

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9054	
Aircraft Registration	ZU-HIT	Date of Accident	30 June 2012		Time of Accident	0802Z
Type of Aircraft	L-39C		Type Operation	Display		
Pilot-in-command Licence Type	ATP - Aeroplane		Age	49	Licence Valid	Yes
Pilot-in-command Flying Experience	Total Flying Hours		2019		Hours on Type	41
Last point of departure	Klerksdorp Aerodrome – North-West Province					
Next point of intended landing	Klerksdorp Aerodrome – North-West Province					
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)						
Outside Klerksdorp Aerodrome boundary at GPS co-ordinates: S26°52.0" E026°43.0"						
Meteorological Information	Fine weather conditions prevailed at the time and place of the accident.					
Number of people on board	1+0	No. of people injured	0	No. of people killed	1	
Synopsis						
<p>On 30 June 2012, two L-39C aerobatic type aircrafts were scheduled to perform some aerobatic manoeuvres at the air show being held at Klerksdorp Aerodrome in the North-West province.</p> <p>Shortly after both aircraft took off from Runway 36 at Klerksdorp Aerodrome at approximately 0802Z, the two aircraft completed one uneventful "loop" in close formation and then commenced to execute a second loop. However, in order to commence the second loop, the leading pilot made a steep left descending turn and the fatal aircraft (ZU-HIT) dropped back (line astern). As the accident aircraft was close to the bottom of the second "loop" the pilot turned into the slipstream and smoke trail (wake) caused by the leading aircraft. The nose of the accident aircraft pitched up and the aircraft then rolled to the right. The aircraft then entered into a steep inverted dive from which the pilot was unable to recover from the time available and nosedived into the ground and sustained fatal injuries.</p> <p>The safety officer allowed the display to go ahead and the SACAA (FOD) did not intervene to stop the display from going ahead despite the fact that no safety briefing was done prior to the flight.</p> <p>Visual examination on the engine and airframe did not reveal pre-impact failures.</p>						
Probable Cause						
<p>The pilot flew into the slipstream and wake turbulence of the leading aircraft resulting in a high speed stall and an uncontrolled inverted dive from which the pilot could not recover from or to eject safely.</p>						
IARC Date				Release Date		



AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Heriot Aviation (Pty) Ltd
Manufacturer : Aero Vodochody
Model : L39C
Nationality : Italian
Registration Marks : ZU-HIT
Place : Outside Klerksdorp Aerodrome boundary – North-West Province at GPS co-ordinates S26°52.0"; E026°43 .0"
Date : 30 June 2012
Time : 0802Z

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 (1997) 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 establish legal liability.***

Disclaimer:

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

1. FACTUAL INFORMATION

1.1 History of Flight

- 1.1.1 On 30 June 2012, two L-39C aerobatic type aircrafts were scheduled to perform some aerobatic manoeuvres at the air show being held at Klerksdorp Aerodrome in the North-West province.
- 1.1.2 Although the pilots discussed the procedure the day prior to the accident, no safety briefing was done prior to the display that was being performed on the day of the accident.
- 1.1.3 Shortly after both aircraft took off from Runway 36 at Klerksdorp Aerodrome at approximately 0802Z, the two aircraft completed one uneventful "loop" in close formation and then commenced to execute a second loop. However, in order to commence the second loop, the leading pilot made a steep left descending turn and the fatal aircraft (ZU-HIT) dropped back (line astern). As the accident aircraft was close to the bottom of the second "loop" the pilot turned into the smoke trail (wake) caused by the leading aircraft. The nose of the accident aircraft pitched up and the aircraft then rolled to the right. The aircraft then entered into a steep inverted dive from which the pilot was unable to recover from the time available and nose-dived into the ground.

1.1.4 The accident occurred outside the Klerksdorp Aerodrome boundaries at a GPS co-ordinates of S26°52.0" E026°43.0" at an elevation of 4444ft AMSL during day light conditions.

