SOUTH AFRICAN CIVIL AVIATION AUTHORITY

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:	CA18/2/3/9732	
Aircraft registration	**ZU-EVW**	**Date of accident**	18 September 2018	**Time of accident**	0820Z
Type of aircraft	Ikarus C42B (Micro-light)		**Type of operation**	Commercial (Part 96)	
Pilot-in-command licence type	Commercial	**Age**	24	**Licence valid**	Yes
Pilot-in-command flying experience	Total flying hours	294.2		Hours on type	47.7
Last point of departure	Bethlehem Aerodrome (FABM), Free-State Province				
Next point of intended landing	Bethlehem Aerodrome (FABM), Free-State Province				
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)					
Bethlehem Aerodrome (GPS position; 28°14'52.25" South 028°20'08.33" East) elevation 5 536 feet AMSL					
Meteorological information	Surface wind; 328˚/7.4kt gusting 10.7kt, temperature; 24.5˚C, CAVOK				
Number of people on board	1 + 1	**No. of people injured**	0	**No. of people killed**	2
Synopsis					

On Wednesday morning, 19 September 2018, the pilot accompanied by a passenger departed from Kroonstad Aerodrome (FAKS) on an agricultural survey flight and landed at Bethlehem Aerodrome (FABM) after being airborne for three hours and twelve minutes (3.2 hours). The aircraft was parked on the northern apron area, where the ground support team refuelled the aircraft with 35 litres in each tank (70 litres in total). After being on the ground for some time the pilot and passenger boarded the aircraft for the second survey flight of the day with the intension to land back at FABM where they would overnight.

The pilot elected to use Runway 11 for take-off and taxied to the intersection, which was 82m from the threshold. The prevailing surface wind at the time was 328° at 7.4kt gusting 10.7kt. This information was obtained from the South African Weather Services, which had a weather station on the aerodrome. From video footage that was obtained from a fixed camera that was installed at one of the aircraft maintenance facilities on the aerodrome, the aircraft can be seen to rotate approximately 262m from where it commenced with the take-off roll. Following rotation, the aircraft yawed to the left, it then disappeared for a period of six seconds behind an obstruction before it impacted with the ground in steep nose down attitude. Shortly after impact smoke emerged from the engine nacelle and shortly thereafter a post impact fire erupted. Thick black smoke could then be seen blowing in a south-easterly direction. Several people that were working on the aerodrome rushed to the scene, some with portable fire extinguishers which they used to try and contain the fire. The two occupants survived the accident but sustained serious burn wounds. They were attended to by paramedics on the scene and were later flown by two EMS helicopters to a hospital in Johannesburg that had a specialised unit that deals with burn wounds/injuries. Both occupants succumbed to their injuries within 24-hours following the accident.

The investigation determined that the aircraft took-off with a tail wind component. Once airborne and ground effect had dissipated the aircraft stalled and impacted with the ground.

SRP date	8 October 2019	Publication date	17 October 2019

Abbreviations	
AGL	Above ground level
AIID	Accident and Incident Investigation Division
AMO	Aircraft Maintenance Organisation
AMSL	Above mean sea level
ATF	Authority to Fly
ATO	Aviation Training Organisation
BKN	Broken (cloud layer)
CAVOK	Ceiling and visibility OK
C of R	Certificate of registration
CVR	Cockpit voice recorder
°	Degrees
°C	Degrees Celsius
EMS	Emergency Medical Services
FABM	Bethlehem Aerodrome
FAKN	Kroonstad Aerodrome
FAKT	Kitty Hawk Aerodrome
FDR	Flight data recorder
fps	Feet per second
ft	feet
HDPE	High-density polyethylene
hp	Horsepower
hPa	hecto Pascal
IIC	Investigator-in-charge
kg	Kilograms
kt	Knot
kW	Kilo Watt
l	Litres
lbs	Pounds
m	Meters
METAR	Meteorological Aeronautical Report
MTOW	Maximum take-off weight
mm	Millimetres
m/sec	Metres per second
nm	Nautical miles
OEM	Original Equipment Manufacturer
%	Percentage
POH	Pilot’s Operating Handbook
ROC	Rate of climb
ROD	Rate of descent
RPM	Revolutions per minute
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Services
VHF	Very high frequency
WCA	Wind Correction Angle
Z	Zulu (Term for Universal Coordinated Time - Zero hours Greenwich)

Name of Owner	**:** Spatial Intelligence (Pty) Ltd
Name of Operator	**:** Grace Air
Manufacturer	**:** Comco-Ikarus Gmbh
Model	**:** Ikarus C42B
Nationality	**:** South African
Registration markings	**:** ZU-EVW
Place	**:** Bethlehem Aerodrome
Date	**:** 19 September 2018
Time	**:** 0820Z

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 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.***

Investigations process:

The Accident and Incident Investigations Division (AIID) of the SACAA was informed about an aircraft accident, involving an Ikarus C42B, which occurred after take-off from Bethlehem Aerodrome on 19 September 2018. The AIID appointed an investigator-in-charge (IIC). The AIID will lead the investigation and issue the Final Report.

Notes:
1. Whenever the following words are mentioned in this report, they shall mean the following:

- *(Accident)- this investigated accident;*
- *(Aircraft)- the Ikarus C42B involved in this accident;*
- *(Investigation)- the investigation into the circumstances of this accident;*
- *(Pilot) – the pilot/s involved in this accident;*
- *(Report)- this accident report.*

2. Photos and figures used in this report are taken from different sources and may be adjusted from the original for the sole purpose of improve 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 addition of text boxes, arrows or lines.

Disclaimer:

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

1. FACTUAL INFORMATION

1.1 History of flight:

1.1.1 Two similar types of aircraft (Ikarus C42B) with registration markings ZU-EVW and ZU-FTO were engaged in an agricultural survey operation and had departed from Kroonstad Aerodrome (FAKS) on the morning of 19 September 2018. After take-off from FAKS, the crew of ZU-EVW continued with the agricultural survey in the Ficksburg, Fouriesburg and Clarens areas. The pilot landed at Bethlehem Aerodrome (FABM) after having been airborne for 3 hours and 12 minutes (3.2 hours). The aircraft was then refuelled, with fuel being supplied by the operator from a trailer bowser, which was supported by a ground crew member. The aircraft ZU-EVW was equipped with two fuel tanks, one on each side, which were installed directly behind the pilot and passenger seats. According to a member of the team, they uplifted 35 litres of fuel in each of the aircraft's fuel tanks. Bringing the aircraft to its maximum capacity of 70 litres of which 5 litres was unusable fuel according to the Ikarus C42 Owner's Manual and that meant that the aircraft had 65 litters useable fuel.

1.1.2 The pilot, accompanied by an observer/passenger, then boarded the aircraft ZU-EVW for their second surveillance flight of the day. They taxied onto runway 11, where the pilot commenced with an intersection take-off as illustrated in Figure 6. The intersection was 82m before the threshold of runway 11. The intention of the flight was to continue with the agricultural survey in the Frankfort, Reitz and Bethlehem area. The prevailing weather conditions, according to the meteorological aerodrome report (METAR) for FABM on 19 September 2018 at 0800Z, was 33005KT CAVOK 22/M07 Q1022=. The wind was from the northwest at 330°/5 knots, with the temperature 22°C, the dew point was -7°C and the pressure altitude setting was 1022 hPa.

1.1.3 There were several eyewitnesses to the accident. Two people were standing outside one of the large aviation companies at the aerodrome and watched the aircraft take off. Another person, who was working for the same company, saw the aircraft from inside the hangar as the hangar doors were open.

1.1.4 They saw the aircraft getting airborne from runway 11, which was 1 175m long and 15m wide and had an asphalt surface. The aircraft remained low altitude after rotation, they estimated it to be not higher than approximately 10m (33ft) to 15m (45ft) above the runway surface. They then saw that the aircraft appeared to have turned left. The left wing then dropped, and the aircraft impacted with the grass-covered field between the two runways in a steep nose-down attitude. The wreckage came to rest facing the direction of take-off, in an upright position. Approximately seven seconds after impact, a fuel-fed post-impact fire erupted, which also set the veld alight.

1.1.5 The three eyewitnesses, as well as employees from other companies at the aerodrome who has seen the flames, rushed to the scene with portable fire extinguishers, but they were unable to extinguish the fire. The fire services from the local municipality was notified of the accident and responded and extinguished the fire. A fire-fighting aircraft, ZS-LUW (Ayres S2R-T34) from one of the aviation companies based at the aerodrome, had started up for a return flight to Howick to continue with fire-fighting standby when the accident occurred. The pilot opted to use Runway 31 for take-off due to wind direction and not Runway 11 which was used by ZU-EVW. After take-off, the pilot was instructed to place one load of water downwind of the wreckage in order to contain the spread of the veld fire until the necessary ground emergency services arrived.

1.1.6 Emergency services were informed of the accident and responded to the scene. The two occupants had sustained serious burn wounds and were treated on the scene by paramedics. The observer/passenger fractured his left leg during the impact sequence. Following an assessment of their respective medical conditions, they were transferred to a private hospital in Bethlehem via road ambulances where their respective conditions were again assessed. It was decided that they should be transferred to a private hospital in Johannesburg that had a unit that specialises in burn wounds/injuries. Later that same day, two EMS helicopters transferred the patients from Bethlehem aerodrome to the hospital in Johannesburg, which was equipped with a licenced helipad. The investigator was notified the next morning that both occupants had succumbed to their injuries.

1.1.7 In addition to the eyewitnesses reports the investigator obtained video footage from a fixed surveillance camera that was installed on the side of a building that was located on the aerodrome to the right of runway 11. The camera only captured a small portion of the aerodrome as it was obstructed by a building and other structures (carport). From the footage the micro-light aircraft could be seen for a very brief period (approximately 1 seconds) where it was still on the runway (take-off roll). The camera time when the aircraft was observed for the first time was 10:24:33. It was then behind a building for a period of 5 seconds and at 10:24:38 the aircraft was visual again for a period of 5 seconds. During this period the aircraft could be seen rotating (becoming airborne), but shortly after rotation it could be seen yawing to the left. It then disappeared out of sight behind a large structure used to park aircraft under. Eight seconds later (10:24:51 camera time) the aircraft could be seen impacting with the ground in a steep nose down attitude with the left wing first followed by the nose section. Two second after impact, smoke white/greyish in colour was observed emanating from the the wreckage, and 7 seconds later a post impact fire erupted from the same area. The three eyewitnesses, who were from the same company ran to the scene and some drove on quad bikes and vehicles to the scene in order to render assistance by dousing the fire with portable fire extinguishers and others attended to the two occupants. A dense cloud of black smoke was visible after the post impact fire erupted, which was blown in a south-easterly direction, indicating that the prevailing wind was from behind the aircraft (tail wind) during the take-off roll. From the video footage it was possible to determine the point where the aircraft rotated, which was 262m from the intersection where the pilot commenced with the take-off roll. The intersection was 82m from the threshold of runway 11.

