SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10252					
Classification	Accident	**Date**	11 January 2023	**Time**	0545Z	
Type of Operation	Aerial Work Application – Agricultural (Part 137)					
Location						
Place of Departure	Leeukop Aerodrome, Deneysville, Free State Province	Place of Intended Landing	Leeukop Aerodrome, Deneysville, Free State Province			
Place of Occurrence	Maize field on Leeukop Farm, Deneysville, Free State Province					
GPS Co-ordinates	Latitude	26°51'57.10" S	Longitude	028°03'58.51" E	Elevation	4 985 ft
Aircraft Information						
Registration	ZS-THH					
Make; Model; S/N	Air Tractor; AT-402A (Serial Number: 402A-1352)					
Damage to Aircraft	Substantial	Total Airframe Hours	1 917.6			
Pilot-in-command						
Licence Type	Commercial Pilot Licence (CPL)	Gender	Male	Age	44	
Licence Valid	Yes	Total Hours on Type	4 751.0	Total Flying Hours	9 988.0	
Total Hours 90 Days	99.1	Total Hours on Type Past 90 Days	99.1			
People On-board	1 + 0	**Injuries**	0	**Fatalities**	0	**Other (on ground)** 0

What Happened

On Wednesday morning, 11 January 2023, a pilot on-board an Air Tractor AT-402A aircraft with registration ZS-THH took off from Leeukop Aerodrome near Deneysville in the Free State Province to engage in agricultural spraying operation on a farm nearby. Leeukop Aerodrome is unlicensed. The flight was conducted under the provisions of Part 137 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot stated that the aircraft had 1 000 litres (l) of herbicide in the hopper tank and 400 litres (l) of Jet A1 fuel in the tanks. The grass runway, which has been in operation on the farm since 1986, is 980 metres (m) long and 25m wide with an orientation of 08/26. According to the pilot, Runway 26 was elected for take-off. The wind was light from a north north-easterly direction at 2 knots (kt). The pilot stated that the runway surface was rough.

***Note**: During follow up post-accident, the investigator drove on the runway surface and found it a bit uneven but certainly not rough. The runway is regularly used by aircraft taking up skydivers. During a discussion with the owner of Leeukop farm he stated he used the runway on a regular basis whilst he was still flying. The farm owner once owned his own aircraft.*

According to the pilot, he had flown from this runway on previous occasions. He stated that there was a light wind of approximately 2kts blowing from the north north-easterly direction at the time, which was negligible. On-board, he had the first load of the day, which was meant to be sprayed on the Vaalbank farm located near the aerodrome.

The pilot reported that after commencing with the take-off run and as the tail of the aircraft started to lift off (tail dragger) with the main wheels still on the ground, he felt a strong gust of wind from the right and the tail wheel settled back on the ground. At this stage, *"he knew he was in trouble"*, and he dumped the hopper load to reduce the take-off weight as this would allow the aircraft to get airborne faster. *The farm perimeter fence with a locked double gate is positioned at the end of the runway; the gate is about 1.20m (4 feet) high*. The left main gear struck the fence post and the support pole, and the left wing collided with the gate. This caused the aircraft to spin 180° along the vertical axis before it crashed on the maize field adjacent to the fence and came to rest facing the direction of take-off. The pilot indicated that he sustained a few bruises during the impact sequence but was able to disembark from the aircraft unassisted. The aircraft was substantially damaged, including the dispersal system.

Figure 1: The aircraft as it came to rest. (Source: Pilot)

Figure 2: The front view of the aircraft on the maize field. (Source: Pilot)

Figure 3: A view of the runway with the aircraft at the threshold of Runway 26 after it was recovered from the maize field. The windsock is visible in the yellow window.

Figure 4: The mangled gate and supporting wooden post with which the aircraft collided.

Figure 5: The left gate viewed from the direction of take-off whilst still intact.

