PRELIMINARY ACCIDENT REPORT

Accident and Incident Investigations Division

Accident
- Preliminary Report -
AIID Ref No: CA18/2/3/10041

Description:

On 20 September 2021 at 1702Z, a Gates Learjet 35A aircraft with registration mark ZS-SFV departed Cape Town International Airport (FACT) for Lanseria International Airport (FALA) with two crew and three passengers on-board. The private flight was conducted in Instrument Flight Rules (IFR) under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended. The crew reported that during their descent to FALA, a sequence of defects occurred which interrupted pre-landing checklist procedure. Because of the workload that the crew was experiencing in the cockpit, the pre-landing checklist was not followed, and the landing gear lever was not selected; therefore, the aircraft landed with landing gears up. The aircraft skidded on its belly and came to rest approximately 2 kilometres (km) from the threshold of Runway 25. All occupants were not injured during the accident sequence, while the aircraft was substantially damaged.

INTRODUCTION

Reference Number	**:** CA18/2/3/10041
Name of Owner	**:** Impuma Group (PTY) LTD
Manufacturer	**:** Gates Learjet Corporation
Model	**:** 35A
Nationality	**:** South African
Registration Marks	**:** ZS-SFV
Place	**:** Lanseria International Airport (FALA), Gauteng Province
Date	**:** 20 September 2021
Time	**:** 1840Z

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to apportion blame or liability****.*

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Investigation Process:

The accident was notified to the Accident and Incident Investigations Division (AIID) on 20 September 2021 at about 1930Z. The investigators dispatched to Lanseria International Airport on 21 September 2021 to conduct an on-site (full scope) investigation. The investigators co-ordinated with all authorities on site by initiating the accident investigation process according to CAR Part 12 and investigation procedures. The AIID is leading the investigation as the Republic of South Africa is the State of Occurrence. The State of Manufacture was notified and an Accredited Representative (AR) was assigned.

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

- *Accident — this investigated accident*
- *Aircraft — the Gates Learjet 35A involved in this accident*
- *Investigation — the investigation into the circumstances of this accident*
- *Pilot — the pilot involved in this accident*
- *Report — this accident report*

2. Photos and figures used in this report were taken from different sources and may have been adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows, or lines.

Disclaimer:

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ABBREVIATION	DESCRIPTION
AIID	Accident and Incident Investigations Division
ACCID	Accident
AMM	Aircraft Maintenance Manual
AMO	Aircraft Maintenance Organisation
ATC	Air Traffic Control
ATPL	Airline Transport Pilot Licence
BAAI	Bureau of Air Accident Investigation
CAR	Civil Aviation Regulation
CDL	Configuration Deviation List
C of A	Certificate of Airworthiness
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
CRMA	Certificate Relating to Maintenance
E	East
ECG	Electrocardiogram
FACT	Cape Town International Airport
FALA	Lanseria International Airport
FAUT	Mthatha Airport
FDR	Flight Data Recorder
FT	Feet
FL	Flight Level
GPS	Global Positioning System
IAW	In Accordance With
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
Kts	Knots
KIAS	Indicated Air Speed
METAR	Meteorological Aeronautical Report
Mhz	Megahertz
PF	Pilot Flying
PM	Pilot Monitoring
PN	Part Number
QNH	Query Nautical Height
RWY	Runway
S	South
SACAR	South African Civil Aviation Regulation
SAWS	South African Weather Service
S/N	Serial Number
TRACON	Terminal Radar Approach Control
UTC	Co-ordinated Universal Time
VREF	Reference Speed
Z	Zulu

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On 20 September 2021 at 1702Z, two pilots and three passengers on-board a Gates Learjet 35A with registration ZS-SFV departed Runway 19 at Cape Town International Airport (FACT), in the Western Cape province, for Lanseria International Airport (FALA), in Gauteng province. The private flight was conducted in Instrument Flight Rules (IFR) under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended. The crew had filed a 1.6-hour flight plan with Air Traffic Control (ATC) prior to departure.

1.1.2 The captain was the pilot flying (PF) and the first officer was the pilot monitoring (PM). The accident flight was the crew members' first flight of the day. Pre-flight checklist was carried out with no anomalies. The crew reported that take-off and cruise were uneventful. At approximately 1825Z during descent to FALA, FALA radar control broadcasted that Runway 25 was in use and that it did not have a precision instrument approach.

1.1.3 While commencing the descent to FALA, the "master warning light" illuminated on the instrument panel. As a result, the crew decided to maintain Reference Landing Speed (VREF) plus 10 kts to ensure that the aircraft maintained sufficient flying air speed so as not to enter a stall. The PF also did not have an air speed indicator reading on his side because the back light on his air speed indicator was unserviceable, thus, they were relying on the air speed indicator that was on the PM side of the cockpit.

1.1.4 On final approach, the crew had initially elected to use Instrument Landing System (ILS) approach for landing Runway 07. Upon air traffic control (ATC) confirming the wind conditions at FALA, which were at the time 210° at approximately 10kts, the crew elected to undertake visual approach for landing Runway 25 so as not to land with excessive tail wind as they were maintaining VREF speed plus 10kts.

1.1.5 Because the PF's side air speed indicator backlight was not readable, the PF handed over control of the aircraft to the PM, who was then tasked with undertaking the landing of the aircraft. However, a further challenge was that the master warning light could not be reset from the PF's side and could only be reset from the PM's side. This meant that the PF was not able to reset the master warning indicator (which had illuminated) from his side of the cockpit nor was he able to reach the switch to reset it on the PM's side of the cockpit. The crew then took a decision to retain control of the aircraft at the PF's side and to undertake landing.

Figure 2: Air speed indicator backlight that was unserviceable.

1.1.6 Upon turning base leg, flaps were selected down to 45°. At that stage, the augmentation aileron system on the aircraft failed. The crew paid special attention to the air speed to avoid a stick pusher activation, while dealing with a system failure which significantly affected roll of the aircraft. Moreover, the PF was relying on verbal air speed readouts from the PM.

Note: Augmentation system: Source: Airplane Flight Manual (AFM)

"*The augmentation aileron system is a system which employs the use of spoilers on top of each wing, to augment roll inputs in respect of the aircraft in all phases of flight, more critically during slow phases of the flights. The failure of this system significantly limits the roll control of the aircraft*".

1.1.7 The crew further reported that the pre-landing checklist was interrupted by the accumulation of defects, and they had thought that all steps in the pre-landing checklist were followed. On base leg when flaps were extended beyond 25° and the speed was approximately 125 Knots Indicated Air Speed (KIAS), the aural landing gear warning horn and three red indication lights did not activate to indicate that the landing gear was not extended as stated in the Pilot Operating Handbook (POH). The aircraft landed on its belly on Runway 25, skidded for approximately 2 kilometres (km) before coming to rest on the right-side of the runway's centreline. Later, the crew admitted that the landing gear had not been selected in the down position and that the aircraft was landed with the undercarriage retracted.

1.1.8 All occupants were not injured during the accident sequence and the aircraft sustained substantial damage.

1.1.9 The accident occurred during night time at FALA's Runway 25 at Global Positioning System (GPS) co-ordinates determined to be 25°56'30.83" South 027°55'23.44 East at an elevation of 4 420 feet (ft).

Figure 3: The approximate skidding distance of the aircraft during the accident. (Source: Google Earth).

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	2	0	3	5	-
Total	2	0	3	5	-

Note: Other means people on ground.

1.3. Damage to Aircraft

1.3.1 The aircraft was substantially damaged during the accident sequence.

Figure 4: The damage underbelly and flaps.

1.4. Other Damage

1.4.1 The runway surface was slightly damaged because of the accident.

Figure 5: Scratch marks on runway surface at FALA.

1.5. Personnel Information

Pilot Flying (PF)/ Pilot-in-command

Nationality	South African	Gender	Male	Age	47
Licence Number	0270270903	Licence Type		Airline Transport Pilot Licence (ATPL)	
Licence Valid	Yes	Type Endorsed		Yes	
Ratings	Instrument, Night rating and Instructor Grade 3				
Medical Expiry Date	31 October 2021				
Restrictions	Corrective lenses				
Previous Accidents	None				

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

Total Hours	4736.6
Total Past 24 Hours	1.6
Total Past 7 Days	4.4
Total Past 90 Days	4.4
Total on Type Past 90 Days	4.4
Total on Type	382.9

1.5.1 The PF was initially issued an Airline Transport Pilot Licence (ATPL) on 8 June 2011 in accordance with the International Civil Aviation Organisation (ICAO) and the South African Civil Aviation Regulations (SACAR) Part 61. His last licence re-validation was carried out on 19 February 2021 and his licence was renewed on 9 March 2021 with an expiry date of 30 April 2022.

1.5.2 The PF was issued a Class 1 medical certificate on 13 October 2020 with an expiry date of 31 October 2021 in terms of Part 67.

Pilot Monitoring (PM)/First Officer

Nationality	South African	Gender	Male	Age	40
Licence Number	0270472384	Licence Type		Airline Transport Pilot Licence (ATPL)	
Licence Valid	Yes	Type Endorsed		Yes	
Ratings	Instrument and Night rating				
Medical Expiry Date	31 May 2024				
Restrictions	None				
Previous Accidents	Yes, see 1.5.7				

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

Total Hours	3459.7
Total Past 24 Hours	1.6
Total Past 7 Days	4.7
Total Past 90 Days	24.7
Total on Type Past 90 Days	4.5
Total on Type	705.7

1.5.3 The PM was initially issued an Airline Transport Pilot Licence (ATPL) on 23 May 2011 in accordance with the International Civil Aviation Organisation (ICAO) and the South African Civil Aviation Regulations (SACAR) Part 61. His last licence re-validation was carried out on 1 August 2021 with an expiry date of 31 August 2022.

1.5.4 The PM was issued a Class 1 medical certificate on 12 May 2021 in terms of Part 67. The PM's Class 1 medical certificate had an expiry date of 31 May 2024.

1.5.5 The PM was also issued Class 1 and Class 2 electrocardiogram (ECG) certificates on 12 May 2021. Class 1 and Class 2 of the electrocardiogram certificates had an expiry date of 31 May 2022.

1.5.6 The PM was issued an Audiogram Class 1 and Class 2 certificates on 27 May 2019. Class 1 and Class 2 of the Audiogram certificates had an expiry date of 31 May 2022.

1.5.7 The PM stated that on 14 October 2017, he was the pilot-in-command (PIC) on a Bombardier Challenger 6005 aircraft with registration ZS-TSN when the aircraft experienced weight-on-wheels input switch failure during landing at FALA. No injuries were reported during that incident and the aircraft was substantially damaged. This occurrence could not be found on the Regulator database but was found on the Bureau of Air Accident Investigation (BAAI) database.

Aircraft Maintenance Engineer (AME)

1.5.8 The Aircraft Maintenance Engineer (AME) who signed out the defects, most of the work packs and Certificates of Release to Service (CRS) was initially issued an AME licence on 18 March 2009 by the Regulator. His last re-validation was issued on 7 May 2021 with an expiry date of 27 March 2023.

Nationality	South African	Gender	Male	Age	45
Licence Type	Aircraft Maintenance Engineer				
Licence Number	0272317082				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Gates Learjet 35 Series, Learjet 60 Series, Learjet 45 Series, Bombardier BD-100-1A10, Garrett Aire TFE731 Series, P & W PW305 and Honeywell AS907-1-1A				

Restrictions	None
Previous Accidents	None

1.5.9 Based on his licence, the AME is a mechanic, rated A (Airframe) and C (Engines) on Gates Learjet 35A.

1.5.10 Based on the AME's written statement, he carried out aircraft maintenance in accordance with (IAW) Aircraft Maintenance Manual (AMM) (see Annexure C).

1.5.11 According to the aircraft maintenance records, the AME was undertaking the aircraft maintenance tasks and signing out work packs, including signing out X/W (Avionics) defects. However, when the Avionics cards are signed out, a subcontractor or avionics documents would be attached or referenced on the job card. According to the Aircraft Maintenance Organisation (AMO), line maintenance control of defects and repetitive defects are rectified IAW the AMO's Manual of Procedure (MOP) (see Annexure D).

1.6. Aircraft Information

1.6.1 According to the aircraft file, the accident aircraft was a Gates Learjet 35A manufactured in the United State of America in 1979 by Gates Learjet Corporation. It was certified on 6 February 1980 and registered in South Africa on 17 June 2008. The aircraft was powered by two Honeywell TFE-731-2C-2B series turbofan engines with 3500 pounds of thrust which were installed on 15 August 1979. The aircraft has retractable landing gears. It has a longer range of 2 789 miles with a Jet A-1 fuel capacity of 931 gallons. The cabin has a volume of 268 cubic feet, seating up to eight passengers.

Airframe:

Manufacturer/Model	Gates Lear Jet Corporation	
Serial Number	35A-275	
Year of Manufacture	1979	
Total Airframe Hours (At Time of Accident)	14 870.2	
Last MPI (Date & Hours)	9 January 2021	14 850.8
Hours Since Last MPI	19.4	
C of A (Issue Date)	8 July 2019	
C of A Expiry Date	31 July 2022	
C of R (Issue Date) (Present Owner)	18 November 2015	
Type of Fuel Used in the Aircraft	Jet A-1	
Operating Categories	Private (Part 91)	
Previous Accidents	None	

Note: Previous accidents refer to past accidents the aircraft was involved in, when relevant to this accident.

1.6.2 According to available information, the aircraft was first registered under the present owner on 18 November 2015. The aircraft was re-issued a Certificate of Release to Service (CRS) on 9 January 2021 which lapses at 15150.8 hours or on 9 January 2022, whichever occurs first.

1.6.3 The crew reported that prior to the accident flight, they flew the aircraft on two flights which took place on 17 September 2021. The aircraft took off from FALA to Mthatha Airport (FAUT) and from FAUT to FACT. The two flights were uneventful except for a minor defect of a left generator warning light illuminating; the crew were able to reset it.

1.6.4 Based on aircraft maintenance records, the last inspection was a 300-hour inspection and was carried out on 9 January 2021 at 14850.8 airframe hours. The aircraft had accumulated an additional 19.4 airframe hours in operation since the last inspection.

1.6.5 Major recurring aircraft defects were recorded on flight folio pages 0413, 0414, 0417 and 0421. Damage based on the aircraft maintenance records:

- On 10 January 2020, 27 January 2021, 18 April 2021, and 20 September 2021, the autopilot did not track Navigation on GPS.
- On 27 January 2021, the test flight was carried out following post-maintenance and it came back with defects:
  a) Left-side engine was not reducing to idle when thrust lever was set to idle
  b) augmentation aileron kept illuminating with full flaps.
- On 18 April 2021, the test flight was carried out by the manufacturer's pilot following a right-side leading-edge repair due to bird strike which occurred on 14 February 2021; it came back with the following major defects:
  a) autopilot was unserviceable.
  b) left-side stall warning coming on.
  c) Altitude alert warning unserviceable.
  d) Landing gear horn inoperative.
  e) Weather radar required calibration.
  f) Augmentation aileron RH roll comes on at 5° and approximately 45°on the left.
  g) Autopilot GPS Nav mode was unserviceable (intermittent).

1.6.6 The aircraft was on ground for approximately five months for repairs of the above and other defects. The aircraft was flown on a post-maintenance test flight on 15 September 2021 by an independent pilot. No defects were reported, and the aircraft was released to service on 17 September 2021. As stated on paragraph 1.6.3, the aircraft flew from FALA to FAUT and then FAUT to FACT.

- On 20 September 2021 during the accident flight from FACT to FALA, the following major defects were recorded:
  a) Augmentation aileron failed when the flaps were set at 45°.
  b) Autopilot did not track Navigation.
  c) Left-side stall master warning activated.
  d) Left-side generator failed, amber caution illuminated.
  e) Emergency air indicator light unserviceable (see Figure 6)
  f) Radar paints left low.
  g) Master landing gear warning unserviceable.

Figure 6: Emergency air unserviceable and radar paints left.

1.6.7 The aircraft had recurring safety defects which were not permanently rectified, and no records showed that the AMO tried to get assistance from the manufacturer regarding the defects. According to the AME statement, "*defects rectifying is done after troubleshooting has been carried out IAW Maintenance Manual. If defects are listed on Flight Folio, same principle would apply but at times rectification would be summarised because of space issues. Signing off on the work pack would be done in detail after work has been carried out in-house or by a subcontractor with their release documents referenced".* See Annexure C.

Engine 1:

Manufacturer/Model	Honeywell
Serial Number	P-74762
Part Number	3070300-9
Hours Since New	13881.5
Hours Since Overhaul	97.6

Engine 2:

Manufacturer/Model	Honey well
Serial Number	P-74759
Part Number	3070300-9
Hours Since New	14358.3
Hours Since Overhaul	20.8

1.7. Meteorological Information

1.7.1 A weather report was obtained from the South African Weather Service (SAWS) for the day and time of the accident. The information provided in the table was obtained from the Meteorological Aeronautical Report (METAR) recorded at FALA on 20 September 2021 at 1900Z.

Wind Direction	160°	Wind Speed	9kts	Visibility	9999m
Temperature	22°C	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	-1°C	QNH	1020hPa		

1.8. Aids to Navigation

1.8.1 The aircraft was equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no reported or recorded defects with the navigational equipment prior to the flight.

1.9. Communication

1.9.1 The aircraft was equipped with standard communication equipment as approved by the Regulator for the aircraft type. There were no recorded defects with the communication equipment before and during the flight when the crew last communicated with ATC on frequency 124.00 MHz.

1.10. Aerodrome Information

1.10.1 FALA is privately owned and is a controlled airport open to public air transport. It has one runway oriented 07/25.

Aerodrome Location	Lanseria International Airport	
Aerodrome Status	Licensed	
Aerodrome Co-ordinates	25°56.38'S 27°55.53'E	
Aerodrome Altitude	4 520 feet AMSL / 1 377m	
Runway Headings	Runway 07 065°	Runway 25 245°
Runway Dimensions	Runway - 07/25 997x 148 feet / 3047 x 45 metres	

Runway Used	25
Runway Surface	Asphalt
Approach Facilities	VOR/DME, NDB, ILS and RNAV.
Radio Frequency	124.00MHz, 121.65MHz and 123.7MHz

1.11. Flight Recorders

1.11.1 The aircraft was fitted with a flight data recorder (FDR) and cockpit voice recorder (CVR) as required by the CAR 2011, Part 135.05.10. The recorders were removed from the aircraft on 20 September 2021 and were both successfully downloaded on 21 September 2021 at the approved AMO facility in the presence of the investigators. (See FDR downloads raw parameters attached as Annexure D). *FDR translation to be carried out by the manufacturer will be included in the final report. CVR transcripts and translation are still in progress and will be included in the final report.*

FDR characteristics:

- Manufacturer: Lockheed Martin
- Type: Fairchild F-1000
- Part Number: S703-1000-00
- Serial Number: 01724
- Date of manufacture: April 1997

CVR characteristics:

- Manufacturer: L3 aviation Products
- Type: FA2100
- Part Number: 2100-1020-50
- Serial Number: 001220852
- Date of manufacture: March 2017

1.12 Wreckage and Impact Information

1.12.1.1 The aircraft touched down on its belly with the landing gears retracted on the threshold of Runway 25; it skidded for approximately 2km in a nose-up attitude. There was no damage on the nose section. The accident was located on a heading of approximately 240 degrees (°) magnetic (MAG).

