INTERIM STATEMENT

Accident and Incident Investigations Division (AIID)

Serious Incident
Boeing 737-400, ZS-OAF
AIID Ref No: CA18/3/2/1325

Figure 1: Boeing 737-400, ZS-OAF. (Source: www.Planespotters.net)

Description:

The Boeing 737-400 aircraft with registration ZS-OAF departed Cape Town International Aerodrome (FACT) on a scheduled domestic flight to East London Aerodrome (FAEL). While the aircraft was climbing through 32 920 feet (ft) above mean sea level (AMSL) to a cruising altitude of 33 000ft, the crew broadcast a *"Cabin Altitude Warning followed by a Mayday, requesting an emergency descent"*. The aircraft commenced with an emergency descent to 10 000ft. Once the crew levelled off at flight level 100 (FL100), the area controller who had the aircraft on primary surveillance radar asked the crew if they will be returning to FACT, but they opted to divert to George Aerodrome (FAGG) and landed safely on Runway 29.

DESCRIPTION OF SERIOUS INCIDENT

Occurrence reference	**:** CA18/3/2/1325
Name of the operator	**:** FlySafair
Manufacturer	**:** Boeing Aircraft Company
Aircraft model	**:** 737-400
Engine type	**:** 2 x CFM 56-3C-1
Nationality	**:** South African
Registration	**:** ZS-OAF
Aircraft serial number	**:** 25116
Year of manufacture	**:** 1991
Type of flight	**:** Air Transport Operations (Part 121)
State of occurrence	**:** South Africa
Place of occurrence	**:** En route from FACT to FAEL
Date and time	**:** 22 November 2020 at 0820Z
Total number of crewmembers	**:** 6
Total number of passengers	**:** 158
Injuries to passengers and crew	**:** Minor injuries
Other injuries	**:** None
Nature of damage	**:** None

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

Purpose of the Investigation:

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

The interim statement is issued in accordance with the International Civil Aviation Organization (ICAO) Annex 13, Chapter 6, sub-paragraph 6.6 and Part 12.05.1(7) of the Civil Aviation Regulations 2011 as amended.

The final report may contain altered information should new evidence becomes available while the investigation is on-going.

Any person who has information pertaining to this accident should contact AIID via the following email address: AiidInbox@caa.co.za

Investigation process:

The incident was categorised as a serious incident and the Accident and Incident Investigations Division (AIID) had assigned an Accident Investigation File Number CA18/3/2/1325 for this investigation.

An accident investigator was assigned to this investigation on 30 November 2020. The National Transportation Safety Board in the United States of America (USA), being the State of the Design and Manufacture, was notified of the serious incident. The State assigned an Accredited Representative to this serious incident. The AIID is leading the investigation and will issue a final report.

AIID reports are made available to the public at:
http://www.caa.co.za/Pages/Accidents%20and%20Incidents/Aircraft-accident-reports.aspx

Disclaimer:

This interim statement is produced without prejudice to the rights of AIID, which are reserved.

Interim Statement:

The serious incident, which occurred on 22 November 2020 at 0820Z, involved a Boeing 737-400 with registration ZS-OAF that was on a scheduled air transport flight. The cockpit crew were both holders of Air Transport Pilot Licences. On-board the aircraft were six crew members and 158 passengers on a flight from Cape Town International Aerodrome (FACT) with the intention to land at East London Aerodrome (FAEL). The flight was conducted under the provisions of Part 121 of the Civil Aviation Regulations (CAR) 2011 as amended.

Following the release of the preliminary report, the investigation had established the following:

This first anniversary interim statement gives a brief account of the progress of the investigation into the subject accident. This interim statement is released in accordance with Standard 6.6 of ICAO Annex 13 and Part 12.05.1(7) of the Civil Aviation Regulations (CAR) 2011 as amended.

On Sunday morning, 22 November 2020 at approximately 0746Z, a Boeing 737-400 aircraft with registration marking ZS-OAF departed Cape Town International Aerodrome (FACT) to East London Aerodrome (FAEL) on a scheduled domestic flight with six crewmembers and 158 passengers on-board.

