AIRCRAFT ACCIDENT SHORT REPORT

CA18/3/2/9728: ZS-OHN, Runway excursion (Overrun) during a touch and go

Date and time	**:** 21 August 2018, 1300Z
Aircraft registration	**:** ZS-OHN
Aircraft manufacturer and model	**:** Textron Aviation Cessna, C172N
Last point of departure	**:** Wonderboom Aerodrome (FAWB)
Next point of intended landing	**:** Thabazimbi Aerodrome (FATI)
Location of accident site with reference to easily defined geographical points (GPS readings if possible)	**:** FARG GPS position: S25°38'20" 0E027°16'01"
Meteorological information	**:** FARG 211300Z: wind: 360°/6 kt, temp: 31°C, dew point: 5°C, visibility 10 km, CAVOK, NOSIG
Type of operation	**:** Private (Part 91)
Persons on board	**:** 1 + 2
Injuries	**:** Minor injuries
Damage to aircraft	**:** Substantial

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

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (2011) this report was compiled in the interests of the promotion of aviation safety and the reduction of the risk of aviation accidents or accidents and ***not to establish blame or liability****.*

Disclaimer:

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

1. SYNOPSIS

1.1 On Tuesday 21 August 2018, at 1230Z, a private pilot accompanied by two passengers departed Wonderboom Aerodrome (FAWB) on a cross-country flight. The planned route was FAWB – Rustenburg Aerodrome (FARG) – Thabazimbi Aerodrome (FATI) – FAWB.

1.2 At approximately 1300Z, the pilot approached and then flew over FARG, complying with the unmanned aerodrome procedure. With the prevailing wind being from the north, he elected runway 34 for a touch-and-go. According to the pilot, after touchdown, the shimmy damper was active for approximately 5 seconds where after he configured (flaps 0°) the aircraft for take-off and applied full power. This resulted in the loss of 547 ft. of runway length.

1.3 After rotating, the aircraft was unable to enter a positive rate of climb (ROC). The pilot decided to abort the take-off and landed back on the remaining runway, but overshot the runway, and impacted with the aerodrome perimeter fence before coming to rest outside the aerodrome in close proximity to an informal settlement.

1.4 The three occupants on-board the aircraft sustained minor injuries and the aircraft sustained substantial damage.

2. HISTORY OF FLIGHT

2.1 On 21 August 2018, the pilot, who was the holder of a private pilot's licence (PPL), was accompanied by two passengers on a flight, which departed from FAWB, with the intention to carry out a cross-country flight and return to FAWB. The aircraft was hired from an aviation training organisation (ATO) at FAWB and was operated in compliance with Part 91 (Private) of the Civil Aviation Regulations (CARs) 2011. The estimated time of departure from FAWB was 1230Z.

2.2 The planned route of the flight was FAWB – FARG – FATI – FAWB. The pilot had intended to carry out a touch-and-go landing at FARG and FATI. A flight plan was filed for this flight.

