

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/8793	
Aircraft Registration	ZS-ZOC	Date of Accident	13 June 2010		Time of Accident	0900Z
Type of Aircraft	Swearingen SA 226 TC Metro II		Type of Operation		Charter Flight	
Pilot-in-command Licence Type		Airline Transport	Age	37	Licence Valid	Yes
Pilot-in-command Flying Experience		Total Flying Hours	6900.00		Hours on Type	400.0
Last point of departure		Lanseria International Airport (FALA)				
Next point of intended landing		Polokwane Airport (FAPP)				
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)						
On Runway 24R at Lanseria International Airport (FALA), at GPS reading: S25°56.151 E027°55.757						
Meteorological Information		Surface Wind:030°/5 kts , Temperature: 17°C, Visibility: >10 km, Cloud base: Nil, Cloud cover: Nil ,				
Number of people on board	2 + 13	No. of people injured	0	No. of people killed	0	
Synopsis						
<p>Two flight crew members accompanied by thirteen passengers departed from FALA to FAPP. The flight was uneventful until during the approach to land on Runway 05 at FAPP. The flight crew selected landing gear down and observed a red light which indicate undercarriage unsafe. The flight crew reported the situation to FAPP Air Traffic Control (ATC). FAPP ATC gave instruction to do a missed approach at low level fly-past. The intention was to conduct a visual inspection of the undercarriage to determine its condition. The ATC observed that the left main gear had not extended.</p> <p>FAPP ATC gave an instruction to the flight crew, to hold over the beacon (BHV), where they could attempt to extend the gear by means of normal and emergency procedure. The flight crew was not successful and undercarriage remained retracted. The flight crew returned to FALA with the intention to carry out an emergency landing.</p> <p>FALA ATC give instructions to the flight crew to hold over the beacon (LIV), to again attempt the normal and emergency undercarriage extension procedures. But jet again; the flight crew was unsuccessful to lower the left main gear. ATC then instructed that the aircraft should execute the emergency landing on Runway 24R. During short finals overhead the threshold, prior to touchdown, the flight crew shut down both engines, feathered the propellers and switched off all the electronics. The aircraft landed and came to a gradual stop on its lower fuselage on the centreline of the runway.</p>						
Probable Cause						
The pilot executed a belly "wheels up" emergency landing after the left main landing gear failed to extend.						
Contributory Factors: The new tyres installed on the main landing gear wheels were not in compliance with the instructions of the Fairchild Service Letter 226-SN-131.						
IARC Date				Release Date		

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : African Skies Aviation CC
Manufacturer : Swearingen
Model : SA226 TC
Nationality : South African
Registration Marks : ZS-ZOC
Place : Lanseria Airport (FALA)
Date : 13 June 2010
Time : 0900Z

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 Sunday, 13 June 2010 at approximately 0604Z, the Swearingen SA 226 TC Metro II aircraft took off from Lanseria International Airport (FALA) to Polokwane International Airport (FAPP). There were two flight crew members and thirteen passengers on board the aircraft. It was a non-scheduled domestic air transportation charter flight which was flown under Instrument Flight Rules (IFR) by day.

1.1.2 The flight crew reported that the flight was uneventful until during descent and approach to Runway 05 at FAPP. The flight crew selected the undercarriage control lever to down position. The flight crew observed the 'undercarriage unsafe' red warning light going on inside the cockpit. The 'undercarriage unsafe' red warning light indicated that the left side main landing gear was not extending. The flight crew requested the FAPP Air Traffic Control (ATC) whether they could carry out a go-around, due to an undercarriage problem. The ATC requested that the flight crew do a fly-by past the tower for them to observe the status of the undercarriage. The ATC informed the flight crew that the left main landing gear doors were partially open, but the gear had not extended.



Figure 1 shows a fly-past in front of FALA tower to inspect undercarriage.

- 1.1.3 The aircraft entered into a holding pattern for approximately 15 minutes, during which period the flight crew attempted to extend the landing gear. The undercarriage was recycled several times with the same indication that the left main landing gear had failed to extend. The flight crew then executed the emergency extension procedures several times, with no success. The flight crew also continued with other recommended best practice emergency procedures which included various manoeuvres to induce additional “G” forces on the aircraft to try and release the left main landing gear, but this was also unsuccessful.
- 1.1.4 The flight crew communicated with FAPP ATC about the emergency situation and elected to return to FALA because they thought that the facilities to handle emergencies of this nature were better at FALA. The flight crew continued to execute the emergency gear deployment procedures while en route to FALA, without success. When the aircraft was inbound approaching FALA, the flight crew establish contact with ATC and they were given instructions to hold over the beacon (HBV) near Hartebeespoortdam. After a while they were routed to hold over the beacon (LIV) near Lanseria, where the flight crew burned off fuel. All normal and emergency procedures used by the flight crew to extend the left main landing gear were unsuccessful.
- 1.1.5 After being airborne for a period of 2.9 hours, the flight crew were given clearance by FALA ATC to land on Runway 06. The intention of the flight crew was to do a low level fly-past in front of the tower for confirmation that the left main landing gear was still not extended. The flight crew then recycled the gear up in preparation for the planned “wheels up” emergency landing. The flight crew made a teardrop manoeuvre to turn back in the opposite direction to approach Runway 24R. During short finals overhead the threshold, prior to touchdown, the flight crew shut down both engines, feathered the propellers and switched off all the electrical power. The radios were off, thus no further communication between the flight crew and FALA ATC was possible. The aircraft came to a gradual stop on its lower fuselage on the centreline of the runway.



Figure 2 shows Runway 24R used for the “wheels up” landing.

1.1.6 The aerodrome rescue fire-fighters (ARFF) were dispatched to the scene. The ARFF sprayed foam to reduce the fire risk and assisted the occupants with the evacuation. The occupants disembarked through the main entrance door of the aircraft. The occupants did not sustain any injuries. The aircraft sustained substantial damage on the lower fuselage.

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	2	-	13	-

1.3 Damage to Aircraft

1.3.1 The aircraft sustained substantial damage in the accident.

1.4 Other Damage

1.4.1 Limited to skid markings on the runway surface.

1.5 Personnel Information

1.5.1 Pilot-in-command (PIC)

Nationality	French	Gender	Male	Age	37
Licence Number	0272269648	Licence Type	Airline Transport		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night & Instrument Rating				
Medical Expiry Date	31 October 2010				
Restrictions	None				
Previous Accidents	None				

Flying Experience:

Total Hours	6900.0
Total Past 90 Days	39.0
Total on Type Past 90 Days	39.0
Total on Type	400.0

1.5.2 First Officer (F/O)

Nationality	South African	Gender	Male	Age	55
Licence Number	0270463243	Licence Type	Commercial		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night, Instrument, Test & Safety Pilot Rating				
Medical Expiry Date	28 February 2011				
Restrictions	Corrective Lenses				
Previous Accidents	None				

Flying Experience:

Total Hours	1630.4
Total Past 90 Days	32.7
Total on Type Past 90 Days	12.0
Total on Type	35.4

1.5.3 According to the pilot-in-command, the first officer was flying the aircraft to FAPP. The pilot-in-command took over control of the aircraft when they experienced the undercarriage (left hand side main landing gear not extending) emergency during the flight.

1.6 Aircraft Information

Airframe:

Type	SA 226 TC	
Serial No.	TC-293	
Manufacturer	Swearingen Metro II	
Date of Manufacture	April 1979	
Total Airframe Hours & Cycles (At time of Accident)	27532.0 Hours	27353.0 Cycles
Last Phase Inspection (Date, Hours & Cycles)	01 June 2010	27529.0 Hours 27351.0 Cycles
Hours & Cycles since Last Phase Inspection	3.0 Hours	
C of A (Issue Date)	20 March 2008	
C of R (Issue Date) (Present owner)	21 November 2007	
Operating Categories	Standard	

1.6.1 The aircraft was deregistered from United States of America (USA) Civil Aircraft Register; effective date 20 June 2007. The aircraft was then imported to Republic of South Africa and issued with a South African Certificate of Registration. The South African Civil Aviation Authority (SACAA) Airworthiness Department inspected the aircraft and issued it with a Certificate of Airworthiness. The South African owner intention was to utilise the aircraft in Air Transportation Operations, which was in accordance with the provisions of Civil Aviation Regulation (CAR) Part 135.

1.6.2 The aircraft documentation (e.g. certificate of registration, certificate of airworthiness, radio station licence etc.) carried onboard the aircraft was inspected during the investigation process and found to be valid. There was only one anomaly identified with the mass and balance certificate, which was not approved.

1.6.3 The aircraft maintenance documentation (work packs) and logbooks (airframe, engines and propellers) were obtained from the aircraft maintenance organisation (AMO) and inspected. The following relevant information was identified:

- (i) Work Package: The last maintenance inspection that was conducted on the aircraft was the following: An M7 Aerospace LP Letter Check Inspection Programmes (A, B, C and D – Cycle 1) were carried out in the period 10 to 17 May 2010. The inspections were carried out in accordance with the SA226 Series aircraft maintenance manual (AMM).

- (ii) There was proof of a list of defects identified by the AMO subcontractor when performing maintenance on the avionic and electrical equipment of the aircraft. There were several defects listed and reported it to the AMO Management. The subcontractor waited for the AMO management to approve the rectification of the defects. No further rectification was taken on the list of defects. The subcontractor did not complete the maintenance. A certificate relating to maintenance of an aircraft (CRMA) dated 13 May 2010, which indicated that all maintenance and regulatory requirements had been complied with during the Service Letter Inspection.
- (iii) After the AMO completed the Letter Check Inspection, the aircraft was certified airworthy and issued with a certificate of release to service (CRS) on 1 June 2010. The CRS was then valid until 27729.0 hours or 31 May 2011, whichever comes first. Due to the fact that the defects were not rectified rendered the aircraft not airworthy and shouldn't have been released to service.

1.6.4 Logbooks: The record of maintenance entries that were supposed to be included in the following logbook sections; Product Removal and Replacement Record, Modifications Embodied, Defect Rectification Record and Certificates Relating to Maintenance of an Aircraft (CRMA) were not written in. The unavailability inclusion of the identified information created an undesirable situation for the IIC, whereby problems were encountered during the investigation with establishing of traceability of maintenance activities performed to the parts and components fitted on the aircraft. The AMO management did not have the historic maintenance information available, thus could not be of any assistance in the investigation into sorting out the traceability issue

1.6.5 Flight Folio: The flight folio that was carried onboard the aircraft had been newly opened. There were no entries of defects recorded in it. The flight information in the flight folio previously in use shows that the aircraft was having a after maintenance test flight on 7 June 2010. After the flight information of the test flight was written in the flight folio, there was no further entry of other flights flown until 13 June 2010 when the accident occurred. The evidence shows that the new tyres were fitted before the test flight was flown.

1.6.6 Aircraft Defects: The flight crew reported that they experienced an undercarriage failure during the flight. The description of the undercarriage failure was that only two (nose landing gear and main landing gear on the right side) extended after the gear extension selection was made. In particular, the main landing gear on the left side of the aircraft did not extend. The observation was that the main landing gear doors on the left side were partially open and landing gear not able to extend.

1.6.7 Undercarriage Maintenance History: After the accident occurred, the maintenance records were reviewed during the investigation to determine what maintenance activities had been carried out on the undercarriage prior to the day of the accident. The records show that the last maintenance carried out on the undercarriage was during the M7 Aerospace LP Letter Check Inspection. The undercarriage was inspected in terms of the aircraft maintenance manual (AMM), Chapter 32-00-00. After the inspection was completed, the undercarriage was operating satisfactorily and certified serviceable.

1.6.8 Aircraft Fuel Status: The aircraft was refuelled at FALA with Jet A-1 on 13 June 2010. The refuelling station indicated that a total quantity of 170 litres (299.3 lbs) fuel was uplifted. The flight crew indicated that the fuel quantity onboard the aircraft at the time of takeoff was 2100 lbs. The fuel remaining onboard the aircraft after the emergency landing was approximately 200 lbs. The operator submitted additional documents indicating that the total fuel quantity onboard the aircraft at takeoff was 2000 lbs, which was different from the takeoff fuel quantity of 2100 lbs entry made on the flight folio. The operator clearly did not know what the aircraft fuel status was on the day.

1.6.9 Mass and Balance Status: The operator also submitted a copy of the Load Sheet to determine the aircraft load on the day of the occurrence. The mass and balance for takeoff and landing were as follows:

	Payload (lbs)
Empty Weight	7757.0
Total Pay Load	2550.0
Zero Fuel Weight	10307.0
Takeoff Fuel Weight	2000.0
Actual Takeoff Weight	12307.0
Trip Fuel (Burn-off)	1800.0
Actual Landing Weight	10507.0
Maximum Allowable Takeoff/Landing Weight (MTOW)	12500.0

- (i) The information in the column above was used to determine whether the mass and balance was within limits. The conclusion was that the aircraft was 1993 lbs below the maximum allowable landing mass. The mass and balance of the aircraft was thus found to be within limits and did not contribute to the cause of the accident.

Engine: Right side

Type	Garrett TPE 331-10UA-5119	
Serial No.	P-54203	
Hours & cycles since new	23760.6 hours	35639 cycles
Hours & cycles since overhaul	4781.2 hours	unknown

Engine: Left side

Type	Garrett TPE 331-10UA-5119	
Serial No.	P-54267	
Hours & cycles since new	10421.8 hours	15677 cycles
Hours & cycles since overhaul	4353.2 hours	unknown

Propeller : Right side

Type	Hartzell HC-B3TN-5G
Serial number	BVA 7724
Hours since new	4680.6
Hours since overhaul	229.3

Propeller : Left side

Type	Hartzell HC-B3TN-5G
Serial number	BVA 6327
Hours since new	6696.9
Hours since overhaul	229.3

1.7 Meteorological Information

1.7.1 The meteorological information included in the column below for the time and place of the accident was obtained from the South African Weather Service. The meteorological information obtained from the crew was considered to be substantially correct.

Wind direction	030°	Wind speed	04 kts	Visibility	CAVOK
Temperature	17°C	Cloud cover	CAVOK	Cloud base	CAVOK
Dew point	10°C				

1.7.2 The meteorological information included in the column below for the time and place of the accident was obtained from the flight crew.

Wind direction	030°	Wind speed	±5 kts	Visibility	>10 km
Temperature	17°C	Cloud cover	Nil	Cloud base	Nil
Dew point	Unknown				

1.8 Aids to Navigation

1.8.1 The navigation and landing aids on Runway 24R at FALA were as follows:

- (i) Very high frequency omni-directional radio range (VOR), frequency 117.4 MHz.
- (ii) Non-directional radio beacon (NDB) - PW: frequency 270 kHz.
- (iii) (ILS), frequency 110.9 MHz.
- (iv) Runway centrelines and identification markings.
- (v) The identified aids to navigation were in a serviceable condition.

1.8.2 According to the aircraft approved equipment list, the aircraft had standard navigation equipment installed. Other additional navigation equipment was approved by the Regulator. There was no report or entries made in the flight folio of any anomalies experienced with the aircraft navigation equipment. The navigation equipment was certified serviceable, but evidence found in the investigation indicated that there was an open defect with the navigation equipment which was not rectified.

1.9 Communications

1.9.1 Polokwane International Airport (FAPP): The communication facilities provided by Air Traffic Services (ATS) at FAPP are that of the Tower (124.3 MHz). The communication facilities are available during weekdays until 18:00 and weekends until 17:00. There was no proof of any anomaly experienced with the communication facilities at the airport.

1.9.2 The communications information between FAPP ATC and the aircraft were obtained immediately after the accident occurred. The information found which was relevant to the flight was recorded in a letter. (See attached appendix B, which is a copy of the letter.)

1.9.3 The emergency rescue services at FAPP were also notified of the emergency situation but not required to dispatch. This was due to the fact that the flight crew decided to return to FALA for the emergency landing.

1.9.4 Lanseria International Airport (FALA): The communication facilities provided by Air Traffic Services (ATS) at FALA are Tower/Approach (124.0 MHz) and Apron (122.85 MHz). The communication facilities are available 24 hours a day. There was no proof of any anomaly experienced with the communication facilities at the airport.

1.9.5 The recordings of communications between FALA ATC and the aircraft were obtained immediately after the accident had occurred. The information which was relevant to the flight was recorded on a transcript. (See attached appendix A, which is a copy of the transcript.)

1.9.6 Aerodrome Rescue Fire-fighters (ARFF): The emergency rescue services (fire-fighters) at FALA were notified by ATC of the emergency situation of the aircraft and dispatched to wait at Runway 24R. All communication with the emergency rescue services was co-ordinated by ATC. There was no anomaly identified with communication between ATC and emergency rescue services.

1.9.7 Aircraft equipment: The aircraft was equipped with a VHF transmitter (2 x Collins VIR 20) radio equipment. In addition to the VHF radio equipment, the flight crew could communicate with the ATC by means of a microphone and to passengers by means of the aircraft's intercom or public address (PA) system. There was no proof of any anomaly experienced with the aircraft's communication equipment on the day.

1.10 Aerodrome Information:

Polokwane International Airport (FAPP)

Aerodrome Location	Polokwane International Airport (FAPP)	
Aerodrome Co-ordinates	S23°5042 E029°2724	
Aerodrome Elevation	4076 ft	
Runway Designations	01/19	05/23
Runway Dimensions	2560 x 45	2320 x 45
Runway Used	None	
Runway Surface	ASPH	
Approach Facilities	VOR, NDB, PAPI & Runway Lights	

Lanseria Airport (FALA):

Aerodrome Location	Lanseria Int. Airport	
Aerodrome Co-ordinates	S25°5600 E027°5520	
Aerodrome Elevation	4517 ft	
Runway Designations	06L/24R	06R/24L
Runway Dimensions	2910 x 30	1760 x 23
Runway Used	24R	
Runway Surface	ASPH	
Approach Facilities	VOR, ILS, DME, PAPI & Runway Lights	

1.10.1 The aircraft first flew from Lanseria International Airport (FALA) to Polokwane International Airport (FAPP). Due to the undercarriage emergency situation the aircraft returned to FALA for emergency landing.

1.10.2 The flight plan indicated that Polokwane International Airport (FAPP) was the last destination. The aircraft did not land at FAPP because the flight crew decided to return back to FALA. The flight crew was of the opinion that FAPP did not have appropriate resources in terms of emergency services to assist during the emergency landing. The emergency procedures in terms of the available emergency services of the aerodrome were investigated and it was found that the aerodrome was perfectly capable of handling an emergency landing situation involving the type of aircraft under discussion.

1.10.3 The disaster management plan of the aerodrome in terms of emergency services agreements with other State Organisations was reviewed and found to be satisfactory.

1.11 Flight Recorders:

1.11.1 Flight Data Recorder (FDR): The aircraft was not equipped with a flight data recorder (FDR) and none was required by regulation.

1.11.2 Cockpit Voice Recorder (CVR): The aircraft was equipped with a cockpit voice recorder (CVR). The particulars of the CVR and Underwater Locator Beacon are as follows:

Cockpit Voice Recorder	
Manufacture:	B&D Instruments
Part Number:	890900321
Serial Number:	401156
Number of Parameters recorded	5 parameters

Underwater Locator Beacon	
Manufacture:	Dukane Corporation
Part Number:	DK100
Serial Number:	DH6596
Expiry Date:	November 2010

1.11.3 The CVR had a magnetic tape as a reading medium and could only retain the last 30 minutes of the flight crew voice communications and noise within the cockpit environment. The flight crew switched off all electronics prior to executing the emergency landing, in order to ensure that the electronics remained switched off and to preserve the voice recordings.

1.11.4 The CVR was removed in a serviceable condition from the aircraft on 15 June 2010. According to a CRMA found attached to the aircraft logbook, there was an operational check carried out on 31 May 2010 and the CVR was found to be in a serviceable condition.

1.11.5 Due to the nature of the emergency situation leading to the accident and ATC transcript information being available and giving full description of what transpired, a decision was made not to download the CVR.

1.12 Wreckage and Impact Information

1.12.1 The location of the wreckage was at GPS reading S25°56.151 E027°55.757 which was on Runway 24R at FALA. During the onsite investigation, the accident site and aircraft were inspected. The aim was to obtain information on the impact and damage sustained during the accident. The crew reported that the aircraft was approaching Runway 24R, with an indicated airspeed (IAS) of 85 kts from a northerly direction. The aircraft wings were level with the ground and the undercarriage retracted. The impact marks on the runway and damage caused to the aircraft indicated that the tail section had struck the runway first at a distance of approximately 370 metres past the threshold. The fuselage impacted the surface of the runway at approximately 433 metres past the threshold. At this point, the aircraft started skidding on the runway and came to a complete stop at approximately 930 metres past the threshold.



Figure 4 shows aircraft flying over the threshold on Runway 24R, ready to do a “wheels up” Emergency landing.



Figure 5 shows the aircraft tail section touching down on the runway at approximately 370 metres past the threshold.



Figure 6 shows the fuselage skidding on the runway and coming to a stop approximately 930 metres past the threshold.



Figure 7 shows the skid marks on the runway caused by the aircraft.

1.12.2 The damage caused to the aircraft was limited to the lower fuselage, wheel well (left and right side landing gear doors), flaps and propellers. The damage caused to the aircraft was mainly as a result of the aircraft skidding on the runway.



Figure 8 shows damage caused to the landing gear doors and left propeller.

1.13 Medical and Pathological Information

1.13.1 None.

1.14 Fire

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

1.15 Survival Aspects

1.15.1 The accident was considered to be survivable. The aircraft was intact and the fuselage sustained substantial damage. The aircraft was exposed to landing impact force only while skidding on the runway surface. The crew and passengers were properly restrained by making use of the aircraft safety belts. All the occupants survived the accident without sustaining any injuries.

1.15.2 The aircraft was operated between two manned aerodromes (FALA and FAPP). The crew filed a flight plan indicating 'SAR Normal' because the flight was bound for licensed aerodromes with an operational ATC.

- (i) A Cannad 406 MHz, Emergency Locator Transmitter (ELT) beacon (P/N S1821502-02 & S/N 2617244-0045) was installed in the aircraft. The ELT was in a serviceable condition. During the investigation, there was proof found indicating that the ELT did not have a remote switch installed. The responsible AMO did not comply with applicable regulation when installing this type of ELT equipment. The ELT was also not registered with the relevant authority – COSPAS SARSAT. The consequence being that; should the ELT transmit a signal in any emergency situation, it would have posed a problem for the South African Search and Rescue (SASAR) operations. If it was in a remote area, the actual location of the aircraft would have been difficult to identify.

1.15.3 The ARFF personnel at FAPP had their response vehicles standing at Runway 24R, waiting for the aircraft to execute an emergency landing. After the aircraft had landed and came to a stop on the runway, the fire-fighters started spraying foam agent. The crew and passengers were then evacuated safely from the aircraft.

1.16 Tests and Research

1.16.1 According to the Swearingen Airplane System Training Manual, the following information about the undercarriage is evident:

- (i) *The aircraft landing gear consist of a steerable dual wheel nose gear and two dual wheel main gears. The landing gear hydraulic system retract mechanism is electrically controlled and hydraulically operated and retracts forward into the wells, becoming completely enclosed by mechanically actuated doors.*

- (ii) *There are two actuating cylinders for each gear. Both actuating cylinders are used for retraction. The outboard actuator on each main gear and left side actuator on the nose gear are used for normal extension. The alternate actuator is used only for emergency extension.*
- (iii) *Each landing gear is locked in the extended position by two sets of down lock assemblies which hold drag struts in an over centre condition. During flight a gear warning horn will sound when one or both power levers are retracted to flight idle position and landing gear is not in the down and locked position. There are also three landing gear lights inside the cockpit on the instrument panel which illuminates red or green. The green light indicating that the landing is safe and red light indicating the landing gear not safe.*
- (iv) *In cases where a problem occurs with the landing gear not extending, an emergency hand pump and manual release system is provided. The manual release handle is located on the cockpit floor on the left hand side of the co-pilot seat.*



Figure 9 shows the emergency landing gear extension system.

- (v) *The operation of the manual release handle releases the landing gear up locks and, with the same action, opens a bypass valve in the power pack. Opening the bypass valve allows fluid to return to the reservoir and bypasses the filter and the selector valve. The manual release system must be actuated prior to hand pump operation. During hand pump operation, fluid is directed to one actuator for each gear. The pressure produced by the hand pump in the system will cause that the gear extend. The manual release system will also permit free fall operation of the gear in the event all hydraulic fluid is lost.*

1.16.2 According to the Pilots Operating Handbook (POH), Emergency and Abnormal Checklist, if a 'landing gear unsafe' indication remains even after attempting landing gear emergency extensions, the flight crew should proceed with gear up landing procedures. These procedures are as follows:

- (i) *“Landing with all three gears up; use full flaps. Approach the runway at 133 to 138 KIAS. Do not feather propellers until landing on the runway is assured. Drag will be reduced and gliding distance increase after propellers are feathered. Switch off electrical power just prior to touchdown (to allow use of the pitch trim system until touchdown). Allow aircraft to touch down in a relatively flat attitude and on centreline. Use rudder for directional control.” The indication was that the flight crew had complied with the above procedure.*

1.16.3 The indication was that the flight crew complied with the emergency and abnormal checklist procedures required by the POH.

1.16.4 Undercarriage Retraction Testing: On 13 June 2010, approximately 1600Z, the aircraft was recovered from the accident site for undercarriage retraction tests. The aircraft was lifted on jacks before attempting to extend the undercarriage. The first extension was unsuccessful due to the nose wheel being stuck fast and nose gear doors not opening freely. An inspection of the nose gear doors revealed that the left side door was stuck and causing an obstruction. The identified nose gear door sustained substantial impact damage during the landing sequence. The left side nose landing gear door was loosened and immediately both nose landing gear doors dropped open. The nose landing gear then started extending, followed by the two (left and right side) main gear assemblies. The undercarriage was then inspected to ensure that all three landing gears were down and locked securely. Inside the cockpit the undercarriage lights illuminated “three greens,” supporting the situation seen on the outside, which indicated that the undercarriage was down and locked. All the jacks and wing stands placed under the aircraft were removed and the aircraft could stand on its wheels without any mechanical support. The aircraft was locked and left parked in front of the hangar where it was being operated.

1.16.5 On 14 June 2010, at approximately 1300Z, the aircraft was towed from the location where it was parked overnight to the facility (hangar) of the maintenance organisation which was to assist with the retraction test investigation. Jacks were put under the aircraft in accordance with applicable maintenance procedures. Before the retraction tests could start, the hydraulic pipes and fittings near the reservoir that shaved through during the “wheels up” landing sequence first needed to be blanked off to stop any possibility of hydraulic leak in the retraction test. A serviceable hydraulic rig was then used to pressurise the hydraulic system with hydraulic fluid. The time that the undercarriage hydraulic system was fully charged with hydraulic fluid, it was considered to be ready for the retraction tests.

1.16.6 The undercarriage was still extended from the activity of the previous day. The undercarriage first required to be cycled to the 'gear up' position. The undercarriage was retracted and all the landing gear doors closed properly without experiencing any mechanical obstruction. The landing gear was then selected to the 'gear down' position, but only two of the gears (nose and main gear on right side) extended to the full 'down and locked' position. An inspection was carried out to identify the cause of the right hand side main gear not extending. The right main gear doors were stuck, holding the gear up inside the wheel well. The right gear doors were forced open, where after the gear extended. Due to the impact damage caused to the landing gear doors during the accident, the right hand side main gear doors continuously got jammed when retracted. The IIC then decided to remove the damaged gear doors to identify if any further obstruction exists. Thereafter the landing gear was cycled up and down again several times without experiencing any problems. The emergency hand pump (manual pump) was also used to extend the landing gear and the gear functioned without any problem.

1.16.7 On completion of the retraction tests, it was concluded that there was no mechanical defect identified with the operation of the landing gear system. The landing gear operated as required without problems. It was the right hand side main landing gear door that obstructed the free movement of the affected landing gear. However, the main landing gear doors (left and right hand side) were destroyed from scraping along the runway during the emergency landing. Therefore it was not possible to carry out rigging and operation testing on the landing gear doors.

1.16.8 Other landing gear failure accident involving the Swearingen SA 226 TC Metro II aircraft type: There was an accident at Winnipeg, Manitoba in Canada on 3 March 2009, which was similar to that of ZS-ZOC. The Winnipeg accident report findings were used to determine if there was any similarity to the findings identified in the investigation of ZS-ZOC. The findings identified in the accident were the following:

Transportation Safety Board of Canada (TSB), Aviation Investigation Report A09C0028 stating;	In the case of ZS-ZOC, the following finding were identified;
<i>The right inboard landing gear door was incorrectly rigged, which reduced the clearance between the tire and gear door during gear extension.</i>	All the landing gear doors on the aircraft were installed by the AMO that previously maintained it. The landing gear doors were installed during the period of 22 May 2007 to 8 February 2008. The landing gear doors were tested and operated satisfactorily. The aircraft operated for approximately 225 hours since the landing gear doors were installed without encountering any anomalies.
<i>The combined effect of the mis-rigged gear door, the installation of the new re-capped tire with large dimensions, growing free play in the gear door bushings/linkage arrangement, and air loading on the gear door reduced clearance sufficiently that the number three tire caught on a ledge on the inboard door skin, preventing the right main gear from extending.</i>	The operator changed AMOs and there was no record that the current AMO carried out maintenance on the landing gear doors which required for it to be removed and/or rigging procedures done.

<p><i>The design of the landing gear placing the tires and gear doors in close proximity to one another during operation. The gear door is designed with a ledge area on the inner door skin, the tire is at risk of becoming snagged if proper tire size and gear door rigging are not ensured.</i></p>	<p><i>The aircraft landing gear door had a ledge on the inboard door skin as described in the Winnipeg Report. However, due to the damage caused to the landing gear doors it was not possible to carry out similar tests as in the Winnipeg Report.</i></p>
	<p><i>The aircraft had Goodyear tyres fitted. The tyre size on the shoulder of the tyre identified the maximum outside diameter to be 19.5 inches with a shoulder width of 6.75 inches. The maximum allowable outside diameter of the new tyre was 19.2 inches with a maximum shoulder width of 6.35 inches.</i></p>
	<p><i>The condition of the tyres installed on the aircraft ZS-ZOC were gave the impression that they were fairly new. According to a Service Letter 226-SN-131 when using re-capped (used) tyres on most commercial aircraft differences in tyres dimensions after re-capping can cause interference problems in the wheel wells, particularly in the main gear wells. To control the maximum dimensions of the tyre in the wheel well that could cause tyre-related gear problems. The maximum allowable outside diameter of a new tyre was set at 19.2 inches with a shoulder width of 6.35 inches. The dimensions of all new tyres will increase once in use, but the maximum tread diameter of a used tyre should not exceed 19.7 inches and a maximum shoulder width of 6.6 inches.</i></p>

1.17 Organisational and Management Information

1.17.1 The nature of the operation of the aircraft made it necessary to determine if all the organisational and management requirements relevant to the operations had been complied with by the operator and all participating organisations in terms of existing regulations. It was for that reason the licensing and approvals of all organisations were checked, especially those that had a direct influence on the operation of the aircraft.

1.17.2 Aircraft Maintenance Organisation (AMO): The AMO responsible for maintenance had a valid Part 145 Approval Certificate, issued on 1 May 2010 with the expiry date of 30 April 2011. The approval certificate had all the appropriate categories and ratings included on it, which authorised the AMO to conduct maintenance on the aircraft.

- (i) During the investigation process, the management of the AMO showed a reluctance to assist in the investigation. The management were not willing to voluntarily provide the aircraft maintenance documentations and relevant information which could be of help in the investigation. The management did not want to cooperate with the investigators. The issue of non-cooperation by the management was reported to the regulator.

- (ii) The AMO had only two certifying inspectors employed. Both certifying inspectors were authorised to carry out maintenance on the aircraft type. Other specialised electrical maintenance was carried out by subcontractors which held the appropriate ratings.
- (i) The AMO facilities were inspected in the investigation to determine if these were conforming to requirements of applicable regulations. The observation was that the hangar used by the AMO was too small for the aircraft to completely fit inside. The AMO did not have adequate ground equipment available to conduct maintenance. The ground equipment used was borrowing from other AMOs.
- (ii) The AMO management opinion was that the undercarriage failure resulted from the hydraulic power pack that was probably malfunctioning. The AMO management was keen on removing the hydraulic power pack. They wanted to remove the component even before the landing gear extension tests. Based on observation made during the investigation, it is the opinion of the investigator that the AMO management and maintenance personnel clearly did not have the appropriate experience to carry out maintenance on the aircraft type and regulatory requirements of the investigations process. The AMO management behaviour ended up being very suspicious throughout the investigation, pretending that they want to assist but instead seeking information to follow up on the progress of the IIC. The IIC had to react and call on the assistance of the regulator to intervene.

1.17.3 Operator: The operator had a valid Class II Air Service licence which was issued on 15 July 2009. The operator had a valid Part 135, Air Operating Certificate (AOC), issued on 19 November 2009 with the expiry date of 20 October 2010. The AOC authorised the operator to perform domestic commercial (non-scheduled, general air service or charter) air operations.

1.17.4 It was discovered in the investigation that the registration, ZS-ZOC of the accident aircraft was not included on the operator's AOC. The operator responded as follows to the finding:

- (i) The operator submitted an application for amendment of their AOC. The application was given to their private aviation consultancy service on 4 June 2010. Instruction was given that the application be handed in at the SACAA to approve the registration: ZS-ZOC on the AOC.
- (ii) The consultancy service provider handed in the package of application to the SACAA on 8 June 2010. The evidence shows that the SACAA Airworthiness Department was still in the process of reviewing the application for approval, the time when the accident occurred.

- (iii) The operator management reported that they assumed that they had complied with the AOC amendment application requirements, which indicated that it would take a minimum of 2 working days for the application to be completely processed. After the two days gone past, the operator management decided to use the aircraft commercially under the AOC. The operator management actions in this regard were found to be not in compliance with applicable regulation.

1.17.5 There were a total of thirteen passengers carried on the aircraft. The operator submitted copies of passenger tickets issued in terms of the applicable regulation. The operator also submitted a copy of the insurance cover which they had for the passengers. The insurance cover for each of the passengers was found to be satisfactorily. There were no other anomalies identified with the operator as they were in compliance with all other operational requirements.

1.17.6 Airport Management: FALA was under private management The aerodrome was issued with a valid Part 139, Category 7 Aerodrome Licence on 31 July 2009. The period of validity of the licence was from 1 August 2009 to 31 July 2010.

1.17.7 The aerodrome management activities were reviewed in the investigation. There was anomalies identified which related to the performance of the aerodrome management. According to the aerodrome approved manual of procedure, in a case of experiencing an accident of this nature, the following should happen:

- (i) *The aircraft involved in an accident may only be removed once SACAA has given the approval, unless the presence of the aircraft poses a danger to the lives of passengers of other aircraft.*
- (ii) *The aerodrome will then ascertain which of the available resources will be used.*
- (iii) *Where possible, the aircraft must be jacked up or lifted at the designed strong points on the fuselage. (If these areas are damaged, then the use of straps should be considered.)*
- (iv) *Care should be taken not to damage the aircraft any further, as this could affect the investigation in determining the cause of the accident.*
- (v) *All costs involved in the removal of the aircraft are to be paid by the owner of the aircraft.*

1.17.8 The IIC arrived at FALA and assessed the accident situation. The IIC gave permission or approval to the owner and aerodrome management to remove the disabled aircraft from the accident location. The observation was that the aerodrome management could not assist with the removal process, due to the unavailability of suitable recovery equipment. As such the aerodrome operations was disturbed unnecessarily for extended time, to allow the owner enough time to arrange to have the wreckage recovered. The delay had an effect whereby other aircraft scheduled to transport FIFA officials, dignitaries and celebrities from FALA prevented from taking off.

- 1.17.9 The aerodrome management showed their frustration by threatening that they were going to drag the wreckage from the runway to resume with normal operations. The IIC advised the aerodrome management of their recovery responsibility in terms of the manual of procedures. The owner of the aircraft also expressed to the aerodrome management their concern involving the recovery matter. The aerodrome management argued that they had been given special authority by SACAA in the world cup preparatory meetings to make the necessary decisions which they may deem appropriate in cases where experiencing runway obstructions affecting their operations; even if it required drastic measures of dragging the wreckage away from the runway to have it re-opened for operation. The instruction which they received overrides the authority of the IIC. The IIC expressed his disapproval of the aerodrome management views and intended action to remove the wreckage. The IIC advised the aerodrome management of the requirements of CAR, Part 12 “Powers of the Investigator in Charge”. After a long waiting period, eventually at approximately 0945Z, the wreckage was recovered.
- 1.17.10 The management of FAPP was administered by the local municipality. The aerodrome had a valid Part 139, Category 7 Aerodrome Licence, issued on 30 October 2009. The period of validity of the licence was from 1 November 2009 to 31 October 2010.
- 1.17.11 The aircraft did not land at FAPP . According to the ATC, the aerodrome was ready to offer the necessary assistance to the flight crew if they had decided carry out the emergency landing.
- 1.17.12 Air Traffic Control Services (ATNS): The Air Traffic Services Units at FALA and FAPP were duly approved in accordance with Part 172 of the applicable regulations. The control towers at the aerodromes were administered by Air Traffic and Navigation Services (ATNS). Both control towers had valid Air Traffic Services Unit Approvals which expiry dates were 31 August 2010 and 31 August 2010.
- 1.17.13 There was no proof found of anomalies identified with the operations of the ATC.
- 1.17.14 Regulator: On arrival at the accident site, the investigation team inspected the wreckage and IIC made the decision that the wreckage should be recovered.
- 1.17.15 The earlier identified issue of the aircraft registration number not included on the AOC was further investigated internally at the SACAA. The information found indicated the following:
- (i) The Flight Operations Department that deals with Part 135 operators received the application on 8 June 2010. This department approved only their section of the application. It took them two days to process and hand documentation over to Airworthiness Department on 11 June 2010. The application documentation was on the table of one of the inspectors and it was not yet completely processed when the accident occurred. The result was that the current situation of the amendment not having been approved and registration of the aircraft subsequently not having been included on the AOC.

- (ii) The AOC amendment application specifies that even though a minimum of two (2) days to process the application was given, the SACAA still reserves the right not to process the application if all information is not provided and is not true and correct. The operator management was aware of this provision but they were optimistic that all will be well and amendment finally be approved. So, they decided to commence with utilising the aircraft in their operation.
- (iii) According to the Airworthiness Department, the operator was required to submit an amended Maintenance Control Manual (MCM) to the SACAA for approval. The MCM was submitted on 7 June 2010, but it was incomplete and subsequently returned to the operator. This also contributed to the registration not being included on the AOC. The Airworthiness department was of the opinion that the operator had operated the aircraft illegally.

1.17.16 SACAA Oversight: At the time of the accident, the SACAA had satellite offices at selected aerodromes which was located in the different World Cup Soccer Tournament host cities. The SACAA then carried out its duties and responsibilities in terms of oversight from these satellite offices. The presence of the SACAA Inspectorate on the aerodrome was very helpful, because the inspectors were amongst the first responders to the scene when the accident occurred. Due to the fact that the regulator was readily available on aerodrome of the accident site, all processes for receiving pertinent initial information, which normally would take considerable time, were fast-tracked and provided to the investigation team immediately.

1.18 Additional Information

1.18.1 Runway Closure: FALA had only one active runway (06L/24R) at the time when the wheels up landing occurred. The other runway (06R/24L) was closed. At the time when the accident occurred, the disabled aircraft was blocking the active runway. Aerodrome operations were affected by the accident, as the runway was blocked. All air operations to and from the aerodrome were subsequently suspended for several hours. Only helicopter operations continued as normal.

1.18.2 The ATC notified all relevant role players about the situation through their normal channels and made a special request to aircraft within the airspace to divert to alternative aerodromes. The aircraft that were parked on the aerodrome were delayed and could not receive takeoff clearance from ATC, due to the aerodrome being closed.

1.18.3 According to the SACAA, the aerodrome had complied with their procedures in terms of drawing up relevant NOTAMs for the runway closures and all operators and flying crew heading to FALA, had received the information timorously. No further emergency situations were reported which may have been caused as a result of the aerodrome closure.

1.18.4 After the accident occurred, the passengers were transported in vehicles to the aerodrome terminals, where they received trauma counselling. The aerodrome management had made arrangements with relevant emergency service to give trauma counselling to passengers. When the assessments of the passengers were completed, some of the passengers requested to be transported by road to Polokwane to attend to their initial business.

1.18.5 Several attempts were made to contact and interview the passengers during the investigation. They were never available to meet with the investigators until their departure from South Africa. Although several attempts were made to interview the passengers, no such attempts were successful.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1 The aircraft was flown on a non-scheduled domestic air transportation charter flight under Instrument Flight Rules (IFR) by day. The operator was transporting thirteen (13) passengers from FALA to FAPP. During the approach to Runway 05 at FAPP, the flight crew noticed a red warning light inside the cockpit. The red light indicated to them that the undercarriage was in an unsafe condition. The flight crew reported the situation to FAPP ATC and given instructions to do a fly-past in front of the tower so that a visual inspection could be carried out. The observation of the FAPP ATC was that the left main gear was retracted and the gear doors were partially open. The flight crew then attempted to lower the undercarriage manually, but they were unsuccessful. An emergency landing was inevitable.

2.2 Only the nose gear and right main gear were extending. The left main gear failed to extend and remained stuck in the wheel well. The flight crew assessed the situation whether to execute the emergency landing at FAPP or at FALA. They then decided to fly the aircraft back to FALA for a belly “wheels up” emergency landing. During the approach for landing at FALA, the ATC gave instructions to the flight crew to do a fly-past in front of the tower for another visual inspection of the undercarriage. The ATC observed the same situation as before in FAPP. The left main gear was not extending. The ATC gave clearance to the flight crew to execute a belly “wheels up” emergency landing on Runway 24R.

2.3 In order to perform a successful and safe emergency landing, there were emergency procedures with which the flight crew had to comply. After the emergency procedures were performed, the flight crew, passengers and aircraft were prepared for the emergency landing. In the mean time the aerodrome rescue fire-fighting services (ARFF) vehicles were dispatched and waited near the runway for the aircraft to land. During short finals over the threshold of Runway 24R, prior to touchdown, the flight crew shut down both engines, feathered the propellers and switched off all the electrical power. The aircraft landed and gradually came to a stop approximately 930 metres from the threshold on the centreline of the runway.

- 2.4 The damaged aircraft was obstructing Runway 24R. FALA ATC eventually close the affected runway. FALA management did not have the right recovery equipment to remove the aircraft from the runway. The result was that the recovery of the aircraft was delayed. FALA operations had to be temporarily suspended. FALA management and Owner of the aircraft were under tremendous pressure to finalise the recovery. FALA management became very frustrated with the owner and warned that the aircraft will be dragged off the runway. The owner objected to the method of recovery and urged FALA management to afford them an opportunity to arrange for the recovery. The aircraft was finally removed by a private subcontract recovery company.
- 2.5 After the aircraft was recovered, an investigation started to determine what may have caused the undercarriage failure. The evidence found shows that when the red light illuminated to show that the undercarriage was unsafe; the flight crew did everything they possibly can to correct the situation. But none of their attempts were successful. The flight crew then executed a belly “wheels up” landing. The main gear doors were severely damaged. The undercarriage system was tested with the aim to determine if the gear would extend and retract freely without any problems. During the first retraction test, the undercarriage did not extend. The undercarriage was stuck due to the main gear doors not opening. The main gear doors had to be forced to open for the gears to extend. All three gears extended successfully without a further problem being experienced.
- 2.6 After the undercarriage extended, the investigation was redirected into finding the reason for the interference or obstruction in the undercarriage movement. Special focus was put on the undercarriage doors and wheels:
- (i) The travel (opening and closing) of the main gear doors was important in this regard. However, the main gear doors sustained severe impact damage in the emergency landing sequence and it was practically impossible to determine if rigging was done according to the manufactures requirements. The incorrect rigging would have definitely resulted in reduced the clearance between the left main gear tyres and gear doors during extension. There was no maintenance information relevant to the undercarriage doors rigging being carried out.
 - (ii) There were new tyres fitted on the wheels of the aircraft. The dimensions of the tyres were checked to determine if the tyres were as per aircraft manufacturer’s specifications. The evidence found shows that the aircraft manufacturer published a service letter which indicated that the dimensions of all new tyres increase once in use. The diameter of a used tyre should not exceed 19.7 inches and shoulder width 6.6 inches. The tyres fitted on the aircraft had diameter = 19.5 inches and shoulder width = 6.75 – 8. The evidence shows that the shoulder width of the tyre was slightly bigger.

- (iii) Also, the design of the gear placing the tyres and gear doors in close proximity to one another during operation. The gear door was designed with a ledge area on the inner door skin, which may cause the tyres to become snagged if proper tyre size and gear door rigging are not ensured. Though it could not be conclusively determined, the possibility does exist that incorrect rigging of the undercarriage gear doors and tyre size could have contributed in the left main gear becoming snagged on a ledge on the inboard door skin, preventing the left main gear from extending.

2.7 The Owner of the aircraft was also the Operator. The investigation was conducted into the activities of the Operator relevant to the operation of the aircraft. The evidence found showed that the Operator was appropriately authorised to conduct air transportation operations; however, it was discovered that the registration: ZS-ZOC was not included amongst the authorised aircraft. It was evident that the aircraft was used unlawfully and that applicable regulations were contravened. The Operator defended them in the matter, stating that a misconception had been created by the SACAA. The misconception being that they were made to believe that the aircraft would be on their licence within two days after submission of the amendment application. The assumption was that the application had been approved; hence the decision to use the aircraft commercially immediately.

2.8 Due to the fact that the accident occurred as a result of an undercarriage failure, it was deemed necessary to conduct a review of the relevant aircraft and maintenance documents. The aim of the review was to identify whether all maintenance activities pertaining to the undercarriage were complied with in accordance with manufacture requirements and applicable regulations. During the review there was proof found of other general maintenance not carried out by the AMO responsible. The anomalies relating to the maintenance were evidence that the aircraft was probably unserviceable for the flight. However, the AMO still continued to issue a certificate of release to service (CRS) certifying that the aircraft was airworthy. The general feeling during the investigation was that the AMO was reluctant to co-operate with the investigation team. They were not willing to clarify certain maintenance issues identified in the investigation. It is the opinion of the investigator that the AMO lacked relevant skill and experience to conduct maintenance on the aircraft type, hence the substandard management over the maintenance being carried out on the aircraft.

2.9 Both the Operator and AMO are relying on the SACAA for approval of their operations and relevant oversight. The SACAA's activities in this regard were also investigated. The evidence shows that the SACAA received an amendment application to include the aircraft: ZS-ZOC on the AOC. It appears as though the application could not be approved, due to the unavailability of airworthiness personnel. The application was put on someone table and left not being processed. The SACAA did not communicate with the Operator informing them of the reason for the delay. The evidence shows that the responsible department did not comply with internal procedures of two days to approve the application.

3. CONCLUSION

3.1 Findings

- 3.1.1 The pilot-in-command had a valid Air Transport Pilot's Licence (ATPL) and the aircraft type rating was endorsed on it.
- 3.1.2 The first officer had a valid Commercial Pilot's Licence (CPL) and the aircraft type rating was endorsed on it.
- 3.1.3 Both flight crew members had valid Class 1 Medical Certificates. The first officer was the only one who had a medical restriction to wear corrective lenses.
- 3.1.4 The operator had a valid Air Service Licence and Air Operating Certificate (AOC).
- 3.1.5 The aircraft was being flown in air transportation operations which were in accordance with CAR, Part 135.
- 3.1.6 The aircraft had a valid Certificate of Registration, Certificate of Airworthiness (C of A) and Certificate of Release to Service (CRS).
- 3.1.7 The aircraft was being flown on a scheduled domestic charter flight between Lanseria International Airport (FALA) and Polokwane International Airport (FAPP).
- 3.1.8 There were two flight crew members and thirteen passengers onboard the aircraft at the time of the accident.
- 3.1.9 None of the occupants carried on the aircraft sustained injuries in the accident.
- 3.1.10 The aircraft sustained substantial damage in the accident.
- 3.1.11 The Aircraft Maintenance Organisation (AMO) which was responsible for maintenance of the aircraft had a valid AMO Approval Certificate and was authorised to carry out maintenance on the accident aircraft.
- 3.1.12 The Aerodromes and Air Traffic Services Unit used by the operator both had valid Licences.
- 3.1.13 During the recovery process, the crane operator caused further damage to the aircraft when the crane pushed a hole into the airframe structure.
- 3.1.14 The management of the aerodrome did not have recovery equipment available to remove the wreckage from the runway, hence they left it up to the owner/operator to arrange the recovery. The aerodrome was closed for the duration of 2 hours while waiting for the recovery equipment and the removal of the wreckage from the runway.
- 3.1.15 The crew experienced an undercarriage failure when approaching FAPP. The left main landing gear did not extend after 'gear down' selection. The crew opted to execute a belly "wheels up" emergency landing on Runway 24R at FALA.

3.1.16 The crew attempted to extend the left main gear by means of carrying out normal and emergency gear retraction and extension procedures in accordance with the Pilot Operating Handbook (POH), but they were unsuccessful.

3.1.17 Unauthorised maintenance activities were found which had been certified by the AMO.

3.2 Probable Cause/s

3.2.1 The pilot executed a belly “wheels up” emergency landing after the left main landing gear failed to extend.

Contributory Factors:

3.2.2 The new tyres installed on the main landing gear wheels were not in compliance with the instructions of the Fairchild Service Letter 226-SN-131.

4. SAFETY RECOMMENDATIONS

4.1 None.

5. APPENDICES

5.1 None.

Compiled by:

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For: Director of Civil Aviation

Date:

Investigator-in-charge:

Date:

Co-Investigator:

Date: