DATA SUMMARY

LOCATION

Date and time	**Tuesday, 07 August 2012; at 15:40 local time[1]**
Site	**25 NM NE of the Tenerife South Airport (Spain)**

AIRCRAFT

Registration	**G-LSAH**
Type and model	**BOEING 757 – 21B**
Operator	**JET2.COM**

Engines

Type and model	**ROLLS ROYCE RB211-535E4**
Number	**2**

CREW

	Captain	First officer
Age	**33 years old**	**40 years old**
Licence	**Airline transport pilot ATPL (A)**	**Commercial pilot CPL (A)**
Total flight hours	**5,110 h**	**3,331 h**
Flight hours on the type	**3,255 h**	**233 h**

INJURIES	Fatal	Serious	Minor/None
Crew			**7**
Passengers			**222**
Third persons			

DAMAGE

Aircraft	**Minor**
Third parties	**None**

FLIGHT DATA

Operation	**Commercial Air Transport – Charter – International – Passenger**
Phase of flight	**En route – Climb to cruise altitude**

REPORT

Date of approval	**27th January 2014**

[1] All times in this report are local. To obtain UTC, subtract one hour from local time.

1. FACTUAL INFORMATION

1.1. History of the flight

On Tuesday, 7 August 2012, a Boeing 757-21B aircraft, registration G-LSAH, was on flight number LS224 en route to the Leeds Bradford Airport (LBA) in the United Kingdom from the Tenerife South Airport (TFS).

It had previously made the flight in the opposite direction, landing at the Tenerife South Airport at 14:02 h, where it was processed by its handling operator.

At about 14:15 h maintenance personnel were contacted when a problem was detected with a service connection for the aft bathrooms. The drain valve had detached from its housing on the service panel and was hanging by the elastic sealant material, which was making it impossible to drain the water.

After removing the detached valve and entering this task in the airplane's maintenance log, the airline was informed so that it could plan the repair and the aircraft was returned to service, though the aft bathrooms remained inoperable.

It was under these conditions that the airplane left Tenerife at 15:15 h with 7 crew and 222 passengers on board.

Some 25 NM northeast of the airport, while climbing through FL 230, having been cleared to a cruise level of FL 360, the crew received an EICAS[2] "CABIN ALT" warning, informing of a pressurization problem.

The crew noticed that the altimeter in the cockpit read between 13,500 and 15,000 ft and indicated a climb rate of about 1,000 fpm.

The crew carried out the depressurization procedure and made an emergency descent to an altitude of 10,000 ft AMSL, having donned their oxygen masks. Since the pressure in the passenger cabin could not be controlled manually, the passengers' oxygen masks dropped automatically, though some masks did not drop, which required the intervention of the flight attendants.

Once they reached a safe altitude, the crew headed to point BAMEL where they circled in order to burn fuel and reduce the airplane's weight to the maximum authorized landing weight (89,811 kg).

They eventually landed uneventfully at TFS at 16:27.

No one on board was injured and the airplane suffered no additional damage.

[2] EICAS: Engine Indicating and Crew Alert System.

1.2. Personnel information

1.2.1. *Captain*

- Age: 33
- Nationality: British
- License: ATPL (A), valid until 30/09/2013
- Ratings:
  - B 757 200 series valid until 30/06/2013
  - IR valid until 30/06/2013
- Class 1 medical certificate valid until 02/09/2012
- Total flight hours: 5,110 h
- Flight hours on the aircraft type: 3,255 h
- Activity in the previous 90 days: 179:37 h
- Activity in the previous 30 days: 86:19 h
- Activity in the previous 24 hours: 5:19 h
- Rest prior to the flight: over 18:48 h
- Start of on-duty period: 08:30 h

1.2.2. *First officer*

- Age: 40
- Nationality: British
- License: CPL (A), issued on 21/04/2011
- Ratings:
  - B 757 200 series valid until 16/03/2013
  - IR valid until 16/03/2013
  - SEP (land) valid until 21/03/2013
- Class 1 medical certificate valid until 08/12/2012
- Total flight hours: 3,331 h
- Flight hours on the aircraft type: 233 h
- Activity in the previous 90 days: 200:03 h
- Activity in the previous 30 days: 78:45 h
- Activity in the previous 24 h: 6:31 h
- Rest prior to the flight: 16:34 h
- Start of on-duty period: 08:30 h

1.2.3. *Maintenance personnel*

The maintenance technician who handled the malfunction on the ground before take-off had an aircraft maintenance license issued by the CAA in the United Kingdom pursuant to EASA Part 66. Said license reflected the fact that he had obtained the B1 category on the Boeing 757-200/300 (RR RB211) on 10 April 2002.

This license allowed the bearer to issue certificates of release to service after performing maintenance duties.

He had been stationed in Tenerife for the previous three years, providing line maintenance support for the operator there.

He thus had about 10 years of experience on the Boeing 757-200, six of them with the company.

1.3. Aircraft information

The incident aircraft was a Boeing 757-21B. It had serial number MSN 24015 and was manufactured in 1987. Its registration code had been G-LSAH since 23 November 2006, after which date it was placed in service by the operator.

It was fitted with two Rolls Royce RB211-535E4 engines.

The aircraft did not have a fuel dump system.

It had the corresponding Airworthiness Review Certificate, valid until 19 March 2013, and an Air Operator Certificate issued by the CAA in the United Kingdom on 25 July 2012.

It also had an insurance certificate, issued on 30 April 2012.

According to the company's own records, the aircraft had passed the relevant scheduled maintenance inspections, in addition to two anti-corrosion inspections carried out on 20 January and 8 February 2010, none of which revealed any abnormalities.

As concerns the bathroom wastewater system, the aircraft's MEL mentions that the individual components can remain inoperative as long as they can be deactivated or isolated from the associated components and the system is verified to have no leaks.

Wastewater system

The aircraft has a wastewater system for the on board bathrooms. This system is supplied from a dedicated tank whose water is recirculated through the various bathrooms on the airplane.

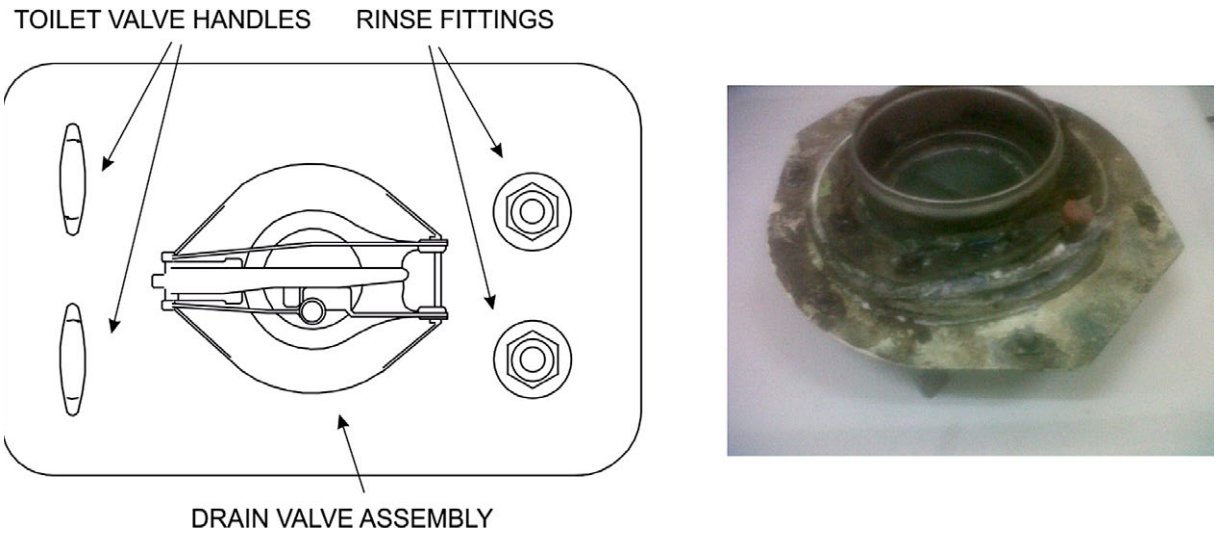

Figure 1. Diagram of the service panel and the affected valve

Each bathroom has an independent system with a dedicated tank.

During stopovers these tanks are drained through the valves located on the service panels. The wastewater tanks are emptied and the water is replaced with clean water that has a disinfecting liquid additive.