Figure 7: The ZS-SFV aircraft as it came to rest on its belly on the runway. (Source: AMO)

1.12.2 On-site investigation found that the aircraft sustained damages on the flaps, antennae and underbelly.

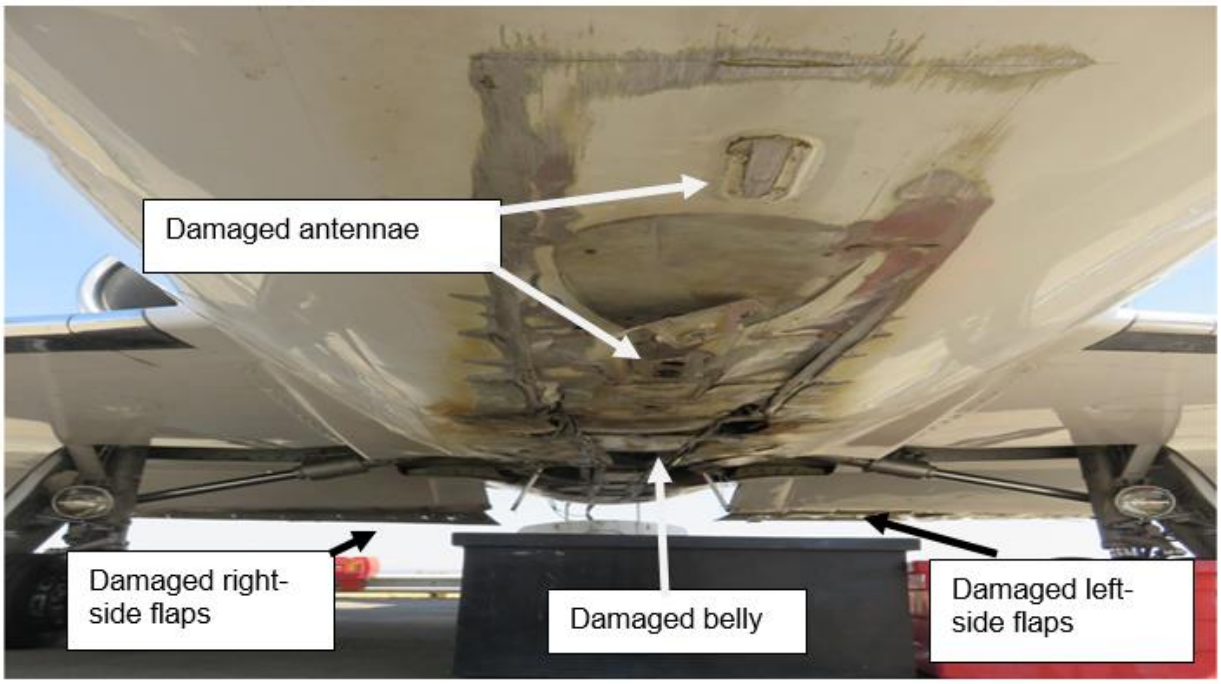


Figure 8: Aircraft damages post-accident.

1.12.3 According to the AMO, the landing gear lever was found in up and locked position.

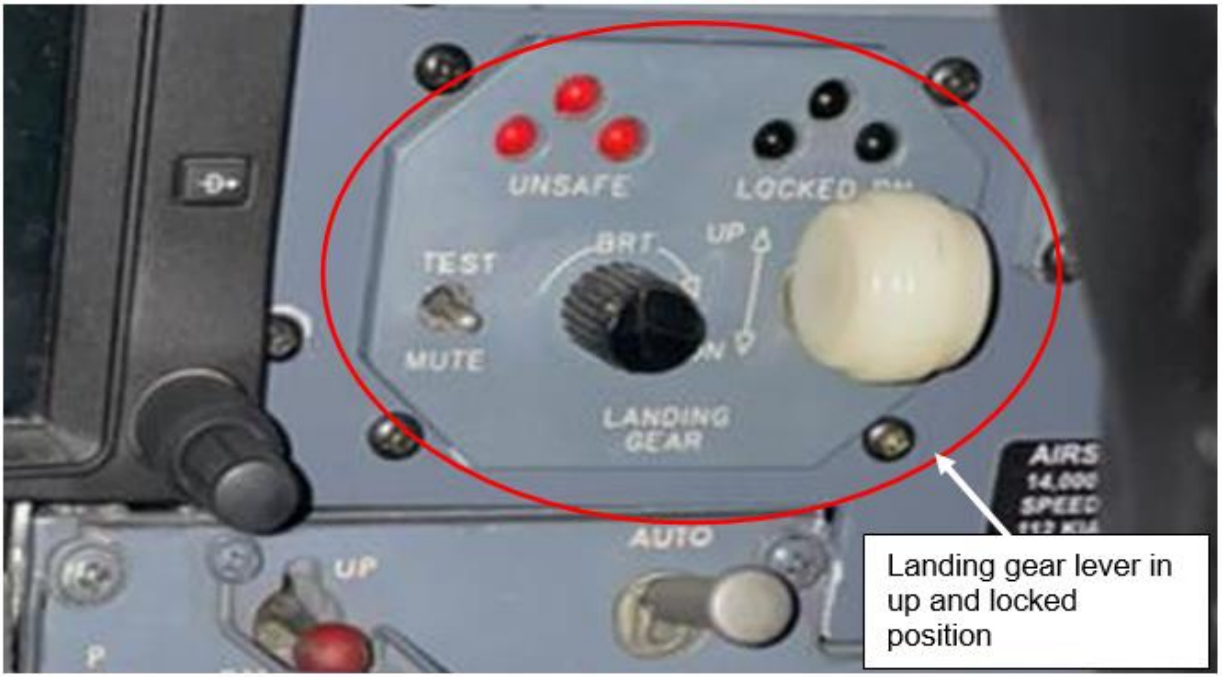


Figure 9: Landing gear lever in up and locked position. (Source: AMO)

1.12.4 During an on-site investigation, it was found that the left-side and right-side main landing gear doors were damaged during the accident sequence.

Figure 10: Damaged main landing gear doors.

1.12.5 During an on-site investigation, it was also found that all circuit breakers (CBs) were in closed position.

Figure 11: All circuit breakers were in a closed position.

1.13 Medical and Pathological Information

1.13.1 None.

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 considered survivable as no damage was caused to the cockpit and cabin structure of the aircraft.

Figure 12: Cockpit and Cabin structure still intact.

1.16 Tests and Research

1.16.1 To be discussed in final report.

1.17 Organisational and Management Information

1.17.1 The aircraft was operated privately under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended. The aircraft had a valid Certificate of Airworthiness issued by the Regulator on 8 July 2019 with an expiry date of 31 July 2022.

1.17.2 The Aircraft Maintenance Organisation (AMO) which carried out the last maintenance inspection (300-hour inspection) prior to the accident flight was in possession of an approved AMO certificate that was issued by the Regulator on 25 September 2020 with an expiry date of 31 October 2021.

1.17.3 The AMO which carried out the avionics maintenance on the aircraft was in possession of an approved AMO certificate that was issued on 25 February 2021 with an expiry date of 28 February 2022.

South African Civil Aviation Regulation Part 145, Sub-part 1

Part 145
Aircraft Maintenance Organisations

Categories of ratings

145.01.6 *(1) The categories of ratings for an AMO approval are—*

(a) Category A ratings for all types of aircraft, excluding rotorcraft either singly or in the classes as prescribed in Document SA-CATS 145.

(b) Category B ratings for aircraft, excluding any engine, either singly or in the classes as prescribed in Document SA-CATS 145.

(c) Category C ratings for all types of engines, excluding engines to be installed in rotorcraft, and Category D ratings for all types of engines, either singly or in the classed as prescribed in Document SA-CATS 145.

(d) Category E ratings for all types of rotorcrafts, either singly or in the classes as prescribed in Document SA-CATS 145.

(e) Category W ratings for all types of—

(i) electrical installations in all types of aircraft, excluding radio apparatus installations, either singly or in the classes as prescribed in Document SA-CATS 145.

(ii) instruments installations in all types of aircraft, either singly or in the classes as prescribed in Document SA-CATS 145; and

(iii)radio apparatus installations in all types of aircraft, either singly or in the classes as prescribed in Document SA-CATS 145; and

(f) Category X ratings for aircraft equipment, instruments, components, accessories, auxiliaries, or parts, either singly or in the classes as prescribed in Document SA-CATS 145.

(2) The Director may issue a limited rating to an AMO that maintains or repairs only a particular type of radio, instrument, or accessory, or part thereof, or performs only specialised maintenance, requiring equipment and skills not ordinary performed under other AMO ratings. Such a rating may be limited to a specific model or constituent part, or to any number of parts made by a particular manufacturer and shall be restricted to those items listed on an approved capability listing.

(3) The Director may issue limited ratings for—

(a) airframes of a particular make and model.

(b) engines of a particular make and model.

(c) propellers of a particular make and model.

(d) instruments of a particular make and model.

(e) radio equipment of a particular make and model.

(f) accessories of a particular make and model.

(g) landing gear components.

(h) floats, by make.

(i) non-destructive inspection, testing and processing.

(j) emergency equipment.

(k) rotor blades, by make and model; and

(l) aircraft fabric work.

(4) For a limited rating for specialised services the operations specifications of the AMO must contain the specification used to perform the specialised service. The specifications may be—

(a) a civil or military specification, currently used by industry, and approved by the Director; or

(b) a specification, developed by the applicant, and approved by the Director.

1.17.4 The aircraft had recurring safety defects which were not permanently rectified, and no records showed that the AMO tried to get assistance from the manufacturer regarding the defects. According to the AME statement, "*defects rectifying is done after troubleshooting has been carried out IAW Maintenance Manual. If defects are listed on Flight Folio, same principle would apply but at times rectification would be summarised because of space issues. Signing off on the work pack would be done in detail after work has been carried out in-house or by a subcontractor with their release documents referenced".* See annexure C.

1.18 Additional Information

1.18.1 Gates Learjet 35A Airplane Flight Manual (AFM)
Normal approach and before landing Checklist Procedure:

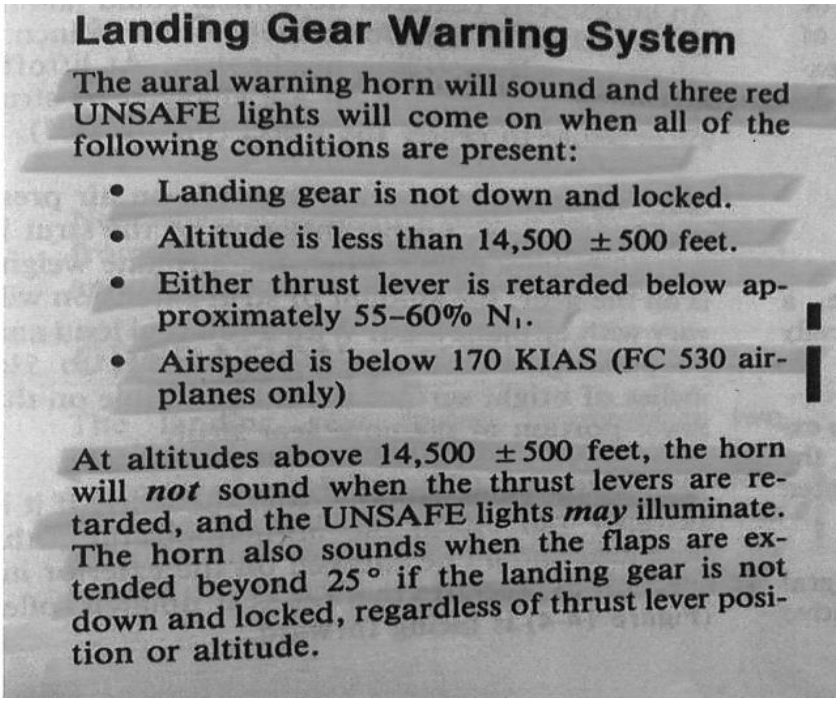
APPROACH (FL 180)

PNF	PF
Altimeters	_____SET
Bugs & V -Speeds	_____SET
Lights	ON
Fuel Balance	CHECKED
Circuit Breakers	CHECKED
Hydraulic & Emer Air	CHECKED
Seat Belt No Smoking Sign	ON
Radar Altimeter	ON
Air Conditioner	ON
Thrust Reverser	ARMED
FLT & NAV Instruments	SET & CHECKED

BEFORE LANDING

PNF	PF
Spoilers	RETRACTED
Landing Gear	DOWN
Landing Lights	ON
Parking Brake	OFF
Hydraulic Pressure	CHECKED
Anti-Skid	CHECKED-ON
Flaps	LAND
Air Ignition	ON
Engine Syncs	OFF
Yaw Damper	OFF

1.18.2 Gates Learjet 35A Airplane Flight Manual (AFM)
Normal Procedure:



Landing Gear Warning System

The aural warning horn will sound and three red UNSAFE lights will come on when all of the following conditions are present:

- Landing gear is not down and locked.
- Altitude is less than 14,500 ±500 feet.
- Either thrust lever is retarded below approximately 55–60% N_1.
- Airspeed is below 170 KIAS (FC 530 airplanes only)

At altitudes above 14,500 ±500 feet, the horn will *not* sound when the thrust levers are retarded, and the UNSAFE lights *may* illuminate. The horn also sounds when the flaps are extended beyond 25° if the landing gear is not down and locked, regardless of thrust lever position or altitude.

1.19 Useful or Effective Investigation Techniques

1.19.1 To be discussed in the final report.

2. Findings

2.1 General

From the available evidence, the following preliminary findings were made with respect to this accident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusions heading:

- **Findings —** are statements of all significant conditions, events or circumstances in this accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.

2.2 Findings

2.2.1 The PF had a valid ATPL and the aircraft type was endorsed on his licence. He also had a valid Class 1 aviation medical certificate issued on 13 October 2020 with an expiry date of 31 October 2021.

2.2.2 The PM had a valid ATPL and the aircraft type was endorsed on his licence. He also had a valid Class 1 aviation medical certificate issued on 5 May 2021 with an expiry date of 31 May 2024.

2.2.3 Based on the Regulator's database, the PM had no accidents, incidents or violations in aviation and no record of any investigations pending against him, but he stated that he had an incident at FALA in which an aircraft had weight-on-wheels input switch failure during landing.

2.2.4 This was a private flight and was conducted in accordance with the provisions of Part 91 of the South African Civil Aviation Regulations 2011 as amended.

2.2.5 The aircraft was maintained by an approved and qualified AME, and the aircraft type was endorsed on his licence, which was initially issued on 18 March 2009. His last re-validation licence was issued on 7 May 2021 with an expiry date of 27 March 2023.

2.2.6 The aircraft was first registered under the current owner on 18 November 2015. The aircraft was issued a Certificate of Airworthiness on 8 July 2019 with an expiry date of 31 July 2022 and the aircraft was re-issued a Certificate of Release to Service (CRS) on 9 January 2021 which would lapse at 15150.8 hours or on 9 January 2022, whichever occurs first.

2.2.7 The AMO which carried out the last maintenance inspection (Annual Inspection) prior to the accident flight was in possession of an approved AMO certificate that was issued by the Regulator on 25 February 2021 with an expiry date of 28 February 2022.

2.2.8 The AMO which carried out the avionics maintenance on the aircraft was in possession of an approved AMO certificate that was issued on 25 February 2021 with an expiry date of 28 February 2022.

2.2.9 The last maintenance inspection (MPI) was carried out on 9 January 2021 at 14850.8 airframe hours. The aircraft had accumulated an additional 19.4 airframe hours in operation since the last inspection.

2.2.10 The aircraft had recurring safety defects which were not permanently rectified, and no records showed that the AMO tried to get assistance from the manufacturer regarding the defects.

2.2.11 The aircraft was fitted with a CVR and FDR as it is a requirement according to CAR 2011, Sub-part 135.05.11 and the recorders were both successfully downloaded on 21 September 2021 at an approved AMO facility in the presence of the investigators. (See FDR downloads raw parameters attached as Annexure D). *FDR translation to be carried by the manufacturer and will be included in the final report. CVR transcripts and translation are still in progress and will be included in the final report.*

2.2.12 Two independent pilots test flew the aircraft on different dates, and both reported similar or same defects. These defects were rectified and signed by the AMO responsible for the maintenance of the aircraft.

2.2.13 According to the aircraft maintenance records, the AME was undertaking the aircraft maintenance tasks and signing out work packs, including signing out X/W (Avionics) defects. However, when the Avionics cards are signed out, a subcontractor or avionics documents would be attached or referenced on the job card.

2.2.14 The crew's attention was diverted by the accumulation of defects occurring at the time and they had thought that all steps in the pre-landing checklist were followed.

2.2.15 On the base leg when flaps were extended beyond 25°, the aural landing gear warning horn and three red indications did not activate as they were supposed to alert the crew that they had failed to properly configure the aircraft for landing.

2.2.16 The crew were flying the aircraft visually during the approach phase while dealing with a stall actuation warning, had no reference to an air speed indicator on the PF's side,

and the augmentation aileron system failure which is a critical system when the aircraft is on approach and reducing speed.

2.2.17 The crew admitted that the landing gear had not been selected in the down position and the aircraft landed with the undercarriage retracted. The aircraft landed on its belly on RWY 25 and skidded for approximately 2 kilometres (km) before coming to rest on the right of the runway's centreline.

2.2.18 The reported weather by SAWS did not have a bearing on the accident.

3. On-going Investigation

3.1 The AIID investigation is on-going and the investigators will be looking into other aspects of this occurrence which may or may not have safety implications.

