AIRCRAFT INCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:			**CA18/3/2/1339**	
Aircraft Registration	ZS-DDT	**Date of Incident**	3 March 2021			**Time of Incident**	1655Z
Type of Aircraft	Hawker 4000		**Type of Operation**			Private (Part 91)	
Pilot-in-command Licence Type	Airline Transport Pilot Licence (ATPL)		**Age**	49		**Licence Valid**	Yes
Pilot-in-command Flying Experience	**Total Flying Hours**		6 615			**Hours on Type**	1 000
Last Point of Departure	Cape Town International Airport (FACT), Western Cape Province						
Next Point of Intended Landing	Plettenberg Bay Airport (FAPG), Western Cape Province						
Damage to Aircraft	Minor						
Location of the incident site with reference to easily defined geographical points (GPS readings if possible)							
Approximately 80 metres from the threshold of Runway 30 at Global Positioning System coordinates determined to be 34º05'20.59" South 023º20'13.97" East at an elevation of 470 feet							
Meteorological Information	Surface wind 200°/1kt; temperature: 21° C; dew point: 17° C; QNH 1014 hPa;						
Number of People On-board	2+0	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0
Synopsis							

On 3 March 2021 at 1326Z, two pilots accompanied by two passengers on-board a Hawker 4000 aircraft with registration ZS-DDT departed Lanseria International Airport (FALA) on a private flight to Cape Town International Airport (FACT). The flight was without incident. At 1558Z, the same aircraft with two pilots on-board took off on a positioning flight from FACT to Plettenberg Bay Airport (FAPG). The intention of the flight was to collect the aircraft's owner at FAPG and then return to FALA.

The take-off from FACT was uneventful and the aircraft was cleared to climb to flight level 270 (FL270). However, while abeam OKTED beacon and climbing to FL110, the crew made a request to radar control (Cape Town East) if they could make a descent and maintain FL100. The request was approved by radar control and the crew made a descent to FL100. During the cruise phase, the aircraft was observed by radar control making a descent below FL100. Radar control asked the pilot to confirm his intentions. The pilot apologised for the descent and climbed back to FL100.

While on visual approach for landing at FAPG, the pilot stated that the brake pressure seemed to have reduced and the deployment of the thrust reversers was delayed. Therefore, the crew was unable to slow down the aircraft and it overran the runway, coming to a stop on the grass surface area 80m from the threshold of Runway 30. This was a straight-in approach, and no unmanned procedures were followed.

The investigation determined that the likely cause of the incident was the aircraft's unstable approach, resulting in a deep landing and a runway excursion because of the unarmed spoiler system. The remaining runway length following the deep landing was inadequate for a safe landing without the aid of the spoilers, hence, the subsequent runway excursion. The crew were not injured during the incident.

Probable Cause

It is likely that the aircraft was unstable on approach, resulting in a deep landing and a runway excursion because the ground spoiler system was not armed during approach for landing.

Contributory Factors

Insufficient runway length following a deep landing.

Failure to follow the operating procedures by not extending the speed brakes and arming the ground spoilers during landing.

Late application of thrust reversers.

The crew did not effectively scan and monitor the primary flight instrumentation parameters during the landing phase.

The crew lacked simulator training of emergency procedures and unusual manoeuvres.

SRP Date	9 November 2021	Publication Date	10 November 2021

INTRODUCTION

Reference Number	: CA18/3/2/1339
Name of Owner/Operator	**:** Rocklight Investments (PTY) LTD
Manufacturer	**:** Hawker Beechcraft
Model	**:** 4000
Nationality	**:** South Africa
Registration Marks	**:** ZS-DDT
Place	**:** Plettenberg Bay Airport (FAPG), Western Cape Province
Date	**:** 3 March 2021
Time	**:** 1655Z

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 incident was notified to the Accident and Incident Investigations Division (AIID) on 3 March 2021 at about 1700Z. The AIID conducted an off-site investigation. The state of manufacturer, which is the National Transportation Safety Board (NTSB) has appointed a non-travelling accredited representative and a technical adviser.

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

- *Incident — this investigated incident*
- *Aircraft — the Hawker 4000 involved in this incident*
- *Investigation — the investigation into the circumstances of this incident*
- *Pilot — the pilot involved in this incident*
- *Report — this incident 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
AMM	Aircraft Maintenance Manual
AMO	Aircraft Maintenance Organisation
AMSL	Above Mean Sea Level
AOC	Air Operating Certificate
ATC	Air Traffic Controller
ATPL	Airline Transport Pilot Licence
BIT	Built-in Test
CAR	Civil Aviation Regulations
CAS	Central Alert System
CMC	Central Maintenance Computer
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
CRMA	Certificate Relating to Maintenance of Aircraft
EASA	European Union Aviation Safety Agency
ECMM	Electronic Command and Maintenance Monitors
EICAS	Engine Indicating and Crew Alerting System
FACT	Cape Town International Airport
FALA	Lanseria Airport
FAPG	Plettenberg Bay Airport
FCEU	Flap Control Electronic Unit
FDE	Flight Data Exchange
FDR	Flight Data Recorder
FL	Flight Level
FO	First Officer
FOD	Foreign Object Damage
Ft	Feet
FSTD	Flight Simulator Training Device
GPS	Global Positioning System
GSCM	Ground Spoiler Control Manifold
IF	Instrument Flight
IFR	Instrument Flight Rules
Kt	Knots
KIAS	Indicated Air Speed (Kt)
Lbs	Pounds
LVDT	Linear Variable Differential Transformers
MAU	Modular Avionics Unit
MCDU	Multifunction Control and Display Unit
MHz	Megahertz
MOR	Mandatory Occurrence Report
NDB	Non-Directional Beacon
NTSB	National Transportation Safety Board
PF	Pilot Flying
PIC	Pilot-in-command
PICUS	Pilot-in-command Under Supervision
PM	Pilot Monitoring
PN	Part Number
PTY (LTD)	Proprietary Limited
RVDT	Rotary Variable Differential Transformers

QNH	Query Nautical Height
SAWS	South African Weather Service
SCM	Spoiler Control Manifolds
SN	Serial Number
TCDS	Type Certificate Data Sheets
Vapp	Approach Speed
Vr	Rotation Speed
Vref	Reference Speed
WOW	Weight-on-Wheels
Z	Zulu

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On 3 March 2021 at 1326Z, two pilots accompanied by two passengers on-board a Hawker 4000 aircraft with registration ZS-DDT departed Lanseria International Airport (FALA) for Cape Town International Airport (FACT) where they landed safely.

1.1.2 At approximately 1558Z, the two pilots took off from FACT with the intention to collect the owner of the aircraft at Plettenberg Bay Airport (FAPG), before returning to FALA. Clear weather conditions prevailed at FAPG at the time leading to the incident. A flight plan was filed for Instrument Flight Rules (IFR). The flight was conducted under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.3 The pilot-in-command (PIC) who was the pilot monitoring (PM) stated that take-off from FACT was uneventful until the aircraft was climbing abeam OKTED beacon. According to the mandatory occurrence report (MOR) issued by the air traffic control (ATC), the aircraft was cleared to climb to flight level 270 (FL270), however, while climbing through FL110, the crew requested to make a descent and maintain FL100 due to cabin altitude warning. The request was approved by radar control. However, during cruise phase, radar control noted the aircraft making a descent below FL100. Radar control then asked the pilot to confirm his intentions. The pilot apologised for the descent and climbed back to FL100. Radar control enquired if the operation was normal, and the pilot advised that operation was normal apart from the slight pressurisation issue. ATC enquired if they required assistance and the PM responded that no assistance was needed and that they will continue to FAPG at FL100. Radar control communication was terminated as the aircraft exited FACT controlled airspace and communication was handed over to George Approach. The pilot stated that they experienced cabin altitude warning during the climbing phase.

1.1.4 The PM stated that upon reaching FAPG, a visual straight-in approach was flown for landing Runway 12 as the wind was favouring this runway at a direction of 120° and at a speed of 5 knots (kts). The approach speed of the aircraft was approximately 125kts. The wing flaps were lowered to full down position, which is 35°. The pilot flying (PF) stated that touchdown was normal in the first quarter of the runway. According to data extracted from the flight data recorder (FDR), the aircraft was in air mode for 8 seconds although weight-on-wheels (WoW) indicated that the aircraft was on the ground. The aircraft touched down with the left main gear first, 356 metres (m) from the threshold of Runway 12. At this stage, the ground speed was 128kts. The FDR data further indicated that neither of the six-wing spoilers deployed during the landing roll. Maximum braking was applied as soon as the aircraft was on the ground (WoW) with both brake applications (PIC and FO sides) indicating 100%. At this

stage, the ground speed reduced to 113kts. Approximately 915m after the threshold of Runway 12, the PF activated the reverse thrust levers. It was further noted that 12 seconds after the aircraft was physically on the runway (WoW), the heading changed as the PF steered the aircraft to the left. At this stage, the ground speed had reduced to 33kts. Six seconds later, the aircraft came to a stop on the grass area approximately 80 metres (m) from the threshold of Runway 30. The aircraft was fitted with a cockpit voice recorder as required by the Regulator, but the recording was not audible. The time of landing was after sunset and the aerodrome does not have capability for night operations.

1.1.5 The incident occurred at Plettenberg Bay Aerodrome at Global Positioning System (GPS) coordinates determined to be 34º05'20.59" South 023º20'13.97" East at an elevation of 470ft.

Figure 1: An overlay of the incident site. (Source: Google Earth)

1.2. Injuries to Persons

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

Note: Other means people on ground.

1.3. Damage to Aircraft

1.3.1 The aircraft sustained damage to the nose wheel tyre and left outboard tyre.

Figure 2: Wear damage on the left-side outboard tyre. (Source: AMO)

Figure 3: Dirt and dry grass on the nose tyre. (Source: AMO)

1.4. Other Damage

1.4.1 None.

1.5. Personnel Information

1.5.1 Pilot-in -command (PIC)

Nationality	South African	Gender	Male	Age	49
Licence Number	027 0263023	Licence Type	ATPL		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument rating				
Medical Expiry Date	11 November 2021				
Restrictions	None				
Previous Incidents	None				

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

Flying Experience:

Total Hours	6615
Total Past 24 Hours	3.1
Total Past 7 Days	3.1
Total Past 90 Days	89.8
Total on Type Past 90 Days	89.8
Total on Type	1000

1.5.2 Pilot Flying (PF)

Nationality	South African	Gender	Male	Age	32
Licence Number	0272319468	Licence Type	ATPL		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument rating and instructor Grade 3				
Medical Expiry Date	31 December 2021				
Restrictions	None				
Previous Incidents	None				

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

Flying Experience:

Total Hours	6174
Total Past 24 Hours	1.9
Total Past 7 Days	1.9
Total Past 90 Days	117.2
Total on Type Past 90 Days	117.2
Total on Type	400.9

1.5.3 The pilot monitoring was the PIC for this flight. The pilot (PM) was initially issued a licence on 10 February 1998. The last licence renewal was conducted on 20 August 2020 with an expiry date of 31 August 2021. The aircraft type was endorsed on his licence. The last simulator training which was the proficiency check for instrument rating was conducted in a Beech 1900 (B190) simulator on 26 May 2019; the instrument flying (IF) renewal was conducted on 20 August 2020 with an expiry date of 31 August 2021. The last proficiency check was conducted on 10 October 2020 with an expiry date of 30 April 2021. The PM did the renewal on type on 14 January 2020 after being on ground (without flying) for six years.

Numerous attempts were made to acquire the copies of the logbook to verify when the initial type rating and simulator training were conducted, but without success.

1.5.4 The pilot flying was the co-pilot for the flight. The PF was initially issued a licence on 20 November 2014. He completed his conversion on type on 11 June 2020, and the conversion was endorsed by the instructor. The PF had accumulated a total of 10.5 dual hours. The last licence renewal was conducted on 20 August 2020 with an expiry date of 31 August 2021. The last proficiency check was conducted on 17 November 2020 with an expiry date of 30 April 2021.

1.5.5 During the investigation, a sampling of the PIC hours logged in the crew's pilot logbook was taken, and a calculation to verify flight duty in the last 24 hours before the incident was carried out using the crew's pilot logbook; both pilots were well within the 10 hours maximum of flight duty required by regulation. *Part 91.02.3 (3) No person shall act as a flight crew member of an aircraft if, prior to each flight, the expected flight time exceeds, or is likely to exceed, the permissible aggregate of—*

(a) all flying—

(i) pilots not subject to an approved flight time and duty period scheme, 10 hours within a 24 hour period;

(ii) 400 hours, during the preceding 90 days;

(iii) 700 hours, during the preceding six months; or

(iv) 1000 hours, during the preceding 12 months;

1.5.6 It was noted that both pilots logged flight time as PIC during both flights (FALA to FACT; and FACT to FAPG) and also in most of the flights they conducted together. The operator's operations manual states that minimum crew for all flights should be two crew (pilot and co-pilot). According to the CAR Part 61.01.8 (7) *The holder of a valid pilot licence must log as PIC only on that flight time during which he or she is—*

(a) the designated PIC of the aircraft; *this shall be the case also if the designated PIC provides command supervision to another pilot in terms of paragraph (b) below;*

(b) Pilot-in-command under supervision (PICUS), provided there is no intervention by the supervising PIC and "PICUS" is indicated in the remarks column with the entry certified by the supervising PIC. PICUS may, irrespective of the licence held, be flown from either the left-hand or the right-hand seat, provided that the pilot is appropriately rated and the aircraft is either certificated for multi-pilot operations or required to be operated by two pilots in terms of Parts 91, 94, 96, 121, 127, 135 or 138;

Co-pilot time

(8) Any appropriately rated pilot occupying a pilot seat as co-pilot of an aircraft requiring more than one pilot under the type certification of the aircraft, or as prescribed by the regulations under which the flight is conducted, must log the flight time as co-pilot.

1.6. Aircraft Information

Airframe:

Manufacturer/Model	Hawker 4000 A4T	
Serial Number	RC-56	
Manufacturer	Hawker Beechcraft Corporation	
Year of Manufacture	2011	
Total Airframe Hours (At Time of Incident)	2 904.04	
Last Inspection (Date & Hours)	1 June 2020	2507.1
Hours Since Last Inspection	396.94	
C of A (Issue Date)	8 February 2018	
C of A Expiry Date	28 February 2022	
C of R (Issue Date) (Present Owner)	10 February 2012	
Operating Categories	Part 91	
Type of Fuel Used in the Aircraft	Jet A1	
Previous Incidents	None	

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

1.6.1 According to available aircraft records, the last phase inspection was carried out on 1 June 2020 at 2 507.1 airframe hours and 1 405 cycles.

1.6.2 The flight folio was made available to the investigation team and there were no reported or recorded defects prior to the incident flight. However, there was a mandatory occurrence report which indicated that the aircraft had a pressurisation issue during climbing phase on 3 March 2021. The aircraft was flown by the same pilot on 26 February 2021 from FALA to FAPG without incident. An internal investigation by the AMO did not reveal any defects or malfunctions with the pressurisation system.

1.6.3 According to the certificate relating to maintenance of aircraft (CRMA) dated 5 March 2021, the aircraft was inspected by a qualified engineer rated on the type to certify the aircraft for a repositioning flight to FALA. No anomalies were found after general visual inspections of the main and nose landing gear attachment structures. However, the right-side nose wheel tyre was replaced due to foreign object damage (FOD) (PN: 5013917 SN: JUL08-0144 was removed and replaced with SN: OCT08-0155); all work carried out was in accordance with Hawker 4000 Aircraft Maintenance Manual (AMM) CH32-40-31 rev A, dated 19 October 2016.

1.6.4 According to the remaining life status report of the aircraft, the FDR was last downloaded on 1 July 2020 at 2 555.22 airframe hours and was due for next download on 1 July 2021 as

part of the annual inspection. The CAR Part 135.05.9 (2) read together with South African Civil Aviation Technical Standards (SA-CATS) 135.05.9(4) 2.a requires that the cockpit voice recorder (CVR) be downloaded annually. There was no record found on the status report (Camp system) for the CVR download.

1.6.5 A general visual inspection of the main landing gear attachment structure was conducted and there were no anomalies found. The outer wheel assembly on the left main gear was replaced due to FOD (PN: 90000233-1 SN: APR08-0222 was removed and replaced with SN: JUN08-0262); all work carried out was in accordance with Hawker 4000 AMM CH32-40-07 rev A, dated 19 October 2016.

1.6.6 A general inspection of the fuselage was carried out, as well as for upper and lower wing surfaces. Both engine intakes were inspected for damage; and no anomalies were found. Engine ground runs were carried out and no anomalies were found.

1.6.7 Upon completion of inspections, the aircraft was issued a special flight permit by the Regulator for repositioning for further inspection at FALA. The special flight permit was issued on 8 March 2021 with an expiry date of 22 March 2021. The aircraft was repositioned from FAPG to FALA on 18 March 2021, and landed safely at its destination without incident. All systems were reported to be functional.

1.6.8 The AMO conducted an internal investigation on the aircraft following the cabin altitude warning. There was no fault found with the aircraft. The pilot stated that the door was not properly latched.

1.6.9 The mass and centre of gravity for the aircraft were within the prescribed limits as stipulated by the manufacturer. The aircraft's maximum take-off weight was 17 917kg (39 500lbs) and the maximum landing weight was 15 195kg (33 500lbs). At the time of landing, the weight of the aircraft was recorded as 13 653kg (30 100lbs).

Engine No 1:

Manufacturer/Model	Pratt & Whitney Canada
Serial Number	PCE-CE0128
Part Number	PW308A
Hours Since New	2904.04
Hours Since Overhaul	Modular sections

Engine No 2:

Manufacturer/Model	Pratt & Whitney Canada
Serial Number	PCE-CE0100
Part Number	PW308A
Hours Since New	760,21
Hours Since Overhaul	Modular sections

1.7. Meteorological Information

1.7.1 The weather information below was obtained from the Automatic Weather Station that was issued by the South African Weather Service (SAWS) for FAPG on 3 March 2021 at 1700Z.

METAR FAPG 031700Z AUTO 20001KT //// // ////// 21/17 Q1014=

Wind Direction	200˚	Wind Speed	01 kt	Visibility	Unknown
Temperature	21˚ C	Cloud Cover	Unknown	Cloud Base	Unknown
Dew Point	17˚ C	QNH	1014hPa		

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. There were no reported or recorded defects with the communication systems before and during the flight.

1.10. Aerodrome Information

Aerodrome Location	Plettenberg Bay Airport (FAPG)
Aerodrome Status	Licensed
Aerodrome Co-ordinates	34º05’17.37” South 023º19’43.02” East
Aerodrome Altitude	465 ft
Runway Headings	12/30
Runway Dimensions	1 240m x 20 m
Runway Used	12
Runway Surface	Asphalt
Approach Facilities	Non-directional beacon (NDB), no runway lights
Radio Frequency	124.8 MHz

1.11. Flight Recorders

1.11.1 The aircraft was equipped with a flight data recorder (FDR) and a cockpit voice recorder (CVR). No defects with the recorders were reported prior to the incident flight.

1.11.2 The CVR installed in the aircraft was the L3 FA2100 with Part Number: 2100-0120-51 and Serial number: 000679668.

1.11.3 The FDR installed in the aircraft was the L3 FA2100 with Part number: 2100-2043- 01 and Serial number: 000668900.

1.11.4 The FDR and CVR units were downloaded at the aircraft maintenance organisation (AMO) facility and raw data was sent to the National Transportation Safety Board (NTSB) for further analysis. According to the cockpit voice recorder replay evaluation report, all channels (1-4) were functional, however, the audio had white noise and no aural chimes. At the time of releasing this report, there was no feedback received from NTSB laboratory regarding clearance of white noise on the CVR. Therefore, communication and activities in the cockpit during the duration of the flight could not be retrieved.

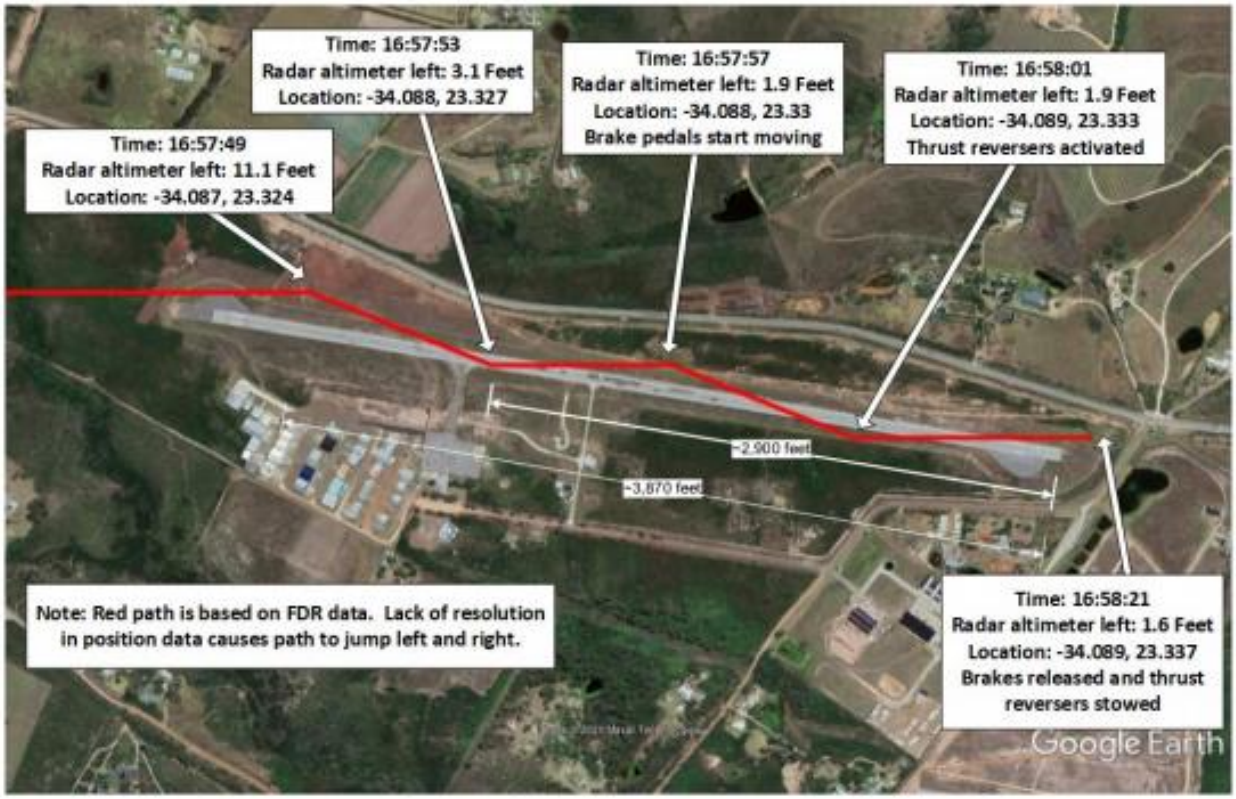
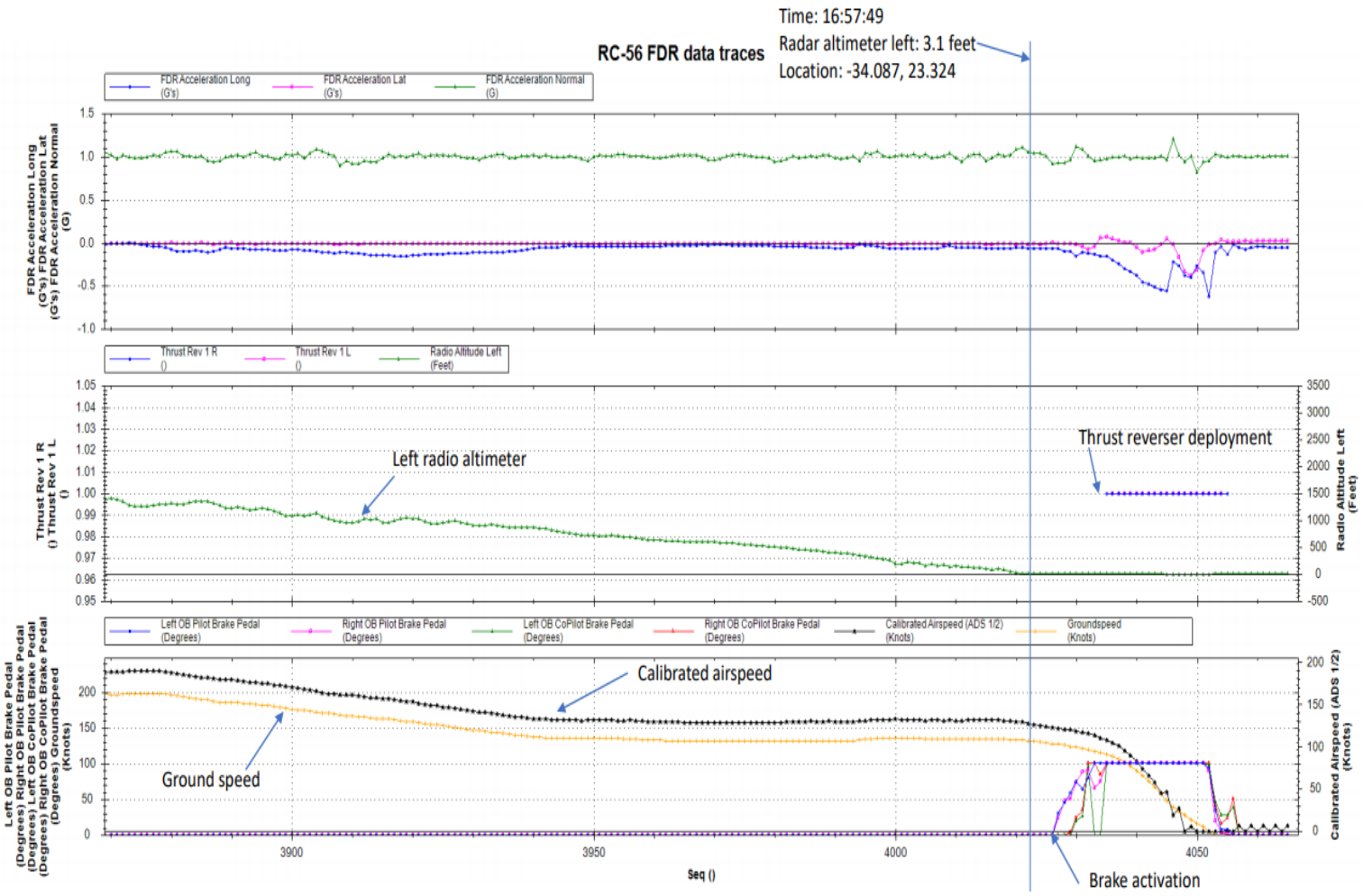


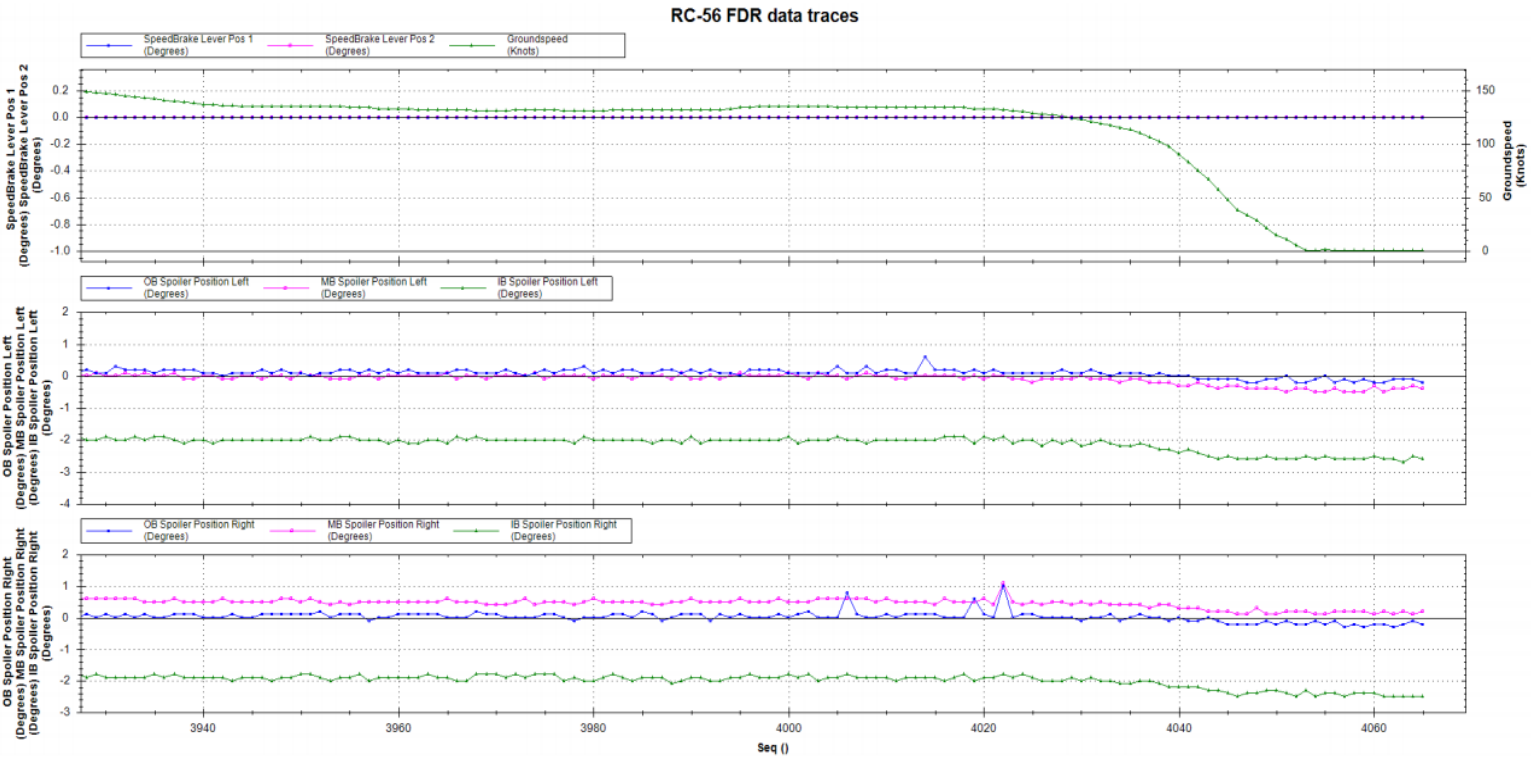
Figure 4: Flight data timeline. (Source: FDR data received from the Aircraft Manufacture)

FDR data as per Figure 4:

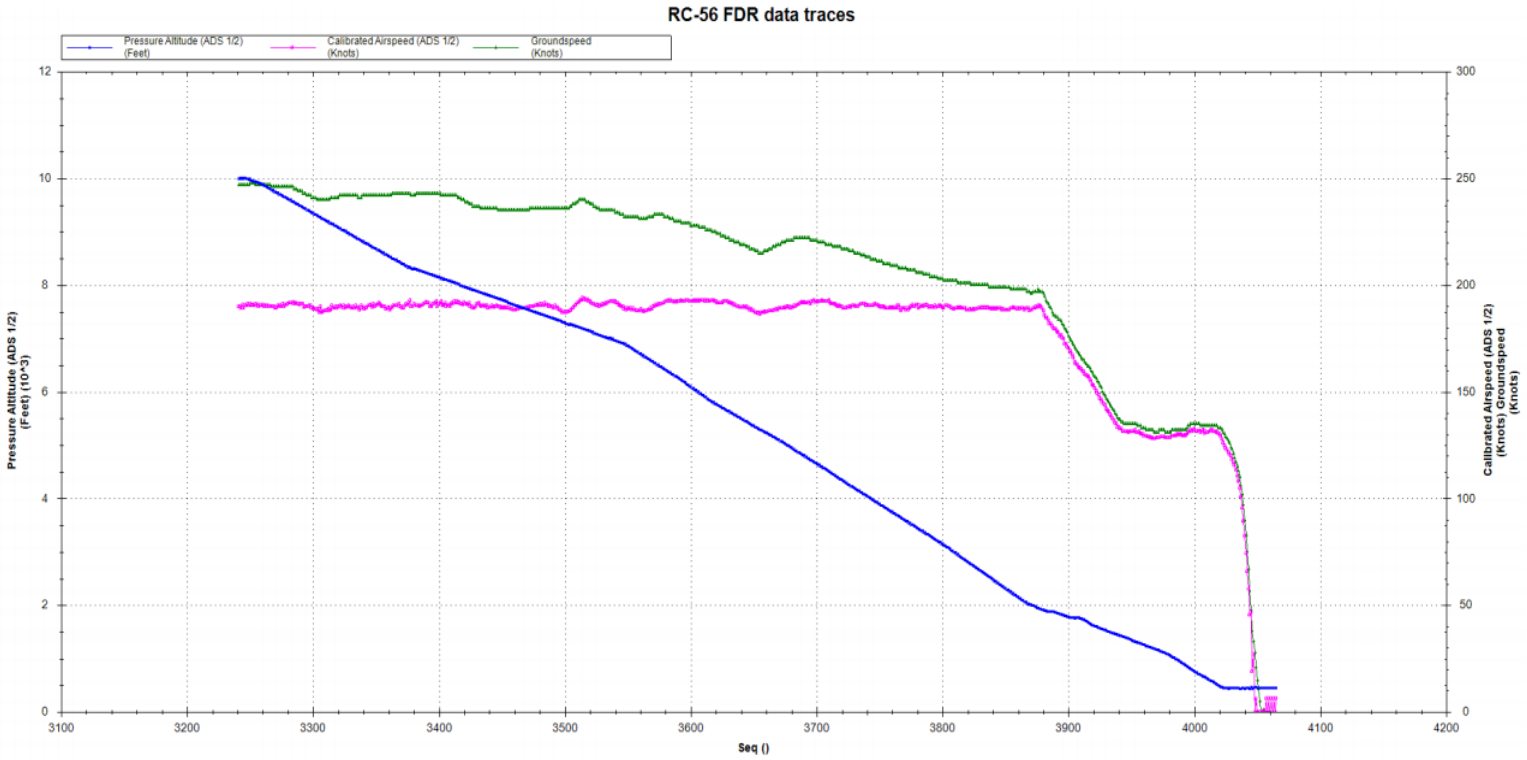
- *The brake pedals were not activated until almost halfway down the runway. The thrust reversers were not activated until the last quarter of the runway.*
- *Pressure was not applied to the brake pedals until almost halfway down the runway. The aircraft's ground speed decreased after the brakes were applied. The aircraft's rate of deceleration increased after the thrust reversers were deployed.*
- The second and third charts (Figures 5 and 6 below) show the spoiler positions. *The spoilers did not deploy upon landing. This could have been caused by the flight crew not arming the ground spoilers before landing.*



Graph 1: The graph depicts the FDR data parameters. (Source: FDR data received from the Aircraft Manufacturer)



Graph 2: Graph depicts FDR data parameters. (Source: FDR data received from the Aircraft Manufacturer)



Graph 3: FDR data parameter traces indicating pressure altitude. (Source: FDR data received from the Aircraft Manufacturer)

- *The graph above shows the aircraft's altitude (blue line) along with airspeed (pink line) and ground speed (green line) from 10 000' to landing. The descent rate appears consistent from 10 000' to about 2 000' where it reduces a bit but remains consistent. The airspeed is consistent until the change in descent rate at 2 000'. When the descent rate changes, the aircraft speed also decreases until it stabilises again at approximately 130 knots. This speed is maintained until just before touchdown at which point the aircraft starts to slow down. According to the aircraft flight manual, approach speed (Vapp) is 135 knots and reference speed (Vref) is 123 knots. Based on the data, the aircraft's speed and descent rate were consistent during approach.*

1.12 Wreckage and Impact Information

1.12.1 The aircraft approached Runway 12 with the wind being 200° at 1kts. Approximately halfway down the runway, the pilot applied brakes from the right-side seat, but the brakes were not effective (as per normal) and did not slow down the aircraft. The pilot then applied the brake pedals as hard as he possibly could. Because there is an embankment with a drop of several metres at the end of Runway 12, the pilot seated on the left-side seat steered the aircraft to the left to avoid crashing on the embankment; the pilots managed to bring the aircraft to a stop. The aircraft overran the runway and stopped 80 metres from the threshold of Runway 30. No major structural damages were visible on the aircraft. The nose wheel hub collected grass between the hub circumference and the tyre. The outboard tyre had an indication of excessive breaking on tread surfaces, evidenced by tyre trails toward the end of the runway

(see Figure 6). The tyre trails were observed approximately 180m from the last quarter of the runway towards the edge. The aircraft continued to roll on unprepared grass, evidenced by tyre width trails (similar to the aircraft tyre width) which spanned for approximately 80m from the end of the runway edge.

Figure 5: Nose wheel hub from the incident aircraft. (Source: AMO)

Figure 6: Tyre trail markings on the runway surface. (Source: AMO)

Figure 7: Final position of the aircraft after exiting the runway. (Source: AMO)

Figures 8 & 9: Foam spread on the undercarriage after the incident. (Source: AMO)

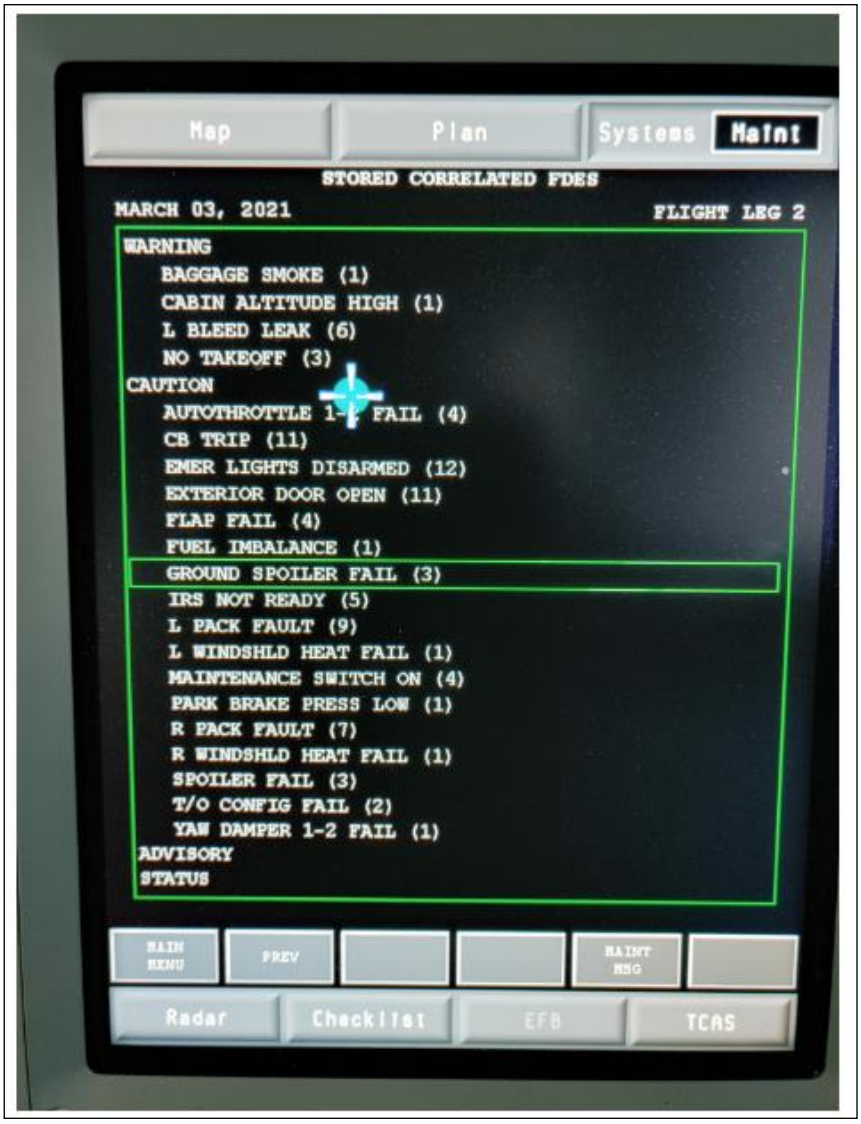


Figure 10: Stored correlated (flight data exchange [FDE]) indicating ground spoiler fail caution message on the multifunction control and display unit (MCDU). (Source: AMO)

1.12.2 The multifunction control and display unit (MCDU) was checked by the AMO. The MCDU records all the stored correlated flight data exchange (FDE) for any warning, caution and advisory messages during flight. The caution for ground spoiler failure registered as a message on the FDE.

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 incident was considered survivable because the fuselage and cockpit structures were still intact, and the two occupants had made use of the aircraft's safety harnesses.

1.16 Tests and Research

1.16.1 An internal investigation by the operator was conducted and the cause of the cabin altitude warning was undetermined. The AMO that recovered the aircraft could not find any anomalies with the aircraft systems or the door. Further investigation by the AIID did not reveal any malfunctions with cabin altitude system. There were no further defects encountered for the duration of the flight until landing at FAPG.

1.17 Organisational and Management Information

1.17.1 The flights were conducted under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.17.2 The AMO that carried out the last maintenance inspection on the incident aircraft prior to the incident flight was in possession of an AMO approval certificate issued on 25 September 2020, with an expiry date of 31 October 2021.

1.17.3 The operator was in possession of an Air Operating Certificate (AOC) No. CAA/N996D issued on 15 October 2020 with an expiry date of 31 October 2021. The aircraft was duly authorised to operate under the AOC.

1.17.4 The operator was in possession of Air Service licences for domestic and international non-schedule flight Class II Licence No: N966D and I/N212 issued on 8 December 2020. The types of Air Service categories are A1, A2 and A3 and the types of Air Service are N1, N2 and N4, respectively.

1.17.5 The aircraft was also registered on two other operator's AOC, N140D and N1015D, respectively. However, at the time of the incident flight, the aircraft was operating under the provisions of Part 91.

1.17.6 The operator was in possession of a dispensation letter issued by the SACAA to conduct annual simulator pilot proficiency currency (PPC) training using actual aircraft platform. The approval was as per CAR 135.03.7, until the international travel restrictions are relaxed for travel to countries with suitable flight simulation training devices (FSTDs). The dispensation letter was approved on 20 November 2020 and was due to be reviewed after 12 months.

1.18 Additional Information

1.18.1 Spoiler control system description (Hawker Aircraft Maintenance Manual Chapter 27 Rev A19)
The spoiler control system consists of six spoiler panels, five Spoiler Control Manifolds

(SCM), six hydraulic actuators, two Electronic Command and Maintenance Monitors (ECMMs), 10 panel position sensors comprising six Rotary Variable Differential Transformers (RVDTs) and four Linear Variable Differential Transformers (LVDTs). The system is electronically controlled and continuously monitored by two ECMMs. In response to spoiler commands from the cockpit, the ECMMs command the actuators to extend or retract, independently, driving the spoiler panels to their commanded positions. The position sensors provide continuous feedback to the ECMMs.

Speed Brake Control System Description

Speed brakes reduce lift and add drag for an unaccelerated controlled flight descent. The speed brake spoiler control system is electrically signalled and hydraulically powered to position the mid and outboard spoiler panels on each wing. The speed brake spoiler system consists of the speed brake control module, spoiler ECMMs, SCMs and spoiler actuators. The spoiler ECMMs, SCMs and spoiler actuators are the same components used for the roll spoiler system.