Source: https://airtractor.com/wp-content/uploads/2016/10/AT-402-502-504-602-Pilot_Training_Course.pdf

The information below was obtained from the website (source as mentioned above) under the Emergency Procedure – Insufficient Runway Remaining. *This is important information to all pilot's when the hopper load needs to be dumped as it was the case in this occurrence.*

During a high speed abort, if the hopper is dumped immediately the sudden decrease in gross weight may put the aircraft into a flying speed range in which case if the stick is not pushed forward, the aircraft could pop off the ground with a fairly aggressive pitch-up.

WARNING: Use extra caution if dumping hopper above 50 mph (44kts) IAS or aircraft may become airborne. Dumping hopper load may reduce braking.

Findings

1. Personnel Information

1.1 The pilot was issued a Commercial Pilot Licence (CPL). The initial issue of the pilot's licence was on 26 June 2007. He had a night as well as an agricultural ratings endorsed on his licence. The pilot had flown a total of 9 988.0 hours of which 4 751.0 were on the aircraft type.

1.2 The pilot had a Class 1 aviation medical certificate that was issued on 14 January 2022 with an expiry date of 31 January 2023. The pilot was properly licensed and medically fit for the flight in accordance with the existing regulations.

1.3 The pilot was involved in an accident on 24 January 2020 with the same aircraft when it collided with a light delivery vehicle during take-off, resulting in damage to the right wing.

2. Aircraft Information

2.1 The last maintenance inspection that was carried out on the aircraft prior to the accident flight was certified on 4 November 2022 at 1 822.0 airframe hours by an approved maintenance organisation (AMO). Since the inspection, a further 95.6 hours were flown with the aircraft.

2.2 The aircraft had a valid Certificate of Airworthiness (C of A) which was issued on 21 July 2017 with an expiry date of 30 November 2023. The aircraft was airworthy when it dispatched for the flight.

2.3 The aircraft's Certificate of Registration (C of R) was issued on 7 June 2017.

2.4 The aircraft was issued a Certificate of Release to Service (CRS) on 4 November 2022, which was valid until 3 November 2023 or at 1 922.0 airframe hours, whichever occurs first.

2.5 The aircraft was fitted with a 404-kilowatt (550SHP) Pratt & Whitney PT6A-11AG engine.

2.6 The aircraft was involved in a previous accident on 24 January 2020 when it collided with a light delivery vehicle on take-off. The right wing was damaged in this accident.

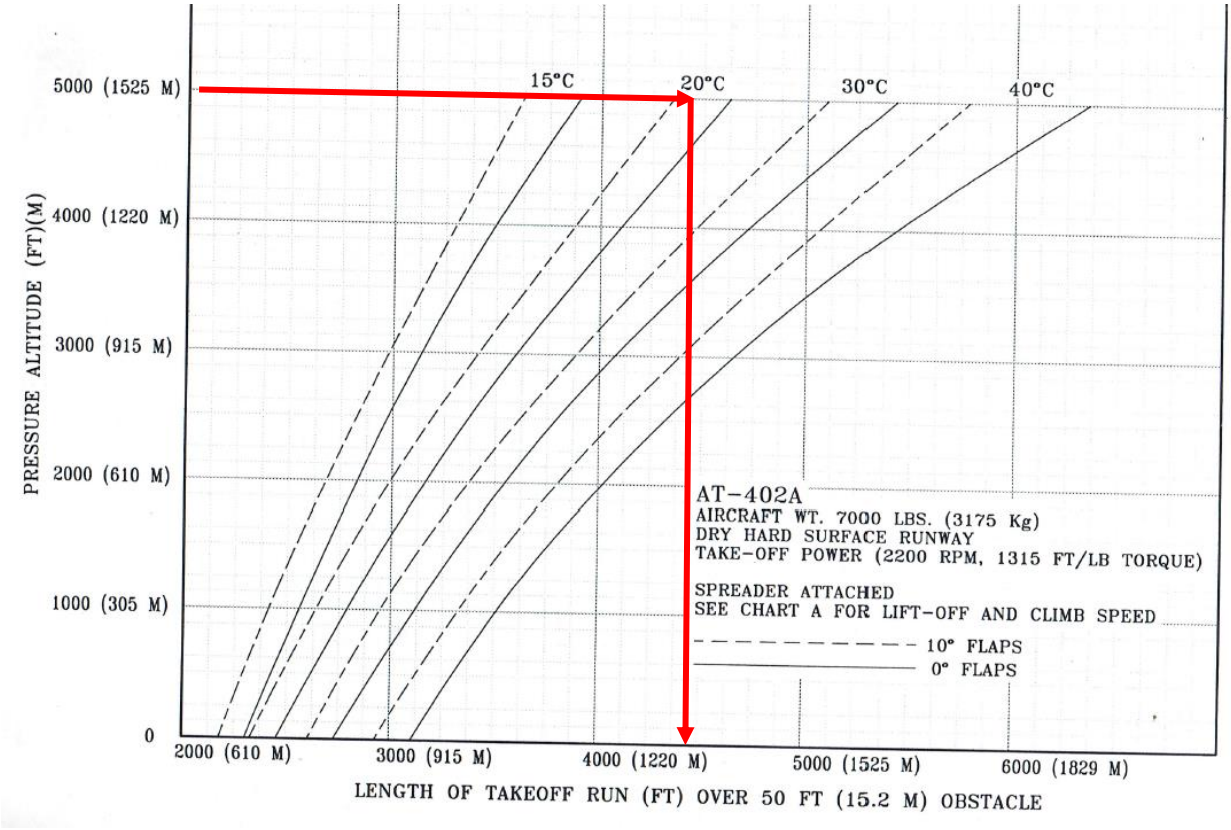
2.7 Weight and Balance:

Item	Weight (kg)
Aircraft empty weight	1 980
Pilot	78
Empty weight	**2 058**
Hopper load	1 000
Fuel (400L x 0.8)	320
Take-off weight	**3 378**

According to the Aircraft Flight Manual (AFM), the maximum take-off weight (MTOW) for the aircraft is 3 175 kilograms (kg) (7 000 pounds [lbs]). The aircraft MTOW was exceeded by approximately 6% (208kg or 460lbs).

2.8 Take-off distance required:

The graph below is an extract from the Air Tractor AT-402A AFM. It indicates the runway length required to clear a 50ft obstacle at the end of the runway.



The graph parameters are for a dry paved runway with the aircraft at its maximum take-off weight (3175kg) and with a flap setting of 10° as per the information the pilot provided in the questionnaire (form CA 12-03). There is no graph for analysis of an unpaved runway in the AFM. The pressure altitude was 4 985 feet and the temperature was 20°C, this equates to a required runway distance of 1 334m (4 377ft) for a dry paved runway. The aircraft was taking off from a grass runway surface with a gentle up hill (incline), therefore, this would increase the required runway length for the take-off run.

3. Meteorological Information

3.1 The weather information in the table below was obtained from the pilot questionnaire.

Wind Direction	020°	Wind Speed	2 kt	Visibility	9999 m
Temperature	20°C	Cloud Cover	Nil	Cloud Base	CAVOK
Dew Point	2°C	QNH	1026hPa		

3.2 The following Meteorological Aerodrome Reports (METARs) were obtained from the South African Weather Service (SAWS) website.

At O.R. Tambo International Aerodrome (FAOR) on 11 January 2023 at 0530Z the temperature was 21°C.
FAOR 110530Z 03007KT CAVOK 21/14 Q1028 NOSIG=

At Rand Aerodrome (FAGM) on 11 January 2023 at 0600Z the temperature was 23°C.
FAGM 110600Z VRB02KT CAVOK 23/11 Q1028=

No METAR data was available for Vereeniging Aerodrome (FAVV) on 11 January 2023 at 0600Z.

No METAR data was available for Heidelberg Aerodrome (FAHG) on 11 January 2023 at 0600Z.

3.3 Density Altitude (https://wahiduddin.net/calc/calc_da.htm)

The temperature of 20°C as provided by the pilot was used for the following calculation.

Elevation	4 985ft (1 520m)
Air Temperature	20°C
Altimeter Setting	1026 hPa
Dew Point	11°C
Density Altitude	**6 461ft (1 970m)**

4. Aerodrome

4.1 The pilot made use of Leeukop Aerodrome, which is unlicensed. According to the farm owner, the runway was constructed in 1986 and has been in operation since. It is grass-covered and is 980m long and 25m wide. The runway orientation is 08/26. The pilot opted to use runway 26 for take-off. He stated that the runway surface was rough.
The runway is used on a regular basis for skydiving activities. The runway has an uphill slope when taking off from Runway 26. The grass was cut short when the investigator visited the aerodrome.

5. Air Operating Certificate (AOC)

5.1 On 12 December 2022, an application and payment were made to the Regulator (SACAA) to add two different aircraft types to the AOC of an established operator. The application process was not completed as the accident aircraft was the first of the two types to be endorsed on the AOC. At the time of the accident, there were still outstanding requirements to be met. Therefore, the aircraft was not endorsed on the AOC at the time of the accident. Part 137.01.3 in sub-heading 6 below addresses the AOC requirements.

6. Civil Aviation Regulations 2011, Part 137 Aerial Work Operations

Maximum certificated mass

Part 137.03.2 *(1) Notwithstanding the provisions of Part 91 and Part 135 and subject to sub-regulation (2), a pilot of an aircraft engaged in an agricultural or fire-fighting operation, may take-off at a mass greater than the MCM specified in the aircraft flight manual if the pilot complies with the requirements as prescribed in Document SA-CATS 137.*

(2) Where there is a third-party risk as specified in Document SA-CATS 137, a pilot shall determine the MTOM from the requirements prescribed in regulations 137.03.3 and 137.03.4.

Take-off distance and flight path

Part 137.03.3 *(1) Where there is a third party as specified in Document SA-CATS 137, a pilot of an aeroplane engaged in an agricultural or fire-fighting operation shall, notwithstanding the provisions of Part 91 and subject to sub-regulation (2), ensure that the take-off distance available is greater than the take-off distance specified in the aeroplane flight manual, multiplied by a factor of 1.2.*

(2) When calculating a take-off distance, a pilot shall take the following factors into account—

(a) mass of the aeroplane at the commencement of the take-off run;

(b) pressure altitude of the aerodrome;

(c) ambient temperature at the aerodrome;

(d) runway surface type and condition;

(e) runway slope in the direction of take-off; and

(f) not more than 50% of the headwind component or not less than 150% of the tailwind component.

SA-CATS-137

Part 137.01.3 REQUIREMENTS FOR COMMERCIAL AGRICULTURAL AND COMMERCIAL FIRE-FIGHTING OPERATIONS

1. AOC requirements

The operator of an aircraft engaged in commercial agricultural or commercial fire-fighting operations, shall not operate the aircraft unless such operator is the holder of an AOC issued in accordance with the applicable provisions of the CAR: Provided that the operator does not need to complete a statement of compliance document."

Probable Cause

The pilot did not calculate the take-off distance prior to the first load of the day and opted to commence with the take-off with an aircraft that exceeded its MTOW, as a result, the aircraft failed to obtain rotational speed. The aircraft impacted the perimeter fence on rotation, and the pilot lost control of the aircraft and crashed.

Contributing Factors

The pilot did not consult the AFM on either the take-off distance required nor did he conduct a weight and balance calculation prior to the flight.

The MTOW of the aircraft was exceeded, which had a direct effect on the aircraft's take-off and climb performance.

The runway distance available was 980m and was inadequate for a safe take-off with the configuration of the aircraft as it was, which was overweight. The aircraft needed 1 334m runway for a safe take off.

The density altitude at the time might have contributed to impaired engine performance, which have contributed to the accident.

Safety Actions

None.

Safety Recommendation/Message

None.

About this Report

The decision 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, a limited scope, fact gathering investigation was conducted to compile this limited report

and allow for greater industry awareness of potential safety issues as well as possible safety action/s that the industry might want to consider in preventing a reoccurrence.

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****.*

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