T/O Weight	**9 691**	**202.5**	**1 962 034. 6**

The maximum certified take-off weight for this type of aircraft was 9 062 pounds (4110kg). The aircraft was equipped with the Aero Acoustics Aircraft System, Inc. Payload Extender 11 Modification STC SA00392SE, which increased the maximum take-off weight of the aircraft from 8 750 to 9 062 pounds.

The weight of the three occupants that were fatally injured in this accident was obtained from the post mortem reports. The weight of the survivor was obtained as 67 kg. The fuel weight used in this calculation was obtained from the pilot's weight

calculation on Easy-plan that was recovered from the accident site.

The cargo weight utilized in this calculation was the weight of the cargo that was recovered from the accident site and then subsequently weighed. The recovered cargo weight amounted to 1132 kilograms. Once again the weight distribution for the purpose of the calculation was based on that of the pilot's load sheet recovered from the accident site.

The pilot made one fundamental error in his weight calculation that he used the incorrect aircraft empty weight. The weight reflected in the loading report that was recovered from the accident site reflect the aircraft empty weight as 4 575 pounds when it was in fact 5 174 pounds, an error of 599 pounds. The pilot obtained the aircraft empty weight of 5174 pounds from the sample loading problem in the pilot's operating handbook (POH), Section 6.The last aircraft mass and balance report, dated 29 April 2005 was in the aircraft at the time of the flight as required in Part91.03.1 (a) (xi) of the South African Civil Aviation Regulations of 1997 (document to be carried onboard an aircraft engaged in an International flight).

1.7 Meteorological Information

Wind direction	180°	Wind speed	8 knots	Visibility	>10km
Temperature	19.3°C	Cloud cover	Nil	Cloud base	Nil
Dew point	Unknown				

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with the following navigational aids;

- Magnetic compass
- Non-directional radio-beacon (NDB)
- Very high frequency omni-directional radio range (VOR)
- Distance Measuring Equipment (DME)
- Instrument Landing System (ILS)
- Transponder
- Bendix King 89K Global Positioning System (GPS)
- Garmin GNS 430 (VHF communications transceiver / VOR / ILS /GPS receiver).

1.9 Communications.

1.9.1 The pilot was cleared for take- off on Runway 19 at Eros airport by the air traffic controller (ATC) and was communicating on frequency 118.7 MHz.

1.9.2 There was no reported communication problem between the pilot and the air traffic controller who handle the flight.

1.10 Aerodrome Information

Aerodrome Location	Eros Airport	
Aerodrome Co-ordinates	S22° 36'26.9 E017° 04'44.9	
Aerodrome Elevation	5585 feet	
Runway Designations	01/19	09/27
Runway Dimensions	1976m × 30m	1005m × 30m
Runway Used	19	
Runway Surface	Tar	
Approach Facilities	Runway Lights & PAPI	

1.11 Flight Recorders

1.11.1 The aircraft was not equipped with flight data recorders (FDR) or cockpit voice recorder (CVR), nor was it required by the regulations.

1.11.2 The aircraft was equipped with a Shading Engine Trend Monitor system (ETM Key Recorder Part No. 943200, Serial No. 815). The unit was recovered from the wreckage in undamaged state and was down loaded by an avionics facility in South Africa under the supervision of an investigator from the South African Civil Aviation Authority (Accredited Representative). The unit did not record any engine exceedances during start-up or prior to impact on the accident flight.

1.12 Wreckage and Impact Information

1.12.1 The aircraft impacted with bush type terrain 1.2 nautical miles from the threshold of Runway 01 on a heading of 225°. The aircraft impacted the ground in a nose down left wing low attitude. Following the ground impact the left wing outer section departed the wing structure. The aircraft ground looped and skidded along the ground for a distance of 150 m before coming to rest facing the approaching direction.

1.12.2 The propeller separated from the engine during the impact sequence and were found downstream along the impact path approximately 100m from the point of impact. The engine, cockpit and nose gear assembly was found in an inverted attitude in front of the main wreckage. The cockpit area was severed from the main fuselage with the pilot seat still forming part of the main wreckage. The right wing outer section showed evidence of buckling on the outer section, which could be associated with ground impact along the wreckage path.

1.12.3 The left main wheel assembly failed on impact and was located 86m from the main wreckage in a south westerly direction. The right main gear assembly was found to have collapsed but was still attached to the main wreckage. The nose gear assembly fractured on impact and was found downstream along the impact path. The left wing structure had penetrated the cabin area during the impact with the ground and the wing strut was found to have fractured and penned into the ground.

1.12.4 The cargo – pod was found to have fractured at its attachment to the lower fuselage and had separated from the main wreckage and was found lying in close proximity to the left wing. A substantial amount of cargo that was onboard the aircraft was found spread out along the impact path. The after fuselage and empennage section of the aircraft remained basically intact. The passenger seats that were installed in the cabin area display evidence of distortion but remained secured to the floor structure.

Figure 1: Aircraft wreckages were found facing the approach directions.

Figure 2: The aircraft cockpit on the left hand side and the left hand wing badly damaged during the accident.

Figure 3: Shows some trees which were uprooted by the aircraft during the impact.

Figure 4: Propeller hub completely disintegrated from the engine a distance away from the main wreckage.

Figure 5: Shows aircraft cockpit instrument.

Figure 6: The nose landing gear was broken off from the aircraft and was found a distance from the main wreckage.

Figure 7: The recovered cargo which was inside the accident aircraft and the aircraft wreckage on the left side behind the trees.

Figure 8: Inside the aircraft cabin where the cargo was placed on top and under the seat and not secured.

1.13 Medical and Pathological Information

1.13.1 It was not available at the time of writing this report.

1.14 Fire

1.14.1 There was no pre- or post impact fire during the accident.

1.15 Survival Aspects

1.15.1 Due to the destruction of the cockpit area and the impact on the left- hand side of the aircraft , which caused a substantial amount of deformation on the front and left side of the aircraft the three occupants sustained numerous blunt force injuries and were unable to sustain life as a result thereof.

1.15.2 The passenger that survived the accident was seated in the second row of seats on

the right-hand side behind the co-pilot seat. He sustained a spinal injury and according to him a substantial amount of cargo (which was not secured) struck him from behind during the impact sequence and was lying on top of him when the aircraft came to halt.

1.15.3 He was wearing his aircraft equipped safety harness (lap strap) at the time of the accident. He evacuated the wreckage unassisted and fainted after walking a few meters. He was attended to by emergency personnel once they arrived on the scene and was admitted to a local hospital.

1.15.4 The aircraft was equipped with an Emergency Locator Transmitter (ELT), type Artex C406-4 that was installed in the aircraft on 16 January 2006. The ELT assembly was located in the aft cabin of the aircraft and was found to be undamaged. The cockpit switch was found in the armed position and the unit switch was found in the OFF position. When in this configuration the unit would have activated, the only limitation would have been dependable on sufficient battery current to activate the signal. According to available records (Maritime Rescue Co-ordination Centre) based at Silver mine near Cape town, which track all distress emergency signal within the Southern Africa territory no signal was received from the aircraft in question. The person registered as the emergency contact person for this unit have not received any notification following this accident.

1.16 Tests and Research.

1.16.1 The cargo that was onboard the aircraft at the time of accident was recovered from the accident site under the control of the Namibian Police and the Accident Investigation Directorate. The cargo was weighed at a cargo handling facility at Eros airport and the total weight amounted to 1132 kilograms.

1.16.2 The aircraft wreckage was recovered from the site of the accident and transported to Eros airport for safe keeping and further investigations.

1.16.3 The fuel sample from the aircraft was tested and no contamination was found and therefore fuel was not considered to be a contributing factor to this accident.

1.17 Organizational and Management Information

1.17.1 The aircraft was on a dry lease to an Angola based operator (Air Nave). The operator was in possession of a valid Certificate of validation that was issued by the Angolan Authorities.

1.17.2 The last Angolan Civil Aviation Authority (CAA) audit to Air Nave was done on 24 October 2009 and based on the results of the referred audit the company was issued with an OAC valid until 24January 2010.

1.17.3 The Company (Air Nave) was approved by Angolan CAA to carry out commercial air operations according to the Angolan Aviation operation regulations.

1.17.4 The main operations base of Air Nave is located at the International airport "4 Fevereiro" in Luanda, Republic of Angola and besides the aircraft that was involved in the accident (ZS-OTU); the Company operates three more airplanes.

1.17.5 This was the first flight after the aircraft was subjected to a Phase 2 maintenance

inspection that was performed at Eros airport. Maintenance personnel from South African based Aircraft Maintenance Organization (AMO) travelled to Namibia to perform the maintenance inspection.

1.17.6 They were assisted by an aircraft maintenance engineer (AME) from a Namibian based AMO. The maintenance inspection was performed over a period of three days.

1.17.7 The required permission to perform maintenance away from the base was obtained from the South African Civil Aviation Authority (SACAA) in collaboration with the Namibian Authorities and was dully authorised.

1.17.8 Following the maintenance at Eros airport the aircraft would have been ferried to Luanda to proceed with the contract of flying personnel between Luanda and Soyo in the Northern part of Angola, most probably people working in the petroleum industry.

1.17.9 Permission to allow Aircraft Maintenance at Work to use Eros airport facility (Aviation Centre) from time to time for the purpose of carrying out required maintenance of ZS-OTU and ZS-OWC was granted and valid from the 9 November 2009 to 23 November 2009.

1.18 Additional Information

1.18.1 The pilot indicated on the flight plan (sector 1 and 2) three people on board, while there were four people on board when the aircraft took – off from Eros airport.

1.19 Useful or Effective Investigation Techniques

1.19.1 None

2. ANALYSIS

2.1.1 On 15 November 2009, at about 04:58 UTC, an aircraft a Caravan 208B, with the South African registration ZS-OTU, with a pilot and three passengers on board took-off from Eros airport for a flight to Luanda via Ondjiva and Lumbango.

2.1.2 The aircraft was loaded with non perishable cargo, which was destined for two separate locations within Angola. The cargo consisted mainly of building material, several containers of paint, boat spares, toolboxes, liquid beverages and frozen meat.

2.1.3 A certain amount of the cargo was weighed by a handling company at Eros airport during the afternoon of 14 November 2009. The weight of the cargo amounted to 810.7kg. The handling agent provided two people that assisted in loading the aircraft under the supervision of the pilot and a security guard. They were also assisted by a person from a local operator based at Eros airport.

2.1.4 On 15 November 2009, prior to departure additional cargo arrived and were loaded into the cargo-pod, consisting mainly of frozen meat and beverages and this was not weighed by the handling agent. The suitcase of the three passengers and the pilot were also not weighed and were loaded inside the cabin towards the back. The cargo inside the cabin was not secured and was placed between and on top of the seats all the way to the roof (all the seats were installed in the aircraft at the time).

2.1.5 The three passengers that were onboard the aircraft were destined to perform maintenance work at a private lodge in Angola. The surviving passengers were trained as a builder and the other two passengers were to service several boats utilizes by the lodge during fishing excursions.

2.1.6 The aircraft was scheduled to depart from Eros airport at 04:00 UTC, on 15 November 2009, but it was delayed for approximately one hour due to logistical problem at the airport. This was the pilot's first flight from Eros airport. The aircraft was cleared for take –off by Air Traffic Controller (ATC) for runway 19 and the wind on take-off was 180° at 08 knots according to the ATC information.

2.1.7 The aircraft landed at Eros airport en-route from Luanda in Angola on 11 November 2009. The aircraft was scheduled for a Phase 2 maintenance inspection, which was conducted at Eros airport by maintenance personnel from South Africa and Namibia. The inspection was conducted over a period of three days and was completed on Saturday afternoon, 14 November 2009.

2.1.8 On 12 November 2009, the pilot of the accident flight was flown from Woonderboom airport to Eros airport on a non schedule flight. His contract arrangements were to conduct a tour of between six to ten weeks in Angola with the aircraft ZS-OTU. The aircraft were to return to Luanda in Angola where it was utilizes in a non-schedule domestic operation, transporting passengers between Luanda and Soyo in Northen Angola under a Validation Certificate that was issued by the Angolan Authorities.

2.1.9 According to the passengers who survived the accident as well as several eyewitness, the aircraft roll pass the main apron and rotated lifting the nose wheel off the runway surface but the main wheels remained on the runway. The aircraft become airborne pass the intersection of Runway 09/27, clearing the aerodrome boundary fence by about 10 feet. It then climbed to a height of approximately 300 feet above ground level (AGL) and then sank back to about 200 feet above ground level (AGL). The aircraft then turned right in a westerly direction and entered into a high nose-up attitude.

2.1.10 The surviving passengers further stated that shortly after take-off the nose of the aircraft pitched up and the left wing dropped and the aircraft started to spin/spiral towards the left. Shortly there after the aircraft impacted with flat bush type of terrain and skidded along the ground, coming to rest about 150m from the point of impact, facing the approaching direction (towards the airport).

2.1.11 The maximum certified take-off weight for this type of aircraft was 9 062 pounds (4110kg). The aircraft was equipped with the Aero Acoustics Aircraft System, Inc. Pay load Extender 11 Modification STC SA00392SE, which increased the maximum take – off weight of the aircraft from 8 750 to 9062.

2.1.12 The aircraft ZS-OTU was deleted from the South African Civil Aircraft Register (SACAR) as from the 2 August 2002 and brought to Namibia with the registration V5-CAR operated by a Local based Company COMAV.

2.1.13 On 26 January 2005, while the aircraft was in the Namibian registry application was submitted by a Local Company to the Regulatory Authority for the removal of MacCauley Propeller 3GFR24C703 and the installation of a Hartzell Propeller HC-B3TN-3AF Serial No.BUA29052 As per STC SA02181 AK by Hartzell propeller incorporation. The application was approved on 9 February 2005. The reason for

modification was on the owner's request. Weight and moment change – none.

2.1.14 Another application was submitted by the same Local Company to the Regulatory Authority for the installation of King KRA-10A wiring harness into the aircraft. The application was approved on 6 September 2005. The reason fro modification was to upgrade the avionics on the customer's request. Weight and moment change 3.8lbs @122.44 inch/lbs.

2.1.15 The aircraft was bought from Namibia by a Company called Aviation @Work based in Pretoria, South Africa and deleted from the Namibian Civil Register of aircraft on 11 April 2005.

2.1.16 Certificate of release to service was issued on 23 June 2009, at 12268.4 airframe hours without any endorsement.

3. CONCLUSION

3.1 Findings

3.1.1 The pilot was the holder of a valid commercial pilot's licence and had the aircraft type endorsed in his log book.

3.1.2 The pilot's medical was properly issued by an approved CAA medical examiner.

3.1.3 The pilot started working for the company on 1 November 2009, and had conducted one flight from Wonderboom to Port Elizabeth and back to Wonderboom on a C208B, with a company check pilot on 2 November 2009.

3.1.4 He was flown to Eros airport from Wonderboom on 12 November 2009, with a Beech 36 (ZS-KAJ), owned by Aviation @ Work. The pilot's intended tour in Luanda would have been between 6 to 10 weeks.

3.1.5 This was the pilot's first flight from Eros airport.

3.1.6 The pilot had filed a flight plan for the intended flight to Ondjiva in Angola, with his alternate being Ondangwa in northern Namibia.

3.1.7 The aircraft was properly maintained and had a valid Certificate of Airworthiness.

3.1.8 The aircraft was subjected to a Phase 2 Maintenance inspection, which was conducted over a period of three days prior to the accident flight.

3.1.9 The aircraft was equipped with an Artex G406-4 ELT. No emergency distress signal was recorded from this unit following the accident.

3.1.10 The cargo that was placed inside the cabin was positioned between and on top of the seats, and was not secured.

3.1.11 The aircraft was refuelled twice the day prior to the accident flight with a total of 572 liters of Jet A1 being uplifted.

3.1.12 Both fuel attendants were interviewed at Eros airport and they indicated that the fuel

tanks were not filled to capacity. The pilot was present on both occasions watching fuel status inside the cockpit and told them to stop. Thirty six pounds of fuel was subtracted for start-up and taxi, which accommodate a six minute time frame period on an average fuel consumption of 400 lbs per hour.

3.1.13 The pilot indicated on the flight plan (sector 1 and 2) that there was three people on board, while in fact there were four people on board when the aircraft took – off from Eros airport.

3.1.14 All passengers were issued with flight tickets by a local operator based at Eros airport, tickets No. 30226, 30227 and 30228, route Eros – Huambo - Luanda. The tickets were issued on the 15 November 2009, and date of departure was supposed to be the 16 November 2009.

3.1.15 During the onsite investigations it was found out that the wing leading edges of the aircraft was spray painted with a harsh anti erosion type paint. This type of paint results in a rough texture which can therefore affect the stalling characteristics of the wing. Verification with the aircraft manufacture confirmed that this did not meet the original airworthiness and was in contradiction of the aircraft manufacture minimum continuous airworthiness standard.

3.1.16 According to the Air Traffic Controller who was on duty on the morning of 15 November 2009, aircraft ZS-OTU, C208B took off from runway 19 for FNGI in Angola. The pilot was given a choice between using runway 19 and 01, because the wind was 180/08 knots. The pilot insisted on using runway 19. After struggling to get aircraft in the air (airborne) the aircraft lifted of abeam the control tower. According to our observation (ATC personnel) the aircraft was too heavy it couldn't get height and it went down south west of Prosperita Industrial area.

3.1.17 The weight of the three occupants that were fatally injured in this accident was obtained from the post mortem reports. The weight of the survivor was obtained as 67 kg. The fuel weight used in this calculation was obtained from the pilot's weight calculation on Easy-plan that was recovered from the accident site and could be found attached to this report as Annexure A.

3.1.18 The cargo weight utilized in this calculation was the weight of the cargo that was recovered from the accident site and then subsequently weighed. The recovered cargo weight amounted to 1132 kilograms. Once again the weight distributed for the purpose of the calculation was based on that of the pilot's load sheet recovered from the accident site.

3.1.19 The pilot made one fundamental error in his weight calculation that he used the incorrect aircraft empty weight. The weight reflected in the loading report that was recovered from the accident site reflect the aircraft empty weight as 4 575 pounds when it was in fact 5 174 pounds, an error of 599 pounds. The pilot obtained the aircraft empty weight of 5174 pounds from the sample loading problem in the pilot's operating handbook (POH), Section 6. The last aircraft mass and balance report, dated 29 April 2005 was in the aircraft at the time of the flight as required in Part 91.03.1 (a) (xi) of the South African Civil Aviation Regulations of 1997 (document to be carried onboard an aircraft engaged in an International flight.

3.1.20 The investigations revealed that during this operation the take-off weight was exceeded

by 629 pounds or 7%.

3.1.21 The aircraft was equipped with a Shading Engine Trend Monitor (ETM Key Recorder Part No. 943200, Serial No. 815). This unit was recovered from the wreckage in undamaged state and was down loaded by an avionics facility in South African under the supervision of an investigator from the South African Civil Authority (Accredited Representative). The unit did not recovered any engine exceedances during start-up or prior to impact on the accident flight.

3.1.22 The aircraft impacted with bush type terrain 1.2 nautical miles from the threshold of Runway 01 on heading of 225°. The aircraft impacted the ground in a nose down left wing low attitude. Following the ground impact the left wing outer section departed the wing structure. The aircraft ground looped and skidded along the ground for a distance of 150 metres before coming to rest facing the approaching direction.

3.1.23 The passengers that survive the accident were seated in the second row seat on the right-hand side behind the co-pilot seat. He sustained a spinal injury and according to him a substantial amount of cargo (which was not secured) struck him from behind during the impact sequence and was lying on top oh him when the aircraft came to halt.

3.1.24 He was wearing his aircraft equipped safety harness (lap strap) at the time of the accident. He evacuated the wreckage unassisted and fainted after walking a few meters. He was attended to by emergency personnel once they arrived on the scene and was admitted to local hospital.

3.1.25 The fuel sample from the aircraft was tested and no contamination was found and therefore fuel was not considered to be a contributing factor to this accident.

3.1.26 The aircraft was on a dry lease to an Angola based operator (Air Nave). The operator was in possession of a valid Certificate of validation that was issued by the Angolan Authorities.

3.1.27 The Angolan Civil Aviation Authority (CAA) conducted an audit on the Company on 24 October 2009, and based on the outcome of the audit the company was issued with an OAC valid until 24 January 2010.

3.1.28 The Company (Air Nave) was approved by Angolan CAA to carry out commercial air operations according to the Angolan Aviation operation regulations.

3.1.29 The main operation base of Air Nave is located at the International airport "4 Fevererio" in Luanda, Republic of Angola and besides the aircraft that was involved in the accident (ZS-OTU), the Company operates three more airplanes.