Speed Brake Control System Operation

The speed brake spoilers may be modulated to any position between 0° and 35° and are controlled using the cockpit pedestal mounted SPEEDBRAKE control lever. The SPEEDBRAKE control lever is mechanically connected to a dual RVDT and is housed in the cockpit pedestal mounted speed brake control module. When the SPEEDBRAKE control lever is engaged, the mid-board and outboard spoiler panels are symmetrically displaced. Two position sensors (RVDT1a & RVDT2a) communicate SPEEDBRAKE control lever position to ECMM1, while the other two position sensors (RVDT1b & RVDT2b) communicate SPEEDBRAKE lever position to ECMM2. In response to the speed brake signals and flap position signals from the Flap Control Electronic Unit (FCEU), the ECMMs send a signal to the SCMs to operate the hydraulic actuators, which position the midboard and outboard spoiler panels. Each ECMM compares the signals of the pairs of RVDTs that it receives. RVDT1a and RVDT2a signals are compared, and if in agreement, RVDT1a position information is used for outboard spoiler panel speed brake control. RVDT1b and RVDT2b signals are compared, and if in agreement, RVDT1b position information is used for midboard spoiler panel speed brake control. If the RVDT signals into one ECMM do not agree, that ECMM shall respond to the RVDT mismatch in accordance with the defined fault detection and action logic. With flaps 20° or less, speed brake spoiler travel of 0° (fully stowed) to 35° (fully deployed) is proportional to the SPEEDBRAKE lever position. With flaps greater than 20°, full SPEEDBRAKE lever travel of 35° commands 17.5° of spoiler panel deployment. Two flap position signals are provided by the FCEU to the monitor channels of each ECMM via the respective modular avionics unit (MAUs). If either flap position signal is lost/not provided,

then the system defaults to flaps greater than 20° to schedule speed brake deployment. When roll commands are combined with speed brake commands, the roll commands are superimposed on the speed brake commands. This can result in some panels being retracted from their speed brake position to achieve the desired roll while speed braking. In this case, the ECMMs command panel positions according to internally programmed panel scheduling laws, which factor in control yoke angle, flap position, and SPEEDBRAKE lever position.

Ground Spoiler Control System Description

Ground spoilers remove lift from the wings, assisting the airplane brakes in stopping the airplane. The ground spoilers operate automatically on landing when the ground spoiler deploy logic is satisfied. On landing, all six spoiler panels deploy to 60° and remain deployed until the throttles are advanced, or the airplane has decelerated to taxi speed. The ground spoiler control system is electrically signalled and hydraulically actuated to position the inboard, midboard and outboard spoiler panels on each wing. The ground spoiler system consists of the GROUND SPOILER arming switch, throttle idle switches, spoiler ECMMs, SCMs, Ground Spoiler Control Manifold (GSCM) and six spoiler actuators. The GROUND SPOILER arming switch, located on the cockpit pedestal, is used to enable or disable automatic ground spoiler deployment. The GROUND SPOILER arming switch is a latching push-button type of switch that is illuminated when it is in the disarmed position. The ECMMs utilise signals from the wheel speed transducers, landing gear Weight-on-Wheels (WOW) sensors, throttle module idle switches, and the GROUND SPOILER arming switch to establish a deployment and stow logic. An inboard spoiler accumulator is located on the main landing gear (MLG) forward bulkhead. The accumulator provides adequate pressure to operate the inboard spoiler actuators to deploy inboard spoilers, in the event system 1 loses hydraulic pressure. This will facilitate a safe landing by a decelerated landing rollout.

Ground Spoiler Control System Operation

When the GROUND SPOILER arming switch is in the armed position, all six spoilers will deploy to 60° on landing touchdown or when the pilot initiates a Rejected Take-off (RTO). While the midboard and outboard spoiler panels have variable displacement capability, and serve as roll, speed brakes and ground spoilers, the inboard spoilers have two positions (stowed and deployed) and function as ground spoilers only. In order to deploy the ground spoilers, the GROUND SPOILER arming switch must be armed, both thrust levers must be in the idle position and the left and right landing gear (either inboard or outboard tyres) must have wheel speed greater than 40 ± 5 knots. Deployment of the ground spoilers can be inhibited by switching the GROUND SPOILER arming switch to the disarmed position. Switching the GROUND SPOILER arming switch to the disarmed position when the ground spoilers are deployed will cause the ground spoilers to stow.

The ECMMs provide the following system status signals to the Engine Indicating and Crew Alerting System (EICAS) via the MAUs:

- *Actuator position*
- *Loss of communication*
- *Loss of power*
- *Loss of input signals*
- *Disagreement between redundant inputs*
- *Hardware faults*

The ECMMs also transmit system status through the MAUs to the Flight Data Recorder (FDR) and maintenance information to the Central Maintenance Computer CMC.

Figure 005 : Sheet 1 : Fig 5 - Inboard Spoiler Control Block Diagram

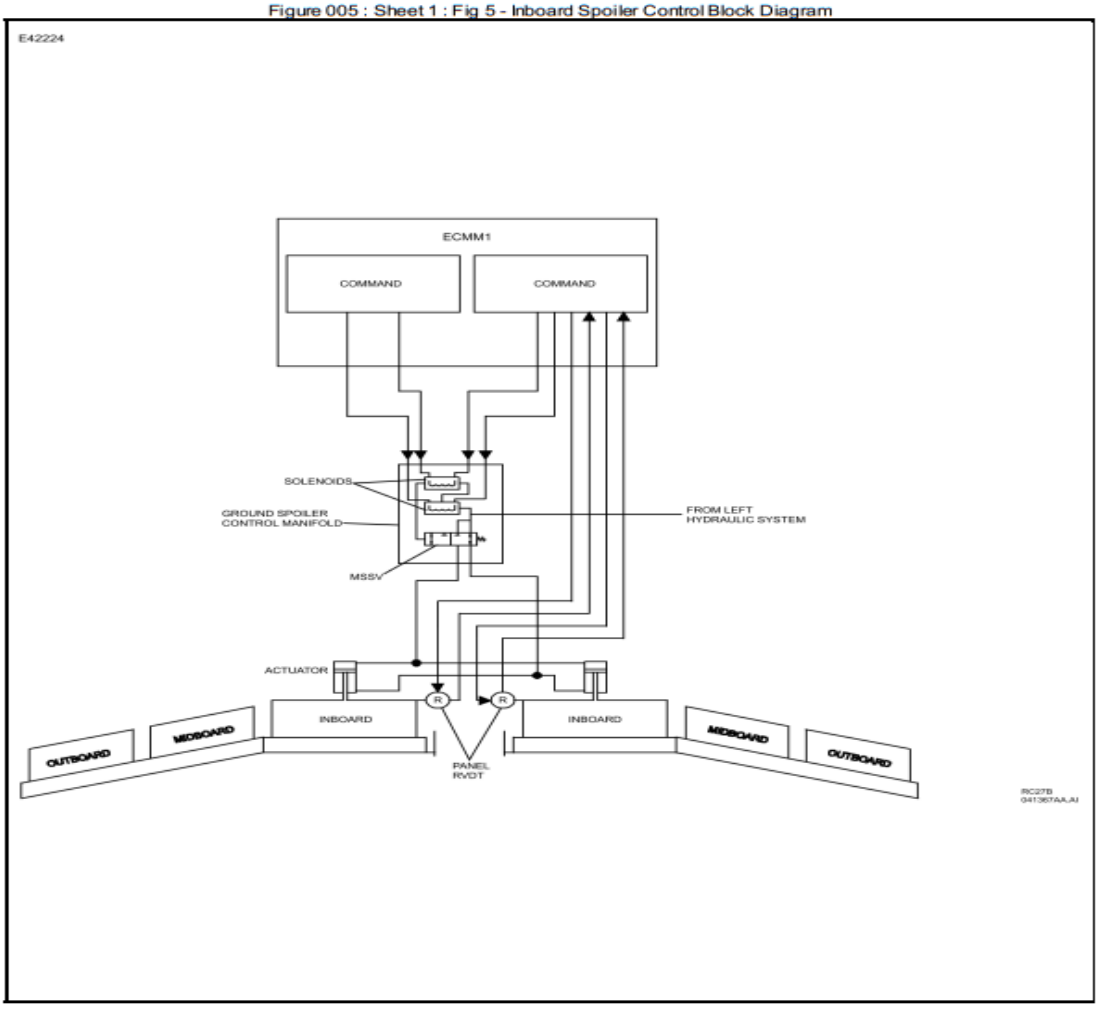


Diagram 1: Spoiler block diagram.

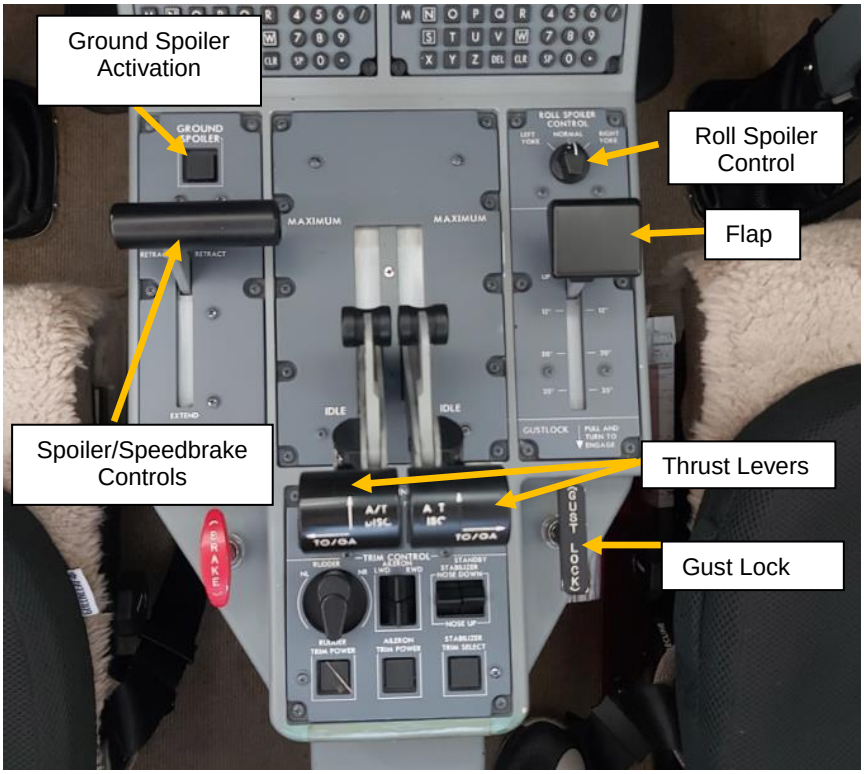


Figure 11: Centre pedestal panel of the aircraft.

1.18.2 ***Approach procedure (Source: AFM)***

- *Altimeters* — *SET/CROSS CHECK*
- *External lights* — *AS REQUIRED*
- *Avionics, FMS, and Flight Guidance* — *SET, PROGRAMMED, SOURCED AND MODES SELECTED*
- Central Alert System *(CAS) messages (MSGs)* — *REVIEW*
- *V speeds and Landing distance* — *COMPUTED/SET*
- *Approach and Landing Briefing* — *COMPLETED*
- *Nosewheel Steering* — *TILLER CLEAR*
- ***GROUND SPOILER*** — ***CONFIRM ARMED***
- *SEAT BELT/NO SMOKING* — *AUTO, OR ON*
- *FLAPS* — *AS DESIRED*

1.18.3 ***Landing procedure (Source: AFM)***

- *Airspeed* — *Vref*
- *Thrust levers* — *IDLE*
- *Brakes (after touch down)* — *APPLY*
- ***SPEEDBRAKE*** — ***EXTEND***
- *Thrust Reversers (after Nosewheel is on ground)* — *DEPLOY, AS REQUIRED*
- *Reverse Thrust (when deployment confirmed)* — *AS REQUIRED*

- *Nosewheel Steering (all gear firmly on ground)* *AS REQUIRED*
- *Reverse Thrust* *IDLE BY 60 KIAS*
- *Thrust Reversers* *STOW BY TAXI SPEED*

1.18.4 ***Ground Spoiler Fail (Source: AFM)***

IN FLIGHT

- *Ground Spoiler Fail and Spoiler Fail CAS MSGs*
  If posted (AB Tab 45) *PERFORM*
- *Landing Considerations:*
- *Select runway with minimum crosswind. No tailwind.*
- *A sudden roll asymmetry may occur upon ground spoiler deployment.*
- *Expected increased sensitivity in roll control after touchdown.*
- ***Landing Distance*** ***MULTIPLY BY 1.4***

1.18.5 ***Spoiler Fail (Source: AFM)***

IN FLIGHT

- *Flt Ctl Synoptic* *OBSERVE SPOILER PANELS*
- *SPEEDBRAKE* *EXTEND/RETRACT TO OBSERVE SPOILER MOVEMENT*
  a. *If the Midboard spoiler panels do not extend to any angle on the flight control (Flt Ctl) Synoptic, one or both of the panels maybe inoperative. Assume the Midboard Spoilers are inoperative for landing.*
  b. *If the Outboard spoiler panels do not extend to any angle on the Flt Ctl Synoptic, one or both of the panels may be inoperative. Assume the Outboard and Inboard Spoilers are inoperative for landing.*
  c. *If none of the spoiler panels extend to any angle on the Flt Ctl Synoptic, assume the Outboard, Midboard and Inboard Spoilers are inoperative for landing.*

  NOTE

  Do not extend flaps beyond 20˚
- *Landing considerations with one or more spoiler panels inoperative:*
  a. *Select runway with minimum crosswind, no tailwind.*
  b. *Select FLAP WARN.*
  c. *Landing Configuration – FLAPS 20° (if flaps operative).*
  d. *Speedbrake and roll power will be reduced.*
  e. *A sudden roll asymmetry may occur upon ground spoiler deployment.*
- *Landing Airspeed, Landing Distance and Brake Energy (See tables)*
  a. *Verify corrected brake energy does not exceed brake failure value stated in the applicable Cautions which follows.*

IF Brake Degrade CAS MSG IS POSTED

CAUTION

Brake failure may occur when brake energy exceeds 28.3 MFP.