Before pushback, the senior cabin crew member (SCCM) informed the pilot-in-command (PIC) that she thinks that the doors, 1R and 2R, were not closed properly. The doors were then disarmed and closed again, with the assistance of a technician, from the outside. This procedure was repeated three times before the doors closed properly.

After take-off from Runway 19, the crew had no lateral navigation (LNAV) and vertical navigation (VNAV) indication in the cockpit. The throttle (THR) HOLD stayed on after take-off and the auto throttle was disconnected by the pilot and the thrust was manipulated manually for the remainder of the flight.

The crew was cleared to climb to flight level 330 (FL330) (33 000 feet) above mean sea level (AMSL). The aircraft was not being interrogated by secondary surveillance radar (SSR) after take-off and the area controller informed the crew that there was negative mode C readout. The crew was then advised to recycle the transponder and to squawk 3226. The crew advised that they have recycled the transponder, but they were informed that there was still no mode C readout. The crew then asked the controller if it was an aircraft problem or a radar problem, whereupon the controller indicated that the problem appeared to be on their side. Approximately 5 minutes later, the crew was advised by the area controller that he had no radar return and instructed the flight crew to route via golf, romeo, victor (GRV), pappa, echo, victor (PEV) and echo, lima, victor (ELV), which was acknowledge. At 08:06:10Z (20 minutes after take-off) while the aircraft was passing through 32 920ft, the Cabin Altitude Warning activated, and the crew declared a MAYDAY. The cabin altitude was at 10 000ft, climbing at approximately 700ft per minute. The crew then initiated the memory items for a descent as per the Quick Reference Handbook

(QRH). Attempts to reduce the cabin rate were unsuccessful and an emergency descent was executed to 10 000ft at 63 nautical miles (nm) distance measuring equipment (DME) from GRV very high frequency omnidirectional range (VOR beacon) at George Aerodrome. The area controller asked the crew if they would be returning to FACT or if they would be landing at George Aerodrome (FAGG). A short while later, the crew indicated that they would be diverting to FAGG.

During the initial stages of the descent, the thrust levers retarded to LOW IDLE (N1 decreased to approximately 30%, according to Quick Access Recorder (QAR) data) with an amber warning activation on the overhead panel (see Figure 2) for both engines. This was supported by an amber alert speed (SPD) activation on the electronic attitude director indicator (EADI) (see Figure 3). Engine thrust was increased to achieve flight idle. The cabin rate of descent started to reduce, and the crew decided not to deploy the passengers' oxygen masks.

Figure 2: LOW IDLE warning for both engines, located on the overhead panel.

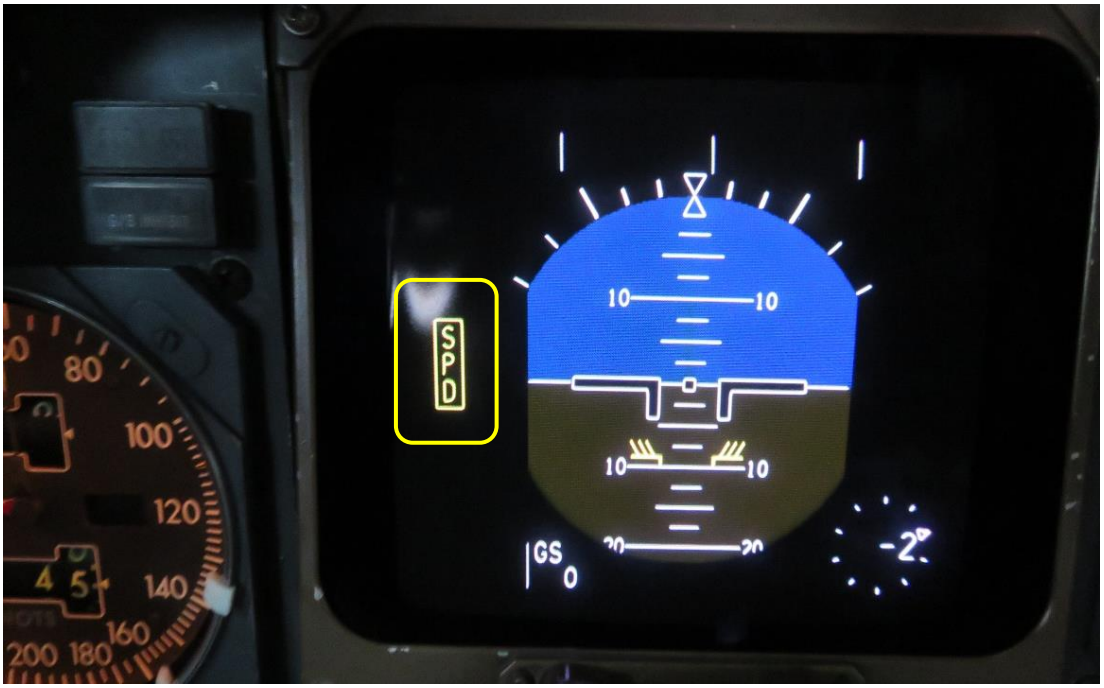


Figure 3: Amber SPD warning (in yellow window) displayed on the EADI (aircraft in ground mode).

At 08:16:08Z the aircraft was handed over to George Approach on the VHF 128.20 Megahertz (MHz). The crew requested to descend to 8 000ft and to enter the right-side hold over GRV. There was no primary radar available at FAGG and the approach controller had to rely on SSR or visually identify the aircraft in the holding pattern. At the time, scattered clouds (3-4 octas) were overhead the aerodrome at 3 300ft, and the aircraft was not being interrogated by SSR. Aerodrome rescue and firefighting (ARFF) personnel were alerted by air traffic control (ATC) and they moved into position. The aircraft touched down at 0840Z on Runway 29.

The cabin crew indicated that one passenger required medical assistance, three passengers had nose bleed and five passengers indicated that they had severe ear pain.

This aircraft was not interrogated by SSR due to the inoperative state of the transponder. The aircraft was visible on primary radar, which is effectively a signal reflected off the aircraft only. The flight was also conducted with traffic collision avoidance system (TCAS) inoperative. The aircraft was briefly detected on SSR for the first time when it was on the right-side hold over GRV, descending through 2 500ft on a left downwind for landing Runway 29 at FAGG.

Figure 4: Overlay of the flight path of the aircraft. (Source: Google Earth)

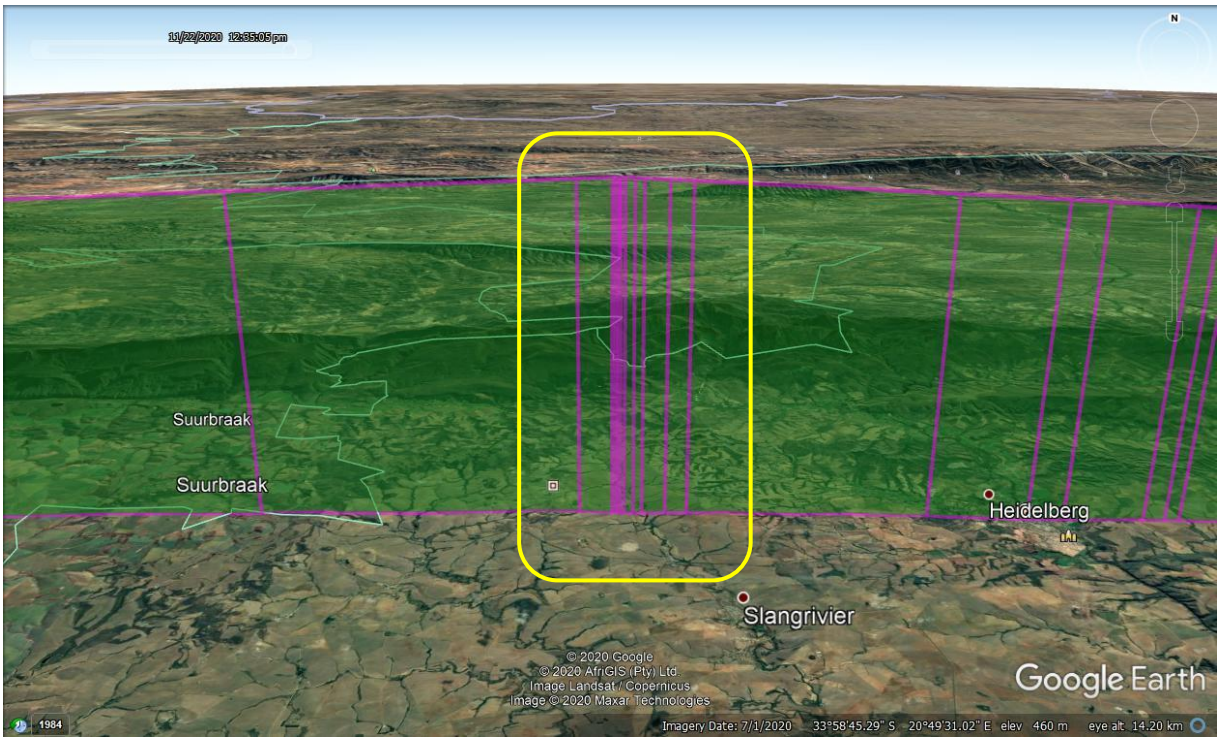


Figure 5: Overly indicating events where the Cabin Altitude, as well as the engine low idle warning activated. (Source: Google Earth)

Metallurgical Examination

The Aircon Bay Pack/Machine Compressor Outlet Duct Assembly with Part No. 65-51552-8 that was installed on the left air-conditioning pack was found to have fractured in an area that was subjected to a previous welding repair (see Figure 6). The air duct was subjected to a metallurgical examination.
An official report was obtained from the SGS MetLab:

The cause of the failure of the ducting was due to an incorrect welding procedure, resulting in material embrittlement as a result of oxygen contamination. The mechanism of failure was initial brittle fracture that continued with a fatigue mechanism.

