INSTITUTO DE PREVENÇÃO E INVESTIGAÇÃO
DE ACIDENTES AERONÁUTICOS E MARÍTIMOS

Final Report

On the Incident of September 14th,

With the B757-200 registered G-OOBA Aircraft

Operated by TUI Airways Limited

Flight TOM579, Boa Vista (BVC) – London (LGW)

Investigation Department
01/INCID-A/IPIAAM/2018

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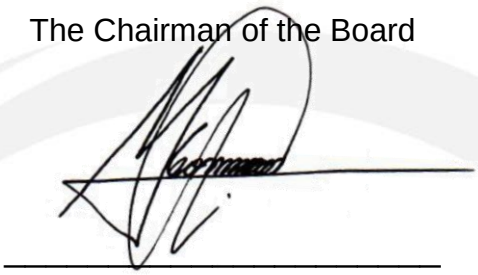
APPROVAL PAGE

This final report is approved in accordance with article 10º, (i) of Decree Law 62/2018 of December 12.

The Chairman of the Board



/Mario Margarito Gomes/

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GLOSSARY

AAC	Agência de Aviação Civil (Civil Aviation Authority of Cabo Verde)
ADC	Air Data Computer
AIP	Agency Information Publication
APP	Sal APP
ASA	Empresa Nacional de Aeroportos e Segurança Aérea - S.A. (National Airport and Aerial Security Company
ASI	Air Speed Indicator
ATC	Air Traffic Controller
BVC	Boa Vista
CPIAA	
CRM	Crew Resource Management
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
DME	Distance Measuring Equipment
FDR	Flight Data Recorder
EADI	Electronic Attitude Direction Indicator
EFIS	Electronic Flight Instrument System
EICAS	Engine Indication and Crew Alerting System
EGKK	London Gatwick Airport
FO	First Officer
GVAC	Amílcar Cabral International Airport
GVBA	Aristides Pereira International Airport
ICAO	International Civil Aviation Organization
IIC	Investigator in Charge
ILS	Instrument Landing System
IPIAAM	Institute for the Prevention and Investigation of Aeronautical and Maritime Accidents
KHZ	Kilohertz
LGW	London Gatwick
LOC	Localizer
LT	Local Time (UTC – 1)
MHZ	Megahertz
MLW	Maximum Landing Weight
MTOW	Maximum Take-off Weight
MTW	Maximum Taxi Weight

MZFW	Maximum Zero Fuel Weight
PIC	Pilot in Command
PN	Part Number
SID	Sal
SN	Serial Number
SSFDR	Solid State Flight Data Recorder
SSCVR	Solid State Cockpit Voice Recorder
NTO	Non-Technical Objection
TWR	Tower
VOR	Very High Frequency Omni-directional Radio Range

EXPLANATION

In accordance with the credentials of the Commission for the Prevention and Investigation of Accidents with Aircraft, dated September 14, 2018, under the provisions of paragraph 1 of article 12 of Decree Law nº 38/2009 of September 28, an investigation team was set up consisting of an Investigator In Charge (IIC) and an AAC inspector, whose objective was to identify the root cause and the contributory factors that were the origin of the incident.

This Report is a technical document that reflects the investigation of the CPIAA regarding the circumstances, under which the incident - the object of the investigation - occurred, as well as its causes and its consequences.

Safety investigation is a technical process conducted only for the purpose of accident prevention and comprises the gathering and analyzing of evidences in order to determine the causes and when appropriate, to issue safety recommendations.

In accordance with Annex 13, the Chicago Convention on International Civil Aviation and CV-CAR-13. A.110 (a), the investigation and the corresponding report is not proposed to establish guilt or determine individual or collective liability, but rather, the sole objective of the investigation will be the prevention of accidents and incidents in order to avoid future recurrences.

The content of this report is in accordance with the documentary information collected and is known to all those involved in the process that caused the incident.

DECLARATION

The investigation team of the incident with the G-OOBA aircraft declares the authenticity of the factual information that is part of this report and emphasizes that all figures in the report are genuine and have not changed.

Note:

A. This report is based on interviews with the crew and with air traffic controllers involved in the incident, as well as analysis of the documentation of the traceability of maintenance and aircraft aeronautics, and a speed indication system;
B. This report contains identified issues through which the investigation team concluded that it was these contributory factors that led to the occurrence of this incident;
C. According to Annex 13, Chapter 3, and paragraph 3.1, CV-CAR-13. A.110 (a), the safety investigation is not intended to establish guilt or determine individual or collective liability;

IMPORTANT NOTE:

The sole aim of this report is to collect lessons, which may help to prevent future incidents. Its use for other purposes may lead to incorrect conclusions.

SYNOPSIS

On September 14 (Friday), 2018, on a scheduled flight, a Boeing 757-200 registered G-OOBA Flight TOM579 took off from BVC-GVBA International Airport to LGW-EGKK London Gatwick Airport at 13:05 LT. In the run for take-off the crews experienced a disagree condition with the airspeed indication between the Captain's and First Officer's Indicators. The Crews did not discover and concluded the failure at this stage. Due to erroneous airspeed indications while climbing through 4000 feet, crews declared a MAYDAY EMERGENCY CALL and climbed to 8000 feet to clear cloud and prepare the aircraft, passengers and crew for a landing at SID, GVAC Amílcar Cabral International Airport.

The aircraft realized an overweight landing at Amílcar Cabral International Airport around 13:58 LT due to the "Mayday" call at SID, GVAC.

The airspeed disagrees resulted in the crew receiving the following advisory warnings in EICAS "IAS DISAGREE", "RUDDER RATIO" and "MACH SPEED TRIM".

The incorrect ASI readings were probably caused by the obstruction of the pitot system by mud and/or debris from a small insect that was introduced in the Pitot tube during the time the aircraft was on the ground.

There were a total of 228 people on board, consisting of a PIC, First Officer and 06 cabin crewmembers, and 221 passengers.

No one was injured, nor was there any damage to the aircraft.

"**Probable Causes**"

The evidence extracted from the investigation points that the airplane had a blocked pitot/static system during departure, which confused the crew due to the false indication and led to them declaring a "Mayday" EMERGENCY CALL.

OUTLINE OF THE INCIDENT INVESTIGATION

The incident covered by this report falls under the category of "MAYDAY, MAYDAY, MAYDAY" situation statement as the aircraft failed the First Officer speed indication, (Airspeed Unreliable) after taking off from BVC to LGW and, as stipulated in attachment C of annex 13, the event is classified as a "**Serious incident**".

INVESTIGATION ORGANIZATION

On September 14, 2018, according to the provisions of paragraph 1 of article 12 of Decree-Law no. 38/2009, of September 28, the Chairman of the Aircraft Accident

Prevention and Investigation Commission (**CPIAA**) designated an Investigator-In-Charge (**IIC**) to investigate this incident.

REPRESENTATIVE FOR THE UNITED KINGDOM

On September 25, 2018, according to an email from the United Kingdom, AAIB was appointed as non-travelling Accrep of the incident investigation.

IMPLEMENTATION OF THE INVESTIGATION

September 15, 2018: Interviews were conducted with the participants of the incident in the ASA conference room, and an on-site aircraft examination was performed.

COMMENTS FROM THE PARTIES RELEVANT TO THE CAUSE OF THE INCIDENT

All parties relevant to the cause of the incident were invited to comment.

COMMENTS FROM THE REPRESENTATIVE OF THE UNITED KINGDOM

The AAIB Accrep was invited to comment on the draft report.

COMMENTS FROM TUI FLIGHT OPERATOR.

The Flight Operator TUI AIRWAYS LIMITED was invited to comment on the draft report

Aircraft: **Boeing 757-28A**

Registration: **G-OOBA**

MSN: **32446**

Line Nº: **0950**

Engines: **Two Rolls Royce - RB-211-535E4-37**

Owner: **TUI AG**

Operator: **TUI AIRWAYS LIMITED**

Date: 14/09/2018

Figure 1 - Tui Airways Limited – Boeing 757-28A G-OOBA | Source - Flickr

Map of Cabo Verde

Figure 2 - Map of Cabo Verde | Source - Mapsland

Aristides Pereira International Airport – GVBA

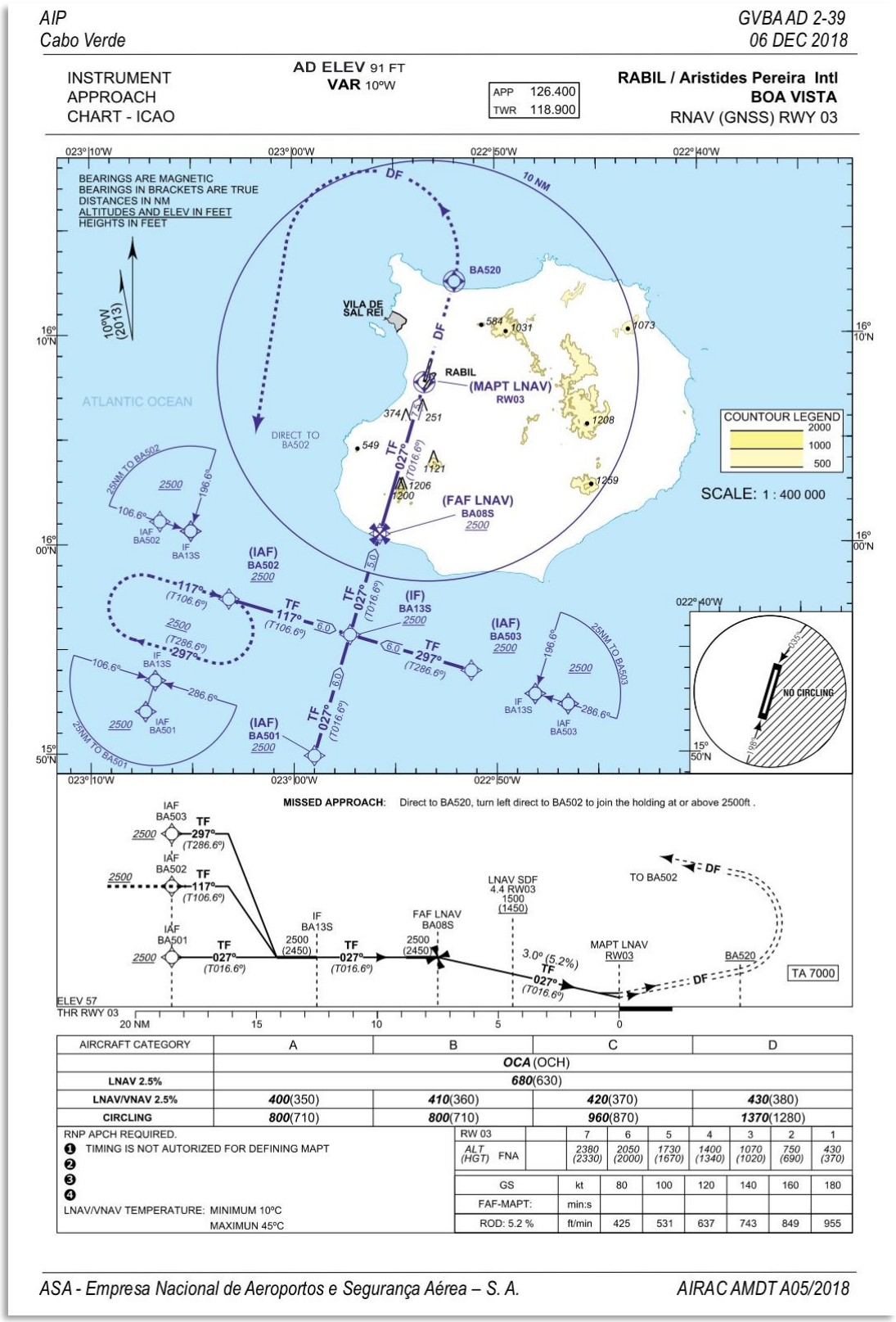

Figure 3 - GVBA – Instrument Approach Chart

Amilcar Cabral International Airport – GVAC

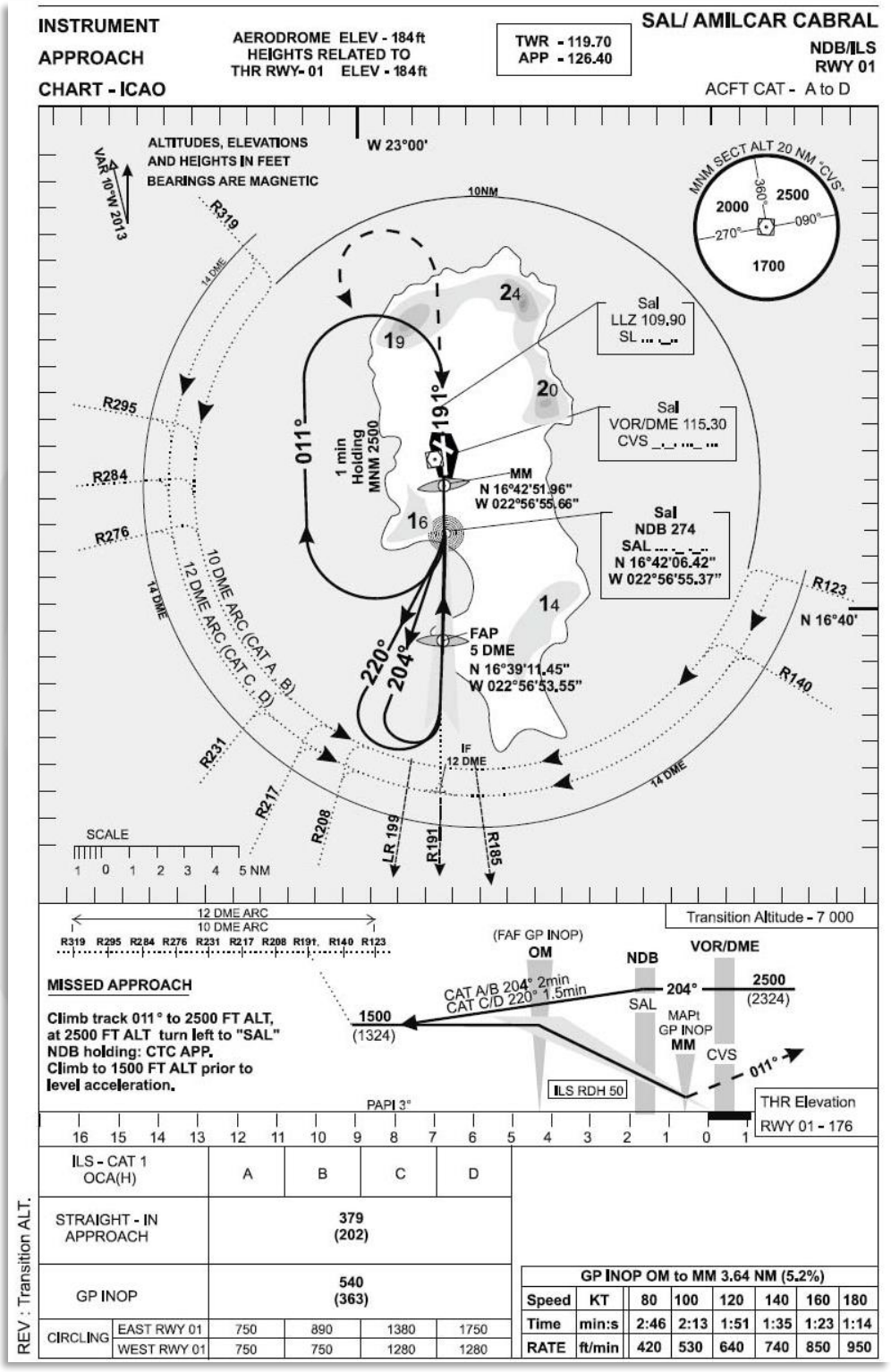

Figure 4 - GVAC – Instrument Approach Chart

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CHAPTER 1
FACTUAL INFORMATION

1.1 – FLIGHT HISTORY

The incident occurred on September 14, 2018, during a TUI AIRWAYS LIMITED company regular flight, with a Boeing 757-200 registered as G-OOBA, on the route from BVC GVBA International Airport to LGW-EGKK London Gatwick Airport, the aircraft carried a total of 228 people on board, consisting of a PIC, First Officer, 06 cabin crewmembers and 221 passengers.

According to information from the cockpit crew, in the run for take-off they experienced a disagree condition with the Air Speed Indication (ASI) between the Captain's and First Officer's Indicators.

They took off with a wind of 270/7, a MAX TOW of 105184-KG available, and an aircraft gross weight of 105 tons.

Upon the take-off roll, aprouching 80 knots, the Air Speed Indicator seemed to hang wich let the crew to miss the 80 knots call. As the crew passed 90 knots, the FO stated that the airspeed was hanging. The PIC glanced at his ASI and it seemed reasonable while the FO made the same statemant as they passed 120 knots ledding the PIC to glance across the cockpit to see the FO ASI stuck between 90 - 100 knots. After the crew approach VI and rotated to climb the EICAS produced "IAS DISAGREE - RUDDER RATIO - MACH SPD TRIM".

The flight crew took the necessary management to control the situation and still unsure of airspeed reliability, the crew checked the ground speed against ASI and determined that PIC ASI was accurate. The altimeter systems seemed unaffected, thereabouts the crew restored the air con system, climbed to cleared level (4000ft), declared a Mayday and began positioning to hold at 8000ft over GVAC (SID) clear of the cloud below. Actioned the QRH and after briefing crew and passengers the crew realized an overweight landing at Amílcar Cabral International Airport, requesting the Fire brigade to inspect the aircraft and later on taxied normally to stand.

The incorrect ASI readings were probably caused by the obstruction of the pitot system by mud and/or debris from a small insect that was introduced in the Pitot tube during the time the aircraft was on the ground.

1.1.2 – Statements of the Pilot in Command (Flying pilot)

The interview to identify and analyze the possible factors that contributed to this incident began on September 14, 2018 at 2:00 PM, in the conference rooms of the Air Navigation Direction, which was generously provided by ASA.

The statements of the Pilot in Command in regard with the incident:

a) At 13:30 Z, he was allowed by ATC to start the engines and do the pushback with weather information;

b) Then he was allowed to taxi onto Runway 03;

c) He asked the ATC to wait until the wind was favorable for take-off;

d) ATC asked if he was ready to take off and he replied no, because he was waiting for the change of wind;

e) He was allowed to taxi to TWY Z and wait for the landing of an aircraft;

f) Then he asked for permission to taxi and to line RWY 03;

g) On departure RWY03, from GVBA, the flight crew experienced a disagree condition with airspeed indication between the Captain's and First Officer's indicators;

h) Considering the phase of the flight, they decided not to abort the take-off and to continue with the flight;

i) Once in the air, in the climbing phase to 4000 feet, the speed on the First Officer's indicator began to increase slowly until it reached the Captain´s speed;

j) However, the flight crew had the following messages in EICAS: "**IAS DISAGREE**", "**RUDDER RATIO**" and "**MACH SPEED TRIM**";

k) Taking into account this scenario, MAYDAY was declared through emergency call communication, made with the GVBA tower;

l) The option to declare "MAYDAY" as emergency declaration "MAYDAY" instead of "PAN", was because the PIC took into account that in certain countries where the company operates, they in the past had emergency situations in which the communication with the ATC, through the declaration of emergency "PAN", had not been understood by the air traffic controllers and the ATC did not have the necessary action on the part of the same ones, this is the reason why, taking also into account that the detected anomaly is not common in this critical flight phase, the PIC decided to declare a MAYDAY situation with TWR in order to have immediate action on their part;

m) In contact with Sal TWR, he was allowed to climb up to 8000 feet, to have sufficient time to complete the checklist related to the detected anomaly, as well as to prepare the crew and passengers for an emergency landing on Sal Island;

n) After completing the checklist at 13:53 Z the flight crew went to the final of the landing on the RWY 01 and they informed the TWR that they were heavy for the landing and therefore they required the services of the firefighters to verify the operation and use of the entire length of the runway;

o) At 13:58 Z, the crew perform the overweight landing safely, with the assistance of firefighters until parking in the standby 01 position;

p) After landing the PIC reported through the Work Order 1193 5667, 1193 5668, 1193 5669, 1193 5670, reference Flight Log 16631128, Air speed disagree, momentary + 20kts exceedance of Flap 5, EICAS message “IAS Disagree”, “Rudder Ratio”, Mach SPD TRIM” and Overweight Landing respectively;

q) The Air Traffic Controller was very helpful.

Note: The IIC asked the Captain if it was the first time he has performed this flight, and he replied NO, also the IIC asked the PIC if he had ever experienced communication problems with air traffic controllers in Cabo Verde and he also replaid NO.

1.1.3 – Statements of First Officer (Not Flying pilot/Pilot Monitoring)

The first officer had nothing to declare besides the captain’s statements.

1.1.4 – Statements of Sal Air Traffic Controller (ATC)

The statement of the SID ATC was referent to a recordig of conversations between the tower and the aircraft crew, which acknowledged that air traffic controllers did a good job.

1.1.5 – Statements of Boa Vista Air Traffic Controller (ATC)

The statements of the Boa Vista Air Traffic Controller:

a) BVC ATC said that after the flight crew took off at 14:05 Z, during the climb phase to 4000 feet, they declared MAYDAY due to experiencing a disagree condition with an airspeed indication between Captain’s and First Officer’s indicators and they were going to require diversion to Sal;

b) BVC ATC called the fligt crew and told them to contact Sal approach at 126,4;

c) And from that moment the operation was assumed by Sal control.

1.1.6 – Maintenance Records

On September 15, 2018, technicians from TUI Airways were transferred to the island of Sal, in order to determine the causes that were at the origin of the anomaly detected with the co-pilot speed indicator. As well as to carry out the appropriate maintenance tasks to items subsequently reported by the captain following the reported defect in order to ensure the continued airworthiness of the aircraft and the aircraft being able to carry out the next flight safely

The following maintenance actions were performed by the technicians, according to the items reported by the crew in the aircraft technical log.

"Airspeed Indication disagree" – Flight Log/Work Order No. 16631128/11935668, 119335671 and 119335672.

- The pitot probe (co-pilot) was disconnected from the pitot pipe according to revision 122 of the B757 Aircraft Maintenance Manual (AMM) 34-11-024-044, taking into account that there was a strong possibility that the anomaly verified with the indication of speed would be linked to that instrument. Following inspection of the pitot probe, leaves were found blocking the air inlet of the tube by about 80%;
- The Air Data Computer (ADC) on the right side (R/H) was removed and the pitot-static system flushed according to AMM 34-11-00-173-009, and the leakage rate values found within the limits established by the AMM 34-11-00-173-175;
- The pitot probe of the pitot pipe was connected and reinstalled according to AMM 34-01-024-044/041;
- The R/H ADC - P/N 4040800-912 (S/N Off: 86120950; S/N In: 93073814) was replaced, and the Built-in Test Equipment (BITE) was made in accordance with AMM 34-12- 01-424-006. No discrepancy was detected between the captain's and the co-pilot's speed indicators according to the pitot leak check performed (BITE).

"Overweight Landing" – Flight Log/work order No. 16631128/11935669

- Inspection was carried out in accordance with AMM 05-51-35-212-031. No damage to the aircraft was evidenced during the inspection performed

"Flap Overspeed" – Flight Log/ work No. 16631128/11935667

- Phase I inspection was performed in accordance with AMM 05-08-212-001. No damage was found during inspection.
- Taking into account the lack of adequate facilities to carry out the phase II inspection according to the same AMM, a Non-Technical Objection (NTO) was requested from Boeing to be carry out a ferry flight between SID and LTN, where TUI Airways has its maintenance base, to carry out the said inspection. Boeing granted the NTO (Thomson Airworthiness Division Concession Number NMA14091801) for the ferry flight taking into account that no damage was reported during the stage I inspection.

Taking into account the performance of all maintenance actions described above, in accordance with the defects reported by the crew, it was demonstrated that the aircraft was still able to carry out the next flight in safety

The aircraft took off from SID to LTN the following morning, September 16, 2018

1.2 – INJURIES TO PERSONS

People on board	228		
Injuries	Crew	Passengers	Others
There were no injuries to persons as a result of the incident			

Table 1 - Injuries to Persons

1.3 – DAMAGE TO THE AIRCRAFT

There was no damage to the Aircraft.

1.4 - OTHER DAMAGE

There was no damage to property or to the environment.

1.5 – PERSONNEL INFORMATION

Both pilots where hired and maintained by the operator. The pilot in command (Captain) was the Pilot Flying while the other pilot (First Officer) was the Pilot Monitoring.

Both pilots were licensed and certified by the United Kingdom Licensing Authority CAA and both were in possession of valid first-class medical certificates as required by regulations. Their medical certificates were issued in March 24, 2018, and November 17, 2017 respectively.

		Pilot in Command (PIC) (Pilot Flying)	First Officer (FO) (Pilot Monitoring)
A	Gender / Age	Male, 57 years old	Male, 44 years old
B	License Issue date	28/05/2012	18/01/2010
C	Category:	ATPLA	ATPLA
D	Pilot Commander:	Since 16/07/2005	
E	Date of Last Medical Exam:	24/03/2018	23/11/2017
F	Validity:	12 months	12 months
G	Recurrent training:	05/05/2018	Last ATE 10/02/2018
H	Flying Experience	17500 hrs	
I	Total Flight Experience Time	17500 hrs	10162 hrs
J	Type Experience	12600 hrs	SEP, MEP, Jetstream 31, Airbus A320/21, B757/767
K	Experience as a	Captain on B7578300 hrs	First Officer on B757: 7727:35 hrs.

L	Total flight time over the last 90 days	220.5 hrs.	233.10 hrs.
M	Total flight time over the last 30 days:	78.5 hrs.	92.35 hrs.
N	A. Total flight time over the last 07 days:	17.3 hrs.	26.40 hrs.
O	Total flight time over the last 24 hours:	6.0 hrs.	00:00 hrs.

Table 2 - Pilots Informations

Air Traffic Controller

		Sal Air Traffic Controller	Boa Vista Air Traffic Controller
A	Gender / Age	Male, 56 years old;	Male, 39 years old;
B	License Issue date	06/11/2013;	30/11/2015;
C	Category:	10Q;	10B;
D	Date of Last Medical Exam:	14/12/2017	09/05/2017;
E	Validity:	14/12/2018	09/05/2021;
F	Recurrent training:	Refresh Course December 2015 /RNAV 2017/ SAR COORDINATOR/ EMERGENCY PLAN	Refresh Course October 2014 / sistasal/AVSEC/RNAV December 2017;
G	ATC Experience:	Since 1980	Since 2006;
H	Total Experience Time	38 YEARS	12 YEARS
I	Experience as a Supervisor:	20 YEARS	coordinator at Boa vista TWR during 6 years;
J	Total time over the last 90 days	+- 228 HOURS	+- 324 HOURS;
K	Total time over the last 30 days:	+- 76 HOURS	+-108 HOURS;
L	Total time over the last 07 days:	+- 24 HOURS	+-24 HOURS;
M	Total time over the last 24 hours:	+- 4 HOURS	6 HOURS;

Table 3 - Air Traffic Controller Informations

1.6 – AIRCRAFT INFORMATION;

Aircraft

BASIC AIRCRAFT INFORMATION

DESIGNATION	DESCRIPTION
Nationality	United Kingdom
Manufacturer	Boeing Company
ICAO Type designator	Boeing 757-200
Registration	G-OOBA
Serial number	32446
Date of manufacture	December 13, 2000
Owner of the aircraft	TUI AIRWAYS LIMITED
Total flying time since manufacture	52208 FH
Total cycles of the aircraft	16696 CY
Certificate validity	30/01/2019

Table 4 - Basic Aircraft Information

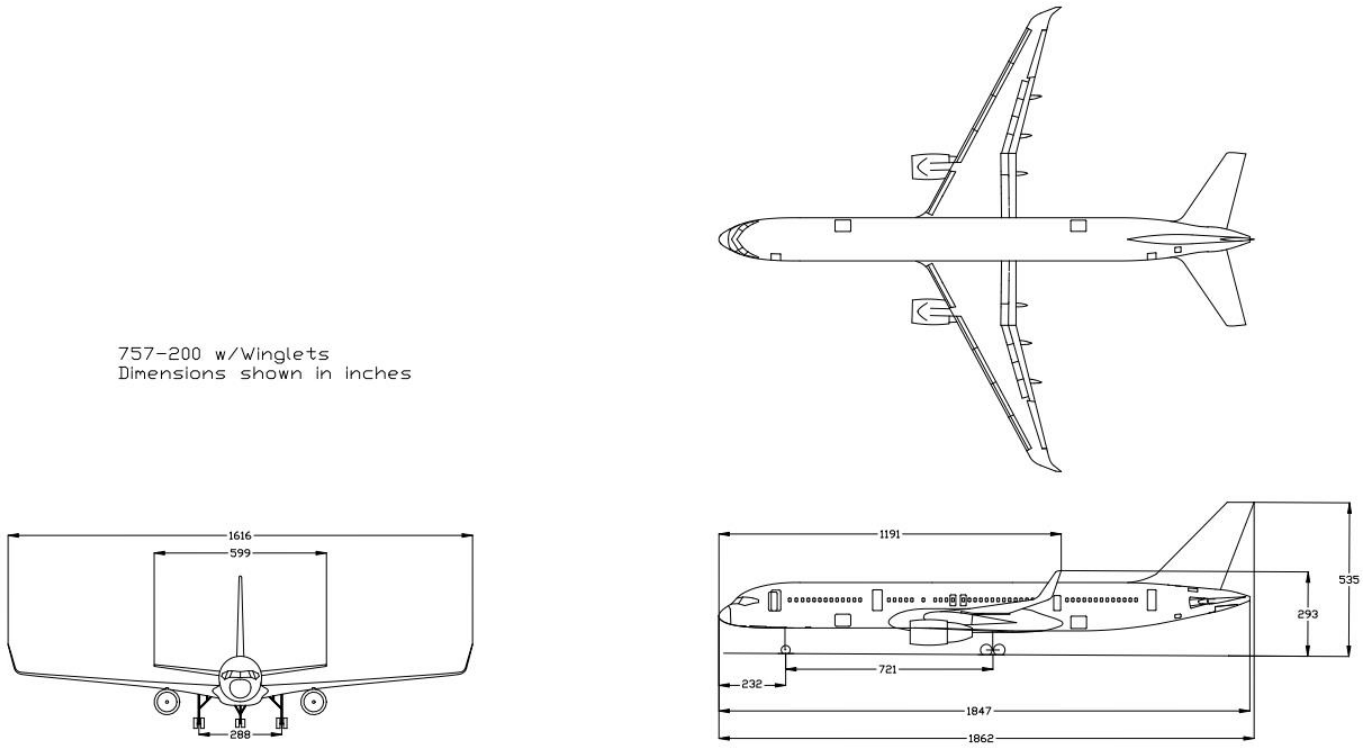

Figure 5 - Boeing 757-200 3-View Drawings

1.6.1 – Aircraft Fueling Information

The aircraft uplifted 23157 liters of Jet A, fuel density 0.8 KG/L from Truck refueling # 44104, on 14 September 2018 from ENACOL Aviation at Aristides Pereira International Airport. The exact amount of fuel on the aircraft prior to its departure according to Flight Log 1663 1128 was **20100** KGs. The arrival fuel from LGW (London Gatwick Airport) was 2300 kg Left, 0 KG Central and 4300 kg Right.

According to TUI LOADSHEET INFO:

RAMP FUEL = 25.000 KGs;

TAXI FUEL = 210 KGs;

TRIP FUEL = 20.000 KGs;

TRIP TIME = 05:41;

1.6.2 – Weight and Balance

According to TUI B757 BASIC WEIGHT SHEET, last weighed on May 16th, 2016.

Kilograms

MTW 113851 – (MAXIMUM TAXI WEIGHT);

MTOW 110999 – (MAXIMUM TAKE OFF WEIGHT);

MLW 89811 – (MAXIMUM LANDING WEIGHT);

MZFW 84096 – (MAXIMUM ZERO FUEL WEIGHT);

The airplane type certificate listed the maximum allowable take-off weight at 115893 kilograms. The maximum allowable structural weight is 116119 kilograms. The weight of the airplane at the time of the incident was 104800 KG, the landing weight of the airplane was 101000 KG.

1.7 – METEOROLOGICAL INFORMATION;

The routine and special aeronautical weather observation reports around the time of this incident were as follows:

The weather was good, with visibility in excess of 10 km. There was some cloud at 1,400 ft. above the airfield and the wind was westerly at 11 kt.

1.8 – AIDS TO NAVIGATION;

At the time of the incident, the GVBA and GVAC International airports used the following navigation aids (according to the AIP Cabo Verde):

Airport	Equipment	Frequency	obs
GVBA	NDB – BVT	341 KHZ	
Airport	**Equipment**	**Frequency**	**obs**
GVAC	NDB – SAL	2740 KHZ	
	VOR/DME	115.3 MHZ /1.187 MHz	
	ILS/LOC	109.9 MHz	
	GP/DME	333.8 MHZ	

Table 5 - Aids to Navigation

No problems were reported with the radio aids or with the radars in use.

1.9 – COMMUNICATIONS

1.9.1 – Communications between the airplane G-OOBA and the ATC Center.

After take-off and during the climb and holding phase, crew of the flight TOM579 contacted the control tower GVBA TWR staff at Aristides Pereira International Airport, over the frequency 118.9 MHz, to report an emergency call. They were transferred to the frequency of the APP (Approach) of Sal (126.4 MHz).

Communications were established with Approach and Departure Controls on frequency 118.900 MHZ as well as GVAC APP 126,4 MHz and Control Tower on 119,7 MHz There were no problems with the availability of communications.

No problem was observed in the communications.

1.10 – AERODROME INFORMATION

Information relative to Aristides Pereira International Airport GVBA and Amílcar Cabral International Airport (GVAC) was obtained from the Department of Civil Aviation Agency Information Publication (AIP) Amendment A02/2018, JUN 21.

Aristides Pereira International airport (airport of departure of the flight) is served with one runway, runway 03/21. Runway 03 has a bearing of 030º E degree true and 10 degrees magnetic heading. Runway 21 is oriented 210º degrees true and 10

degrees magnetic heading. The airport has a magnetic variation of 10 degrees west. The runway is constructed of asphalt and has available take-off and landing dimensions of 45 meters wide by 2.100 meters long. The airport is located at coordinates Latitude 16 degree 8 minutes and 15 seconds North and Longitude 22 degree 53 minutes and 21.84 seconds West.

Amílcar Cabral International airport (landing airport of the flight) is served by two runways, runway 01/19 and runway 07/25. Runway 01 has a bearing of 010 degrees true and 190 degrees magnetic heading. Runway 07 is oriented 070 degrees true and 250 degrees magnetic heading. The airport has a magnetic variation of 10 degrees west. The runways are constructed of asphalt and have available take-off and landing dimensions of 3,272 meters and 1500 meters long respectively. The airport is located at coordinates Latitude 16 degree 44 minutes and 33 seconds North and Longitude 22 degree 56 minutes and 53 seconds West.

1.11 – FLIGHT RECORDERS

In accordance with the regulations in force, the airplane was equipped with flight recorders:

1.11.1 - Cockpit Voice Recorder (CVR);

- ✓ Manufacturer: Honeywell;
- ✓ Model: SSCVR;
- ✓ Part number (P/N): 980-6022-001;
- ✓ Serial number (S/N): CVR120-06564;

Figure 6 - Cockpit Voice Recorder (CVR)

1.11.2 - Flight Data Recorder (FDR);

- ✓ Manufacturer: Honeywell;
- ✓ Model: DFDR;
- ✓ Part number (P/N): 980-4700-042;
- ✓ Serial number (S/N):6331;

This is a solid-state flight data recorder (SSCVR) with a recording capacity of at least twenty-five hours.

The records at the time of the occurrence of this incident was intact therefore were requested for analysis.

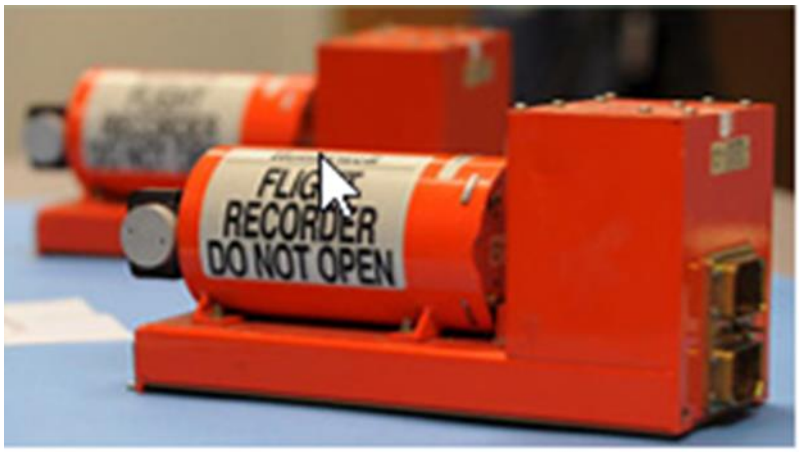

Figure 7 - Flight Data Recorder (FDR)

1.11.3 TUI Internal Air Safety statement after the download and analyze of the FDR:

1.11.3.1 The Crew report

We executed a normal turnaround at GVBA, and with 'normal' NE trade winds taxied for T/O on RWY 03. The wind sock however was now exhibiting a tailwind and windcheck reported 240/6. A performance check on threshold revealed we were unable to takeoff on RWY 03 (RWY 21 at GVBA is unavailable to class C&D aircraft). We taxied to ramp having ascertained that 'AIR CON OFF' and 'NO IMPROVED CLIMB' would not restore performance. We then burnt fuel off, first on ramp and then on runway, all the while monitoring wind until the weight was low enough and wind had moved to an almost complete crosswind. So having pushed at 1325z, at 1404z we took off with a wind of 270/7 and a MAX TOW of 105184-KG available, and an aircraft gross weight of 105 tons, temp 31o, QNH1013, AIR CON OFF, IMPROVED CLIMB OFF. We had reviewed AIR CON OFF checklist in QRH. Given these circumstances we were very focused upon the take-off roll (and any change in wind was at the forefront of our minds). At 80KIAS, the FO (PM) was distracted by an apparent change in wind direction leading to acceleration on his ASI seeming to hang (this led to us missing the 80KIAS call). As we passed 90 KIAS (on PF/CAPTS ASI) FO stated airspeed was hanging. I thought he was likely seeing a gust. I glanced at my ASI and it seemed reasonable. He made the same comment as we passed 120 KIAS and I glanced across the cockpit to see his ASI stuck between 90 - 100 KIAS. PF ASI approaching VI, PF called VI, we rotated and as we climbed away the EICAS produced - IAS DISAGREE - RUDDER RATIO - MACH SPD TRIM.

As we digested this we think FO FLT DIR disappeared and CAPTS FLT DIR lost the pitch bar, so as a matter of airmanship we switched them off, possibly also switching auto throttle off too, if not then shortly afterwards as A/T mode was blank. Now very unsure of the reliability of any of the ASI systems, PF lowered nose at 1200ft and allowed aircraft to accelerate, calling for flap 5. With the aircraft more or less level, and speed showing rapid increase we selected 'Flaps Up' at maybe 240KIAS. Still unsure of airspeed reliability, as a crew we checked ground speed against ASI and determined that Capts ASI was accurate, as was the standby. Altimeter systems seemed unaffected. Thereabouts we restored the air con system. Climbed to cleared level (4000ft), declared a Mayday and began positioning to hold at 8000ft over GVAC (SID) clear of the cloud below. Actioned the QRH and after briefing crew and passengers we made an uneventful flap20 ILS landing at 103 tons at GVAC in VMC. Fire brigade inspected aircraft and taxied normally to stand.

1.11.3.2 Flight Analyze

The aircraft taxied to the end of Runway 03 and held position. Gross Weight was recorded as 105.6t. After approximately 10 mins, the aircraft was taxied back to the apron. After a further 10 mins the aircraft taxied onto the runway again facing the opposite direction 21 and came to a halt. The engines were run at a higher setting than idle for some 5 mins before the aircraft backtracked and lined up on Runway 03.

The engines were run at above idle for just under 1 min before the T/O roll was commenced. Gross Weight indicated 104.8 t. Thrust was set to 1.72 EPR after brakes were released. Throughout the T/O roll the IAS and Groundspeed values in comparison suggested a light quartering tailwind, with the IAS lagging GS. The IAS increased steadily and the aircraft was rotated at just over V2.

The aircraft lifted off, gear was selected up and initially climbed away normally at the T/O flap setting of Flaps 20, at a pitch angle of 18°. Passing around 200 ft. AAL, the Flight Directors (FD) were switched off in turn, CP then F/O EICAS IAS DISAGREE condition became active within a few seconds. Passing 1,100 ft. the pitch attitude was reduced to around 5° and aircraft accelerated. Air conditioning packs were selected ON as this occurred.

Passing 1,600ft and at 184 kt, Flaps 5 was selected and A/T began to reduce thrust. A/T was disconnected and thrust was increased to 1.71EPR. Meanwhile the pitch angle had reduced further and IAS increased, exceeding the Flaps 5 speed limitation. Pitch was then increased however the IAS reached 236 kt before Flaps 1 was selected and 242 kt by the time Flaps Up was selected.

The aircraft climbed away at around 250 kt, in manual flight with FDs switched off. Runway heading was maintained. The MCP selected altitude was 4,000ft, the aircraft briefly overshot 4,000 ft, reaching 4300ft before descending again to 4000 ft. About 1 min after reaching 4,000 ft there was a further altitude excursion, down to 3,800ft,

and roll variations of 20° left and right with heading changes of circa 15°. Upon climbing back to 4,000ft the MCP altitude was increased to 6000 ft and the climb continued. There were several VHF transmissions during this period.

Passing 4,700 ft, the aircraft, having been on runway heading for some 20 nm, turned left towards CVS VOR, (15nm NW of the aircraft position). Passing 5,600 ft, the MCP altitude was increased to 8,000 ft and shortly afterwards the altimeter subscale was changed to STD (1013 hPa), with the aircraft briefly levelling off at 6,100ft (FL061) before continuing climb to FL 80 (TA 7000ft). During this time there were multiple VHF transmissions, also the CP FD was switched on briefly and then switched off again.

The aircraft levelled at FL80 and entered a right hand holding pattern over CVS VOR, approximating a 191° inbound course (Standard hold is 191° RH for ILS + VOR 1). The aircraft remained in the hold for approximately 21 min in manual flight. Minor altitude excursions of up to 250 ft up/down were observed.

FDs were switched on and Left autopilot was engaged in CMD. The aircraft flew one more pattern in HDG SEL mode before leaving the hold.

Upon leaving the hold the aircraft positioned for a long left hand downwind leg for ILS 01. Vertical speed mode (V/S) was engaged to initiate the descent from 8,000 ft to 2,000 ft with IAS at 238 kt. The A/T had not been re-engaged (as per non-normal checklist). Thrust remained at a setting for level flight, consequently the IAS increased. Shortly afterwards Flaps 1 was selected just as the IAS was increasing through 239 kt, exceeding the Flaps 1 limit speed. Some 18 seconds later with the IAS at 250 kt, the thrust levers were retarded and a further 28 s later the IAS reduced below 240 kt. Speedbrakes were then extended and aircraft was configured to Flaps 5.

Towards the end of the downwind leg the gear was selected down, the autopilot disconnected, FLCH mode was selected and the rate of descent increased. On the base turn Flaps 15 was selected. Passing 4,000 ft the aircraft was configured gear down, Flaps 15 with speedbrakes extended. Aircraft was below the G/S. Thrust was increased to 1.30 EPR, reducing rate of descent. LOC was captured at 2,300 ft and aircraft turned onto inbound course, speedbrakes were then retracted. Flaps 20 was then selected at 184 kt and G/S capture occurred shortly afterwards.

Approach was stable by 1,800ft and remained so throughout. The landing was uneventful and full reverse thrust used on the rollout. Gross weight was 101 t. The aircraft vacated the runway and stopped for approx. 90s before taxiing to the apron.

1.11.3.3 Flight Data Summary:

- After start, the aircraft weight was reduced by around 800kg through taxiing to burn off fuel.
- Flaps 20, Packs Off takeoff commenced at 104.8 t some 35 mins after first line up.
- It was noted by comparison of IAS and Groundspeed that a quartering tailwind was likely present throughout the takeoff roll, which was otherwise uneventful, rotation commenced at approx. V2.
- EICAS IAS DISAGREE condition activated shortly after takeoff and both FDs were switched off.
- After restoring the Packs the aircraft was accelerated and Flaps retracted to Flaps 5. However the IAS rapidly increased and exceeded Flaps 5 limitation by approx.16 kt before Flaps Up selected.
- Aircraft climbed away on runway heading to 4000 ft and with slight overshoot to 4300 ft.
- Some hesitation during the climb towards the hold was reportedly due to negotiating a different level to avoid cloud.
- After some 20nm, the aircraft was flown into a holding pattern at Sal over CVS VOR at 8000 ft.
- Holding was flown in manual flight for some 21mins with no FD, with minor altitude excursions.
- Left Autopilot was engaged in CMD and aircraft positioned left downwind for an ILS 01 approach.
- Descent was initiated in Vertical /Speed mode with Autothrust disengaged. Thrust was not manually reduced. Consequently, the IAS increased and when Flaps 1 selected the IAS increased to 10 kt above the limit speed before thrust was reduced to recover.
- Remainder of approach flown with high drag and thrust – reportedly the aircraft was initially high on profile and speedbrakes inadvertently left extended for a short period.
- Stabilised Flaps 20 approach to an uneventful landing.

1.12 – WRECKAGE AND IMPACT INFORMATION

As stated in sub-section 1.3 of this report the aircraft was undamaged.

1.13 – MEDICAL AND PATHOLOGICAL INFORMATION

No medical or pathological investigations were conducted as a result of this incident, nor were they required.

1.14 – FIRE AND FIREFIGHTING

1.14.1 - At 13:50:18 LT, the first message from G-OOBA requesting APP of the services of firefighters to supervise the landing operation;

1.14.2 - At 13:53:04 LT, the Airport Fire Brigade Team were put on stand-by;

1.14.3 - At 13:56:52 LT, G-OOBA requested TWR to ask the Fire Brigade to come and check the temperature of the brakes. The firefighters inspected the brakes and found no anomalies.

1.15 – SURVIVAL ASPECTS

The aircraft landed uneventfully, remained on the runway until the inspections of the brakes by the firefighters was completed and taxied to the stand, where the passengers disembarked normally.

1.16 – TESTS AND RESEARCH

TUI AIRWAYS relocated technical staff to the island of Sal to proceed with troubleshooting of anomalies, and requested instructions from the aircraft manufacturer NTO (Non-Technical Objection) to carry out a ferry flight and perform the second phase of maintenance tasks related to the “Flap Over speed” occurred during the descent phase to Sal.

The interviews carried out with the crew; reveal the need to listen to the records of the aircraft, by using the CVR and FDR, aiming to define of crew performance.

1.17 – ORGANIZATIONAL AND MANAGEMENT INFORMATION

TUI AIRWAYS LIMITED was established to provide scheduled passenger air transport, and holds an Air Operator certificate Ref.294 that operates as a charter and scheduled airlines service and owns the aircraft G-OOBA as one of its aircraft to carry out its business plan.

The airline has its operations base at Luton Airport and, at the time of the incident, an AOC ref.294 that had been issued on 01 November 2008 and the aircraft Airworthiness Certificate Ref.052689/006 were valid until 30/01/2019.

1.18 – ADDITIONAL INFORMATION

1.18.1 – General Description

1.18.1.1 Distress and Urgency Communications

Mayday - Mayday - Mayday

A Mayday radio call should be reserved for life threatening situations. These may include, but are not limited to:

Loss, or imminent loss of aircraft control for any number of different reasons

- Aircraft upset by turbulence;
- Pilot incapacitation;
- Spatial disorientation;
- Control surface or structural failure;
- Engine failure that will lead to a forced landing/ditching/ejection/bailout; or
- An onboard fire.

Pan - Pan - Pan

A Pan-Pan call should be used for urgent situations that are not immediately life threatening, but require assistance from someone on the ground. These include, but are not limited to:

- Becoming lost;
- A serious aircraft system failure, that requires an immediate route or altitude change;
- Other emergencies that require immediate attention and assistance from the ground.

1.18.1.2 - Air Data Instruments

The air data instruments display airplane speed and altitude based upon inputs from the atmosphere. These instruments are classified as either electric or pneumatic displays. The pneumatic displays receive inputs from the pitot and static systems. The electric displays receive inputs from other units through ARINC 429 data buse.

The pneumatic instruments include the standby airspeed indicator and standby altimeter. The airspeed display receives input pressure from the alternate static system and input pressure from the No. 1 auxiliary pitot system. The standby altimeter receives static inputs from the alternate static system.

The electric instruments include the Captain's and F/O's altimeters and MACH airspeed indicators. They receive inputs from the air data computer (ADC).

The Electronic Attitude Direction Indicators (EADIs) also display airspeed data and are part of the Electronic Flight Instrument System (EFIS).

The EADI is an advanced version of attitude and electric attitude indicators. In addition to displaying the aircraft's attitude, numerous other situational flight parameters are displayed. Most notable are those that relate to instrument approaches and the flight director command bars. Annunciation of active systems, such as the AFCS and navigation systems, is typical.

The concept behind an EADI is to put all data related to the flight situation in close proximity for easy observation by the pilot. [See Appendix 5.9] Most EADIs can be switched between different display screens depending on the preference of the pilot and the phase of flight. EADIs vary from manufacturer to manufacturer and aircraft to aircraft. However, most of the same information is displayed.

The airspeed data is provided by the ADC, which feeds the EFIS Symbol Generators via ARINC 429 data buses. The EFIS Symbol Generators convert this data into video signals and transmit them for display on the EADIs.

True airspeed/static air temperature (TAS/SAT) and total air temperature (TAT), usually part of air data instruments, are displayed elsewhere. TAS/SAT is displayed on the FMC control display unit.

TAT is displayed on the EICAS indicator.

According to the Boeing Flight Crew Operations Manual and Quick Reference Handbook, in case of unreliable airspeed indications, the procedures for processing the anomaly are as follows:

a) The crew has to recognize the abnormality of airspeed;
b) Depending on the phase of the flight, make the decision to reject or continue with the flight or take-off, which must be made before V1 speed;
c) Rejecting the take-off after V1 is not recommended unless the Captain judges the airplane to be incapable of flight;
d) The pilot monitoring (PM) during take-off roll should monitor engine instruments and airspeed indications should announce any abnormalities passing 80 kts and before V1 and VR to the pilot flying at the appropriate times;
e) The air crews should ensure that the airspeed indicators are functioning and reasonable at 80 kts callout;
f) If the accuracy of either primary airspeed indication is in question, reference the standby airspeed indicator;
g) If abnormal airspeed is recognized, set the aircraft configuration from the Airspeed Unreliable **memory items** and when the aircraft control is established, accomplish the Airspeed Unreliable Non-Normal Checklist (NNC) and alert ATC;

h) In order to determine if a reliable source of indicated airspeed is available, the Airspeed Unreliable checklist says:

- ✓ When stabilized, crosscheck the Captain, First Officer and standby airspeed indicators;

The objective of these memory items is to maintain the airplane within the envelope and stabilize the flight path to allow time to find the more precise value to be used for the flight in the Quick Reference Manual.

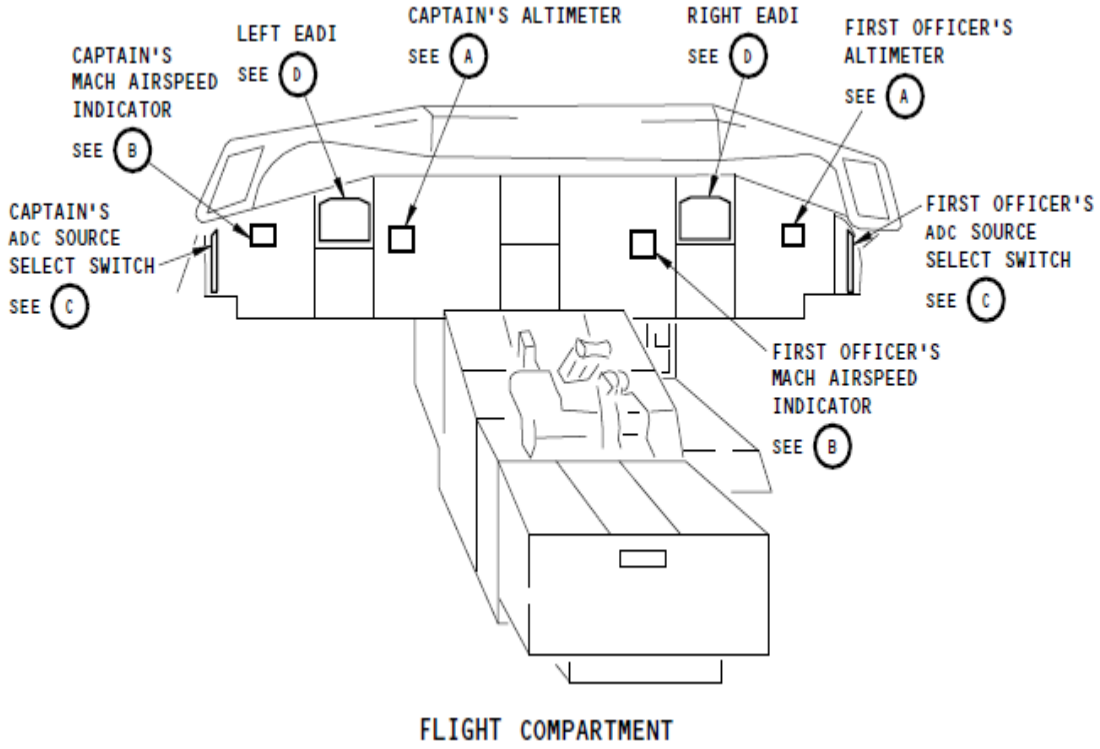

Figure 8 - Air Data Instruments

1.18.1.3 – MACH Airspeed Indicator

The MACH airspeed indicator displays the computed airspeed, commanded airspeed, MACH number, and maximum allowable airspeed. The indicator has a 4-inch face.

Computed airspeed is displayed by a white pointer read against a numbered dial. The dial is divided into 2-knot or 5-knot increments from 60 to 250 knots. From 250 to 450 knots, it is divided into 10-knot increments. Airspeed is also displayed by a 3-digit display window.

Airspeed is displayed in 1-knot increments from 60 to 450 knots in conjunction with the pointer.

MACH number is indicated by three magnetic wheels in the range of .400 to .999 MACH. The decimal point is fixed on the indicator face. MACH indications below .4 are masked by a black shutter.

The commanded airspeed is displayed by a cursor moving around the periphery of the airspeed scale. The cursor is electrically positioned from a remote selector on the autopilot mode control panel.

The maximum allowable airspeed (VMO/MMO) is displayed by a red and white striped pointer. The VMO/MMO is read against the computed airspeed scale.

Four indices may be manually set around the face of the indicator. They are used for reference as chosen by the pilot.

Failure warning flags within the indicator come into view in event of input signal and/or indicator circuit failure.

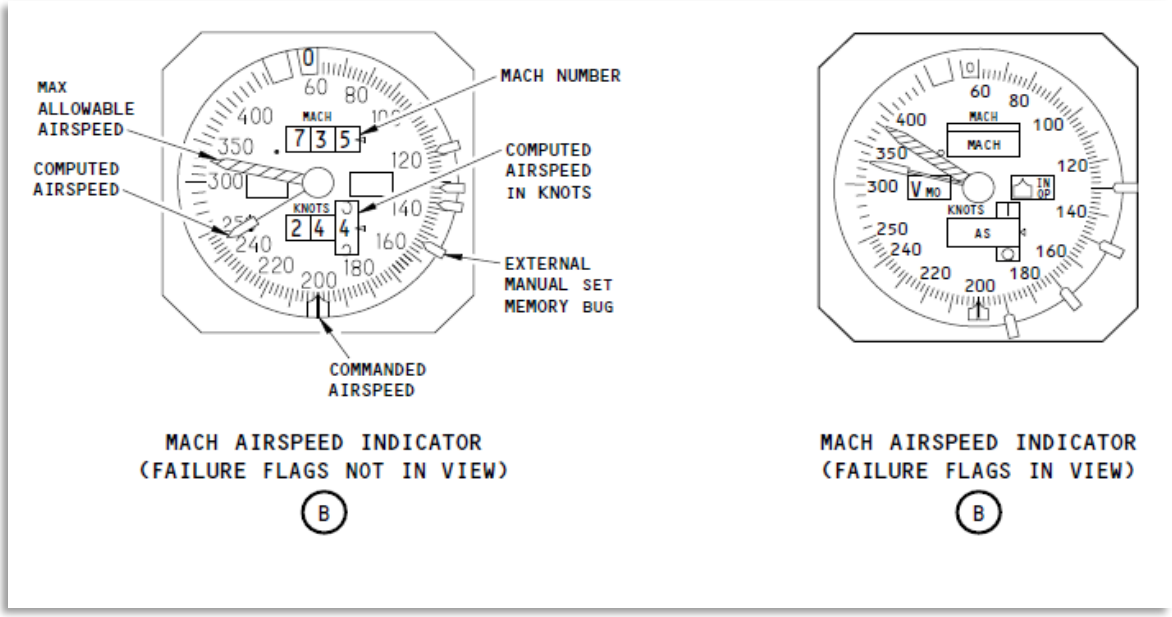

Figure 9 - MACH Airspeed Indicator

1.18.1.4 – Standby Airspeed Indicator

The standby airspeed indicator provides a visual display of the indicated airspeed in the range of 60 to 450 knots. Airspeed is indicated by a pointer read against a graduated scale. The scale is divided into 2-knot increments from 60 to 250 knots, and 10-knot increments from 250 to 450 knots.

On some indicators, five indices may be manually set around the face of the indicator. They are used for reference as chosen by the pilot.

The standby airspeed indicator is installed in the pilot's center instrument panel.

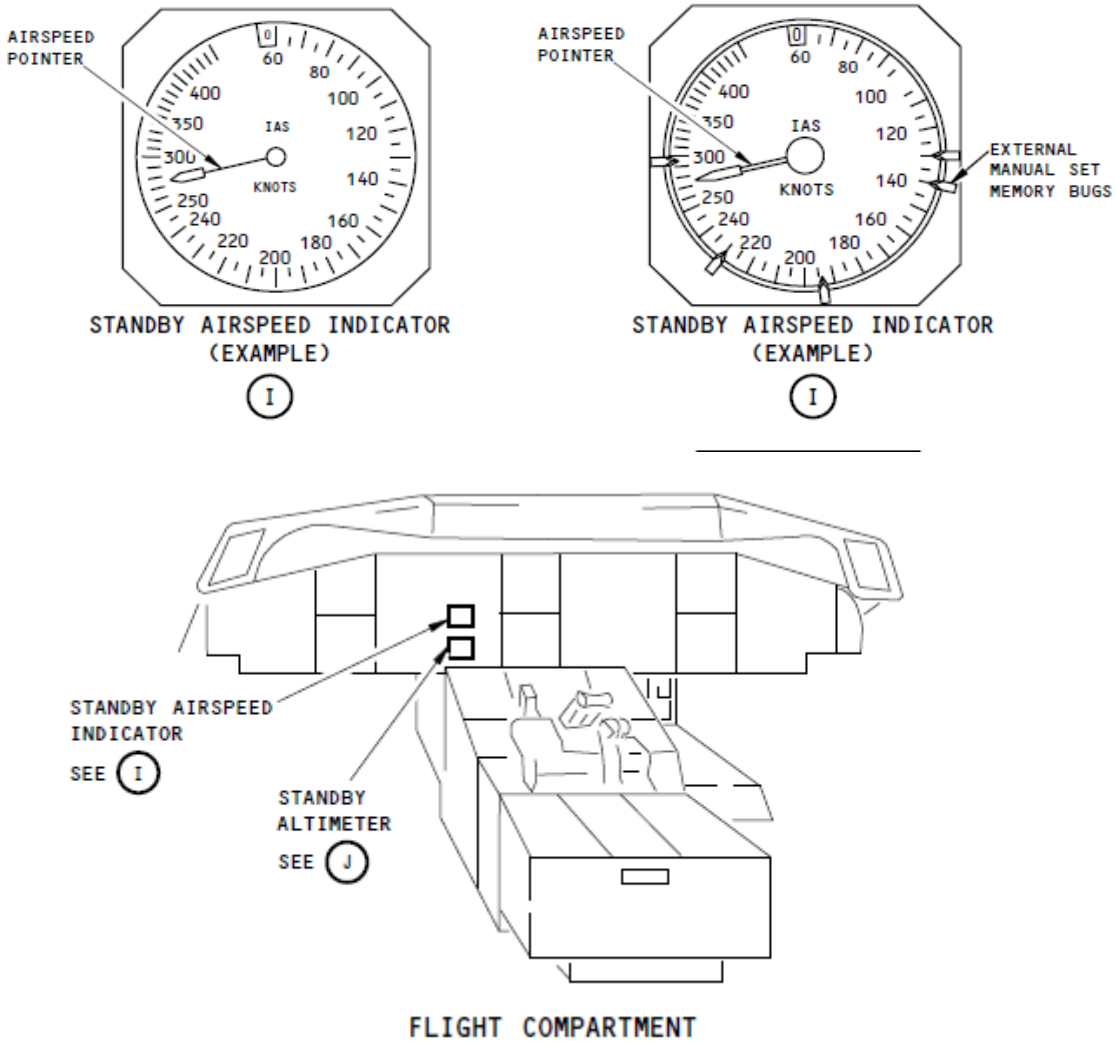

Figure 10 - Standby Airspeed Indicator

1.18.1.5 – Pitot-Static System

A pitot-static system is a system of pressure-sensitive instruments that is most often used in aviation to determine an aircraft's airspeed, Mach number, altitude, and altitude trend. A pitot-static system generally consists of a pitot tube, a static port, and the pitot-static instruments. Other instruments that might be connected are air data computers, flight data recorders, altitude encoders, cabin pressurization controllers, and various airspeed switches. Errors in pitot-static system readings can be extremely dangerous as the information obtained from the pitot static system, such as altitude, is potentially safety-critical. Several commercial airline disasters have been traced to a failure of the pitot-static system.

Pitot-static instrument

The pitot-static system obtains pressures for interpretation by the pitot-static instruments. Many modern aircraft use an air data computer (ADC) to calculate airspeed, rate of climb, altitude and Mach number. In some aircraft, two ADCs receive

total and static pressure from independent pitot tubes and static ports, and the aircraft's flight data computer compares the information from both computers and checks one against the other. There are also "standby instruments", which are back-up pneumatic instruments employed in the case of problems with the primary instruments.

Pitot-static errors

There are several situations that can affect the accuracy of the pitot-static instruments. Some of these involve failures of the pitot-static system itself - which may be classified as "system malfunctions" - while others are the result of faulty instrument placement or other environmental factors - which may be classified as "inherent errors".

System malfunctions

Blocked pitot tube

A blocked pitot tube is a pitot-static problem that will only affect airspeed indicators. A blocked pitot tube will cause the airspeed indicator to register an increase in airspeed when the aircraft climbs, even though actual airspeed is constant. (As long as the drain hole is also blocked, as the air pressure would otherwise leak out to the atmosphere.) This is caused by the pressure in the pitot system remaining constant when the atmospheric pressure (and static pressure) are decreasing. Conversely, the airspeed indicator will show a decrease in airspeed when the aircraft descends. The pitot tube is susceptible to becoming clogged by ice, water, insects or some other obstruction.

Blocked static port

A blocked static port is a more serious situation because it affects all pitot-static instruments. A blocked static port will cause the altimeter to freeze at a constant value, the altitude at which the static port became blocked. The vertical speed indicator will read zero and will not change at all, even if vertical speed increases or decreases. The airspeed indicator will reverse the error that occurs with a clogged pitot tube and cause the airspeed to be read less than it actually is as the aircraft climbs. When the aircraft is descending, the airspeed will be over-reported. In most aircraft with unpressurized cabins, an alternative static source is available and can be selected from within the cockpit.

1.18.1.6 - Pitot-Static System Components

See appendix 5.6

CHAPTER 2
ANALYSIS

2.1- GENERAL

The aim of this analysis is to determine at least the root cause or contributory factors that affected the expected behaviors and skills of the crew during the situation encountered.

This analysis involved the identification of the failures that occurred during take-off, climb, holding and landing, in relation to the explicit or implicit assumptions and expectations concerning safety.

The management of unexpected anomalies had to do with the assurance of operational safety, after detecting the anomaly the appropriate crew intervention is to ensure control of the aircraft and subsequent flight steps.

2.1.1 – Airspeed Indication Disagree

The airspeed disagrees detected during the aircraft's take-off phase was due to the malfunction of the aircraft's pitot probe system, due a contamination of the copilot's pitot tube has influenced the speed of the copilot which is processed through air data computer (ADC).

2.1.2 – Emergency call

The PIC instructed the FO to make a MAYDAY call because he did have previous experience of a PAN PAN call not being understood by ATC and no proper response to necessary action in other destinations. Although he had no communication difficulties with ATC during the flight or on previous flights to Cape Verde.

2.1.3 – Request of the PIC to climb to 8000ft

The crew’s intention to continue with the flight, to climb until a flight level of 8000 feet, was to clear cloud, to detect the anomaly, define their priorities and act on processing the anomaly associated with the checklist in the expected timeframe in line with critical logic.

2.1.4 – Flaps Overspeed

Due to airspeed disagree the airspeed has exceeded a safe limitation. The safe speed for the extended flaps was exceeded, which can cause damage to the flap system. In the case of a flap overspeed, a full inspection must be made of the flap system before the aircraft can fly again.

2.1.5 – Overweight Landing

Due to airspeed disagree checklist and diversion to Sal an overweight landing was made at a gross weight in excess of the maximum design.

2.1.6 – Qualifications of Crew Members

The PIC and the FO both held valid pilot competence certificates and valid aviation medical certificates.

2.1.7 – Aircraft Airworthiness Certificate

The Aircraft had a valid airworthiness certificate and had been maintained as prescribed.

2.2 – OPERATIONAL ASPECTS

2.2.1 – With regard to meteorology

With the meteorological information that was available when flight TOM579 departed, a technical analysis did not predict any major bad weather conditions. As such, the crew conducted the flight that they had scheduled prior to departure.

2.2.2 – With regard to operative dispatch

The meteorological information that was provided during the operational flight dispatch and the prevailing conditions were not a factor in this incident on which there was a form regarding the minimum information that the Aircraft Dispatcher needed to provide the crew with.

2.2.3 – With regard to the flight

As is practice on these weekly THOMSON flights, the crew took the flight from Boa Vista.

After obtaining authorization, the aircraft took off at 13:05 LT.

During the take-off run, the crew faced an anomaly, which, according to the Captain, is unusual at this phase of flight, consisting of an airspeed disagree between the Captain's and First Officer's indicators.

- ✓ The crew tried to control the continuity of the flight and stability of the aircraft to avoid a worse situation;
- ✓ The crew understood that the flight phase did not allow their discontinuity, or to reject take-off;
- ✓ The crew understood that continuing the flight, climbing to flight levels 4000, 6000 and 8000 feet, would create the conditions to stabilize the aircraft,

correctly identify the fault, prepare the cabin and passengers for an emergency landing;

- ✓ Using the references of chapter 2.1.2, they understood to declare Mayday and to make an overweight landing, since the previous experiences with the company's airplanes influenced the decision-making;

The crew's experience was fundamental in this specific case, having had a profound perception of the danger, which consequently did not provoke the spread of stress that in turn could reduce confidence.

The operational attitude taken can and should be considered as a combination of aeronautical experience, as well as technical skills of the crew that made it possible to understand the possible danger / risk, because when decisions are taken under stress, the probability of choosing risky alternatives is high.

It is more likely that a crew tolerates an ambiguity than maintaining an intermediate position when in a situation of stress, as was the case in this instance.

The greater the pressure (stress), the greater the impact on the perception of danger and the ability to identify the risk.

2.3 – MATERIAL ASPECTS

The scrutiny of the aircraft records on board revealed that the aircraft was in an airworthy state.

CHAPTER 3
CONCLUSIONS

From the evidence available, the following findings, causes, and contributing factors were made with respect to this incident. These can not be used to apportion blame or responsibility to any one in particular.

3.1 – PRELIMINARY FINDINGS

3.1.1 – The aircraft's documentation was in order;

3.1.2 – The crew was properly licensed and qualified to carry out the flight;

3.1.3 – The aircraft was maintained in accordance with an approved maintenance schedule;

3.1.4 – The aircraft had taken off from Boa Vista, according to the Flight Log, without any known technical problems;

3.1.5 – Both engines were producing good power at the time of the incident;

3.1.6 – The air speed disagrees between the Captain's and First Officer's indicators or unreliable airspeed was due to contamination of the pitot probe by a leaf–like material found blocking 80% of the pipe;

3.1.7 – The airspeed disagree led to a Flap overspeed;

3.1.8 – The first emergency call (alert) messages were sent by the crews to Boa Vista ATC and Sal ATC between 13:09:12 LT and 13:09:33 LT;

3.1.9 – The flight was transferred from the Boa Vista control center to the Sal control center;

3.1.10 – The crew performed overweight landing due to airspeed disagrees checklist;

3.1.11 – The debris leaf-like material was found, after pitot probe disconnection from the pitot pipe, immediately on arrival of a technician from the TUI maintenance organization;

3.1.12 – During the interview, we did not find any evidence of stress or fatigue with the pilots assigned to the flight.

3.2 – PROBABLE CAUSES

The Institute for the Prevention and Investigation of Aeronautical and Maritime Aircraft Accidents (IPIAAM) determines that the probable causes of this incident are:

3.2.1 – The obstruction of pitot/ static probes during take-off phase at the time of incident;

3.2.2 – Temporary airspeed disagrees between the Captain's and First Officer's instruments, likely following the obstruction of the Pitot / statics probes by leaf-like materials that, in particular, caused the EICAS messages such as "IAS DISAGREE", "RUDDER RATIO" and "MACH SPD TRIM";

3.2.3 – The occurrence of the Airspeed Indicator failure during take-off completely surprised the pilots of flight G-OOBA;

3.2.4 – The erroneous reading or disagree of airspeed indications between the Captain's and First Officer's indicators and EICAS messages, did not help the crews with their diagnosis.

3.3 – CONTRIBUTING FACTORS:

The following factors may have contributed to the incident:

3.3.1 – Environmental factor, rainy season and weed growth and insect development increase the likelihood of weeds being transported to the pitot orifices.

3.3.2 – Change in wind position and crosswind experienced by the crew during take-off, may have contributed for blockage of the pitot tube.

Chapter 4
SAFETY RECOMMENDATIONS

During the course of the investigation and following discussions with the investigation team regarding the incident of flight TOM579, the IPIAAM urges the operator to take note of and implement the following actions that will make improvements in safety on one of the most critical phases of flight:

SAFETY RECOMMENDATION NO. 001-IIA-2018

As a result of the investigation, taking into account the chance of such an incident being repeated during the rainy season, it is recommended that operator TUI Airways Limited should promote the crew´s adherence to protect the static and pitot probes after landing and while the aircraft remains on the ground;

SAFETY RECOMMENDATION NO. 002-IIA-2018

TUI Airways Limited shall take safety actions subsequent to this incident and an in-house safety education magazine shall feature the incident in question as a case study, including points to note in the case of airspeed disagree, (airspeed unreliable) in order to prevent the recurrence of this incident;

SAFETY RECOMMENDATION NO. 003-IIA-2018

TUI Airways Limited shall bring to the attention of all crew that operates at Boa Vista airport at this time, the entire process of managing this incident, taking into account the end of the flight in question;

SAFETY RECOMMENDATION NO. 004-IIA-2018

The Civil Aviation Authority of Cabo Verde shall intensify the ramp inspection by airport services to identify the presence of insects around the aircraft mainly during the rainy season, which can in turn carry herbs and seek to hide holding herbs;

SAFETY RECOMMENDATION NO. 005-IIA-2018

As a safety prevention action, TUI Airways Limited shall observe the need for crew training in regard to similar failures, their evaluation and consequent monitoring.