This process is carried out by contracted cleaning companies and requires using a panel located outside and near the bathrooms. This panel contains the fill and drain connections.

The valve involved in this incident was used to empty the wastewater tank for the aft bathroom, and was located on the underside at the aft part of the fuselage.

1.4. Meteorological information

The information in the 15:00Z METAR for the Tenerife South Airport indicated that the wind was from 100° at 18 kt varying in direction from 070° to 130°, visibility in excess of 10 km, few clouds at 3,000 ft, an outside air temperature of 26 °C and QNH of 1,017 mb.

1.5. Communications

The crew established contact with ATC, first to declare the initial urgency (PAN PAN) and subsequently to declare an emergency (MAYDAY).

The crew also contacted the airline's handling agent so that it could prepare to disembark the passengers.

1.6. Aerodrome information

The Tenerife South Airport has one 3,200 m long, 45 m wide asphalt runway in a 08-26 magnetic orientation.

The Airport Reference Point (ARP) is at coordinates 280240N 0163421W.

Both thresholds feature navigational aids that allow for Cat I ILS approaches. The two thresholds also have PAPI[3] visual approach aids.

The rescue and firefighting service has an ICAO category 9 rating, sufficient to handle aircraft like the Boeing 757 in this incident.

Once airport personnel realized that LS224 was returning due to a depressurization problem, they activated a "Yellow Alert" as per the airport's Emergency Response Plan, with the relevant services being alerted in case their response was required. The "Yellow Alert" was cancelled at 16:40 h once the duty manager verified that the situation had returned to normal.

1.7. Flight recorders

The aircraft was equipped with a cockpit voice recorder (CVR) and a digital flight data recorder (DFDR). The CVR was made by L3 Communications and had part number 2100-1020-00 and serial number 000297650. It was removed from the aircraft and sent to the CIAIAC laboratory to be downloaded.

The DFDR was downloaded at the operator's facilities, which sent a PCMCIA card containing the information recorded on the DFDR.

The data extracted from the two recorders yielded information on the progression of the incident and on the actions carried out by the crew and by the ATC stations involved.

At 14:58:36 h the aircraft contacted ATC and was cleared to start up. The crew was also cleared to execute Standard Instrument Departure (SID) BIMBO7E.

At 15:26:32 h the aircraft took off from Runway 08 at Tenerife South.

At 15:40:30 h at an altitude of 2,3171 ft en route to point KASAS, the crew received an EICAS "CABIN ALT" alert, indicating a pressurization problem.

Forty seconds later the flight crew donned their oxygen masks and carried out the immediate actions in the "Cabin altitude or Rapid Depressurization" procedure while at the same time declaring urgency (PAN, PAN, PAN).

[3] Precision Approach Path Indicator.

The crew started a left turn to course 223° and set an altitude of 10,000 ft. Once they started to descend, the crew read the items on the "Cabin altitude or Rapid Depressurization" emergency checklist contained in the QRH[4].

Since they were north of the island of Tenerife at the time of the incident, ATC offered the crew the option of proceeding to either of the island's two airports.

The aircraft reached FL 100 at 15:46:45 h. Upon nearing said flight level the EICAS "CABIN ALT" warning cleared and the crew removed their oxygen masks.

At 15:47:44 h the crew lowered the landing gear to increase their fuel consumption, thus reducing their flying time.

Once the passengers and flight attendants were informed of the situation, the crew once more contacted ATC at 15:49:57 h to convey their situation and intentions. They were cleared to proceed straight to point GANTA.

After setting a course toward this point, the crew carried out the "Diversion" and the "Overweight Landing" lists contained in the QRH as operational information. Both lists include instructions to consider in the event that the crew has to divert to an airport that is not the destination airport with a weight in excess of the maximum authorized landing weight.

The crew expressed their concerns about remaining airborne for too long, considering they did not know the cause of the depressurization, though they stated their suspicions that the drain valve had caused the problem.

At 15:56:38 h the crew declared an emergency (MAYDAY) to ATC, and they expressed their intention to proceed to GANTA and then to BAMEL, where they wanted to circle to consume fuel and reduce the aircraft's weight.

At 16:07:18 h the aircraft reached point BAMEL, where it executed three circling patterns. During this time the crew contacted the handling agent to inform them that they were planning to land in 15 minutes so that the agent could prepare to disembark the passengers.

At 16:17:09 h they requested vectors for the Runway 08 ILS approach.

They made a stabilized approach in a "Flaps 30" landing configuration, in keeping with the overweight landing checklist, touching down the runway at 16:26:54 h.

[4] QRH: Quick Reference Handbook.

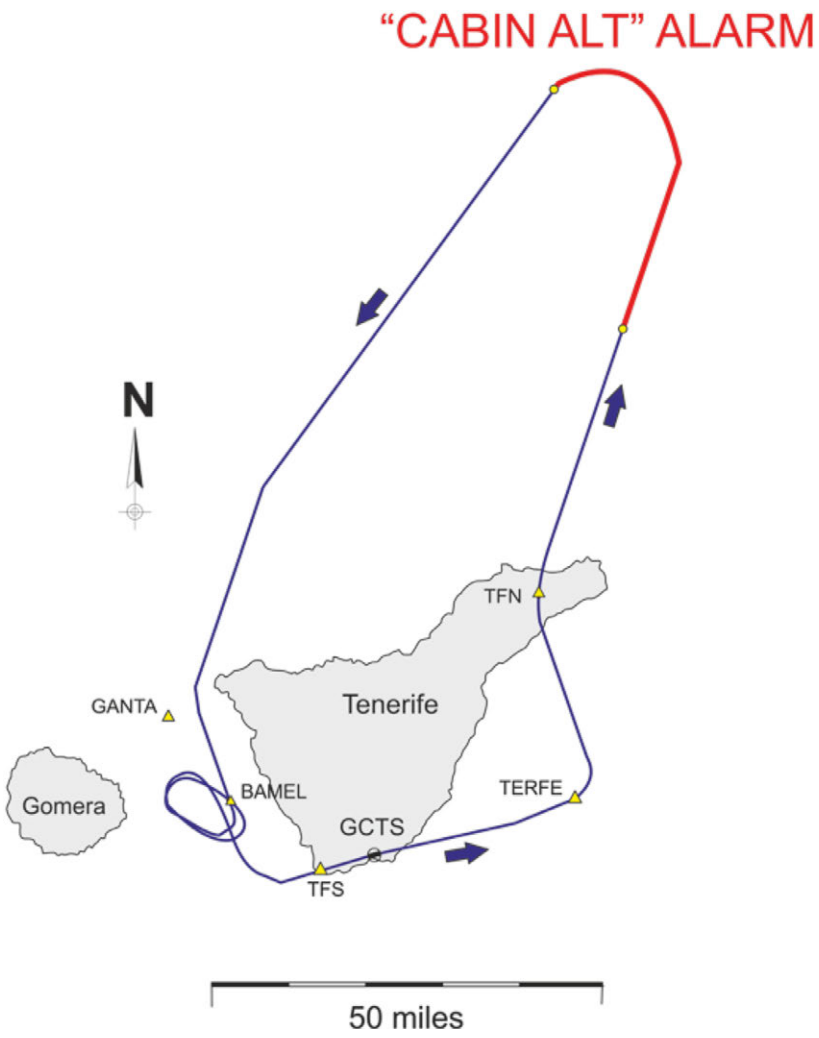

Figure 2. Aircraft flight path

1.8. Tests and research

1.8.1. *Crew statements*

1.8.1.1. Flight crew

In his statement the captain indicated that the cabin altitude and pressure were normal during the climb until, on passing through approximately FL 220 – FL 230, an EICAS CABIN ALT warning was received. They leveled off at FL 235 and donned their oxygen masks. They then carried out the procedure indicated in the QRH but to no effect. The cockpit altimeter indicated between 13,500 ft and 15,000 ft with a positive climb rate of 1,000 fpm. The outflow valve was closed.

They then made an emergency descent to 10,000 ft and proceeded to point BAMEL.

They held a briefing with the flight attendants, who informed them that the passengers had made use of the oxygen system.

They circled over BAMEL with the landing gear down and the spoilers deployed to burn fuel to reduce the aircraft below its maximum landing weight.

They eventually landed without further incident.