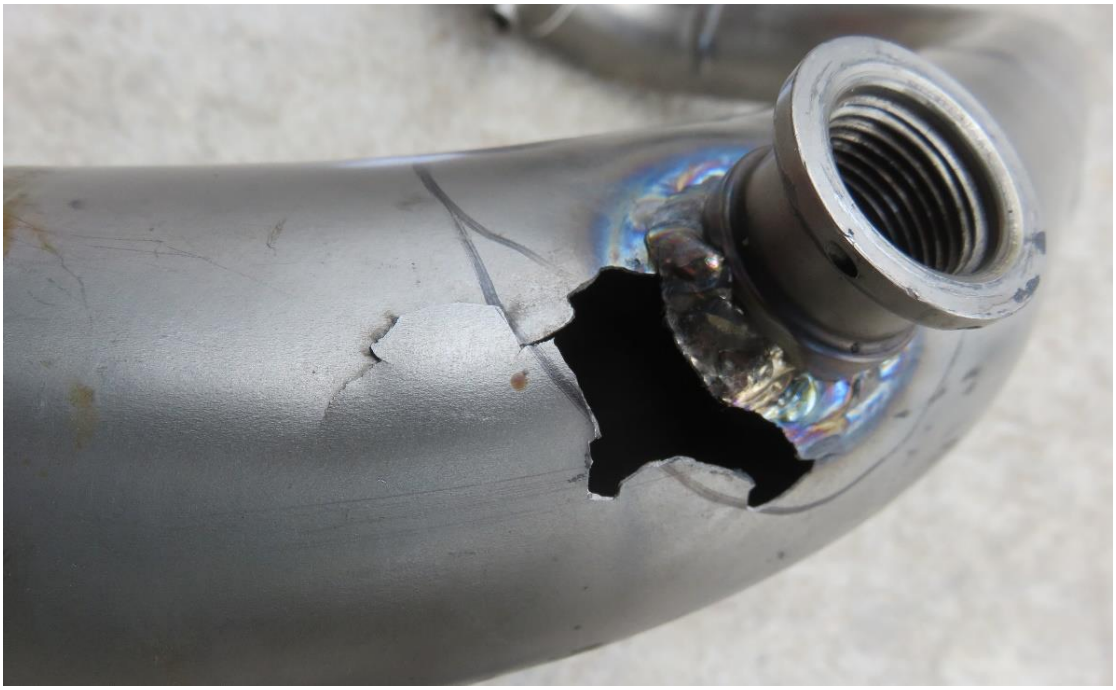


Figure 6: Damage to the Aircon Bay Compressor Outlet Duct (left air-conditioning pack).

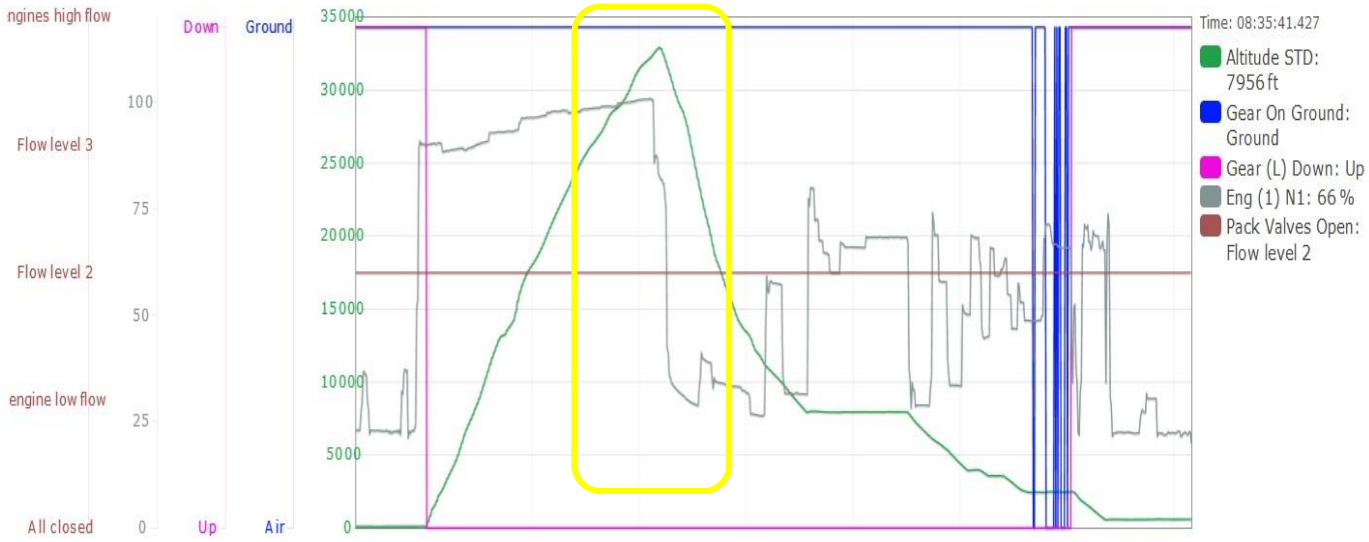
The Air/Ground Sensor

The Air/Ground proximity sensor located in the right main landing gear wheel well was found to be defective and was replaced. The aircraft was then jacked up and several retractions were performed to confirm correct operation of the switch. A post-maintenance acceptance (confidence) flight was performed, and all operations were found to be normal. No adjustments were made to the Teleflex cable on the right main gear. This sensor was found to have caused numerous warnings that the crew encountered in the cockpit during the flight.

The Air/Ground squat switch is only fitted to the right main gear consists of a Teleflex cable, which compresses or extends as the weight of the aircraft shifts on the right main gear. The Teleflex cable is connected to the air/ground sensor, which activates the switch by sensing if the aircraft is in air or ground mode.

Figure 7: The Air/Ground proximity sensor pointed out in the right main wheel well.

The aircraft was equipped with a flight data recorder (FDR) and a cockpit voice recorder (CVR). The FDR and QAR data were secured by the operator, but the CVR data was not. From the graph below, the yellow window indicates when the crew commenced with the descent (green line) after the Cabin Altitude Warning activated and both engines' N1 decayed to approximately 30% (grey line).



Graph 1: The graph of the serious incident flight with essential data captured. (Source: Safair)

1. Findings

The Crew

1.1 The PIC had an Airline Transport Pilot Licence (ATPL) and the aircraft type was endorsed on his licence. He also had a valid Class 1 aviation medical certificate with an expiry date of 31 January 2021.

1.2 The first officer (FO) had an ATPL and the aircraft type was endorsed on his licence. He also had a valid Class 1 aviation medical certificate with an expiry date of 31 January 2021.

1.3 The crew declared a Mayday at 08:06:08Z on the Cape Town West sector frequency 125.10 MHz.

1.4 Following the Mayday call, the crew diverted to FAGG. The radar controller had cleared the aircraft to commence with a descent to FL100 as requested by the crew.

1.5 The crew made a decision not to deploy the oxygen masks in the cabin area.

The Aircraft

1.6 The aircraft had a valid Certificate of Airworthiness (C of A), which was issued on 4 April 2007 with an expiry date of 30 April 2021.

1.7 The last maintenance inspection (C2-check) that was carried out on the aircraft prior to the serious incident flight was certified on 27 October 2020 at 65 664.47 airframe hours. Following the inspection, a further 158.92 hours were flown with the aircraft.

1.8 Following take-off from FACT, the aircraft was not interrogated by secondary surveillance radar due to a transponder-related activation malfunction on the aircraft.

1.9 The air duct with Part No. 65-51552-8 located on the left air-conditioning pack was found fractured in the area where a previous repair was made (as per Figure 6), which drastically reduced the efficiency of the left-side air-conditioning pack system.

1.10 The two right doors, 1L and 1R, were adjusted as per the aircraft maintenance manual (AMM) requirements.

1.11 The aft cargo compartment door seal was replaced after it was found to be torn on the aft left lower corner.

1.12 The Air/Ground proximity sensor located within the right wheel well was found to be defective and was replaced. This unit caused multiple cockpit indications and also contributed to the transponder being inoperative while the landing gear was in the retracted position. The transponder only became live (being detected by radar) after the landing gear was lowered for landing Runway 29 at FAGG.

1.13 Data from the QAR was downloaded by the operator for the purpose of this investigation.

1.14 The CVR was not secured by the operator prior to the ferry flight from FAGG to FAOR and, therefore, the information was not available.

Weather Information

1.15 Fine weather conditions prevailed at the time and had no bearing on the flight.

The Operator

1.16 The operator had a valid Air Operating Certificate (AOC) which was issued on 28 April 2020 by the SACAA with an expiry date of 30 April 2021. The aircraft was duly authorised under the AOC.

1.17 No primary surveillance radar was available at FAGG. The aircraft was interrogated for the first time during the flight by SSR when the aircraft descended below 2 500ft AMSL while positioning for landing Runway 29 at FAGG.

1.18 The aircraft landed safely on Runway 29 at 0840Z.

1.19 The cabin crew had indicated that one of the passengers required medical assistance, three others had bleeding noses and five others indicated they had severe ear pain.

Passengers

1.20 The injuries (nose bleeding and ear pain) that some of the passengers suffered during the flight were viewed as minor.

2. Safety Recommendations

2.1 It is recommended that the aircraft maintenance organisation conducts a fleet inspection to check the status of the air duct with Part No. 65-51552-8 located on the left air-conditioning pack that was found to have failed during operation. Such inspection should be conducted at the aircraft's next maintenance inspection despite the type of maintenance the aircraft is scheduled for.

2.2 It is recommended that the operator issues a notice to cockpit/flight deck crew that the absence/unavailability of transponder data during the flight renders the aircraft not being interrogated by SSR. The aircraft was only visible on primary surveillance radar reflected as a signal, with no altitude or speed data available to the controller.

This interim statement is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa