BRIEFING to MEDIA

by

The Malaysian ICAO Annex 13 Safety Investigation Team for MH370
30th July 2018

on

SAFETY INVESTIGATION REPORT
MALAYSIA AIRLINES BOEING B777-200ER (9M-MRO)
8th March 2014
OBJECTIVE
AIR ACCIDENT OR INCIDENT INVESTIGATION

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

ICAO’s Annex 13, Chapter 3, General, para. 3.1, page 3-1 to the Convention on Civil Aviation Aircraft Accident and Incident Investigation
The Government of Malaysia, under Regulation 126(1) of the Malaysian Civil Aviation Regulations (MCAR) 1996, established on 25th April 2014 The Malaysian ICAO Annex 13 Safety Investigation Team for MH370 with 19 Malaysians and 7 Accredited Representatives (ARs) of 7 international air safety investigation authorities to investigate into the disappearance of MH370 on 8th March 2014.
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<td>Australia</td>
<td>Australian Transport Safety Bureau (ATSB)</td>
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<td>2.</td>
<td>China</td>
<td>Civil Aviation Administration of the People’s Republic of China (CAAC)</td>
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<td>3.</td>
<td>France</td>
<td>Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation civile (BEA)</td>
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<td>4.</td>
<td>Indonesia</td>
<td>National Transportation Safety Committee (NTSC)</td>
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<td>5.</td>
<td>Singapore</td>
<td>Transport Safety Investigation Bureau (TSIB)</td>
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<td>6.</td>
<td>United Kingdom</td>
<td>Air Accidents Investigation Branch (AAIB)</td>
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<tr>
<td>7.</td>
<td>United States of America</td>
<td>National Transportation Safety Board (NTSB)</td>
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## SECTION 1 - FACTUAL INFORMATION (ANNEX 13, CHAPTER 1, ITEMS 1.1 - 1.19)

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KEY AREAS ANALYSED

1) Diversion from Filed Flight Plan Route
2) Flight Crew Profile
3) Airworthiness & Maintenance and Aircraft Systems
4) Satellite Communications (SATCOM)
5) Wreckage and Impact Information
6) Cargo Consignment
7) Air Traffic Services from 0119 to 0632 MYT
1. DEP at 0042 MYT (08 March 14)
   on Runway 32R KLIA

2. At 0042 MYT -
   KL ATC cleared
   MH370 to climb
   to FL180

3. At 0043 MYT -
   KL ATC coordinated
   with HCM on direct
   line ETA at Waypoint
   IGARI at 0122 MYT

4. Last ACARS report occurred
   at 0107 MYT

5. MH370 reported
   FL350 at 0101 MYT.
   Repeated same transmision
   at 0107 MYT

6. At 0119 MYT
   KL ATC instructed
   MH370 to contact HCM
   on 120.9 MHz

7. At 0119 MYT
   “Goodnight Malaysian 370
   (last recorded transmission)

8. Radar recording
   MH370 passed
   IGARI at 0120 MYT

9. KL ATC captured
   last radar position
   at 0121 MYT
TURN BACK AND MILITARY RADAR (RMAF)

1. P3362: Appeared at 1739.37 UTC [0139:37 MYT]
3. P3401: Appeared at 1738:56 UTC [0138:56 MYT]
5. P3415: Appeared at 1747:32 UTC [0147:32 MYT]
7. P3426: Appeared at 1751:45 UTC [0151:45 MYT]
9. The primary target (military radar) appeared to track west-northwest direction joining RNAV Route N571 at waypoint VAMPI thence to 10 nm north MEKAR
   Source: RMAF
10. The primary target ended at 10 nm after MEKAR at 1822:12 UTC [0222:12 MYT]
    Source: RMAF
DIVERSION FROM FILED FLIGHT PLAN

1) Evidence shows that Flight MH370 diverted from the Filed Flight Plan Route.

2) The changes in the aircraft flight path after waypoint IGARI are difficult to attribute to anomalous system issues alone.

3) Flight simulator trials established that the turn back was made while the aircraft was under manual control and not using autopilot.

4) Civilian and Military radars consistent with each other.
5) Team believes position, bearing and heading of radar returns of Civilian and Military should be the same target.

6) Ho Chi Minh (HCM) and Medan ACC tracked aircraft for a while until it disappeared.

7) Autopilot has to be disengaged to achieve time closest to recorded data of 2 minutes 10 seconds.

8) Reason could not be established why only transponder signal from MH370 ceased and not from other aircraft on the radar display.
9) Not established if aircraft flew by anyone other than pilots

10) Based on review of the Military recorded radar display and printout - no evidence of rapid altitude and/or speed changes to indicate that MH370 was evading radar

11) Primary radar designated aircraft as “friendly” by RMAF and posed no threat to airspace security, integrity and sovereignty
FLIGHT CREW PROFILE

1) Pilot-in-Command of MH370

a) Personal Information
   • 53 years old from Penang
   • Married with 3 children
   • MCE (1978)

b) Work Experience
   • 18,000 hours
   • 8,700 hours on B777

c) Qualifications/Training
   • 1981 - Manila Flying School
   • 1983 - MAS Fokker 27
   • 1985 - FO of B737-200
   • 1991 - Captain B737-400
   • 1996 - Captain A330-300
   • 1998 - Captain B777-200ER
1) Pilot In Command of MH370 (cont.)

d) Medical History

- Spinal injury (Jan 2007) undergoing surgery
- Osteoarthritis (May 2007)
- No long-term medication
- No evidence of mental/psychiatric treatment
- No history of apathy anxiety or instability

e) Social Habits

- No conflict issues with family or friends
- No signs of social isolation/self neglect
- No abuse of alcohol/drug
- No change in habits/interest
- No stress or anxiety in audio-recordings
- No signs of behavioural significant in CCTV recordings
- No evidence of stress and anxiety
FLIGHT CREW PROFILE (cont.)

1) Pilot-in-Command of MH370 (cont.)

f) Competency

• Smooth career path
• Flawless safety records
• Ability to handle stress well
• Valid license
• Medically fit
• Within Duty Time Limitations and well-rested
• No personal issues with FO though flying first time together
2) First Officer of MH370

a) Personal Information
   - 27 years old from Kelantan
   - Not married
   - SPM
   - Langkawi Airspace Training 2008

b) Medical History
   - No health-related issue
   - Yearly medical checkup for continued licence to fly

c) Financial
   - 2 saving and a national trust fund accounts
   - Not much saving
   - 2 cars
   - 1 life insurance policy and a mortgage insurance policy for a car
2) First Officer of MH370 (cont.)

d) Career

• 2010 - FO B737
• 2012 - FO A330-330
• 2013 - FO B777-200
• 2014 - Last training flight B777

e) Work Experience

• Total: 2813:43 hours
• 39:11 hours on B777
PILOT-IN-COMMAND’S HOME SIMULATOR

1) PIC’s home flight simulator documented more than 2,700 coordinates retrieved from separate file fragments, mainly default game coordinates

2) Coordinates stored in Volume Shadow Information (VSI) file dated 03 February 2014 (VSI saved information when a computer is left idle for more than 15 minutes). Hence, the RMP Forensic Report could not determine if the waypoints came from one or more files
3) The RMP Forensic Report on simulator did not find any data that showed the aircraft was performing climb, altitude or heading manoeuvres, nor did it show a similar route flown by MH370

4) The RMP Forensic Report concluded no unusual activities other than game-related flight simulations
DETECTION OF HAND PHONE SIGNAL

1) The Telco service provider confirmed a signal “hit” occurred at 0152:27 MYT on 08 March 2014, coming from the mobile phone tower Location Base station (LBS) at Bandar Baru Farlim, Penang.

2) The “hit” was traced to the registered number xxx of the FO.

3) The signal “hit” did not record any communication except to confirm that it was in the ON mode signal related to the “hit”
## AIRWORTHINESS & MAINTENANCE AND AIRCRAFT SYSTEMS

### Manufacturer
**Boeing Company**

### Model
**B777-200ER**

### Registration
**9M-MRO**

### Engines
Rolls-Royce Trent

### Date of Manufacture
29 May 2002

### Certificate of Airworthiness
Valid till 02 June 2014

### Total Airframe Time (as of 07 March 2014)
53,471.6 hours

### Engines (Time in Service)
(as of 07 March 2014)
1. Engine 1 (Left): 40,779 hours/5,574 cycles
2. Engine 2 (Right): 40,046 hours/5,508 cycles

### 1 Major Repair
Damage to right wing tip during taxing at Pudong, China on 09 August 2012. Repair approved by FAA

### Last Airworthiness Directive
Replaced low pressure oxygen hoses in flight deck - reducing likelihood of potential fire
1) Records show all Airworthiness Directives (mandatory inspections and modifications) had been complied with

2) Technical Log Review since last D Check in June 2010 shows no significant defect trends

3) Engine Health Monitoring (EHM) trend reports over last 3 months show no evidence of unusual engine behaviour

4) Two EHM reports, (Take-off and Climb) were transmitted. Both show no unusual engine behaviour
5) Transmission of Central Maintenance Computing System (CMCS) messages during last 10 flights, showing the system was functioning normal.

6) No pre-existing defects affecting safety of flight.

7) Maintenance complied with Approved Maintenance Schedule except for the instance of expired SS FDR ULB (solid state flight data recorder underwater locator beacon) battery.
REMOTE CONTROL TAKEOVER OF AIRCRAFT

1) A system, once activated would remove all controls from pilots and automatically fly and land aircraft at predetermined location

2) Boeing received patent in November 2006

3) According to patent, bullet-proof cockpit doors and carriage of air marshals are vulnerable, so a need for such a system to foil hijack attempts
4) This ‘uninterruptible’ autopilot could be activated by pilots, on-board sensors or remotely via radio or satellite links.

5) Boeing has confirmed that it has not implemented the patented system or any other system to remotely pilot a commercial aircraft or aware of any Boeing commercial aircraft that has incorporated such technology.
6) 9M-MRO was delivered in May 2002 before the patent was issued in 2006

7) Aircraft modification data do not indicate that any such systems were installed on the aircraft post delivery

8) No evidence to support the belief that MH370 was taken over control remotely
## SATELLITE COMMUNICATIONS (SATCOM)

### 1) Handshake

<table>
<thead>
<tr>
<th>MYT</th>
<th>SATCOM TRANSMISSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0042</td>
<td>Aircraft left KLIA</td>
</tr>
<tr>
<td>0107</td>
<td>Last ACARS</td>
</tr>
<tr>
<td>0225</td>
<td>1(^{st}) handshake initiated by the aircraft</td>
</tr>
<tr>
<td>0239</td>
<td>Unanswered ground-to-air telephone call</td>
</tr>
<tr>
<td>0341</td>
<td>2(^{nd}) handshake initiated by ground station</td>
</tr>
<tr>
<td>0441</td>
<td>3(^{rd}) handshake initiated by ground station</td>
</tr>
<tr>
<td>0541</td>
<td>4(^{th}) handshake initiated by ground station</td>
</tr>
<tr>
<td>0641</td>
<td>5(^{th}) handshake initiated by ground station</td>
</tr>
<tr>
<td>0713</td>
<td>Unanswered ground-to-air telephone call</td>
</tr>
<tr>
<td>0810</td>
<td>6(^{th}) handshake initiated by ground station</td>
</tr>
<tr>
<td>0819</td>
<td>7(^{th}) handshake initiated by the aircraft</td>
</tr>
</tbody>
</table>
2) Data from the last seven SATCOM ‘handshakes’ were used to help establish the approximate path of the aircraft over the Indian Ocean.

3) At 0107 MYT SATCOM was used to send ACARS report which is normally sent every 30 minutes. However next report expected at 0137 MYT and subsequent were not received.
WRECKAGE AND IMPACT INFORMATION

1) 27 Significant Debris Recovered and Examined:

   • 3 pieces (Items 1, 10 and 19) **confirmed** to be from MH370
   • 7 pieces (Items 2, 3, 4, 6, 16, 22 & 27) as **almost certain** from MH370
   • 8 pieces (Items 5, 8, 9, 11, 15, 18, 20 & 26) as **highly likely** from MH370
   • 1 pieces (Item 7) as **likely** from MH370
   • 8 pieces (Items 12, 13, 14, 17, 21, 23, 24 and 25) **not identifiable**

   (26 of 27 pieces under custody of Malaysia. Flaperon still with French Judicial Authority)

2) Summary on Debris uploaded on: [www.mot.gov.my](http://www.mot.gov.my)
3) **Confirmed And Almost Certain Debris Identification**

<table>
<thead>
<tr>
<th>Status</th>
<th>Total</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Confirmed</strong></td>
<td>3</td>
<td>1) Reunion Island - Item 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Mauritius - Items 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Tanzania - Item 19</td>
</tr>
<tr>
<td><strong>Almost Certain</strong></td>
<td>7</td>
<td>4) Mozambique - Items 2, 3, 6 &amp; 22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5) South Africa - Item 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6) Madagascar - Item 16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7) Mauritius - Item 5</td>
</tr>
</tbody>
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**WRECKAGE AND IMPACT INFORMATION (cont.)**

**Keys**

- Item 1: Flaperon
- Item 2: Right Wing No. 7
- Item 3: Right Horizontal Stabilizer (upper)
- Item 4: Engine Nose Cowl
- Item 5: Door 1 Right Stowage Closet
- Item 6: Right Fan Cowling
- Item 10: Left Outboard Aft Flap
- Item 16: Cabin Interior Panel
- Item 19: Right hand Outboard Aft Flap
- Item 22: Vertical Stabilizer panel
4) To date, the main wreckage of MH370 has still not been found. However, items of debris possibly/confirmed from MH370, have been found as far north as the eastern coast of Tanzania and far south as the eastern coast of South Africa.

5) Damage examination found on the right flaperon and the right outboard flap has led to the conclusion that the right outboard flap was most likely in the retracted position and the right flaperon was probably at the neutral position at the time they separated from the wing.
<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>223,000 kg of take-off weight</td>
<td></td>
</tr>
<tr>
<td>17,000 kg of total PAX weight</td>
<td></td>
</tr>
<tr>
<td>10,000 kg of total cargo (gross weight)</td>
<td></td>
</tr>
<tr>
<td>3,300 kg of total baggage weight</td>
<td></td>
</tr>
<tr>
<td>4,500 kg of mangosteen</td>
<td></td>
</tr>
<tr>
<td>220 kg of lithium batteries and 2,200 kg of accessories</td>
<td></td>
</tr>
</tbody>
</table>
LITHIUM-ION BATTERIES

1) Assembled on 07 March 2014, packed and placed on wooden pallets

2) From Motorola forwarder NNR Global Logistics sent shipment to MASkargo Penang

3) Battery shipment physically inspected by MASkargo staff but not screened by MAS Security using x-ray machine (then no available x-ray machine large enough to screen cargo in Penang)

4) Also went through Customs inspection and clearance

5) Li-Ion batteries not classified as dangerous goods because packing adhered to the Guidelines stipulated in the Lithium Battery Guidance Document
MANGOSTEENS

1) 2,500 kg - Poh Seng Kian from Muar, the rest from Sumatra

2) Mangosteens placed in plastic baskets (8 to 9 kg per basket), sponge soaked with water put on top of baskets to maintain freshness. Loaded onto trucks and sent to MASkargo, KLIA

3) MAS provided Unit Load Device (ULD) to the forwarding agent
5) Fruits put into ULD, checked by Federal Agricultural Marketing Authority (FAMA) and MAS and loaded into aircraft - 4 ULDs used

6) A total of 85 shipment to China from January to May 2014

7) Regular consignment for the past few years

8) No irregularity in packing process
AIR TRAFFIC SERVICES FROM 0119 TO 0632 MYT

1) Transfer of control should be at 0122 MYT or when MH370 was over IGARI on radar
   (HCM ACC not aware that MH370 had been transferred at 0119) by transferring at 0119 MYT
   KL ATC Controller did not comply with established procedures

2) KL Radar Controller transferred aircraft before 0122 MYT and did not:
   • Record the time on the flight strip of MH370
   • Monitor progress of flight MH370 after transfer of control, and when aircraft dropped off
     from radar display at 0121 MYT

3) HCM ACC at 0122 MYT (as per estimate time) should call KL by 0127, 5 minutes later (Letter of
   Agreement between HCM ATC and KL ATC), but only did at 0139 MYT - 12 minutes later
4) Based on above chronology of events from 0119 to 0632 hours, investigation concluded KL ATSC Radar Control had:

a) Not maintained continuous watch on radar display as required

b) Released control before agreed transfer of control point

c) Relied too much on MAS information

d) Not initiated various emergency phases as required

e) Not made effort to liaise with RMAF
CONCLUSION

1) Evidence shows that Flight MH370 diverted from the Filed Flight Plan Route. The changes in the aircraft flight path after waypoint IGARI are difficult to attribute to anomalous system issues alone.

2) Flight simulator trials established that the turn back was made while the aircraft was under manual control and not using autopilot.

3) HCM ACC did not notify the transferring unit (KL ATSC) when two-way communication was not established with MH370 within (5) five minutes of the estimated time of the transfer of control point.
CONCLUSION (cont.)

4) KL ATSC relied too much on position information of the aircraft provided by MAS Flight Operations

5) Air Traffic Controllers did not initiate the various emergency phases as required, thereby delaying the activation of the Search and Rescue operations

6) The PIC and FO held valid airman licences and medical certification were within duty-time limits, and were adequately rested
CONCLUSION (cont.)

7) There had been no financial stress or behavioural changes to the PIC and FO.

8) The radio-telephony communication by the PIC and the FO with the air traffic controllers showed no evidence of anxiety or stress.

9) The aircraft maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures, except for the instance of the FDR ULB battery which had expired.
CONCLUSION (cont.)

10) No record or report of any defect or malfunction in the aircraft that could have contributed to the event

11) It is possible that the absence of communications prior to the flight path diversion was due to the systems being manually turned off, whether with intent or otherwise

12) The analysis of the relevant systems taking into account the route followed by the aircraft and the height at which it flew, does not suggest a mechanical problem with the aircraft’s airframe, control systems, fuel or engines
13) Data from the last seven SATCOM ‘handshakes’ were used to help establish the approximate path of the aircraft over the Indian Ocean.

14) Log-on at 0225 MYT (08 March 2014) initiated by the aircraft was most likely due to power interruption to the SATCOM avionics.

15) Log-on at 0819 MYT was most likely due to power interruption, probably due to fuel exhaustion at this time resulting in the loss of both engines and automatic start-up of APU and powering of the busses.
CONCLUSION (cont.)

16) To date, the main wreckage of MH370 has still not been found. However, items of debris possibly/confirmed from MH370, have been found as far north as the eastern coast of Tanzania and far south as the eastern coast of South Africa.

17) Damage examination found on the right flaperon and the right outboard flap has led to the conclusion that the right outboard flap was most likely in the retracted position and the right flaperon was probably at the neutral position at the time they separated from the wing.
18) The flaperon, a part of the right outboard flap and a section of the left outboard flap were confirmed to be from MH370.

19) Two cargo items of interest (the Lithium ion Batteries and Mangosteens) which were carried on MH370 had also been transported via scheduled flights on MAS before and after the event. These items were packed and loaded according to standard operating procedures.

20) The possibility of intervention by a third party cannot be excluded.
21) It should be recognised that there is a significant lack of evidence available to the Team to determine with any certainty the reasons that the aircraft diverted from its filed flight plan route.

22) The lack of evidence includes the information recorded on the Flight Data Recorder, Cockpit Voice Recorder and other recording devices on the aircraft that could indicate why the aircraft flew to the Southern Indian Ocean.

23) In conclusion, the Team is unable to determine the real cause for the disappearance of MH370.
REPORT AVAILABLE:

mh370.mot.gov.my

FOR ENQUIRIES:

Email: MH370SafetyInvestigation@mot.gov.my

TERIMA KASIH
QUESTIONS & ANSWERS SESSION

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