



**AIRCRAFT SERIOUS INCIDENT  
FINAL REPORT  
SI 01/19**

**Air Accident Investigation Bureau (AAIB)  
Ministry of Transport Malaysia**

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**Serious Incident involving Fixed Wing Aircraft Boeing 737 - 800  
Registration 9M - MXH  
at Sultan Thaha Syaifuddin Airport (WIJJ) Jambi, Indonesia  
on the 25 February 2019**



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**AIR ACCIDENT INVESTIGATION BUREAU (AAIB)  
MALAYSIA**

**SERIOUS INCIDENT REPORT NO. : SI 01/19**

**OPERATOR : MALAYSIA AIRLINE BERHAD**

**AIRCRAFT TYPE : BOEING 737 – 800**

**NATIONALITY : MALAYSIA**

**REGISTRATION : 9M-MXH**

**PLACE OF OCCURRENCE : SULTAN THAHA SYAIFUDDIN  
AIRPORT (WIJJ) JAMBI,  
INDONESIA**

**DATE AND TIME : 25 FEBRUARY 2019 AT 1415 UTC**

This investigation is carried out to determine the circumstances and causes of the accident with a view to the preservation of life and the avoidance of accident in the future: It is not the purpose to apportion blame or liability (Annex 13 to the Chicago Convention and Civil Aviation Regulations 2016).

## INTRODUCTION

### **The Air Accident Investigation Bureau of Malaysia**

The Air Accident Investigation Bureau (AAIB) is the air accident and serious incident investigation authority in Malaysia and is responsible to the Ministry of Transport. Its mission is to promote aviation safety through the conduct of independent and objective investigations into air accidents and serious incidents.

The AAIB conducts the investigations in accordance with Annex 13 to the Chicago Convention and Civil Aviation Regulations of Malaysia 2016.

In carrying out the investigations, the AAIB will adhere to ICAO's stated objective, which is as follows:

*“The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability”.*

Accordingly, it is inappropriate that AAIB reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

## AIRCRAFT ACCIDENT/SERIOUS INCIDENT REPORT

**Aircraft Type** : **Boeing**

**Model** : **737 - 800**

**Owner** : **Malaysia Airline Berhad (MAB)**

**Nationality** : **Malaysia**

**Year of Manufacture** : **2012**

**Aircraft Registration** : **9M-MXH**

**Serial Number** : **40135**

**State of Registration** : **Malaysia**

**Place and State of Occurrence** : **Sultan Thaha Syaifuddin Airport (WIJJ),  
Jambi, Indonesia**

**Date and Time of Occurrence** : **25 February 2019 1415 UTC**

**All times in this report are UTC hours**

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## **SYNOPSIS**

On 25 February 2019, at 1250, a Boeing 737-800 bearing registration 9M-MXH performing a scheduled flight from Jakarta (CGK) enroute to Kuala Lumpur (KUL) with 120 passengers and 7 crew members, declared an emergency due to suspected fuel leak on main tank No.1.

Aircraft diverted to Jambi (DJB) and landed at 1426. Upon arrival at the bay and after engine shutdown, fuel indication in main tank No.1 increased. Engineer completed walk-around checks and found nil signs of fuel leak. Maintenance entry cleared by Garuda Maintenance Facility (GMF) Engineer. Aircraft departed DJB for KUL at 1912 after 4 hours and 32 minutes in DJB.

In accordance to ICAO Annex 13, after considering the availability and access to the aircraft which was declared airworthy and flown back to KUL on the same day of the incident, Indonesia as the State of Occurrence has delegated the investigation to Malaysia as the State of Operator and Registry.

## **1.0 FACTUAL INFORMATION**

### **1.1 History of the Flight**

On 25 February 2019, at 1308, a Boeing 737-800 bearing registration 9M-MXH was performing a scheduled flight from Jakarta (CGK) to Kuala Lumpur (KUL). There was a total of 120 passengers on board (118 adults and 2 infants), and 7 crew members (2 flight crew and 5 cabin crew).

The Captain acted as the Pilot Monitoring (PM) initially, while the Second Officer was the Pilot Flying (PF).

At 1401, while cruising at FL 380, in-flight fuel check was carried out abeam Palembang VOR (PLB) with no signs of the fuel leak.

Flight crew noticed a fuel imbalance of approximately 20 kilograms (kgs). Fuel pumps switches for main tank No. 1 was selected OFF but the flight crew noticed that the fuel quantity in main tank No. 1 decreased at a faster rate than the main tank No. 2.

According to both flight crew, they then checked several times whether they switched off the correct fuel pumps.

Fuel alert "IMBAL" triggered at 1404. The Captain then took over controls as PF and the Second Officer reverted to PM duties. The PM then carried out the Non-Normal Checklist. From the "Non-Normal - fuel IMBAL" checklist the flight crew were directed to the "Non-Normal - FUEL LEAK ENGINE" checklist.

While going through the "Non-Normal - FUEL LEAK ENGINE" checklist, the action item No. 6 which requires flight crew to check the change in fuel imbalance of 230 kgs within 30 minutes or less was not conducted. This does not affect the decision as flight crew chose "Engine fuel leak is not confirmed" at step 8.

Flight crew decided that fuel leak exist based on the Additional Information at the end of the checklist which includes "The total fuel quantity was decreasing at an abnormal

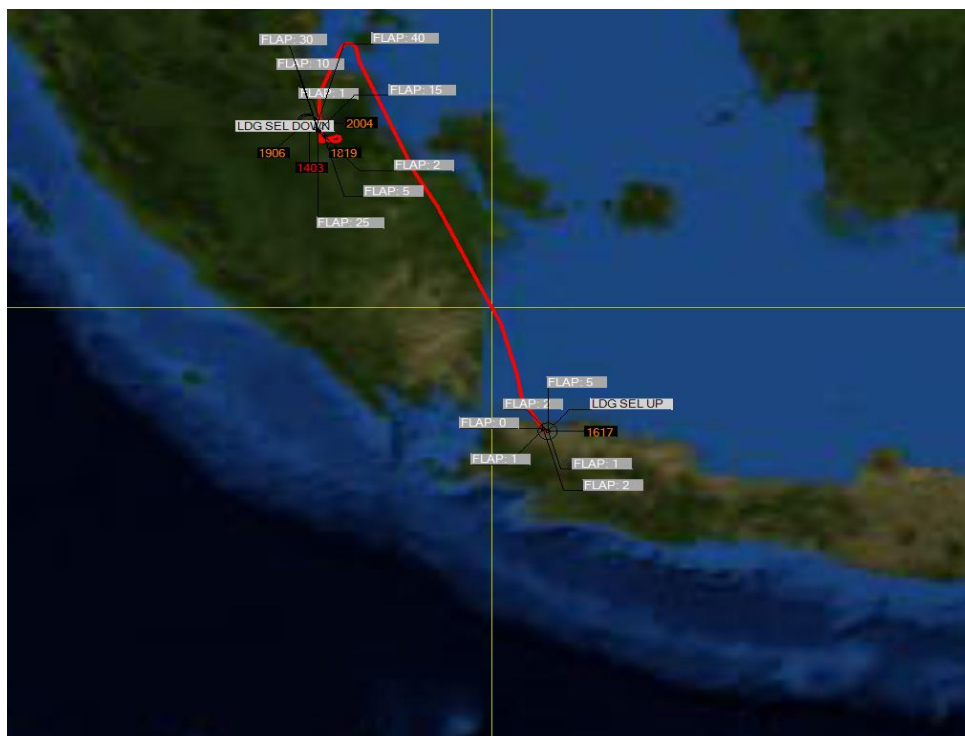
rate, the fuel IMBAL alert showed, and the fuel LOW alert showed”.

The flight crew initially requested a diversion to Singapore (SIN) and was cleared to SIN. According to the flight crew, they then noticed that the fuel quantity in main tank No. 1 reduced at a faster rate.

At 1416, the fuel “LOW” alert triggered on main tank No. 1. The Captain requested air traffic controller for the nearest airport and was informed that Jambi (DJB) was the nearest. Captain then declared an emergency and was cleared to DJB.

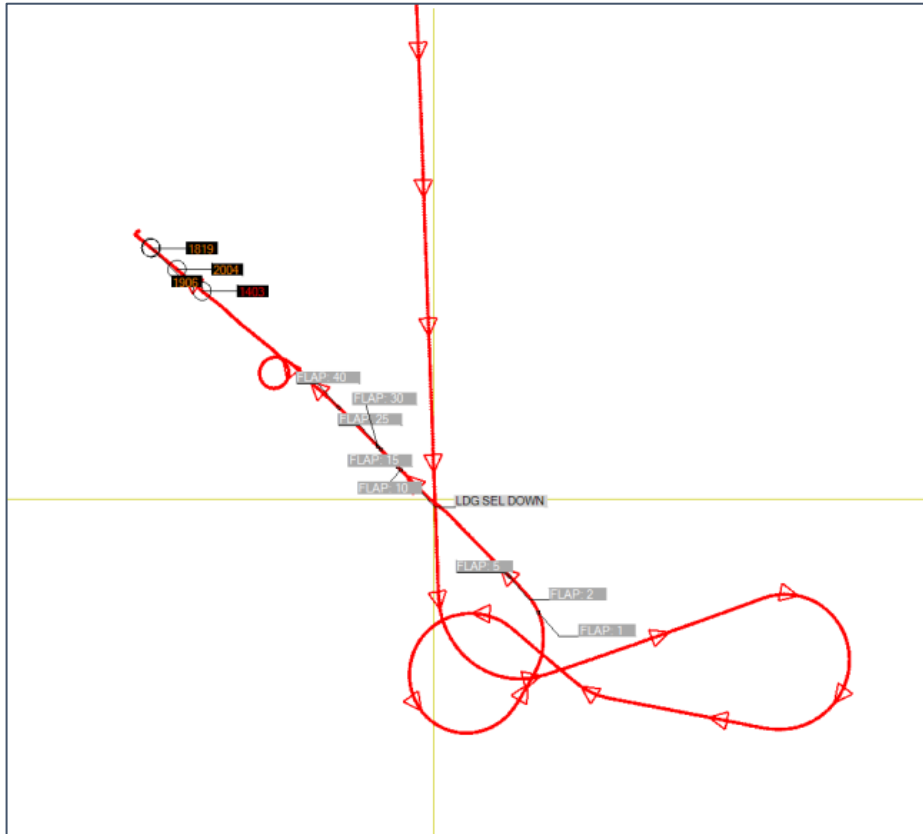
As the approach charts for DJB were not available, the flight crew requested the required information from the air traffic controller and the information was given by another aircraft on the same frequency.

Aircraft conducted one left orbit on manual flying to reduce the height to intercept ILS runway 31 in DJB. Aircraft landed safely in DJB at 1450 and was assigned to Bay 6. The aircraft did not suffer any damage and no injuries were reported to the crew and passengers.



**Aircraft Flight Path from CGK to DJB**





**Aircraft Approach Path in to DJB**

Fuel quantity in main tank No. 1 indicated 630 kgs after landing. The fuel quantity, however, increased to 2380 kgs after engine shutdown.

Aircraft was attended to by Garuda Maintenance Facility (GMF) AeroAsia engineers. GMF AeroAsia engineer found no physical signs of the fuel leak. The Engineer then carried out a fuel quantity system test and found nil anomalies. There was also no sign of water contamination in the tank. A magna stick check was carried out after refueling. The magna stick check reading was compared to the fuel quantity indicator reading and no discrepancy was found.

As Malaysia Airlines does not have a ground handling agreement with GMF AeroAsia in DJB, a one-time dispensation was given by Manager, Quality Assurance (MQA), Engineering MAB to the GMF AeroAsia Engineer for a once-off certification.

On arrival at DJB, the following documents were made available to the flight crew:

- a. DJB Airport Facility Chart and Instrument Arrival Chart.
- b. DJB ILS 31 Approach Chart.

Multiple personnel from various departments within MAB contacted the flight crew requesting for information regarding the diversion. The flight crew had to explain the situation repeatedly to each personnel.

Aircraft departed DJB at 1858 once all the documentation was completed and arrived safely in KUL at 2021. There was no abnormal indication during the flight to KUL.

## 1.2 Injuries to Persons

INJURY	CREW	PASSENGER
Fatal	Nil	Nil
Serious	Nil	Nil
Minor	Nil	Nil
None	7	120

## 1.3 Damage to Aircraft

No damage to aircraft reported.

## 1.4 Other Damage

No other damage reported.

## 1.5 Personnel Information

### 1.5.1 Captain

The Captain was previously employed by MASwings, a subsidiary of Malaysia Aviation Group (MAG) and joined Malaysia Airlines Berhad (MAB) on 1 September 2016. The Captain held an Air Transport Pilot License (ATPL) issued by the Civil Aviation Authority Malaysia (CAAM). The validity of the ATPL license, ratings and flying hours are listed in the following:

<b>Status</b>		
<b>Nationality</b>		Malaysian
<b>Age</b>		54
<b>Gender</b>		Male
<b>License Type</b>		ATPL
<b>License Validity</b>		29 February 2020
<b>Medical Examination</b>		29 February 2020
<b>Aircraft Rating</b>		29 May 2019
<b>Instructor Rating</b>		Nil
<b>Flying Hours</b>	Total Hours	12911:01
	Total on Type	1901:30

### 1.5.2 Co-Pilot

It was the co-pilot's first line flying flight with MAB. The Co-pilot held a Commercial Pilot License (CPL) issued by CAAM. The validity of the CPL license, ratings and flying hours are listed in the following:

<b>Status</b>		
<b>Nationality</b>		Malaysian
<b>Age</b>		30
<b>Gender</b>		Male
<b>License Type</b>		CPL
<b>License Validity</b>		31 December 2019
<b>Medical Examination</b>		31 December 2019
<b>Aircraft Rating</b>		26 August 2019
<b>Instructor Rating</b>		Nil
<b>Flying Hours</b>	Total Hours	458:52
	Total on Type	253:52

### 1.5.3 Cabin Crew

There were five cabin crew members on board the flight. The validity of the qualifications and ratings were in accordance with the required regulatory and company policy.

## 1.6 Aircraft Information

### 1.6.1 General

<b>Aircraft</b>	Boeing 737-8H6
<b>Owner</b>	MSN INTERNATIONAL 40135, LTD
<b>Registration</b>	9M-MXH
<b>Serial No.</b>	40135
<b>C of A No.</b>	(Nil cert. serial number for new C of A)
<b>C of A Expiry</b>	31 Jan 2020
<b>C of R No.</b>	AR/16/186
<b>C of R Expiry</b>	28 Sep 2019
<b>Year of Manufacture</b>	31 Jan 2012

### 1.6.2 Fuel system

Both engines are normally pressure fed from the centre tank until the centre tank quantity decreases to near zero. The engine is normally pressure fed from their respective main tanks. Check valves are located throughout the fuel system to ensure the proper direction of fuel flow and to prevent the transfer of fuel between tanks.

Fuel "IMBAL" alert displayed amber when the following condition exist:

- a. Main tanks differ by more than 453 kgs.
- b. Inhibited when the aeroplane is on the ground.
- c. Inhibited by fuel LOW indication when both indications exist.
- d. Displayed until the imbalance is reduced to 91 kgs.

Fuel "LOW" alert displayed (amber) when the following condition exist:

- a. fuel tank quantity less than 907 kgs in related main tank.
- b. display remains until fuel tank quantity is increased to 1134 kgs.

## **1.7 Meteorological Information**

Weather was not a factor for this incident.

## **1.8 Aids to Navigation**

DJB was equipped with ILS RME Runway 31 (IJMB 109.9), VOR DME Runway 13 and 31 (JMB 117.5 MHz), and NDB Runway 31 (NX 365). All navigational aids were operational during the aircraft diversion.

## **1.9 Communications**

Standard communication protocol was used within Jakarta FIR.

## **1.10 Aerodrome Information**

The airport, named Jambi Sultan Thaha Syaifuddin has one runway comprising of Runway 13/31 with the length of 2220m and width of 45m. The aerodrome operates from 2300 to 1400.

## **1.11 Flight Recorders**

### **1.11.1 Cockpit Voice Recorder (CVR)**

The aircraft was equipped with an L3 Aviation Recorders, P/no: 2100-1025-22 S/no: 000744569. The CVR was removed from the aircraft and data readout was taken for the investigation. However, the audio readout was only available for the approach phase while the aircraft departing from DJB to KUL and not related to the diversion.

### **1.11.2 Flight Data Recorder (FDR)**

The FDR was not removed for this incident.

## **1.12 Wreckage and Impact Information**

Not applicable.

## **1.13 Medical and Pathological Information**

Not applicable.

## **1.14 Fire**

No pre or post incident fire.

## **1.15 Survival Aspects**

Not applicable.

## **1.16 Test and Research**

Not applicable.

## **1.17 Organisational and Management Information**

Not applicable.

## **1.18 Additional Information**

### **1.18.1 Training Syllabus for B737-800 Conversion Training**

The current syllabus for B737-800 conversion training was reviewed by the investigation team. It was found that the training for Fuel Leak was available, which includes identifying fuel leak, comparing fuel log against actual fuel burn, consideration for engine shutdown, and balancing fuel.

### **1.18.2 Indoctrination Program for Direct Entry Commander**

The indoctrination program for direct entry commander includes the company's operations policies and procedures, which includes stable approach criteria, fuel policy and diversion procedures.

### **1.19 Useful and Effective Investigation Technique**

Nil

### **1.20 Limitations during Investigation**

The investigation was conducted without information from the CVR as the audio readout was only available for the approach phase while the aircraft was departing from DJB to KUL and not related to the diversion.

Inflight radio transmission recording from Jakarta FIR during the flight was not requested as it is not crucial to this investigation.

## **2.0 ANALYSIS**

### **2.1 General**

The Captain and Co-Pilot had a valid license and qualified in accordance with applicable Regulations and Operator's requirements. The cabin crew involved were trained and qualified in accordance with the regulatory (CAAM) and company proficiency requirement.

Both the flight and cabin crew's Flight Duty Period (FDP) and rest period provided prior to this duty pattern was in accordance with the Flight and Duty Time Limitation Scheme approved by Civil Aviation Authority Malaysia (CAAM).

The aircraft was properly certificated, equipped and maintained in accordance with the regulations and approved procedures. The aircraft did not have

significant pre-existing problems or deferred defects that may have contributed towards this incident.

## **2.2 Diversion Decision Due to Suspected Fuel Leak**

Flight crew initially suspected a fuel leak due to fuel “IMBAL” alert triggered – where the fuel difference between main tank No.1 and main tank No.2 was more than 453 kgs. The flight crew did the “Non-Normal - fuel IMBAL” checklist which directed them to the “Non-Normal - FUEL LEAK ENGINE” checklist.

