LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10257						
Classification	Accident		**Date**	27 January 2023		**Time**	0542Z
Type of Operation	Training (Part 141)						
Location							
Place of Departure	Wonderboom Aerodrome (FAWB), Gauteng Province		Place of Intended Landing	Wonderboom Aerodrome (FAWB), Gauteng Province			
Place of Occurrence	Taxiway Delta at FAWB, Gauteng Province						
GPS Co-ordinates	Latitude	25°39' 19.11" S	Longitude	028°13' 16.81" E		Elevation	4 095 ft
Aircraft Information							
Registration	ZS-SNS						
Make; Model; S/N	Cessna 172M Skyhawk (Serial Number: 172-61620)						
Damage to Aircraft	Substantial		Total Aircraft Hours	1 819.6			
Pilot-in-command							
Licence Type	Student Pilot Licence (SPL)		Gender	Female		Age	24
Licence Valid	Yes	Total Hours	35	Total Hours on Type			17
Total Hours Past 30 Days	17		Total Flying Hours on Type Past 90 Days	17			
People On-board	1 + 0	**Injuries** 0	**Fatalities**	0	**Other (on ground)**		0

What Happened

On Friday morning, 27 January 2023, a student pilot and a Grade II flight instructor reported at the Approved Training Organisation (ATO) facility at Wonderboom Aerodrome (FAWB) in preparation for a pre-solo check flight. The instructor stated that they had a short briefing before the flight in which they discussed the intended flight exercises which comprised simulated engine failures and touch-and-go landing exercises. Thereafter, a pre-flight inspection on a Cessna 172M Skyhawk aircraft with registration ZS-SNS was carried out; nothing abnormal was detected on the aircraft. The aircraft had 38 US gallons of Avgas LL100 fuel in the tanks. Visual meteorological conditions (VMC) by day prevailed at the time of the flight. The flight was conducted under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.

The student pilot was the pilot flying (PF). She started the engine and taxied the aircraft to Taxiway Bravo to perform the engine run-up checks. The engine indications were within limits and the aircraft was taxied to the threshold of Runway 11. After a few moments, the student pilot opened the throttle to 2 400 engine revolutions per minute (RPM) and took off. The aircraft climbed to the circuit altitude cruising at 2 300 RPM. Thereafter, she executed a glide approach exercise on Runway 11, which was followed by an uneventful go-around.

The student pilot flew another (second) circuit and performed a touch-and-go landing on Runway 11. During the climb phase at approximately 600 feet (ft) above ground level (AGL), she simulated an engine failure exercise. The instructor reported that the student pilot recovered without difficulty at 350 feet (ft) above ground level (AGL) and, thereafter, flew two more circuits with uneventful touch-and-go landings. The instructor was satisfied with the student pilot's performance during the check flight. The instructor briefed her on the requirements of the initial solo (INSO) flight, pointing out the expected taxi route after landing. The student pilot completed the circuit and landed safely on Runway 11. The aircraft was taxied through Charlie Bravo to apron A, which was closer to the ATO's facility after exiting the active runway. The flight duration was one hour (1.0). Approximately 32 gallons of Avgas 100LL fuel remained in the tanks. The instructor assessed the weather conditions which remained favourable before allowing the student pilot to conduct her INSO flight.

The instructor disembarked from the aircraft and headed for the ATO's facility to monitor the flight from the balcony. According to the air traffic control (ATC) recordings, the student pilot was heard communicating with the ground ATC on very high frequency (VHF) 118.35-Megahertz (MHz) whilst parked at the apron, informing them of her intention to conduct the INSO flight, which was approved. The student pilot was instructed to turn left on the intersection of Bravo Delta to the holding point of Runway 11 and to report when she was ready for departure. Upon reaching the intersection, the student pilot noted two stationary aircraft (ZS-EAD and ZS-SCE, both Cessna 172 models), that had queued on the left-side of the taxiway Delta and engaged in engine run-up checks in preparation for departure. The student pilot stated that judging from the distance, the available space behind the ZS-EAD, which was number 2 on the queue, seemed insufficient to accommodate her aircraft (ZS-SNS). Furthermore, her aircraft was blocking the intersection/exit runway.