4. APPENDICES

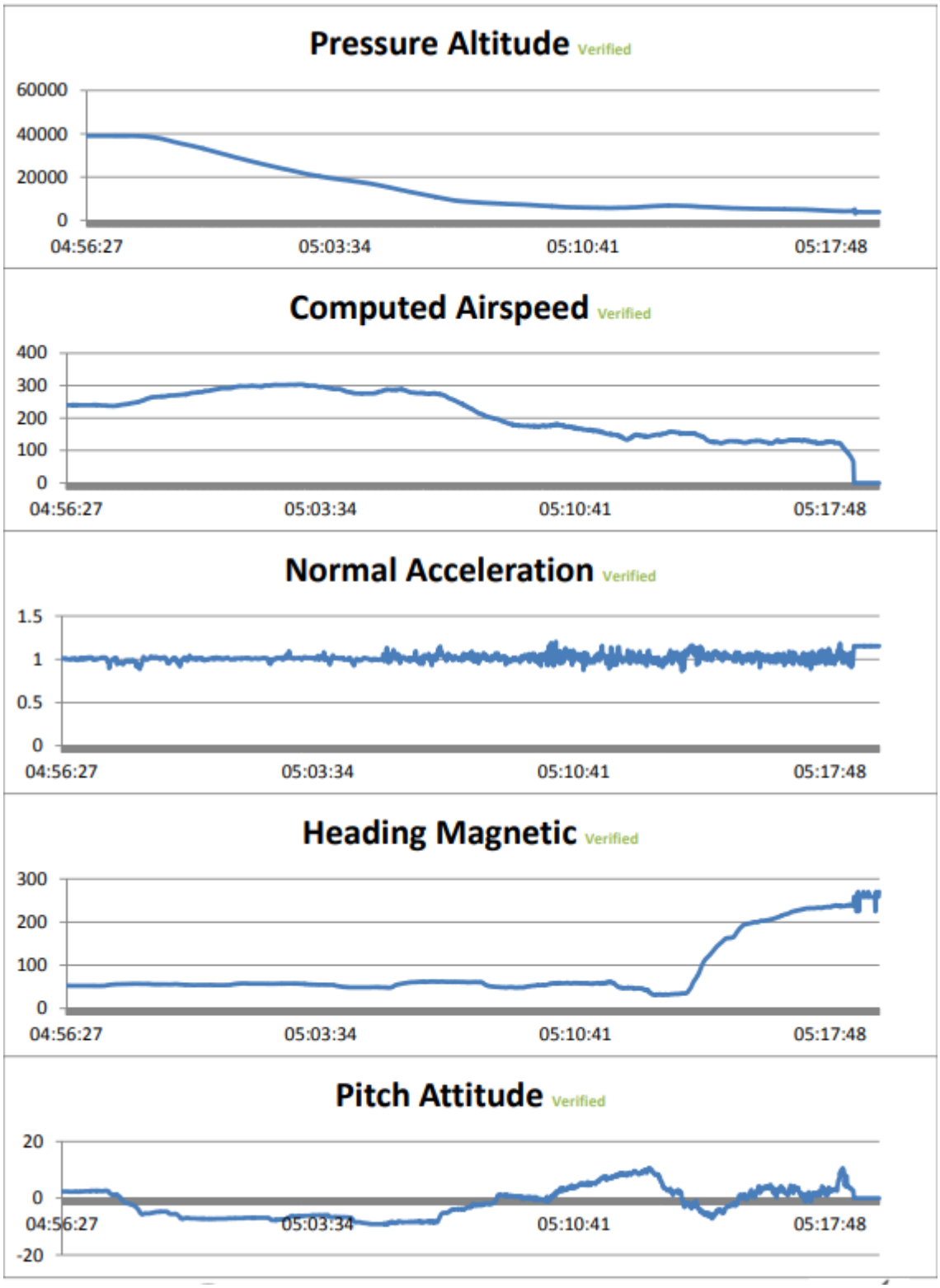
4.1. **Annexure A -** FDR downloads parameters
4.2 **Annexure B -** FALA aerodrome chart
4.3 **Annexure C -** AME's statement
4.4 **Annexure D -** AMO's MOP

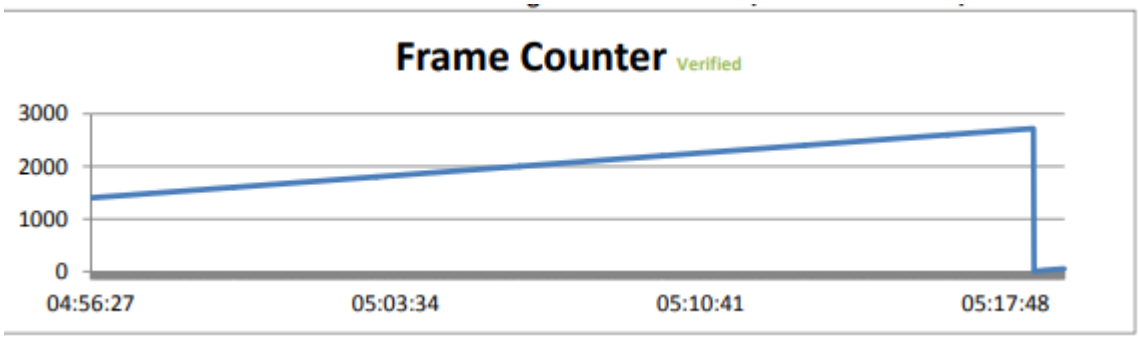
This report is issued by:

Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa

Annexure A

Transcription Graphs for Gates Learjet 35A / S/N 275 ZS-SFV 2021/09/21 L3 Communications F1000 Solid State Flight Data Recorder P/N S703-1000-00 S/N 01724