The “Non-Normal - FUEL LEAK ENGINE” checklist guided the pilot that there was no fuel leak. However, the fuel imbalance kept on increasing. The flight crew went through the “Additional Information” section of the checklist which gave guidance on reasons that an engine fuel leak should be suspected. As the total fuel quantity was decreasing at an abnormal rate and the fuel LOW alert showed, the flight crew suspected there was a fuel leak.

## **2.3 Diversion Decision to DJB**

Due to the fuel leak, Captain mentioned that he wanted to land the aircraft down as soon as possible to avoid any controllability issues. Initially, the decision was the divert to SIN. However, Captain decided to divert to a nearer airport which was DJB, as advised by ATC.

The Operator's Operational Manual – A (OMA) indicated that adequate aerodrome shall have the applicable approach charts. The Operator does not have DJB approach charts in the aircraft as DJB is not listed as an adequate aerodrome for the Operator. Aircraft was already heading to DJB when the Co-pilot asked the Captain if they can divert to DJB without the approach charts. Captain convinced the Co-pilot that it was a safe decision.



## **2.4 Maintenance Action by Engineering & Maintenance**

Initial inspection and troubleshooting carried out by GMF AeroAsia personnel at DJB, no evidence of fuel leak was observed at wing and engine area. Fuel quantity system test revealed that 28- 41108 COMPENSATOR unit having a bad data. A second test was performed, test pass. Water draining was carried out from the tanks. Nil sign of water contamination found in the fuel.

In KUL, MAB engineer carried out microbiological growth on the fuel tank as per AMM 28-10-00. Result was negligible, no further action required.

MAB engineer also carried out inspection on the fuel tank electrical bussing plug for any sign of corrosion or damages to the pin. Nil anomalies found. Fuel Tank wiring continuity and resistance check was performed as per FIM 28-41 task 807. All continuity and resistance values are within limits. The bussing plug was cleaned prior installation.

Fuel Quantity Processor Unit (FQPU) was replaced for evaluation due nil positive finding.

The tank No. 1 compensator was also replaced due intermittent bad data previously tested at DJB. Post installation test was satisfactory.

## **2.5 Spurious Unreliable Fuel Quantity Indication**

The tank No. 1 indicated 630kg on landing, however, the fuel indication returned to normal after engine shut down. The tank No. 1 then indicated 2380kgs, which was the correct quantity in the tank.

Initial inspection carried out by GMF AeroAsia found no evidence of fuel leak around the wing and engine area. Initial test faulted the compensator. However, the second test carried out found nil anomalies.

The FQPU was replaced in KUL on 27 Feb 2019 for further evaluation. As of 7 June 2019, there have been no further reports of No. 1 main fuel quantity indication error or imbalance since the FQPU was replaced.

### **3.0 CONCLUSION**

#### **3.1 Findings**

3.1.1 The flight crew were licensed and qualified for the flight in accordance with applicable regulations.

3.1.2 The flight crew held valid medical certificates and was medically fit to operate the flight.

3.1.3 The flight crew were provided adequate rest and their flight duty times were in compliance with the Flight Time Limitation Scheme established by MAB and approved by CAAM.

3.1.4 The aircraft was properly certificated, equipped and maintained in accordance with the applicable regulations and Operator's requirements.

3.1.5 When reading the Fuel Leak Engine Non-Normal Checklist, the flight crew did not perform the item no 6. This lead to the checklist conclusion that the fuel leak was not confirmed. The flight crew decided that the fuel leak was present due to the aircraft total fuel quantity reduced at an abnormal rate and they had a fuel "LOW" alert.

3.1.6 Flight crew decided to divert to the nearest airport, which was DJB as informed by ATC due to the suspected fuel leak. After completion of the Fuel Leak Engine Non- Normal Checklist, there was still an almost linear increase in fuel imbalance, coupled with fuel alert "IMBAL" and fuel "LOW" alert, which caused the flight crew to confirm the suspected fuel leak.

3.1.7 The approach charts for DJB was not available to the flight crew and was not subscribed by the Operator. The Flight Management Computer (FMC) database also did not have approach charts for DJB. This is due to the fact that DJB is not a nominated alternate diversion airport for the Operator. The flight crew relied on radar vectors by ATC and obtained approach information from another aircraft in the vicinity.

3.1.8 Aircraft landed with fuel quantity in main tank No. 1 indicated 630 kgs. The fuel quantity increased to 2380 kgs after engine shutdown.

3.1.9 As the Operator does not have a ground handling agreement with GMF AeroAsia in DJB, a one-time dispensation was given by the Operator's Manager, Quality Assurance (MQA) and Engineering to the GMF AeroAsia Engineer for a once-off certification to fly back to KUL.

3.1.10 As of 7 June 2019, there have been no further reports of No. 1 main fuel tank configuration and imbalance since the Fuel Quantity Processor Unit (FQPU) was replaced on 27 Feb 2019. The strip down workshop report on the removed FQPU found the followings:

- a. J1 connector was damaged. J1 connector was replaced.
- b. Tank 1 circuit card assembly (CCA) failed the pre-test for Density. The clock signal from the OSC1 on the CCA was found faulty. OSC1 was replaced and subsequently passed the test.

3.1.11 The compensator strip report shows nil fault found during shop visit.

3.1.12 No previous report of fuel indication defect for the past 3 months before the incident.

3.1.13 Training for Fuel Leak was available during the Standard Transition Course to B737- 800.

3.1.14 The indoctrination program for direct entry commander includes a small portion of the company's operations policies and procedures, which includes license validity, stable approach criteria, among others.

3.1.15 After the diversion, according to the flight crew, a few personnel from various departments contacted the flight crew and requested for the explanation regarding the situation. The flight crew had to explain the situation multiple times.

3.2.16 Engineering & Maintenance actions taken at KUL after aircraft landed from DJB are as follows:

a. Water draining was carried out from the tanks. Nil sign of water contamination found in the fuel. MAB engineer carried out microbiological growth on the fuel tank as per AMM 28-10-00. Result was negligible, no further action required.

b. MAB engineer also carried out inspection on the fuel tank electrical bussing plug for any sign of corrosion or damages to the pin. Nil anomalies found. Fuel Tank wiring continuity and resistance check was performed as per FIM 28-41 task 807. All continuity and resistance values are within limits. The bussing plug was cleaned prior installation.

c. Fuel Quantity Processor Unit (FQPU) was replaced for evaluation due to nil positive findings.

d. Tank No. 1 compensator was replaced on 9th May 2019. Post installation test was satisfactory.

3.2.17 Flight Operations action taken is as follows:

a. Flight crew involved has been coached regarding diversion decision and checklist reading.

### **3.2 CAUSES/CONTRIBUTING FACTORS**

The main cause of this incident was attributed to a technical fault of the Fuel Quantity Processor Unit (FQPU). The fault from the bad J1 connector and faulty clock signal from OSC1 was the cause for the unreliable fuel tank 1 quantity indication. It resulted in fuel configuration and imbalance on No. 1 tank light to illuminate.

This caused the fuel from left and right tanks to show a gradual increase in imbalance with fuel "IMBAL" and fuel "LOW" alerts triggered. The flight crew initiated a diversion due to suspected fuel leak caused by the misleading fuel indication.

### **4.0 SAFETY RECOMMENDATIONS**

The Operator is to carry out the following safety recommendations:

4.1.1 To continuously monitor the FQPU with Original Equipment Manufacturer (OEM) for any reliability issues.

4.1.2 To coach the flight crew involved with regards to checklist reading and sequencing during training briefing and debriefs.

4.1.3 To include multiple checklist condition and high workload environment in future training sessions for flight crew during simulator training.

4.1.4 To have an operations one-stop centre or single contact point to channel correctly and promptly all relevant information relay to and from the Captain in an event of a diversion to an Adequate Aerodrome which is not the operator's destination.