1.1.8 The accident occurred during daylight conditions, at a geographical position that was determined to be 28˚14'52.25" South 028˚20'08.33" East, at an elevation of 5536 ft above mean sea level (AMSL).

1.2 Injuries to persons:

Injuries	Pilot	Crew	Pass.	Other
Fatal	1	-	1	-
Serious	-	-	-	-
Minor	-	-	-	-
None	-	-	-	-

1.3 Damage to aircraft:

1.3.1 The micro-light aircraft was consumed by the post impact fuel fed fire that erupted.

Figure 1: The wreckage was consumed by the post impact fire

1.4 Other damage:

1.4.1 Minor damage was caused when the veld between the two runways was set alight following the crash.

1.5 Personnel information:

1.5.1 Pilot-in-command (PIC)

Nationality	South African	Gender	Male	Age	24
Licence number	027 245 6948	Licence type	Commercial		
Licence valid	Yes	Type endorsed	Yes		
Ratings	Instrument				
Medical expiry date	31 October 2018 (Class 1)				
Restrictions	None				
Previous accident	None				

According to the pilot's SACAA file, he had applied for a student pilot licence on 7 May 2013, which was accordingly issued. On 30 July 2013 the pilot conducted his skills test for his private pilot licence, which he passed. He was issued with a private pilot licence after submitting all the required forms to the CAA on 12 September 2013. He had the Jabiru series of aircraft and the Sling 2 endorsed on his private pilot licence. On 12 June 2014 he passed his skills test for a night rating, which was endorsed on his licence. On 30 October 2015 he conducted his skills test for his commercial pilot licence (aeroplane) as well as his instrument rating, which he passed. On 27 October 2016 he renewed his instrument rating and on 2 November 2016 he revalidated his commercial pilot licence.

According to the pilot's logbook he had conducted flight training on the Tecnam P2006T (ZS-SYY), which was a twin-engine aircraft over the period 30 October 2017 to 15 January 2018. On 15 January 2018 he renewed his instrument rating as well as his twin-engine pilot rating on the aircraft ZS-SYY.

The pilot conducted his familiarisation training on the Ikarus C42 type aircraft on 20 July 2018 through a CAA approved aviation training organisation (ATO) in Gauteng. According to the CAA form (CA 61-09.7) the practical flight test pertaining to this rating was 1 hour and 12 minutes (1.2 hours). The micro-light aircraft type was endorsed in his pilot licence.

According to the pilot's logbook the last entry was on 25 August 2018, when he had flown the aircraft with registration markings ZU-EPG from Klerksdorp aerodrome (FAKD) to Kitty Hawk aerodrome (FAKT).

During the period 19 August 2018 to 19 September 2018 the pilot had flown a total of 46.5 hours on the Ikarus C42 aircraft. During this period, he was flying either one of the three aircraft, the operator had in their fleet at the time, that being ZU-EPG, ZU-FTO and ZU-EVW. These hours were obtained from live tracking data (Spidertracks), which was a tracking device that was installed in all the operator's aircraft.

It was noted that on 18 September 2018 (prior to the accident) he flew 6.7 hours on the aircraft ZU-EVW, which consisted of two flights. On the morning of 19 September 2018, he flew the same aircraft again. After landing at FABM they had been airborne for 3.2 hours. The accident occurred during take-off, on what was to be their second flight of the day.

Flying experience:

*Total hours	294.2
Total past 90 days	47.7
Total on type past 90 days	47.7
Total on type	47.7

1.6 Aircraft information:

1.6.1 The Ikarus C42 is a two-seat side by side general aviation micro-light aircraft, manufactured in Germany by Comco Ikarus. The micro-light aircraft was fitted with a four cylinder horizontally opposed Rotax 912 ULS engine, with a three bladed Kiev 283 propeller. The engine power output was 75 kilowatt (kW) (100 horsepower). It has a strutted high wing, with ailerons and flaps. Its tricycle undercarriage was fixed and incorporates shock absorption on all three wheels. According to the SACAA Register this aircraft was first registered in South Africa on 13 March 2008, with a maximum take-off weight (MTOW) of 520 kg (1 146 lbs).

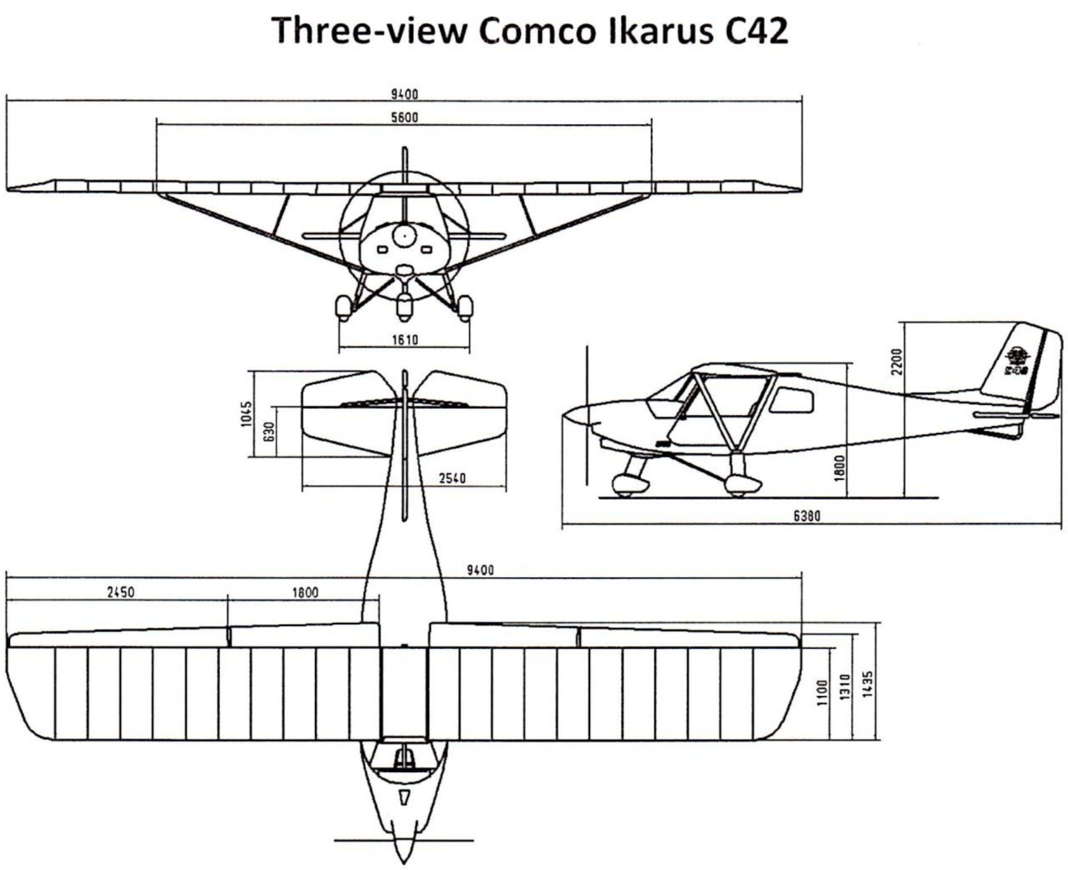


Figure 2: The dimensions of the Ikarus C42

The micro-light aircraft with registration markings ZU-FTO (Ikarus C42) was one of two aircraft that was deployed in this survey. Following the accident in question the operation was halted and the aircraft was parked at FABM. This micro-light aircraft was equipped with only one fuel tank, the reason being, it was also equipped with a ballistic parachute, which was not installed in ZU-EVW, therefore ZU-EVW could accommodate two fuel tanks.

According to information received from Ikarus Flight Center South Africa, the fuel tanks in these aircraft are fabricated from high-density polyethylene (HDPE) as can be seen in Figure 3.

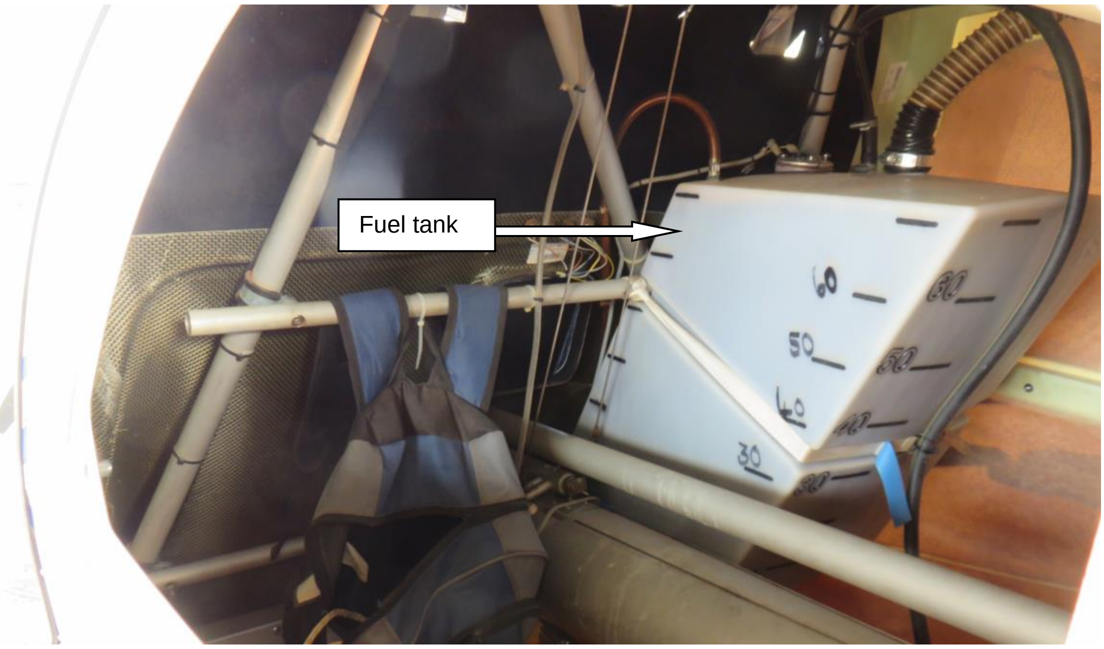


Figure 3: The fuel tank that was installed in the aircraft, ZU-FTO

Airframe:

Type	Ikarus C42B	
Serial number	0710-6920	
Manufacturer	Comco-Ikarus Gmbh	
Year of manufacture	2008	
Total airframe hours (at time of accident)	1 724.5	
Last MPI (hours & date)	1 648.1	1 August 2018
Hours since last MPI	76.4	
Authority to Fly (issue date)	15 December 2016	
Authority to Fly (expiry date)	31 December 2018	
C of R (issue date) (Present owner)	17 November 2015	
Operating category	Part 96	
Maximum take-off weight (MTOW)	520 kg	

Engine:

Type	Rotax 912 ULS
Serial number	564-8589
Hours since new	1 724.5
Hours since overhaul	TBO not yet reached

Propeller:

Type	Kiev 283
Serial number	283-1486
Hours since new	1 724.5
Hours since overhaul	TBO not yet reached

1.7 Meteorological information:

1.7.1 An official weather report was requested from the South African Weather Services (SAWS) following this accident.

"According to the satellite image that was taken at 0800Z on the day there was no significant clouds in the area.