Flap Position		*0˚*	*12˚*	*20˚*
Landing Speed (KIAS)		*Vref +25*	*Vref +15*	*Vref +10*
Midboard Spoiler Inop	*Landing Distance Brake Energy*	*Multiply by 2.5 Increase by 12.8 MFP*	*Multiply by 2.1 Increase by 9.9 MFP*	*Multiply by 2.1 Increase by 7.0 MFP*
Outboard and Inboard Spoiler Inop	*Landing Distance Brake Energy*	*Multiply by 2.8 Increase by 14.1 MFP*	*Multiply by 2.4 Increase by 10.7 MFP*	*Multiply by 2.4 Increase by 8.2 MFP*
Outboard, Midboard and Inboard Spoiler Inop	*Landing Distance Brake Energy*	*Multiply by 3.9 (**A**) Increase by 15.0 MFP (**A**)*	*Multiply by 3.1 Increase by 12.2 MFP*	*Multiply by 3.1 Increase by 12.8 MFP*

FOOT NOTE:

(A) Landing weight not to exceed 38 750 LB (17 577KG)

Procedure Competed

IF AMBER "Brake Degraded" CAS MSG IS CLEARED:

CAUTION

Brake failure may occur when brake energy exceeds 46.2 MFP

Flap Position		*0˚*	*12˚*	*20˚*
Landing Speed (KIAS)		*Vref +25*	*Vref +15*	*Vref +10*
Midboard Spoiler Inop	*Landing Distance Brake Energy*	*Multiply by 2.1 Increase by 19.2 MFP*	*Multiply by 1.8 Increase by 14.5 MFP*	*Multiply by 1.8 Increase by 10.8 MFP*
Outboard and Inboard Spoiler Inop	*Landing Distance Brake Energy*	*Multiply by 2.3 Increase by 20.5 MFP*	*Multiply by 1.9 Increase by 16.0 MFP*	*Multiply by 1.9 Increase by 12.1 MFP*
Outboard, Midboard and Inboard Spoiler Inop	*Landing Distance Brake Energy*	*Multiply by 2.6 Increase by 22.7*	*Multiply by 2.5 Increase by 17.9 MFP*	*Multiply by 2.3 Increase by 12.8 MFP*

Procedure Completed

ON GROUND (BOTH ENGINES RUNNING)

A complete power down with batteries OFF and subsequent restoring of normal electrical power may clear the Amber "Spoiler Fail" CAS MSG

IF Spoiler Fail CAS MSG IS POSTED

- *No Dispatch.*

Procedure Completed

IF AMBER "Spoiler Fail CAS MSG IS POSTED:

- *Normal Dispatch*

Procedure Completed

1.18.6 **All Engine Go Around *(Source: AFM)***

1. TO/GA.....SELECT

2. Thrust Levers .....FORWARD STOP (VERIFY TAKEOFF N1)

3. Airplane Pitch Attitude .....12° (FD PITCH COMMAND)

4. FLAPS.....12°

5. LANDING GEAR Handle (positive rate of climb is confirmed) .....UP

6. Climb Airspeed (minimum) .....VREF

7. FLAPS (at VREF + 25 KIAS) .....UP/0°

8. Anti-ice/De-ice.....AS REQUIRED

1.18.7 **Take-off field distance (Dry runway)** ***(Source: AFM)***

TAKEOFF FIELD LENGTH - DRY RUNWAY **FLAPS 20°**

REFER TO APPROPRIATE TAKEOFF CONDITIONS **1000 FT**

SOME CONDITIONS MAY BE CLIMB LIMITED - CHECK MAXIMUM ALLOWABLE WEIGHT PERMITTED BY CLIMB REQUIREMENTS TABLES

TARGET PITCH ATTITUDE IS APPROXIMATELY 10° AT END OF ROTATION, APPROXIMATELY 8° IF SHADED

WEIGHT = 34000 LB															WEIGHT = 32000 LB													
	TAILWIND			ZERO			HEADWINDS									TAILWIND			ZERO			HEADWINDS						
TEMP	10 KT			WIND			10 KT			30 KT					TEMP	10 KT			WIND			10 KT			30 KT			
DEG	V1	DIST	BE	V1	DIST	BE	V1	DIST	BE	V1	DIST	BE	VR	V2	DEG	V1	DIST	BE	V1	DIST	BE	V1	DIST	BE	V1	DIST	BE	VR	V2
C	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	FT	MFP	KIAS		C	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	
-40	116	3956	22.9	111	3107	17.7	110	2955	16.3	109	2661	13.9	119	126	-40	110	3514	20.0	105	2850	15.5	104	2709	14.2	104	2436	12.1	115	122
-20	116	4184	24.3	111	3305	19.0	109	3149	17.5	109	2846	15.0	119	126	-20	110	3730	21.3	105	3027	16.6	104	2882	15.3	104	2601	13.1	115	122
0	115	4432	25.8	111	3505	20.3	109	3345	18.8	109	3033	16.2	119	126	0	109	3952	22.6	105	3206	17.8	104	3057	16.4	103	2768	14.1	114	122
10	115	4571	26.6	111	3610	21.0	109	3447	19.4	108	3130	16.8	119	126	10	109	4074	23.3	105	3301	18.4	104	3150	17.0	103	2857	14.7	115	122
15	115	4642	27.0	111	3672	21.4	109	3501	19.8	109	3181	17.1	119	126	15	109	4136	23.7	105	3350	18.7	104	3198	17.3	104	2902	14.9	115	122
20	115	4713	27.4	111	3734	21.7	109	3557	20.1	109	3235	17.4	119	126	20	109	4200	24.0	105	3399	19.0	104	3246	17.6	104	2948	15.2	115	122
25	116	4828	28.0	111	3823	22.2	110	3622	20.5	109	3297	17.8	119	126	25	110	4295	24.5	106	3457	19.4	105	3303	17.9	104	3002	15.5	115	122
30	118	5094	29.0	113	4007	22.9	111	3740	21.1	110	3406	18.3	120	126	30	112	4508	25.3	107	3564	20.0	106	3404	18.5	105	3095	16.0	115	122
35	120	5762	30.0	116	4390	24.1	114	4044	22.2	112	3575	19.0	121	126	35	114	4845	26.2	109	3802	20.6	107	3562	19.0	106	3239	16.5	116	122
40	121	6777	30.5	120	4908	25.8	118	4496	23.7	115	3791	20.0	121	126	40	116	5227	27.2	111	4066	21.3	109	3746	19.6	108	3400	16.9	117	122
45	122	7613	31.0	122	5338	26.5	120	4821	24.5	116	4042	20.6	122	126	45	117	5989	27.6	113	4433	22.4	112	4067	20.5	109	3572	17.5	117	122
48	122	8281	31.3	122	5715	26.8	121	5052	25.1	117	4214	21.0	122	126	48	117	6766	27.9	117	4827	23.7	115	4412	21.7	111	3704	18.2	118	122

WEIGHT = 30000 LB															WEIGHT = 28000 LB													
	TAILWIND			ZERO			HEADWINDS									TAILWIND			ZERO			HEADWINDS						
TEMP	10 KT			WIND			10 KT			30 KT					TEMP	10 KT			WIND			10 KT			30 KT			
DEG	V1	DIST	BE	V1	DIST	BE	V1	DIST	BE	V1	DIST	BE	VR	V2	DEG	V1	DIST	BE	V1	DIST	BE	V1	DIST	BE	V1	DIST	BE	VR	V2
C	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	FT	MFP	KIAS		C	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	FT	MFP	KIAS	
-40	104	3163	17.6	100	2617	13.6	99	2487	12.4	99	2233	10.5	110	118	-40	99	2865	15.6	96	2387	12.0	95	2266	10.9	93	2031	9.1	105	115
-20	104	3359	18.7	100	2777	14.6	99	2643	13.4	98	2382	11.4	110	118	-20	99	3042	16.6	96	2524	12.9	95	2401	11.8	93	2160	9.8	105	115
0	104	3561	19.9	100	2936	15.6	99	2798	14.4	98	2530	12.2	110	118	0	99	3224	17.6	96	2662	13.8	95	2535	12.6	93	2289	10.6	105	115
10	104	3665	20.5	100	3018	16.2	99	2879	14.9	98	2607	12.7	110	118	10	99	3321	18.1	96	2737	14.2	95	2609	13.1	93	2358	11.0	105	115
15	104	3721	20.8	100	3061	16.4	99	2920	15.1	98	2646	12.9	110	118	15	99	3370	18.4	96	2776	14.5	95	2646	13.3	93	2394	11.2	105	115
20	104	3774	21.1	100	3105	16.7	99	2963	15.4	98	2687	13.1	110	118	20	99	3419	18.7	96	2816	14.7	95	2685	13.5	93	2431	11.4	105	115
25	104	3839	21.4	100	3157	16.9	99	3013	15.6	99	2735	13.4	110	118	25	99	3476	18.9	96	2866	14.9	95	2734	13.7	94	2477	11.6	105	115
30	105	3988	21.9	101	3245	17.3	100	3098	16.0	100	2813	13.8	111	118	30	100	3580	19.3	96	2957	15.2	95	2822	14.0	94	2559	11.9	106	114
35	107	4264	22.7	103	3381	17.9	102	3228	16.5	101	2931	14.2	111	118	35	101	3754	19.6	97	3070	15.4	96	2929	14.2	96	2656	12.2	107	114
40	110	4561	23.5	105	3573	18.4	103	3377	17.0	102	3065	14.7	112	118	40	103	3979	20.2	99	3197	15.9	98	3050	14.6	97	2764	12.6	107	114
45	112	4893	24.3	106	3810	19.0	105	3537	17.5	104	3210	15.1	113	118	45	105	4240	20.8	100	3336	16.3	99	3182	15.0	98	2883	13.0	108	114
48	113	5202	24.7	107	3972	19.4	106	3656	17.8	104	3306	15.3	113	118	48	106	4424	21.3	101	3448	16.6	100	3267	15.3	99	2960	13.2	108	114

Taking into consideration the zero wind and the temperature of 21°C (1 000ft was used as well as temperature of 20˚C to the take-off distance), the weight of the aircraft was 30 100 lbs (13 653kg) as reported by the crew at the time of landing with landing speed of Vref 125. According to the table above, the V1 speed was 96kts and Vr and V2 were 105kts and 115, respectively.

Note: V1 = commit to fly speed, Vr = rotation speed and V2 = take off safety speed

1.18.8 **Landing distance calculations**

According to the aircraft flight manual, the landing distance for this aircraft type is 2 808 feet (856m) taking into consideration the zero wind and the temperature of 21°C (an average between sea level and 1 000ft was used as well as temperature of 20°C to the landing distance). The weight of the aircraft was 30 100 lbs (13 653kg) as reported by the crew at the time of landing with landing speed of Vref 125kts.

According to the multifunction control and display unit (MCDU), there was a ground spoiler fail caution message recorded and the speed brake was not extended on touch down. According to emergency procedures, with the ground spoiler deactivated and with the speed

brake not extended, the overall landing distance is multiplied by 2.3. Therefore, the corrected landing distance was computed to be 2 808 feet by 2.3 which gave a total distance of 6 459 feet (1 969m).

The runway length for FAPG is 4 068ft (1 240m) as stipulated in the Aeronautical charts.

1.18.9 **Go Around *(Source: AFM)***

- *TO/GA* *SELECT*
- *Thrust Levers* *FORWARD STOP (VERIFY TAKE-OFF N1)*
- *Airplane Pitch Attitude*
- *FLAPS (if available)* *12˚*
- *LANDING GEAR Handle (positive rate of climb confirmed)* *UP*
- *Climb Airspeed (minimum)* *LANDING*
- *FLAPS (if available, at Vref +25 KIAS* *UP/0˚*
- *Anti-ice/De-ice* *AS REQUIRED*

1.18.10 **Cockpit voice recorders**

Part *135.05.11 (1) An air service operator shall ensure the aeroplanes specified in Document SA-CATS 135, when operated in terms of this part, are equipped with the CVR specified in Document SA-CATS 135 and that such CVR complies with the specifications prescribed therein.*

(2) The CVR shall record, with reference to a time scale—

(a) voice communications transmitted from or received on the flight deck or in the cockpit by radio;

(b) the aural environment of the flight deck or cockpit, including without interruption, the audio signals received from each microphone in use;

(c) voice communications of flight crew members on the flight deck or in the cockpit using the interphone system of the aeroplane, if installed;

(d) voice or audio signals identifying navigation or approach aids introduced into a headset or speaker; and

(e) voice communications of flight crew members on the flight deck or crew members in the cockpit using the public address system of the aeroplane, if installed.

(3) The CVR shall—

(a) be capable of retaining information recorded during at least the period of time as prescribed in Document SA-CATS 135;

(b) start automatically to record the aeroplane moving under its own power and continue to record, until the termination of the flight when the aeroplane is no longer capable of moving under its own power; and

(c) if possible, start to record the cockpit checks prior to engine start at the beginning of the flight, until the cockpit checks immediately following engine shutdown at the end of the flight.

(4) The CVR may be combined with a FDR referred to in regulation 135.05.11.

(5) From 1 January 2016, no operator may operate an aeroplane equipped with a CVR using magnetic tape or wire.

(6) An aeroplane may commence a flight with the CVR inoperative: Provided that—

(a) for aeroplanes with an approved MEL, such aeroplane is operated in accordance with that MEL and such MEL incorporates the provisions of paragraph (b) below; or

(b) for aeroplanes without an approved MEL—

(i) the aeroplane shall not take-off from an aerodrome where repairs or replacements to such CVR can be made;

(ii) the aeroplane does not exceed six further consecutive flights with the CVR unserviceable;

(iii) not more than 48 hours have elapsed since the CVR became unserviceable; and

(iv) any FDR required to be carried is operative, unless the FDR is combined with a CVR.

1.18.11 *SA-CATS 135.05.9(4). Inspections of flight recorders*

(2) Annual inspections shall be carried out as follows –

(a) the read-out of the recorded data from the FDR and CVR should confirm that the recorder operates correctly for the nominal duration of the recording;

(b) the analysis of the FDR should evaluate the quality of the recorded data to determine whether the bit error rate is within acceptable limits and to determine the nature and distribution of the errors;

(c) a complete flight from the FDR should be examined in engineering units to evaluate the validity of all recorded parameters. Particular attention should be given to parameters from sensors dedicated to the FDR. Parameters taken from the aircraft's electrical bus system need not be checked if their serviceability can be detected by other aircraft systems;

(3) The results of the annual inspections shall be recorded and retained for a period of five years calculated from the date of such check.

(4) Flight recorder systems should be considered unserviceable if there is a significant period of poor quality data, unintelligible signals or if one or more of the mandatory parameters is not recorded correctly.

(5) When requested, a report of the annual inspection should be made available to the Director for monitoring purposes.

1.18.12 ***FLIGHT RECORDERS CAR Part 91.04.10***

1. Flight data recorders

(1) The data obtained from a flight data recorder shall be obtained from aircraft sources which enable accurate correlation with information displayed to the flight crew and shall be correlated to the recorded cockpit audio.

(2) The flight data recorder shall start automatically to record the data prior to the aircraft being capable of moving under its own power and shall stop automatically after the aircraft is incapable of moving under its own power.

(3) Parameters

(a) The parameters for aeroplanes are –

(i) A Type IA FDR shall be capable of recording, as appropriate to the aeroplane, at least the 78 parameters in the table in sub-paragraph (i);

(ii) A Type I FDR shall be capable of recording, as appropriate to the aeroplane, at least the first 32 parameters in the table in sub-paragraph (i); and

(iii) Type II and IIA FDRs shall be capable of recording, as appropriate to the aeroplane, at least the first 15 parameters in the table in sub-paragraph (i). In addition, a Type IIA FDR shall retain sufficient information from the preceding take-off for calibration purposes.

1.18.13 Flight recorders

135.05.9 *(1) An air service operator shall ensure that the aeroplanes required to be equipped with the flight recorders as provided in this subpart are installed as specified in Document SA-CATS 135 and meet the crashworthiness and fire protection specifications as provided therein.*

(2) Flight recorders shall be checked and inspected daily and on an annual basis as specified in Document SA-CATS 135.

(3) Flight recorders shall be deactivated upon completion of flight time following an accident or incident. The flight recorders shall not be reactivated before their disposition to the accident or incident investigation team.

(4) An operator shall ensure, to the extent possible, in the event the aeroplane becomes involved in an accident or a serious incident in which the aeroplane is not able to continue on its intended itinerary, the preservation of all related flight recorder records and, if necessary, the associated flight recorders and their retention in safe custody pending their disposition as determined in accordance with part 12.

(5) The flight recorder shall not be switched off during flight time.

1.18.14 Unmanned joining procedures (SACAA leaflet)

At unmanned airfields, the joining procedure by law is: Join overhead the field at 2000 ft above ground level (AGL) and observe the wind conditions. Descend on the "dead" side of the field and join the circuit at 1000 ft AGL. The purpose of the overhead join is to allow either non-radio aircraft, or aircraft arriving at a non-radio airfield, to overfly the airfield at a safe height, to observe, determine the runway in use and circuit direction, and then descend into the circuit pattern. The best course of action when visiting an unmanned aerodrome is:

- *Check the arrival procedures of the next destination first, before leaving.*
- *Effective radio communication and traffic awareness are all-important and will help prevent a collision.*
- *Keep the standard phraseology when communicating.*
- *Report your exact position to avoid confusion.*

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1. General

From the available evidence, the following analysis was made with respect to this incident. This shall not be read as apportioning blame or liability to any particular organisation or individual.

2.2. Analysis

2.2.1 Man

The pilot-in-command (PIC) was issued an Airline Transport Pilot Licence (ATPL) on 20 August 2020 with an expiry date of 31 August 21. The PIC was in possession of a valid aviation Class 1 medical certificate with no medical waiver, issued on 11 November 2020 with an expiry date of 11 November 2021. The PIC's (PM) last simulator training was conducted in a Beech 1900 flight simulator on 26 May 2019. There were no records found

that a simulator training on type similar to the incident aircraft was conducted. The operator's manual of procedure requires that the pilot commanding the aircraft should have a set requirement credentials before acting as PIC on the aircraft. Part of the credentials required, should be, but not limited to, the simulator training on type. The simulator training helps to sharpen the piloting skills and to build a muscle memory which will assist the pilot to take corrective action when faced with emergencies during flight. Due to international travel restrictions, the PIC could not travel to a country with a suitable FSTD. The operator was in possession of the dispensation letter of exemption issued by the SACAA. At the time of finalising this report, the pilot (PIC) had not yet furnished the AIID with a copy of the logbook and endorsement page regarding the simulator training and initial type training.

The pilot flying (PF) was initially issued a licence on 20 November 2014. The pilot completed his conversion on type on 11 June 2020 and the conversion was endorsed by the instructor. A total of 10.5 dual hours were logged in the logbook. The last renewal was conducted on 20 August 2020 with an expiry date of 31 August 2021. The PF was in possession of a valid aviation Class 1 medical certificate with no medical waiver, issued on 21 December 2020 with an expiry date of 31 December 2021. The PF did not do simulator training as he did the type rating in June 2020.

This was not the first time the PIC landed at this airport. The last landing that the PIC conducted on the same runway was on 26 February 2021 without any mishaps. The PIC landed on the same runway numerous times without any incident.

Crew Resource Management (CRM)

The investigation revealed that the crew composition for the flight had operated together in previous flights. It is not clear who was responsible for the incident aircraft flight as both crew members logged as PICs for this incident flight in their logbooks. During the pilot interview, it was revealed that the PM was the PIC for the flight, and he was sitting on the right-side seat. This seemed like a norm as it was noted that on previous occasions, both pilots had logged as PICs. This was not in line with the requirements of the CAR Part 61.01.8 (7&8) as amended. The implication of both pilots recording PIC on the same flight creates uncertainty regarding the responsible person for the flight to handle any emergencies during critical phases of flight. Although the PM stated that he was the PIC for the flight, the responsibility of the aircraft is assumed from the left-side seat and not from the right-side seat for this type of aircraft.

In terms of the recency, the PF was the most recent in the aircraft as he completed the conversion on type on 11 June 2020. Although the crew had flown together in previous flights, they both had not attended the flight simulator training at the manufacturer's accredited simulator facility, however, the proficiency check was conducted with real aircraft as

exempted by the Regulator. At the time of finalising this report, the pilot (PIC) had not furnished the AIID with a logbook copy and endorsement page regarding the simulator training and initial type training. The PF did not do simulator training as he did the type rating in June 2020.

In terms of type experience, the PIC had more flying hours than the PF. The CRM for the flight to FAPG was found to be inadequate as the mitigating process of the cabin altitude warning was not in line with the checklist procedures; also, the prelanding checklist was not followed during approach for landing at FAPG. The pilot stated that the door was not properly latched. An open-door event during the flight could lead to structural damage to the aircraft if left unattended for prolonged periods. The crew did not follow unmanned airfield joining procedure at FAPG.

2.2.2 Machine

The aircraft was maintained by an AMO in FALA, the last annual inspection was carried out at 2 507.1 flying hours on 1 June 2020 and 1 405 landing cycles by an approved aircraft maintenance engineer (AME), which issued a Certificate of Release to Service on 2 June 2020. The crew experienced cabin altitude warning while on the climb phase, which resulted in the crew requesting to remain at FL100, granted by the ATC. The crew continued with the flight instead of landing at the nearest aerodrome or returning to the departure aerodrome as required by the flight manual checklist. The checklist requires the crew to don the masks immediately and land as soon as practicable, and this was not done as the crew continued with the flight.

An internal investigation by the operator was conducted and the cause of the cabin altitude was undetermined. The AMO that recovered the aircraft could not find any anomalies with the aircraft systems or the door. Further investigation by the AIID did not reveal any malfunctions with cabin altitude system. There were no further defects encountered for the duration of the flight until the landing phase at FAPG.

The aircraft had a runway overrun and the damages incurred were to the nose wheel and tyre and left under carriage outboard tyre which was changed by a qualified engineer who is rated on type. The aircraft was towed back to the flight line while awaiting the special flight permit. A special flight permit was issued by the Regulator for the aircraft to be repositioned to a facility at FALA for post-incident maintenance. There were no structural mechanical damages sustained by the aircraft. The aircraft was repositioned on 18 March 2021 and the aircraft landed safely without any defects.

The mass and centre of gravity for the aircraft were within the prescribed limits as stipulated by the manufacturer. The aircraft's maximum weight during landing was recorded as 30 100

pounds (lbs) and the maximum landing mass for this aircraft type is 33 500 lbs (source: EASA TCDS/AFM).

The CVR data downloaded did not meet the requirements of SA-CATS Part 135.05.11 which renders the Certificate of Airworthiness invalid as stipulated by Part 43 requirements. There were no aural environment sounds on the flight deck, nor voice communication transmitted from or received in the aircraft. Also, the voice or audio signals identifying navigation or approach aids introduced in the headset or speaker were unreadable. All four channels had the same results. It is likely that the white noise feedback is a result of an erased memory after the flight. Although the hypothesis could not be proven with certainty.

2.2.3 Environment

The weather reported by the SAWS and the pilot did not have a bearing on the serious incident. The automatic weather station at FAPG does not have equipment that show clouds and visibility. However, at the time of the incident, the pilot reported visibility as approximately 10 000km. The runway surface was not contaminated.

2.2.4 Mission

This was a private flight from FACT to FAPG to collect the owner of the aircraft before heading to FALA. The crew conducted many landings at FAPG in the past without any mishaps. An IFR flight plan was filed with ATC, however, the approach and landing were conducted under Visual Flight Rules (VFR) by day due to FAPG not having instrument landing facilities. During landing at FAPG, the aircraft was unable to stop and it overshot the runway due to the braking system not deployed timeously.

The pilot monitoring stated that the aircraft touched down 356m from the threshold of Runway 12 and that the braking capability of the aircraft was reduced as there was a delay in deploying the thrust reversers.

Data from the FDR was downloaded and analysed. The results of the readout revealed that the approach was stable. The speed and rate of descent were consistent until touch down, Vref was at 125kts. The aircraft is fitted with ground spoilers, midboard and outboard spoilers that act as Speedbrake after landing when deployed. To activate the ground spoiler, the switch in the centre console must be armed by the pilot during approach, the deployment of the spoiler is achieved by contact of weight on wheels.

From the readout, it was determined that the switch was not armed by the crew as part of the critical phase of flight (approach) as required by the landing procedures. This was evidenced

by a recorded FDE message on the MCDU which gave an indication that the switch was not armed; moreover, there were no recorded caution messages (e.g. spoiler fail, brake degrade) on the instrument panel. Furthermore, the landing checklist/procedure requires that the speedbrake be extended after touchdown.

Ground spoilers when used in conjunction with the speedbrake remove the lift from the wings and assist the airplane to be firmly on the ground for brakes to be effective in stopping the airplane within the calculated landing distance. When deployed, the position of all panels is displayed on the flight synoptic page for the pilot monitoring.

The speedbrake lever was not moved to the extended position after landing as required by the landing checklist. The checklist further alerts the pilot that without all six panels deployed, the landing distance needs to be factored by 2.3, which will require a landing distance calculation to be computed.

The thrust reversers were deployed late into the landing towards the last quarter of the runway. There was no evidence found to suggest that the control quadrant was defective. If this was the case, the control quadrant could have given erroneous operation during the repositioning flight after the incident. The thrust reversers were deployed late as a result of delayed braking action by the crew. It is likely that a decreased braking efficiency gave the PF a perception that the system was not operating as it should, therefore, contributed to the delay in applying the thrust reversers. During this time, the aircraft might have floated due to ground cushion as the landing was unstable. This was evidence by the intermittent WOW indication between left and right on the FDR data, an indication of wings rocking.

The calculated landing distance that the aircraft needed to safely stop was 2 808ft, given all braking systems worked properly and all six panels deployed together with the thrust reversers. Because the spoilers were inoperative, the corrected landing distance was calculated to be 6 459ft (1 969m), which exceeded the runway length of 4 068ft (1 240m). It is likely that when the pilot was experiencing the reduced braking efficiency, the aircraft was not firmly on the ground to allow the break energy effect.

The braking action was initiated in the middle of the runway with only 2 900ft (884m) of runway length remaining. The aircraft was slowing down; the tyre markings towards the end of the runway were an indication that the brakes were working effectively, and anti-skid prevented brakes to lock. It is the view of the investigation team that the incident would have been avoidable should the crew activated the speed brake immediately after touchdown as required by landing procedures; alternatively, the crew should have opted to do a go-around when they realised that the aircraft would not be able to stop in time, as the aircraft speed of 125 Vref was above Vr (115kts), which is the safe speed for this type of aircraft to rotate. An

all-engine take-off/go-around (TO/GA) should have been selected as the aircraft was accelerating down the runway with available distance remaining.

The investigation determined that the likely cause of the incident was that the aircraft was unstable on approach, resulting in a deep landing and a runway excursion because of the spoiler system that was not armed during approach for landing. The remaining runway length following a deep landing was inadequate for a safe landing without the aid of the spoilers, hence, the subsequent runway excursion.

3. CONCLUSION

3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this incident. 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 conclusion heading:

- **Findings —** are statements of all significant conditions, events or circumstances in this incident. The findings are significant steps in this incident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions or a combination thereof, which led to this incident.
- **Contributing factors —** are actions, omissions, events, conditions or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the incident occurring, or would have mitigated the severity of the consequences of the incident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

3.2. Findings

3.2.1 The PIC was in possession of a valid Airline Transport Pilot Licence (ATPL) issued on 20 August 2020 with an expiry date of 31 August 2021.

3.2.2 The PIC was in possession of a valid aviation Class 1 medical certificate with no medical waiver, issued on 11 November 2020 with an expiry date of 11 November 2021.

3.2.3 The PIC's last simulator training which was the proficiency check for instrument rating was

conducted in the Beech 1900 (B190) simulator on 26 May 2019. There were no records found that a similar type of simulator training was conducted prior to the issuance of the exemption letter by the Regulator before international travel restrictions came into effect, however, the PIC conducted the proficiency check in the actual aircraft due to an exemption issued by the Regulator.

3.2.4 The PF was issued an initial licence on 20 November 2014. He completed his conversion on type on 11 June 2020 and the conversion was endorsed by the instructor. A total of 10.5 dual hours was logged in the logbook. The last renewal was conducted on 20 August 2020 with an expiry date of 31 August 2021. There were no records found that suggested a similar type of simulator training was conducted prior to the issuance of the exemption letter by the Regulator before international travel restrictions came into effect, however, the PF conducted the proficiency check in an actual aircraft due to an exemption issued by the Regulator.

3.2.5 The crew did not follow CAR Part 61.01.8 (7&8) as they both recorded PIC flight time in the logbook for the incident flight, as well as on previous flights they had flown together. This was not in line with the requirements of Part 61.01.8 (7a and 8).

3.2.6 The crew was within the flight duty time as required by regulation Part 91.02.3 (3).

3.2.7 The crew did not follow unmanned airfield joining procedures at FAPG.

3.2.8 The aircraft had a valid Certificate of Airworthiness (C of A) which was initially issued on 8 February 2018 with an expiry date of 28 February 2022. The aircraft was issued a valid certificate of Registration (C of R) on 10 February 2012 with the present owner.

