

# **BRIEFING to MEDIA**

by

**The Malaysian ICAO Annex 13 Safety Investigation Team for MH370  
30<sup>th</sup> July 2018**

on

**SAFETY INVESTIGATION REPORT  
MALAYSIA AIRLINES BOEING B777-200ER (9M-MRO)  
8<sup>th</sup> 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

## ESTABLISHMENT

### THE MALAYSIAN ICAO ANNEX 13 SAFETY INVESTIGATION TEAM FOR MH370

The Government of Malaysia, under Regulation 126(1) of the Malaysian Civil Aviation Regulations (MCAIR) 1996, established on 25<sup>th</sup> 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 8<sup>th</sup> March 2014

**ACCREDITED REPRESENTATIVES**  
**MALAYSIAN ICAO ANNEX 13 SAFETY INVESTIGATION TEAM FOR MH370**

<b>No.</b>	<b>COUNTRY</b>	<b>ORGANISATION</b>
1.	Australia	Australian Transport Safety Bureau (ATSB)
2.	China	Civil Aviation Administration of the People's Republic of China (CAAC)
3.	France	Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation civile (BEA)
4.	Indonesia	National Transportation Safety Committee (NTSC)
5.	Singapore	Transport Safety Investigation Bureau (TSIB)
6.	United Kingdom	Air Accidents Investigation Branch (AAIB)
7.	United States of America	National Transportation Safety Board (NTSB)

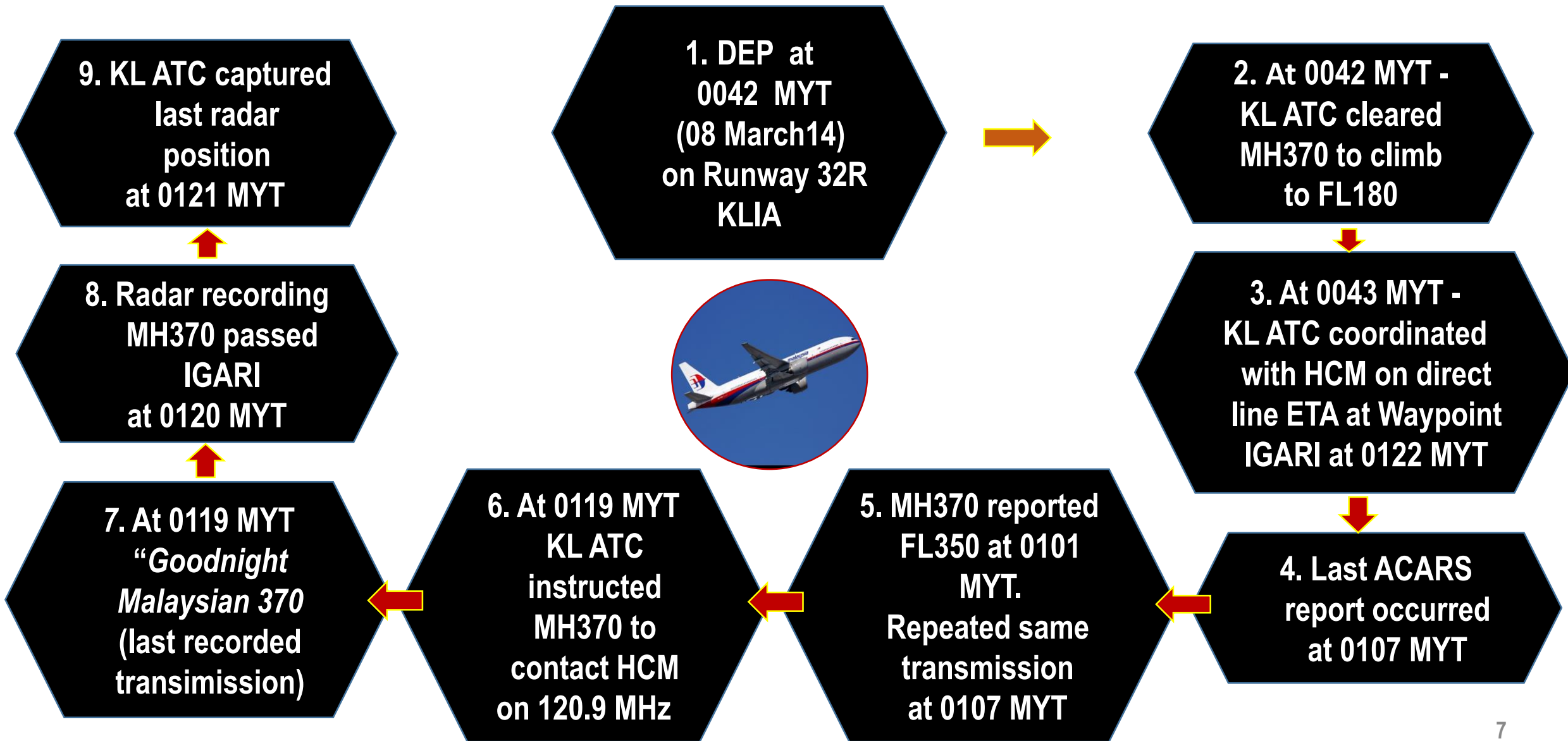
## SECTION 1 - FACTUAL INFORMATION (ANNEX 13, CHAPTER 1, ITEMS 1.1 - 1.19)