The meteorological aeronautical report (METAR) for 0800Z for FABM contains the following weather variables:

Dry-bulb temperature	-	*22˚C*
Dew-point temperature	-	*-7˚C*
Wind direction and speed	-	*330˚ at 5 kt*
Weather phenomenon	-	*Clear skies*
Clouds amount and height	-	*No clouds*
Pressure reduced to mean sea level	-	*1022 hPa*

As per forecast models, the wind speed increased in height. At FL070 the wind was already about 20 kt, and approaching 40 kt at FL100.

Low-level weather charts indicate that there was severe turbulence between FL050 and FL100 over the area covering the aerodrome and moderate turbulence between FL100 and FL120."

1.7.2 Weather station on Bethlehem Aerodrome

The data captured in the table on the next page was obtained from the Bethlehem weather station for 19 September 2018. The data was available in five-minute intervals. The weather information at the time of the accident (0820Z) has been highlighted in bold in the table. *NOTE: The wind data as contained in the table below were measured in true north, a variation of 20˚ should be added to convert it to magnetic north. This was done to the wind direction that was captured at 0820Z.

Time (Zulu)	Wind speed m/sec **(knots)**	Wind direction from True North **(Magnetic North)**	Wind gust m/sec **(knots)**	Temperature ˚C	Humidity %	Rain mm
0810	3.1	310.7	4.5	23.7	13.4	0
0815	3.1	316.7	4.8	24.2	12.7	0
0820	**3.8 (7.4)**	**308.4 (328.4)**	**5.5 (10.7)**	**24.5**	**13**	**0**
0825	3.4	320.3	5	25	12.8	0
0830	2.7	310.9	4.1	15.5	12.9	0

Figure 4: The wind component (Source: https://www.e6bx.com)

1.7.3 Pressure altitude

Pressure altitude (PA) = Elevation + 30 x (1013 – QNH)

PA = 5 536 + 30 x (1013 – 1022)
= 5 536 + 30 x (-9)
= 5 536 – 270
= 5 266

1.7.4 Density altitude

Source: http://www.pilotfriend.com/pilot_resources/density.htm

Elevation	5 266 ft
Air temperature	24.5˚C
Dew point	-7˚C
Altimeter setting	1022 mb

Density altitude at take-off	**7 295 ft**	**2 223 m**

1.7.5 The aerodrome windsock

The photograph in Figure 5 was obtained courtesy of a person that was at the aerodrome when the accident occurred and made it available to the investigator. Some smoke from the veld fire, which was as a result of the accident was still visible in the background.

Figure 5: Windsock at FABM, with the smoke from the veld fire (post-accident) still visible

1.8 Aids to navigation:

1.8.1 The micro-light aircraft was equipped with standard navigational equipment. It also had a Gamin 296 GPS unit installed, which was destroyed by the post impact fire.

1.9 Communication:

1.9.1 The micro-light aircraft was fitted with a Garmin SL-40 VHF radio. The designated aerodrome traffic advisory frequency in use was 124.80 MHz.

1.9.2 The micro-light aircraft was fitted with a Garmin GTX-327 transponder.

1.10 Aerodrome information:

1.10.1 The accident occurred 67m to the left of the centreline of runway 11 at FABM, which was a licenced aerodrome and had one asphalt runway, which was orientated 11/29, which was 1 175m long and 15m wide. There was also a grass surface runway, which was orientated 13/31, which was 1 311m long and 46m wide. Runway 11 as well as 13 sloped up wards.

Aerodrome	Bethlehem Aerodrome (FABM)	
Aerodrome Coordinates	28°14'52.25" South 028°20'08.33" East	
Aerodrome Elevation	5 561 feet above mean sea level	
Runway Designations	11/29	13/31
Runway Dimensions	1 175 x 15m	1 311 x 46m
Runway Used	11	
Runway surface	Asphalt	
Runway slope	Up slope	
Approach facilities	Runway lights	
Aerodrome status	Licensed	
Aerodrome Rescue & Fire Fighting	ARFF services were not available at the aerodrome.	

1.10.2 There was no aerodrome rescue and firefighting (ARFF) personnel based at the aerodrome. People working at several of the aircraft maintenance organisations (AMO) on the aerodrome responded with fire extinguishers as well as a first aid kits to the scene of the accident. The fire services from the local municipality was notified of the accident and they responded to the scene and extinguished the fire.

1.10.3 See aerodrome chart attached to this report as Annexure A.

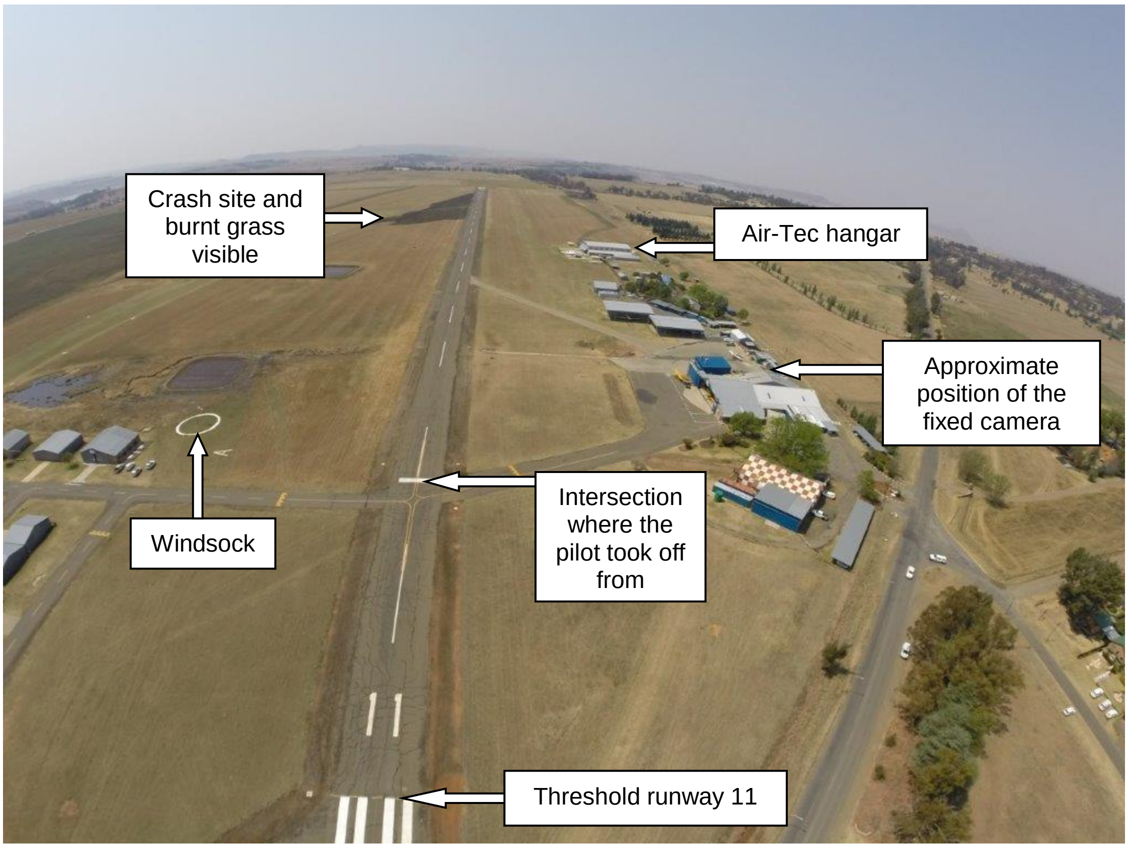


Figure 6: An aerial view of the Bethlehem aerodrome (photograph courtesy of Kobus Smit)

Figure 7: Runway 11, which had an up slope (photograph was taken by the Investigator)

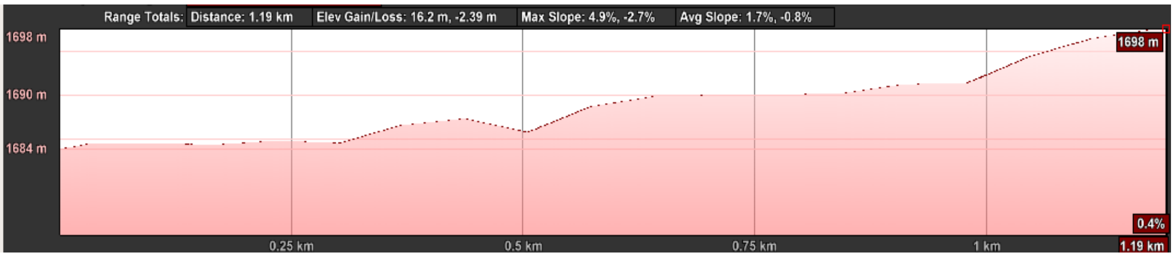


Figure 8: Up slope for runway 11 left to right (Source: google earth)

1.11 Flight recorders:

1.11.1 The micro-light aircraft was not equipped with a flight data recorder (FDR) neither a cockpit voice recorder (CVR), nor was it required to be fitted to this type of aircraft.

1.11.2 The operator had a real-time tracking system installed in all their aircraft to assist them with tracking, managing and communicating with the aircraft. This was possible from an internet connected device; via an application (App) on a smart phone, tablet, or computer/laptop. The system they utilised was Spidertracks (https://www.spidertracks.com).

1.12 Wreckage and impact information:

1.12.1 The aircraft impacted with grass covered terrain within the aerodrome parameter 67m to the left of the centreline of runway 11. It was noted that the composite blades from the propeller broke off at the hub assembly (see Figure 9) when the nose section impacted with the ground. The airspeed indicator as can be seen in Figure 13 was the only instrument that was located on the site, from which a reading could be obtained. It had a dual speed indication with miles per hour (mph) displayed on the outer circumference and knots on the inner circumference. The needle evidence mark indicated a speed of just above 100 kts / 54 mph. The wreckage came to rest in the direction of take-off approximately 180m from the point where the aircraft was observed to rotate and basically in line with the position where two eyewitnesses (first responders) were standing when the accident occurred. The distance from where the eyewitnesses (first responders) were standing to the accident site was approximately 170m.

Video footage was obtained from a fixed surveillance camera that captured a portion of the aerodrome. It could be seen from the footage that the aircraft was in a steep nose down attitude (at nearly 90˚ to the ground) when the left wing followed by the propeller/nose section first impacted with the ground. This is in line with the first impact markings on the scene, which was not destroyed when the veld caught fire. The micro-light aircraft then rotated through approximately 90˚, remaining stationary in an upright attitude (tail in the air for a very brief period). The aircraft came to rest in an upright position facing in the direction of take-off and was consumed by the post impact fuel fed fire that erupted.

Figure 9: Nose impact markings with propeller blade fragments visible

Figure 10 below shows the direction which the aircraft was facing post-accident and the runway is positioned behind the wreckage. Figure 11 and 12 shows the position of the engine with a missing propeller assembly within the wreckage area.

Figure 10: The burnt-out wreckage [photograph was taken in the direction of take-off (110°)]

Figure 11: The engine was found in an upright position

Figure 12: A closer view of the engine gearbox and the propeller flange assembly

Figure 13: The airspeed indicator as it was found on site, indicating a speed of approximately 100 kt / 54 mph

1.13 Medical and pathological information:

1.13.1 By the time this report was concluded no official post-mortem reports was available for either of the two occupants that have succumbed to their injuries following the accident, even after asking for assistance from the family and the South African Police Services (SAPS). The hospital reports indicate the cause of death to be: Severe burn wounds sustained during an aircraft accident.

1.13.2 The pilot was the holder of a valid Class 1 aviation medical certificate.

1.14 Fire:

1.14.1 Approximately 6 seconds after the aircraft impacted with the ground in a steep nose down attitude a fuel fed post-impact fire erupted from what appear to be the engine compartment. The timeline was obtained from video footage of a fixed camera that was positioned at one of the aircraft maintenance organisations at the aerodrome.

1.14.2 There was no aerodrome rescue and fire-fighting (ARFF) personnel stationed at the aerodrome. People, from several of the AMO's at the aerodrome rushed to the scene with portable fire extinguishers to assist the occupants and extinguish the fire. The fire services from the local municipality was informed of the accident and they dispatched to the scene. The micro-light aircraft was consumed by the fuel-fed post impact fire.

1.14.3 In Figures 14 and 15 below the wreckage could be seen where it is still on fire. It should be noted that this photograph was taken after the two occupants were removed from accident site by first responders and medical emergency personnel that responded to the accident site.

1.14.4 The black smoke could have been attributed to the petroleum-based material that was burning, which would have included the tyres of the aircraft and the fabric/composite materials used during the manufacturing process.

1.14.5 The fire and smoke direction in figure 14 below provide an indication of what the prevailing wind conditions were like at the time of the accident.

Figure 14: Part of the wreckage still on fire, with the smoke blowing in the direction of take-off

Figure 15: Fire services personnel from the local municipality extinguishing the fire

1.15 Survival aspects:

1.15.1 The accident was considered not survivable due to the fact that: (i) The structural integrity of the aircraft after initial impact remained fairly intact. (ii) The post-crash environment, in this case the post impact fire, however presented an immediate threat to the occupants as well as the rescuers.

1.15.2 The two occupants sustained extensive burn wounds and were both airlifted by two EMS helicopters respectively. They were flown to a hospital in Johannesburg that was equipped with a unit specializing in burn wounds/injuries. However, due to severity of their burn injuries they both succumbed to their injures within 24-hours following the accident.

1.15.3 The fact that the two fuel tanks, which were manufactured of the none-crashworthy type of material, were located directly behind the cockpit/cabin area contributed significantly to the intensity of the post impact fire and the burn wounds that were sustained by the two occupants.

1.15.4 Neither of the occupants were wearing any fire-resistant clothing (i.e., Nomex flying overhauls), nor were they flying with helmets.

1.15.5 A substantial number of people that were working on the aerodrome responded to the scene of the accident within seconds after impact. They used a substantial number of portable fire extinguishers, but they were unable to extinguish the post impact fire. The local fire services were notified of the accident and they managed to dose the fire.

1.15.6 Some of the first responders rendered first aid assistance to the two occupants until emergency medical personnel (paramedics) arrived at the scene.

1.16 Tests and research:

1.16.1 None was considered necessary.

1.17 Organizational and management information:

1.17.1 The aircraft was being operated under Part 96 of the CARs. The operator was in possession of a valid air operating certificate (AOC) and the aircraft was duly authorised to operate under the AOC. The AOC of the operator was renewed by the CAA on 12 September 2018 and was valid until 31 August 2019.

1.17.2 The aircraft was being operated commercially and was in possession of a valid authority to fly, which was valid at the time of the accident and it was due to expire on 31 December 2018.

1.17.3 The aircraft was maintained by an approved aircraft maintenance organisation (AMO) that was located in Gauteng.

1.18 Additional information:

1.18.1 The take-off leg

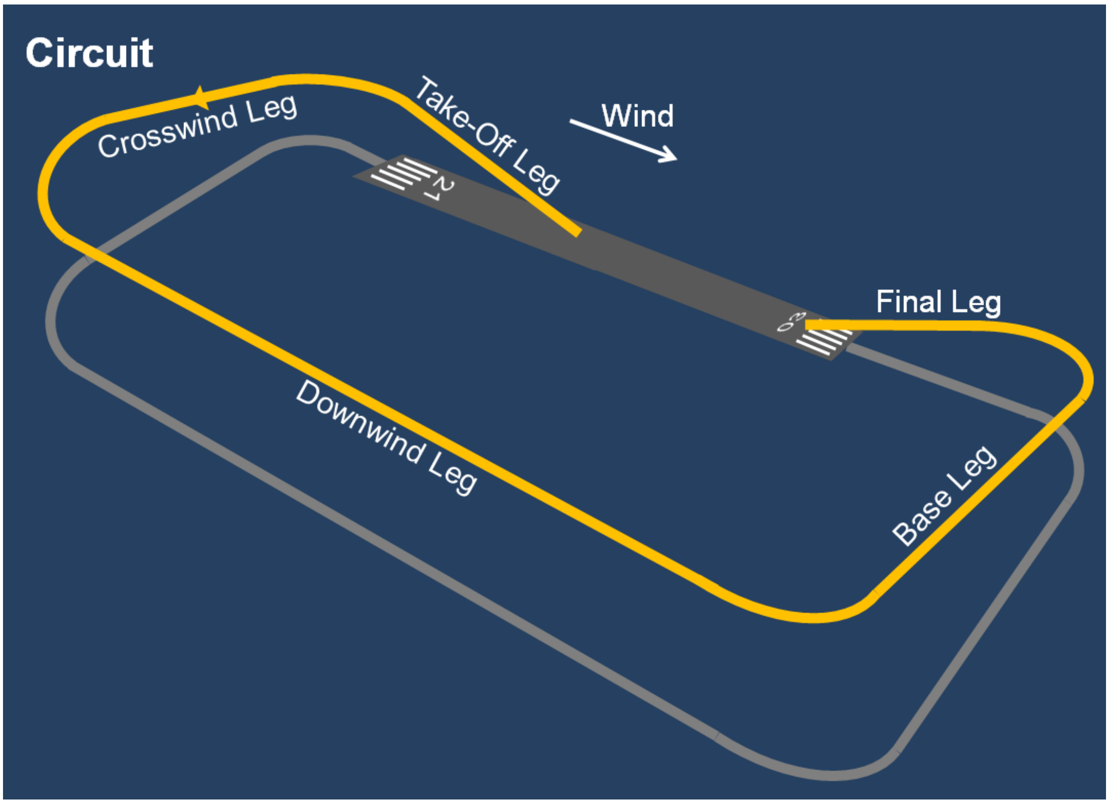


Figure 16: Example of an airfield circuit layout with the take-off leg being into wind as illustrated
Source: www.ppl-flight-training.com/circuits-briefing.html

"It is customary to take off into the wind. This is sensible, since lift is dependent on airflow over the wing from the leading edge flowing over the trailing edge. The wing doesn't care whether the lift is from wind blowing over it, or from the power of the engine moving the aircraft forward.

With the aircraft cowling pointing into say a 10-knot wind, you will have 10 knots of airflow over the wing before you apply any power. This means you will reach your rotate and flying speed a lot sooner, which will reduce your ground roll.

Another advantage is that your angle of climb will be increased, so if you have to clear obstacles, a brisk wind assists you to do so.

During a downwind departure, a higher ground speed is needed to take-off and therefore a longer runway will be required. Another effect is that the climb-out angle is lower due to the tailwind, lowering the obstacle clearance and increasing the risk of controlled flight into terrain (CFIT)."

1.18.2 Wind direction on take-off in relation with the two runways at FABM

Figure 15 provide a schematic of the direction of the prevailing wind when ZU-EVW took-off from runway 11. A tailwind component was present, which was blowing from the left aft position at an angle of approximately 42˚ onto the aircraft fuselage during the take-off roll and subsequent rotation according to the wind data received.

With the wind as assessed at the time, it was 18˚ from the right front (into wind) when runway 31 would have been used, yet the pilot of ZU-EVW opted to take-off from runway 11.

