AIRCRAFT SERIOUS INCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:	CA18/3/2/1490	
Aircraft Registration	ZS-ZWO	**Date of Incident**	2 August 2025	**Time of Incident**	0922Z
Type of Aircraft	Boeing 737-800		**Type of Operation**	Air Transport (Part 121)	
Pilot-in-command Licence Type	Airline Transport Pilot Licence (ATPL)	**Age**	38	**Licence Valid**	Yes
Flying Experience	**Total Flying Hours**	8 965.0	**Hours on Type**	4 486.0	
Last Point of Departure	O.R. Tambo International Aerodrome (FAOR), Gauteng Province, South Africa				
Next Point of Intended Landing	Abeid Amani Karume International Aerodrome (HTZA), Zanzibar, Tanzania				
Damage to Aircraft	No damage				
Location of the incident site with reference to easily defined geographical points (GPS readings if possible)					
Approximately 30 675 feet (ft) at Global Positioning System (GPS) co-ordinates: 24°54'06.4" S 029°52'47.3" E					
Meteorological Information	Surface wind: 020°/12kt; temperature: 6°C; dew point: 5°C; Visibility: CAVOK				

Number of People On-board	2+5+161	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On Saturday, 2 August 2025, seven crew members comprising two pilots and five cabin members, as well as 161 passengers on-board a Boeing 737-800 aircraft, operated as a scheduled international flight FA570, departed from O.R. Tambo International Aerodrome (FAOR) in Gauteng province, South Africa, to Abeid Amani Karume International Aerodrome (HTZA) in Zanzibar, Tanzania. The flight was conducted under the provisions of Part 121 of the Civil Aviation Regulations 2011, as amended.

During taxi to the runway for take-off, the crew reported low pressure in the left bleed air duct and elected to return to the parking bay as advised by the maintenance control centre (MCC). Maintenance personnel troubleshot the reported defect in the parking bay and, later, released the aircraft as serviceable, approximately 1 hour after the reported incident. At 0806Z, the aircraft took off from Runway 03L at FAOR.

During climb whilst passing through 30 675 feet (ft) to flight level (FL) 35 000ft (FL350), the Bleed Trip Off amber light illuminated on the right pack (overhead panel) and the crew confirmed cabin altitude while climbing. Thereafter, the crew commenced with an emergency descent during which the cabin altitude visual and aural warnings activated in the cockpit.

The cockpit crew donned their oxygen masks and followed the Quick Reference Handbook (QRH) Checklist for rapid depressurisation. Moreover, the passengers' oxygen masks deployed automatically in the cabin. The crew descended to 10 000ft and maintained a holding pattern to burn off fuel before they returned to FAOR for a full-stop landing. All occupants on-board were not injured. The aircraft was not damaged during the serious incident.

Probable Cause			
Abrupt loss of cabin pressure during flight due to simultaneous failure of the aircraft's bleed air system triggered by a rupture in the sense lines of engine Number 1. This compromised its bleed air output, compounded by a Bleed Trip Off condition on engine Number 2 which further disrupted the pressurisation system. **Contributing Factors** • Isolation valve was left in open position which compromised the bleed air flow. • No built-in test equipment (BITE) was conducted to check system integrity prior to dispatch.			
SRP Date	13 January 2026	Publication Date	19 January 2026

Occurrence Details

Reference Number	**:** CA18/3/2/1490
Occurrence Category	**:** Serious Incident (Category 3)
Type of Operation	**:** Air Transport Operations (Part 121)
Name of Operator	**:** FlySafair
Aircraft Registrations	**:** ZS-ZWO
Aircraft Make and Model	**:** Boeing 737-800
Nationality	**:** South African
Place	**:** En route from FAOR to HTZA
Date and Time	**:** 2 August 2025 at 0822Z
Injuries	**:** None
Damage	**:** Minor

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 and Incident Investigations Division (AIID) was notified of the occurrence on 2 August 2025. The occurrence was categorised as a serious incident according to the CAR 2011 Part 12 and the International Civil Aviation Organisation (ICAO) STD Annex 13 definitions. The investigator did not dispatch to the serious incident site.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Serious Incident — this investigated serious incident
   Aircraft — the Boeing 737-800 involved in this serious incident
   Investigation — the investigation into the circumstances of this serious incident
   Pilot — the pilot involved in this serious incident
   Report — this serious 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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Table of Contents

Abbreviation

Abbreviation	Description
°	Degrees
°C	Degrees Celsius
ACAU	Air Conditioning Accessory Unit
AIID	Accident and Incident Investigations Division
AMM	Aircraft Maintenance Manual
ANC	Abnormal Non-normal Checklist
APU	Auxiliary Power Unit
ATC	Air Traffic Control
ATLR	Aircraft Technical Log Report
ATPL	Airline Transport Pilot Licence
BAR	Bleed Air Regulator
CAA	Civil Aviation Authority
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
FAOR	O.R. Tambo International Aerodrome
FCOM	Flight Crew Operations Manual
FDR	Flight Data Recorder
FL	Flight Level
FO	First Officer
ft	Feet
hPa	Hectopascal
HSR	High Stage Regulator
HSV	High Stage Valve
HTZA	Abeid Amani Karume International Aerodrome (Zanzibar)
IFR	Instrument Flight Rules
kt	Knots
m	Metres
MCC	Maintenance Control Centre
METAR	Meteorological Aerodrome Report
MTOW	Maximum Take-off Weight
NNC	Non-normal Checklist
OEM	Original Equipment Manufacturer
PCCV	Pressure Control Check Valve
PF	Pilot Flying
PIC	Pilot-in-Command
PM	Pilot Monitoring
PRSOV	Pressure Regulating and Shut-off Valve
psi	Pounds per Square Inch
QNH	Barometric Pressure Adjusted to Sea Level
QRH	Quick Reference Handbook
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
UTC	Universal Co-ordinated Time
WTAI	Wing Thermal Anti-Ice
WIV	Whiskey India Victor (VOR beacon)
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 On Saturday morning, 2 August 2025, a Boeing 737-800 aircraft with registration ZS-ZWO, operated as a scheduled passenger international flight FA570, took off from O.R. Tambo International Aerodrome (FAOR) in Gauteng province, South Africa, to Abeid Amani Karume International Aerodrome (HTZA) in Zanzibar, Tanzania. A total of two pilots, five crew members and 161 passengers were on-board. The flight was conducted under the provisions of Part 121 of the Civil Aviation Regulations 2011, as amended.

1.1.2 During taxi to the threshold for take-off, the crew noticed that the left duct pressure was low, and they elected to return to the parking bay after discussing the defect with the maintenance control centre (MCC) personnel. Maintenance personnel conducted tests whilst the auxiliary power unit (APU) and the left engine (Number 1) were kept running. No faults were detected.

1.1.3 Approximately 1 hour later, the crew started both engines without any abnormal indications; they elected to continue with the flight. At 0806Z, the aircraft took off from Runway 03L; the first officer was the pilot flying (PF), and the pilot-in-command (PIC) was the pilot monitoring (PM). There was also an engineer on-board in the jump seat (the engineer was on board to facilitate aircraft turnaround and issue certificate of airworthiness at HTZA since the airline did not have permanent staff and ground crew to provide that service for them to continue its journey back to FAOR). Throughout the take-off and climb phases, no abnormalities were noted. At 10 000 feet (ft), the cabin pressure was checked as well as duct pressures; at 20 000 ft, the same procedure was followed without any anomalies noted.

1.1.4 However, as the aircraft was passing through 30 675 ft for the cruise altitude at 35 000 ft (FL350), a Bleed Trip Off light illuminated on the right pack. The PM noticed that both duct pressures had dropped to zero. The crew could feel in their ears that the cabin rate was climbing, which was confirmed by the cabin rate indicator. The PF confirmed the outflow valve indicator was in the fully closed position. The PM took over as PF; he commenced the emergency descent to the cleared altitude of 14 000 ft, followed by a further descent to 10 000 ft. The cabin altitude warning light on each pilot's forward panel illuminated, and the aural warning sounded. *(The warning light illuminates simultaneously with the aural warning when the cabin altitude is greater than 10 000 ft and remains illuminated until the cabin altitude pressure switch deactivates. The cabin altitude pressure switch can deactivate between 500 and 1 500 ft below the activation altitude.)* The cockpit crew donned their oxygen masks and completed memory items for cabin altitude warning or rapid decompression.

1.1.5 Once the Abnormal Non-Normal Checklist (ANC) was completed, the Cabin Altitude Non-Normal Checklist (NNC) was completed first, followed by the Bleed Trip as per the Quick Reference Handbook (QRH).

1.1.6 As the aircraft was above its maximum landing weight, the crew maintained a hold pattern north of Witbank Aerodrome's (FAWI's) Whiskey Indy Victor (WIV) beacon to burn off fuel. Once the aircraft's weight was satisfactorily reduced (*maximum landing weight limit is 66 360 kilograms [kg]*), the air traffic control (ATC) personnel cleared the crew to land on Runway 03L at FAOR.

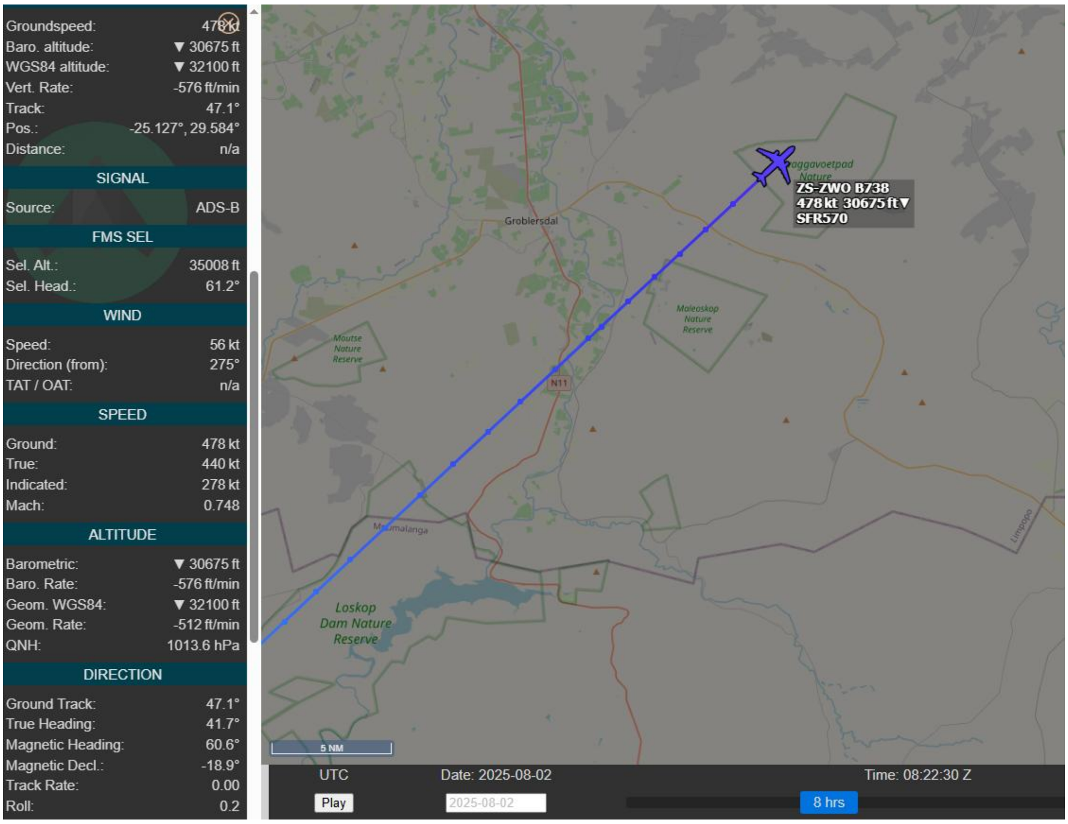


Figure 1: Radar information showing altitude captured at 30 675ft.

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	2	5	161	168	-
Total	**2**	**5**	**161**	**168**	**-**

Note: Other means people on the ground.