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Verified
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2000
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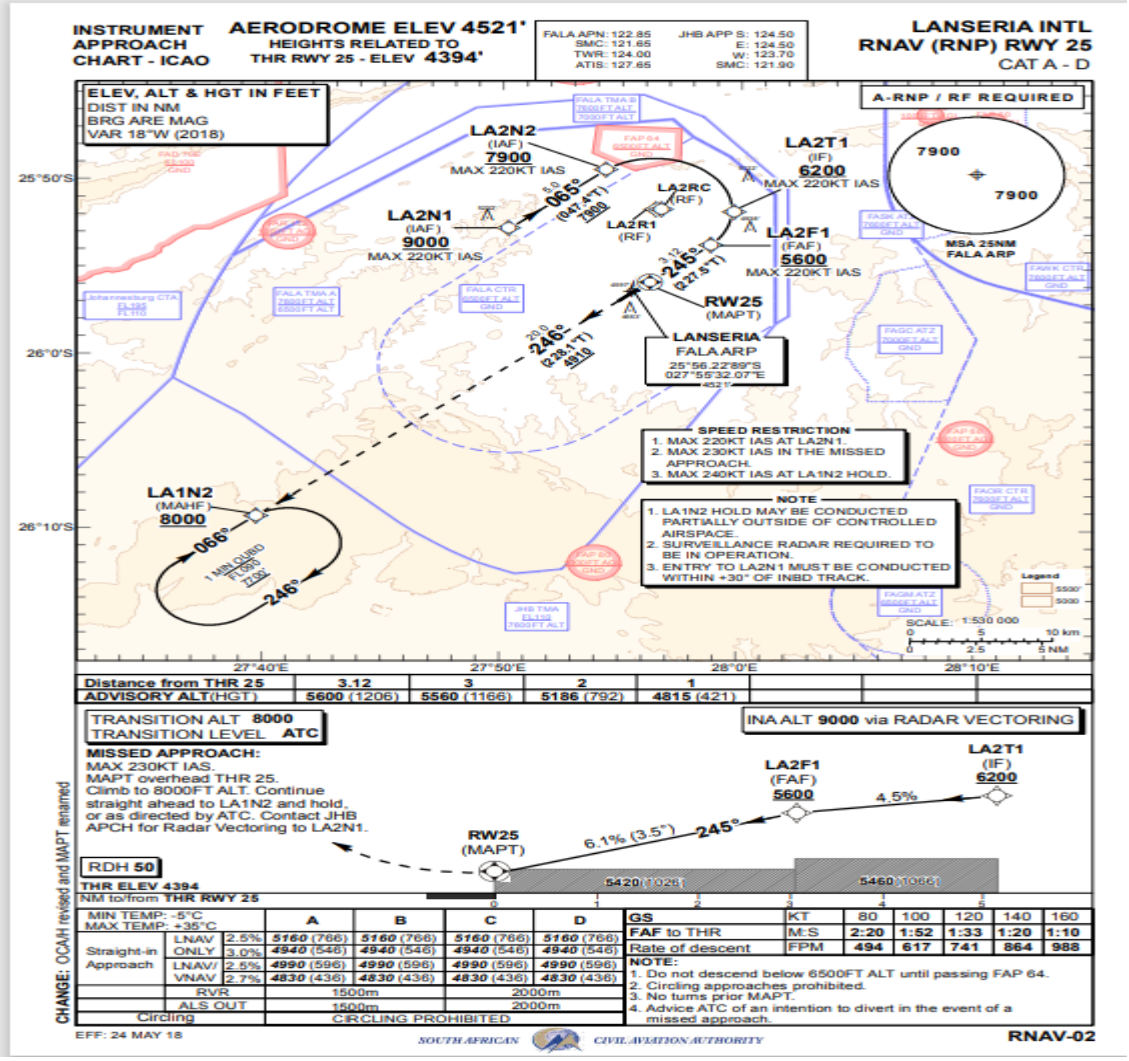
Annexure B



Annexure C

"*Defects rectifying is done after troubleshooting has been carried out I.A.W Maintenance Manual. If defects are listed on Flight Folio, same principle would apply but at times rectification would be summarised because of space issues. Signing off on the work pack would be done in details after work has been carried out in house or by subcontractor with their release documents referenced***."**

Annexure D

L2.3 Line Maintenance Control of Defects and Repetitive Defects - Defects arising during Line Maintenance activities may fall into two categories, those that affect the airworthiness of the aircraft and require immediate rectification and those that may be deferred to a more suitable time for rectification. All defects, regardless of their status, will be recorded in the relevant maintenance records (Work packs, non-routine aircraft/engine work order traveller/discrepancy sheets, flight folios etc.) as well as the corrective actions implemented to rectify (or defer) such defects. A review of repetitive defects should be taken of the log entries, with the crew or maintenance controllers for those previous actions taken and to aid in troubleshooting. When processing Parts or Equipment required being purchased/delivered in order to rectify an Aircraft On Ground (AOG) emergency, such processing shall be done in accordance with procedure in the MOE. All deferrals will be carried out in accordance with the approved Minimum Equipment List (MEL) or Configuration Deviation List (CDL) and those procedures concerning the deferment in consultation with the aircraft operator. Due regard will be made of current MEL OPEN deferred defects and tech log analysis to ensure the airworthiness of the aircraft is not affected, or undue load placed on the crew due to multiple systems being inoperative. Only those deferrals will be carried out which are within the limitations specified in the relevant maintenance manuals and the Operators approved MEL including those procedures listed in the relevant MEL required with regard to Maintenance, Operations and Placarding. It shall remain the responsibility of an Engineer issuing a Release to Service to determine if a defect may be considered a Reportable Occurrence under the SACAA System of Technical Occurrence Reporting or bring to the attention of the Compliance Manager the details in order to make that determination. In each case, he shall prepare a report of the details and forward onto the CM per MOE 02

L2.4 Line Procedure for Completion of Technical Log, the Technical/Journey Log, is the property of the Owner/Operator of the aircraft. Technical/Journey Logs are usually specific to each Owner/Operator and the procedure for completion is particular to the Owner/Operator. However, as a minimum, an entry in the relevant Technical Log Book shall be made by the Certifying Engineer, referring to any work order/pack raised, in which work was performed on that aircraft as per MOE 2.13 and 2.16. EMS will ensure that specific instructions (if any) from the Owner/Operator in regard to the completion of Technical/Journey Logs are obtained and implemented for those

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Contracting Operators listed as per this MOE.

Details of those procedures will be referred to and incorporated into the continuation training program for relevant Certifying Staff and Planners to ensure up-to-date knowledge and application of such. Copies of the Technical/Journey Logs will be retained in accordance with Operators approved MCM when so contracted. In all cases, the Certifying Staff will ensure that the following is clearly detailed on the

Technical/Journey Log: a) The CRS/CRMA Statement or abbreviated statement; b) The AMO Approval number of MRO Services (Pty) Ltd; c) The Certifying Staff Authorization number and; d) Name/Signature of the Certifying Staff; e) The flight times/cycles and dates are clearly annotated in the area relevant to the work to be released. If, due to the nature of the defect, a duplicate inspection is required, that inspection will be detailed in the Technical Log, when a work pack is not available for such activities. L2.5 Line Procedure for Pooled Parts and Loan Parts of parts common to the aircraft or fleet of aircraft being operated. These customers/operators may contract EMS to store and distribute parts in accordance with Owner/Operator but in all other respects will be subject to the full extent of EMS Procedures, including the robbing of parts, and goods receiving (Away From Base) as and if applicable. Due regards must be taken to ensure that Modification Standards and Airworthiness Directive Compliance requirements are being met. L2.6 Line Procedure for Return of Defective Part Removed from Aircraft During Line Maintenance, occasions may arise where defective parts and/or components are required to be removed from an aircraft. In this case, the Customer/Operator may exercise the option to: Have the Maintenance Organization replace (repair and refit) the affected part, or; Have the affected part sent for repair to their facility and/or approved contractor;