3.1.30 Permission to allow Aircraft Maintenance at Work to use Eros airport facility (Aviation Centre) from time to time for the purpose of carrying out maintenance of ZS-OTU and ZS-OWC was granted and valid from the 9 November 2009 to 23 November 2009.

3.1.31 The aircraft ZS-OUT was deleted from the South African Civil Aircraft Register (SACAR) as from the 2 August 2002 and brought to Namibia with the registration V5-CAR operated by a Local based Company.

3.1.32 On 26 January 2005, while the aircraft was in the Namibian registry application was submitted by a Local Company to the Regulation Authority for the removal of MacCauley Propeller 3GFR24C703 and the installation of a Hartzell propeller HC-B3TN-3AF Serial No.BUA29052 As per STC SA02181 AK by Hartzell propeller incorporation. The application was approved on 9 February 2005. The reason for modification was to upgrade the avionics on the customer's request. Weight and moment change – None.

3.1.33 Another application was submitted by the same Local Company to the Regulatory Authority for the installation of King- 10A wiring harness into the aircraft. The application was approved on 6 September 2005. The reason fro modification was to upgrade the avionics on the customer's request. Weight and moment change 3.8lbs@1224.44 inch/lbs.

3.1.34 The aircraft was bought from Namibia by a Company called Aviation @ Work based in Pretoria, South Africa and deleted from the Namibia Civil Register of aircraft on 11 April 2005.

3.2 Probable Cause/s

3.2.1 The investigations revealed that during this operation the aircraft's take-off weight was exceeded by 629 pounds.

3.2.2 The aircraft failed to maintain flying speed and stalled shortly after take-off, rendering ground impact inevitable.

3.3 Contributory factor (s)

3.3.1 This was the pilot's first flight from Eros airport therefore being unfamiliar with the airport and the environmental phenomena's associated with it (especially taking off from Runway 19).

3.3.2 The pilot made one fundamental error in his weight calculation that he used the incorrect aircraft empty weight.

3.3.3 The cargo that was in the cabin was packed between and underneath and on top of the seats and was not secured.

3.3.4 The aircraft took-off from runway 19, which was an upslope runway.

3.3.5 Taking off from Runway 19 the terrain kept rising with mountains straight ahead as well as to the left and right.

3.3.6 The pilot retracted the flaps shortly after rotation, which resulted in an attitude change and performance (aircraft lost altitude), which should be regarded as a significant contributory factor to this accident.

3.3.7 The pilot was observed to turn to the right shortly after take-off, which increased the drag on the aircraft as well as the stall speed.

drag on the aircraft as well as the stall speed.

3.3.8 Harsh anti-erosion rubber paint that was sprayed onto the leading edge of the wings resulted in an increased stall speed.

3.3.9 Inadequate oversight by the regulatory authority should be regarded as a significant contributory factor to this accident.

4.0 SAFETY RECOMMENDATIONS

4.1.1 It is recommended that aircrew not familiar with this airport be subjected to a proper pre-departure briefing, where the hazards and associated phenomena's be addressed in details. This briefing should be conducted either by the briefing office or air traffic control, verbally or in the form of an information pamphlet.

4.1.2 It is recommended that the Namibian Civil Aviation Authority enrol on a campaign to perform ad hoc oversight inspections at their airports with special emphasis on weight and balance compliance prior to flight. These ad hoc inspections should be specifically aimed to ensure that aircraft operators and owners comply with the weight limitations as prescribed by the aircraft manufacture in the Pilot Operating Handbook (POH).

4.1.3 It is strongly recommended that aircraft operators should ensure that aircraft carrying cargo should be provided with proper means of securing the cargo.

4.1.4 It is strongly recommended that pilot should use the correct weight of the aircraft and should update themselves with the Pilot Operating Handbook (POH).

4.1.5 Aircraft Operators should refrain from doing modifications that are in contradiction with the aircraft manufactures.

4.1.6 Pilots are advice to give the correct number of people on board for each flight.

Compiled by:

Date: 07-04-2010

T. Shuungula

Titus Shuungula
Investigator – in – Charge

Released by :

Date: 16/04/10

Erkki Nghimtina (MP)
MINISTER: MINISTRY OF WORKS AND TRANSPORT