1.3 Damage to Aircraft

1.3.1 A general visual inspection of the aircraft was conducted to assess and identify damage, and none was found.

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	38
Licence Type	Airline Transport Pilot Licence (ATPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument				
Medical Expiry Date	30 September 2025 (Class 1)				
Restrictions	None				
Previous Incidents	None				

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

Flying Experience:

Total Hours	8 965.0
Total Past 24 Hours	1.0
Total Past 7 Days	1.0
Total Past 90 Days	234.0
Total on Type Past 90 Days	234.0
Total on Type	4 486.0

1.5.2 First Officer (FO)

Nationality	South African	Gender	Male	Age	31
Licence Type	Airline Transport Pilot Licence (ATPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument				
Medical Expiry Date	31 March 2026 (Class 1)				
Restrictions	None				
Previous Incidents	None				

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

Flying Experience:

Total Hours	4 147.2
Total Past 24 Hours	1.0
Total Past 7 Days	1.0
Total Past 90 Days	198.1
Total on Type Past 90 Days	197.1
Total on Type	308.0

1.6 Aircraft Information

1.6.1 Boeing 737-800 (Source: www.boeing.com)

The Boeing 737-800 is a subsonic, narrow-body, twin-engine commercial jet airliner from the Boeing 737 Next Generation (737NG) family, designed for short- to medium-haul flights. It *features a stretched fuselage for higher passenger capacity, typically seating 162 in two classes or up to 189 in a single class. The aircraft is powered by two high-bypass CFM56-7B turbofan engines manufactured by International Aero Engines. It has a glass cockpit with updated Rockwell Collins avionics and incorporates winglets to improve efficiency. The maximum take-off weight (MTOW) is 79 015kg and the maximum landing weight is 66 360kg.*

Figure 2: The file picture of the aircraft. (Source: Planespotters.com)

Airframe:

Manufacturer/Model	Boeing/737-8K2	
Serial Number	28373	
Year of Manufacture	1998	
Total Airframe Hours (at time of incident)	82 309.0	
Last Inspection (hours & date)	81 947.2	18 June 2025
Airframe Hours Since Last Inspection	361.8	
C of A (Issue Date & Expiry Date)	14 November 2014	31 December 2025
C of R (Issue Date) (Present Owner)	11 May 2021	
Operating Category	Part 121	
MTOW	79 015kg	
Type of Fuel Used	Jet A1	
Previous Incidents	None	

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

Engines:

Manufacturer	CFM International	
Make / Model	CFM56-7B27	
Position	Engine No. 1	Engine No. 2
Serial Number	960195	802185
Time Since New	55 176.4	34 420.2

1.6.2 The General Engine Bleed Air System Description (Boeing 737 AMM)

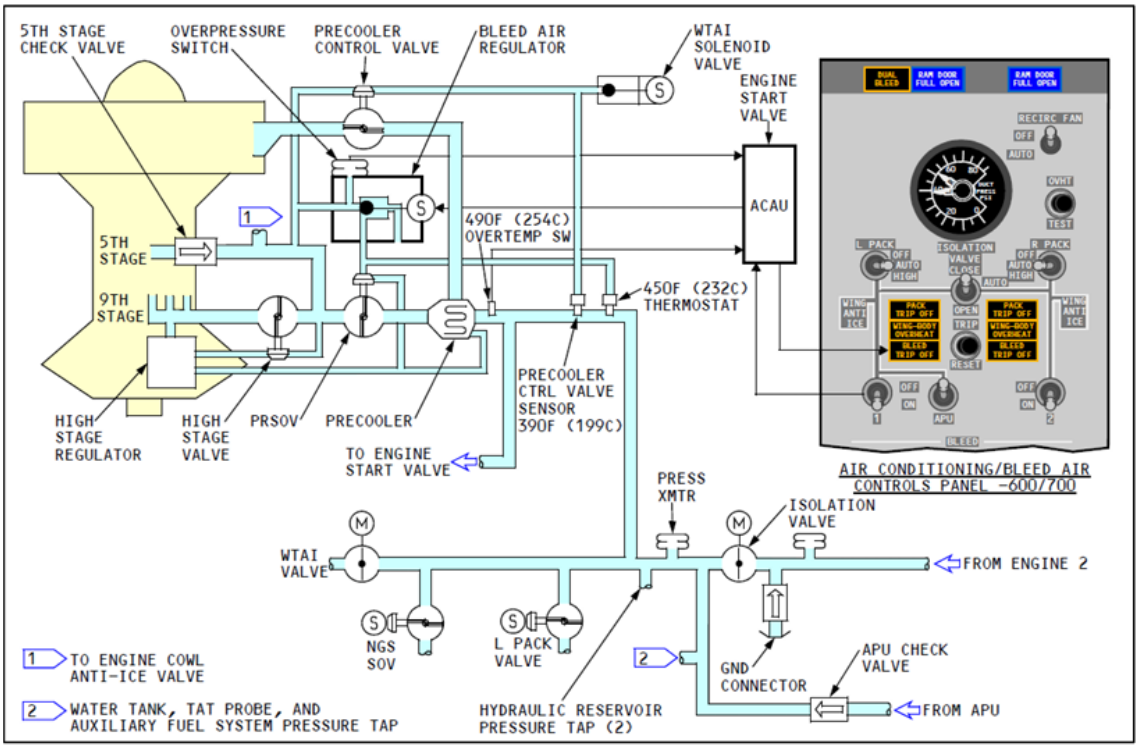


Diagram 1: Schematic representation of the engine bleed air system.

Figure 3: The air conditioning bleed air controls panel.

As illustrated in Diagram 1, bleed air comes from the 9th and 5th stages of the engine high-stage compressor. At low speed, the pneumatic system uses 9th stage air, which is not sufficient for the pneumatic system's demands at low engine speeds. At low engine speed, the high stage regulator (HSR) and high stage valve (HSV) control the pressure of the engine bleed air.

At low engine speed, the 5th stage check valve prevents reverse flow. At high engine speed, the HSV closes, and the 5th stage valve opens to supply bleed air to the pressure-regulating shut-off valve (PRSOV). The air conditioning bleed air control panel has engine bleed switches to control the PRSOV. Moreover, there are Bleed Trip Off lights that show overpressure or over-temperature conditions.

The Bleed Air Regulator (BAR) and PRSOV control the flow of engine bleed air to the pneumatic manifold. The BAR has over-pressure switches to prevent over-pressure conditions and turn on the Bleed Trip Off lights. The 450°F (232°C) thermostat makes the PRSOV move toward "close" position when the temperature gets to 450°F (232°C). The air conditioning accessory unit (ACAU) is an interface between the air conditioning bleed air control panel and the PRSOVs. The 490°F (245°C) overheat switches turn on the Bleed Trip Off lights and close the PRSOVs. This prevents overheating damage to the pneumatic manifold and user systems.

1.6.3 High Stage Regulator (HSR) and High Stage Valve (HSV)

The HSR controls the HSV. The HSV controls the flow of bleed air from the 9th stage engine bleed air manifold. The HSV is a butterfly valve, spring-loaded to the "close" position. The operation of HSR is automatic. There are no operational controls. The operation of the HSV is automatic. Moreover, there is a manual override to lock the valve in the "close" position. The HSR and HSV can be tested using external test equipment (Engine Bleed Air System Test).

1.6.4 Bleed Air Regulator (BAR) and Pressure Regulator and Shut-off Valve (PRSOV)

The BAR operates the PRSOV. The PRSOV controls the flow of bleed air from the engine. The following are the PRSOV control functions:

- Shut off of engine bleed air
- Pressure regulation of engine bleed air (42 pounds per square inch [psi] nominal)

The temperature limitation of engine bleed air is 450°F (232°C).

1.6.5 Bleed Trip

The Bleed Trip Off lights are amber. There is one Bleed Trip Off light for the left and right pneumatic manifold. They turn on when the pneumatic system has an overpressure or overtemperature condition.

Operation of either the 220psi overpressure switch or the 490°F (254°C) overheat switch will cause a bleed trip-off condition. A bleed trip-off condition sends a signal from the Air Conditioning Accessory Unit (ACAU) to close the BAR solenoid valve, regardless of the bleed switch position.

1.6.6 Sense Lines

The engine bleed air sense lines monitor the pressure and temperature of the air from the engine's compressor stages using pressure sense lines that run to the PRSOV. Temperature sensors are positioned after the PRSOV, both temperature and pressure sensor trigger Bleed Trip Off light and automatically close the engine bleed valve if excessive conditions occur. A downstream sense line is used to test for leaks after the pre-cooler, which can cause high duct pressure.

1.7 Meteorological Information

1.7.1 The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS), recorded at FAOR on 2 August 2025 at 0800Z.

FAOR 020800Z 01011KT 7000 OVC005 08/05 Q1034 BECMG BKN010=

Wind Direction	010°	Wind Speed	11kt	Visibility	7000m
Temperature	8°C	Cloud Cover	8 octas	Cloud Base	500ft
Dew Point	5°C	QNH	1034hPa		

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 records indicating that the navigational equipment was unserviceable before the serious incident.

1.9 Communication

1.9.1 The aircraft was equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system before the serious incident.

1.9.2 The crew had maintained two-way communication with ATC during the flight.

1.10 Aerodrome Information

1.10.1 The aircraft departed from FAOR and returned to the same aerodrome.

Aerodrome Name	O.R. Tambo International Aerodrome (FAOR)	
Aerodrome Location	Gauteng Province	
Aerodrome Status	Licensed	
Aerodrome GPS coordinates	26°08'01.30" South 028°14'32.34" East	
Aerodrome Elevation	5 558ft	
Runway Headings	03L/21R	03R/21L
Dimensions of Runway Used	4 421m x 60m	3 405m x 60m
Heading of Runway Used	03L	
Surface of Runway Used	Asphalt	
Approach Facilities	DVOR/DME, ILS LOC, ILS GP, Runway lights, PAPIs	
Radio Frequency	ATIS: 126.20 Apron: 122.65 Tower East: 118.60 Tower West: 118.10 Approach South: 124.50 Approach East: 124.50 Approach West: 123.70 Surface Movement Control (Ground): 121.90	

1.11 Flight Recorders

1.11.1 The aircraft was equipped with a flight data recorder (FDR) and a cockpit voice recorder (CVR). The CVR recording was overwritten and the investigator was unable to obtain any information recorded from the event flight.

1.12 Wreckage and Impact Information

1.12.1 There was no damage to the aircraft.

1.13 Medical and Pathological Information

1.13.1 None.

1.14 Fire

1.14.1 There was no pre- of post-impact fire during the serious incident.

1.15 Survival Aspects

1.15.1 The serious incident was survivable. The passenger oxygen masks deployed automatically when the cabin pressure altitude reached approximately 14 000 ft. *The flight crew could also deploy the masks manually from the cockpit using a guarded switch on the overhead panel if required.* The flight crew had their own dedicated, high-pressure oxygen system and masks which they immediately donned during the decompression event. The cockpit crew initiated a rapid descent to a safe altitude and, later, executed a safe landing at FAOR.

1.16 Tests and Research

1.16.1 Whilst taxiing towards the runway for take-off, the crew opted to return to the parking bay due to the low duct pressure indication. Engineers attended to the defect whilst the aircraft was in the parking bay.

1.16.2 It should be noted that the FDM does not record the actual switch position of the isolation valve in the cockpit; it only records whether the isolation valve is open or closed.

1.16.3 Twenty-six seconds before the aircraft was taxied, the isolation valve transitioned to open position.

1.16.4 The isolation valve remained in open position until the aircraft reached an altitude of 8 000 ft when it momentarily closed and then opened again.

1.16.5 The isolation valve remained in open position until the completion of the emergency descent.

1.16.6 Cabin pressure, cabin altitude and duct pressure recordings were not available and, therefore, could not be determined based on the data available.

1.16.7 The pressurisation problem persisted in the bleed air supply of engine Number 1; the isolation valve was in “open” position, and both engines were running, with normal bleed air supply on engine Number 2. The crew was not able to identify a possible reduction in left duct pressure. The isolation valve indicated a balanced duct pressure and it masked the potential pressurisation problems on engine Number 1.

1.16.8 A cabin altitude warning was recorded after a Bleed Trip Off on engine Number 2. *The Bleed Trip Off light illuminates when the engine bleed air temperature or pressure exceeds its limits, and the affected bleed valve automatically closes. This protects the system from damage*. The crew initiated an emergency descent from 30 675 ft to 14 000 ft within 4 minutes and 40 seconds.

1.16.9 Once the aircraft was on the ground, the AMO troubleshot the bleed air system; it was found that the system was leaking. The leak was determined to have originated from the two sense lines on engine Number 1 which had ruptured.

1.16.10 The sense lines are installed on the side of the engine. However, the heatshield surrounding these lines significantly impedes visual inspection, making it difficult to assess their condition effectively.

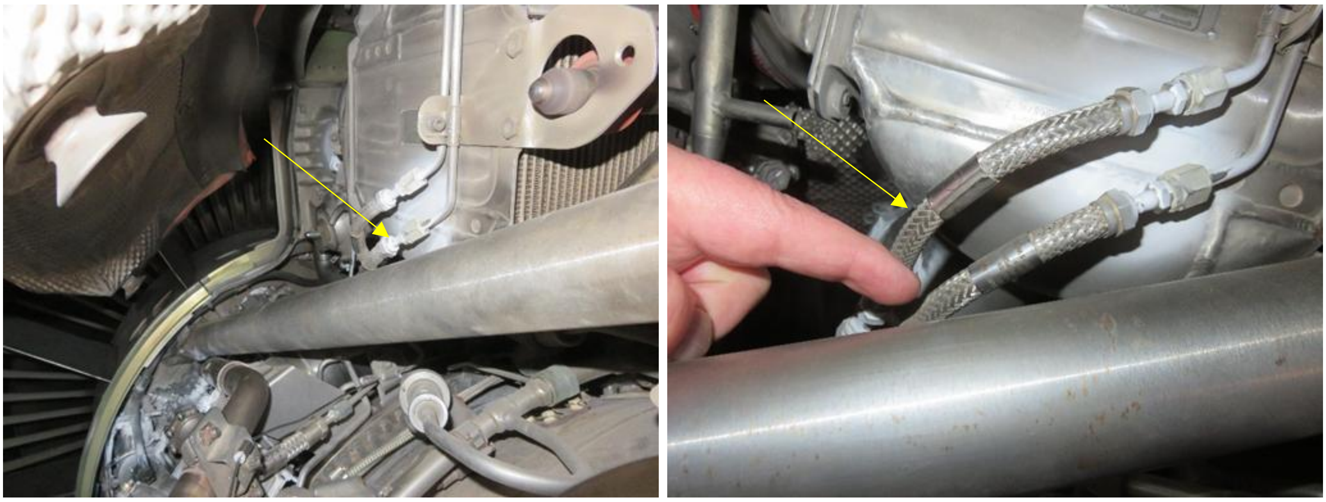


Figure 4: Example of the two sense lines on the side of the engine.

Figure 5: The leaking sense lines after they were removed from the engine.

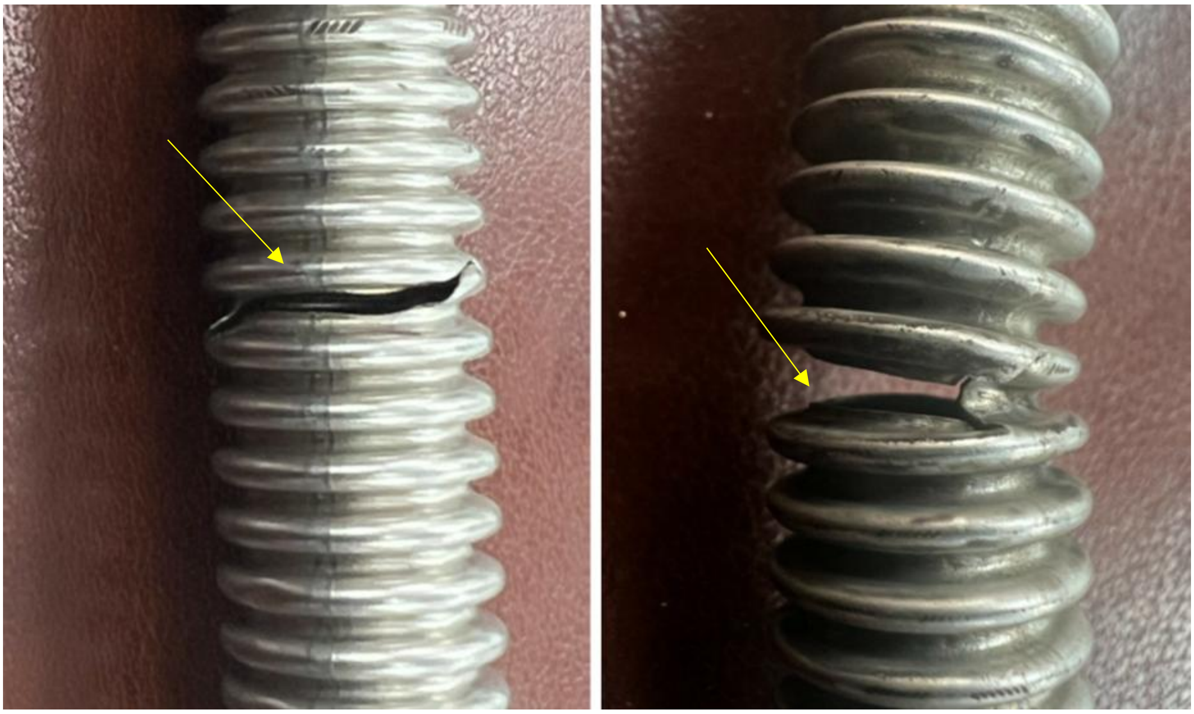


Figure 6: The ruptured sense lines after they were disassembled.

