



# **FACTUAL INFORMATION**

## **SAFETY INVESTIGATION FOR MH370**

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**Malaysia Airlines MH370 Boeing B777-200ER (9M-MRO)  
08 March 2014**



**By**

**The Malaysian ICAO Annex 13 Safety Investigation Team for MH370**

Issued on 8<sup>th</sup> March 2015  
(Updated on 15<sup>th</sup> April 2015)



The Malaysian ICAO Annex 13  
Safety Investigation Team for MH370

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

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### Addendum

Section	Page	Change	Date
1.9.4.1	46	Unit for Gross Weight (GWT) in Table 1.9A changed from kg to lb	15 Apr 2015
Appendix 1.6B	1	lb added as unit for Gross Weight (GWT)	15 Apr 2015
Appendix 1.6B	2	Abbreviation 'SFC' described	15 Apr 2015
Appendix 1.6B	1 & 2	Last 4 rows in EHM Parameter Key moved from Page 1 to Page 2	15 Apr 2015

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**OBJECTIVE OF INVESTIGATION**

**The sole objective of the investigation is  
the prevention of future accidents or incidents and  
not for the purpose to apportion blame or liability.**

(Annex 13, Chapter 3, paragraph 3.1, page 3.1)

**DISCLAIMER**

The factual information provided herein is of an interim nature.  
Readers are advised that new information may become available that may alter this interim factual information prior to the publication of the Final Report.

This factual information contains facts which have been determined up to the time of issue. This information is published to inform the aviation industry and the public of the general circumstances of the accident of MH370 and must necessarily be regarded as tentative and subject to alteration or correction if additional evidence becomes available.

Extracts can be published without specific permission providing that the source is duly acknowledged.

## **a. GLOSSARY OF TERMS**

When the following terms are used, they have the following meaning:

**Accident** - An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

a) a person is fatally or seriously injured as a result of:

- being in the aircraft, or
- direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
- direct exposure to jet blast,

*Except* when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) the aircraft sustains damage or structural failure which:

- adversely affects the structural strength, performance or flight characteristics of the aircraft, and
- would normally require major repair or replacement of the affected component,

*except* for engine failure or damage, when the damage is limited to a single engine (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome); or

c) the aircraft is missing or is completely inaccessible.

*Note 1 - For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified, by ICAO, as a fatal injury.*

*Note 2 - An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.*

*Note 3 - The type of unmanned aircraft system to be investigated is addressed in 5.1.*

*Note 4 - Guidance for the determination of aircraft damage can be found in Attachment F.*

**Accredited Representative** - A person designated by a State, on the basis of his or her qualifications, for the purpose of participating in an investigation conducted by another State. Where the State has been established an accident investigation authority, the designated accredited representative would normally be from that authority.



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**Advisor** - A person appointed by a State, on the basis of his or her qualifications, for the purpose of assisting its accredited representative in an investigation.

**Aeronautical fixed telecommunication network (AFTN)** - A worldwide system of aeronautical fixed circuit provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics.

**Air-ground communication** - Two-way communication between aircraft and stations or locations on the surface of the earth.

**Aircraft** - Any machine that can give derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

**Alert Phase** - A situation wherein apprehension exists as to the safety of an aircraft or marine vessel, and of the persons on board.

**Alerting Post** - Any facility intended to serve as an intermediary between a person reporting an emergency and a rescue co-ordination centre or rescue sub-centre.

**Blind transmission** - A transmission from one station to another station in circumstances where two-way communication cannot be established but where it is believed that the called station is able to receive the transmission.

**Cabin Crew Member** - A crew member who performs, in the interest of safety passengers, duties assigned by the operator or the pilot-in-command of the aircraft, but who shall not act as a flight crew member.

**Cargo** - Any property carried on an aircraft other than mail, stores and accompanied or mishandled baggage.

**Causes** - Actions, omissions, events, conditioning, or a combination of thereof, which led to the accident or incident. The identification of causes does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

**Co-ordinated Universal Time (UTC)** - International term for time at the prime meridian.

**Conversion Training** - Training required when a pilot is posted to a different aircraft type or model

**Detresfa** - The code word used to designate a distress phase

**Distress Phase** - A situation wherein there is reasonable certainty than an aircraft and its occupants are threatened by grave and imminent danger or require immediate assistance.

**Emergency Phase** - A generic term meaning, as the case may be, uncertainty phase, or distress phase

**Filed Flight Plan** - The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes.

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**Flight plan** - Specified information provided to the air traffic units, relative to an intended flight or portion of a flight of an aircraft.