Chapter 5
APPENDICES

5.1 – INCIDENT NOTIFICATION FORM completed by the Captain;

5.2 – FLIGHT LOG – Ref.1663 1127 and 1663 1128;

5.3 – Work Order- 1193 5667 and 1193 5668;

5.4 – Work Order- 1193 5669 and 1193 5670;

5.5 – Work Order- 1193 5671 and 1193 5672;

5.6 – Pitot-Static System Components;

5.7 – Pitot-Static System Schematic;

5.8 – Pitot-Static System Component Location;

5.9 – Electronic Attitude Direction Indicators (EADIs)

5.10 – Communication Transcript

APPENDIX 5.1
INCIDENT NOTIFICATION FORM COMPLETED BY THE CAPTAIN.

asa – Empresa nacional de Aeroportos e Segurança Aérea - SA
Gabinete Safety & Security

NOTIFICAÇÃO DE OCORRÊNCIA (Acidentes/Incidentes)

I.

1. ÓRGÃO: (TUI) THOMSON AIRWAYS

2. QUEM NOTIFICA: _____ FUNÇÃO: _____

4. DATA DA NOTIFICAÇÃO: 19 / 9 / 18 HORA DA NOTIFICAÇÃO: _____H_____

5. ÁREA DA OCORRÊNCIA:

a) AEROPORTO/OUTRAS INFRAESTRUTURAS ☐
b) TMA ☐
c) FIR ☐

6. DESCRIÇÃO DA OCORRÊNCIA:

ON DEPARTURE (RW 03) FROM GVBA WE EXPERIENCED A DISAGREE CONDITION WITH THE AIRSPEED INDICATION BETWEEN CAPTAINS & FIRST OFFICERS INDICATORS. WE CLIMBED TO 4000FT, DECLARED A 'MAYDAY' EMERGENCY CALL, CLIMBED TO 8000FT (TO CLEAR CLOUD) & PREPARED THE AIRCRAFT, PAX AND CREW FOR A LANDING AT ~~GA~~ GVAC. THE ~~AP~~ CHECKLIST FOR THIS FAILURE IS LONG & INVOLVED SO IT TOOK SEVERAL MINUTES TO COMPLETE. WITH THE CHECKLIST COMPLETE WE MADE AN OVERWEIGHT LANDING (DUE TO AMOUNT OF FUEL ON THE AIRCRAFT – THIS IS ALLOWED) ON THE VERY LONG RUNWAY AT GVAC. THE AIR TRAFFIC CONTROL WAS VERY HELPFUL, AND AFTER LANDING THE FIRE DEPARTMENT INSPECTED THE AIRCRAFT FOR SAFETY, ESPECIALLY THE ~~BAT~~ BRAKES. ALL WAS OK SO WE TAXIED TO THE RAMP.

Figure 11 - Incident Notification Form Completed by the Captain.

APPENDIX 5.2
FLIGHT LOG – REF.1663 1127 AND 1663 1128

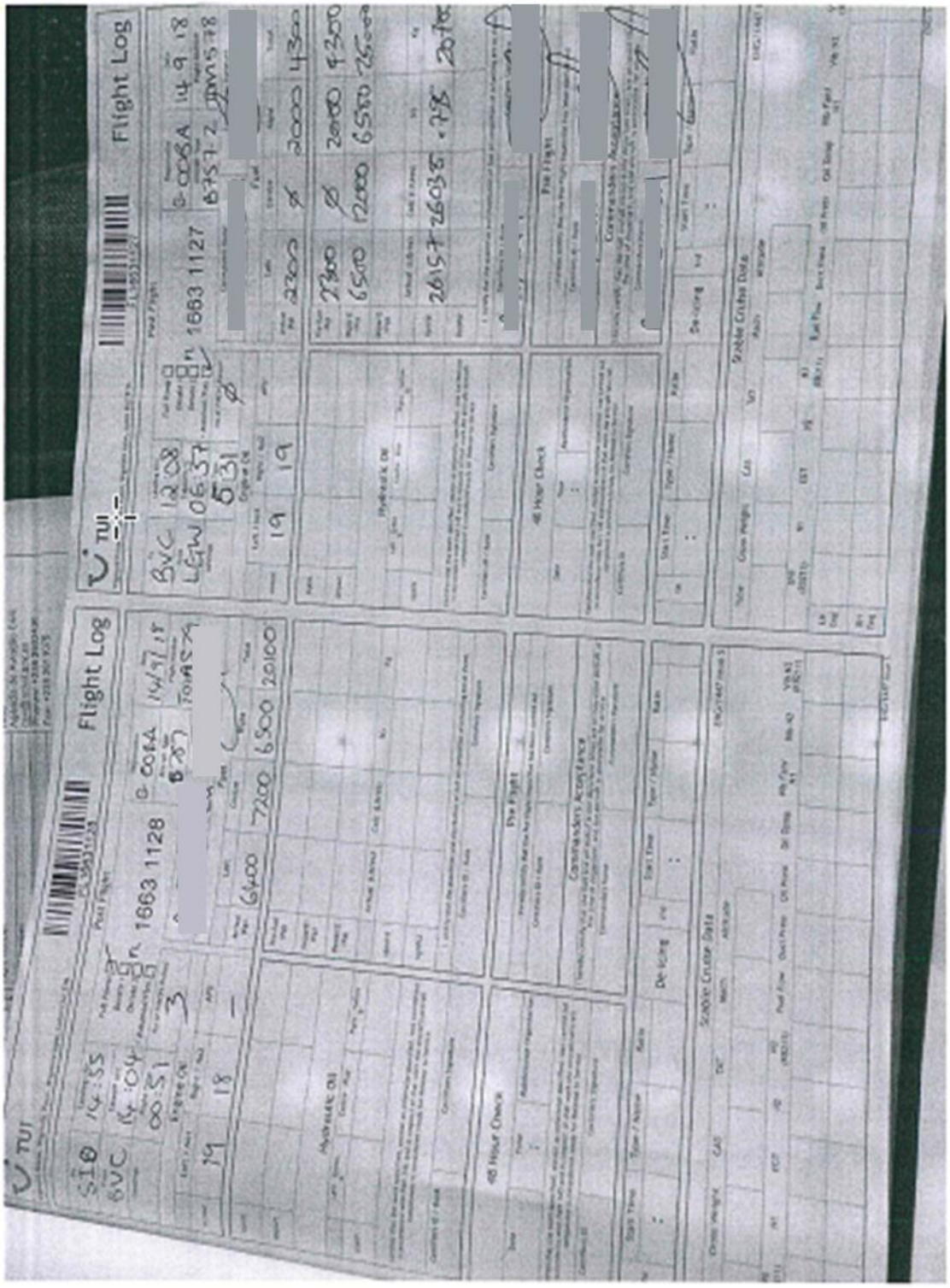

Figure 12 - Flight Log – Ref.1663 1127 And 1663 1128

APPENDIX 5.3
WORK ORDER- 1193 5667 AND 1193 5668.

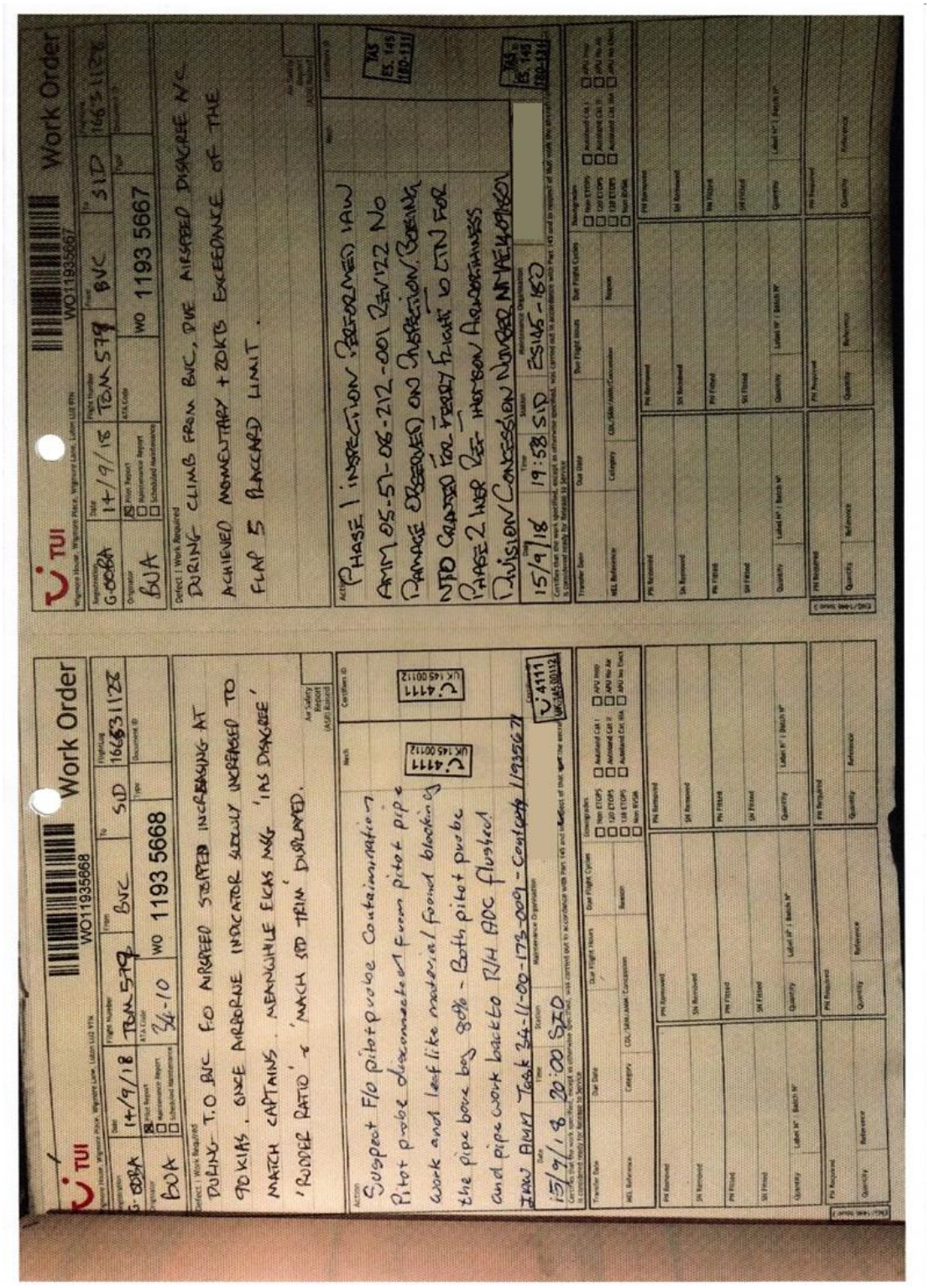

Figure 13 - WORK ORDER- 1193 5667 AND 1193 5668.

APPENDIX 5.4
WORK ORDER- 1193 5669 AND 1193 5670

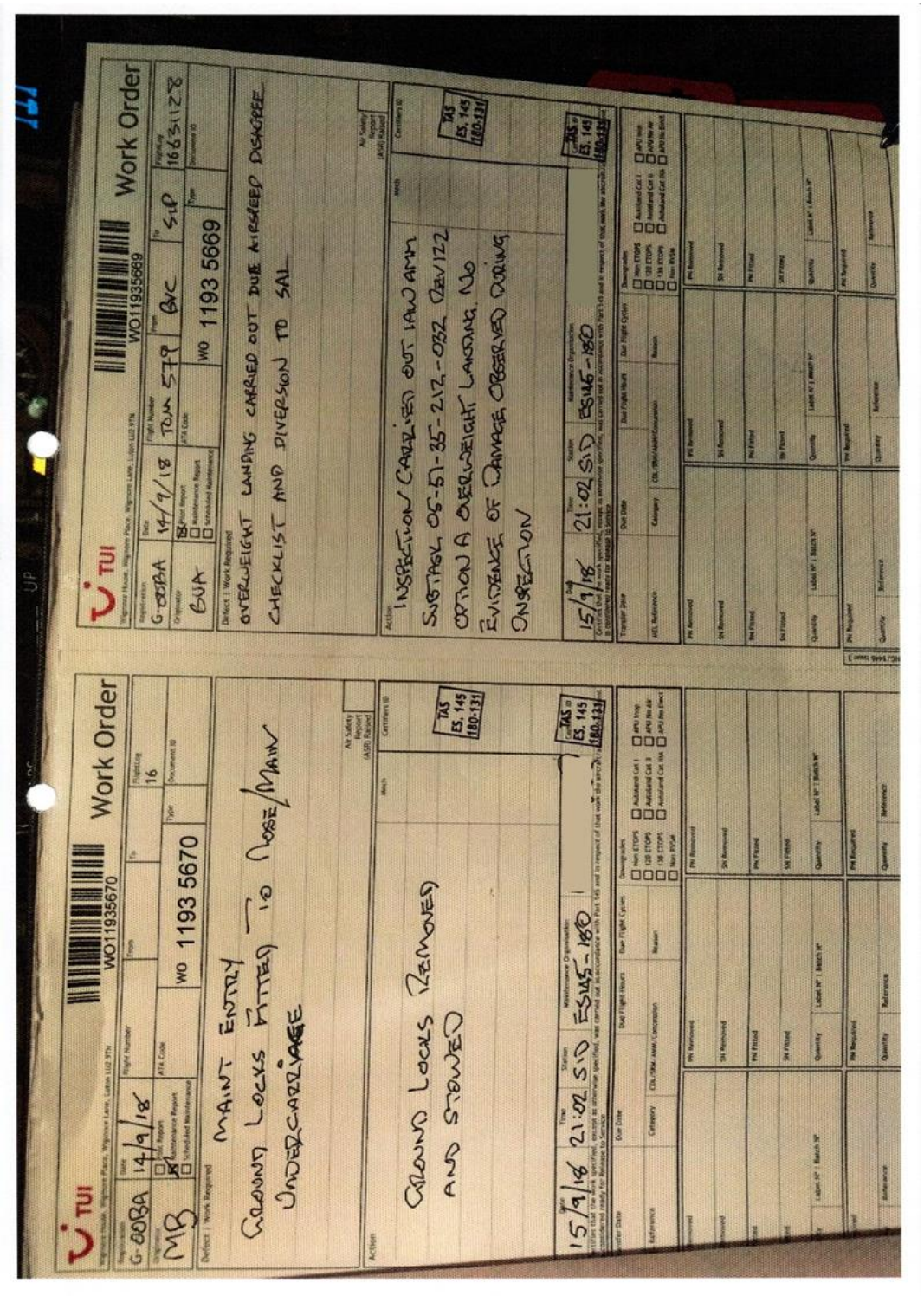

Figure 14 - WORK ORDER- 1193 5669 AND 1193 5670

APPENDIX 5.5
WORK ORDER- 1193 5671 AND 1193 5672

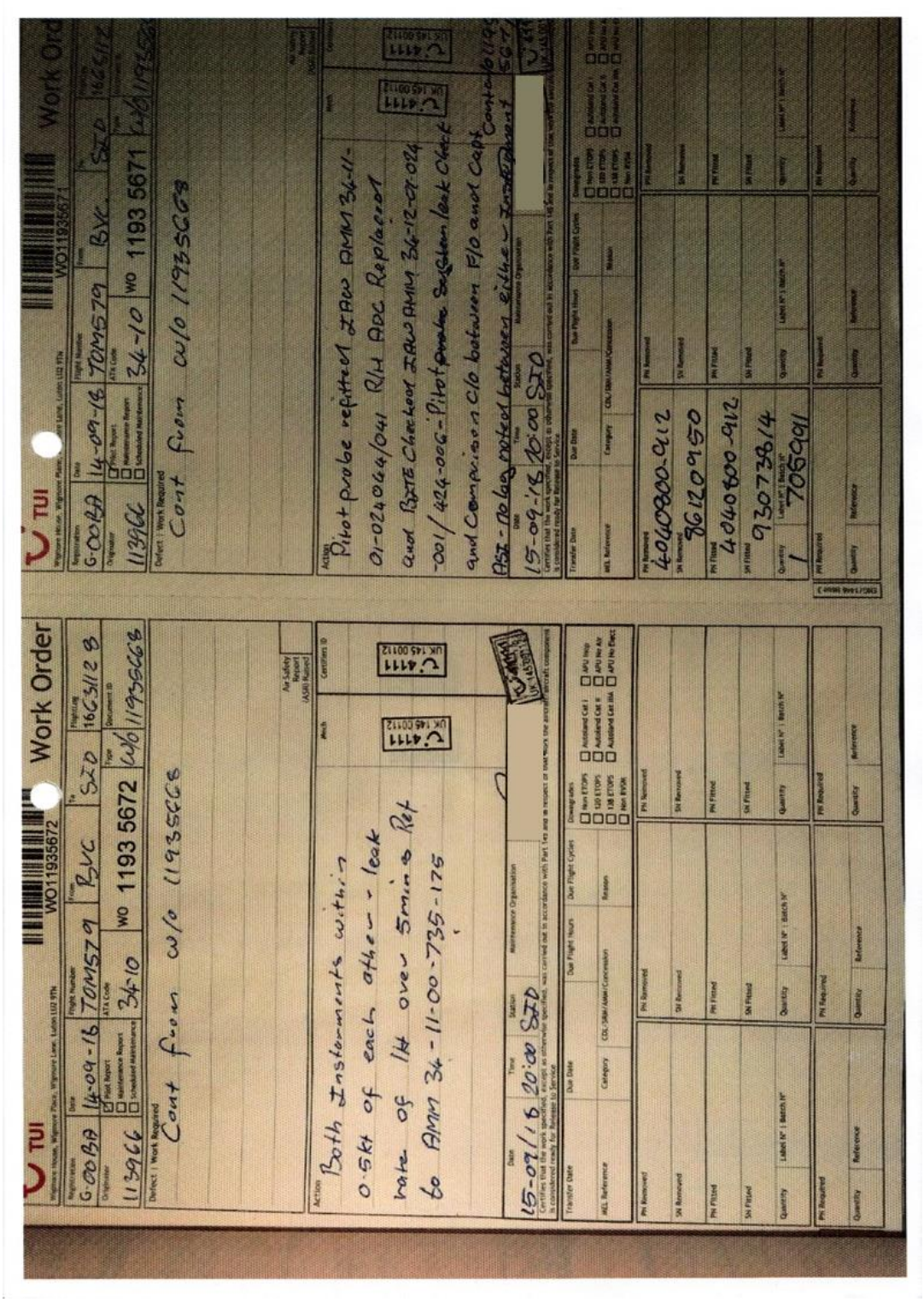

Figure 15 - WORK ORDER- 1193 5671 AND 1193 5672

APPENDIX 5.6
PITOT-STATIC SYSTEM COMPONENTS

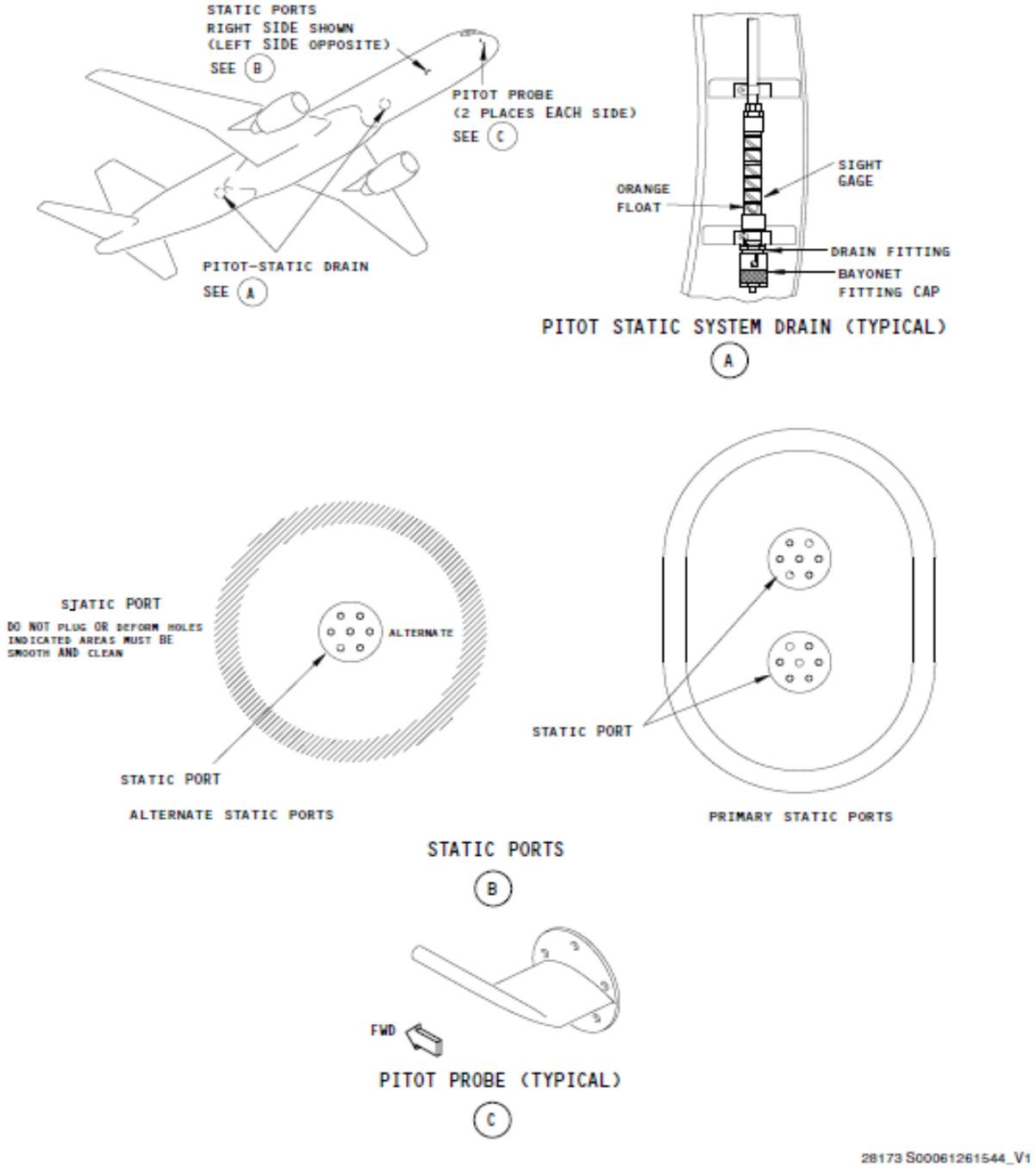

Figure 16 - PITOT-STATIC SYSTEM COMPONENTS

APPENDIX 5.7
PITOT-STATIC SYSTEM SCHEMATIC

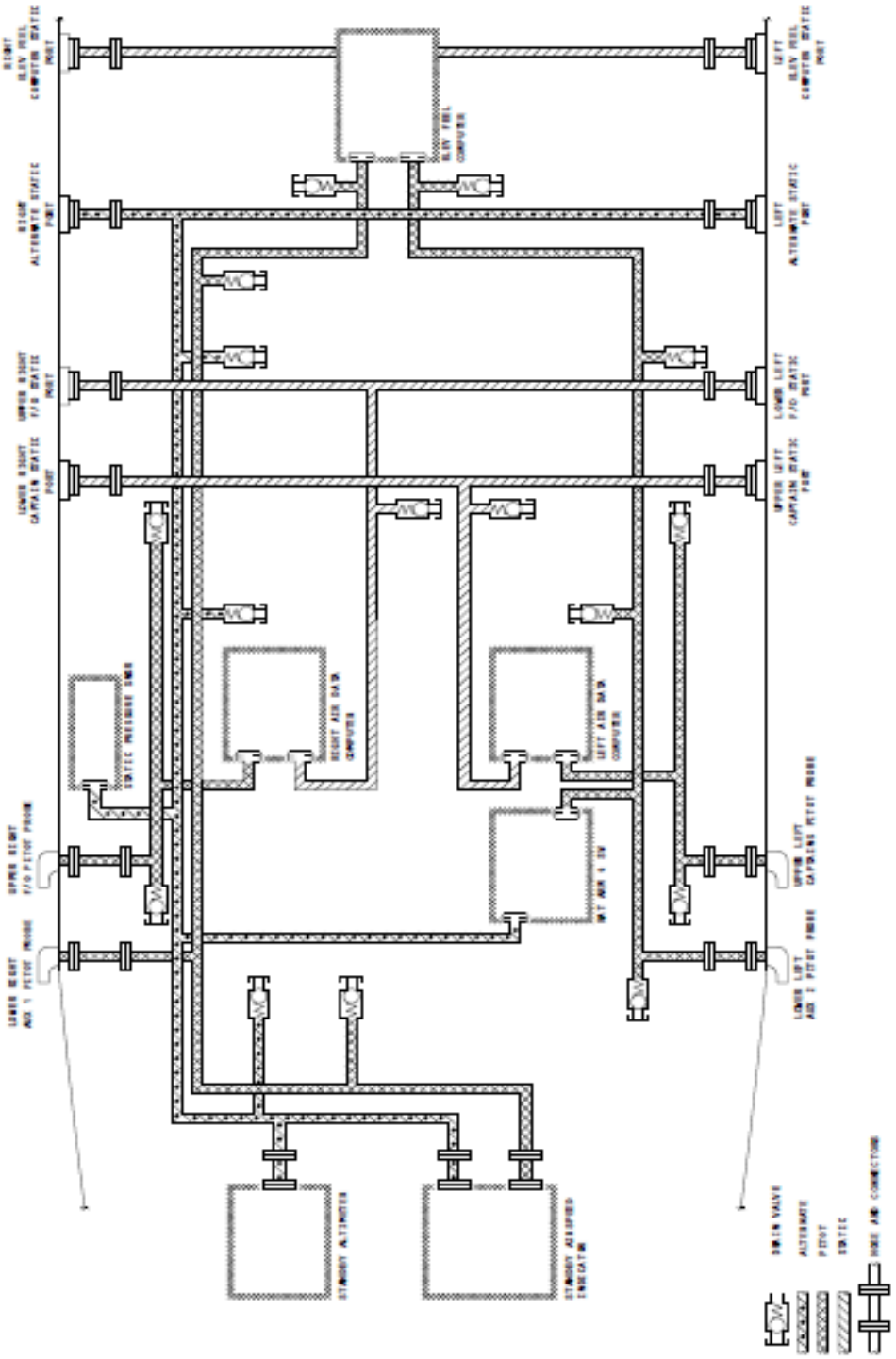

Figure 17 - PITOT-STATIC SYSTEM SCHEMATIC

APPENDIX 5.8
PITOT-STATIC SYSTEM COMPONENT LOCATION

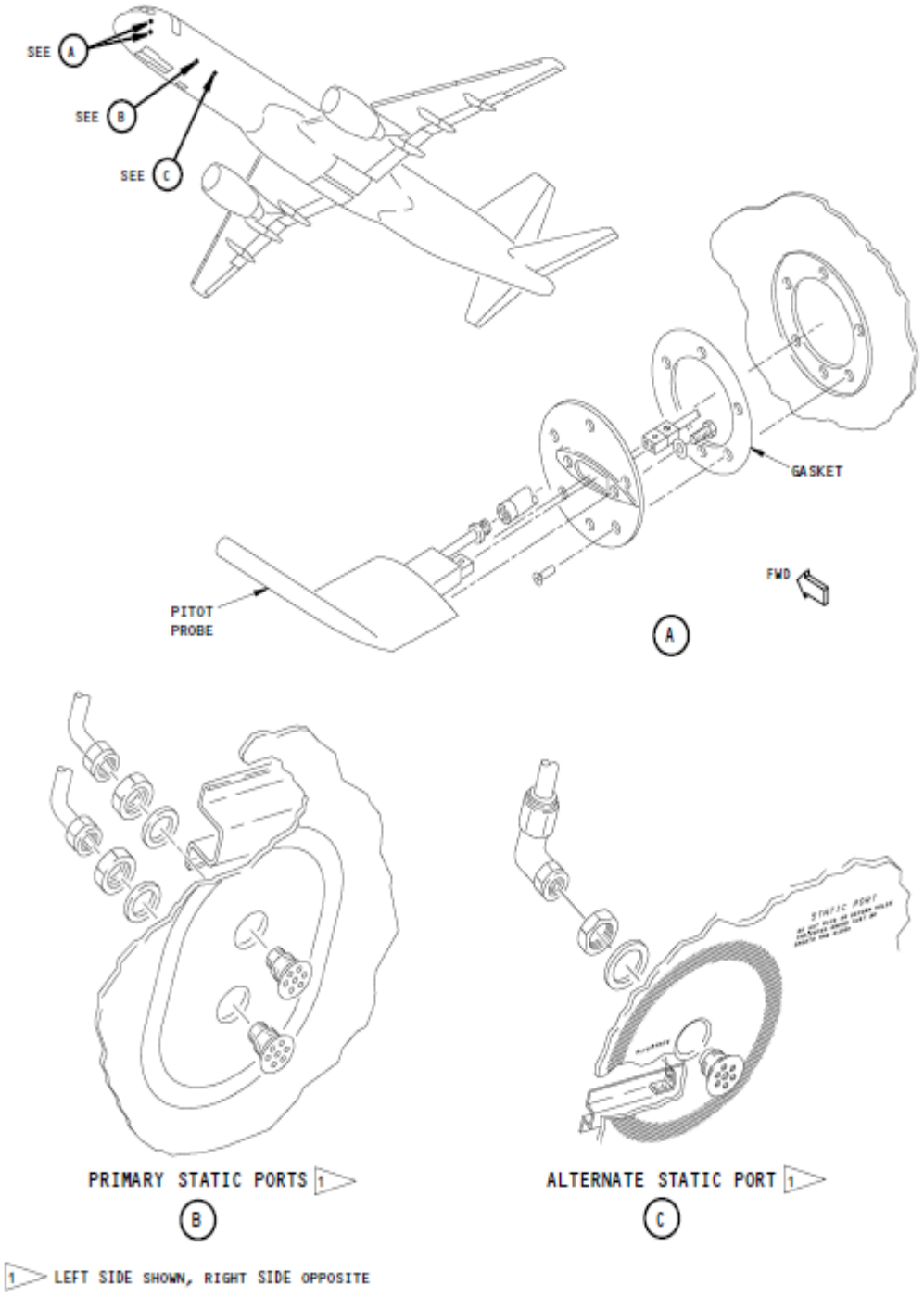

Figure 18 - Pitot-Static System Component Location

APPENDIX 5.9
ELECTRONIC ATTITUDE DIRECTION INDICATORS (EADIS)

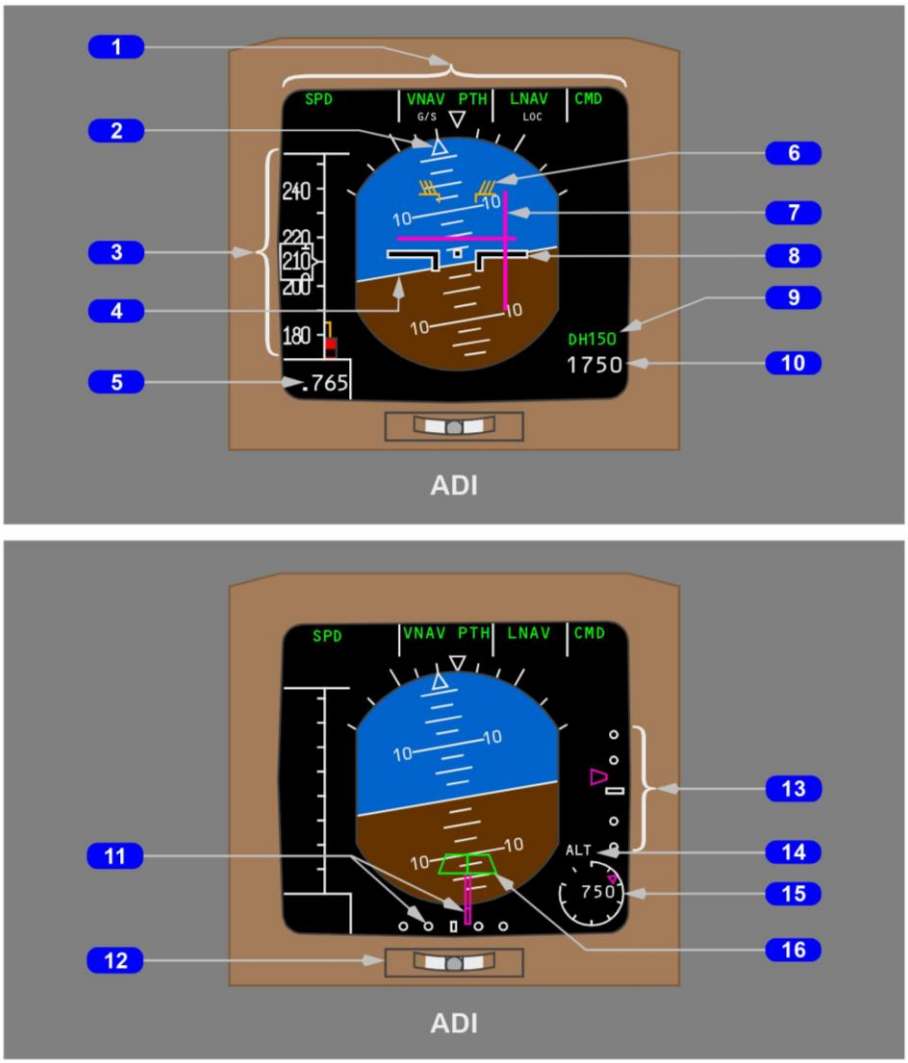

Figure 19 - Electronic Attitude Direction Indicators (Eadis)

1 Flight Mode Annunciations

Displays Autopilot Flight Director System (AFDS) mode status. Refer to Automatic Flight, Chapter 4 for description.

2 Bank Pointer and Scale

Indicates IRS bank in reference to the bank scale.

3 Speed Tape Airspeed Indicator

4 Horizon Line and Pitch Angle Scale

Indicates the IRS horizon relative to the airplane symbol. Pitch scale is in 2.5 degree increments.

5 Mach Number

6 Pitch Limit Indicator

7 Flight Director Command Bars

8 Airplane Symbol

9 Decision Height

10 Radio Altitude

11 Localizer Pointer and Deviation Scale

12 Slip Indicator

Indicates coordinated flight.

13 Glideslope Pointer and Deviation Scale

14 Height Alert

15 Radio Altitude Dial

16 Rising Runway

APPENDIX 5.10
COMMUNICATION TRANSCRIPT

13:05 LT - On September 14, 2018 at RWY03 a Boeing 757-200 aircraft, registration G-OOBA took off from GVBA International Airport Aristides Pereira to destination EGKK London Gatwick Airport performing the regular flight TOM579;

13:09:12 LT – TOM579 declared a MAYDAY, MAYDAY, MAYDAY emergency call on departure from GVBA, due to experiencing a disagree condition with an airspeed indication between Captain's and First Officer's indicators;

13:09:33 LT – GVBA TWR requested TOM579 to contact Sal APP on 126.4;

13:09:39 LT – TOM579 contacted Sal APP and declared a MAYDAY, MAYDAY, MAYDAY emergency call, due to partial instrument failure on departure from GVBA and requested to take a hold climbing to an altitude of 6000 feet;

13:10:01 LT – APP authorized TOM579 to proceed to CVS for hold;

13:10:06 LT – TOM579 confirmed AAP to CVS for hold TOM579;

13:10:23 LT – At CVS, TOM579 requested APP to climb to an altitude level of 6000 feet;

13:10:32 LT – APP approved TOM579, at a level of 6000 feet;

13:10:34 LT – TOM579 confirmed APP climb to a level of 6000 feet;

13:12:50 LT – TOM579 requested APP to continue the climb to a level of 8000 feet, to avoid adverse weather conditions;

13:12:58 LT – APP asked TOM579 to confirm its request of a level of 8000 feet;

13:13:00 LT – TOM579 affirmed APP, clarifying level 80;

13:13:04 LT – APP confirmed TOM579 8000 feet, and a transition level of 85;

13:13:60 LT – TOM579 confirmed its climb to an altitude of 8000 feet;

13:16:35 LT – TOM579 contacted APP Radar "this is MAYDAY TOM579 requesting air field data in Sal please";

13:17:06 LT – APP requested TOM579 to repeat;

13:17:09 LT – TOM579 requested APP air field data at Sal;

13:17:13 LT – APP transmitted TOM579, at Sal wind 120º 09kts, 10 km, SCT013 plus SCT015, T30, QNH 1013;

13:17:31 LT – TOM579 confirmed APP information copied QNH1013, “thanks stand by for further intention”;

13:17:37 LT – APP confirmed TOM579, information Roger;

13:24:58 LT – APP contacted TOM579;

13:25:13 LT – APP contacted TOM579;

13:25:16 LT – TOM579 replied to APP, TOM579 Sal, go ahead;

13:25:19 LT – APP contacted TOM579, informing, “Roger, we have an estimate within seven minutes” asking, “No problem for you?”

13:25:26 LT – TOM579 contacted APP to repeat;

13:25:30 LT – APP repeated to TOM579, “we have an estimate to Sal within seven minutes”;

13:25:34 LT – TOM579 replied to APP, “negative we are going to be longer than that”;

13:25:37 LT – APP confirmed to TOM579, Roger;

13:42:59 LT – TOM579 contacted APP, asking for a wind check;

13:43:04 LT– APP replied to TOM579, informing Wind 120º/09kts;

13:43:59 LT – APP contacted TOM579 Sal;

13:45:15 LT – TOM579 replied to APP, Sal Radar this is TOM579, we are ready to commence approach now and request vectors for the ILS RWY01;

13:45:23 LT – APP informed TOM579, Roger TOM579 fly HDG215;

13:45:31 LT – TOM579 contacted APP, TOM579;

13:46:09 LT – APP contacted TOM579 to confirm intention to descent now or maintain;

13:46:17 LT – TOM579 contact APP, requesting descent now and requesting a vector to twelve miles final;

13:46:24 LT – APP confirm TOM579, Roger descent to 2000 feet and QNH1013 TRANSITION LEVEL 85;

13:46:30 LT – TOM579 confirm APP, DESCENT ALTITUDE 2000 feet, and QNH1013;

13:46:36 LT – APP reply TOM579, Roger, I will give you the vectors, fly HDG170;

13:46:45 LT – TOM579 contact APP, HDG170 Roger;

13:47:23 LT – APP requested TOM579 to confirm what kind of problem, confirm what kind of problem he has on board?

13:47:32 LT – TOM579 inform APP, we had an instrument failure with air speed indication. We not (imperceptible) now enable to continue back to destination (imperceptible) we expecting;

13:47:49 LT – APP contact TOM579 to say thank you, giving directives to turn left HDG100;

13:47:57 LT – TOM579 contact APP, replying HDG 100, just go about altitude to leave now so we can need a list to 15 miles final;

13:48:05 LT – APP confirm TOM579, Roger;

13:48:55 LT – TOM579 request APP to confirm heading;

13:48:59 LT – APP confirm TOM579, 100 left;

13:49:01 LT – TOM579 to APP, 100;

13:50:10 LT – TOM579 contact APP, Radar TOM579;

13:50:14 LT – APP reply to TOM579, turn left HDG040 cleared ILS RWY01;

13:50:18 LT – TOM579 reply to APP, 040 cleared for ILS RWY01 TOM579 and we are very heavy on landing, so we will require the fire service, Fire Service, to check the operation for landing we will need full length of runway;

13:50:31 LT – APP reply to TOM579, is already advised;

13:50:42 LT – APP reply to TOM579, is already in position…. TOM579. Fire Service is already in position. Ok?

13:50:48 LT – TOM579 reply to APP, Roger TOM579;

13:50:55 LT – APP contact TOM579, to contact TWR, Amílcar Cabral TWR 1197;

13:51:00 LT – TOM579 reply to APP, in event if we were to go around we need to climb straight ahead;

13:51:04 LT – APP reply to TOM579, Roger;

13:52:37 LT – APP contact TOM579 to contact TWR, Amílcar Cabral TWR 1197;

13:52:42 LT – TOM579 reply to APP, 57…..TOM579;

13:52:49 LT – TOM579 contact TWR, TWR TOM579 established 01;

13:52:54 LT – TWR reply to TOM579, TOM579 Amílcar Cabral TWR, wind 110º 11kts RWY01 cleared to land;

13:53:00 LT – TOM579 reply to TWR, cleared to land 01 TOM579;

13:53:04 LT – TWR contact TOM579, TOM579 Fire Brigade on standby position;

13:54:50 LT – TWR inform TOM579, wind 110º KTs;

13:56:35 LT – TWR contact TOM579, TOM579 Amílcar Cabral TWR;

13:56:38 LT – TOM579 reply to TWR, 579….;

13:56:42 LT – TWR contact TOM579, TOM579 confirm are you able to taxi safely to the apron?

13:56:52 LT – TOM579 contact TWR, TOM579 wait, affirm, we would like fire truck just to come and check the temperature of the brakes;

13:57:02 LT – TWR reply to TOM579, TOM579 hold at TWY Alfa4. Cleared of runway.

13:57:08 LT – TOM579 reply to TWR, TOM579;

13:58:33 LT – TWR contact TOM579, TOM579 Sal;

13:58:35 LT – TOM579 reply to TWR, TOM579 go ahead;

13:58:38 LT – TWR inform TOM579, TOM579, according to the fire brigade, everything appears to be fine;

13:58:45 LT – TOM579 reply to TWR, TOM579 thank you a lot, in that case we would like to taxi to the apron;

13:58:50 LT – TWR contact TOM579, TOM579 taxi with caution via Alfa and Bravo;

14:02:12 LT – TWR contact TOM579, TOM579 continue taxi straight ahead second left TWY Bravo;

14:02:12 LT – TOM579 reply to TWR, TWY Bravo……;

14:02:17 LT – TOM579 contact TWR, TOM579 just information we require air …. Maintenance of the aircraft so we were being carrying on where for long;

14:02:17 LT – TWR reply to TOM579, Roger. After park contact Handling Service;

14:14:26 LT – TWR contact TOM579, TOM579 Sal;

14:14:36 LT – TWR contact TOM579, TOM579 Sal;

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1. Annex 13 of ICAO;
2. ICAO Doc.9156;
3. ICAO Doc.9422;
4. ICAO Doc.9756, PART1, PART2, PART3 & PART4;
5. ICAO Doc.9859;
6. DL-nº38 / 2009, article 14, of September 28;
7. Aircraft Maintenance Manual;
8. Boeing Flight Crew Training Manual;