Ministry of Works and Transport | INCID/04/2019/01-05

# DIRECTORATE OF AIRCRAFT ACCIDENT INVESTIGATION
# INCIDENT REPORT – EXECUTIVE SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| **Aircraft Registration** | V5-WAC | **Date of Incident** | 20th April 2019 | **Time of Incident** | 10:11 UTC |
| **Type of Aircraft** | CESSNA 404 | | **Type of Operation** | Charter | |
| **Pilot- In - command License Type** | CPL | **Age** | 23 | **License Valid** | valid |
| **Pilot-In-command Flying Experience** | Total Flying Hours | 1500 | | **Hours on Type** | 230 |
| **Last point of departure** | FYAR ( Arandis airfield) | | | | |
| **Next point of intended landing** | Mowe bay | | | | |

**Location of the accident site with reference to easily defined geographical points (GPS readings if possible)**

S 22° 13' 14 & E 14° 14'39'

| | | | | | |
|---|---|---|---|---|---|
| **Meteorological Information** | Wind Direction: Northerly, Wind speed: 4-8 kt , Visibility: Good, Temperature: Unknown Cloud cover: OVC, Cloud base: CAVOK, Dew point: Unknown | | | | |
| **Number of people on board** | 1+8 | **No. of people injured** | 0 | **No. of people killed** | 0 |

## Synopsis


On the 20st April 2019 at 10: 01 UTC, a Cessna C404 with Registration Number V5-WAC took off from Arandis Airfield (FYAR) on a charter flight to Mowe bay. There were one pilot and eight passengers on board. The flight was planned under Visual Flight Rules (VFR) conditions that were prevailing at that time.

Takeoff out of FYAR was normal. During the climb the pilot stated that engine number two oil pressure was slightly lower than normal for the climb. He decided to level the aircraft and investigate. He noticed all other engine indications were normal and then decided to try the climb again however he experienced the same results. The pilot thereafter decided to shut down the engine as precaution for a possible engine failure. He flew with one serviceable engine back to Arandis and landed the aircraft safely.

The Directorate of Aircraft Accident Investigation (DAAI) was informed telephonically about the incident on 20 April 2019 by the Operator. The Minister of Works and Transport was responsible for the release of the official final accident report.

There were no injuries to the occupants. There was no damage to the aircraft at the time of accident.

The weather was fine with good visibility.

The pilot was a holder of a commercial Pilot License. His medical certificate was valid with no restrictions. The aircraft type was also endorsed into his license.

The last Mandatory Periodic Inspection (MPI) was certified on 14 March 2019 at 15756.9 airframe hours. At the time of the incident the aircraft had accumulated a further 26 hours.

According to the records, the Aircraft Maintenance Organization (AMO) that certified the last MPI on the aircraft prior to the incident was in possession of a valid AMO Approval No. 99 which was issued on 15 February 2018 and has an expiry date of 12 February 2019. There were no discrepancies identified when the Regulatory Authority conducted a conformity inspection on the Aircraft on the 31st Oct 2018 as per FSS-AIR-FORM 008F 11/2016.


**Probable Cause:** Failure to achieve predicted performance during initial climb.

**Contributing factor (s):**

1. Piston failure in No.2 Cylinder due to undetermined factors.

**AIRCRAFT INCIDENT REPORT**

| | |
|---|---|
| **Name of Owner/Operator** | **: Westair Aviation (Pty) Ltd** |
| **Manufacture** | **: Cessna** |
| **Model** | **: 404** |
| **Nationality** | **: Namibian** |
| **Registration** | **: V5 - WAC** |
| **Location** | **: Arandis airfield** |
| **Date** | **: 20th April 2019** |
| **Time** | **:10:11** |

*All times given in this report are in 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 the Civil Aviation Act (Act No. 6 of 2016) and 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 blame or 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 the 20th April 2019 at 10: 01 UTC, a Cessna C404 with Registration Number V5-WAC took off from Arandis Airfield (FYAR) on a safari charter flight to Mowe bay. There were one pilot and eight passengers on board. The charter flight departed from FYAR (Arandis airfield) at 10:00 UTC.

1.1.2 The aircraft had previous flight from Eros that morning which was uneventful. About 10 minutes into the climb the pilot noticed that the No. two engine oil pressure being slightly lower than normal for the climb. He stated that it was stationary at roughly 45 PSI compared to No.1 engine which was at 52 PSI. From his experience he stated that oil pressure on that specific aircraft normally would be between 50-60 PSI, although the normal operating range is between 30-60 PSI. The pilot however elected to level off and investigate.

1.1.3 The pilot monitored other engine parameters and found them within limits for that phase of flight. He then reduced power from max climb power of 33.5 manifold /1900RPM to cruise at 31 manifold/1800RPM, the oil pressure rose slightly but still remained below 50 PSI.

1.1.4 Further climb was attempted with similar results as before. Oil PSI on engine No. 2 dropped back to 45 PSI and peaked at low of about 41/42 PSI. Few seconds later the manifold and RPM on engine No. 2 started to drop. The pilot stated that he considered weight and temperature (WAT) and performance figures done for the leg before deciding to secure no. 2 engine and

return to FYAR. He made a safe landing at around 10:23 and the emergency services arrived around 10:30.


**Figure 1:** Aircraft after landing safely and parked at designated area. FYAR

### 1.2 Injuries to Persons

| Injuries | Crew | Passengers | Total in the Aircraft. | Other |
|---|---|---|---|---|
| Fatal | nil | nil | nil | nil |
| Serious | nil | nil | nil | nil |
| Minor | nil | nil | nil | |
| None | - | - | - | |

### 1.3 Damage to Aircraft

**1.3.1** The aircraft did not sustain any visual damage and landed safely.

### 1.4 Other Damage

1.4.1 There was no other damage

### 1.5 Personnel Information

1.5.1 Pilot-in-in command

| Nationality | | Namibian | | | |
|---|---|---|---|---|---|
| Licence No | CA72031 | Gender | Male | Age | 23 |
| Licence valid | | Yes | Type Endorsed | Yes | |
| Ratings | | Night flying, Instrument | | | |

| | |
|---|---|
| Medical Expiry Date | 31 March 2020 |
| Restrictions | None |
| Previous Accidents | Unknown |

Flying Experience:

| | |
|---|---|
| Total Hours | 1535 |
| Total Past 90 Days | 92.3 |
| Total on Type Past 90 Days | 20 |
| Total on Type | 345.3 |

## 1.6 Aircraft Information

**Airframe:**

The aircraft was registered to Namibia Wildlife Charters by the Namibian Civil Aviation Authority. (C of A) No. 646/97/1 and was operated by Westair Aviation (Pty) Ltd with an Air Operators certificate (AOC) No. AOC/010/2013 which was valid till 20/05/2019 for non-scheduled operations.

| | |
|---|---|
| Type | Cessna 404 |
| Serial No. | 404-0616 |
| Manufacture | Cessna Aircraft Corp ( TexTron Aviation) |
| Year of Manufacture | 1980 |
| Total Airframe Hours (At time of Accident) | 15782.9 |
| Last MPI (Date & Hours) | 14 march 2019 |
| Hours since Last MPI | 26 |
| C of A (validity) | 30 November 2019 |
| C of R (Issue Date) | 17 Dec 2014 |
| Operating Categories | Standard, **A,B,C,D,E,F** |

**Engine: NO 2**

| | |
|---|---|
| Manufacturer | CONTINENTAL |
| Model number | GTS10-520M2B |
| Serial No. | 1010912 |
| Hours since New | 977.7 |
| Hours since Overhaul | NA |

**Propeller:**

| | |
|---|---|
| Manufacturer | McCauley |
| Type | 3FF32C501C |
| Serial No. | 960439 |
| Hours since New | 5034.8 |
| Hours since Overhaul | 318.7 |

## 1.7 Meteorological Information

1.7.1 The weather was reported to be fine. The visibility also was good at the time of the occurrence.

## 1.8 Aids to Navigation

1.8.1 The aircraft was equipped with standard navigation equipment.

### 1.9 Communications.

1.9.1 Initial communications with Walvis Bay approach was reported as unreadable, a relay was done by crew flying V5-ASB using secondary radio. (118.0) who relayed the information to Walvis Bay tower. On the turn the communication was established and emergency services were alerted at the airfield.

### 1.10 Aerodrome Information

The Aircraft landed safely at Arandis Airport, which is 5 kilometers (3.1 miles) south of Arandis town, at coordinates 22°27′44″S 14°58′48″E which lies at about AMSL 1,905 ft / 581 m.

| Runways | | | |
|---|---|---|---|
| Direction | Length | | Surface |
| | m | ft | |
| 10/28 | 1,920 | 6,299 | Asphalt |

### 1.11 Flight Recorders

1.11.1 The Aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR) nor was it required by the relevant aviation regulations.

### 1.12 Wreckage and Impact Information

The aircraft landed safely with no visual damage. However initial field investigation showed evidence of metal deposits on the No.2 spark plug.

**Figure 2.** Metal deposits on the No.2 spark plug.

**Figure 3.** Grounded Spark Plug Electrodes on No.2 cylinder of the right engine.

**1.13 Medical and Pathological Information**

1.13.1. Not conducted

**1.14 Fire**

1.14.1. There was no evidence of pre or post impact fire.

**1.15 Survival Aspects.**

1.15.1 The aircraft landed safely at 10:23 UTC. Fire and medical services arrived at 10:35 UTC.

**1.16 Tests and Research.**

1.16.1. The engine was removed and transported to a maintenance facility in Windhoek for a comprehensive investigation. A teardown process which involved removal of all pistons and accessory gearbox was performed under supervision of the Investigator-In-charge (IIC).

1.16.2. All cylinders were removed sequentially and pistons examined. The number two piston exhibited substantial wear and the upper piston ring was found badly damaged which resulted into a piston failure.


Figure 3. Piston no.2 exhibiting substantial wear.

Figure 4. A close up view of the excessive heat damage on the piston head

1.16.3 Fuel injection nozzles were inspected carefully and found free of any foreign object or clogging.

**1.17 Organizational and Management Information.**

1.17.1. The aircraft was owned by Namibia Wildlife Charters and had been operated by Westair Aviation (Pty) ltd.

1.17.2 The operator was in possession of a valid Part 135 Air Operator Certificate (AOC), issued on 30- 08-2018

1.17.3 The Aircraft Maintenance Organization (AMO) responsible for the last MPI was duly certified to carry out the required maintenance on the aircraft and was in possession of a valid AMO certificate No. 99 Valid till 12 February 2019.

**1.18 Additional Information**

1.18.1 Piston failure can be attributed to many factors, one of it being detonation. Detonation is the abrupt combustion or explosion of the fuel charge inside the cylinder[1]
During combustion, the spark plugs ignite the fuel charge and the fuel has a consistent and even burn as the piston moves through the power stroke and chemical energy is efficiently converted to mechanical energy. i.e. the combustive force applied to the piston in a stable manner pushes the piston down. In case of detonation the fuel air mixture burns explosively rather than progressively The explosive burning during detonation results in an extremely rapid pressure rise.
Unless detonation is heavy, there is no flight deck evidence of its presence. Light to medium detonation does not cause noticeable roughness, temperature increase, or loss of power. As a result, it can be present during takeoff and high-power climb without being known to the flight crew. (Aviation, 2018)
The effects of detonation are often not discovered until after teardown of the engine. When the engine is overhauled, however, the presence of severe detonation during its operation is indicated by dished piston heads, collapsed valve heads, broken ring lands, or eroded portions of valves, pistons, or cylinder heads (Aviation, 2018).

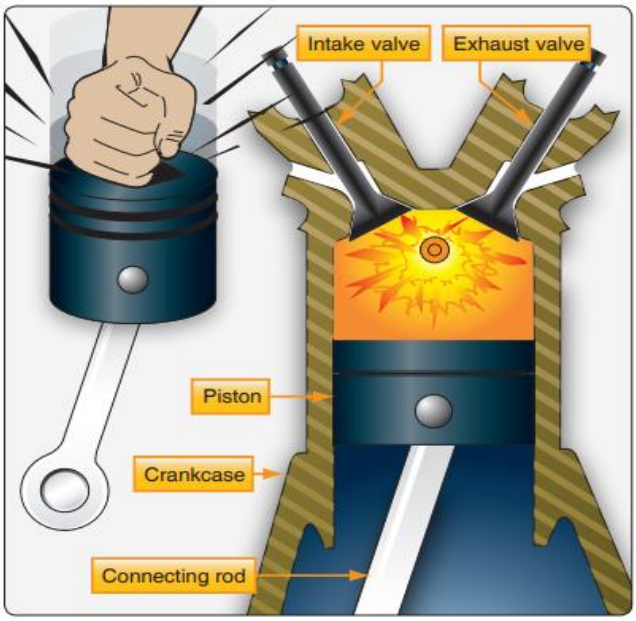

Figure 5. Detonation within a cylinder.

Prevention of detonation is critical and is a function of both the ground and the flight crew the flight crew to observe acceptable rpm and manifold pressure limits by continuously monitoring Cylinder head temperatures (CHT), the maintenance to ensure periodic bore scope inspections are done thoroughly, proper timing of the valves (opening and closing) cannot be over emphasized as failure

can result into reduced engine inefficiency and even failure.

Pre-ignition is another form of abnormal combustion although no explosive combustion occurs in this case. In pre-ignition, the fuel-air mixture is ignited prior to the timed ignition initiated by the spark plugs. This affects the whole cycle of the piston, and is thus considered to be “destructive” for the cylinder heads. In this case lead deposits around the spark plugs are most common source of pre-ignition.

Prevention of pre-ignition can best be achieved by reducing cylinder head temperatures by retarding the throttle which reduces the amount of fuel charge and hence the heat generated, the mixture should be enriched, if possible, to lower combustion temperature. If the engine is at high power when pre-ignition occurs, retarding the throttle for a few seconds may provide enough cooling to chip off some of the lead, or other deposit, within the combustion chamber. These chipped-off particles pass out through the exhaust.

### 1.19 Useful or Effective Investigation Techniques

1.19.1 Not applicable

# 2. ANALYSIS

2.1. The charter flight was scheduled to commence from Arandis airfield for Mowe Bay. During climb from the airfield the pilot experienced discrepancies in oil pressure on number 2 engine and after a sequence of actions decided to secure the engine and land with the single operative engine. He executed a safe landing shortly after.

2.3 The pilot and the rest of the occupants did not sustain any injuries.

2. 4. The pilot was licensed and rated on the aircraft type to conduct the flight and was the holder of a valid medical certificate.

2.5 The aircraft was not equipped with a flight data recorder or a cockpit voice recorder nor was it required by the relevant aviation regulations.

# 3. CONCLUSION

## 3.1 Findings

3.1.1 The pilots’ licences and medical certificates were valid at the time of the accident.

3.1.2 The pilot and the rest of the occupants did not sustain any injuries.

3.1.3 The aircraft Certificate of Airworthiness (C of A) and Certificate of Registration (C of R) were valid at the time of occurrence.

## 3.2 Probable Cause/s

3.2.1. Failure to achieve predicted performance during initial climb.

## 3.3 Contributing factor/s

3.3.1 Piston failure in No.2 Cylinder on the right engine due to undetermined factors.

## 4. Safety Recommendations

None

Compiled by

Date 5 JUNE 2020

Hafeni Mweshixwa
**Investigator-In-Charge**

Released by

Hon John Mutorwa, MP
**Minister of Works and Transport**

Date 8.6.2020

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**References**

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