SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division Accident and Incident Investigations Division Form Number: CA 12-57

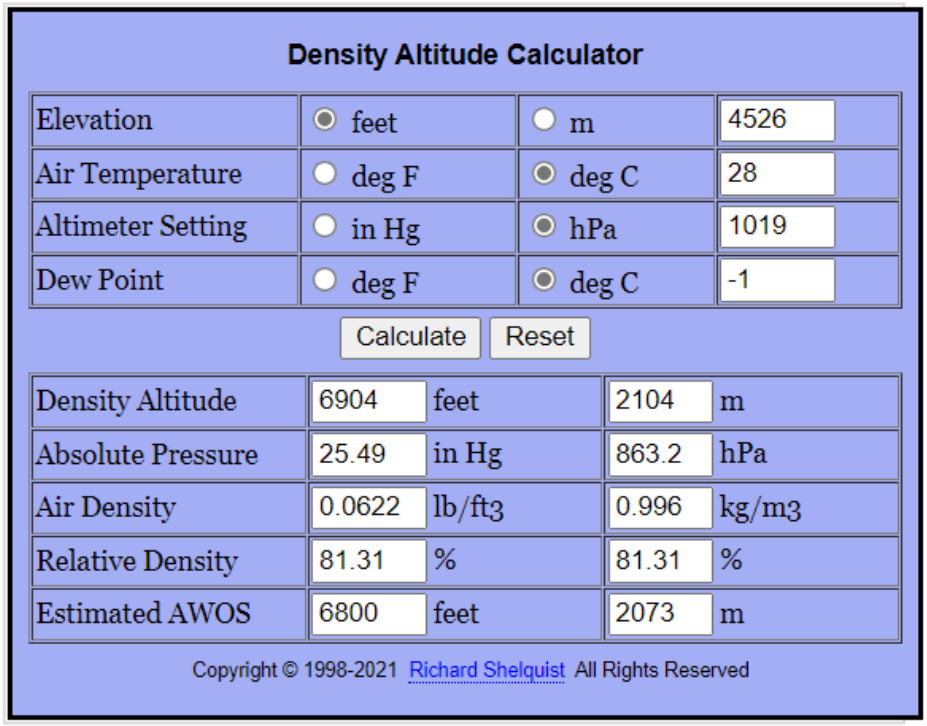
LIMITED ACCIDENT INVESTIGATION REPORT

Reference Number	CA18/2/3/10066						
Classification	Accident	**Date**	3 November 2021	**Time**	1150Z		
Type of Operation	Aerial Work / Crop-spraying (Part 138)						
Location							
Place of Departure	Farm Mooipan, Theunnisen District, Free State Province		Place of Intended Landing	Farm Mooipan, Theunnisen District, Free State Province			
Place of Accident	Runway 35 overrun area on farm Mooipan, Theunnisen District						
GPS Co-ordinates	Latitude	28°17'01.74" S	Longitude	026°37'53.28" E	Elevation	4 526 ft	
Aircraft Information							
Registration	ZS-DZM						
Make/Model	Air Tractor AT402B (Serial Number: 402B-1397)						
Damage to Aircraft	Substantial		Total Aircraft Hours	1 459.6			
Pilot-in-command							
Licence Valid	Yes		Gender	Male	Age: 38		
Licence Type	Commercial Pilot Licence						
Total Hours on Type	5.4		Total Flying Hours	1 553.9			
People On-board	1 + 0	Injuries	0	Fatalities	0	Other (On Ground)	0
What Happened							

On Wednesday afternoon, 3 November 2021, a commercial pilot took off on-board an Air Tractor AT402B with registration ZS-DZM on a crop-spraying flight from Runway 35 at Mooipan farm at approximately 1150Z. This was his sixth load of the day to spray on the farm, approximately 6 nautical miles (nm) from where he uplifted the loads. The hopper tank, which had a capacity of 400 US gallons (1 514 litres) was filled to capacity with agricultural pesticide spray mixture. The pilot stated that there was 60 US gallons (228 litres) of fuel on-board the aircraft before take-off. The runway in use had a hard-compacted gravel surface, which was 1170 metres (m) long and 30m wide. The meteorological routine aerodrome report (METAR) for Welkom Aerodrome (FAWM) on 3 November 2021 at 1200Z was: FAWM 031200Z AUTO 28006KT //// // ////// 28/M01 Q1019=, the surface wind was 280°/6 knots, the temperature 28°C, the dew point -1°C and the barometric pressure at sea level was 1019 hectopascal (hPa). FAWM is located 17 nautical miles (nm) north of the runway in used on the farm. The density altitude was determined to be 6 904 feet (ft).

SRP date: 8 March 2022 Publication date: 10 March 2022

Density Altitude Calculator – Source: https://wahiduddin.net/calc/calc_da.htm



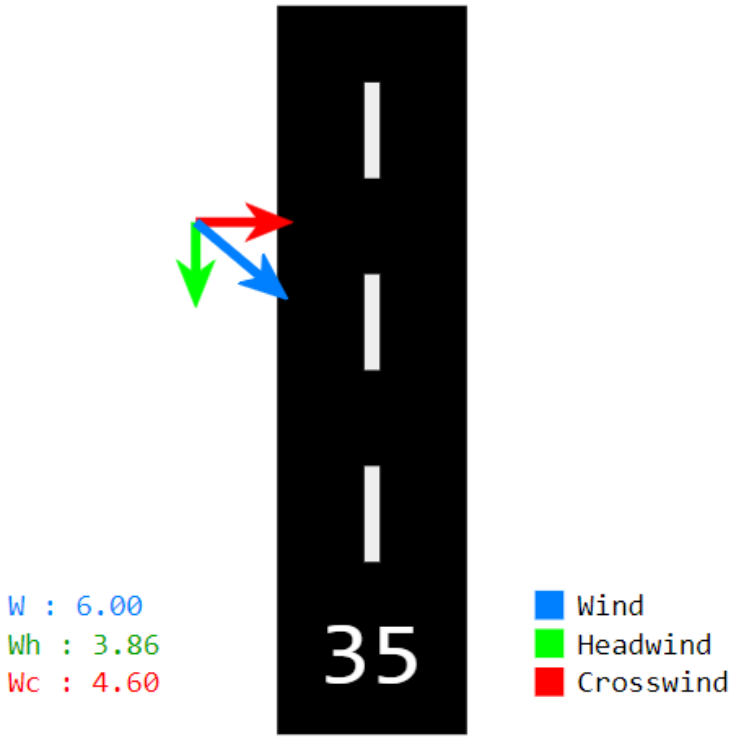
Density Altitude Calculator

Elevation	(•) feet	( ) m	4526
Air Temperature	( ) deg F	(•) deg C	28
Altimeter Setting	( ) in Hg	(•) hPa	1019
Dew Point	( ) deg F	(•) deg C	-1

Calculate Reset

Density Altitude	6904	feet	2104	m
Absolute Pressure	25.49	in Hg	863.2	hPa
Air Density	0.0622	lb/ft3	0.996	kg/m3
Relative Density	81.31	%	81.31	%
Estimated AWOS	6800	feet	2073	m

Prevailing wind conditions at the time of the accident. (Source: https://e6bx.com)



The hopper tank was filled by ground personnel near the threshold of Runway 17. Once filled, the pilot taxied to the threshold of Runway 35, which was the active runway at the time with the prevailing wind from north-west. The pilot stated that he selected a slight nose up trim and lowered the wing flaps as required for take-off. It should be noted that the pilot determines the flap setting as there is no pre-selected flap settings as those found on most other aircraft types. The aircraft is fitted with a wing flap toggle switch (see Figure 7).

The pilot commenced with the take-off roll and, during the initial roll, the tail lifted off the ground as normal. The pilot stated that as he reached rotation speed, he pulled back on the control stick; and at that stage, the tail lowered, and the tail wheel touched the ground. He then opted to abort take-off and applied maximum braking *("I stepped on the brakes")* but was unable to bring the aircraft to a stop before the end of the runway surface. The pilot also stated in an interview that he retracted the wing flaps in an attempt to increase braking effectiveness. The brake markings (see Figure 2) started 850m from the threshold of Runway 35, which left the pilot with approximately 320m to the end of the runway surface.

The pilot overran the runway as he was unable to bring the aircraft to a stop before the end of the runway surface. The left wing impacted a tree and uprooted it. Further along, the same wing impacted a brick building (store room), which caused the aircraft to ground loop to the right before coming to rest facing the building. The pilot was not injured in the accident. As he disembarked the aircraft, he noticed smoke coming from the front section of the engine. He then took portable fire extinguisher that was in the cockpit and dosed the fire. The source of smoke was found to be from an engine oil line that ruptured, and the leaking oil coming into contact with the hot engine.

Aircraft information

The aircraft is an Air Tractor AT-402B with serial number 402B-1397. It was manufactured in the United States of America (USA) and was fitted with a Pratt & Whitney PT6A-15AG engine (producing 680 shaft horsepower at 2 200 rpm), manufactured in Canada. It is a low-wing monoplane taildragger; the aircraft has a chemical hopper tank, which is located between the engine firewall and the cockpit. The aircraft was imported into South Africa as new, and the Certificate of Registration was issued on 26 June 2018. At the time of the accident, the aircraft had a valid Certificate of Airworthiness that was issued on 3 August 2018 with an expiry date of 31 August 2022. The last maintenance inspection that was carried out on the aircraft prior to the accident flight was certified on 1 October 2021 at 1 443.9 airframe hours. Following the maintenance inspection, a further 15.7 hours were flown with the aircraft. Following inspection, there were no defects entered in the flight folio that could have contributed or have caused the accident. The pilot also stated that the aircraft was serviceable prior to the flight.

Weight and Balance for the flight.

Item	Weight (lbs)	Arm (Inches)	Moment (lbs x inches)
Aircraft empty weight	4 399	26.11	114 862.46
Pilot (82kg)	181	74	13 394
Hopper tank	3 250	12	39 000
Fuel Jet A1 (60 US gallons)	402	33	13 266
Take-off weight	**8 232**	**21.93**	**180 522.46**

The maximum take-off weight (MTOW) for this aircraft is 9170 pounds (lbs) according to the Aircraft Flight Manual (AFM). The aircraft was operated within its MTOW limitations.

Aborted take-off:
There is no official procedure published in the AFM for an aborted take-off.

Pilot conversion onto the Air Tractor AT-402B

The pilot had a Commercial Pilot Licence (CPL). He had flown a total of 1553.9 hours of which 822.0 hours were during crop-spraying operation. The pilot had a valid Class 1 aviation medical certificate, which was issued on 18 November 2020 and was valid until 30 November 2021.

At the time of the accident, the pilot had accumulated a total of 5.4 flying hours on the aircraft type. He obtained his rating onto the aircraft type the previous day. During his conversion, he had flown three hours with an empty hopper tank under supervision of a flight instructor who was on the

ground and communicating with him via radio. The pilot had also written a technical exam on the aircraft, which was completed a week prior to the accident flight at the aviation training organisation (ATO) facilities at Kroonstad Aerodrome. This was the pilot's first turbine-driven engine aircraft he had to fly. He had the Piper PA-25-235 (Pawnee) and the Air Tractor 401B (radial reciprocating engine) endorsed on his licence. Following the conversion training, the flight instructor advised the pilot to fly at least 5 to 10 hours with an empty hopper tank; he was not allowed to exceed half loads in the next 20 hours (i.e., 30 hectare) so as to get the feel of the aircraft during spray-operations. However, this instruction/advise was not complied with due to commercial pressure from his employer. The flight instructor had also instructed the pilot not to use reverse thrust during landing as the runway surface was covered with small stones/rocks that could find their way into the engine and cause internal damage, as well as the fact that he was not familiar with the aircraft yet. The pilot was supposed to get familiar and comfortable with the aircraft in doing proper approaches and landings first.

Previous accident:

The pilot was involved in an accident on 1 April 2015 while piloting a Piper PA-25-235 Pawnee (ZS-FBB). The pilot was involved in a crop-spraying operation in a sugar cane farm in KwaZulu-Natal. The engine stopped due to fuel exhaustion while spraying crop and he executed a forced landing on the sugar cane field. The aircraft was substantially damaged. (Accident reference number CA18/2/3/9427).

The Operator:

This was a commercial flight. The operator was issued an Air Service Licence by the Department of Transport as well as an Air Operating Certificate (AOC) by the South African Civil Aviation Authority (SACAA) on 23 December 2020, which was valid until 31 December 2021. Their operator's head office is located in Limpopo province. The aircraft ZS-DZM was dually authorised to operate under the AOC.

According to the statement from the pilot, he was not acquainted with the operating procedures of this AOC as it was not made available to him, nor has any member from the head office been in contact with him while he was employed as a crop-spraying pilot flying under this AOC.

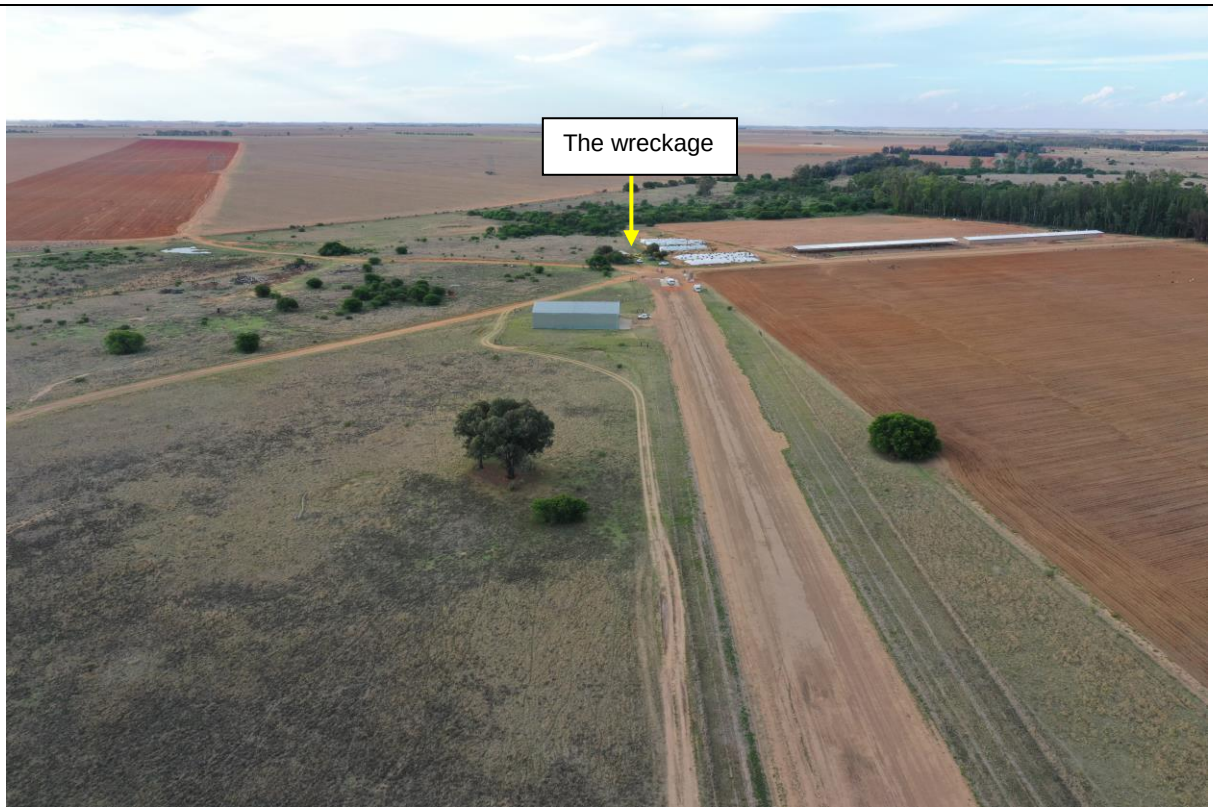


Figure 1: An aerial view of part of the runway and the final position of the wreckage. (Source: AAS)

Figure 2: Tyre brake markings visible on the gravel runway.

Figure 3: Man-made obstacles on the runway overrun area.

Figure 4: The aircraft as it came to rest.

Figure 5: The accident aircraft with the store room in front of it.

Figure 6: A closer view of the engine and propeller.

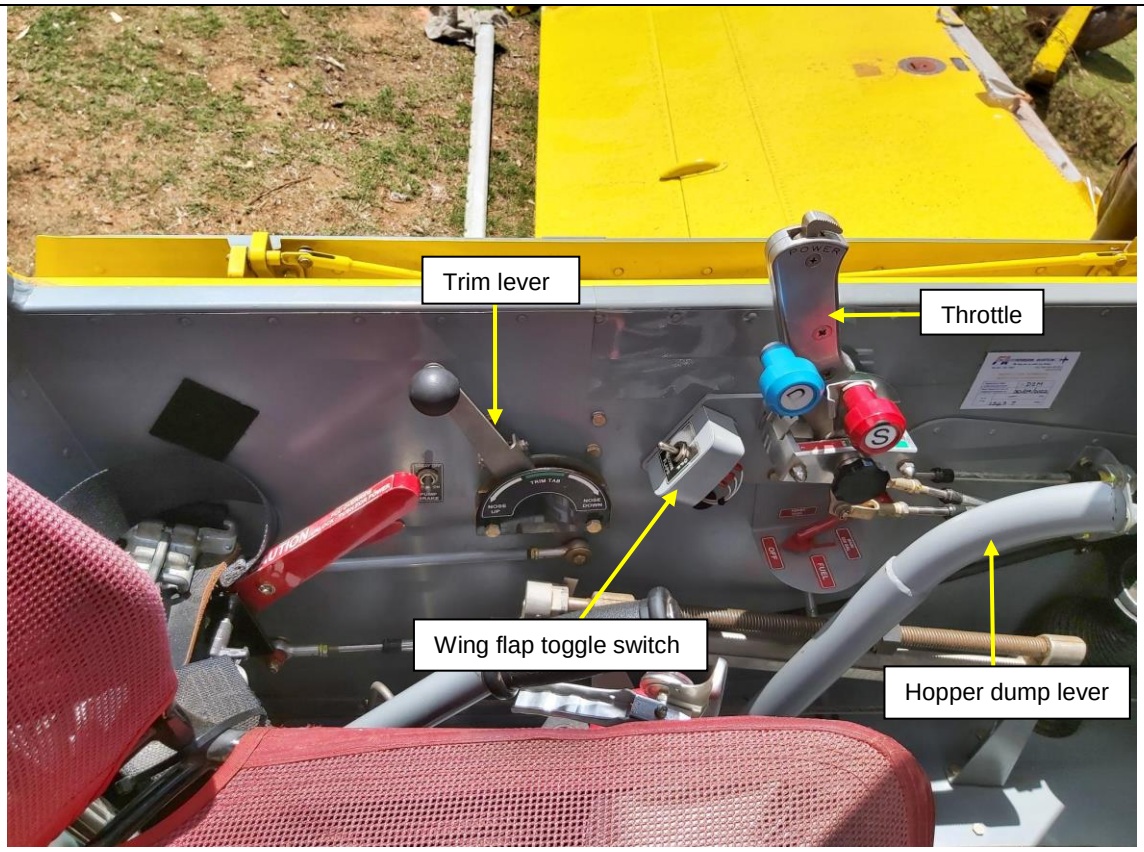


Figure 7: A cockpit view illustrating some primary controls.

What was found:

(i) No mechanical malfunction with the aircraft or its engine was noted that could have contributed or have caused the accident.
(ii) The pilot had limited flying experience on the aircraft type.
(iii) According to the aircraft manufacturer, the nose trim position was in the correct position for take-off with a full hopper load.
(iv) There is no official aborted take-off procedure published in the AFM for this aircraft.
(v) The pilot did not dump the hopper load immediately when he decided to abort take-off. According to the aircraft manufacturer, the hopper tank takes approximately 6 to 8 seconds to empty when filled to maximum capacity. The pilot was familiar with the system as the Air Tractor AT-401B he was rated on and flying was equipped with the same hopper tank dump system.
(v) The pilot did not make use of reverse thrust to decelerate the aircraft following the aborted take-off.
(vii) This was an unlicensed aerodrome with several man-made obstructions on the overrun area of Runway 35, which the pilot could not avoid when the aircraft overran the runway.
(viii) The runway surface had stones/rocks (see Figure 2) which not only posed a risk of foreign object damage to the aircraft making use of the runway, but also could affect the effectiveness of the brakes, especially during an aborted take-off.
(ix) This was a commercial operation conducted under the provisions of an AOC. The pilot was not

aware of the operating procedures of this AOC as there was no communication between him and the AOC holder at any stage while he was engaged in crop-spraying undertakings.

Probable cause

During an aborted take-off, the pilot did not dump the hopper load, nor did he make use of reverse thrust to bring the aircraft to a safe stop before the end of the runway surface.

Contributor factors

1. There were several man-made obstructions on the overrun area of Runway 35, which the pilot was unable to avoid.
2. The pilot had limited flying experience on the aircraft type.
3. This was the first time the pilot flew a turbine-driven engine aircraft.
4. The pilot did not take into consideration the effect of density altitude as the day progressed.
5. The pilot did not comply with the recommendation as per the flight instructor's advice following his conversion the previous day of flying with an empty hopper tank for 5 to 10 hours and, thereafter, flying with half-load for the next 20 hours.
6. Operational pressure was found to be a significant contributory factor in this accident, which is why the flight instructor's recommendation was ignored by the employer and the pilot immediately started flying with full hopper loads the next day.

Safety Action

It is recommended that the pilot conversion onto the Air Tractor AT-402B be evaluated by the relevant division within the South African Civil Aviation Authority (SACAA) and that the required corrective action be taken to ensure compliance with respect to applicable provisions of the Civil Aviation Regulations.

Safety Message and/or Safety Recommendation/s

1. It is recommended to the farm owner (Mooipan) that all obstructions on the overrun area of Runway 35 be removed to ensure there is a proper runway end safety area (RESA). This recommendation was issued in the interest of aviation safety.

2. It is also recommended to the farm owner (Mooipan) that the runway surface be cleared of all stones/rocks on the runway surface. These stones/rocks have the potential not only to cause foreign object damage (FOD) to the aircraft, but could also contribute to inadequate braking and controllability related issues during crosswind conditions.

3. It is recommended that the SACAA conducts a detailed ad-hoc inspection relating to the operator as it is clear that they do not have any oversight of remote operations of aircraft authorised under their AOC.

Purpose of the Investigation

In terms of Part 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****.*

About this Report

Decisions regarding whether to investigate, and the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, no 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 brief report. The report has been compiled using information supplied in the initial notification, as well as follow-up information 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 accident.

This report provides an opportunity to share safety message/s in the absence of an investigation.

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.

Disclaimer

This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa