Operational Search for MH370
2014-2017

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8 March 2014 Malaysia Airlines Flight MH370 - Kuala Lumpur to Beijing

239 People on board
- 227 passengers
- 12 crew members
8-15 March
Surface search Malay Peninsula

Satellite data revealed the flight was in the air another 6 hours

15 March search operations moved further south

24 March analysis discounted northern route

7.1 million km² covered
52 days of surface search
Shipboard Bathymetry Survey
- 40m grid of Bathymetry
- 15m grid of Backscatter
- Processed by Geoscience Australia

278,651 km² Search Area
432,420 km² Transit
710,000 km² Total, ~size of Texas, France (274,000 sqm)
Typical deep water towing arrangement

- Deeptow: 50 m
- Depressor: 100 - 150 m
- 2-5 km
- 9 km
Total area covered = 121,502 km²
Search Area Creation
Event 1: 1642 UTC MH370 departed Kuala Lumpur International Airport
Event 2: 1701:17 UTC PIC reported maintaining FL350
Event 3: 1707:29 UTC ACARS report transmitted
Event 4: 1719:30 UTC Last radio transmission from MH370
Event 5: 1720:31 UTC Aircraft passed over waypoint IGARI
Event 6: 1721:13 UTC Last recorded secondary surveillance radar position
Event 7: 1752:27 UTC First officer's mobile phone detected by Penang Comm system
Event 8: 1822:12 UTC Last primary surveillance radar position
Satellite Data Analysis

- BTO arcs (distance)
- BFO analysis (direction)
- Cockpit Voice calls and SMS
- Aircraft Communication Addressing and Reporting System (ACARS)
- Independent validation and peer review analysis US, UK, and OZ
Arcs of known distance from Inmarsat-3 F1

The 7 arcs

Fast
Slow

18:28
19:41
20:41
21:41
22:41
00:11
00:19

Indicative tracks
MH370 Underwater Search Areas Planning Map


Date: 2014/06/24
Map Number: 2014/011

Place: Western Australia

Areas:
- Broken Ridge
- 7th Arc
- Indian Ocean
- Exmouth
- Perth
Data Visualisation
3m Wall Map - ArcMap 10.2
ArcMap 10.2

1m resolution
Sidescan Sonar Line
as Esri Raster
ArcMap 10.2

Polygon footprint of raster
Quality Assurance
Data flow (~6GB per day)

Vessels acquire data 24/7

Data transfer via satellite

Data reviewed for anomalies, quality and positional accuracy

Data copy stored on vessel

Secure cloud storage

Data reviewed for anomalies, quality and positional accuracy

Contractor onshore office

Independent analysts

Automatic detection process

Data archive public release

Australian Transport Safety Bureau

Geoscience Australia
Example of matching SSS to bathymetric feature

Position Check

Surface vessel collected 3D bathymetric data

Deep tow Side Scan Sonar data overlaid on 3D bathymetry

Feature matched typically within 50m
Position Check

Confirming overlap and position offsets

Positional offsets (red line) are typical less than 100m.

Along track error typically greater than across track error.

Overlap nominally 300m @1000m range - 18%
(500m @1100m range - 29%)

Same feature on 2 adjacent lines (yellow circle)
Coverage calculated for every line captured

Line 23 SE – 1,345.012 km²

Coverage is calculated to 3 decimal places
Data Gap Capture

- Terrain Shadow Holiday
- Terrain Avoidance Holiday
- Lower Probability of Detection Area

- Steep Ridge Line
- Side Scan Sonar
- Multibeam Sonar Gap Filler
- 3D Bathymetry (collected from surface vessel)
Initial shipwreck detection mosaic

Shipwreck #1
Wide Area Search
Deeptow Line
Initial shipwreck detection – single line

Anomaly Review

2200m Swath

Shipwreck#1 Debris Field
300m x 250m
Anomaly Review

AUV mosaic of shipwreck using high frequency sonar
Anomaly Review

Shipwreck AUV images – Sonar and Camera

AUV High Frequency Side Scan Sonar Image

AUV Camera pass over same area.
Operational Planning
Data Gaps

<table>
<thead>
<tr>
<th>Data Holidays</th>
<th>Area km²</th>
<th>Count</th>
<th>% of Area (120,802 km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remaining Data Holidays</td>
<td>785 km²</td>
<td>6,746</td>
<td>0.65%</td>
</tr>
<tr>
<td>Remaining Lower Probability of Detection Areas</td>
<td>2,312 km²</td>
<td>7,755</td>
<td>1.90%</td>
</tr>
</tbody>
</table>
Anomalies to investigate
Network between Anomalies
Shortest Route
Story Map
The data behind the search for MH370

The Australian Government led search operations for the missing Boeing 777 aircraft operating Malaysia Airlines flight MH370 in the southern Indian Ocean. The search involved the collection and analysis of large volumes of marine data from a remote area. The data obtained during the first phase of sea floor mapping is now available to the public.
Where to Next? - Ocean Infinity
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