1.2 Injuries to Persons

1.2.1 Pilot-in-command

Injuries	Pilot	Crew	Passengers	Other
Fatal	1	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	-	-	-	-

1.3 Damage to Aircraft

1.3.1 The aircraft was destroyed during the accident sequence and the ensuing fire that erupted after the aircraft impacted the ground. Below is the remains of the aircraft wreckage.



Figure 1: The main core of the turbine engine that separated from the A/C on impact



Figure 2: Wreckage pieces were spread over a distance of approximately 300m

1.4 Other Damage

- 1.4.1 After the ground impact, the wreckage skidded a further 250m. Debris from the aircraft wreckage propelled and caused damage to a pedestrian entry gate at the cemetery and to the “wall of remembrance”.



Figure3: Shows damage to the “Wall of Remembrance”

- 1.4.2 One of ejector seat explosive canisters separated from the wreckage and was located next to the unoccupied caretakers’ cottage at the Klerksdorp Cemetery. The South African Police exploded the canister, as they believed that it was a safety hazard. The exploding canister shattered all the windows of the caretakers’ cottage.



Figure 4: Damage to the Caretakers Office

1.5 Personnel Information:

Nationality	Italian	Gender	Male	Age	49
Licence Number	0270168321	Licence Type	Airline Transport Pilot - Aeroplane		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night Rating Instrument (From: 2 February 2012 to 28 February 2013) Display / Aerobatic – Expiry Date: 31 December 2012				
Medical Expiry Date	30 June 2012				
Restrictions	Nil				
Previous Accidents	Nil				

1.5.1 Additional Information of the pilot:

The following limitations applied in terms of the Display / Aerobatic rating, for the accident pilot:	
Formation Flight	200 ft Above Ground Level (AGL)
Jet Aerobatics manoeuvres	750 ft Above Ground Level (AGL)
Jet Aerobatic Level Fly Pass	500 ft Above Ground Level (AGL)

1.5.2 The pilot of the leading aircraft stated that the exit of the loop was at the same altitude as the entry altitude of 5500ft AMSL and is determined by the altimeter instrument in the cockpit.

1.5.3 Flying Experience:

Total Hours	2019
Total Past 6 months	39.0
Total on Type Past 6 months	39.0
Total on Type	41.0

- 1.5.3.1 The pilots' logbook could not be located during the accident investigation. However, during his last flight test on 2 February 2012 in order to revalidate his instrument rating, the flying hours were recorded as shown above. The experience reflected for the past 6 months was all on type.

1.6 Aircraft Information

1.6.1 Airframe:

Type	L39C	
Serial Number	232202	
Manufacturer	Aero Vodochody	
Date of Manufacture	1982	
Total Airframe Hours (At time of Accident)	1832.0	
Last Annual Inspection (Date & Hours)	12 Oct 2011	1825.0
Last 6 Month Inspection (Date & Hours)	14 Apr 2012	1831.0
Hours since Last Annual Inspection	7.0	
Authority to Fly (Issue Date & Expiry Date)	12 Oct 2011	11 Oct 2012
C of R (Issue Date) (Present owner)	1 Dec 2005	
Operating Categories	NTCA Commercial	

1.6.2 Engine:

Type	Ukraine Zaporozhe A1-25TL
Serial Number	708 252 3500214
Hours since New	1042
Hours since Overhaul	355.1

1.7 Meteorological Information

Wind direction	NW	Wind speed	4 kts	Visibility	1000m+
Temperature	14°C	Cloud cover	Nil	Cloud base	Nil
Dew point	-1°C				

1.8 Aids to Navigation

- 1.8.1 The aircraft was equipped with standard navigation equipment as per the minimum equipment list approved by the regulator for the aircraft type. No defects were reported prior to the flight.

1.9 Communications.

1.9.1 The aircraft was equipped with standard navigation equipment as per the minimum equipment list approved by the regulator for the aircraft type. No defects were reported during or prior to the flight and there was no officially recorded communication available to this accident.

1.10 Aerodrome Information

Aerodrome Location	Klerksdorp – North West Province		
Aerodrome Co-ordinates	S26°52.0" E026°43.0"		
Aerodrome Elevation	4444' AMSL		
Runway Designations	18/36	15/33	05/23
Runway Dimensions	1500m x 18m	1000m x 25m	900m x 25m
Runway Used	36		
Runway Surface	Tar	Gravel	Gravel
Approach Facilities	NDB 280.0 S26°53.2" E026° 43. 4"		

1.11 Flight Recorders

1.11.1 The aircraft was not equipped with a Flight Data Recorder (FDR) or a Cockpit Voice Recorder (CVR). According to the Aviation Regulations, it is not required that either of the recorders to be fitted to the aircraft type.

1.12 Wreckage and Impact Information

1.12.1 The ground impact was almost in a wings level attitude. After the initial impact the aircraft partly disintegrated and the wreckage was spread over a distance of approximately 250m.



Figure5: Shows the deep scar mark during the initial impact sequence



Figure 6: Shows the wreckage trail after the initial impact with the ground



Figure 7: Shows a view of the approximate flight path followed by the aircraft with the position of the forward cockpit as indicated.

1.13 Medical and Pathological Information

1.13.1 The results of the post mortem report and toxicology tests were not available at the time of compiling this report. Should any of the results, once received, indicate that medical aspects might have affected the performance of the pilot, this will be considered new evidence and the investigation be re-opened.

1.14 Fire

1.14.1 The aircraft erupted in fire during the ground impact.



Figure 8: The aircraft exploded and a post impact fire erupted during the ground impact

1.15 Survival Aspects

1.15.1 The pilot was properly secured with the aircraft safety harnesses and shoulder harness installed into the aircraft. The safety harnesses did not fail during the accident sequence.

1.15.2 The aircraft was equipped with a serviceable Escape System (Ejection seat) which was not utilised by the pilot. The L-39 Escape System provides fully automated survivable escape regardless of aircraft attitude dependable on the time available to trigger the escape system.

1.15.3 The accident is considered not survivable due to the high impact forces involved when the aircraft impacted the ground and the pre-impact fire that erupted.

1.16 Tests and Research

1.16.1 Examination of the engine and airframe did not reveal any anomalies or pre- or post-impact failures whatsoever

1.17 Organizational and Management Information

- 1.17.1 This was a display flight with the owner of the aircraft also being the pilot.
- 1.17.2 The last maintenance inspections, that was certified on the aircraft prior to the accident flight, was an annual inspection conducted on 12 October 2011 at 1825.0 airframe hours and a 6 month inspection which was conducted on 14 April 2012 at 1831.0 airframe hours. Both these inspections was carried out by an aircraft maintenance organisation (AMO) that was in possession of a valid AMO Approval certificate.
- 1.17.3 The Authority to Fly was issued on 12 October 2011 and was valid until 11 October 2012.

1.18 Additional Information

1.18.1 Escape System (Ejection seat)

- 1.18.1.1 Although the aircraft was equipped with an Escape System (Ejection seat), the pilot did not activate, the system with the limited time available. Note: According to the documentation from the Annual Inspection performed on 5 October 2011, the Bowdene ejection seat was inspected and found to be serviceable.
- 1.18.1.2 The L-39 Escape System provides fully automated survivable escape regardless of aircraft attitude. Safe escape is provided for most combinations of aircraft altitude, speed, attitude and flight path, within the envelope including zero altitude and 150 km/h minimum speed.
- 1.18.1.3 The Escape System provides a fully automated survivable escape regardless of the aircraft orientation. The VS-2 ejection seat is cartridge operated and rocket assisted. The system comprises: Fully automatic sequencing, Dual redundant system (main electro-pyrotechnic system and independent standby pyrotechnic system), Automatic canopy jettison at a speed over 310 km/h (167 kt) and Canopy fragmentation by the Miniature Detonating Cord (MDC) at lower speeds. The backup capability of the system comprises Ejection through the canopy transparency in case of an electric power supply failure or a failure of the canopy jettison, Independent canopy jettison by the canopy jettison handle located in both Cockpits, Drogue deployment, pilot/seat separation and parachute deployment are automatically controlled, Manual pilot/seat separation system in case of an automatic release failure, Integrated harness and leg restraint system and Integrated Emergency Oxygen.