Section	Item	Section	Item
1.1	History of the Flight	1.11	Flight Recorders
1.2	Injuries to Persons	1.12	Wreckage and Impact Information
1.3	Damage to Aircraft	1.13	Medical and Pathological Information
1.4	Other Damages	1.14	Fire
1.5	Personnel Information	1.15	Survivability
1.6	Aircraft Information	1.16	Tests and Research
1.7	Meteorological Information	1.17	Organisational & Management Information
1.8	Aids to Navigation	1.18	Additional Information
1.9	Communications	1.19	New Investigation Techniques
1.10	Aerodrome Information		

## 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

# HISTORY OF THE FLIGHT



# TURN BACK AND MILITARY RADAR (RMAF)

1	P3362: Appeared at 1730:37 UTC [0130:37 MYT]
2	P3362: Coasted at 1737:12 UTC [0137:12 MYT] Dropped at 1737:22 UTC [0137:22 MYT]
3	P3401: Appeared at 1738:56 UTC [0138:56 MYT]
4	P3401: Coasted at 1744:42 UTC [0144:42 MYT] Dropped at 1744:52 UTC [0144:52 MYT]
5	P3415: Appeared at 1747:02 UTC [0147:02 MYT]
6	P3415: Coasted at 1748:29 UTC [0148:29 MYT] Dropped at 1748:39 UTC [0148:39 MYT]
7	P3426: Appeared at 1751:45 UTC [0151:45 MYT]
8	P3426: Coasted at 1752:25 UTC [0152:25 MYT] Dropped at 1752:35 UTC [0152:35 MYT] P3426 last seen on radar display Approximately 6 nm south of Penang
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 <i>Source: RMAF</i>
10	The primary target ended at 10 nm after MEKAR at 1822:12 UTC [0222:12 MYT] <i>Source: RMAF</i>



	Filed Flight Plan Route
	Diversion route
	Radar target appearance
	Radar target coasted/dropped off



## 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

## **DIVERSION FROM FILED FLIGHT PLAN (cont.)**

- 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

## DIVERSION FROM FILED FLIGHT PLAN (cont.)

- 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

## FLIGHT CREW PROFILE (cont.)



### 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

## FLIGHT CREW PROFILE (cont.)



### 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

## FLIGHT CREW PROFILE (cont.)

### 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

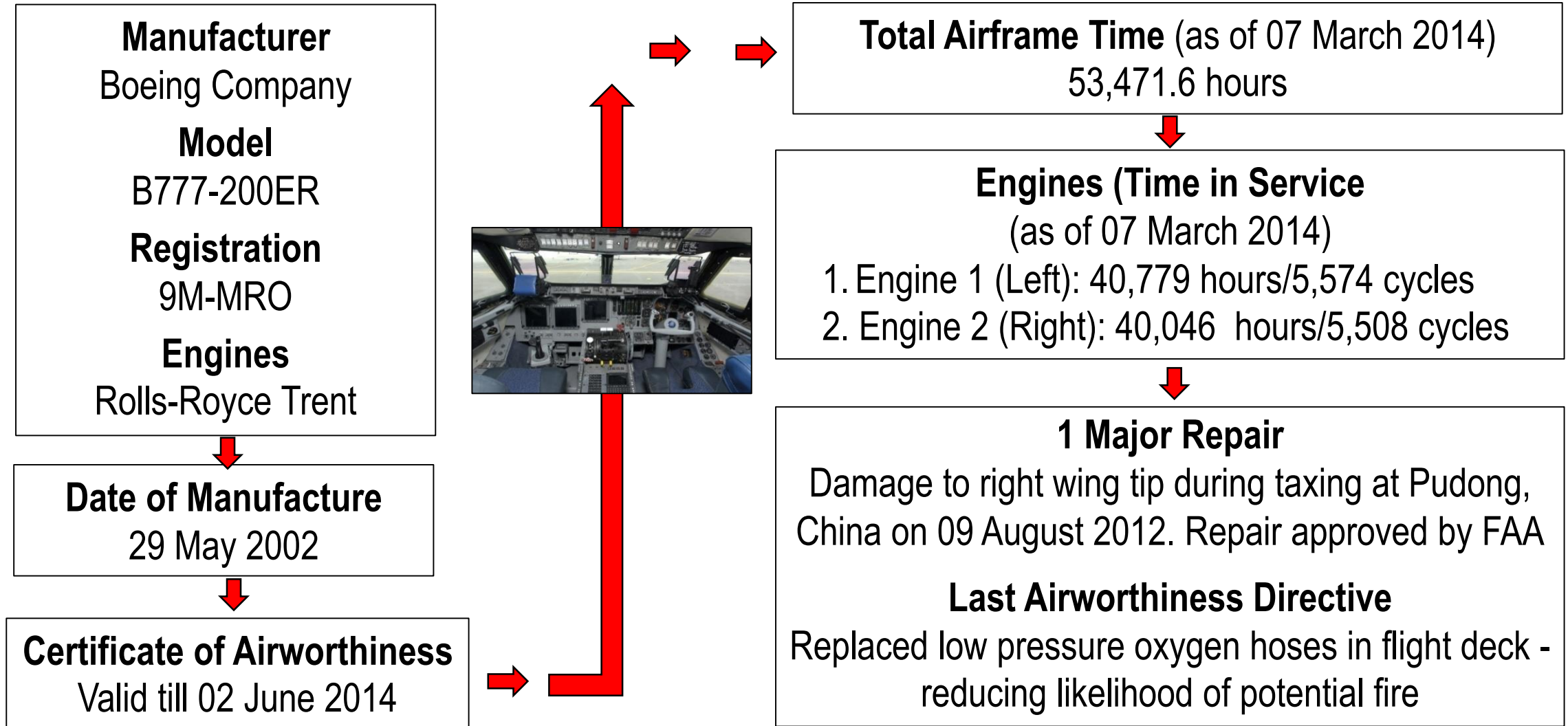
## 1) PILOT-IN-COMMAND'S HOME SIMULATOR

- 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



## AIRWORTHINESS & MAINTENANCE AND AIRCRAFT SYSTEMS (cont.)

- 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)

## **AIRWORTHINESS & MAINTENANCE AND AIRCRAFT SYSTEMS (cont.)**

- 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

## REMOTE CONTROL TAKEOVER OF AIRCRAFT (cont.)

- 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



## REMOTE CONTROL TAKEOVER OF AIRCRAFT (cont.)

- 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

MYT	SATCOM TRANSMISSIONS
0042	Aircraft left KLIA
0107	Last ACARS
0225	1 <sup>st</sup> handshake initiated by the aircraft
0239	Unanswered ground-to-air telephone call
0341	2 <sup>nd</sup> handshake initiated by ground station
0441	3 <sup>rd</sup> handshake initiated by ground station
0541	4 <sup>th</sup> handshake initiated by ground station
0641	5 <sup>th</sup> handshake initiated by ground station
0713	Unanswered ground-to-air telephone call
0810	6 <sup>th</sup> handshake initiated by ground station
0819	7 <sup>th</sup> handshake initiated by the aircraft

## **SATELLITE COMMUNICATIONS (cont.)**

- 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)

## WRECKAGE AND IMPACT INFORMATION (cont.)

### 3) Confirmed And Almost Certain Debris Identification

The diagram shows a Malaysia Airlines aircraft with the following debris items identified:

- Item 22** (Yellow box): Vertical Stabilizer panel
- Item 10** (Black box): Left Outboard Aft Flap
- Item 5** (Yellow box): Door 1 Right Stowage Closet
- Item 4** (Yellow box): Engine Nose Cowl
- Item 1** (Black box): Flaperon
- Item 6** (Yellow box): Right Fan Cowling
- Item 3** (Yellow box): Right Horizontal Stabilizer (upper)
- Item 19** (Black box): Right hand Outboard Aft Flap
- Item 2** (Yellow box): Right Wing No. 7
- Item 16** (Yellow box): Cabin Interior Panel

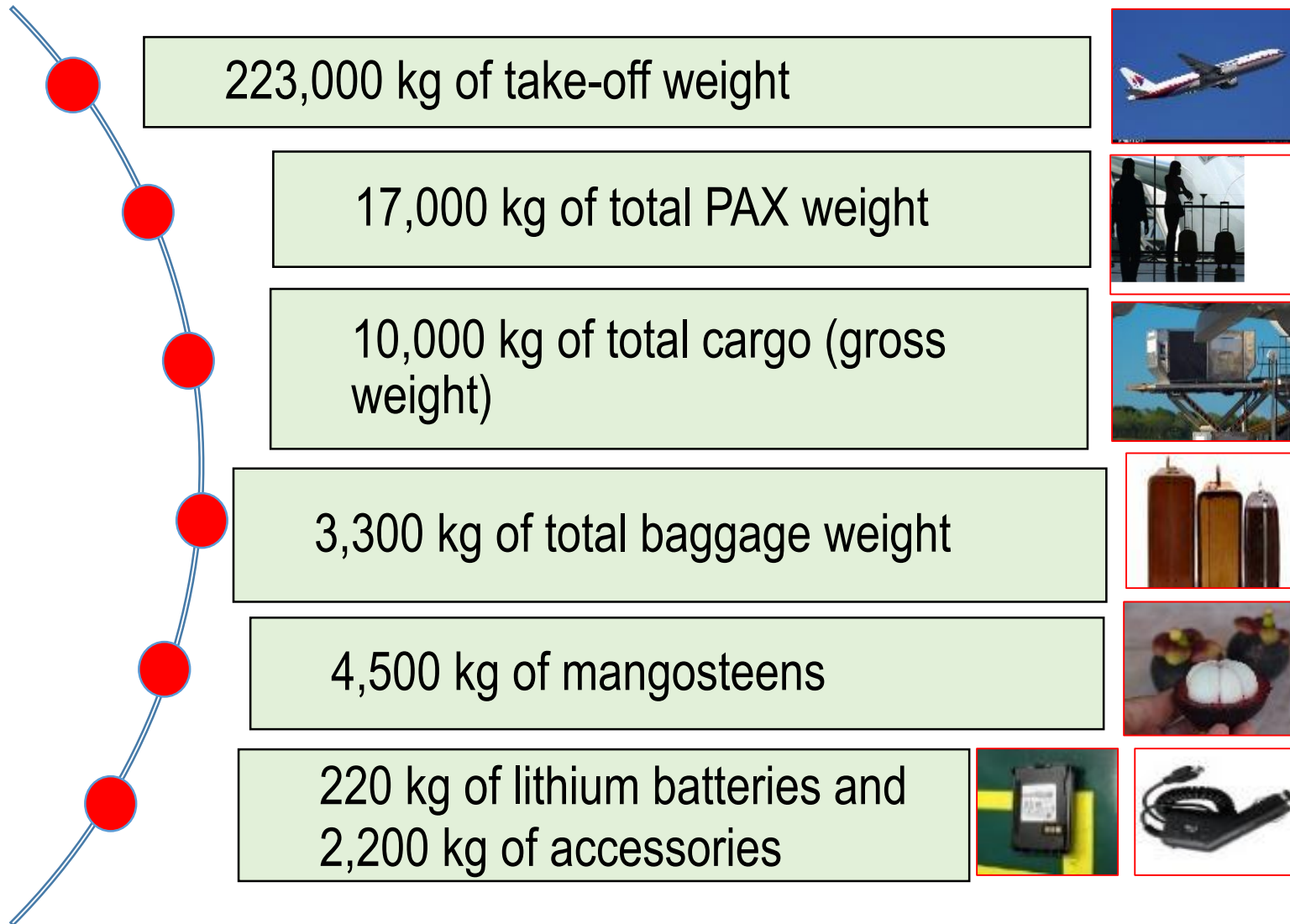
**Keys**

Status	Total	Locations
<b>Confirmed</b>	3	1) Reunion Island - Item 1 2) Mauritius - Items 10 3) Tanzania - Item 19
<b>Almost Certain</b>	7	4) Mozambique - Items 2, 3, 6 & 22 5) South Africa - Item 4 6) Madagascar - Item 16 7) Mauritius - Item 5

## **WRECKAGE AND IMPACT INFORMATION (cont.)**

- 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

# CARGO CONSIGNMENT



## 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

## MANGOSTEENS (cont...)

- 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

## CHRONOLOGY OF KL ATSC EVENTS FROM 0119 - 0632 HOURS

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



## CONCLUSION (cont.)

- 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

## CONCLUSION (cont...)

- 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

## CONCLUSION (cont.)

- 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](http://mh370.mot.gov.my)

## **FOR ENQUIRIES:**

**Email:** [MH370SafetyInvestigation@mot.gov.my](mailto:MH370SafetyInvestigation@mot.gov.my)

# **TERIMA KASIH**

# **QUESTIONS & ANSWERS SESSION**

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