



AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/8758	
Aircraft Registration	ZS-MRD	Date of Accident	16 February 2010		Time of Accident	1224Z
Type of Aircraft	Cessna 177 RG		Type of Operation	Private		
Pilot-in-command Licence Type		Private Pilot Aeroplane	Age	41	Licence Valid	Yes
Pilot-in-command Flying Experience		Total Flying Hours	2 127.4		Hours on Type	12.7
Last point of departure		Lanseria Aerodrome (FALA)				
Next point of intended landing		Heidelberg Aerodrome (FAHG)				
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)						
Runway 06R at Lanseria Aerodrome (FALA)						
Meteorological Information		Fine weather prevailed. Temp: 27°C; Wind speed: light and variable; Visibility: CAVOK				
Number of people on board	1 + 0	No. of people injured	0	No. of people killed	0	
Synopsis						
<p>The pilot was engaged in a private flight from Lanseria aerodrome to Heidelberg aerodrome. During the approach for landing at Heidelberg, the undercarriage failed to extend. The pilot decided to fly back to Lanseria where he performed a wheels-up landing on runway 06 Right. The aircraft skidded for approximately 100 m before coming to a halt.</p> <p>The propeller tips, lower fuselage antenna and sheet metal on the belly were damaged.</p> <p>A retraction test was carried out at an approved aircraft maintenance organisation (AMO) in the presence of the investigator in charge. It was found that the eye-end rod had broken off from the main gear actuator, and as a result the wheels had failed to extend.</p>						
Probable Cause						
Pilots failure to manually extend landing gears following the main system failure.						
IARC Date				Release Date		



AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Marshall Eagle Aviation (PTY) Ltd
Manufacturer : Cessna Aircraft Company
Model : Cessna 177 RG
Nationality : South African
Registration Marks : ZS-MRD
Place : Lanseria Aerodrome
Date : 16 February 2010
Time : 1224Z

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 The pilot was engaged on a private flight from Lanseria to Heidelberg. During approach for landing at Heidelberg aerodrome, the undercarriage failed to extend and the pilot decided to return to Lanseria.
- 1.1.2 On arrival at Lanseria aerodrome, the pilot reported the problem to the tower. He also called the aircraft maintenance organisation (AMO) responsible for the aircraft from the air, tried various techniques to extend the gear, and performed low "G" manoeuvres – all to no avail.
- 1.1.3 The pilot stated that he could not use the manual extension system as it was impossible to operate whilst flying solo.
- 1.1.4 He then executed a wheels-up landing on runway 06 Right. The aircraft skidded for approximately 100 m before coming to a halt.
- 1.1.5 The propeller tips, lower fuselage antenna and sheet metal on the belly were damaged.

1.2 Injuries to Persons

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

1.3 Damage to Aircraft

1.3.1 The propeller tips were bent, and the lower fuselage antenna and sheet metal on the belly were slight damaged.



Figure 1. The bent propeller tips.



Figure 2: Damage to the belly and antenna.

1.4 Other Damage

1.4.1 None.

1.5 Personnel Information

Nationality	South African	Gender	Male	Age	41
Licence Number	*****	Licence Type	Private pilot		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	30 September 2010				
Restrictions	None				
Previous Accidents	None				

Flying Experience

Total Hours	2127.4
Total Past 90 Days	16,8
Total on Type Past 90 Days	1,0
Total on Type	12,7

1.6 Aircraft Information

1.6.1 Airframe

Type	Cessna 177 RG	
Serial Number	177RG-1228	
Manufacturer	Cessna Aircraft Company	
Date of Manufacture	1977	
Total Airframe Hours (at time of accident)	2 008,1	
Last MPI (Date & Hours)	23 November 2009	2006,8
Hours since Last MPI	1,3	
C of A (Issue Date)	8 May 1990	
C of R (Issue Date) (Present Owner)	4 December 2009	
Operating Categories	Standard	

Maintenance records were reviewed and it was found that the inspection had been carried out according to the Cessna service manual, which calls for an inspection of the undercarriage system.

1.6.2 Engine

Type	Lycoming IO-360-A1B6D
Serial Number	L-28488-51E
Hours since New	2 236,8
Hours since Overhaul	236,1

1.6.3 Propeller

Type	Hartzell HC-C3YR-1RF
Serial Number	DY-3731A
Hours since New	998,2
Hours since Overhaul	44,9

1.7 Meteorological Information

1.7.1 Weather information as obtained from the pilot questionnaire:

Wind direction	Light	Wind speed	Light	Visibility	Good
Temperature	27°C	Cloud cover	Broken	Cloud base	8 000 ft
Dew point	-				

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with standard navigational equipment as per the minimum equipment list approved by the Regulator. There were no recorded defects to the equipment prior to the flight.

1.9 Communications

1.9.1 The aircraft was equipped with standard communication equipment as per the minimum equipment list approved by the Regulator. There were no recorded defects to the equipment prior to the flight.

1.9.2 The pilot broadcasted his intentions on frequency 124.0 MHz. The pilot did not file a flight plan as he was flying from controlled to uncontrolled airspace.

1.10 Aerodrome Information

Aerodrome Location	Lanseria International Airport	
Aerodrome Co-ordinates	S25° 56' 23" E27° 55' 28.8"	
Aerodrome Elevation	4 517 ft AMSL	
Runway Designations	06R/24L	06L/24R
Runway Dimensions	1 747 m x 23 m	2 906 m x 30 m
Runway Used	06R	
Runway Surface	Tar	
Approach Facilities	NDB, VOR, ILS and DME	

1.11 Flight Recorders

1.11.1 The aircraft was not fitted with a flight data recorder or cockpit voice recorder. Neither was required by regulations to be fitted to this type of aircraft.

1.12 Wreckage and Impact Information

1.12.1 The pilot landed in a wheels-up configuration. The aircraft skidded for approximately 100 m before coming to a halt. Damage was sustained to the belly, propeller blade tips and bottom fuselage antenna.



Figure 3. Aircraft on runway 06R/24L after belly landing.

1.13 Medical and Pathological Information

1.13.1 The pilot was in possession of a valid medical certificate.

1.14 Fire

1.14.1 There was no evidence of a pre- or post-impact fire.

1.15 Survival Aspects

1.15.1 The accident was survivable as the pilot had been properly restrained, there was virtually no damage to the cockpit area and impact forces were low.

1.16 Tests and Research

1.16.1 A spherical ball joint rod-end from the accident aircraft was submitted to an approved metallurgist.

1.16.2 The rod-end had broken in the first thread adjacent to the ball housing (see Figure 4). On close examination, it was determined that the fracture surface was of the ductile overload type and had initiated in a thread root (see Figures 4 and 5). It was noted that the threaded half of the fracture surface was severely battered (see

Figure 4). The spherical element of the ball joint displayed normal freedom of movement without excessive free play.



Figure 4. The ball-joint end fracture surface showing ductile overload.



Figure 5. Another view of the ball-joint end fracture surface.



Figure 6. The threaded end of the fracture showing severe battering.

1.16.3 It is believed that this ball joint failed due to dynamic overload when the aircraft landed on a previous occasion without the undercarriage being fully extended. The battered condition of the one fracture surface supports this supposition.

1.16.4 Description of the landing gear system

The Cessna 177RG's retractable landing gear is hydraulically actuated. The nose landing gear, which has its own hydraulic actuator, retracts rearwards beneath the engine and the main gear legs retract rearwards into wheel wells in the aft fuselage. The main gear legs are mechanically linked and move as one unit; they are operated by a single hydraulic actuator attached to the gear by an eye-shaped rod end. The actuator rod is fully extended when the gear is retracted. The rod retracts and pulls on the main gear attachment to extend the gear until the gear engages a lock in the down position. When hydraulic pressure is lost, the gear can free fall but will not rotate forwards into the locked position by gravity alone. The aircraft has an emergency hand pump to provide hydraulic pressure to extend the gear fully.

1.16.5 Following the gear-up landing, the aircraft was lifted with air bags. It was discovered that the main gear could be pulled down by hand until it locked in the down position. An investigation by maintenance engineers revealed that the main gear hydraulic actuator rod end had failed. The actuator was no longer connected to the main gear and so could not actuate the gear into the extended position.

1.17 Organisational and Management Information

1.17.1 This was a private flight.

1.17.2 The aircraft was properly maintained by a valid AMO which had a valid certificate at the time of the accident.

1.18 Additional Information

1.18.1 None.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1 The aircraft was serviceable and no defects were reported prior to the accident.

2.2 The pilot was engaged on a private flight from Lanseria to Heidelberg aerodrome. During the approach for landing at Heidelberg, the landing gear would not extend and the pilot decided to return to Lanseria aerodrome.

2.3 On arrival at Lanseria, he informed the tower that the gears would not extend. He then called the AMO that serviced the aircraft, and tried various techniques to extend the gears, including low "G" manoeuvres. None was successful, however.

2.4 The pilot said that as he was flying solo, it was impossible to use the manual gear extension system.

- 2.5 He performed a wheels-up landing at Lanseria on runway 06R, and the aircraft sustained damage to the propeller tips and belly.
- 2.6 The aeroplane was inspected by an AMO in the presence of the investigator-in-charge and it was found that the eye-end rod had broken from the main gear actuator.
- 2.7 The eye-end rod was taken for analysis to determine the cause of failure. It was found that the rod had failed due to dynamic overload when the aircraft had landed without the undercarriage being fully extended.
- 2.8 As stipulated in the analysis of the report under appendix 5.1, paragraph 4 of the attached report (Conclusion), a further investigation was conducted to examine why the system had failed to deploy fully to the down-and-locked position. However, no cause was found.

3. CONCLUSION

3.1 Findings

- 3.1.1 This was a private flight.
- 3.1.2 The pilot was correctly licensed and the type was correctly endorsed in his licence.
- 3.1.3 The pilot held a valid medical certificate with no restrictions.
- 3.1.4 The pilot failed to use the manual gear extension.
- 3.1.5 The aircraft had a valid certificate of airworthiness and certificate of registration.
- 3.1.6 The maintenance records indicated that the aircraft had been maintained in accordance with existing regulations and procedures.
- 3.1.6 The weather, which was reported to be fine at the time, did not contribute to the accident.
- 3.1.7 A retraction test was carried out at an approved AMO in the presence of the investigator-in-charge and it was found that the eye-end on the main gear actuator had broken off.

3.2 Probable Cause/s

- 3.2.1 Pilot's failure to manually extend landing gears following the main system failure.

4. SAFETY RECOMMENDATIONS

- 4.1 None.

5. APPENDICES

5.1 Appendix A - Examination of Spherical Ball Rod End Report.

Report reviewed and amended by the Advisory Safety Panel 19 October 2010.

-END-

Appendix A - Examination of Spherical Ball Rod End Report

Report No: MR(10)272

Examination of Spherical Ball Rod End from Cessna C-177RG ZS-MRD

by

T.J.Carter C.Eng., FIMMM.

Submitted to: Mr A Motala,
South African Civil Aviation Authority
Pvt Bag X73,
Halfway House, 1685

7th March 2010
Tim J Carter Consulting.
P O Box 1535, Roosevelt Park, 2129.
TJC/te



T J Carter C.Eng., FIMMM

Abstract

1. Introduction.

A spherical ball joint rod end from Cessna C-177RG registration ZS-MRD was submitted to Tim J Carter Consulting after the aircraft failed to fully deploy the undercarriage and made a belly landing, sustaining damage to the fuselage underside and propeller.

2. Examination.**2.1 Background.**

The aircraft was on a flight from Lanseria to Heidelberg and on approach at Heidelberg the Pilot reported that the undercarriage would not extend and lock. He then returned to Lanseria and performed a wheels-up landing, sustaining slight damage to the aircraft belly and propeller blade tips. Subsequent examination revealed that the spherical ball joint rod end on the undercarriage actuator was broken.

2.2 Visual Examination.

The rod end had broken in the first thread adjacent to the ball housing, figure 1.

On close examination, it was determined that the fracture surface was of the ductile overload type, figures 2 & 3, initiating in a thread root. It was noted that the threaded half of the fracture surface was severely battered, figure 4.

It was noted that the spherical element of the ball joint was fully free to move and displayed only normal freedom of movement without excessive free play.

3. Discussion.

It is considered that this ball joint failed by dynamic overload upon impact suffered by the aircraft when it was landed without the undercarriage extended. The battered condition of the one fracture surface supports this.

4. Conclusions.

It is clear that this rod-end has failed as the result of a single, large overload event.

Since it comprises part of the undercarriage extension/retract mechanism, it is apparent that, in this case, in which the undercarriage is known to have failed to fully extend to the locked position, the rod-end was subjected to the full weight of the aircraft on landing, a load to which it was neither designed nor intended to be expected to withstand.

It is therefore considered that this failure is consequential to another failure, that of the undercarriage deployment mechanism. It is recommended that the system be further examined to determine the cause of failure of the system to fully deploy to the down and locked condition before landing.



Figure 1. The rod-end as submitted, showing the location of fracture.



Figure 2. The ball-joint end fracture surface showing only ductile overload features.



Figure 3. The ball-joint end fracture surface showing only ductile overload features.



Figure 4. The threaded end of the fracture showing severe battering.