

Note on the ATC-Caption-2025 dataset

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Version 1.7 – 15/09/2026

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The reader is encouraged to contact the authors by email if he or she has a specific idea about a particular and relevant use of the raw data.

Update 16/12/2025: Corrections in the merged files of the previous version (v1.4, 09/10/2025):

- Positions of different aircraft were erroneously mixed because of the reuse of track number in the Senai radar data
- Removal of Mode A only tracks caused by garbled codes
- The ADS-C and Langkawi data of JAI12, SIA495, and MAS176 are now combined

Update 18/07/2026: Corrections in the ADSB_KT.raw (the previous version was truncated)

Update 15/09/2026:

- Corrections in the Langkawi_SSR_UAE343.csv (the previous version contained positions of another flight sharing the same Mode A code later in the recording)
- Addition of ADS-C metadata for flights UAE343 and SIA68
- Addition of the UAE343 flight plan
- Addition of KML files
- Corrections in the merged files
- Corrections in the note
- Corrections in the Flights.xlsx file

Presentation of the ATC-Caption-2025 Dataset

The decoding explanations and the detailed quality analysis of the ATC-Caption-2025 dataset are well documented in the recently published report “Analysis of the 7 march 2014 raw ATC radar data” by Trise5631, Jean-Luc Marchand and Captain Blelly from CAPTION.

Both the dataset and the detailed report are available at www.mh370-caption.net

The ATC-Caption-2025 dataset includes the following data:

1. Data directly concerning flight MH370 are gathered in the folder « MH370 CSV » which includes 14 CSV files. Each file contains target reports data of one type only and from one source only as presented in the following table:

ADSB	Genting	Genting_ADSB_MH370.csv
	KT	KT_ADSB_MH370.csv
SSR	BW	BW_SSR_MH370.csv
	BW*	BW_SSR_MH370_corrected.csv
	Genting	Genting_SSR_MH370.csv
	KB	KB_SSR_MH370.csv
	Kuantan	Kuantan_SSR_MH370.csv
	Senai	Senai_SSR_MH370.csv
	Subang	Subang_SSR_MH370.csv
	Langkawi	Langkawi_SSR_MH370.csv
PSR	BW	BW_PSR_MH370.csv
	BW*	BW_PSR_MH370_corrected.csv
	KB-in	KB_PSR_IN_MH370.csv
	KB-out	KB_PSR_OUT_MH370.csv

* Same data, but “theta” values have been corrected for the azimuth angle bias estimated by comparing SSR measurements with ADS-B data. “Lat” and “lon” values are changed accordingly, but “x”, “y”, “lat2”, and “lon2” values are retained.

KB-in and KB-out designate the track when the aircraft flew towards Kota Bharu radar and away from it respectively.

2. Data from Comm-B messages from MH370 received by Senai and KB “Mode S” SSR radars are stored in the “CommB” folder. One binary data file is provided per BDS type. These data are also encompassed in the CSV and JSON files.
3. Data of all identified flights within the time window from 16h to 19h UTC. One csv file has been created per aircraft and it includes the aircraft position every 10 seconds. The full set is stored in the “Merging” folder.
4. For the sake of universality, usefulness and completeness, JSON formatted files are provided including MH370 data coming from Genting and KT ADSB as well as from Genting, Subang, Kuantan, BW, Langkawi, KB and Senai SSR/PSR. They can be found in

the JSON folder. Service messages data is also provided as it is an essential information for timing and position determination and in particular in BW (Butterworth) data.

5. ADS-B data from KT is also provided in the RAW format.
6. Additionally, to help reconstructing the trajectory, a CSV file is provided including the wind and temperature information around MH370 flight during the Mode-S coverage of KB and Senai as well as the same type of information but provided by the Copernicus ERA5 data¹.
7. Furthermore, for completeness, data concerning the flights mentioned in the detailed analysis report is provided in CSV format. They are namely VH-PFS, CES5093, BBC086, SIA68, UAE343 and IGO053. Even though these flights did not see MH370, they were most likely seen by MH370 and somehow influenced the decisions of the person in command.
8. An Excel file containing context data from all the flights, with some details on the aircraft

1. MH370 CSV files

Data from target positions of MH370 from Genting, Subang, Kuantan, BW, Langkawi, KB and Senai SSR, and Genting and KT ADS-B receivers, as well as BW and KB PSR after IGARI.

¹ The results contain modified Copernicus Climate Change Service information 2020. Neither the European Commission nor ECMWF is responsible for any use that may be made of the Copernicus information or data it contains.

Copernicus Climate Change Service, Climate Data Store, ERA5 hourly data on pressure levels from 1940 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS), 2023.

Hersbach, H., Bell, B., Berrisford, P., Biavati, G., Horányi, A., Muñoz Sabater, J., Nicolas, J., Peubey, C., Radu, R., Rozum, I., Schepers, D., Simmons, A., Soci, C., Dee, D., Thépaut, J-N. (2023): ERA5 hourly data on pressure levels from 1940 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS), DOI: [10.24381/cds.bd0915c6](https://doi.org/10.24381/cds.bd0915c6)

For radar files:

<i>Name</i>	<i>Description</i>	<i>Unit</i>	<i>type</i>	<i>Report type</i>
<i>ToD</i>	Time of day	Seconds	0	No detection
<i>type</i>	Report type	➔	1	Single PSR detection
<i>rho</i>	Slant range	NM	2	Single SSR detection
<i>theta</i>	Azimuth	°	3	SSR + PSR detection
<i>x</i>	X coordinate	NM	4	Single ModeS All-Call
<i>y</i>	Y coordinate	NM	5	Single ModeS Roll-Call
<i>FL</i>	Flight level		6	ModeS All-Call + PSR
<i>CGS</i>	Tracker calculated ground speed	Knots	7	ModeS Roll-Call +PSR
<i>CHdg</i>	Tracker calculated heading	°		
<i>lat</i>	Latitude (from rho/theta)	Degrees		
<i>lon</i>	Longitude (from rho/theta)	Degrees		
<i>lat2</i>	Latitude (from x/y)	Degrees		
<i>lon2</i>	Longitude (from x/y)	Degrees		
<i>MCPAlt</i>	MCP selected altitude*	Feet		
<i>roll</i>	Roll angle*	°		
<i>trackAngle</i>	Track angle*	°		
<i>trackAngleRate</i>	Track angle rate*	°/s		
<i>GS</i>	Ground speed*	Knots		
<i>heading</i>	Heading*	°		
<i>IAS</i>	Indicated Air Speed*	Knots		
<i>TAS</i>	True Air Speed*	Knots		
<i>mach</i>	Mach*			
<i>modeA</i>	Mode A code			
<i>CS</i>	Call Sign*			
<i>ICAO24</i>	ICAO24 address			
<i>40</i>	BDS 4,0 content			
<i>50</i>	BDS 5,0 content			
<i>60</i>	BDS 6,0 content			
<i>10</i>	BDS 1,0 content			
<i>17</i>	BDS 1,7 content			
<i>1d</i>	Unclear			
<i>spf1</i>	Special Field 1			
<i>spf2</i>	Special Field 2			
<i>spf3</i>	Special Field 3			
<i>spf4</i>	Special Field 4			
<i>spf5</i>	Special Field 5			
<i>spf6</i>	Special Field 6			
<i>spf7</i>	Special Field 7			
<i>spf8</i>	Special Field 8			

*: data extracted from BDS content

For ADS-B files:

<i>Name</i>	<i>Description</i>	<i>Unit</i>
<i>ToD</i>	Time	Seconds
<i>ModeA</i>	Mode A code	
<i>lat</i>	Latitude	Degrees
<i>lon</i>	Longitude	Degrees
<i>galt</i>	Geometric altitude	Feet
<i>FL</i>	Flight level	
<i>BVR</i>	Barometric vertical rate	Feet/min
<i>GS</i>	Ground Speed	Knots
<i>TA</i>	Track Angle	Degrees
<i>CS</i>	Call sign	
<i>tas</i>	True Airspeed	Knots
<i>mh</i>	Magnetic heading	Degrees
<i>trd</i>	Target Report Descriptor	
<i>DCR</i>	Differential correction bit	
<i>GBS</i>	Ground bit	
<i>SIM</i>	Simulation bit	
<i>TST</i>	Test bit	
<i>RAB</i>	Fixed transponder bit	
<i>SAA</i>	Selected altitude bit	
<i>SPI</i>	Special Position Identification bit	
<i>ATP</i>	Address Type	
<i>ARC</i>	Altitude Reporting Capability	
<i>fom</i>	Figure of merit	
<i>AC</i>	ACAS State	
<i>MN</i>	Multiple navigational aids	
<i>DC</i>	Differential correction	
<i>PA</i>	Position Accuracy	
<i>DTI</i>	Cockpit Display of Traffic Information	
<i>MDS</i>	Mode-S Extended Squitter	
<i>UAT</i>	UAT	
<i>VDL</i>	VDL mode 4	
<i>OTR</i>	Other technology	
<i>VA</i>	Velocity Accuracy	
<i>Sig</i>	Signal Amplitude	0-255 ²
<i>ec</i>	Emitter Category	
<i>SP</i>	Special Field	

² The amplitude seems be reversed (maximum signal for Sig=0), the variations in KT values may be due to the fact that the KT ADS-B system uses multiple receivers.

2. MH370 Comm-B Messages

Data from Comm-B messages from MH370 received by Senai and KB Mode S SSR radars.

The CSV files columns are:

- 1) Time of Day
- 2) 56 bit Comm-B message in hexadecimal

The messages are separated by BDS codes, one file for each:

- BDS code 1,0 — Data link capability report
- BDS code 1,D — unknown, possibly used by the radar to transmit other data
- BDS code 1,7 — Common usage GICB capability report
- BDS code 4,0 — Selected vertical intention
- BDS code 5,0 — Track and turn report
- BDS code 6,0 — Heading and speed report

3. Merged files

"Merged files" are CSV files produced using the original ASTERIX data. Each file contains the interpolated position every 10s of the same aircraft during the recording, based on multiple sources. As some aircraft serve multiple flights during the 6-hour recording, the corresponding files have multiple flight numbers. Some aircraft could only be identified by their mode A (flights that are just tracked by "mode A" SSR during the recordings -> names starting with a "!"), others only by their flight numbers (as the ADS-C data does not contain ICAO24 addresses -> names starting with a "+"). The files include some ground vehicles, for which no flight number is associated, therefore, these "flights" only contain the ICAO24 address. The columns are:

<i>Column</i>	<i>Description</i>
1	Time of day of the interpolation
2	Source of the closest data point
3	Latitude
4	Longitude
5	Ground Speed
6	Track Angle
7	Time from the closest data point

For several flights for which the flight route is known, the data has been extrapolated using the hypothesis of a constant Mach, based on GDAS weather data.

The source code numbers correspond to:

<i>Code</i>	<i>Description</i>
1	ADS-B (KT or Genting) data
2	ADS-C data (mainly in the Northwest of the FIR)
3	Langkawi Mode A/C SSR data
4	KT and Senai Mode A/C/S SSR data, (KB/BW PSR radar for MH370)
5	MH370 trajectory: Geoscience points before 18h UTC, Blelly/Marchand trajectory after.
6	AMDAR data (Aircraft Meteorological Data Relay), ACARS positions every 6-8 minutes (only for SAA287 and DLH779)

This is also the order of priority of interpolation.

Other sources have been excluded, as they would only increase the coverage of some flights at low altitudes, during take-off or landing.

The file `!!flightIDs.csv` contains all the flight numbers associations. The columns are:

<i>Column</i>	<i>Description</i>
1	ICAO24 address of the aircraft
2	Flight number
3	First Time the aircraft sends this flight number
4	Last Time the aircraft sends this flight number

4. JSON files

The "JSON files" are transcripts of ASTERIX messages from the Genting and KT ADS-B stations, as well as the Genting, Kuantan, Subang, Langkawi, Senai, KB, and BW PSRs/SSRs.

The "JSON files" contain all service messages between 16:00 UTC and 19:00 UTC, all target reports bearing either Mode A code 2157, ICAO24 address 75008f, or runway number 1744 or 1827 (for KB entries and exits). In addition, they contain points without Mode A codes that appear to originate from MH370 (BW PSRs and some SSR positions without Mode A codes).

Each line of the file is a JSON message corresponding to an ASTERIX message. In the case of BW, some messages appear to have been repeated. Additionally, keep in mind that BW target reports do not contain time-of-day information, and that the time must be calculated from the theta angle value, the northbound service message, and the rotation rate, keeping in mind that the north crossing service messages are ahead of the target reports in the recordings, so much that a target report with a theta of 213° or more is recorded after the north crossing service message of the next rotation. Other service messages also seem to be out of sync.

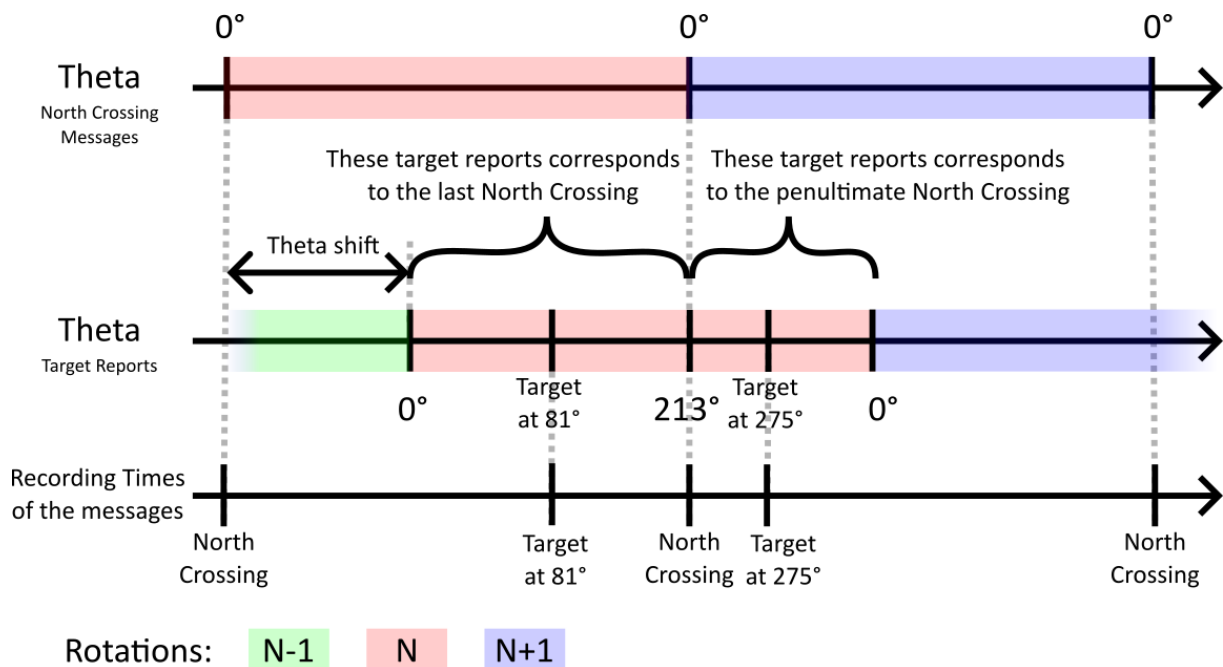


Figure 1 Illustration of the shift between the north crossing messages and the target reports

The structure and labels of the items are similar to those of the CroatiaControl ASTERIX parser, but the data was produced by a specifically in-house designed Python parser.

With the exception of ADS-B KT, for which information is already publicly available, the SIC and SAC codes have been removed. It should be noted that, in the dataset, these codes do not comply with ICAO code assignments.

5. ADS-B KT files

The ADSB_KT.raw file contains the raw data of the entire recording of the ADS-B KT receiver. The messages are in ASTERIX CAT021 version 0.26 format.

The ADSB_KT_MH370_hex.txt file contains all ASTERIX CAT021 records for flight MH370. Each CAT021 message (called a data block) contains multiple records for different aircraft. This file is an extract of all MH370 records from the ADSB_KT.raw file, and was added for ease of use. In practice, it could be parsed manually by treating each line as a CAT21 message without the data category octet.

Additionally, two PNG screen snapshots of the KT system from 2013 from a Prezi presentation are available.

6. MH370 Mode S wind CSV files

Wind and temperature values calculated from Mode S data from KB SSR.

<i>Name</i>	<i>Description</i>	<i>Unit</i>
<i>ToD</i>	Time of day	Seconds
<i>FL</i>	Flight level	
<i>lat2</i>	Latitude (from x/y)	Degrees
<i>lon2</i>	Longitude (from x/y)	Degrees
<i>GS</i>	Ground speed*	Knots
<i>trackAngle</i>	Track angle*	°
<i>TAS</i>	True Air Speed*	Knots
<i>heading</i>	Heading*	°
<i>WindSpd</i>	Wind Speed*	Knots
<i>WindDir</i>	Wind Direction*	°
<i>WindNS</i>	Wind Speed NS*	Knots
<i>WindEW</i>	Wind Speed EW*	Knots
<i>temp</i>	Temperature*	Kelvin
<i>windSpdERA5</i>	Wind Speed (from ERA5)	Knots
<i>windDirERA5</i>	Wind Direction (from ERA5)	°
<i>tempERA5</i>	Temperature (from ERA5)	Kelvin

*: data extracted/calculated from BDS content

Wind speed and direction are calculated by subtracting the groundspeed vector (GS and track angle) from the airspeed vector (TAS and heading). Temperature is calculated from the Mach and TAS values. ERA5 values are interpolated (4D linear interpolation) with the pressure level calculated with the flight level.

7. Influential flights CSV files

Data concerning the flights mentioned in the detailed analysis report is provided in CSV format. They are namely VH-PFS, CES5093, BBC086, SIA68, UAE343 and IGO053. Even though these flights did not see MH370, they were most likely seen by MH370 and somehow influenced the decisions of the person in command.

The ADS-C metadata directory contains different information about the management of the ADS contracts with SIA68 and UAE343 by the ATC systems.

8. KML files

Files in the MH370 CSV and Traffic CSV directories, converted in KML (Google Earth) format.

<i>Type</i>	<i>Color</i>
<i>No detection (coasting)</i>	White
<i>PSR only</i>	Blue
<i>SSR mode A/C only</i>	Green
<i>PSR + SSR mode A/C</i>	Red
<i>SSR mode S only</i>	Lime
<i>ADS-B/ADS-C</i>	Lime
<i>PSR + SSR mode S</i>	Magenta

9. Flights and aircraft details

The Flights.xlsx Excel file contains the list of flights tracked during the recordings. The first sheet contains data based on Mode S (Senai and KB) and ADS-B (Genting and KT) data, the second sheet contains data originating from the ATC system (which could contain flights scheduled before or after the recordings).

The UAE343 flight plan.txt file contains the flight plan registered in the ATC system for UAE343.