3.2.9 The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and procedures. The last annual phase inspection was carried out at 2507.1 flying hours on 1 June 2020 and 1 405 cycles by an approved AMO, which issued a Certificate of Release to Service on 2 June 2020.

3.2.10 The operator was in possession of an Air Operating Certificate No. CAA/N996D issued on 15 October 2020 with an expiry date of 31 October 2021. The aircraft was duly authorised to operate under the AOC.

3.2.11 The operator was in possession of Air Service licences for domestic and international non-schedule Class II Licence No: N966D and I/N212 issued on 8 December 2020. The types of Air Service categories are A1, A2 and A3 and the types of Air Services are N1, N2 and N4.

3.2.12 The mass and centre of gravity for the aircraft were within the prescribed limits as stipulated by the manufacturer.

3.2.13 There was a reported defect of cabin altitude warning during the climbing phase from FACT to FAPG. The crew did not make an air turn back to return to the departure airport. There were no faults found with the pressurisation system and the cabin altitude warning was undetermined.

3.2.14 The landing phase was unstable, and the aircraft floated due to ground cushion before touch down.

3.2.15 Given the conditions of the configuration for the flight, the aircraft was not going to stop safely in the remaining runway. Although the aircraft touched down approximately 356m from the threshold of Runway 12, the aircraft had sufficient landing distance to stop had the speedbrake and ground spoilers been deployed timeously.

3.2.16 Airport management provided prompt and effective assistance to the flight crew and the airport fire and rescue arrived timeously and applied foam to the landing gear wheels.

3.2.17 The reported weather by SAWS did not have a bearing on the incident.

3.2.18 The CVR did not comply with the provisions of SA-CATS 135.05.4.9(4). The voice and chimes recording of all four channels were inaudible.

3.2.19 The AMO did not record the last downloading of the CVR as required by the Regulator for this type of CVR. This was not in line with the requirements of the CAR Part 135.

3.2.20 Braking performance analysis indicated that in the conditions existing at the time of the incident, the aircraft could not have stopped on the runway available. The crew did not perform a go-around.

3.2.21 The investigation determined that the likely cause of the incident was that the aircraft was unstable on approach, resulting in a deep landing and a runway excursion because the spoiler system was not armed during approach for landing. The remaining runway length following a deep landing was also inadequate for a safe landing without the aid of the spoilers, hence, the subsequent runway excursion. Had the crew performed a go-around, the runway excursion could have been avoided.

3.3. Probable Cause/s

3.3.1 It is likely that the aircraft was unstable on landing, resulting in a deep landing and a runway excursion because the ground spoiler system was not armed during approach for landing.

3.4 Contributory Factors

3.4.1 Insufficient runway length following a deep landing.

3.4.2 Failure to follow the operating procedures by not extending the speed brakes and arming the ground spoilers during landing.

3.4.3 Late application of thrust reversers.

3.4.4 The crew did not effectively scan and monitor primary flight instrumentation parameters during the landing phase.

3.4.5 The crew lacked simulator training of emergency procedures and unusual manoeuvres.

4. SAFETY RECOMMENDATIONS

4.1. General

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report. The AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisations.

4.2 Safety Recommendations

4.2.1 It is recommended to the operator to send the crew for simulator training in line with the company policy requirements and the CAR Part 61.01.12.

4.2.2 In the interest of safety, it is recommended to the DCA to evaluate CVRs compatibility and serviceability before the next flight to verify that they record clear voice and chimes audio signals on all the mounted microphones in the cockpit and cabin without interference as required by SA-CATS Part 135.

4.2.3 It is recommended to the AMOs to fulfil their mandate as required by the regulation CAR Part 43.02.3 for the completion of and recording of maintenance tasks that are conducted in accordance with the manufacturer-approved maintenance schedules in the appropriate documents/tools for compliance.

5. APPENDICES

5.1. Annexure A - FDR graph plots

5.2 Annexure B - FAPG aerodrome chart

5.3 Annexure C - Environmental pressurisation checklist

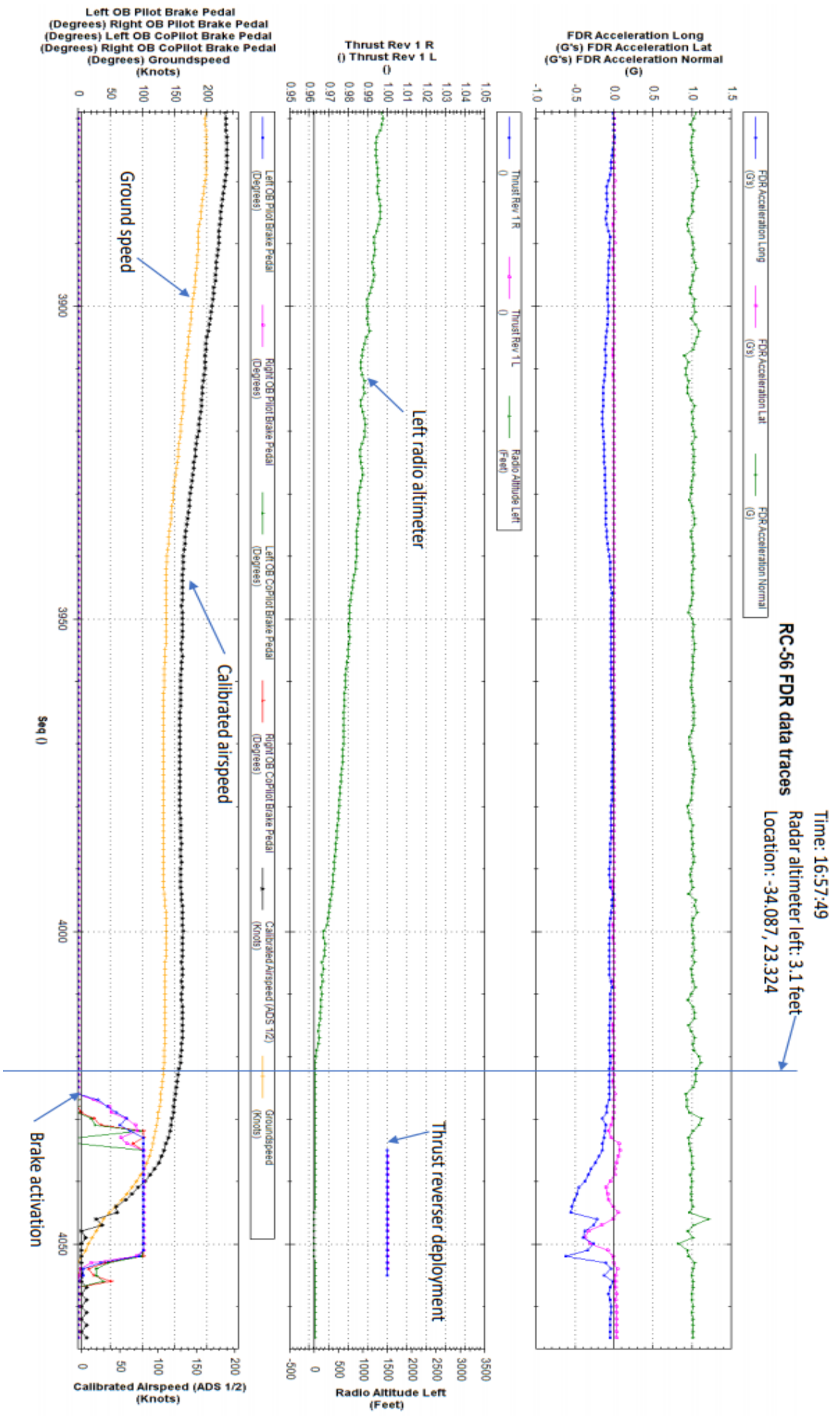
5.4 Annexure D - SA-CATS 135

5.5 Annexure E – CAR Part 43

This report is issued by:

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

Annexure A


RC-56 FDR data traces
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Radar altimeter left: 3.1 feet
Location: -34.087, 23.324
FDR Acceleration Long (G's) FDR Acceleration Lat (G's) FDR Acceleration Normal (G)
FDR Acceleration Long (G's)
FDR Acceleration Lat (G's)
FDR Acceleration Normal (G)
Thrust Rev 1 R () Thrust Rev 1 L ()
Thrust Rev 1 R ()
Thrust Rev 1 L ()
Radio Altitude Left (Feet)
Left OB Pilot Brake Pedal (Degrees) Right OB Pilot Brake Pedal (Degrees) Left OB CoPilot Brake Pedal (Degrees) Right OB CoPilot Brake Pedal (Degrees) Groundspeed (Knots)
Left OB Pilot Brake Pedal (Degrees)
Right OB Pilot Brake Pedal (Degrees)
Left OB CoPilot Brake Pedal (Degrees)
Right OB CoPilot Brake Pedal (Degrees)
Calibrated Airspeed (ADS 1/2) (Knots)
Groundspeed (Knots)
Ground speed
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Calibrated airspeed
Thrust reverser deployment
Brake activation
Seq ()
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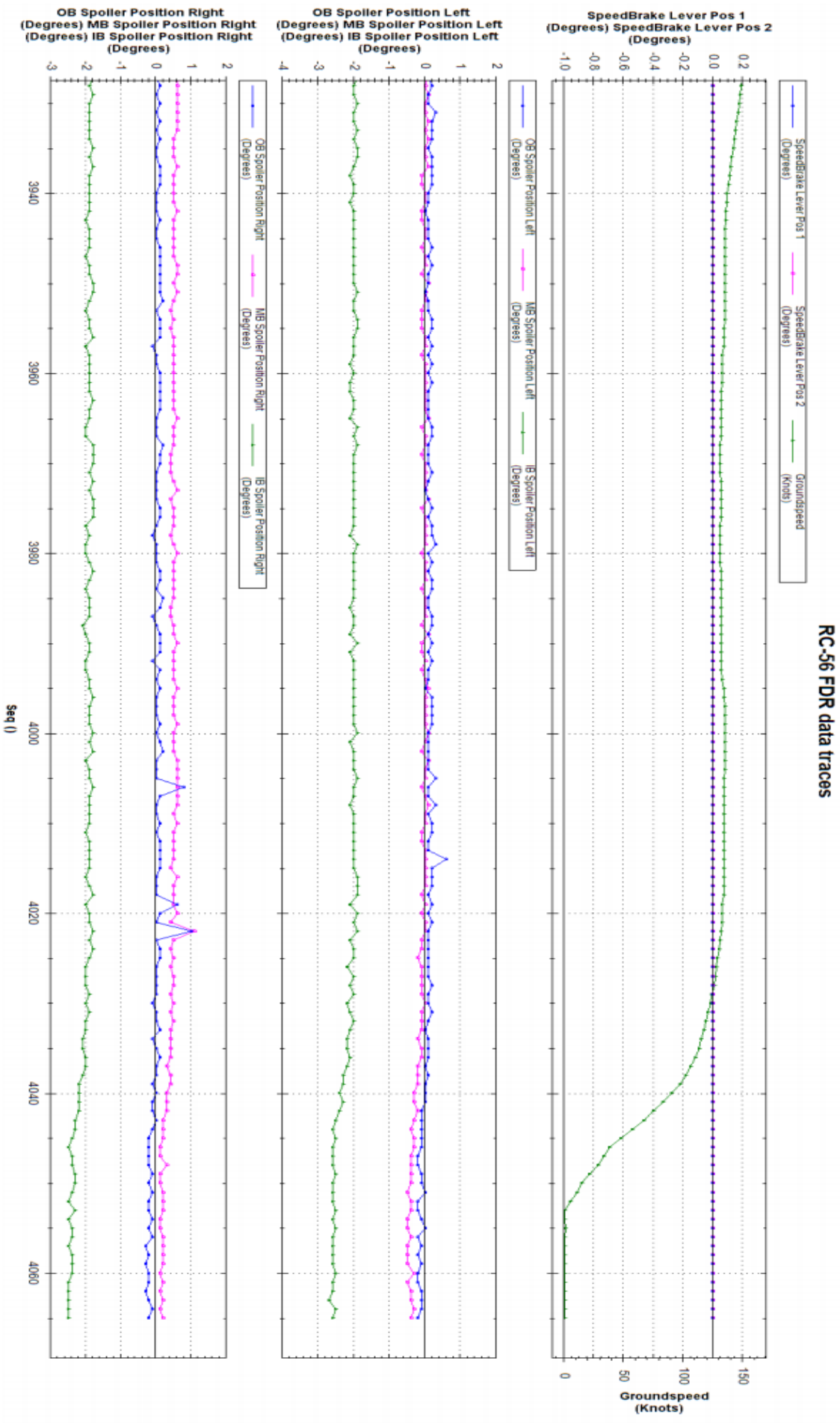
Radio Altitude Left (Feet)