1.17 Organisational and Management Information

1.17.1 This flight was conducted under the provisions of Part 121 of the CAR 2011.

1.17.2 The operator had an approved Class 1 Air Service Licence for domestic and international schedule flights which was issued by the Department of Transport on 24 April 2025. The licence authorised the carrier to operate under the following categories: Type S1 – transport of passengers between two or more specified points, and Type S2 – transport of cargo or mail between two or more specified points.

1.17.3 The operator had a valid Air Operating Certificate (AOC) (SACAA.AOC.0113-PART 121) that was issued by the Regulator on 24 April 2025 with an expiry date of 30 April 2026.

1.17.4 The aircraft maintenance organisation (AMO) which performed the last maintenance of the aircraft had a valid AMO Certificate that was issued by the Regulator on 9 October 2024 with an expiry date of 31 October 2025.

1.18 Additional Information

1.18.1 Boeing 737-800 Pre-flight Checklist (operator's version)

Oxygen	Tested, 100%
Navigation transfer and display switches	NORMAL, AUTO
Window heat	ON
Pressurization mode selector	AUTO
Flight Instruments	Heading ; Altimeter
Parking brake	Set
Engine start levers	CUTOFF
Gear Pins	Removed

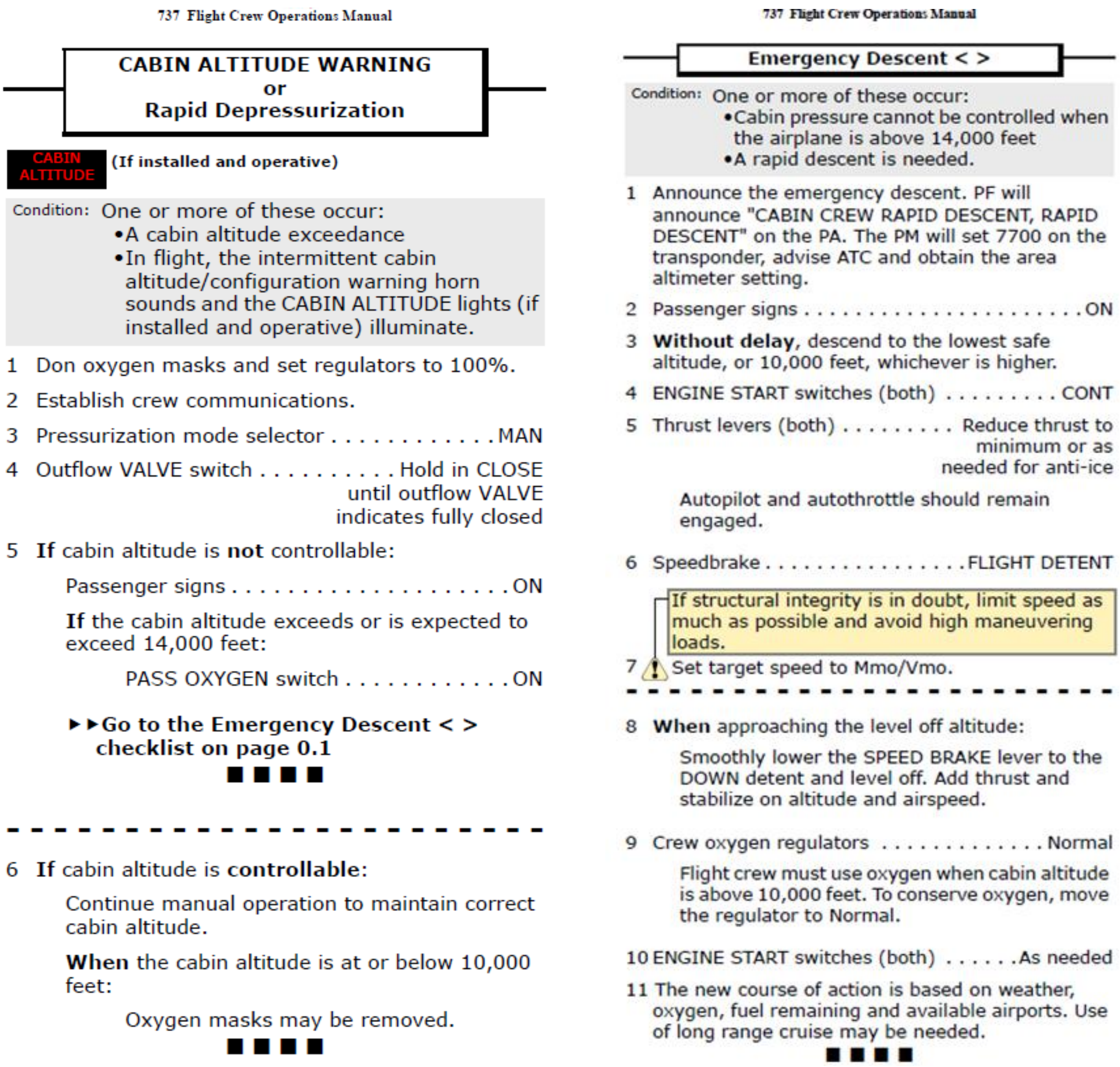
1.18.2 Boeing 737-800 Before Taxi (operator's version)

Generators	AUTO
Probe heat	AUTO
Anti-ice	--------
Isolation valve	AUTO
Engine start switches	CONT
Recall	Checked
Autobrake	RTO
Engine start levers	IDLE detent
Flight controls	Checked
Ground personnel and equipment	Clear

Note: The operator's Before Taxi Checklist stipulates that the isolation valve should be in "auto" position. Based on the FDR data, it was determined that the flight commenced with the isolation valve in "open" position.

1.18.3 Flight Crew Operations Manual (FCOM)

The crew followed the FCOM procedure after the cabin altitude/rapid depressurisation warning, which then referred them to the Emergency Descent Checklist.



737 Flight Crew Operations Manual

CABIN ALTITUDE WARNING
or
Rapid Depressurization

CABIN ALTITUDE **(If installed and operative)**

Condition: One or more of these occur:
- A cabin altitude exceedance
- In flight, the intermittent cabin altitude/configuration warning horn sounds and the CABIN ALTITUDE lights (if installed and operative) illuminate.