1.18.2 Stall & Stall recovery of the L-39

- 1.18.2.1 Stalls are conventional for a jet aircraft of this type, with a stall break that is not sharply defined, and does *not* result in the nose dropping. Instead, the stall is preceded by an easily identified low-frequency rumble that feels about the same regardless of landing gear or flap position.
- 1.18.2.2 Wings-level stall speed ranges from 92 to 105 KIAS, depending on flap setting. The slow spool-up time of the engine (nominally 9-12 seconds from

idle to full power) means that the stall recovery must be a finesse exercise. Rushing the process will almost always result in a secondary stall and a further loss of altitude. The latter is a very important concept to grasp, especially in the traffic pattern, and it's why L-39 pilots-in-training should spend a lot of time doing stalls and exploring the lower edge of the speed envelope.

1.18.3 Safety officer and SACAA (FOD) officer

1.18.3.1 The safety officer allowed the display to go ahead despite the fact that no safety briefing was done prior to the flight and the SACAA (FOD), did not intervene to stop the display from going ahead despite the fact that no safety briefing was done prior to the flight.

1.18.4 Engine

1.18.4.1 The investigation revealed that the engine was producing power throughout the flight. The latter is substantiated by the fact that the smoke trail, generated by the smoke generator, was evident right to the final impact with the terrain.

1.19 Useful or Effective Investigation Techniques

1.19.1 An amateur photographer captured the sequence of events on a video. This video was used to reconstruct the sequence of events leading to the accident.



Figure 9: Both aircraft during takeoff simultaneously



Figure 10: Commencing with the 2nd “loop”, the leading pilot made a steep turn and the pilot of the accident aircraft moved into a “line astern” position as planned.

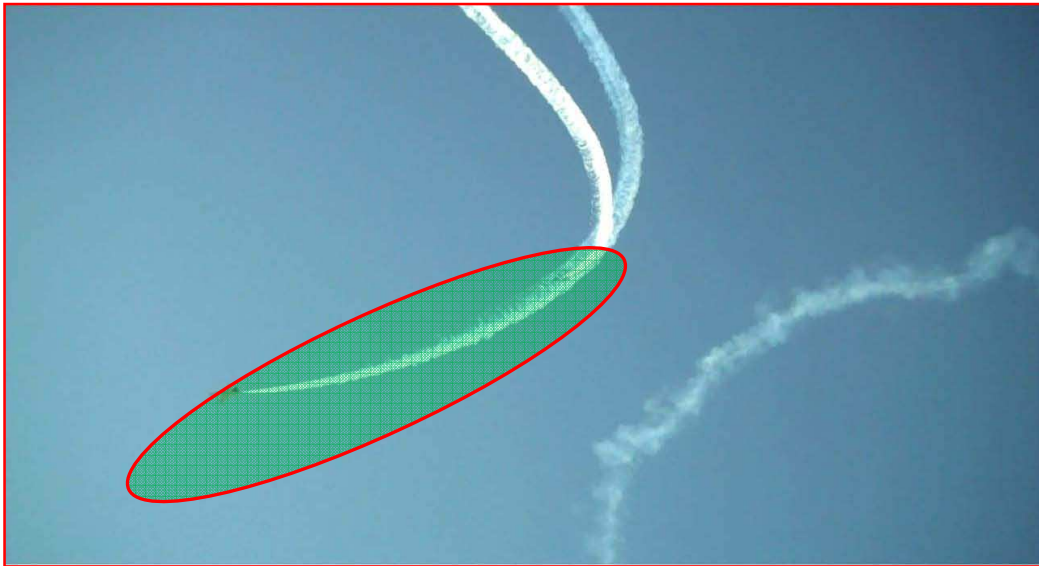


Figure 11: The accident aircraft flies into the wake of the leading aircraft.