RC-56 FDR data traces
SpeedBrake Lever Pos 1 (Degrees) SpeedBrake Lever Pos 2 (Degrees)
SpeedBrake Lever Pos 1 (Degrees)
SpeedBrake Lever Pos 2 (Degrees)
Groundspeed (Knots)
Groundspeed (Knots)
OB Spoiler Position Left (Degrees) MB Spoiler Position Left (Degrees) IB Spoiler Position Left (Degrees)
OB Spoiler Position Left (Degrees)
MB Spoiler Position Left (Degrees)
IB Spoiler Position Left (Degrees)
OB Spoiler Position Right (Degrees) MB Spoiler Position Right (Degrees) IB Spoiler Position Right (Degrees)
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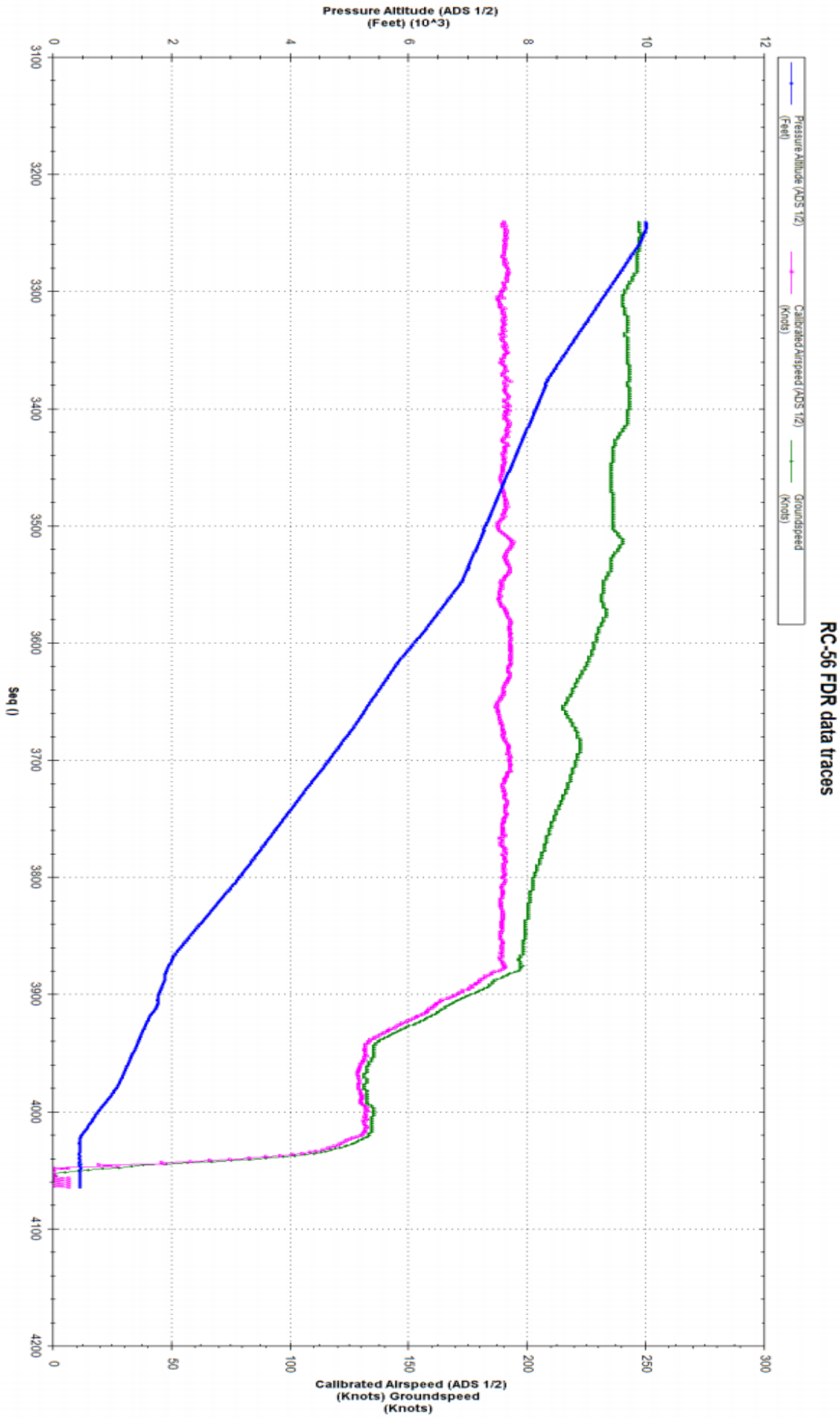
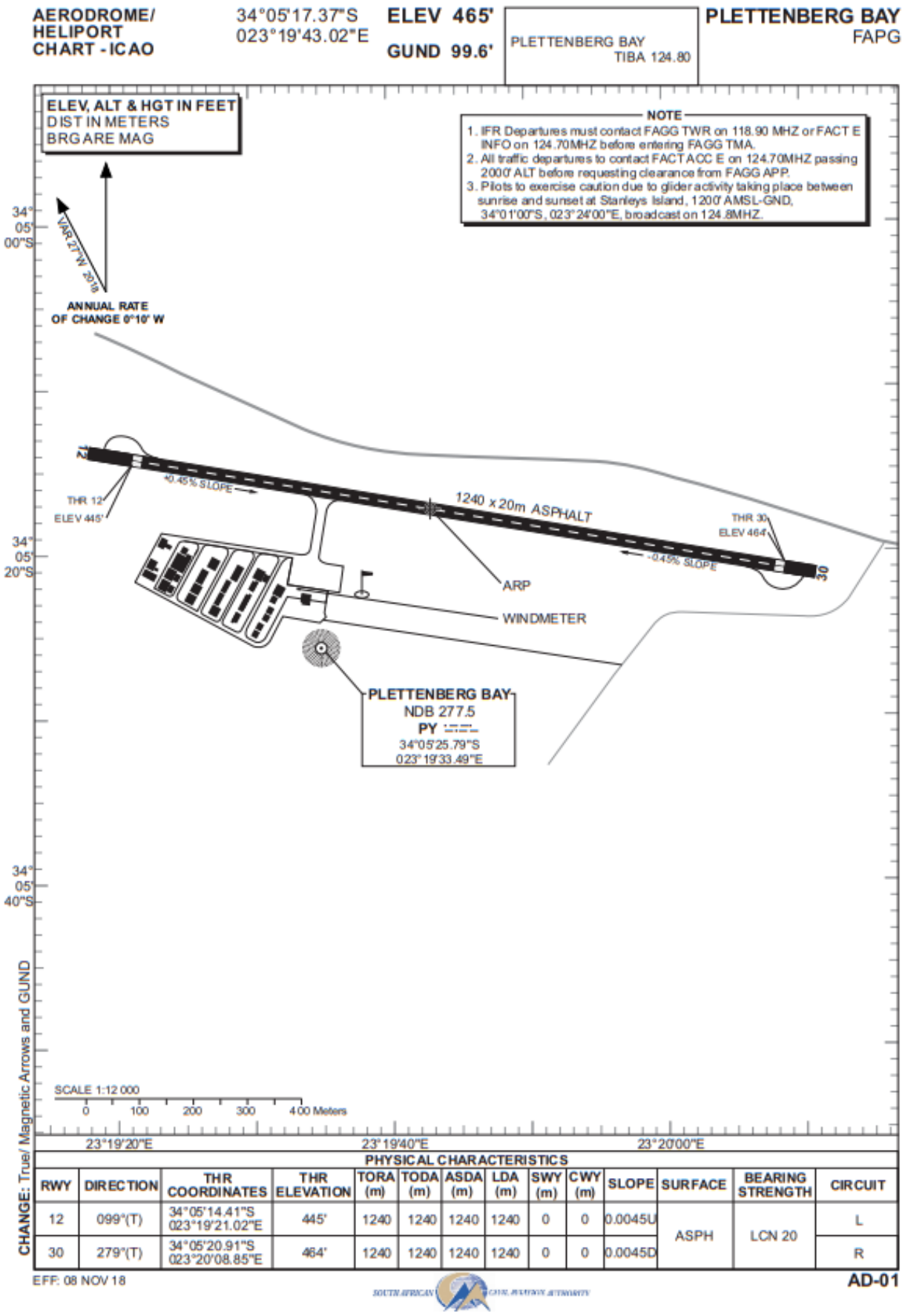
IB Spoiler Position Right (Degrees)
Seq ()



RC-56 FDR data traces

Annexure B



PHYSICAL CHARACTERISTICS

RWY	DIRECTION	THR COORDINATES	THR ELEVATION	TORA (m)	TODA (m)	ASDA (m)	LDA (m)	SWY (m)	CWY (m)	SLOPE	SURFACE	BEARING STRENGTH	CIRCUIT
12	099°(T)	34°05'14.41"S 023°19'21.02"E	445'	1240	1240	1240	1240	0	0	0.0045U	ASPH	LCN 20	L
30	279°(T)	34°05'20.91"S 023°20'08.85"E	464'	1240	1240	1240	1240	0	0	0.0045D			R

EFF: 08 NOV 18

AD-01

Annexure C

ENVIRONMENTAL / PRESSURIZATION / DOORS

E4.1 CABIN ALTITUDE HIGH Cabin Altitude High

Cabin Altitude Above 10,000 FT (14,200 FT for High Field Operation)

WARNING

It must be ensured that the crew oxygen masks are donned quickly and fit properly. Large eyeglasses, headsets and hats may need to be removed before donning an oxygen mask.

1. **Oxygen Masks** . . . . . **DON**
2. **Crew Communication** . . . . . **ESTABLISH**
3. Cabin Altitude and Rate . . . . . CHECK

■ **IF CABIN DEPRESSURIZATION IS RAPID:**

a. **EMERGENCY DESCENT (E1.3)** . . . . . PERFORM
b. Land . . . . . NEAREST SUITABLE AIRPORT

Procedure Completed

■ **IF CABIN DEPRESSURIZATION IS NOT RAPID:**

a. L and R BLEEDS and L and R PACKS . . . . . CONFIRM AUTO
b. FLIGHT DECK and CABIN HIGH FLOW . . . . . HIGH
c. Cabin Altitude . . . . . MAINTAIN 10,000 FT OR BELOW

● **IF CABIN ALTITUDE CANNOT BE MAINTAINED AT OR BELOW 10,000 FT:**

1) **AUTO PRESSURIZE FAIL (A4.1)** . . . . . PERFORM
2) Land . . . . . AS SOON AS PRACTICAL

Procedure Completed

● **IF CABIN ALTITUDE CAN BE MAINTAINED AT OR BELOW 10,000 FT:**

Procedure Completed

Annexure D

SA-CATS Part 135.05.11 COCKPIT VOICE RECORDERS

1. Aeroplanes for which voice or aural recorders are required

Notes –

1. CVR performance requirements are as contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) document for Flight Recorder Systems of the European Organization for Civil Aviation Equipment (EUROCAE) for Crash Protected Airborne Recorder Systems, or equivalent documents.

2. CARS performance requirements are as contained in the EUROCAE ED-155, MOPS for Lightweight Flight Recorder Systems, or equivalent documents.

(1) An operator shall ensure any aeroplane operated in a commercial air transport operation is equipped with a CVR or CARS capable of recording the aural environment of the flight deck during flight time in accordance with the following table—

TABLE

Group See note 1.	***Conditions See note 2.***	***Maximum Certificated Take-Off Mass (kg)***	***Propulsion System***	***Recording retained for the last 30 minutes of operation***	***Recording retained for the last 2 hours of operation***	***Recording retained for at least the last 25 hours of operation***
1	*Application for type certification submitted to Contracting State on or after 1 January 2016 and required to be operated by more than one pilot*	*> 2250 but ≤ 5700*	*Turbine*		*X*	
2	*Individual certificate of airworthiness first issued on or after 1 January 2003*	*> 5700*	*All*		*X*	

3	*Individual certificate of airworthiness first issued on or after 1 January 1987*	*> 5700*	*All*	*-*	*X*	
4	*Individual certificate of airworthiness first issued before 1 January 1987 whose types of which the prototype was certificated by the appropriate national authority after 30 September 1969*	*> 27000*	*Turbine*	*-*	*X*	
5	*individual certificate of airworthiness is first issued on or after 1 January 2021*	*> 27000*	*All*			*X*

Notes –

1. Group 2, 3 and 4 recorders shall be CVRs, Group 1 shall be either a CVR or a CARS.

2. For the purposes of this regulation, any reference to the application for the type certification being submitted to a Contracting State on or after a specified date means the date an application is made for a new aircraft type, not the date of certification of particular aircraft variants or derivative models. Any reference to the individual certificate of airworthiness being issued first on or after a specified date means the first time a certificate of airworthiness is issued for a new individual aircraft serial number that has just come off the assembly line.

[Section 1 substituted by SA-CATS 1/2017 w.e.f. 1 June 2017.]

2. CVR specifications

***Notes** –*

1. Group

(1) Any recorder required to be installed shall have an independent power source with the capability of automatically engaging and providing ten minutes of operation whenever aircraft power to the recorder ceases, either by normal shutdown or by any other loss of power to the recorder.

(2) For all aeroplanes for which the type certificate is first issued on or after 1 January 2016 and which are required to be fitted with a CVR, the CVR shall be provided with an independent power source that

shall power exclusively the CVR and the cockpit area microphone components. In installations where two CVRs are fitted in aeroplanes, the forward CVR shall be provided with an independent power source.

Note – *When the CVR function is combined with other recording functions within the same unit, powering the other functions is allowed.*

(3) For all aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 2016 and which are required to be fitted with a CVR, the CVR shall be provided with an independent power source. In installations where two CVRs are fitted in aeroplanes, the forward CVR shall be provided with an independent power source.

(4) The CVR shall record on four separate channels, or more, at least the following –

(a) voice communication transmitted from or received in the aeroplane by radio;

(b) aural environment on the flight deck;

(c) voice communication of flight crew members on the flight deck using the aeroplane's interphone system, if installed;

(d) voice or audio signals identifying navigation or approach aids introduced in the headset or speaker; and

(e) voice communication of flight crew members using the passenger address system, if installed

(5) The CARS shall record on two separate channels, or more, at least the following –

(a) voice communication transmitted from or received in the aeroplane by radio;

(b) aural environment on the flight deck; and

(c) voice communication of flight crew members on the flight deck using the aeroplane's interphone system, if installed.

(6) The CVR shall be capable of recording on at least four channels simultaneously. On a tape-based CVR, to ensure accurate time correlation between channels, the CVR is to record in an in-line format. If a bi-directional configuration is used, the in-line format and channel allocation shall be retained in both directions.

(7) The preferred track channel allocation is shall be as follows –

(a) Channel 1 – co-pilot headphones and live boom microphone;

(b) Channel 2 – pilot headphones and live boom microphone;

(c) Channel 3 – area microphone; and

(d) Channel 4 – time reference plus the third and fourth crew members' headphone and live microphone, if applicable.

Notes –

1. Channel 1 is to be located closest to the base of the recording head.

2. The preferred channel allocation presumes use of current conventional magnetic tape transport mechanisms and is specified because the outer edges of the tape have a higher risk of damage than the middle. It is not intended to preclude use of alternative recording media where such constraints may not apply.

Annexure E

Carrying out of maintenance

43.02.3 Any person who carries out maintenance on an aircraft or aircraft component shall—

(*a*) have available adequate accommodation and facilities for the necessary disassembly, proper inspection and re-assembly of the aircraft or aircraft component;

(*b*) use methods, techniques and practices which are—

(i) prescribed in the current manufacturer's maintenance manual or in any instructions for safe operation and continued airworthiness;

(ii) in accordance with the approved maintenance programme for the aircraft;

(iii) in accordance with Document SA-CATS 43; or

(iv) approved by the Director;

(*c*) use the tools, equipment and test apparatus necessary to ensure that the maintenance is carried out in accordance with the appropriate manufacturer's requirements or standard practices approved by the Director;

(*d*) on completion of the maintenance, ensure that the condition of the aircraft or aircraft component is satisfactory for release to service and is at least equal to its original or properly modified condition with regard to—

(i) aerodynamic function;

(ii) structural strength;

(iii) resistance to vibration and deterioration; and

(iv) other qualities affecting airworthiness;

(*e*) use any special or test equipment recommended by the manufacturer, or equivalent equipment approved by the Director; and

(*f*) if maintenance is carried out on an aircraft operated under an aircraft operating certificate, carry out such maintenance in accordance with the operator's approved maintenance control manual. The format and requirements for an maintenance control manual are prescribed in Document SA-CATS 43.