1 Don oxygen masks and set regulators to 100%.

2 Establish crew communications.

3 Pressurization mode selector . . . . .MAN

4 Outflow VALVE switch . . . . Hold in CLOSE until outflow VALVE indicates fully closed

5 **If** cabin altitude is **not** controllable:

Passenger signs . . . . .ON

If the cabin altitude exceeds or is expected to exceed 14,000 feet:

PASS OXYGEN switch . . . . ON

▶▶**Go to the Emergency Descent < > checklist on page 0.1**

■ ■ ■ ■

6 **If** cabin altitude is **controllable**:

Continue manual operation to maintain correct cabin altitude.

When the cabin altitude is at or below 10,000 feet:

Oxygen masks may be removed.

■ ■ ■ ■

737 Flight Crew Operations Manual

Emergency Descent < >

Condition: One or more of these occur:
- Cabin pressure cannot be controlled when the airplane is above 14,000 feet
- A rapid descent is needed.

1 Announce the emergency descent. PF will announce "CABIN CREW RAPID DESCENT, RAPID DESCENT" on the PA. The PM will set 7700 on the transponder, advise ATC and obtain the area altimeter setting.

2 Passenger signs . . . . .ON

3 **Without delay**, descend to the lowest safe altitude, or 10,000 feet, whichever is higher.

4 ENGINE START switches (both) . . . . CONT

5 Thrust levers (both) . . . . Reduce thrust to minimum or as needed for anti-ice

Autopilot and autothrottle should remain engaged.

6 Speedbrake . . . . .FLIGHT DETENT

If structural integrity is in doubt, limit speed as much as possible and avoid high maneuvering loads.

7 Set target speed to Mmo/Vmo.

8 **When** approaching the level off altitude:

Smoothly lower the SPEED BRAKE lever to the DOWN detent and level off. Add thrust and stabilize on altitude and airspeed.

9 Crew oxygen regulators . . . . Normal

Flight crew must use oxygen when cabin altitude is above 10,000 feet. To conserve oxygen, move the regulator to Normal.

10 ENGINE START switches (both) . . . . . .As needed

11 The new course of action is based on weather, oxygen, fuel remaining and available airports. Use of long range cruise may be needed.

■ ■ ■ ■

Figure 7: An extract from the Flight Crew Operations Manual.

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 serious incident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2 Analysis

2.2.1 <u>The crew</u>

The crew was properly rated and qualified to conduct the flight. Upon observing a low Left Duct Press indication during taxi, they promptly co-ordinated with the Maintenance Control Centre (MCC) personnel on frequency 131.80-Megahertz (MHz) and made the decision to return to the parking bay. Maintenance conducted troubleshoot with the APU and Number 1 engine still running. No faults were identified during these tests. The Aircraft Technical Log Report (ATLR) was completed in the presence of a ground engineer.

After a successful engine restart and confirmation of normal system indications, the crew proceeded with departure. Take-off and initial climb were uneventful. At both 10 000 ft and 20 000 ft, cabin and duct pressure indications were checked and confirmed normal by both pilots. At 30 675 ft, the right Bleed Trip Off light illuminated. The PIC observed that both duct pressure indications had dropped to zero. As there were no associated memory items for this indication, an immediate descent was requested to the lowest safe altitude.

Shortly after initiating descent and whilst referencing the Quick Reference Handbook (QRH) and Non-Normal Checklist (NNC) for Bleed Trip Off, an aural and visual cabin altitude warning was triggered. Both pilots immediately donned their oxygen masks and completed the memory items from Cabin Altitude Warning or Rapid Depressurisation as per the QRH. The outflow valve was verified to be in “close” position; however, cabin altitude continued to climb uncontrollably, exceeding 10 000 ft.

Once memory items were completed, the crew proceeded with the QRH Checklist for “Cabin Altitude Warning” and “Emergency Descent”, followed by re-completion of the Bleed Trip Off Checklist, and a descent to FL100.

After completion of the Required Maintenance Message (RMM), a decision was made to return to FAOR.

A normal approach and landing were conducted on Runway 03L, and the aircraft was taxied to stand D8 without further incident.

According to the FDR data, it was determined that the flight commenced with the isolation valve in “open” position, which is contrary to the stipulation in Before Taxi Checklist which indicated that the valve should be in “auto” position.

During engine start and taxi (ground operations), the isolation valve is set to “open” to allow the APU to supply bleed air to both engine starters for the engine to start. Once both engines are running, the isolation valve should be set to “auto” for take-off.

2.2.2 <u>Aircraft</u>

At the time of the flight, the aircraft was confirmed airworthy and compliant with the required certifications.

While the crew was taxiing to the threshold for take-off, Duct Press Low warning activated and the crew elected to return to the parking bay for the engineers to attend to the problem.

To investigate the Duct Press Low warning, the maintenance crew conducted diagnostic tests in the parking bay with APU and engine Number 1 operating. As part of the troubleshooting process, a zone temperature controller test was performed in the electronic and equipment (E/E) bay to identify any system faults. During the inspection, the pilot reported that engine Number 1 was not supplying bleed air. At the engineer’s request, the captain started engine Number 1 in the bay to verify bleed air availability and to initiate a cross-bleed check.

While preparing for headset communication, the engineers observed that the initial assessment had ruled out a pack fault and identified the issue as originating from the engine bleed air system. Following the engine stabilisation, the pilot confirmed that bleed air was present and operating normally. As a result, the cross-bleed check was deemed unnecessary and was discontinued. An ATLR was completed with the ground engineer. The pilot started both engines without any abnormal indications and elected to continue with the flight.

According to the FDR data, it was determined that the flight commenced with the isolation valve in open position, which was contrary to what was stipulated in the Before Taxi Checklist that the valve should be in auto position. The FDR could only tell if isolation valve was in “open” or “close” position.

During the flight, the open isolation valve allowed cross-feed between the left and right duct systems, equalising pressure readings. This design, whilst intended to provide redundancy, inadvertently conceal a fault of engine Number 1’s bleed air supply. This configuration masked the pressurisation issue as the system appeared balanced.

Leaving the isolation valve open during take-off whilst engine Number 1 was experiencing a bleed leak caused by the raptured sense lines significantly exacerbated the problem which led to a potential dual bleed system failure and the inability to maintain proper cabin pressurisation during climb, potentially causing the cabin altitude to climb at a high rate.

For safety, the isolation valve separates the left and right bleed air systems. Before take-off, it is set to “auto” to ensure that if one engine is lost, the second engine could continue to operate. This prevents a failure of one engine to affect the second engine.

For passenger comfort, the isolation valve in auto mode allows the functioning engine to supply bleed air to the air conditioning packs. If an engine fails after take-off, the isolation valve automatically closes to keep the good engine bleed air flowing to the passenger cabin and flight deck.

Without independent duct pressure monitoring or cabin pressure data (which was unavailable on ZS-ZWO), the crew was unable to detect any fault in the bleed air system until the cabin altitude warning activated. When engine Number 2 experienced a Bleed Trip Off, the aircraft lost its only effective source of bleed air, triggering a cabin altitude warning and prompting an emergency descent.

Following this serious incident, a bleed system health check was conducted on engine Number 1, which revealed leaks in the PRSOV and associated sense lines; both components were subsequently replaced. Post-replacement testing confirmed the system was free of further leaks; engine Number 2 underwent the same inspection with no defects found.

Another contributing factor that made it impossible to notice the ruptured sense lines was due to limited visibility with the heat shield that covered the sense lines. This design impeded effective visual inspection and contributed to the failure going unnoticed.

2.2.3 Conclusion

Following a return to the parking bay after the Duct Press Low warning activated, engineers attempted to trace the origin whilst the aircraft was in the parking bay. The built-in test equipment (BITE) test was not applied when the aircraft returned to the parking, and the leaking sense lines on engine Number 1 were not detected; the aircraft was released to service. (*BITE for avionics primarily refers to passive fault management and diagnosis equipment built into airborne systems to support maintenance processes*). After starting and taxiing to the threshold for the second take-off, no abnormalities were noted in the cockpit.

Whilst climbing to cruise altitude FL350, the aircraft's Bleed Trip Off warning light illuminated. The isolation valve was in “open” position and not in “auto” position as called for in the Before Taxi Checklist.

If the isolation valve is left in “open” position during take-off, a failure of one engine would lead to a cascade failure of the air conditioning system to both sides of the aircraft. This is a critical safety risk that the “auto” setting of the isolation valve prevents.

3. CONCLUSION

3.1 General

From the available evidence, the following findings, causes, and contributing factors were made with respect to this serious incident. These shall not be read as apportioning blame or liability to any 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 serious 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 serious 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 serious incident occurring, or would have mitigated the severity of the consequences of the serious 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

<u>Crew</u>

3.2.1 The pilot-in-command (PIC) had an Airline Transport Pilot Licence (ATPL) that was initially issued by the Regulator (SACAA) on 24 April 2013. The licence was renewed on 23 August 2025 with an expiry date of 31 August 2026.

3.2.2 The PIC had a Class 1 aviation medical certificate that was issued on 17 September 2024 with an expiry date of 30 September 2025 with no limitations.

3.2.3 The first officer (FO) had an Airline Transport Pilot Licence (ATPL) that was initially issued by the Regulator (SACAA) on 9 December 2016. The licence was renewed on 8 April 2025 with an expiry date of 31 January 2026.

3.2.4 The FO had a Class 1 aviation medical certificate that was issued on the 24 March 2025 with an expiry date of 31 March 2026 with no limitations

3.2.5 There was no evidence suggesting that incapacitation or any physiological factors affected the performance of the flight crew.

3.2.6 The Before Taxi Checklist requires that the isolation valve be selected to “auto” position. The flight commenced with the isolation valve in “open” position, according to the FDR, and it remained in that position for the entire flight. The isolation valve should only remain in “open” position during ground operations (starting the engines with the APU running).

3.2.7 The crew decided to perform an air turn back to FAOR.

<u>Aircraft</u>

3.2.8 The aircraft was declared serviceable and airworthy for the flight.

3.2.9 The last maintenance inspection of the aircraft was conducted and certified on 18 June 2025 at 81974.17 airframe hours. The aircraft had flown a further 361.8 hours after the inspection.

3.2.10 The aircraft had a valid Certificate of Airworthiness (C of A) that was issued by the Regulator on 14 November 2014 with an expiry date of 31 December 2025.

3.2.11 A Certificate of Registration (C of R) was issued to the present owner on 11 May 2021.

3.2.12 The passenger oxygen masks deployed automatically during the serious incident, and the flight crew donned their own masks.

3.2.13 The isolation valve was in "open" position, and both engines were supplying bleed air. Any deficiency in engine Number 1's bleed air output was masked by the normal supply from engine Number 2. The system showed a balanced duct pressure across both sides, giving the crew no clear indication of a localised failure.

3.2.14 Post-flight diagnostics confirmed a leak in the bleed air system in engine Number 1 which was traced to the ruptured sense lines on the engine.

Flight Recorders

3.2.15 The cockpit voice recorder (CVR) recording was overwritten, and the investigator was unable to obtain any information from the serious incident flight.

Maintenance

3.2.16 The leaking sense lines on engine Number 1 were not detected when the aircraft returned to the parking bay after the engineers' intervention.

3.3 Probable Cause

3.3.1 An abrupt loss of cabin pressure occurred during flight due to a simultaneous failure in the aircraft's bleed air system. The serious incident was triggered by a rupture in the sense lines of engine Number 1, which compromised its bleed air output and compounded by a Bleed Trip Off condition on engine Number 2, which further disrupted the pressurisation system.

3.4 Contributory Factors

3.4.1 Isolation valve was left in open position, which compromised bleed air flow. No built-in test equipment (BITE) was conducted to check system integrity prior to dispatch.

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 Actions

4.2.1 The operator revised the inspection procedures and had included enhanced checks of the sense lines. This has been done on the Boeing 737-800 fleet, and the additional check has been incorporated into the maintenance schedule.

4.2.2 A notice to pilots was sent to encourage them to report any abnormalities or concerns regarding aircraft pressurisation systems to enable timely troubleshooting and intervention by maintenance teams.

5. APPENDICES

5.1 None.

This report is issued by:

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