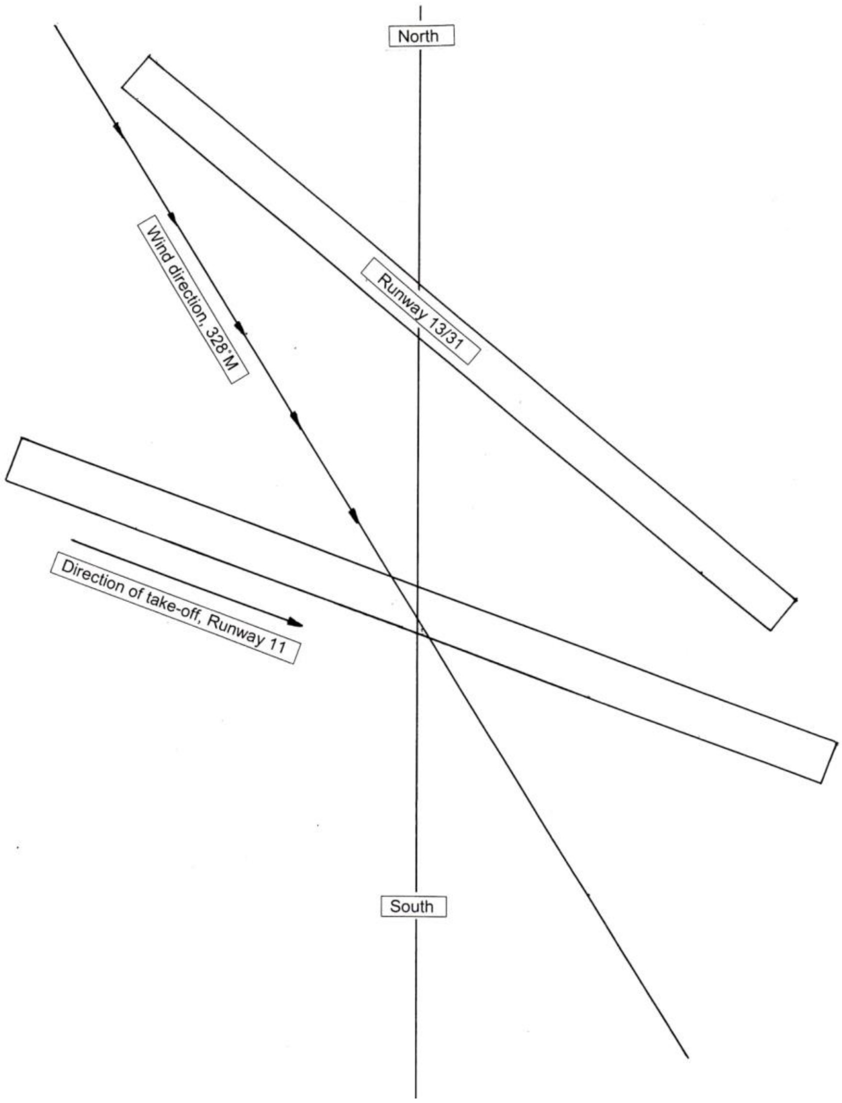


Figure 17: Schematic indicating the prevailing wind at the time in relation with the two runways at FABM

1.18.3 Wind correction angle (WCA)

The wind correction angle (WCA) for take-off is illustrated in Figure 16 was calculated to be -10˚ (100˚), which was then subtracted from the take-off course, which was 110˚. A wind speed of 10.7 knots was used during the calculation as it was evident from the video footage that the wind was gusting at the time.

In the calculations to determine the WCA a true airspeed of 40 knots was used, which equated to a ground speed of 48 knots if the wind correction was taken into account. This speed was 2 kt above the value as captured on the airspeed indicator that was found on the accident site as displayed in Figure 13 of this report.

These calculations were made by making use of an online-based calculation program, source: https://www.e6bx.com.

According to information that was obtained from the Ikarus Flight Center, South Africa they state that *"Take-off with the Ikarus C42 is almost without exception with one notch of flaps (half flaps). The stall speed in this configuration is VS2 38 kt IAS or 40 kt EAS (74 km/h at 540kg TOW)."*

Figure 18: Schematic of the prevailing winds at the time of the accident flight

1.18.4 Ground Effect

Source: https://www.skybrary.aero/index.php/Ground_Effect

Definition

"Ground effect is the positive influence on the lifting characteristics of the horizontal surfaces of an aircraft wing when it is close to the ground. This effect is a consequence of the distortion of the airflow below the surfaces attributable to the proximity of the ground.

Aerodynamic Theory

The increase in lift created by ground effect comes primarily from the reduction in the amount of induced drag generated, which improves the lift/drag ratio. In most circumstances, this increased lift is supplemented by a direct increase in the lift generated by the wing.

The reduction in induced drag – so called because it is a function of the lift generated by the wing – occurs at the wing tip. When generated in proximity to the ground, the form of the wing tip vortex, which is always generated when an aerofoil moves through the air, because pressure beneath a wing is always higher that that above it, is modified. Instead of being circular, vortices in proximity to the ground become elliptical as the airflow is pushed outwards. This causes the effective aspect ratio of the wing to become greater than the geometric aspect ratio and reduces induced drag. Both lift (and airspeed for any given engine power setting) are increased.

The direct effect on lift arises because a reduction in both upwash and downwash, as the air beneath a wing is compressed by ground proximity, creates a cushion effect. The effect is proportional to the chord of the wing but the extent to which it occurs is dependant upon the profile of the lower wing surface. If this lower surface is markedly convex, and the angle of attack is small, then the effect on lift eventually becomes negative.

The overall effect of an improved lift/drag ration when a wing is in ground effect is that a given amount of lift will be produced at a lower angle of attack than would be required in free air.

Stalling angle of attack

In ground effect, the angle of attack required before a wing stalls, for a given amount of lift, is reduced. The extent of this decrease in stalling angle of attack will vary according to the nature of the aerofoil but can be several degrees. The difference will also be affected by any reduction in the maximum lift coefficient of a particular wing in ground effect, compared to that coefficient in free air.

A generic portrayal of the difference in stalling angle of attack in and of the ground effect is provided below. Since bringing the wing into ground effect increase lift, it follows that a given angle of attack will reach maximum lift at a lower angle of attack than it would in free air – but also that maximum lift will be less than in free air because of the reduced drag.

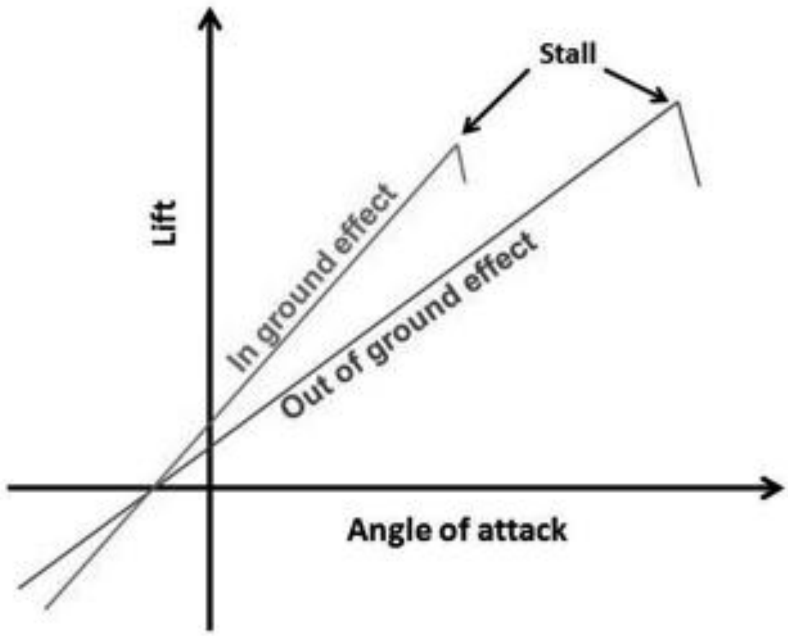


Figure 19a: Stall in relation to lift and angle of attack

The Extent of Ground Effect

Since the 'lift bonus' attributed to ground effect is primarily a consequence of a reduction in induced drag, the way in which this change with height above the ground is effectively a proxy for changes in the loft-coefficient. As can be seen from the diagram below, induced drag increases non-linearly as the distance from the *ground increases and reaches its free air value at a height above ground equivalent to the wingspan of a fixed wing aircraft. This means a rapid drop off of ground effect as height above the ground increases so that it is typically reduced to half of the adjacent-to-surface maximum at a height above the ground which is equal to 10% of the wing span, to a quarter of this at a height equivalent to 25% of the wing span and to 10% of it by the time this height is equivalent to 90% of the wingspan. The detail, but not the principle, of this height-based change in ground effect will be affected by the extent to which a wing is swept back.*

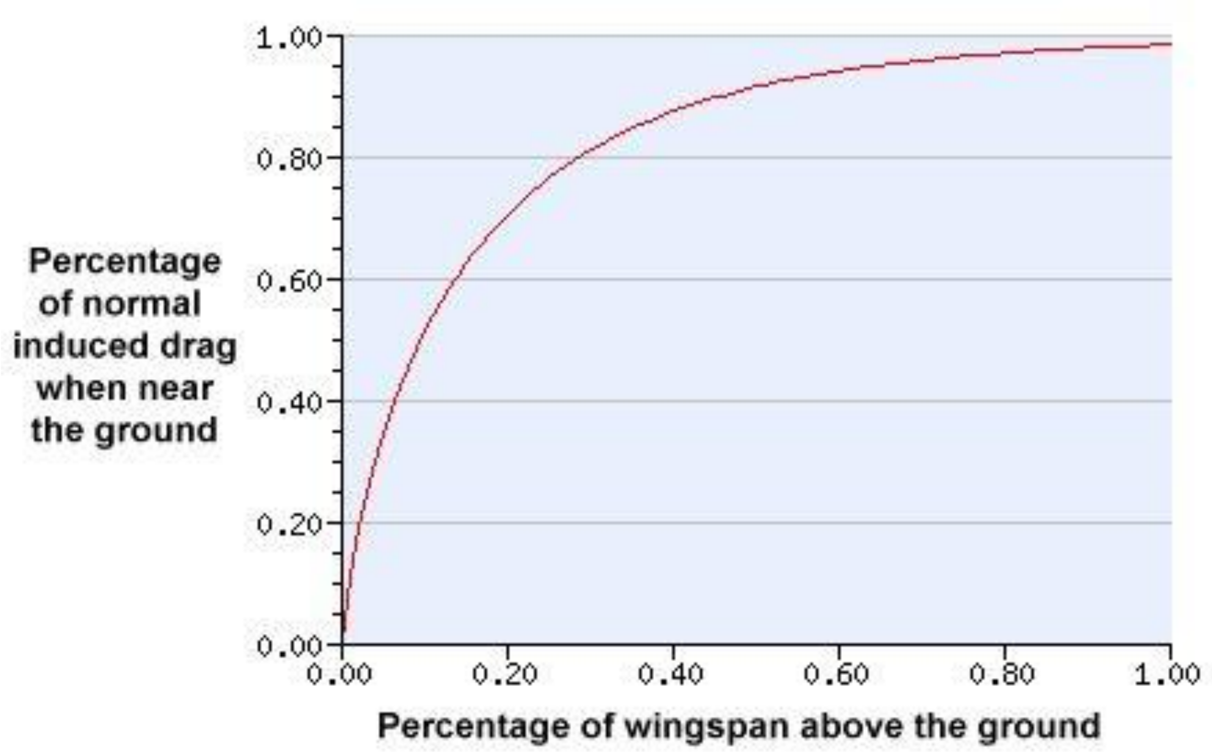


Figure 19b: Increase in induced drag as ground effect dissipates

Taking the wingspan of a fixed wing aircraft which is usually expressed in metres and converting it to feet as usually used in measuring height above the ground.

Ground effect is maximised in calm wind conditions and over a smooth and level hard surface. The effect over grass, an uneven surface and sometimes over water is likely to be much less. Not surprisingly, fixed wing aircraft with low wing fuselage attachment receive maximum ground effect.

The Implications of Ground Effect

In normal flight operations, awareness of ground effect is important during the landing flare since it will exacerbate any tendency of an aircraft to float if either airspeed over the threshold or pitch control is not optimum. It has been suggested *that wake vortices descending into the ground effect may not necessarily move laterally away from the runway upon reaching it as usually stated but can rebound.*

In the case where either rotation for take-off or an attempt to conduct a go around after touch down is initiated at too low a speed for the aircraft configuration or weight, ground effect may lead to an initial airborne state, which cannot be sustained as the distance from the runway surface increase and the lift premium from the ground effect reduces. However, it may be possible in some of these cases to accelerate in ground effect to attain a speed compatible with flight in free air before pitching up and leaving ground effect."

1.18.5 Wingtip Vortices

Source: https://howthingsfly.si.edu/aerodynamics/vortex-drag

"The pressure imbalance that produces lift creates a problem at the wing tips. The higher-pressure air below a wing spills up over the tip into the area of lower-pressure air above as can be seen in Figure 20. The wing's forward motion spins this upwards spill of air into a long spiral, like a small tornado, that trails off the wing tip. These wing tip vortices create a form of pressure drag called vortex drag.

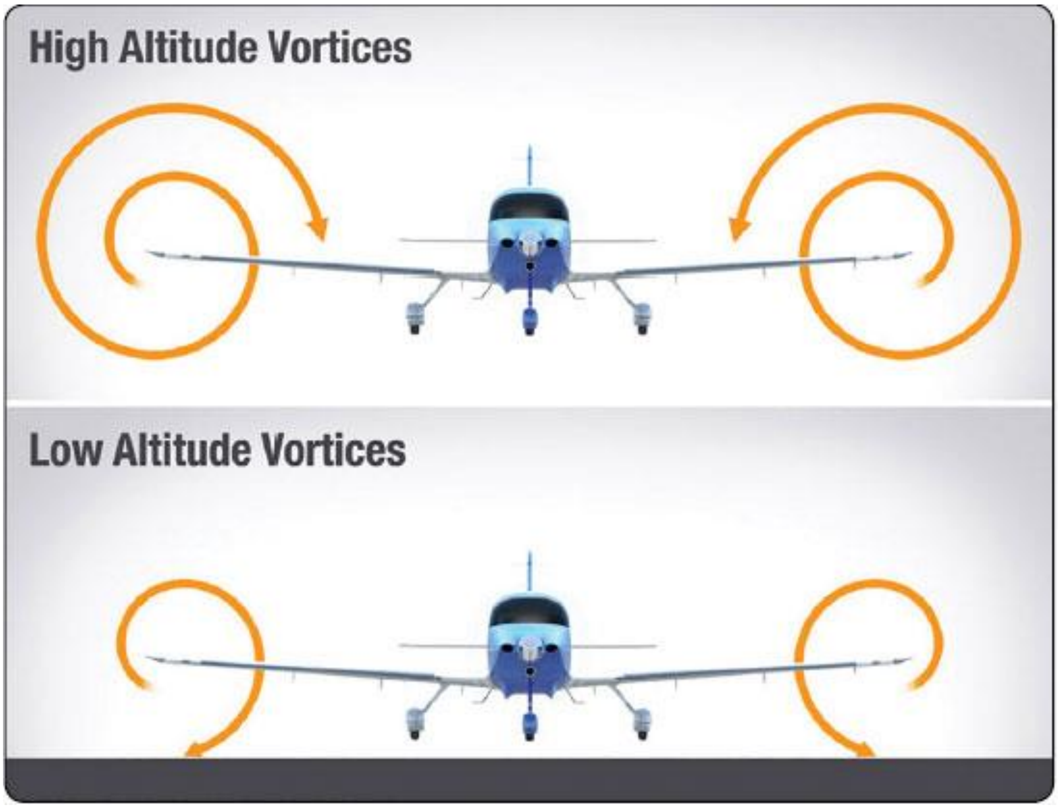


Figure 20: Schematic illustrating the effect of wingtip vortices

Vortices reduce the air pressure along the entire rear edge of the wing, which increases the pressure drag on the aircraft. The energy required to produce a vortex comes at the expense of the forward motion of the aircraft.

Tilting the aircraft's wings upwards makes the vortices stronger and increases vortex drag. Vortices are especially strong during take-off and landing, when the aircraft is flying slowly with its wings tilted upwards".

1.18.6 Effects of Downwash on Lift

Source: https://www.grc.nasa.gov/www/k-12/airplane/downwash.html

"There are many factors, which influence the amount of aerodynamic lift, which a body generates. Lift depends on the shape, size, inclination, and flow conditions of the air passing the object. For a three-dimensional wing, there is an additional effect on lift, called ***downwash.***

For a lifting wing, the air pressure on the top of the wing is lower than the pressure below the wing. Near the tips of the wing, the air is free to move from the region of high pressure into the region of low pressure. The resulting flow is shown on Figure 17 by the two circular red lines with the arrowheads showing the flow direction. As the aircraft moves, a pair of counter-rotating vortices area formed at the wing tips. The lines marking the centre of the vortices area shown as red vortex lines leading from the wing tips. If the atmosphere has very high humidity, you can sometimes see the vortex lines on an airliner during landing as long thin "clouds" leaving the wing tips. The wing tip vortices produce a ***downwash*** *of air behind the wing, which is very strong near the wing tips and decreases towards the wing root. The effective angle of attack of the wing is decreased by the flow induced by the downwash, giving an additional, downstream facing, component to the aerodynamic force acting over the entire wing. The downstream component of the force is called* <u>*induced drag*</u> *because it faces downstream and had been "induced" by the action of the tip vortices. The lift near the wing tips is defined to be perpendicular to the local flow. The local flow is at a lower effective angle of attack than the free stream flow because of the induced flow. Resolving the tip lift to the free stream reference produces a* ***reduction*** *in the lift coefficient of the entire wing.*

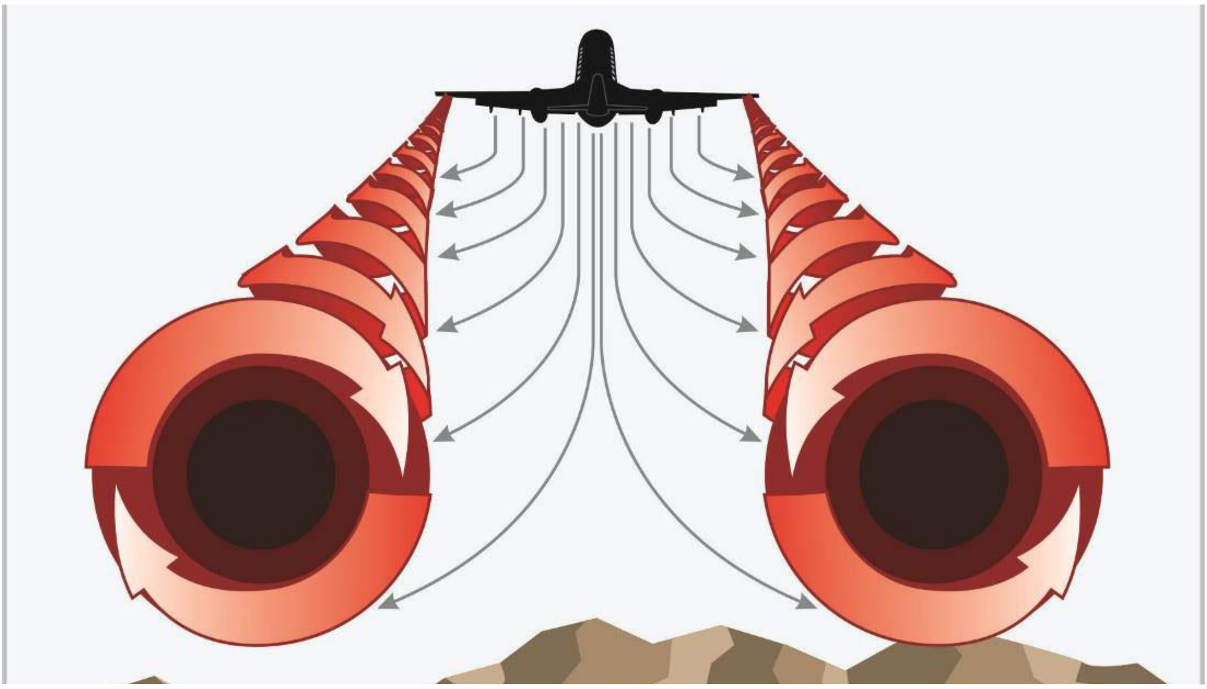


Figure 21: Schematic illustrating the effect of wingtip vortices

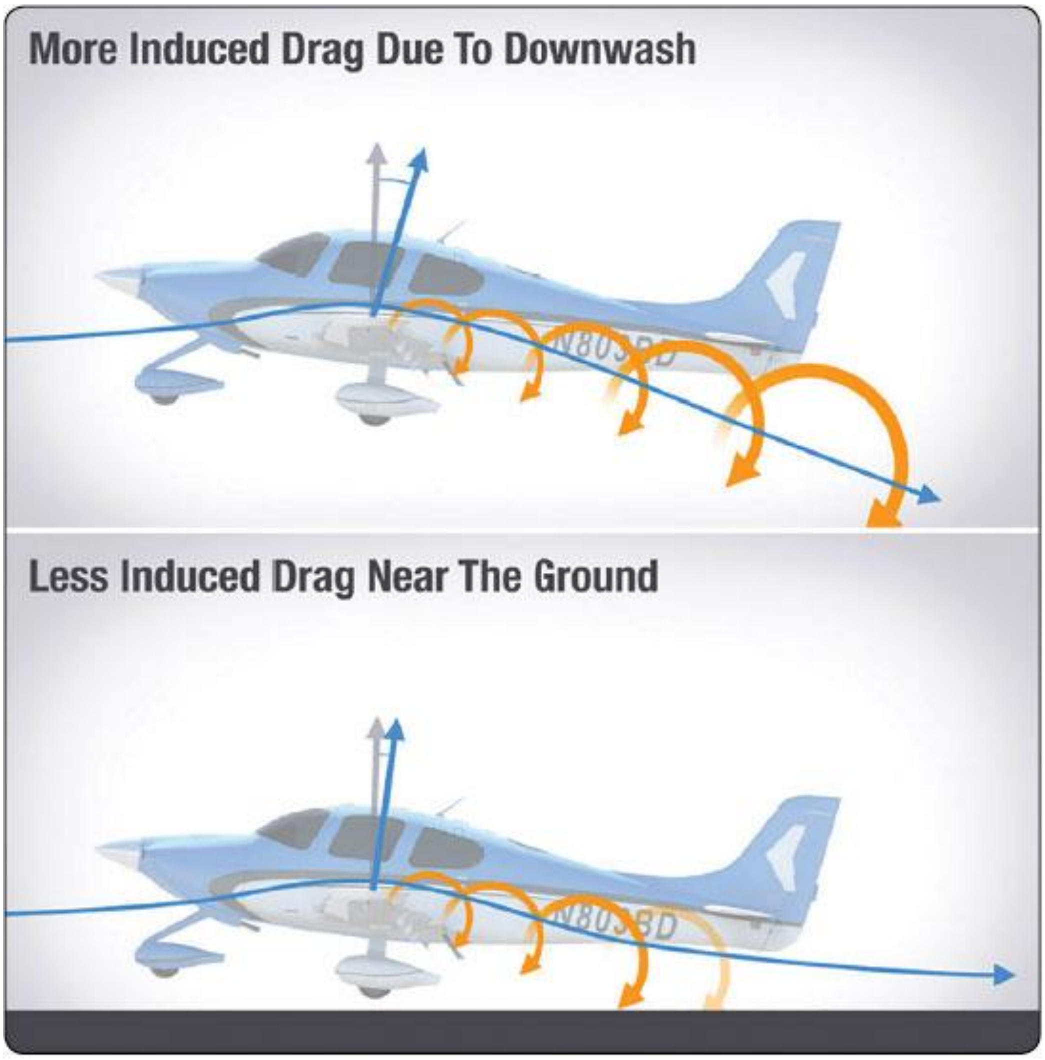


Figure 22: Schematic illustrating the effect of downwash on induced drag

1.19 Useful or effective investigation techniques:

1.19.1 No new methods were used.

2. ANALYSIS

2.1 Man (Pilot)

The pilot was 24 years of age and was the holder of a valid commercial pilot licence. He was also the holder of a valid Class 1 aviation medical certificate, which was renewed on 4 October 2017. The pilot conducted his familiarisation training on the Ikarus C42 type aircraft 20 July 2018. During the period 19 August 2018 to 19 September 2018 he had flown a total of 46.5 hours on the Ikarus C42 aircraft. At the time of the accident, he had accumulated a total of 47.7 flying hours on the aircraft type.

He had flown 6.7 hours with the aircraft ZU-EVW the previous day and had completed one flight of 3.2 hours on the morning of 19 September 2018. This flight originated at Kroonstad Aerodrome and they flew along a designated route for survey purposes before they landed at FABM. After landing they spend some time on the ground and during that period ground support personnel refuelled the aircraft for the next flight of the day.

The pilot opted to use runway 11 for take-off from FABM for the second flight of the day. The prevailing wind at the time was 328˚M at 7.4kts gusting 10.7kts. From where the aircraft was parked to the intersection the pilot taxied past a designated windsock, which provided to him a good indication of what the wind was like at the time. The pilot however, opted for an intersection take-off from runway 11. The intersection was 82m past the threshold of runway 11.

From the video camera footage, it was determined that the aircraft rotated approximately 262m from where the pilot commenced with the take-off roll. From the time of rotation until it impacted with the ground to the left of runway 11 was 10 seconds. It was further evident from the footage that the aircraft basically immediately after rotation yawed to the left, the pilot was not able to arrest the situation and allowed the aircraft to stall and ground impact followed.

2.2 Machine (Aircraft)

This was a micro-light aircraft, which had a maximum take-off weight of 520kg. There were no mechanical defects reported to the ground support personnel when the aircraft was on the ground at FABM being refuelled for the next flight. The pilot had flown the same aircraft the previous day for a duration of 6.7 as well as the morning prior to the accident flight.

The aircraft had a wingspan of 9.4m (30ft). The height of the wings was 1.8m (6ft) from the ground with the aircraft being parked on level ground. With these figures in mind, once the aircraft become airborne and start climbing, at a height of approximately 7.3m (24ft) above the runway surface (one time the wingspan height), ground effect will start to dissipate, induced drag increased, and lift decreased, which caused the aircraft to stall.

The last maintenance inspection that was carried out on the aircraft prior to the accident flight was certified on 1 August 2018, and subsequent to the inspection a further 76.1 hours were flown over a period of 7 weeks with the aircraft. The reviewed aircraft maintenance records confirm that the aircraft had no defects prior to the accident flight.

2.3 Environment

The prevailing wind at the time of take-off according to the data received from the Bethlehem weather station was 328˚M at 7.4kt gusting 10.7kt. Runway 31 would have been the most appropriate runway to use should the pilot have opted to do an into wind take-off, as the wind would have been slightly from the right on the nose of the aircraft instead of the 138˚ from the tail as was the case during the take-off from runway 11.

The one thing pilot's have no control over during their flight planning phase as well as during the actual flight, is the weather conditions. It is therefore of utmost importance that pilot's conduct their flight planning with as much detailed information as possible especially with regard to the prevailing weather conditions at point of departure, en-route and their intended final destination, should they not opt to divert. Even tough comprehensive weather reports are issued at regular intervals, some of the information contained in these reports might not be 100% accurate for the specific place or area prior to departure. Many flights are being conducted to remote areas, for which there are no official weather forecast or weather data available. The only option the pilot has is to contact a person or persons on the ground at his/her intended destination prior to take-off. In many cases the area can be so remote that there are no people living there.

Prior to take-off the pilot taxied from the apron area on the northern side of the aerodrome where the aircraft was refuelled via the taxiway to the runway intersection as depicted in Figure 6 on page 17 of this report. In order to get to the runway intersection, the pilot had to taxi past the aerodrome windsock, which was located approximately 45m from the taxiway centreline. This would have given him a clear indication of what the prevailing wind conditions was at the time.

From the video/camera footage, thick black smoke emerged following the post impact fire. The prevailing wind at the time being from the northwest blew the smoke in a south-easterly direction. It also set the veld alight which supported the fact that a tail wind prevailed at the time.

It should be noted that there was a weather station on FABM as can be seen in Figure 24. Accurate weather data was available to the pilot should he have opted to contact the local weather office, but he most probably trusted on the visual clues / observations that was available to him, seeing they were going to return to FABM.

Figure 24: The weather station at FABM (Photograph was taken by the Investigator)

2.4 Mission

The flight to be conducted was nothing out of the norm, the pilot was aware of what was required of him. During the past 30 days he had flown 46.5 hours on the Ikarus C42 type aircraft.

2.5 Crash survivability

This accident was considered not survivable as the structure of the aircraft remained fairly intact as can be seen from the video footage as it was associated an approximate speed of 100kt / 54 mph). It was however not possible to determine the injuries or seat damage which could have led to the occupants not being able to vacate the aircraft in time and before they could sustain burn injuries. The post-crash environment presented the immediate threat as a post-impact fuel fed fire erupted. The fuel tanks of this aircraft, which was of the non-crashworthy type (being manufactured from high-density polyethylene (HDPE) were installed directly behind the two cockpit seats. The fuel that spilled from these tanks, which perished during the impact sequence intensified the post-impact fire, which rendered a threat to first responders/rescuers and the two occupants. Though the first responders/rescuers responded to the scene with several portable fire extinguishers they were unable to extinguish the fire.
As to why the aircraft manufacturer had not opted to install the fuel tanks within the wings, as is the case with most high wing aircraft was unknown. What further aggravated the situation was that the fuel tanks were manufactured from a high-density polyethylene, which displayed very little, if any crashworthy integrity. This design option should be regarded as a significant factor when considering the crashworthiness protection of the occupants that were on board the aircraft.

The fact that neither of the occupants were wearing fire-resistant clothing, increased their exposure to the post impact fire considerably, as they both sustained severe burn wounds.

2.6 Conclusion

The take-off is the only manoeuvre in flying that gives the pilot unlimited time to plan because once the aircraft becomes airborne the scenario changes considerable. The pilot should have had all the information available he needed before commencing with the take-off to ensure the take-off could succeed considering all the possible factors, conditions and margins. Most take-off accidents are not as a result of an engine failure, (with emphasis on single-engine aircraft), it involves improper flight planning. Planning should be accurate, realistic and every detail should be considered, to keep the pilot and his passenger(s) out of any possible situation that could cause the aircraft to stall after take-off or collide with obstacles and or terrain. The pilot should therefore have a firm plan of action in mind before he or she commence with the take-off roll.

Taking into consideration the information that is depicted in Figure 16 on page 27 of this report, which provides the orientation of the two runways at FABM and the prevailing wind conditions at the time. From this illustration it could be seen that if the pilot had planned the flight better, he would have most probably opted to make use of runway 31, which would have allowed for an into wind take off. The pilot that was flying ZS-LUW, which was the first aircraft that took-off from FABM following the accident in question, did opt to use runway 31 due to the prevailing wind conditions, which was still from the northwest (unchanged) at the time. Taking off into wind increases lift, and also assist the aircraft in becoming airborne at a lower ground speed and a shorter take-off roll is required.

The aircraft encountered a tailwind component from the left aft position as depicted in the illustration in Figure 25 on page 41. This would also explain the observation that was made from the video footage, where the aircraft was observed to yaw to the left after rotation, which was a classic weathercock / weathervane effect.

With the tail wind component the ground speed was substantially higher than the true airspeed, the speed could have felt to the pilot adequate to rotate the aircraft, which he did, however once the aircraft exited ground effect, which was at a height of approximately 20 to 30ft above the runway surface the induced lift that supported the aircraft to sustain flight dissipated and was no longer available. The flight characteristics of the aircraft changed rapidly and the left wing, stalled before the right wing. It could be that the pilot then used aileron control to attempt to ‘pick up’ the left wing, which would have increased the angle of attach (AoA) and further stalled the wing, which rendered recovery impossible due to insufficient altitude being available.

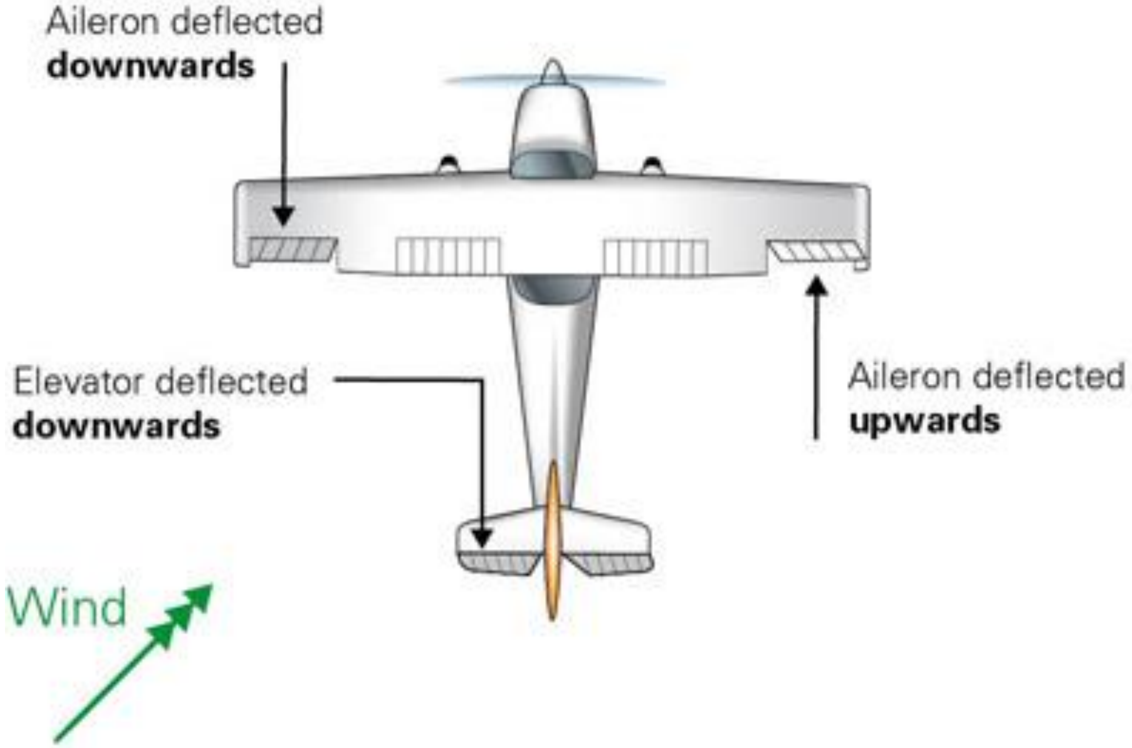


Figure 25: Illustrates the position of the wind on the aircraft during take off

The investigation determined that the aircraft took-off with a tail wind component. Once airborne and ground effect had dissipated the aircraft stalled and impacted with the ground.

3. CONCLUSION

3.1 Findings

3.1.1 The pilot was the holder of a valid commercial pilot licence (aeroplane). The aircraft type was endorsed on his licence.

3.1.2 The pilot was in possession of a Class 1 aviation medical certificate, which was issued on 4 October 2017 and was valid until 31 August 2019.

3.1.3 The pilot had accumulated a total of 294.2 flying hours, of which 47.7 hours were on the Ikarus C42 aircraft type, with 46.5 hours being flown during the past 30-days.

3.1.4 This was the pilot's second flight of the day as he had already flown for 3.2 hours prior to the accident flight.

3.1.5 The pilot elected to take-off from the intersection of runway 11, which was 82m past the threshold.

3.1.6 This was a commercial operation, which was conducted under the provisions of Part 96 of the CAR's. The operator was in possession of a valid air operating certificate (AOC) with an expiry date of 31 August 2019.

3.1.7 The aircraft was in possession of a valid release to service certificate that was issued on 12 July 2018 and would have lapsed on 1 748.1 airframe hours or 31 December 2018, whichever comes first.

3.1.8 The aircraft was in possession of a valid authority to fly that was issued on 15 December 2016 and was to expire on 31 December 2018.

3.1.9 The last maintenance inspection that was carried out on the aircraft prior to the accident flight was certified on 1 August 2018 at 1 684.5 airframe hours. Following the inspection, a further 76.4 hours were flown with the aircraft.

3.1.10 The flight folio was on board the aircraft and was consumed by the post impact fire. The previous flight folio was reviewed and the last entry was on 28 March 2018 at 1647.9 hours. According to a software program used by the operator the Hobbs meter reading prior to the aircraft taking-off from FABM was 1 724.5.

3.1.11 According to available information the aircraft was refuelled prior to the flight and a total of 70 litres of fuel was on board, approximately 35 litres in each of the two fuel tanks. These tanks were fabricated from high-density polyethylene (HDPE), and were installed directly behind the pilot and the passenger seats as can be seen in Figure 4 (ZU-FTO) of this report.

3.1.12 According to the METAR that was received for FABM, the prevailing surface wind at 0800Z, which was 20 minutes prior to the accident was from the northwest (330°) at 5kt and the temperature was 22°C.

3.1.13 The weather data that was obtained from the weather station at FABM at the time of the accident 0820Z, indicate the surface wind as 328˚ from true north at 7.4 knots gusting 10.7 knots, with a temperature of 24.5˚C and a humidity of 13%. The pilot therefore took off with a tailwind component.

3.1.14 The density altitude was calculated to be 7 295 ft at the time.

3.1.15 The main wreckage was found located between the two runways in an upright position, facing in the direction of take-off. It was consumed by the post impact fuel fed fire that erupted.

3.1.16 The observer/passenger was found lying next to the wreckage on the left-hand side by the first responders. He sustained serious burn wounds and were treated on site by paramedics. He also broke his left leg during the impact sequence.

3.1.17 The pilot was found wondering on the accident scene by the first responders who assisted him and treated his burn wounds with special burn wound dressing, which they had with them in a first aid kit. Once paramedics arrived, they attended to him.

3.1.18 Both occupants were transferred by EMS helicopters to a hospital in Johannesburg that lodged a specialised burn unit.

3.1.19 FABM was a licenced aerodrome and had one asphalt runway, which was orientated 11/29. The runway was 1 175m long and 15m wide. There was also a grass covered runway, which was orientated 13/31. The asphalt runway surface was dry during the takeoff.

3.1.20 Runway 11 that was selected by the pilot for take-off had an up slope.

3.1.21 The pilot that was flying the aircraft ZS-LUW that dropped a hopper load of water to contain the spread of the veld fire used runway 31 for take-off.

3.1.22 The investigation determined that the aircraft took-off with a tail wind component. Once airborne and ground effect had dissipated the aircraft stalled and impacted with the ground.

3.2 Probable cause

3.2.1 The aircraft took-off with a tail wind component, once airborne and ground effect had dissipated the aircraft stalled and impacted with the ground.

3.3 Contributory factors

3.3.1 Improper flight planning, which led to poor judgement and decision making.

3.3.2 The pilot made the decision not to use Runway 31 for take-off, which was the most suitable runway available for the prevailing wind conditions at the time.

3.3.3 High density altitude conditions prevailed, which also had a direct effect on aircraft performance.

3.3.4 The possibility of premature rotation could not be ruled out as the ground speed with the prevailing wind at the time was approximately 8kt more than the indicated airspeed or true airspeed, which could have provided the pilot with the sensation that the aircraft could be rotate.

4. SAFETY RECOMMENDATIONS

4.1 It is recommended that the aircraft manufacturer (OEM) review the design and location of the fuel tank to the one such as bladder type fuel tank.

5. APPENDICES

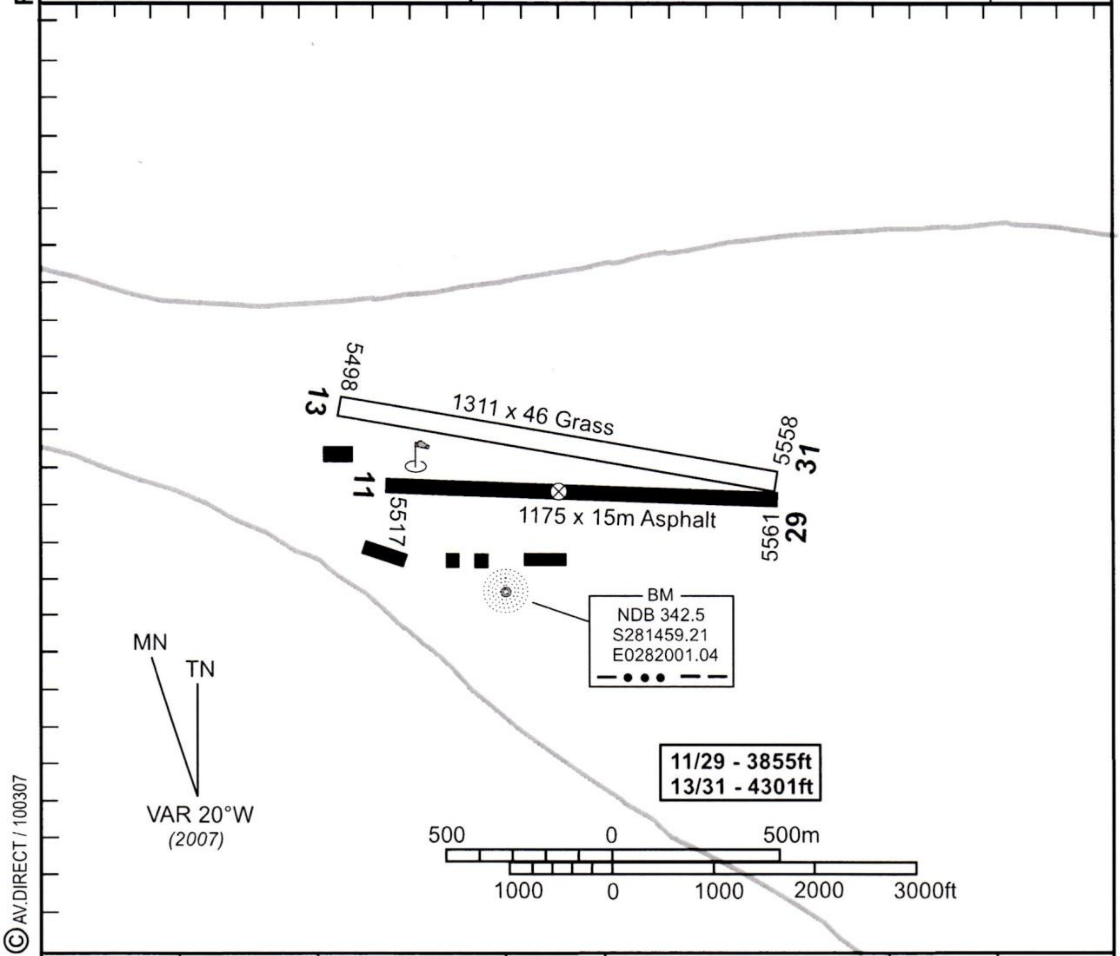
5.1 Annexure A (FABM Aerodrome chart)

ANNEXURE A

AERODROME CHART S28°14'55" E028°20'10" ELEV 5561 **BETHLEHEM**

FABM **BETHLEHEM**
124.8 (Common traffic advisory)

AD-01
EFF **07 Jun 07**



RWY	PAPI	APPROACH	THR	RUNWAY	L. DIST	SLOPE
11 (096°T)	Nil	Nil	Gr	MRL	Full	N/A
29 (276°T)					Full	
13 (108°T)	Nil	Nil	Nil	Nil	Full	N/A
31 (288°T)					Full	

OTHER LIGHTING: Nil

CIRCLING OCH

STOPWAYS

RUNWAY AVAILABILITY

CAA South Africa

Rev: New Format. WGS-84