AIRCRAFT INCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/3/2/1256		
Aircraft Registration	ZU-BJY	**Date of Incident**	21 March 2019		**Time of Incident**	05:15Z	
Type of Aircraft	Tecnam P92 Echo		**Type of Operation**		Training (Part 141)		
Pilot-in-command Licence Type	Commercial Pilot		**Age**	36	**Licence Valid**	Yes	
Pilot-in-command Flying Experience	Total Flying Hours		1220.1		Hours on Type	666.8	
Last point of departure	Aeropark Zyn Kraal Aerodrome-Gauteng Province						
Next point of intended landing	Aeropark Zyn Kraal Aerodrome-Gauteng Province						
Location of the incident site with reference to easily defined geographical points (GPS readings if possible)							
At Aeropark Zyn Kraal Aerodrome during landing roll collision with perimeter fence with GPS (S 25°54'15" 5, E 028°32'34") with a field elevation of 4900 ft.							
Meteorological Information	Wind direction: 350° Wind speed: 05kt; Visibility: 9999m, CAVOK						
Number of people on board	2+0	**No. of people injured**	0	**No. of people killed**	0		
Synopsis							

An instructor and a student pilot were engaged in a training flight when the incident occurred. The student pilot carried out a pre-flight inspection and topped up the brake fluid prior to take-off. No brake anomalies were detected during the aircraft's taxiing and power checks. The take-off and training exercises were uneventful. On return to the aerodrome, the instructor was in control of the aircraft during landing. The touchdown was uneventful; however, during the landing roll, the aircraft's brakes failed. The instructor then shut down the engine to reduce forward speed; however, the aircraft overshot the runway and crashed onto a parameter fence.

After the aircraft came to a halt, the instructor and his student disembarked without assistance. They then inspected the aircraft and observed that it sustained damage to the propeller blades. A post-incident inspection on the brake system revealed that the brake master cylinder O-ring seals were worn out. No other damages were reported. None of the occupants sustained any injuries during the incident sequence.

The investigation revealed that the incident occurred due to brakes failure caused by the failed brake master cylinder O-rings. This resulted in the aircraft overshooting the runway and crashing into the perimeter fence. The cause of the O-ring failure was due to a normal wear and tear.

SRP Date	19 September 2019	Publication Date	17 October 2019

Abbreviation/Acronym	Definition
AMO	Aircraft Maintenance Organisation
AMM	Aircraft Maintenance Manual
AMSL	Above Mean Sea Level
ATO	Aviation Training Organisation
A to F	Authority to Fly
°C	Degrees Celsius
CAR	Civil Aviation Regulations
CAVOK	Ceiling and Visibility OK
CPL	Commercial Pilot Licence
C of R	Certificate of Registration
CVR	Cockpit Voice Recorder
FDR	Flight Data Recorder
ft	Feet
GPS	Global Positioning System
KT	Knots
MPI	Mandatory Periodic Inspection
NTCA	Non-Type Certified Aircraft
POH	Pilot Operating Handbook
PSI	Pounds Per Square Inch
TBO	Time Before Overhaul
VMC	Visual Meteorological Conditions

Reference Number	**:** CA18/3/2/1256
Name of Owner/Operator	**:** Accolade Flying School
Manufacturer	**:** Amateur Build Wing
Model	**:** Tecnam P92 ECHO
Nationality	**:** South African
Registration Marks	**:** ZU-BJY
Place	**:** Aeropark Zyn Kraal Aerodrome
Date	**:** 21 March 2019
Time	**:** 05:15Z

All times given in this report are Coordinated 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 (CAR), 2011 this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to apportion blame or liability****.*

Any person who has information concerning this incident should contact the *Accident and Incident Investigations Division (*AIID) on AIIDinbox@caa.co.za

Investigations process:

The AIID was informed about an aircraft incident, involving a Tecnam P92 ECHO which occurred at Aeropark Zyn Kraal on 21 March 2019. The incident was notified to the AIID investigator on call at 05:30Z.

The AIID appointed an investigator-in-charge. Notifications were sent to the State of Registry and State of Operator. The AIID will lead the investigation and issue the Final Report.

The information contained in this Preliminary Report is derived from the information gathered during the ongoing investigation into the occurrence. Later Interim or Final Reports may contain altered information in case new evidence appears during the ongoing investigation that requires changes to the information depicted in this report.

The AIID Reports are made available to the public at:
http://www.caa.co.za/Pages/Accidents%20and%20Incidents/Aircraft-accident-reports.aspx

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   - *Incident – this investigated incident*
   - *Aircraft – the Tecnam P92 ECHO involved in this incident*
   - *Investigation – the investigation into the circumstances of this incident*
   - *Pilot – the pilot involved in this incident*
   - *Report – this incident report*

2. *Photos and figures used in this report were obtained from different sources and may be adjusted from the original for the sole purpose of improving the clarity of the report. Modifications to images used in this report are limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or the addition of text boxes, arrows or lines.*

Disclaimer:

This report is produced without prejudice to the rights of the South African Civil Aviation Authority (SACAA), which are reserved.

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 On 21 March 2019, an instructor pilot and a student pilot were engaged in a training flight. The aircraft took off from Aeropark Zyn Kraal Aerodrome after the student pilot had conducted a pre-flight inspection of the aircraft. According to the instructor, brake fluid was topped up during the pre-flight inspection. During start-up, take-off power checks were conducted with brakes on. There was no indication of brakes failure.

1.1.2 The aircraft's take-off and training exercises were uneventful. On completion of the training exercises, the student pilot was instructed to return to home base for a full stop landing. Upon approach for landing, the instructor noticed that the student was having difficulties with maintaining a stable approach and he took over the aircraft's controls for landing. A stable landing approach was achieved by the instructor and the aircraft was committed for a full stop landing. The touchdown was uneventful, however, during the landing roll, the instructor noticed that the aircraft had a total brakes failure. He then tried pumping the brakes multiple times without success and decided to shut down the engine to reduce forward speed. The aircraft overshot the runway and crashed onto a perimeter fence.

1.1.3 The instructor and his student disembarked unassisted and uninjured. The aircraft sustained damage on the propeller blades.

1.1.4 The aircraft incident occurred during visual meteorological conditions with Global Positioning System (GPS) coordinates: S 25°54'15" 5, E 028°32'34" at a field elevation of 4900 feet (ft).

1.2 Injuries to Persons

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

1.3 Damage to Aircraft

1.3.1 The aircraft sustained damage on the propeller blades during collision.

Figure 1: Damage on the propeller after the incident.

1.4 Other Damage

1.4.1 Damage was limited to the perimeter fence.

1.5 Personnel Information

Instructor Pilot

Nationality	South African	Gender	Male	Age	36
Licence Number	**********	Licence Type	Commercial Pilot Licence		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Instrument, Night, Instructor Grade 3				
Medical Expiry Date	31 May 2019				
Restrictions	Corrective lenses				
Previous Accidents	None				

Flying Experience:

Total Hours	1220.1
Total Past 90 Days	105.3
Total on Type Past 90 Days	97.4
Total on Type	666.8

Student Pilot

Nationality	Central African	Gender	Male	Age	25
Licence Number	**********	Licence Type	Student Pilot Licence		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	31 March 2019				
Restrictions	None				
Previous Accidents	None				

The student was a foreign national issued with a South African student pilot licence.

Flying Experience:

Total Hours	47.6
Total Past 90 Days	5.8
Total on Type Past 90 Days	5.8
Total on Type	47.6

1.6 Aircraft Information

Airframe:

Type	Tecnam P92 ECHO	
Serial Number	248	
Manufacturer	Tecnam	
Date of Manufacture	Unknown	
Total Airframe Hours (At time of Accident)	3304.7	
Last MPI (Date & Hours)	7 February 2019	3258.7
Hours since Last MPI	46	
A to F (Issue Date)	9 February 2016	
C of R (Issue Date) (Present owner)	6 October 2014	
Operating Categories	Part 141	

Engine:

Type	Rotax 912 ULS
Serial Number	564 6666
Hours since New	1813.4
Hours since Overhaul	TBO not yet reached

Propeller:

Type	Tanini QT Echo 2/172/164
Serial Number	1926
Hours since New	545.5
Hours since Overhaul	TBO not yet reached

1.6.1 The Tecnam P92 ECHO is an amateur build aircraft type for recreational purposes flown by sport rated pilots. It is a single engine equipped airplane with tricycle fixed landing gear type. The aircraft is registered under the South African Civil Aviation Authority as a recreational Non-Type Certified Aircraft (NTCA).

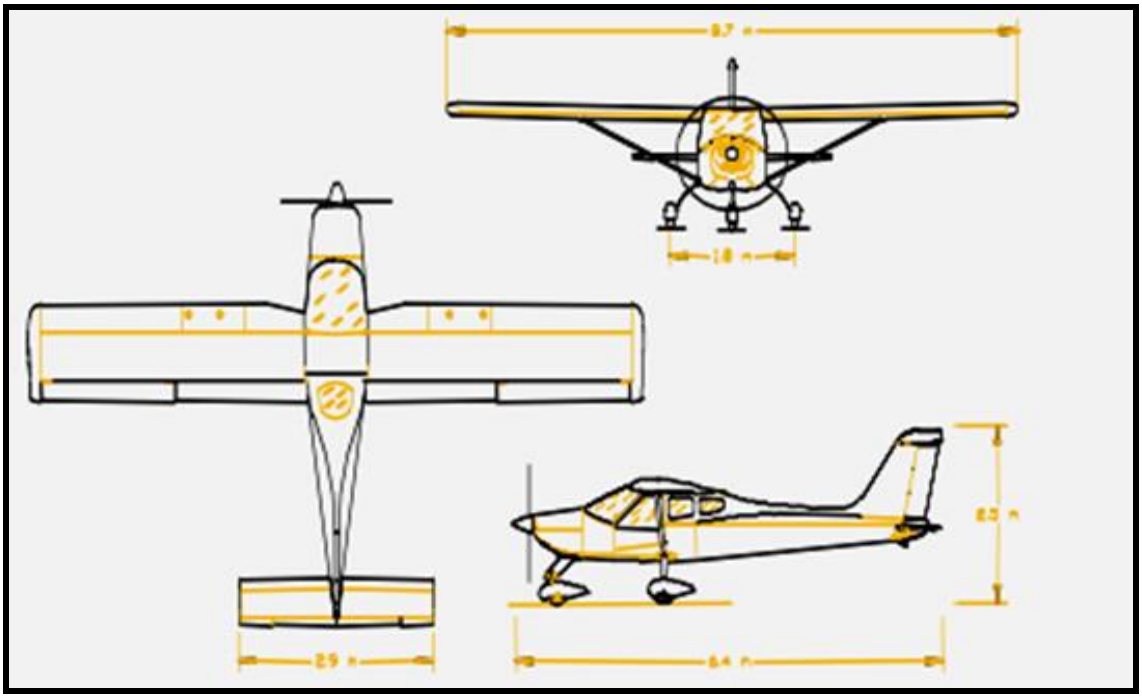

Figure 1: General view of the schematic diagram of a Technam P92 ECHO aircraft.

1.6.2. **Landing Gear System**

The following information was extracted from the aircraft type Pilot Operating Handbook (POH).

1.6.2.1. *The main landing gear consists of two special steel spring–leaf struts positioned crossways to the fuselage for elastic cushioning of landing loads. The two-steel spring-leaf struts are attached to the fuselage underside via the main girder. Two rawhide liners are inserted between each spring-leaf and the girder. Two bolts and nuts secure the individual spring-leaf to the edge of the girder via light alloy clamp while a single bolt and nut secures the in-board end of the leaf-spring to the girder.*

1.6.2.2. *The wheels are cantilevered on the gear struts and feature hydraulically actuated disc brakes controlled by a lever located on cabin tunnel between seats. Main gear wheels mount Air-Trac type 5.00-5 tyres inflated to 23 PSI (1.6 bar). A hydraulic circuit shut-off valve is positioned between the seats with circuit shut off; pulling emergency brake lever activates parking brake function. Braking is simultaneous on both wheels via a T-shaped joint. The control lever activates the master cylinder that features a built-in brake fluid reservoir. The brake system is equipped with a non-return valve, which ensures that braking action is effective even if parking brake circuit should be accidentally closed.*

1.6.3 **Brake System**

The aircraft's brake system is a single-system acting on both wheels of the main landing gear through disk brakes. The same circuit acts as a parking brake by setting the parking brake. In order for the brakes to be activated it must be ensured that the brake shut-off valve, positioned in the tunnel between the pilots is in the OFF position. To activate the parking brake, the brake lever is pulled up and the brake shut-valve set to the ON position. The reservoir tank is located under the pilot's seat.

1.6.4 Aircraft Maintenance records

A review of the maintenance records in the mandatory periodic inspections/annual records of the past two years dated (24/10/2018 and 01/02/2019) was conducted. Although the record stated that all maintenance work on the aircraft was conducted in accordance with maintenance manual reference: Doc. N° 27-13-200-00 with publication revision status: 14/12/2007, it does not contain any reference of landing gear maintenance inspection. There is no recorded evidence in the flight folio or any other document relating to the brake fluid topping events.

1.7 Meteorological Report

1.7.1 Meteorological condition as provided by the pilot:

Wind direction	350°	Wind speed	5 kt.	Visibility	CAVOK
Temperature	17°C	Cloud cover	None	Cloud base	N/A
Dew point	0	QNH	Unknown		

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with a navigational system approved by the Regulator. There were no recorded defects regarding the navigation equipment prior to the incident.

1.9 Communication

1.9.1 The aircraft was equipped with the high frequency radio communication approved by the Regulator. There were no recorded defects relating to the radio prior to the incident.

1.10 Aerodrome Information

Aerodrome Location	Aeropark Zyn Kraal	
Aerodrome Co-ordinates	25°54'15"S, 028°32'34"E	
Aerodrome Altitude	4900 ft. AMSL	
Runway Headings	09/27	
Runway Dimensions (Length/Width)	950 m (3117 ft.)	8 m (26 ft.)
Runway Used	27	
Runway Surface	Asphalt	
Approach Facilities	None	
Radio Frequency	125.4 – Unmanned airfield procedures apply	

1.11 Flight Recorders

1.11.1 The aircraft was not equipped with a flight data recorder (FDR) nor a cockpit voice recorder (CVR), nor was it required by regulation to be fitted to this aircraft type.

1.12 Wreckage and Impact Information

1.12.1. The aircraft overshot Runway 27 and was brought to a stop by the parameter fence. The aircraft sustained damage to the propeller blades when they got entangled with the fence wire.

Figure 2: Google Earth map view of the accident site.

1.13 Medical and Pathological Information

1.13.1 Not applicable.

1.14 Fire

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

1.15 Survival Aspects

1.15.1 The incident was considered survivable as the aircraft did not sustain damage which would have compromised the integrity of the cockpit security and that would have led to the occupants sustaining injuries.

1.16 Tests and Research

1.16.1 According to the technical report issued regarding the incident, the aircraft's brake system was inspected and no fluid leak was observed. Several tests and inspections were conducted, and no fault was found until the brakes were applied hard and the failure was detected. After the brake failure detection, the brake system was disassembled to inspect the master cylinder and all its parts. Two O-rings were found damaged and were identified as the ones causing the brake fluid leak, which resulted in the brakes failure.

1.16.2 The AMO has developed a check list of the applicable aircraft maintenance manual for its in-house maintenance use. According to the P92 Echo Super maintenance manual and the P92 Eaglet LSA maintenance manual, both these maintenance manuals require a 100-hour service inspection on the landing gear (3.12.5) and provide guides as referenced in Doc. N 27-13-200-00, Revision date: 12-14-2007 Revision number: 1: 01 and Revision date: 10-29-2007 Revision number: 3.01.

The above maintenance manuals require that the landing gear inspection be conducted as follows for every 100-hour service/ annual:

3.12.5 Landing gear group

1. *Check all units for poor condition and insecurity of attachment*
2. *Check shock absorbing devices for damage*
3. *Check linkages, trusses, and members for undue or excessive wear fatigue and distortion*
4. *Check hydraulic lines for leakage*
5. *Check electrical system for change and improper operation of switches*
6. *Check wheels for cracks, defects and condition of bearings*
7. *Check tyres for wear and cuts*
8. *Check brakes for improper adjustment*

The AMO also submitted a P2002 Serria maintenance ref: Section B, pag. B-21 2st Edition, April 22th, 2008 which they have mentioned that is part of their referral for landing gear maintenance. The 100 maintenance schedule highlights the following points for landing gear inspection.

- *Check brakes system for (reservoir, master cylinder, lines and calliper)*

1.17 Organisational and Management Information

1.17.1 The aircraft was operated by an aircraft training organisation (ATO) that held a valid training certificate number CAA/0104 with an expiry date of 27 February 2022.

1.17.2 According to the available information, the aircraft's maintenance was conducted by an approved AMO on 7 February 2019. The AMO's operational submission for regulatory approval includes two aircraft maintenance manuals reference: P2002 Sierra: Doc.n°2002/61, 1st Edition, April 22th 2008, Revision, 0; and P92 Eaglet line maintenance manual US-LSA: D0c. N°27-13-200-00 with publication date 12-14-2007 and revision number: 1.01. The AMO was expected to use only P92 Eaglet line maintenance manual and not P2002 Sierra for maintenance on the brakes system. This is in contravention of Civil Aviation Regulations (CAR) 2011, Part 43.02.3(b)(i) which requires that *methods, techniques and practices used to maintain an aircraft should be in line with the manufacturer's maintenance manual.* At the time of the incident, the AMO was issued with an operation certificate on 26 April 2018 with an expiry date of 30 April 2019.

1.18 Additional Information

1.18.1 None.

1.19 Useful or Effective Investigation Techniques

1.19.1 None

2. ANALYSIS

2.1 General

From the evidence available, the following analysis was made with respect to this incident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

2.2 Analysis

2.2.1 The instructor pilot of the aircraft was qualified and licensed for the training flight in accordance with the applicable regulatory procedure. He was issued with a commercial pilot licence on 16 October 2018 with an expiry date of 30 September 2019. He was also issued with a medical certificate on 30 May 2018 with an expiry date of 31 May 2019. The aircraft type was endorsed on his licence. His last skills test was carried on 21 September 2018.

2.2.2 The student pilot was a foreign national who was issued with a South Africa student pilot licence on 23 July 2018 with an expiry date of 8 July 2019. His medical certificate was issued on 5 March 2018 with an expiry date of 31 March 2023. The aircraft type was endorsed on his licence.

2.2.3 There was no evidence given to the investigators which supported the statement made by the AMO that maintenance was carried out on the brakes system. Therefore, the damage on the brake master cylinder O-rings and the leak indicated that no inspection or maintenance checks were carried out. It is probable that the AMO and the operator did not inspect the brakes system because the aircraft's high consumption of the brake fluid was not noticed nor recorded.

2.2.4 On the day of the flight, the brake fluid was topped up during a pre-flight inspection. This was a clear indication that there was a brake fluid leak. It is highly unlikely that the brake fluid had to be replenished frequently than normal. Upon noticing this discrepancy, the aircraft should have been grounded until the brakes problem was resolved. There is no recorded evidence on the flight folio or any other document relating to the brake fluid topping events. This incident would have been avoided if the brake fluid issue was reported to the relevant technical person to inspect and apply appropriated maintenance action. Based on the above findings that led to the occurrence and of the pilots not reporting the brake fluid uplift, it is, thus, the investigator's opinion that the uplifts were not viewed as a sign of fault in the brake system.

2.2.5 A review of the AMO's maintenance procedure as stipulated by the organisational check list in reference of the aircraft type maintenance manual documentation must be aligned with the aircraft manufacturer's prescribed procedures.

2.2.6 The investigation revealed that the incident occurred due to brakes failure caused by the failed brake master cylinder O-rings. This resulted in the aircraft overshooting the runway and crashing onto the perimeter fence. The cause of the O-ring failure was due to a normal wear and tear.

3. CONCLUSION

3.1 General

From the evidence available, the following findings, causes and contributing factors were made with respect to this Incident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

To serve the objective of this Investigation, the following sections are included in the conclusions heading:

- **Findings-** are statements of all significant conditions, events or circumstances in this Incident. The findings are significant steps in this Incident sequence but they are not always causal or indicate deficiencies.
- **Causes-** are actions, omissions, events, conditions, or a combination thereof, which led to this Incident.
- **Contributing factors-** are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident or incident occurring, or mitigated the severity of the consequences of the Incident. The identification of

contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

3.2 Findings

3.2.1 The instructor pilot was licensed and adequately qualified for the training flight in accordance with the approved regulatory requirements. His licence was issued on 16 October 2018 and was valid at the time of the incident. He had a valid medical certificate that was issued on 30 May 2018 and expiring on 31 May 2019.

3.2.2 The student pilot was a foreign national who held a valid licence issued by the local regulating authority in accordance with applicable regulatory requirements. The student pilot licence was issued on 23 July 2018 with an expiry date of 8 July 2019. His medical certificate was valid and was issued on 5 March 2018 with an expiry date of 31 March 2023. The aircraft type was endorsed on his licence. There are no further records relating to the history of his flying experience from the country of origin.

3.2.3 The aircraft was declared airworthy at the time of the incident and was validated by the authority to fly certificate with an expiry date of 29 February 2020.

3.2.4 The aircraft's certificate of release to service was valid and due to expire at 1863.5 hours (Hobbs) of flight time or on 31 January 2020 whichever occurs first.

3.2.5 On the day of the incident, the aircraft was topped up with brake fluid during a pre-flight inspection. It is not known how much brake fluid was uplifted.

3.2.6 After the incident, several tests were conducted for fault findings on the brakes system and it was reported that during normal brake operation, no anomalies where detected.

3.2.7 According to the available maintenance records, the aircraft was not maintained in accordance with the manufacturer's prescribed procedure. There were no records for the landing gear maintenance and inspection in the annual inspection work pack as provided by the AMO.

3.2.8 According to the available records, the AMO did not include the landing gear maintenance inspection/check procedure in its in-house maintenance check list as prescribed by the aircraft manufacturer in its referral AMM.

3.2.9 The AMO held a valid AMO certificate with an expiry date of 30 April 2019.

3.2.10 The incident flight could have been avoided if the crew reported the high consumption of brake fluid and that proper maintenance check was conducted adhering to the relevant maintenance manual prior to the flight.

3.2.11 The investigation revealed that the incident occurred due to brakes failure caused by the failed brake master cylinder O-rings. This resulted in the aircraft overshooting the runway and crashing onto a perimeter fence. The cause of the O-ring failure was due to a normal wear and tear.

3.3 Probable Cause/s

3.3.1 Brakes failure caused by the failed brake master cylinder O-rings, which resulted in the aircraft overshooting the runway and crashing onto a perimeter fence. The cause of the O-ring failure was due to a normal wear and tear.

4. SAFETY RECOMMENDATIONS

4.1 General

The safety recommendations listed in this Report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation, and are based on the conclusions listed in heading 3 of this Report; the AIID expects that all safety issues identified by the Investigation are addressed by the receiving States and organizations.

4.2 Safety Recommendation/s

4.2.1 The AMO to include the inspection and servicing of the brake system in its maintenance work pack or check list to align with the requirements of the manufacturer and to adhere to the regulatory requirement (CAR 2011, Part 43).

5. APPENDICES

5.1 None