Searching for MH370: lessons from the greatest aviation hunt

Octavian Thor Pleter, Associate Professor,
NUST Politehnica Bucharest (Faculty of Aerospace Engineering)

The greatest mystery in aviation history has always been the disappearance of Amelia Earhart's circumnavigation flight on July 2 1937. 87 years later, in January 2024, we might have, for the first time, a plausible theory of what might have happened confirmed. Presumably, a sonar image of a Lockheed Electra wreckage has been identified in the Pacific, near Howland Island. The wreckage is still neither confirmed nor recovered, but at least there are strong leads to follow through. Sooner rather than later, this mystery will be solved. The plausible scenario of this flight is a fascinating story, but very far from the wild speculations which have been circulated for almost a century. It was just an aviation accident caused by a radio-navigation error, no alien abduction, no espionage agents captured. The reality was much less extraordinary. However, people found refuge in imagining the strangest explanations of this disappearance. For some reason, the wildest fiction trumps common sense.

Since March 8 2014, Amelia Earhart's flight mystery has been eclipsed by the disappearance of Malaysian Flight 370. A Boeing 777-200ER (B772) disappeared with 239 people on board while flying from Kuala Lumpur to Beijing. This is still a mystery after 12 years. ATSB published a report after ending the search operations in 2017 without success [B3], and an inconclusive final investigation report was published in 2018 [B4]. Enormous amounts of resources have gone into search operations between 2014 and 2017. Unfortunately, the lack of results of the most extensive and expensive search in the history of aviation inspired many conspiracy theories, which invaded the news and generated false accusations and false questions. The conspiracy theories were exacerbated, and the subject became so sensitive that many people approach it without an open mind and neutrality. In the era of social networks, bizarre claims and stories from content creators circulate faster than scientific research and studies done by professional experts. If someone were to try to rank the most important influencers in the MH370 case, most of these "creators of content" are journalists and private sleuths, such as Jeff Wise, a journalist and a founding

In the era of social networks, bizarre claims and stories from content creators circulate faster than scientific research and studies done by professional experts.

member of the Independent Group in 2014. The Independent Group was formed as a private alternative to the official search organisations, the ATSB (Australian Transport Safety Bureau), and the JACC (Joint Agency Coordination Centre). The activity of all these actors is documented in the remarkable Ean Higgins' book, The Hunt for MH370 [C2]. Ean Higgins was the senior editor on The Australian and led the international coverage of the MH370 mystery until 2020, when he disappeared without a trace, a mystery in its own right.

Coming back to Jeff Wise, he was extensively featured in the Netflix MH370 Docuseries [C9]. There, he declared that he teamed with some aviation experts, but at some point, when the experts unanimously rejected his theory as impossible, he had no choice but to exclude them from the group. The Netflix production relies 90% on extravagant journalist theories and just 10% on facts and aviation expert theories. To its credit, the movie opens all the imaginable scenarios, including the possible ones, not just the tabloid oddities.

The predominant obsession of these journalists, such as Jeff Wise and Florence de Changy [C6], is that someone is trying to prevent us from finding the wreckage. The reasoning is brutally simplistic: if it was not found, then it is because someone did not want us to find it. In other words, we are omnipotent in finding anything if we wanted to, so we have been outsmarted by the global elite who want us to fail in finding the wreckage.

All conspiracy theories are based on the most simplistic assumptions. Jeff Wise claims that if the wreckage was not found where the Inmarsat signals indicated, then the Inmarsat signals were tampered with, or downright falsified as a diversion, part of the conspiracy. The reality is always more complex than that. In any real-life problem, there is much complexity to be expected. Things are never so simple.

The classic scientific methods to determine the trajectory of the lost plane can be grouped into four categories:

1. Analysis of satellite images to search for accidental captures of the flight
2. Forward algorithms based on Inmarsat signals and flight simulation to estimate the location where the airplane lost power
3. Backtrack algorithms based on oceanic currents to estimate the location where the crash occurred, generating debris
4. Analysis of the debris to estimate the speed and the flight path angle of the aircraft at impact

There was no image showing a debris field, which led to the conclusion that the impact trajectory was not very steep, and consequently, the speed of impact was not very high.

I. Satellite Images

Nothing was found in the satellite images, and the main reason is the visibility. Out of the 7½ hours of powered flight, 6½ hours were a moonless night and ½ hour morning twilight. There was no image showing a debris field, which led to the conclusion that the impact trajectory was not very steep, and consequently, the speed of impact was not very high.

2. Forward algorithms based on Inmarsat signals and flight simulation

Together with my friend Prof. Cristi Constantinescu and a brilliant student at the time, Barna Jakab, we engaged in the research based on the Inmarsat signals, and published two papers [A1], [A3]. For the second paper, we won the Richey Medal of the Royal Institute of Navigation in 2017. The most influential paper using this type of algorithm was written in 2014 by a team of Inmarsat experts, Ashton et al. [A2]. The Richey Medal was awarded in 2016 for this paper. The results based on the Inmarsat signals were all located south of the Broken Ridge (Fig. 1).

In 2024, we made a 10-year retrospective of all scientific papers on MH370, and we were surprised to find that our old papers stood the test of time, our results being independently confirmed by other scientists [A5], [B3]. This encouraged us to do new research, which was presented in the EASN Conference in Thessaloniki 2024 [A27], and based on this, a new paper is in the course of publication. The results do not differ much from what we calculated in 2014-2015, but the new paper benefits from a better methodology and a complete repository of factual data, which became available only in 2018, when the final investigation report was released.

3. Backtrack algorithms based on oceanic currents

On July 29, 2015, on a beach in Saint-André, Réunion, the first debris of the MH370 aircraft was found. It was a flaperon with barnacle shells attached to the frame, due to the long time spent in the water. The part was positively identified by Boeing as belonging to the MH370 airframe. This discovery, followed by other parts discovered on various beaches in the Indian Ocean basin, triggered new research based on backtracking algorithms, using oceanic currents. These results were all located north of the Broken Ridge (Fig. 1), with two exceptions [A12] and [A24]. The [A24] paper is remarkable, because it uses backtracking algorithms on debris spotted in satellite images, so in an early stage of their drift (just 6 months of drift instead of 16 months or more). Thus, the accuracy of the method is greatly improved, and consequently, [A24] indicated a probable crash area not only south of Broken Ridge, but very far south, in total dissonance with other papers based on ocean drift backtracking.