**Flight Recorder** - Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation - *Annex 6, Parts I, II and III, for specifications relating to flight recorders.*

**Incident** - An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety operation - *The types of incidents which are of main interest to the International Civil Aviation Organization for accident prevention studies are listed in Attachment C of Annex 13.*

**Inmarsat** - A system of geostationary satellites for world-wide mobile communications services, and which support the Global Maritime Distress and Safety System and other emergency communications systems.

**Investigation** - A process conducted for the purpose of accident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and/or contributing factors and, when appropriate, the making of safety recommendations.

**Investigator-in-Charge** A person charged, on the basis of his or her qualifications, with the responsibility for the organization, conduct and control of an investigation - *Nothing in the above definition is intended to preclude the functions of an investigator-in-charge being assigned to a commission or other body.*

**NOTAM** - A notice distributed by means of telecommunication containing information concerning the establishment, condition of change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

**Operator** - A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

**Pilot-in-command** - The pilot responsible for the operation and the safety of the aircraft during flight time.

**Safety Recommendation** - A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident. In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from the diverse sources, including safety studies.

**State of Design** - The State having jurisdiction over the organization responsible for the type design.

**State of Manufacture** - The State having jurisdiction over the organization responsible for the final assembly of the aircraft.

**State of Occurrence** - The State in the territory of which an accident or incident occurs.

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**State of the Operator** - The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

**State of Registry** - The State on whose register the aircraft is entered. *In the case of the registration of aircraft of an international operating agency on other than a national basis, the States constituting the agency are jointly and severally bound to assume the obligations which, under the Chicago Convention, attach to a State of Registry. See, in this regard, the Council Resolution of 14 December 1967 on Nationality and Registration of Aircraft Operated by International Operating Agencies which can be found in Policy and Guidance Material on the Economic Regulation of International Air Transport (Doc 9587).*

**State Safety Programme (SSP)** - An integrated set of regulations and activities aimed at improving safety.

**Knot (kt)** - A unit of speed equal to one nautical mile per hour.

**Pilot-in-Command** - The pilot responsible for the operation and the safety of the aircraft during flight time.

**Uncertainty Phase** - A situation wherein doubt exists as to the safety of an aircraft or marine vessel, and of the persons on board.

**b. ABBREVIATIONS & CODES****A**

A/P	Autopilot
A/T	Autothrottle
AAIB	Air Accident Investigation Branch (United Kingdom)
AAIB	Air Accident Investigation Bureau (Singapore)
AC	Alternating Current
ACARS	Aircraft Communications Addressing and Reporting System
ACC	Area Control Centre
ACD	Airways Clearance Delivery
ACE	Actuator Control Electronic
ACIPS	Air foil Cowl Ice Protection System
ACMP	AC Motor Pump
ACMS	Aircraft Condition Monitoring System
ACP	Audio Control Panel
AD	Airworthiness Directive
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
ADP	Air Driven Pump
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
AES	Aircraft Earth Station
AFD	Assistant Flight Data
AFDS	Autoflight Director System
AFTN	Aeronautical Fixed Telecommunication Network
AIMS	Airplane Information Management System
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Service
ALERFA	Alert Phase
ALR	Alerting
ALT	Altitude
AM	Amplitude Modification
AMU	Audio Management Unit
AN	Aircraft Number; Airworthiness Notice
AOA	Angle of Attack
AOC	Air Operator's Certificate
APP	Approach
APU	Auxiliary Power Unit
APUC	Auxiliary Power Unit Controller
ARINC	Aeronautical Incorporated
ASB	Amanah Saham Bumiputra (A Government-back Trust Fund)
ASN	Amanah Saham Nasional (A Government-back Trust Fund)
ASCPC	Air Supply Cabin Pressure Controller
ATC	Air Traffic Control
ATCC	Air Traffic Control Centre

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ATPL	Air Traffic Pilot Licence
ATS	Air Traffic Services
ATSB	Australian Transport Safety Bureau
ATSC	Air Traffic Services Centre
ATM	Air Traffic Management
ATSU	Air Traffic Service Unit
ATTN	Attenuator
AUTO	Automatic
AVBL	Available
AWL	Airworthiness Limitation

### **B**

BEA	Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation civile (France)
BEW	Basic Empty Weight
BFO	Burst Frequency Offset
BITE	Built In Test Equipment
BSCU	Brake System Control Unit
BSU	Beam Steering Unit
BTO	Burst Timing Offset

### **C**

C	Degree Celsius (Centigrade)
C of A	Certificate of Airworthiness
C of G	Centre of Gravity
C of R	Certificate of Registration
CA	Collective Agreement
CAAC	Civil Aviation Administration China
CAAS	Civil Aviation Authority Singapore
CAM	Cockpit Area Microphone
CAT	Clear Air Turbulence
CCD	Cursor Control Device
CDU	Control Display Unit
CHIRPS	Confidential Human Factors Accident Incident Reporting System
CLB	Climb
Cm	Centimetre
CMCS	Central Maintenance Computing System
CMR	Certificate Maintenance Requirement
CMS	Central Maintenance System
COSPAS	Space System for Search of Vessels in Distress
CPDLC	Controller Pilot Data Link Communications
CPL	Commercial Pilot Licence
CPM	Core Processor Module
CPMU	Cabin Passenger Management Unit
CRM	Crew Resource Management
CRZ	Cruise
CTR	Control Zone
CTRL	Control

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CTU	Cabin Telecommunications Unit
CVR	Cockpit Voice Recorder
CX	C Extended
CWP	Controller Working Position

**D**

dB	decibel
DC	Direct Current
DCA	Department of Civil Aviation
DCGF	Data Conversion Gateway Function
DCMF	Data Communication Management Function
DCMS	Data Communication Management System
Deg	Degree
DEOR	Daily Engineering Operations Report
DES	Descent
DETRESFA	Distress Phase
DFDAF	Digital Flight Data Acquisition Function
DFDAU	Digital Flight Data Acquisition Unit
DIP	Diplexer
DLNA	Diplexer Low Noise Amplifier
DME	Distance Measuring Equipment
DOW	Dry Operating Weight

**E**

ECL	Electronic Checklist
EDIU	Engine Data Interface Unit
EDP	Engine Driven Pump
EEC	Electronic Engine Control
EFIS	Electronic Flight Instrument System
EFS	Electronic Flight Strips
EHM	Engine Health Monitoring
EICAS	Engine Indicating and Crew Alerting System
ELMS	Electrical Load Management System
ELT	Emergency Locator Transmitter
EMS	Engineering Maintenance System
ENR	En-route
EPR	Engine Pressure Ratio
EST	Estimate
ETA	Estimated Time of Arrival
ETOPS	Extended Twin Engine Operations
EXT	External

**F**

FO	First Officer
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FDP	Flight Data Processing

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FDR	Flight Data Recorder
FPL	Filed Flight Plan ( <i>message type designator</i> )
FIR	Flight Information Region
FL	Flight Level
FLCH	Flight Level Change
FMCF	Flight Management Control Function
FMCS	Flight Management Control System
FMS	Flight Management System
FO	Flight Officer
FPA	Flight Path Angle
FSCU	Flap Slat Control Unit
FSEU	Flap Slat Electronic Unit
FPS	Flight Progress Strip
FS	Flight Steward
FSS	Flight Stewardess
FT	Feet ( <i>dimensional unit</i> )

### **G**

G/S	Glide Slope
GA	Go Around
GADSS	Global Aeronautical Distress and Safety System
GCC	Golden Class Club
GEN	Generator
GES	Ground Earth Station
GHz	Giga Hertz
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GSP	Ground Service Provider
GWT	Gross Weight

### **H**

hPa	Hectopascal
HDG	Heading
HF	High Frequency
HF/AMSS	High Frequency Aeronautical Mobile Service Station
HGA	High Gain Antenna
HLCS	High Lift Control System
HPA	High Power Amplifier
HR	Hours
HYDIM	Hydraulic Interface Module
Hz	Hertz

### **I**

i.u.	index unit
IAMSAR	International Maritime Search and Rescue
IAS	Indicated Airspeed
IATA	International Air Transport Association

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ICAO	International Civil Aviation Organisation
ID	Identification
IDG	Integrated Drive Generator
IFE	In-flight Entertainment
IFS	In-flight Supervisor
IGV	Inlet Guide Vane
ILS	Instrument Landing System
In.	Inches
INCERFA	Uncertainty Phase
IOM	Input/output Module
IOR	Indian Oceanic Region
IRP	Integrated Refuel Panel
ISLN	Isolation

### **K**

KHz	Kilo Hertz
KLIA	KL International Airport
Kg	Kilogram
Kt	Knot
KVA	Kilo Volt Ampere

### **L**

LAME	Licensed Aircraft Maintenance Engineer
LAT	Latitude
lb.	Pound
LDW	Landing Weight
LGA	Low Gain Antenna
LH	Left Hand
LLAR	Lower Lobe Attendant Rest
LNA	Low Noise Amplifier
LNAV	Lateral Navigation
LOA	Letters of Agreement
LOC	Localiser
LONG	Longitude
LOPA	Lay Out of Passenger Accommodation
LRU	Line Replaceable Unit
LS	Leading Steward

### **M**

M	Metre
MAC	Mean Aerodynamic Chord
MARA	Majlis Amanah Rakyat (An agency of the Government)
MAS	Malaysia Airlines
MATS	Manual of Air Traffic Services
MET	Meteorological or meteorology
MCC	Maintenance Control Centre



MCDU	Multi-purpose Control Display Unit
MCP	Mode Control Panel
MEC	Main Equipment Centre
MEL	Minimum Equipment List
MFD	Multi-Function Display
MGSCU	Main Gear Steering Control Unit
MHz	Megahertz
Min	Minute
MOR	Mandatory Occurrence Report
MPD	Maintenance Planning Document
MR1	Maintenance Report 1
MR2	Maintenance Report 2
MRB	Maintenance Review Board
ms	meter second
MTSAT	Multifunctional Transport Satellites of Japan Meteorological Agency (JMA)
MU	Management Unit
MYT	Malaysian Time

**N**

ND	Navigation Display
NDB	Non-directional Beacon
NM	Nautical Mile
NOTAM	Notices to Airmen
NOTOC	Notice to Crew
NTC	Notes to Crew
NTSB	National Transportation Safety Board
NTSC	National Transportation Safety Committee (Indonesia)

**O**

OCC	Operations Control Centre
OCXO	Oven Controlled Crystal Oscillator
OPR	Operator
OPS	Operations
OOOI	Out, Off, On, In

**P**

P/N	Part Number
PASS	Passenger(s)
PDS	Primary Display System
PDU	Power Drive Unit
PFCS	Primary Flight Control System
PFD	Primary Flight Display
PIC	Pilot in Command
PLN	Flight Plan
PMG	Permanent Magnet Generator
POB	Person on Board

POR	Pacific Oceanic Region
PSA	Power Supply Assembly
PSEU	Proximity Switch Electronic Unit
psi	pounds per square inch
PSR	Primary Surveillance Radar
PSU	Passenger Service Unit
PTT	Push to Talk
PWR	Power
PWS	Predictive Windshear
<b><u>Q</u></b>	
Q & A	Questions and Answers
QAE	Quality Assurance Engineer
<b><u>R</u></b>	
RAT	Ram Air Turbine
REF	Reference
RF	Radio Frequency
RFS	Radio Frequency Splitter
RFU	Radio Frequency Unit
RH	Right Hand
rms	Root Mean Square
RTP	Radio Tuning Panel
RVSM	Reduced Vertical Separation Margin
RQS	Request Supplementary Flight Plan
RADAR	Radio Detection and Range
RCC	Rescue Coordination Centre
RDP	Radar Data Processor
RSC	Rescue Sub-Centre
RNAV	Area Navigation
RWY	Runway
<b><u>S</u></b>	
SAP	Safety Awareness Programme
SAR	Search and Rescue
SATCOM	Satellite Communications
SC	Search and Rescue Coordinator
SEA 1	South East Asia 1
SEA 2	South East Asia 2
SELCAL	Selective Calling System
SIGMET	Significant meteorological information
SIGWX	Significant weather chart
SMC	Search and Rescue Mission Coordinator
SOI	Supplementary Operations Instructions
SRR	Search and Rescue Region
SSR	Secondary Surveillance Radar

## FACTUAL INFORMATION      SAFETY INVESTIGATION FOR MH370 (9M-MRO)

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### T

T	Tonne
TAT	Total Air Temperature
TCAS	Traffic Collision Avoidance System
THDG	True Heading
TMA	Terminal Control Area
TH	True Heading
THR	Thrust
TMCF	Thrust Management Control Function
TO	Take-off
TRE	Type Rating Examiner
TRI	Type Rating Instructor
TRK	Track
TRTO	Type Rating Training Organization
TRU	Transformer Rectifier Unit
TSO	Technical Standard Order
UHF	Ultra High Frequency
ULB	Underwater Locating Beacon
USB	Upper Side Band
UTC	Universal Time Coordinated

### V

V	Volt
V/S	Vertical Speed
VAAC	Very High Frequency
VNAV	Vertical Navigation
VOR	Very High Frequency Omni Directional Range

### W

W	Watt
WHCU	Window Heat Control Unit
WINDIR	Wind Direction
WINDSP	Wind Speed
WMKC	ICAO 4-letter location indicator for Kota Bharu Airport (used in AFTN messages)
WMKK	ICAO 4-letter location indicator for Kuala Lumpur International Airport
WMKN	ICAO 4-letter location indicator for Kuala Terengganu Airport
WMKP	ICAO 4-letter location indicator for Penang International Airport
WWW	Worldwide web
WXR/WX	Weather

### Z

ZBAA	ICAO 4-letter location indicator for Peking-Capital International Airport
ZFW	Zero Fuel Weight
Z	Coordinated Universal Time ( <i>in meteorological messages</i> )