Analysis of Flight MH370

Addendum to the Final report

Captain Patrick Blelly, Jean-Luc Marchand-MSc
patrick.blelly@protonmail.com, jean-luc.marchand@mh370-caption.net
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Presentation:

This short document includes an addendum to the final report "Analysis of the trajectory of Flight MH370 - Technical and Aeronautical analysis from take-off to the end of the flight", *Version 2.0 – 16 February 2023 – updated 19 March 2023* in which it is now included in Chapter 7.

But for those who already studied a previous version, it is provided as a separate document to be attached to this previous document.

This dedicated section demonstrates that the reconstructed trajectory is fully in line with Boeing range computations for the considered flight level FL300. The full coherency with Boeing result shows that the proposed search area is even more to be taken into consideration.

7.2 How does our trajectory compare with Boeing Performance Analysis?

In Appendix-1.6E-Aircraft-Performance-Analysis-MH370-(9M-MRO) [25] to the Malaysian report [2], Boeing present the results of their performance analysis in which potential trajectories are defined based on different values of the true air speed.

Figure 1 presents the range computation made by Boeing considering first the flight level and then the TAS at standard ISA.

Table 4: Range Capability for Altitude/Speed Combinations (from Arc 1)

Flight Level	True Airspeed (knots)	Mach (*=MRC)	Time (hours)	Range (nm)
FL400	494	0.861	5.0	2491
FL400	475	0.828	5.9	2803
FL400	469	0.818*	6.0	2806
FL400	417	0.727	6.1	2538
FL350	500	0.867	4.7	2356
FL350	475	0.824	5.6	2657
FL350	466	0.824	5.9	2747
FL350	443	0.769*	6.2	2711
FL350	400	0.694	6.6	2624
FL300	500	0.848	4.5	2270
FL300	437	0.742	5.7	2523
FL300	416	0.706*	6.1	2552
FL300	323	0.548	6.8	2181
FL250	471	0.782	4.6	2151
FL250	383	0.642*	6.1	2363
FL250	291	0.483	6.8	1970
FL150	407	0.65	4.5	1835
FL150	333	0.532*	5.8	1923
FL150	250	0.399	6.75	1662
FL030	345	0.535	4.2	1446
FL030	284	0.437*	5.7	1534
FL030	235	0.359	6.2	1464

VMO-MMO
LRC
MRC
V Stall

Figure 1: Range computation by Boeing – FL300 is of interest – Arc1-Boeing is at 18h28:06 UTC (Source [25])

Based on these results they constructed possible flight paths as shown in Figure 2. In our case, the blue paths at FL300 are of particular interest.

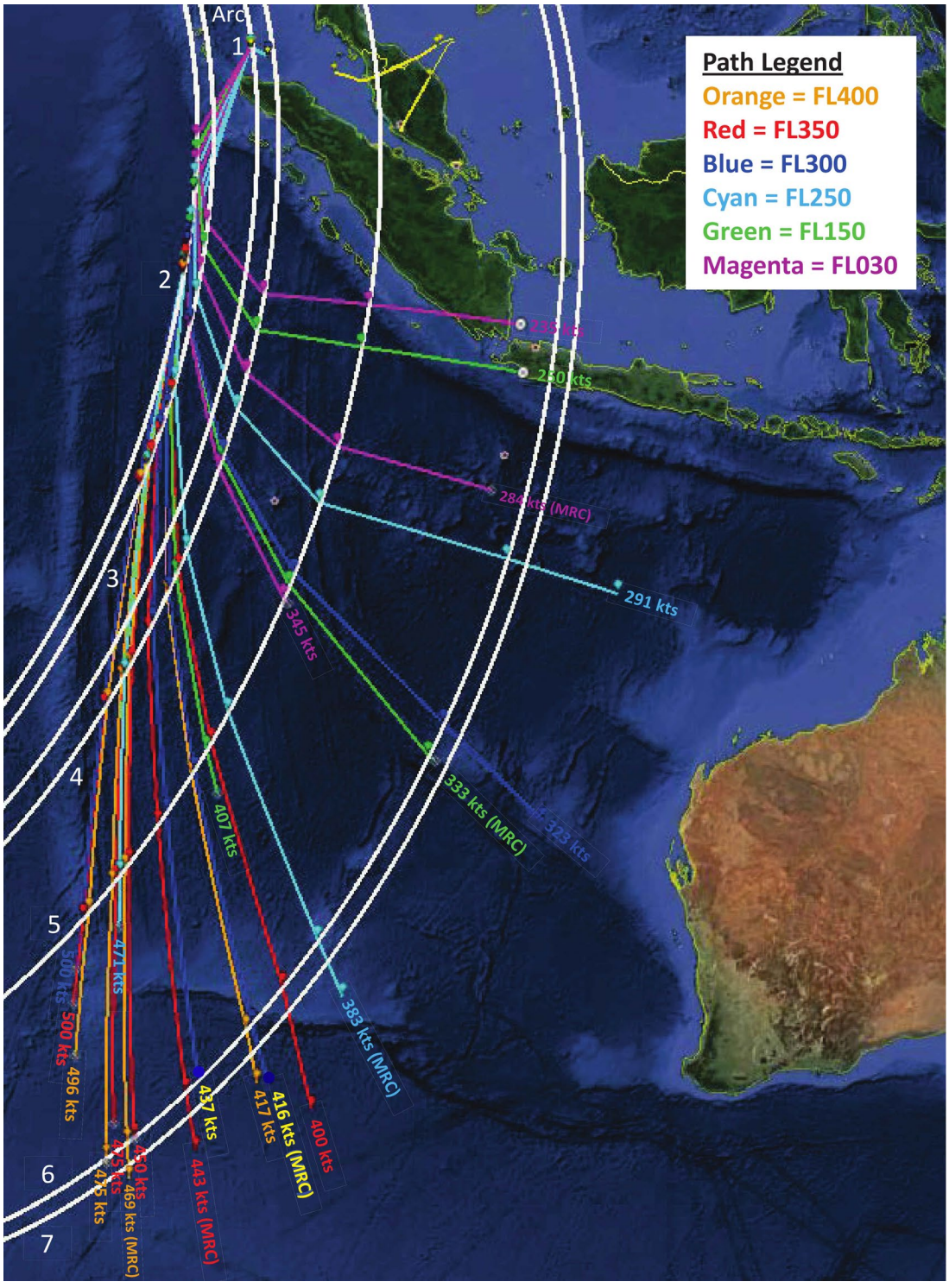

Figure 2 : Boeing calculated possible Flight Paths (Fig. 3 of [25])

Note: The blue paths TAS tags have been underlined in yellow for better contrast in the picture

The question addressed here is “how does our trajectory compare with these flight paths?”

Our trajectory is levelled at FL300, the average true air speed TAS is 431kt at ISA of the day (ISA+12) and the total air distance flown from 18h28:06 (Arc1-Boeing) is 2522Nm. Thus, we focus our attention on the data given by Boeing for this flight level.

In Table 1 a line has been inserted including a flight path at TAS 431kt using the same computation from Boeing for determining the flight time and range (underlined in Red).

Table 1: Flight paths range including our trajectory

Flight Level	True Airspeed (knots)	Mach (ISA standard) (*=MRC)	Time (hours)	Range (Nm)
FL300	500	0.848	4.5	2270
FL300	437	0.742	5.7	2523
FL300	431	0.706 (ISA + 12)	5.9	2544
FL300	416	0.706*	6.1	2552
FL300	323	0.548	6.8	2181

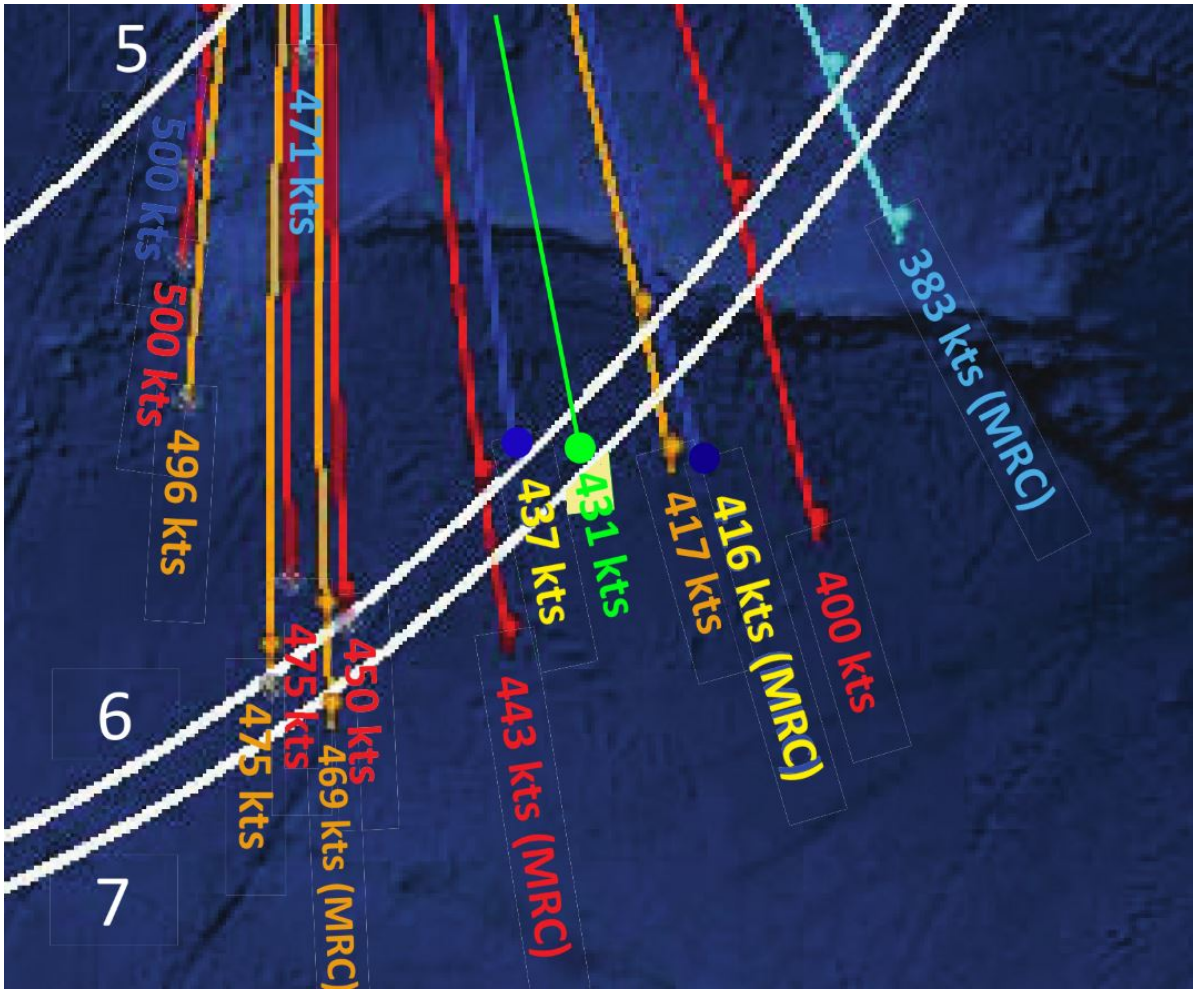

Figure 3: Range of our trajectory (Green) compared with Boeing possible paths at FL300
note: the proposed search zone is illustrated in yellow

In interpolating the range and time in Table 1 with the ISA of the day (in average ISA+12) we should match the corrected range of 2544Nm which is illustrated in Green in Figure 3. But actually, the path of our trajectory is 2522Nm long and was flown during 5.825 hours from 18h28:06 UTC.

The shortfall of 22Nm results most likely from the drag of the deployed RAT leading to a fuel overconsumption. From ARC1-Boeing at 18h28:06 UTC, we estimate this overconsumption at about ~300kg i.e. 0.9% of the fuel consumed during this southern leg.

Figure 4 illustrates a deployed RAT configuration where the turbine and its hatch are clearly justifying a fuel overconsumption.

Figure 4: Ram Air Turbine (RAT) and its hatch have been deployed

Additional References

[25] Boeing Performance Analysis, Appendix-1.6E-Aircraft-Performance-Analysis-MH370-(9M-MRO)