Figure 12: The nose of the accident aircraft pitches upwards



Figure 13: The accident aircraft starts rolling to the right



Figure 14: The accident aircraft continues rolling to the right



Figure 15: The accident aircraft is now inverted.
Note the vertical fin facing downward



Figure 16: The accident aircraft diving inverted downwards

- 1.19.5 The pilot unintentionally without realising it, flew into the wake turbulence of the leading aircraft resulting in a high speed stall followed by an uncontrolled inverted dive.
- 1.19.6 The pilot of the leading aircraft stated that the levelling height after recovery was at 5500' AMSL which is approximately 1000ft AGL and insufficient height to recover when the aircraft went into an inverted attitude. The pilot managed to level the wings of the aircraft but the aircraft impacted the ground due to the high rate of descent.



Figure 17: The pilot of the accident aircraft starts rolling to the wings level



Figure 18: The accident aircraft starts pulling out of the dive close to the ground

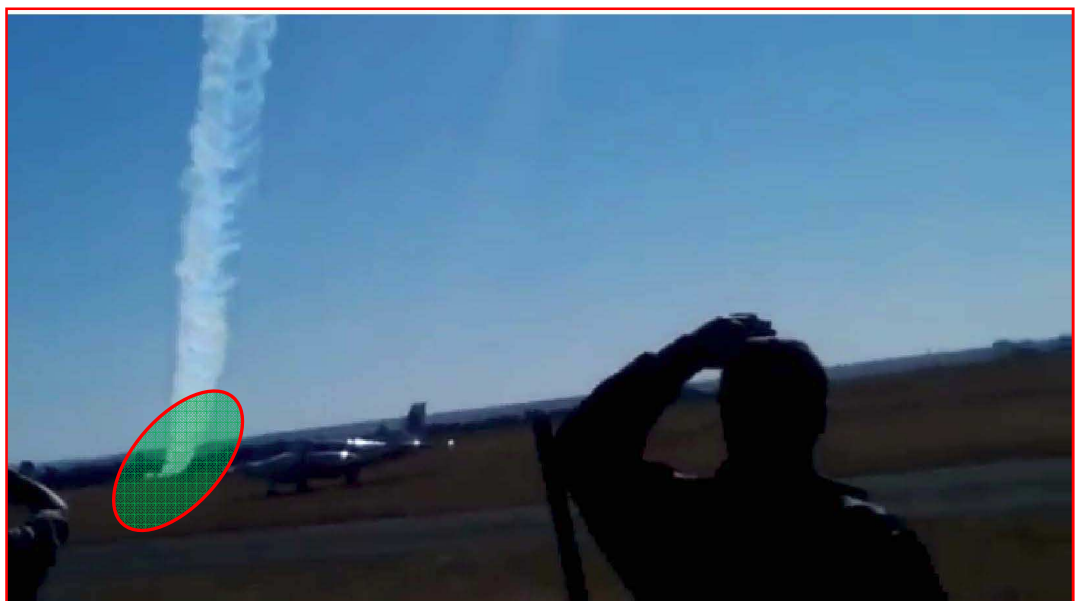


Figure 19: Shows as the accident aircraft “mushed” into the ground

2. ANALYSIS

2.1 Man:

- 2.1.1 The pilot was the holder of a valid Airline Transport Pilot License and rated on the aircraft type.
- 2.1.2 No flight briefing was carried prior to the flight. If a detailed flight briefing were done prior to the flight, the pilot could have been alerted and possibly been able to avoid the circumstances leading to the cause of the accident. It is of concern that the safety officer allowed the display to go ahead despite the fact that no safety briefing was done prior to the flight. It is also a concern that the SACAA (FOD), did not intervene to stop the display from going ahead despite the fact that no safety briefing was done prior to the flight.
- 2.1.3 Once the aircraft became inverted, the pilot immediately attempted to counteract the situation by rolling the aircraft to the upright attitude again, but failed to do so in the limited time available.
- 2.1.4 As with all other aspects of high-performance flying, a thorough knowledge of the airplane and its limitations is imperative in order to fly satisfactory and safely in formation in the L-39. The slow engine response time dictates a higher level of pilot anticipation and experience than in some other jets.

2.2 Machine:

- 2.2.1 The on-site and off-site field investigation revealed no anomalies with the engine or the airframe that could have caused or could have contributed to the cause of the accident.
- 2.2.2 The aircraft was destroyed during the sequence of events. However, the investigation revealed that the engine was producing sufficient power throughout the flight and did not contribute to the cause of the accident.
- 2.2.3 A detailed inspection of the airframe was conducted and no anomalies could be found to indicate an airframe component malfunction during the flight.

2.3 Mission:

- 2.3.1 The flight was not out of the norm and was part of a normal aerobatic maneuver display that went wrong at an unexpected stage when the accident aircraft went into the slipstream and subsequent wake turbulence of the leading aircraft and crashed after it became inverted.

3. CONCLUSION

3.1 Findings

3.1 Findings

- 3.1.1 On 30 June 2012, two L-39C aerobatic type aircrafts were performing some aerobatic manoeuvres at the air-show at Klerksdorp Aerodrome in the North-West province, when the accident aircraft went into the slipstream and wake turbulence of

the leading aircraft during an aerobatic manoeuvre and crashed into the ground.

- 3.1.2 The pilot held a valid airline transport pilot license and was rated on the aircraft type. He was also in possession of a valid display- and aerobatic rating and therefore was appropriately rated to conduct the flight.
- 3.1.3 The pilot held a valid aviation medical certificate that was issued by an approved SACAA medical examiner.
- 3.1.4 The aircraft was maintained in accordance with the existing regulations and no outstanding defects had been noted.
- 3.1.5 The aircraft was in possession of a valid Authority to Fly at the time of the accident.
- 3.1.6 Inspection of the engine and airframe did not reveal any pre- or post-impact failures that could have contributed to the cause of the accident.
- 3.1.7 The safety officer allowed the display to go ahead and the SACAA (FOD) did not intervene to stop the display from going ahead despite the fact that no safety briefing was done prior to the flight.

3.2 Probable Cause/s

- 3.2.1 The pilot flew into the slipstream and wake turbulence of the leading aircraft resulting in a high speed stall and an uncontrolled inverted dive from which the pilot could not recover timeously or to safely eject from the accident aircraft.

4. SAFETY RECOMMENDATIONS

- 4.1 Stalls are conventional for a jet aircraft of this type. The stall break that is not sharply defined and does *not* result in the nose dropping. Instead, the stall is preceded by an easily identified low-frequency rumble that feels about the same regardless of landing gear or flap position.

With the above in mind it is recommended that the Director for Civil Aviation should ensure that pilots spend a lot of time doing stalls and exploring the lower edge of the speed envelope before being rated on the aircraft type.

- 4.2 The safety officer allowed the display to go ahead and the SACAA (FOD) did not intervene to stop the display from going ahead despite the fact that no safety briefing was done prior to the flight.

With the above in mind it is recommended that the Director for Civil Aviation should ensure that proper safety briefings are done by the safety officer prior to any display. The SACAA FOD should intervene if this is not done. Furthermore this should form part of the CARs (Civil Aviation Regulations).

5. APPENDICES

5.1 None.

Compiled by:

J.J. du Plessis
For: Director of Civil Aviation

Date: 26 September 2012

J.J. du Plessis
Investigator-in-charge

Date: 26 September 21012