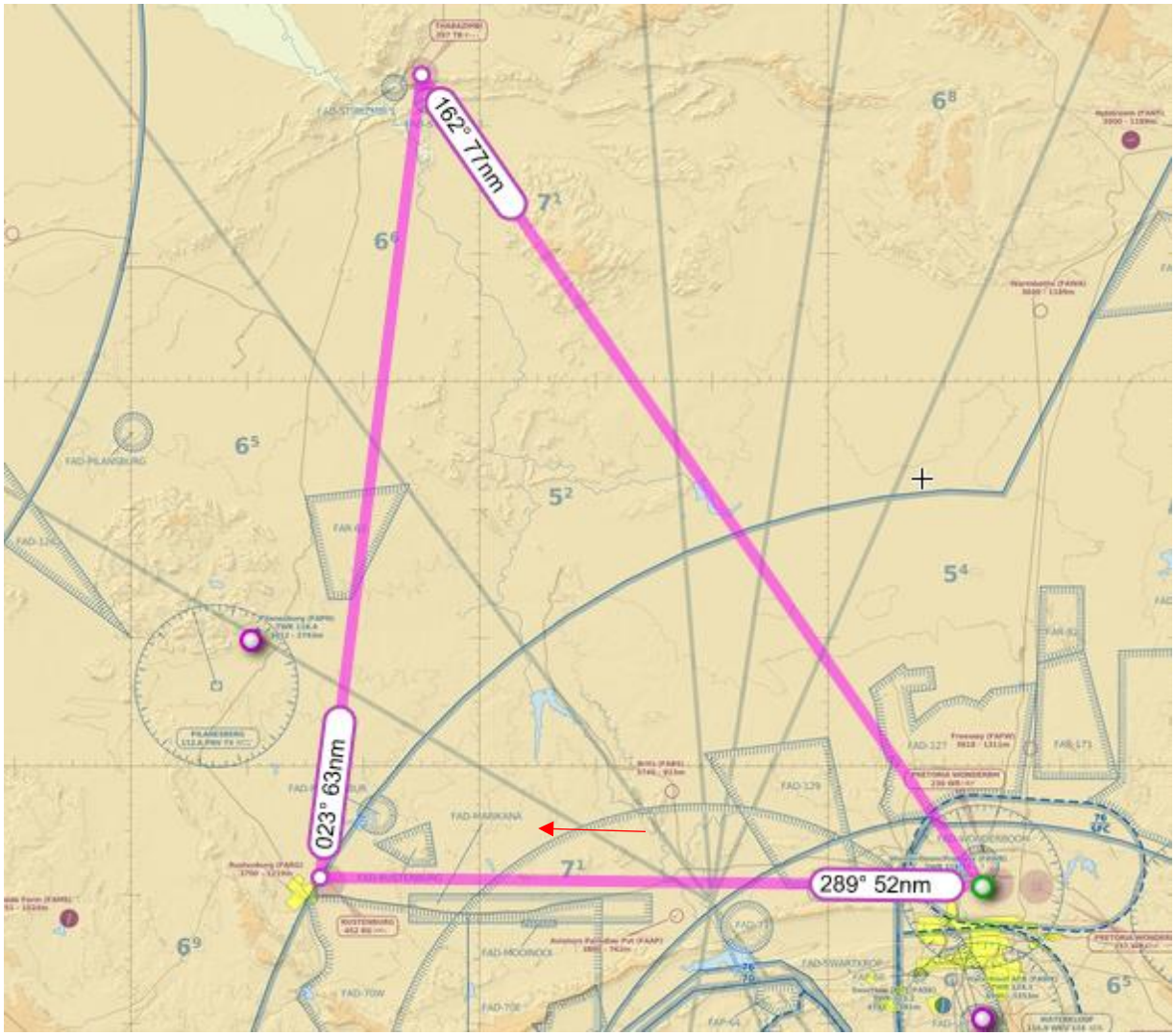


Figure 1: The planned flight route (skyvector)

2.3 The aircraft departed FAWB and maintained flight level (FL) 085 en route to FARG. On arriving overhead FARG, the pilot broadcasted on the FARG frequency (122.4 MHz), and established that there was another aircraft in the circuit at the time. The pilot commenced the descent on the dead side of the circuit, and on reaching circuit altitude entered on a left downwind for runway 34.

2.4 The pilot reported the touchdown to be normal; however, he delayed taking full power to allow the shimmy damper to stop vibrating. This resulted in the loss of 547 ft. of runway length. At approximately halfway down the runway, the pilot applied full power.

2.5 After reaching 60 kts, with 300m (984 ft.) of runway surface remaining, the pilot prematurely rotated the aircraft and was unable to enter the climb phase. With the runway running out, the pilot landed back on the available runway surface but was unable to bring the aircraft to a stop and a runway excursion (overrun) followed.

2.6 The stopping distance was insufficient and the aircraft burst through the aerodrome perimeter fence, which was approximately 80 m past the threshold of runway 16. The aircraft came to rest on a pile of domestic and building rubble that had been dumped there.

2.7 The aircraft sustained substantial damage to both wings, the propeller, the fuselage and the nose gear. The three occupants on-board sustained minor injuries. The aircraft flattened the aerodrome perimeter fence.

Figure 2: Damage sustained to the aircraft after the runway excursion

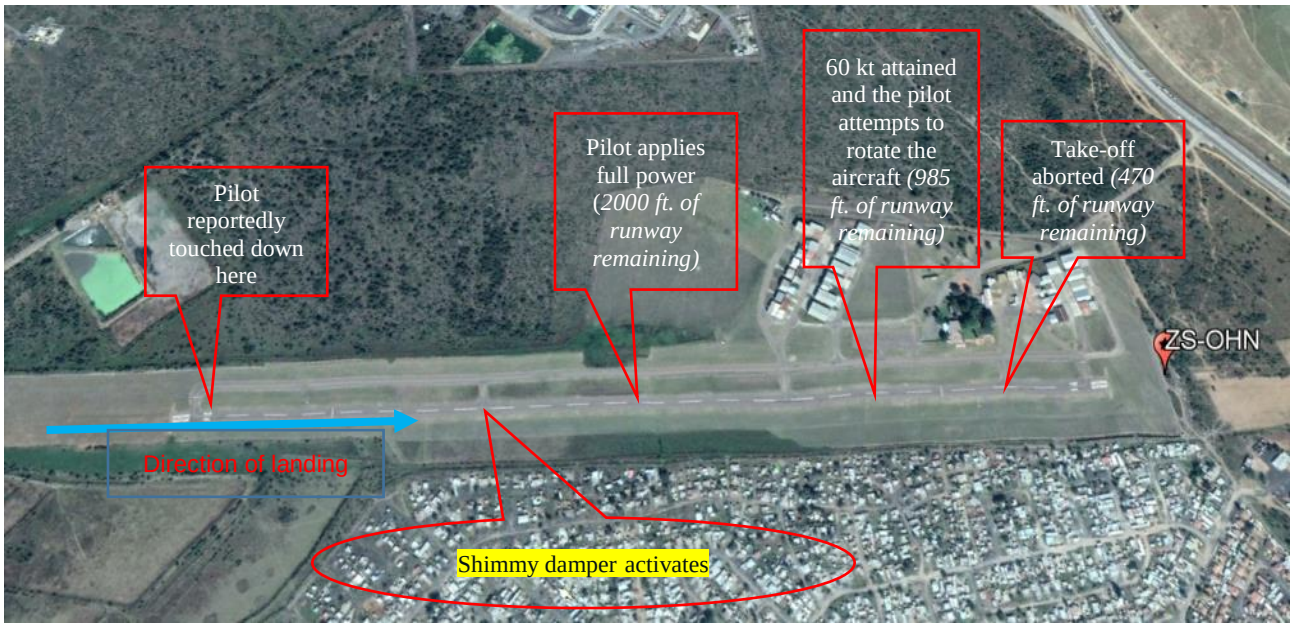


Figure 3: Direction of landing and final resting position of ZS-OHN. The above distances are approximates as supplied by the PIC

3. FACTUAL INFORMATION

3.1 The pilot held a private pilot's licence (PPL) that had been initially issued on 22 April 2016 and is due to expire on 30 November 2018. The aircraft type was endorsed on the pilot's licence. The pilot complied with maintenance of license competency.