1.8.1.2. Flight attendants

According to the statements from the flight attendants, the fasten seat belt sign cleared after take-off only to be lit again a short time later. The purser called the cockpit to inquire about the situation and was informed by the pilots that they had donned their oxygen masks. She was then instructed to secure the passenger cabin.

About one minute after this call the oxygen masks dropped. The masks in the forward and aft service areas and in the bathrooms failed to drop. The masks in row 1 (Seats D, E and F) and row 4 (Seats D, E and F) also failed to drop, even after the alternate method of opening the compartment using a pin was used.

The passenger in Seat 1D used the mask from Seat 2C. A woman sat in Seat 1E was also moved to row 3 on the left side of the cabin to use one of the masks over these seats. A passenger in Seat 4D had to use the oxygen mask from Seat 4C.

The captain made an emergency descent announcement, which forced the crewmembers to take their seats.

The flight crew then reported that the descent was complete and called the purser to the cockpit. She went there with a portable oxygen bottle, entered the emergency code into the keypad and went inside. The captain informed her that they had suffered a decompression event and would return to Tenerife South after circling for some 15 minutes to burn off fuel. He did not give her any other instructions other than to secure the cabin and then remain seated.

The entire maneuver lasted less than 12 minutes, after which time the oxygen was still flowing from the masks.

Most of the passengers reacted calmly and wanted to keep the oxygen masks on.

They had to wait an additional 20 minutes before landing, which the captain communicated to the purser and to the passengers.

1.8.1.3. Statement from the maintenance technician

In his statement the maintenance technician indicated that he was summoned by the operator's check-in service manager at 14:15 h, who notified him of a problem with the bathroom services equipment on airplane G-LSAH.

When he arrived at the airplane at 14:30 h, the hose operator from the cleaning service told him that he could not service the aft bathrooms because the drain valve had detached from the airplane and was hanging by its rubber seal inside the service panel. The hose operator also told him that he had found the valve in that condition when he opened the panel.

The technician investigated the malfunction and concluded that the valve, which was stuck to the fuselage, had detached due to use and time in service. The clamp that holds the rubber to the drain valve was also loose.

He thought the valve was in an unpressurized area because the captain had not reported any pressurization problems in the previous flight. Since reattaching the valve and clamp would have required unloading all the baggage from the aft cargo hold to access the front panel, he decided to remove the valve from the airplane to minimize the delay.

He notified the captain of his intention and removed the valve, giving it to the crew so that it could be installed and sealed at the destination airport. Maintenance control was advised of this and a deferred entry, ADD 66979/1A, was made.

He checked the levels in the aft bathrooms and found them to be half full. He reported this to the crew and they decided it would be sufficient for the flight to LBA since the forward bathrooms had been properly serviced and were fully operational.

The cabin crew were instructed to place one of the aft bathrooms out of service before take-off to minimize its use by the passengers. The idea was to use the other one until it became full, then place it out of service and return to service the previously unused bathroom. This would allow the airplane to make the return flight while minimizing the inconvenience to the passengers.

The airplane was released to service at 14:45 h, at which time the passengers were boarded. The airplane was pushed back at 15:14 h.

He received a call later from operator's check-in at 16:00 h informing him that the aircraft was returning to the TFS airport due to a pressurization problem. The airplane landed at 16:34 h.

The oxygen masks had been deployed. The captain told him that they had received a cabin altitude alert at approximately 23,000 ft. They had selected the manual

pressurization mode but the cabin altitude continued to increase. The technical crew deployed the oxygen masks at a cabin altitude of 13,500 ft.

The engineer did a test of both cabin pressure controllers using the built-in test equipment (BITE), which resulted in a "LOW INFLOW" fault light.

The seals on the cargo and cabin doors, as well as the outflow and the positive and negative pressure relief valves, were inspected and found to be in good condition.

A final inspection of the area around the bathroom drain valve exhibited evidence of an air leak.

1.8.2. *Subsequent inspections*

Between 11 and 14 August 2012, the airplane was inspected at the airline's facilities at the Leeds Bradford Airport in the United Kingdom as part of the internal investigation carried out by the airline. These inspections revealed the following:

The drain valve for the aft bathroom had failed due to a corrosion problem. The valve was repaired, and in addition the spent oxygen generators and bottles were replaced and the oxygen masks were re-stowed.

Since the oxygen mask deployment system had not worked properly for every seat, the system was checked as per instruction IAW 35-21-00/50, which revealed that the associated release tabs had been improperly set. Once they were readjusted and the oxygen masks were re-stowed, the airplane was returned to service.

The maintenance actions carried out at the Tenerife South Airport were not included in any instruction contained in the maintenance documentation (Aircraft Maintenance Manual (AMM), Structural Repair Manual (SRM), etc.).

The MEL (Minimum Equipment List) was also not used, nor was any other documentation referenced to defer the malfunction in the airplane's log book.

The pilots accepted the dispatch of the airplane with the deferred item without checking if it was allowed by the MEL and without considering if it could lead to a pressurization problem.

The operator found that the telephone and computer systems available at Tenerife South for communicating with maintenance control were deficient, as was the dissemination of the technical information.

As a result of the inspection the operator urgently adopted the following measures:

- Conducted proficiency checks for its personnel stationed at TFS and gave the relevant refresher training in those cases where a lack of proficiency was detected.
- Given the fact that being removed from the main maintenance centers engenders a culture of not following standard procedures when carrying out tasks, personnel rotations were implemented for airline personnel so that they would not spend long periods of time far away from the main maintenance centers and could re-familiarize themselves with standard maintenance practices.
- The materials provided to field personnel were upgraded and improved to ensure proper communications with management centers and to provide them with updated information.
- Crews were reminded and advised of the responsibility to accept a dispatched aircraft in accordance with established procedures, as reflected in the MEL/CDL and AMM.

2. ANALYSIS AND CONCLUSIONS

On Tuesday, 7 August 2012, a Boeing 757-21B aircraft, registration G-LSAH, operated by Jet2.COM was making flight LS224 from the Tenerife South Airport (TFS) to the Leeds Bradford Airport (LBA) in the United Kingdom.

While climbing through FL 230, the crew received an EICAS "CABIN ALT" warning indicative of a pressurization problem.

The analysis of the information provided by the data and cockpit voice recorders concluded that the crew properly executed the depressurization procedure contained in the QRH by conducting an emergency descent to 10,000 ft and burning fuel to reduce the weight to the maximum allowed for landing.

The oxygen masks were deployed automatically, though some failed to do so correctly, which forced the flight attendants to relocate some of the passengers. The subsequent inspection revealed that improperly set release tabs had caused these failures.

The flight crew and the mechanic who worked on the aircraft at the Tenerife South Airport had the proper valid licenses and medical certificates.

The aircraft had the necessary Certificate of Airworthiness and it had been maintained in accordance with its maintenance program.

According to the mechanic's statement, after checking with the crew he proceeded to remove the deteriorated drain valve thinking that if the airplane had made it to its destination without any problem with the system in those conditions, it could continue to do so, the only caveat being the aft bathrooms would not be available. It may be said that he was under self-induced pressure to avoid delaying the flight and did not consider the process for deferring items specified in established references. The

maintenance action taken that was carried out was not included in any documented instruction (AMM, SRM, etc.). In keeping with the MEL, the aircraft would actually have been airworthy had the rest of the wastewater system been properly isolated after removing the valve so as to eliminate any leaks.

The results of the post-incident inspection indicate that the depressurization took place in the area of the detached valve and that the valve had deteriorated as a result of corrosion.

In addition, the company´s own personnel stated that the telephone and computer systems in place at TFS for communicating with the maintenance center were deficient, as was the availability of technical information.

As a result, it may be concluded that the aircraft experienced an in-flight depressurization due to an air leak through the area where the deteriorated drain valve for the aft bathrooms was located. This was caused due to an improper action of maintenance, without taking into account the relevant documentation on aircraft maintenance or the process for deferring items. The acceptance by the flight crew of the maintenance measures taken on the ground was a determining factor in the incident.

The shortage of telephone and computer resources and the absence of technical instructions, added to the self-induced pressure not to cause any delays, contributed to the eventual outcome of the incident.

The analysis and the ensuing urgent actions carried out by the operator to mitigate the deficiencies detected are deemed adequate. As a result, no safety recommendations are necessary.