The student pilot, without the approval of the ground ATC, decided that she would taxi past the two aircraft with the intention to park or stop in front of the ZS-SCE which was number 1 in the queue and the next in line for take-off. The student pilot reported that she first assessed the situation and thought she had sufficient space to taxi on the right side. She then slowly started taxiing and made a left turn while monitoring the tip of her left wing. During the manoeuvre, the ZS-SNS left wing tip struck the right-wing tip fairing upper section of the ZS-EAD. The ZS-SNS then pivoted to the right-side in the direction of the taxiway lights mounted on the Delta taxiway edge. In trying to avoid colliding with the taxiway lights, the student pilot steered the aircraft to the left and that resulted in the ZS-SNS left wing tip striking the right-wing bottom surface area of the ZS-SCE before impacting its rotating two-blade all metal propeller, which severed the (ZS-SNS) left-wing tip. The ZS-SNS aircraft came to a stop approximately 20 metres (m) in front of the ZS-SCE.

Figure 1: FAWB layout. The two white arrows indicate the position of the two stationary aircraft the ZS-SNS collided with on taxiway Delta to Runway 11. (Source: Google Earth).

The student pilot applied the parking brake and switched off the engine before disembarking from the aircraft. The crash alarm was activated, and the Aerodrome Rescue and Firefighting (ARFF) team was dispatched to the scene. The student pilot was unharmed; however, the aircraft was substantially damaged. The ZS-EAD was not damaged, whilst the ZS-SCE did not show any visible damage, however, engineers who responded to the scene stated that an engine shock load will be necessary to determine if the aircraft sustained internal damage. The occupants of the stationary aircraft were not injured.

The accident occurred during daylight at Global Positioning System (GPS) co-ordinates determined to be 25°39' 19.11" South and 028°13' 16.81" East, at an elevation of 4 095ft.

Figure 2: The ZS-SNS aircraft after the accident. (Source: ARFF)

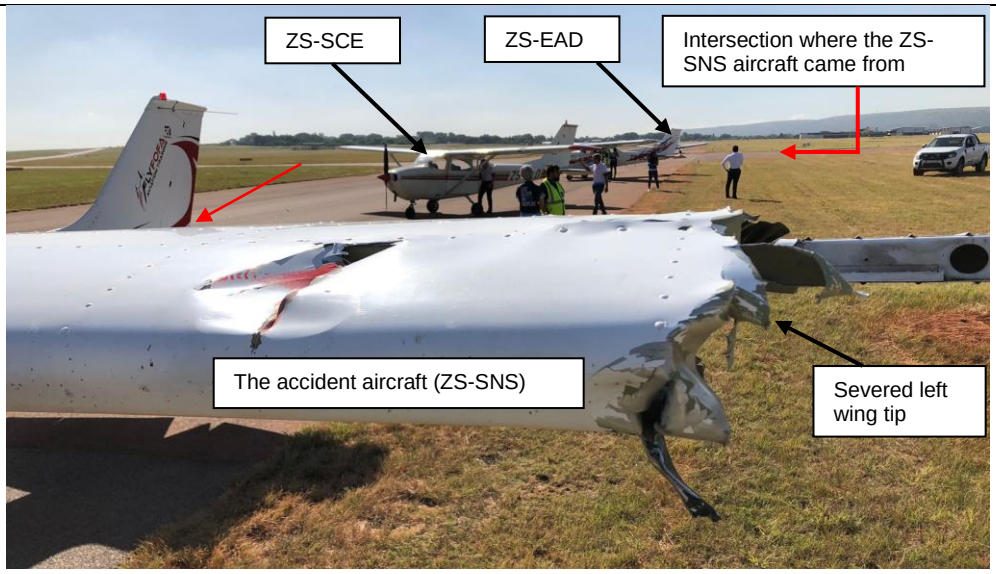

Figure 3: The accident aircraft (forefront) and the two stationary aircraft that had lined-up on taxiway Delta. (Source: ARFF)

Third Party (The ATO that owns the ZS-EAD and ZS-SCE aircraft)

The ZS-EAD and ZS-SCE were operated by the same ATO in FAWB. The training organisation was issued an ATO certificate by the South African Civil Aviation Authority (SACAA) on 23 February 2022 with an expiry date of 31 January 2023. Both aircraft were authorised on the Training Operations Specifications certificate, which was issued by the SACAA with an effective date of 23 February 2022 and an expiry date of 31 January 2023. The ZS-EAD had accumulated 5 643.15 total airframe hours at the time of the accident, and the ZS-SCE had 7 529.1 hours. Below are witness marks left on the third-party owned aircraft.

Figure 4: Paint scraping on the ZS-EAD right wing tip fairing.

Figures 5 and 6: Scrape marks on the ZS-SCE aircraft right wing lower skin surface area and fairing (left picture). Witness marks on the blade as it cut through the ZS-SNS left wing tip (right picture).

Wonderboom Aerodrome (FAWB)

FAWB is a Category 2 aerodrome with licence No: 0019, issued in accordance with (IAW) Part 139 of the CAR 2011 as amended. The licence was renewed by the SACAA on 31 July 2022 with a validity period from 1 August 2022 to 31 July 2023. The aerodrome has two runways. The first runway is orientated 29/11 and is 1 828 metres (m) long and 30m wide, and the second runway is orientated 24/06 and is 1 280m long and 22m wide. Both runways are covered in asphalt. The aerodrome elevation is 4 095ft. *All departures are performed from the threshold of Runway 11 with no designated area for pre-take off engine run-up area / holding point. The taxiways Bravo and Delta are 15m wide.* The aerodrome also comprises the ARFF which responded to the accident site after the crash alarm was activated by the ATC.

The student Pilot

The student pilot was initially issued a Student Pilot Licence (SPL) by the SACAA on 10 August 2018 with an expiry date of 21 September 2023. The student pilot's logbook was examined, and it was found that at the time of the accident, she had flown a total of 35 hours, of which 17 hours were on the aircraft type (Cessna 172M aircraft). The pilot had the aircraft type endorsed on her licence. The student pilot had a valid Class 2 aviation medical certificate which was issued on 23 May 2018 with an expiry date of 30 May 2023 with no restrictions.

Approved Training Organisation (ATO)

The ATO that the student pilot was registered with was issued an ATO certificate IAW Part 141 of the CAR 2011 on 6 November 2020 and valid until 30 November 2025. The aircraft was authorised on the Training Operations Specifications certificate which was issued by the Regulator, effective from 18 October 2022 to 30 November 2023.

The Air Traffic Control (ATC)

Nationality	South African	Gender	Female	Age	26
Licence Type			Air Traffic Services (ATS)		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Aerodrome Control (AD) Approach Control Procedure (APP)				

The ATC's last proficiency check for Aerodrome Control (AD) and Approach Control Procedure (APP) was carried out on 6 July 2022 with validity until 5 July 2023. The Air Traffic and Navigation System (ATNS) employed the ATC at FAWB control tower on 10 August 2017. The ATC's Class 3 medical certificate was issued on 13 January 2023 with an expiry date of 31 January 2027 and without waivers or limitations.

The Aircraft (Source: Aircraft Manual)

The Cessna F172M Skyhawk is a four-seat, high wing monoplane aircraft of all semi-monocoque construction, equipped with a fixed tabular spring steel main gear struts and a steerable nose gear in tricycle configuration. The nose gear has an air/oil fluid shock strut. The aircraft is powered by a four-cylinder, horizontally opposed, air cooled normally aspirated Lycoming O-320-E2D carburettor engine (Serial number L-37424-27A) with power output of 150 brake horsepower (BHP) at 2 700 RPM, driving a McCauley two-blade fixed pitch propeller (Model 1C160/DTM7557-M1 and serial number AOD44007).

A review of the aircraft's maintenance records indicated that the last 100-hour mandatory periodic inspection (MPI) was certified on 6 January 2023 at 1 723.6 airframe hours. The aircraft had logged 1 819.6 total hours at the time of the accident flight, meaning that it had been flown a further 96 hours since the last inspection. The aircraft's Certificate of Airworthiness (C of A) was issued on 22 December 2009; the latest C of A had an expiry date of 31 December 2023. The aircraft maintenance organisation (AMO) that certified the maintenance task was in possession of an approval certificate issued on 25 October 2022 with an expiry date of 30 September 2023.

The Certificate of Registration (C of R) was issued to the current owner on 18 March 2021. The Certificate of Release to Service (CRS) was issued on 6 January 2023 with an expiry date of 5 January 2024 or at 1 823.6 hours, whichever occurs first.

The weather report from FAWB ATC for 27 January 2023 at 0540Z was as follows:.

Wind Direction	110°	Wind Speed	3 knots	Visibility	> 10km
Temperature	20°C	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	12°C	QNH	1019		

Post-accident examination of the aircraft at the accident site

The accident aircraft (ZS-SNS) was visually examined at FAWB to assess the damage sustained during the accident sequence. The left-wing tip was severed by the rotating propeller of the ZS-SCE aircraft. The left-wing bladder fuel tank remained intact with no evidence of spillage observed on the tarmac taxiway Delta. Examination of the aircraft steering control indicated nothing abnormal. There was no evidence of hydraulic fluid leakage on the nose gear strut oleo and main landing gear wheels brake linings, fittings and callipers. The main wheels brakes were tested after the accident and were found to operate normally.

Figure 7: The severed wing tip of the ZS-SNS aircraft. (Source: ARFF)

The ATC personnel are responsible for the safe and efficient movement of aircraft and support vehicles operating on the taxiways and runways. The ATC had a full view of the departing aircraft on the taxiway Delta from the control tower but could not guarantee the likelihood of collision because it is expected that pilots should be always on the lookout, thus, maintaining a safe following distance and adhering to instructions provided. In this context, the main role of the ATC was to ensure the aircraft's sequencing order to the threshold of Runway 11.

According to the ATC recordings, the student pilot whilst parked at apron A, called the ATC and requested a slot for the INSO flight, which was approved. The student pilot was then instructed by the ground ATC to follow taxiway Bravo Delta to the holding point (taxiway Delta in this case which is 15m wide) and to report when she was ready for departure. From the intersection of Bravo Delta, the student pilot had to enter taxiway Delta and queue behind the ZS-EAD aircraft which was number 2 and last at the holding point. Upon reaching the intersection of Bravo Delta, the student pilot noticed that the available space behind the ZS-EAD aircraft was not sufficient to accommodate her aircraft (ZS-SNS) and that her aircraft was blocking the exit taxiway.

The student pilot seemed to have thought that she had a right of way and made a left turn while entering taxiway Delta, but soon realised she made an error in judgement after colliding with two stationary aircraft (ZS-EAD first and then ZS-SCE) on the left of the taxiway Delta. The student pilot did not consider waiting on the intersection of Bravo Delta until the holding point was clear of traffic. According to the ATC recordings, the student pilot did not request assistance or guidance from the ground ATC, probably thinking that it was a minor deviation that she could correct herself. This was deemed a contravention of Part 91.06.11 of the SA CAR 2011 as amended. From a high wing aircraft such as a Cessna 172 with a wingspan of 36ft and 1 inch (11m), it may have been difficult or even impossible for the student pilot who was on her first solo flight to sufficiently assess the distance of the tip of her aircraft's left wing from another one similar to hers.

The investigation concluded that the student pilot seemed to have made a premature left turn when entering the taxiway Delta and had misjudged the distance between her aircraft's (ZS-SNS) left wing tip and that of the ZS-EAD right wing tip fairing and collided with the left-wing tip; the aircraft further struck the ZS-SCE wing tip.

<u>The student pilot remedial action plan by the ATO</u>

<u>Phase one</u>:

I. The student pilot was to be briefed by a training instructor on Exercise 5, which is taxiing and emergencies on the ground.

II. The student pilot was to be briefed on radio procedures on the ground and to recapitulate Exercise 12.13e, which is circuits and landings at FAWB.

<u>Phase two</u>:

I. The chief flight instructor (CFI) was to conduct an assessment flight with the student pilot and, thereafter, continue to train with a Grade II instructor assigned by the CFI until the INSO flight. The student pilot was also to complete a solo consolidation flight with a Grade II instructor before she could continue her training with a Grade III instructor.

Taxi rules

91.06.11 *(9) An aircraft operated on a controlled aerodrome shall not taxi on the manoeuvring area without clearance from the aerodrome control tower and shall comply with any instructions given by that unit.*

(10) An aircraft taxiing on the manoeuvring area of an uncontrolled aerodrome shall taxi in accordance with the ground control procedures which may be in force at such aerodrome.

(11) While taxiing, an aircraft shall –

(a) stop and hold at all runway-holding positions unless otherwise authorized by the aerodrome control tower; and

(b) stop at all lighted stop bars and may proceed further when the lights are switched off.

(12) Nothing in this regulation shall relieve the PIC of an aircraft or the person in charge of a vehicle, from the responsibility for taking such action as will best aid to avert collision.

Findings

(i) The student pilot was initially issued a Student Pilot Licence (SPL) by the South African Civil Aviation Authority (SACAA) on 10 August 2018 with an expiry date of 21 September 2023.

(ii) The student pilot's logbook was examined, and it was found that at the time of the accident, she had flown a total of 35 hours, of which 17 hours were on the aircraft type.

(iii) The student pilot had a valid Class 2 aviation medical certificate which was issued on 23 May 2018 with an expiry date of 30 May 2023. The student pilot had no restrictions listed on her licence.

(iv) The student pilot contravened Part 91.06.11 of the SA CAR 2011 as amended.

(v) The instructor who oversaw the student pilot's check flight before the accident was in possession of a CPL that was reissued on 26 November 2022 with an expiry date of 31 January 2024. The instructor had a Grade II rating endorsed in his licence, which was issued on 15 August 2022 with an expiry date of 31 August 2023.

(vi) The instructor had a valid Class 1 aviation medical certificate which was issued on 5 January 2022 with an expiry date of 31 January 2023 with no restrictions listed on the licence.

(vii) This flight was conducted under the provisions of Part 141 of the CAR 2011 as amended.

(viii) Based on the weather report from the ATC, no significant weather was present at the time of the accident.

(ix) The last 100-hour MPI prior to the accident flight was certified on 6 January 2023 at 1 723.6 airframe hours. The aircraft had logged 1 819.6 total hours at the time of the flight, meaning that it was flown a further 96 hours since the last inspection.

(x) The aircraft's C of A was issued on 22 December 2009 with an expiry date of 31 December 2023.

(xi) The AMO that carried out the MPI had an approval certificate issued on 25 October 2022 with an expiry date of 30 September 2023.

(xii) The ATC had an ATS licence which necessitated her to exercise her duties.

(xiii) No person was injured during the accident sequence.

Probable Cause

The student pilot's non-adherence to ATC instructions and aerodrome procedures led her to misjudge the distance between her aircraft and the other two aircraft which were readying for departure.

Contributing Factor

I. Lack of experience.

Safety Action(s)

The student pilot was to be briefed by the training instructor on Exercise 5 taxiing, emergencies on the ground, radio procedures on the ground and recapitulate Exercise 12.13e circuits and landings at FAWB.

Safety Message and/or Safety Recommendation/s

It is recommended to the FAWB management to consider erecting a designated engine run-up area before holding point Runway 11 to ensure consistent aircraft separation and to reduce delay for departing traffic.

About this Report

The decision to conduct a limited investigation is based on factors including whether the cause is known and the evidence supporting the cause is clear, the level of safety benefit likely to be obtained from an investigation and that will determine the scope of an investigation. For this occurrence, a limited investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person/s and organisation/s to compile this limited report. The report has been compiled using information supplied in the initial notification, as well as from follow-up desk top enquiries to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action/s that the industry might want to consider in preventing a recurrence of a similar occurrence.

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

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011 and ICAO Annex 13, 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.

Disclaimer

This report is issued by:

Accident and Incident Investigations Division

South African Civil Aviation Authority

Republic of South Africa