3.2 The pilot was in possession of a valid class 1 aviation medical certificate that had been issued by a designated medical examiner on 16 July 2018. The medical certificate expired on 31 July 2018.

3.3 The aircraft had a valid Certificate of Airworthiness, which had been issued on 10 May 2016 and which is due to expire on 31 May 2019.

3.4 The aircraft was in possession of a valid Certificate of Release to service, which had been issued on 11 July 2018. The last mandatory periodic inspection (MPI) had been carried out at 7 907,9 airframe hours. The aircraft had flown a total of 83,4 hours since the last MPI.

3.5 The last mass and balance report issued for the aircraft stipulated the empty mass to be 1 516.66 lb at an arm of 39.98 in. The report had been issued on 10 February 2016.

3.6 The ATO's electronic flight authorisation system, which would have warned the pilot of any exceedance of potential aircraft limitations, had not been used by the pilot on the day prior to departure. A simulation was carried out on the electronic system to demonstrate the operation and associated warnings generated after the accident occurred by the ATO. (See Appendix D)

3.7 According to the pilot's operating handbook (POH), the maximum take-off and landing mass for the Cessna 172N was 687.95 kg (2 300 lb).

3.8 The mass of each the occupants, respectively, was:

- pilot: 82 kg (181 lb)
- passenger one (front right seat): 85 kg (187 lb)
- passenger two (rear seat): 103 kg (227 lb)

3.9 The estimated total fuel burn for this flight was approximately 5,8 US gallons (USG). This is based on an estimated 1.1 USG for the taxi and take-off, 1.7 USG for the climb to cruise and 2 USG for the cruise to FARG. One additional USG can be added for the circuit pattern entry at FARG and any additional manoeuvring. This leaves approximately 34,8 USG worth of fuel that would be used after the departure from FARG.

3.10 Runway 34 was used for landing at FARG. The runway is 1 225 m (4 019 ft.) in length and 15 m (50 ft.) wide. (See appendix C)

3.11 Visual meteorological conditions (VMC) prevailed at the time of landing.

3.12 The METAR for FARG was as follows:

FARG 211300Z AUTO 36006KT //// // ////// 31/05 Q1017=

3.13 The density altitude at the time of the accident was 6 210 ft. According to the Koch Chart, an increase of 91% of take-off distance was required in order to compensate for the higher density altitude. The take-off distance required was 385 m (1 265 ft.). With the density altitude correction, the take-off distance required would have increased to 736 m (2 417 ft.). (See Appendix B)

4. WEIGHT AND BALANCE

4.1 The weight and balance calculation on the aircraft was carried out using a chart that was not approved by the ATO from which the aircraft was hired. (see Appendix E)

4.2 The pilot did not make use of the correct empty weight of the aircraft for his weight and balance calculation.

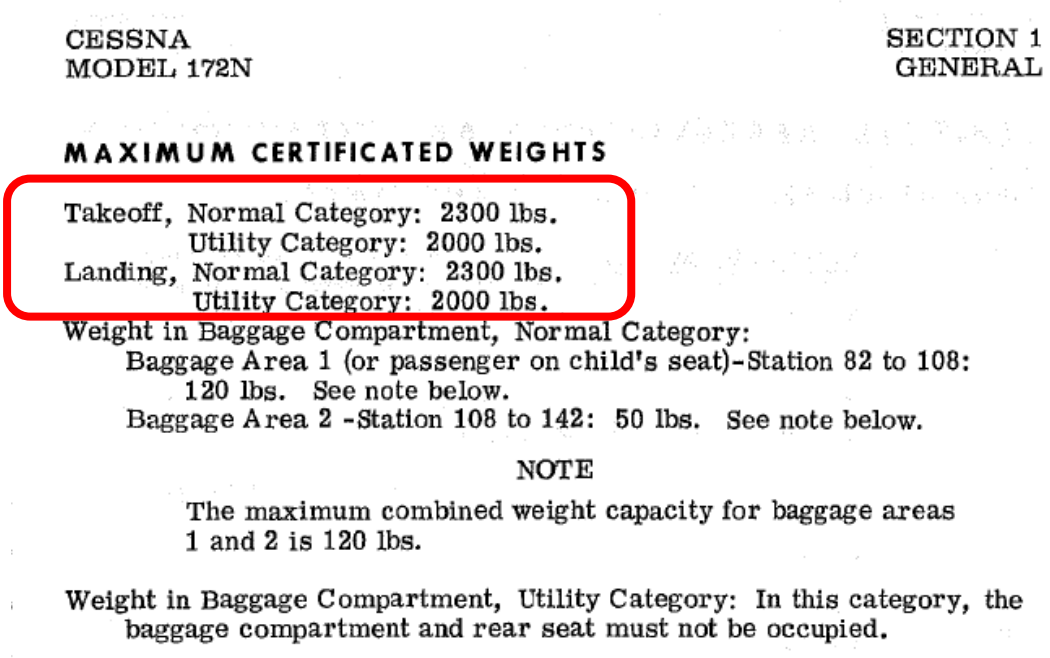
4.3 The passengers' mass used by the pilot in his weight and balance calculation was 136 kg (300 lb) in total. The actual weight of the two passengers was 188 kg (414 lb).

4.4 The corrected aircraft zero fuel weight was 2 122 lb. Therefore, the fuel uplift should not have exceeded 178 lb.

4.5 The aircraft departed FAWB with the maximum take-off weight, as stipulated in the POH of the C172N, exceeded. (Estimated take-off weight was ±2 352 lb.)

4.6 The aircraft landed at FARG above the weight limits stipulated in the C172N POH. (Estimated landing weight was ±2 331 lb.)

4.7 The pilot attempted to depart FARG above the weight limits stipulated in the C172N POH. (estimated take-off weight was ± 2 325 lb)



CESSNA
MODEL 172N

SECTION 1
GENERAL

MAXIMUM CERTIFICATED WEIGHTS

Takeoff, Normal Category: 2300 lbs.
Utility Category: 2000 lbs.
Landing, Normal Category: 2300 lbs.
Utility Category: 2000 lbs.
Weight in Baggage Compartment, Normal Category:
Baggage Area 1 (or passenger on child's seat)-Station 82 to 108: 120 lbs. See note below.
Baggage Area 2 -Station 108 to 142: 50 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas 1 and 2 is 120 lbs.

Weight in Baggage Compartment, Utility Category: In this category, the baggage compartment and rear seat must not be occupied.

Figure 4: Extract from the C172N POH, stipulating the maximum weight for operation

Actual weight and balance corrected for passenger and aircraft mass

Investigation		Weight (lb)	Arm (inches)	Moment (in-lb)
Aircraft Empty Weight		1 517	39.98	60 649.66
Front Seats 1 & 2		368	37.00	13 616.00
Fuel (40 US gallons)		240	47.90	11 496.00
Rear Seats 1 & 2		227	73.00	16 571.00
Baggage Area 1		10	95.00	950.00
Gross Weight		2 362		103 283.00
Loaded Centre of Gravity			43.73	

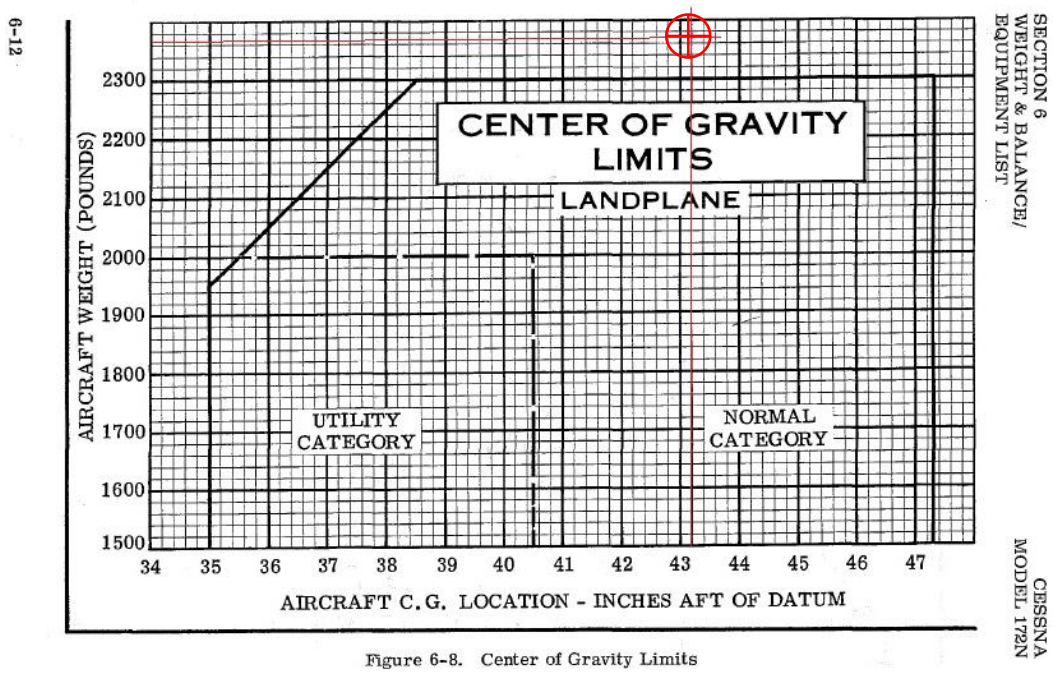


Figure 5: Actual Centre of Gravity position

Weight and balance used by the pilot for departure

Pilot		Weight (lb)	Arm (inches)	Moment (in-lb)
Aircraft Empty Weight		1 460	37.40	54 604
Front Seats 1 & 2		300	37.00	11 100
Fuel (40 US gallons)		240	47.90	11 496
Rear Seats 1 & 2		0	73.00	16 571
Baggage Area 1		10	95.00	950
Gross Weight		2 010		78 150
Loaded Centre of Gravity			38.88	

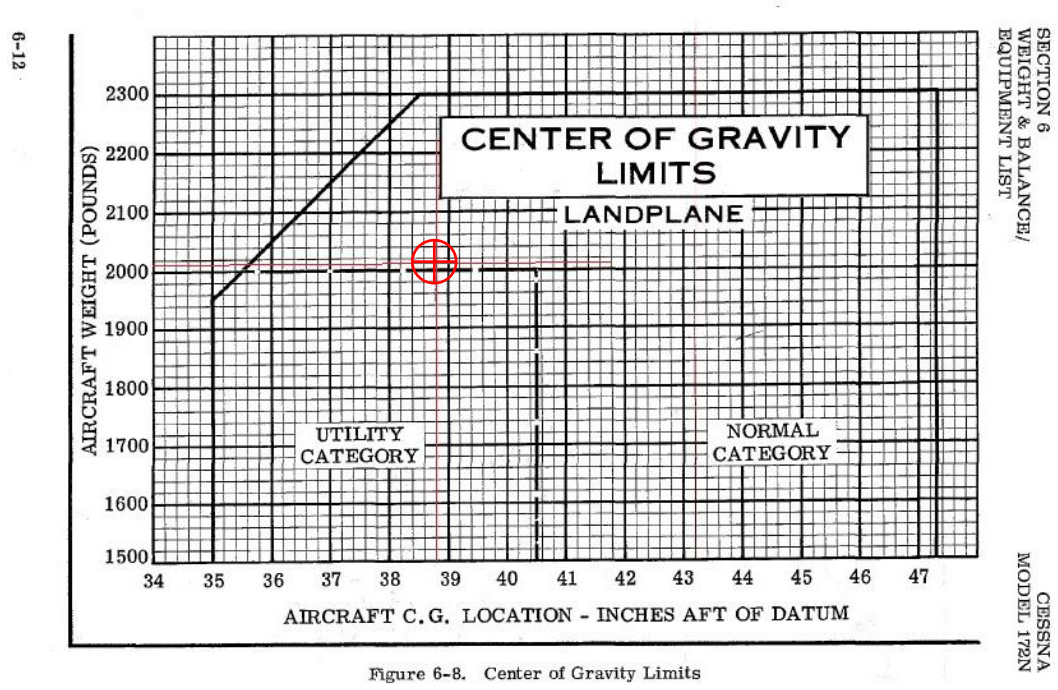


Figure 6: Centre of Gravity position estimated by the pilot

5. FARG AERODROME

5.1 FARG Aerodrome is located 1 nm to the north-east of the town of Rustenburg in the North West Province.

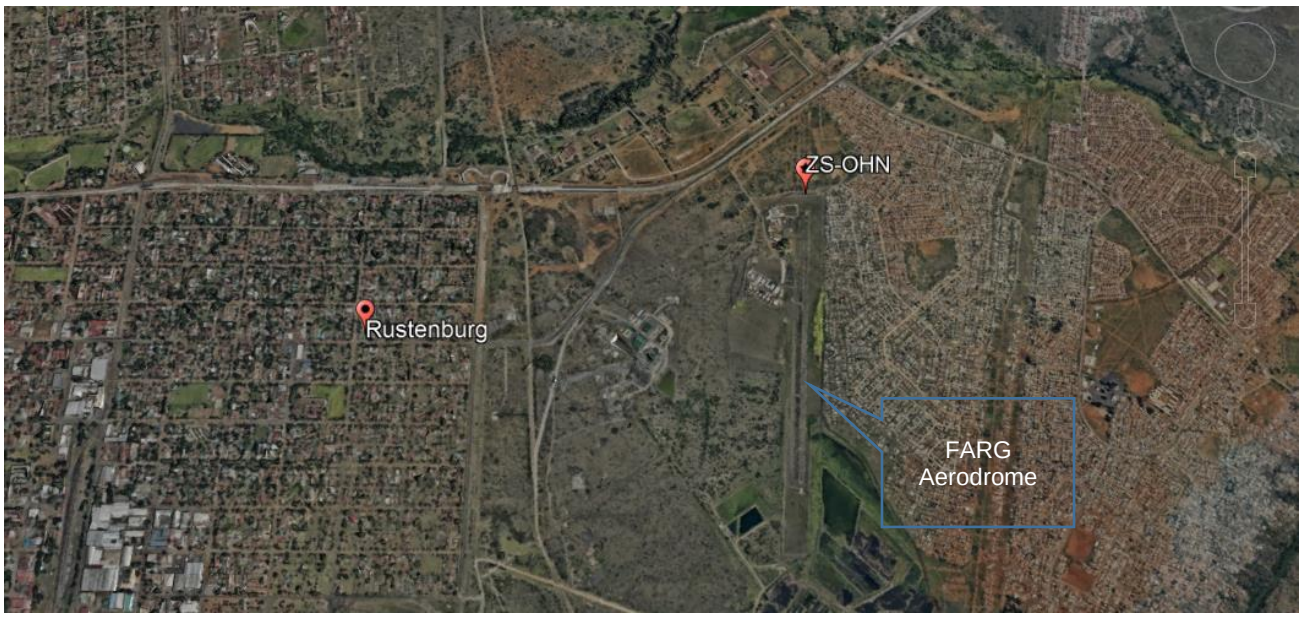


Figure 5: Location of FARG in relation to Rustenburg

5.2 The runway is 1 225 m (4 019 ft.) long and 15.4 m (50 ft.) wide. The runway designation is 16/34 and it has an asphalt surface. (See appendix C)

5.3 The aerodrome is licensed by the South African Civil Aviation Authority (SACAA), licence number 117.

5.4 After inspection of the pictures of where ZS-OHN came to rest, it was determined that a dumpsite exists on the outside perimeter of the aerodrome.

Figure 6: Dumpsite near the aerodrome

6. PROBABLE CAUSE

6.2 Due to a premature rotation, the aircraft was unable to enter a positive rate of climb.

7. CONTRIBUTING FACTORS

7.1 Aircraft overweight:

7.1.1 The aircraft was overweight at the time of landing at FARG. Following this, the pilot attempted an overweight take-off from FARG. The pilot had used the incorrect load sheet (See appendix E). If the pilot had used the electronic authorisation sheet (See appendix D), the pilot would have been notified that the operating limits of the aircraft were being exceeded.

8. REFERENCES USED IN THIS REPORT

8.1 Cessna 172N Pilot Operating Handbook

8.2 https://www.faasafety.gov/files/gslac/library/documents/2011/Aug/56396/FAA%20P-8740-02%20DensityAltitude[hi-res]%20branded.pdf

8.3 South African Weather Service Report

8.4 SACAA Aerodrome Directory

9. SAFETY RECOMMENDATION

9.1 None

10. ORGANISATION

10.1 None.

11. TYPE OF SAFETY ACTION

11.1 None.

12. SAFETY MESSAGE

12.1 The importance of doing an accurate weight and balance calculation prior to departure is imperative to the safe operation of the aircraft. Using figures, which are not accurate, or an assumption can place the aircraft outside it safe operating limitations.

13. APPENDICES

13.1 Appendix A: Latest mass and balance report

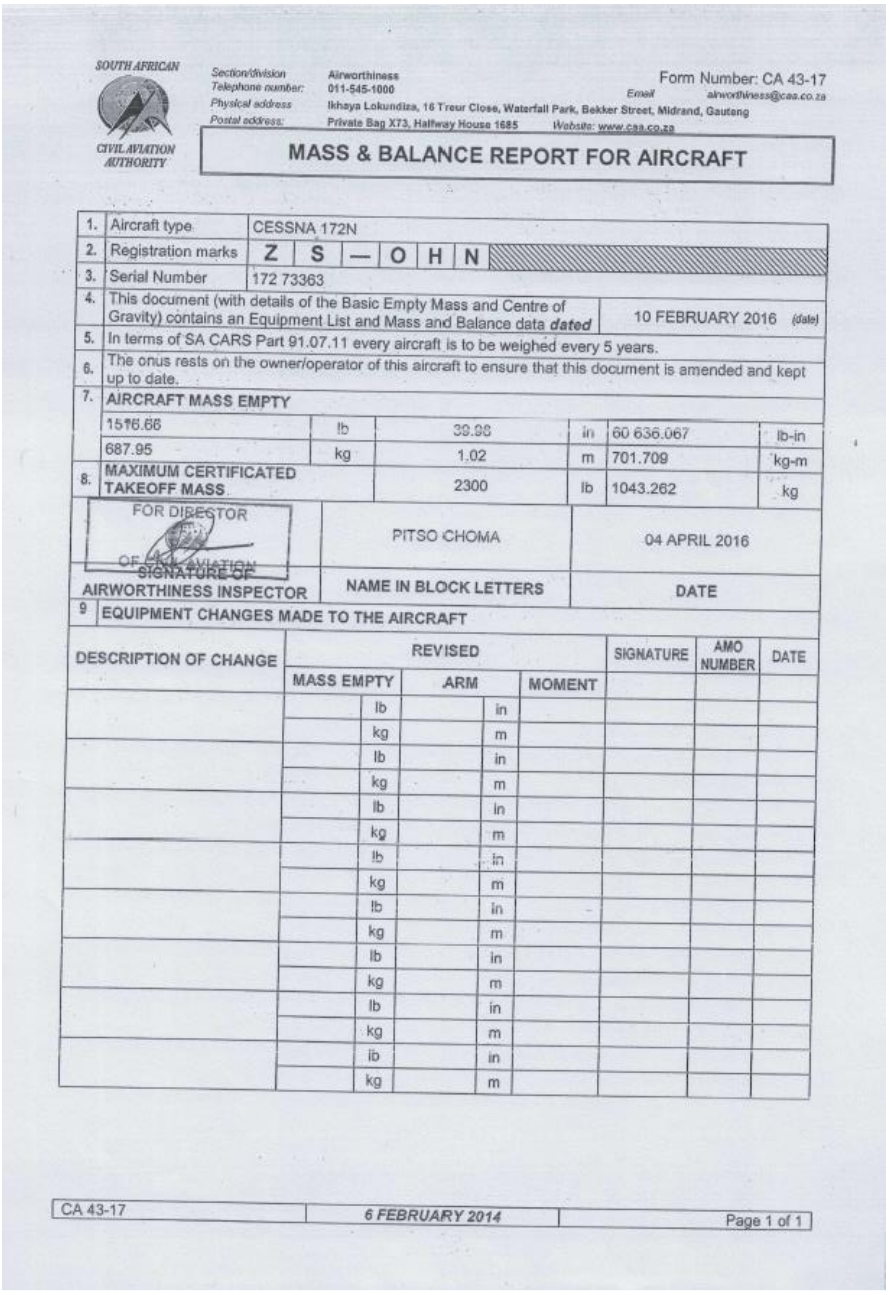
13.2 Appendix B: Koch Chart for density altitude correction at FARG

13.3 Appendix C: FARG aerodrome information

13.4 Appendix D: Electronic authorisation simulation

13.5 Appendix E: Load sheet used by the pilot

APPENDIX A



SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division: Airworthiness
Telephone number: 011-545-1000
Physical address: Ikhaya Lokundiza, 16 Treur Close, Waterfall Park, Bekker Street, Midrand, Gauteng
Postal address: Private Bag X73, Halfway House 1685
Email: airworthiness@caa.co.za
Website: www.caa.co.za

Form Number: CA 43-17

MASS & BALANCE REPORT FOR AIRCRAFT

1.	Aircraft type	CESSNA 172N
2.	Registration marks	Z S — O H N
3.	Serial Number	172 73363
4.	This document (with details of the Basic Empty Mass and Centre of Gravity) contains an Equipment List and Mass and Balance data *dated*	10 FEBRUARY 2016 *(date)*
5.	In terms of SA CARS Part 91.07.11 every aircraft is to be weighed every 5 years.	
6.	The onus rests on the owner/operator of this aircraft to ensure that this document is amended and kept up to date.	
7.	AIRCRAFT MASS EMPTY	

1516.66	lb	39.98	in	60 636.067	lb-in
687.95	kg	1.02	m	701.709	kg-m
8. MAXIMUM CERTIFICATED TAKEOFF MASS		2300	lb	1043.262	kg

FOR DIRECTOR OF CIVIL AVIATION	PITSO CHOMA	04 APRIL 2016
SIGNATURE OF AIRWORTHINESS INSPECTOR	NAME IN BLOCK LETTERS	DATE

9 EQUIPMENT CHANGES MADE TO THE AIRCRAFT

DESCRIPTION OF CHANGE	REVISED MASS EMPTY		REVISED ARM		REVISED MOMENT	SIGNATURE	AMO NUMBER	DATE
	lb		in					
	kg		m					
	lb		in					
	kg		m					
	lb		in					
	kg		m					
	lb		in					
	kg		m					
	lb		in					
	kg		m					
	lb		in					
	kg		m					
	lb		in					
	kg		m					
	lb		in					
	kg		m					

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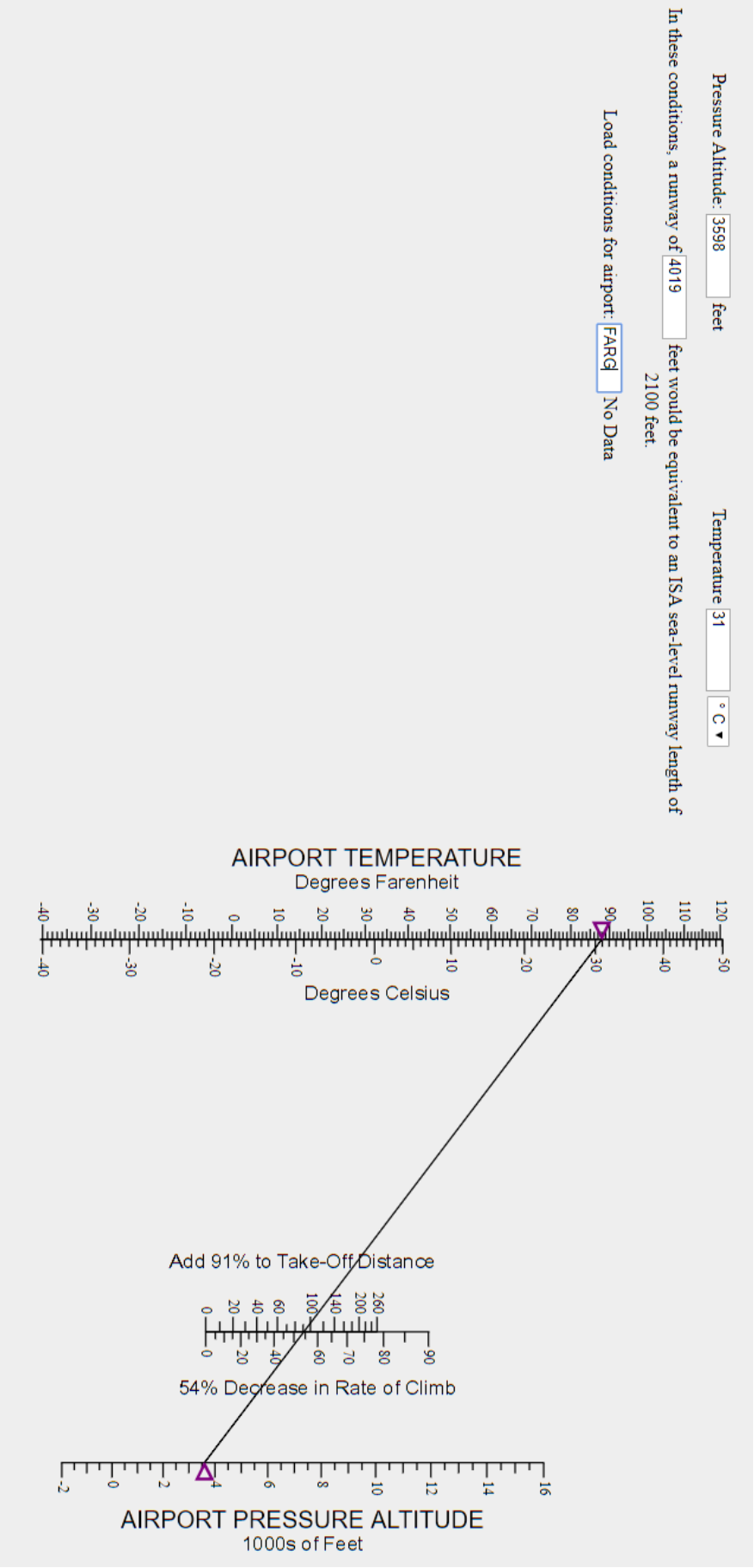
APPENDIX B


Pressure Altitude: 3598 feet
Temperature 31 °C
In these conditions, a runway of 4019 feet would be equivalent to an ISA sea-level runway length of 2100 feet.
Load conditions for airport: FARG No Data
AIRPORT TEMPERATURE
Degrees Farenheit
Degrees Celsius
Add 91% to Take-Off Distance
54% Decrease in Rate of Climb
AIRPORT PRESSURE ALTITUDE
1000s of Feet

APPENDIX C

AD 2 AERODROMES

FARG AD 2.1 AERODROME LOCATION INDICATOR AND NAME

FARG - RUSTENBURG (117)

FARG AD 2.2 AERODROME GEOGRAPHICAL AND ADMINISTRATIVE DATA

1	ARP Coordinates and site at AD	Ref. Point: S253840.4 E0271615.9
2	Direction and distance from city	1 NM NE
3	Elevation / Reference temperature	Elev: 3700 FT
5	MAG VAR / Annual change	17.3°W / 2007
6	AD Administration, address, telephone, telefax, telex, AFS	Authority Supervising the Aerodrome and Remarks: PUB AD CHF: MUNICIPALITY, P O Box 16, RUSTENBURG, 0300. TEL: (014) 5903111 Flying Club - CEO: 082-4528943 TEL: 083-4504422 TEL: Secretary (014) 5971796/5928435 FAX: (014) 7860251 Clubhouse on AD TEL: (014) 5967066 FAX: (014) 5971796/7860251 VHF 122.4 MHz
7	Remarks	Landing charges will be charged in terms of airport operation Act. Apron charges will not be charged.

FARG AD 2.3 OPERATIONAL HOURS

1	AD administration	AD Operational hours: H12
8	Fuelling	Supplier : SHELL/ Rustenburg Flying Club. TEL : (014) 5967066. HOD : MON - SUN: 0400 - 1600. A/H R 50-00 levy fee.

FARG AD 2.4 HANDLING SERVICES AND FACILITIES

2	Fuel/oil types	AVGAS 100. OIL : ASO W100.

FARG AD 2.5 PASSENGER FACILITIES

3	Transportation	John's Taxi - Cell No. 082-7712146

FARG AD 2.10 AERODROME OBSTACLES

In Area 2					
OBST ID/Designation	OBST type	OBST position	ELEV/HGT	Markings/Type, colour	Remarks
a	b	c	d	e	f
	TWR		HGT 99 FT		4 NM SSW
	Radio mast	S253958 E0271512	3788 / 78.7 FT		1.9 NM WSW
	Radio mast	S254018 E0271520	HGT 78.7 FT		2 NM W

FARG AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

Designations RWY NR	TRUE & MAG BRG	Dimensions of RWY (M)	Strength (PCN) and surface of RWY and SWY	THR coordinates	THR elevation and highest elevation of TDZ of precision APP RWY
1	2	3	4	5	6
16 34		1225 x 15,4	ASPH LCN 18		

FARG AD 2.14 APPROACH AND RUNWAY LIGHTING

Available from SS - SR. All lights will automatically be switched on FM SS till 1900; thenceforth RWY LGT remote switch AVBL with 5 clicks on FREQ 122.40 MHz.

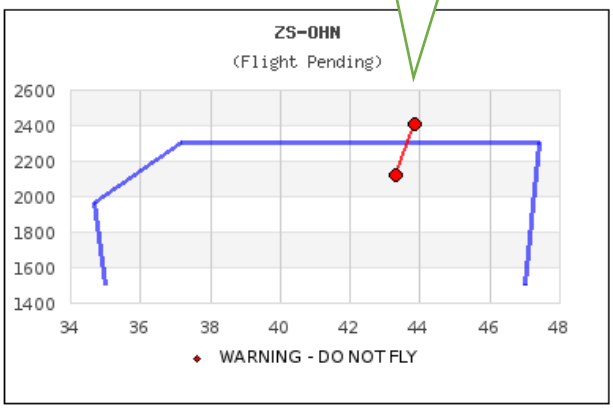
FARG AD 2.19 RADIO NAVIGATION AND LANDING AIDS

Type of aid, MAG VAR, Type of supported OP (VOR/ILS/ MLS, give declination)	ID	Frequency	Hours of operation	Position of transmitting antenna coordinates	Elevation of DME Transmitting antenna	Remarks
NDB	RG	452,5 kHz	H24	S253900 E0271700		PRIV NDB. PWR output 100 W.

APPENDIX D

Eagle Air

Flight Authorisation	
Name	[redacted]
Date of Flight	2018-08-29
Aircraft	ZS-OHN (Hobbs : 4800.0000, Tacho : 7991.3000)
Estimated Deaprture Time	0941 Z
Destination/Route	
Exercise	CAA TEST M&B
Flight Type	Other



Aircraft centre of gravity and weight are outside the operating envelope

Mass & Balance and Passenger Manifest

	Mass (lb)	Arm (in)	Moment (lb.in)	Lat Arm (in)	Lat Moment (lb.in)	Name	Weight (kg)	Next of Kin
Basic Empty Mass	1516	39.98	60636	0.00	0	ZS-OHN	689	
Pilot	176	37.00	6512	0.00	0	[redacted]		
Seat 2	187	37.00	6919	0.00	0		85	
Seat 3	226	73.00	16542	0.00	0		103	
Seat 4	0	73.00	0	0.00	0			
Fuel	288	47.80	13766	0.00	0	Fuel for 4.8 hours	48	<<<<< Gal
Baggage Area 1	11	95.00	1045	0.00	0		5	
Ramp Weight	2405	43.83	105420	0.00	0	You may not fly the aircraft in this configuration (Too heavy by 106 lb (18 Gal))		

Refresh

Warning to the pilot that the aircraft is too heavy for the planned operation

APPENDIX E

[redacted]

LOAD SHEET

Date: 21/08/18 Type: C-172 Registration: ZS-OHN

Route: FAWB-FAPN-FAPT FAWB Commander: [redacted]

		Mass (lbs)	Arm (Inches)	Moment (lb in X 1,000)
	Basic Empty Mass	1466	37.4	54604
Variable Load	Crew	300	37.0	11100
	Crew Baggage	10	94.9	949
	Dry Operating Mass	1770	37.6	66653
USEFUL LOAD	Seat Row 1			
	Seat Row 2	/	/	/
Traffic Load	Seat Row 3	/	/	/
	Baggage Front (Max Lbs)	/	/	/
	Baggage Centre (Max Lbs)			
	Baggage Rear (Max Lbs)			
	Zero Fuel Mass (ZFM)	1770	37.6	66653
	Fuel Main LB USG	240	45.3	10872
Fuel	Fuel Aux. USG			
	Fuel Tip USG			
	Ramp Mass	2010	38.5	77525
	Taxy Fuel	12	45.3	5436
	TAKE OFF MASS (Max Lbs)	1998	39.07	78068.6
	Flight Fuel USG	168	45.3	7610.4
	LANDING MASS (Max Lbs)	1830	46.8	85679

I hereby certify that the load distribution is in accordance with the Flight Manual and the Maximum Certified Mass has not been exceeded.

Date: 21/08/18 Signed: [redacted]