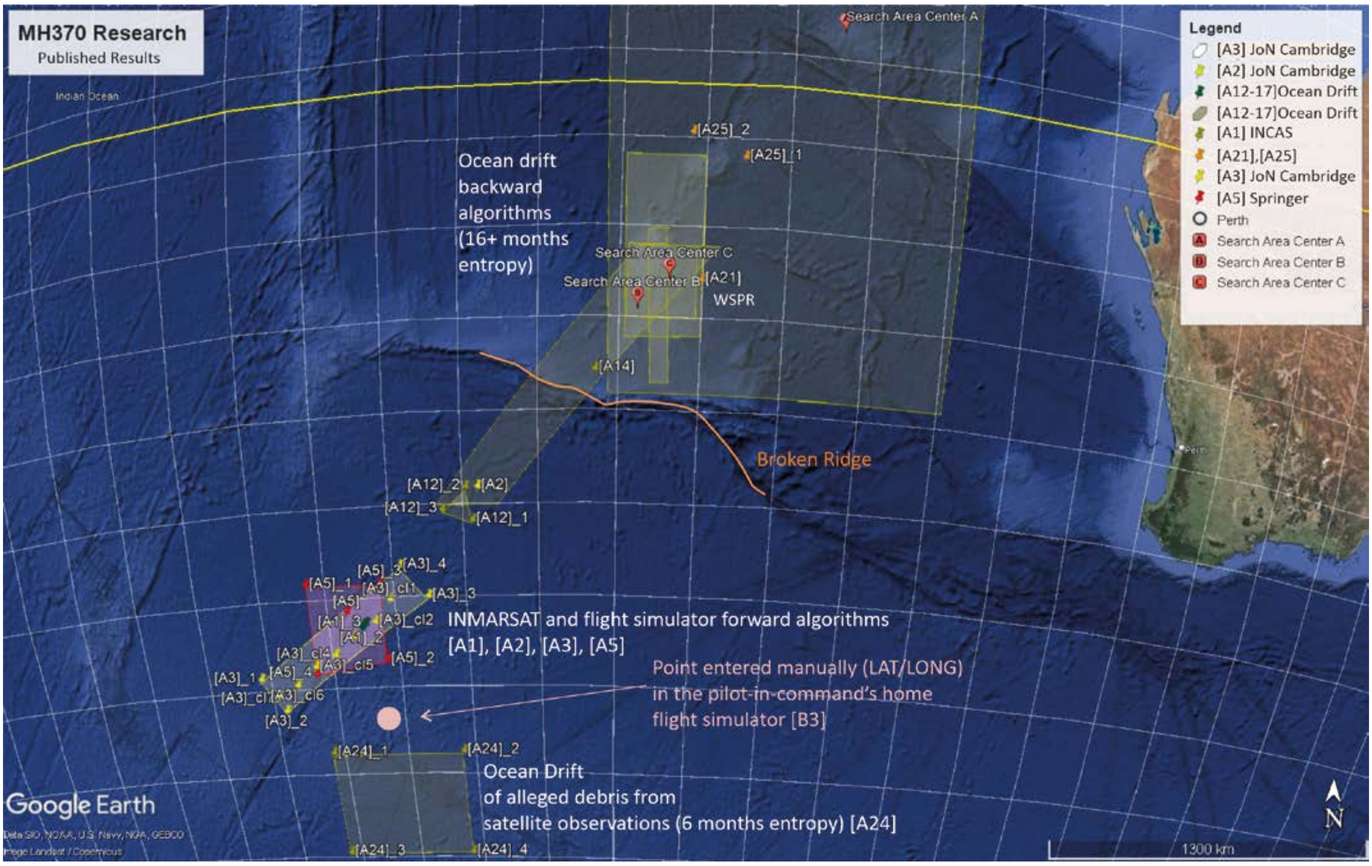

Figure 1 – Probable crash areas resulting from various scientific papers on MH370

4. Analysis of the debris

The fragmentation and the fracture patterns of the debris are consistent with a lower glide path angle (not a vertical impact), which is confirmed by the above-mentioned lack of detection in the satellite images of a debris field. On a vertical impact, the airplane breaks into smaller pieces, which stay afloat. If the airplane touches the water in one piece, it keeps its integrity to some degree and sinks. According to our simulations and flight dynamics calculations, a powerless B772 with the weight and weight distribution of the MH370 case, with controls blocked, hits the water on a 7°-11° slope, and the airspeed at impact is less than 200 kts. Here we disagree with many experts, who consider that a B772 running out of fuel would spiral dive and crash at a very high speed. The latter scenario is possible and even plausible, but for mass – centre of gravity configurations other than those of the particular MH370 aircraft.

In 2017, the official search ended, and ATSB published a report of the search [B3]. Between 2017 and 2019, it seemed that nothing new could restart the search, but since 2019, a series of new ideas have hit the media:

5. The weak signals theory
6. The controlled ditching of the airplane theory
7. The acoustic signal produced by the impact of the airplane in water
8. The cover-up theory (Inmarsat signals were spoofed)

The only scientifically sound idea is 7, based on acoustics. The others are far-fetched speculations.

5. The weak signals theory

The weak signals theory of Richard Godfrey promoted on www.mh370search.com [B14, C7] is based on an undisclosed database of HF radio signals recorded at the time of the flight. The published articles [A21], [B9], [B10] were neither peer-reviewed nor published in accredited scientific journals, and the weak signals data are kept secret, making it impossible to independently verify any claim. Richard Godfrey, in a 2021 interview for the BBC, indicated a precise location for the airplane (S33° 095°E) [C7], but nobody knows how it was calculated. WSPR is based mainly on HF frequencies, with a mixture of sky wave and line of sight propagation, and MF frequencies, which also suffer from ground wave propagation. HF is the only part of the radio spectrum which has never been used for radio location, and the reason for that is exactly the uncertainty of the propagation path due to sky wave and the multipath effect, which is the cause of the specific phenomenon called fading. Thus, attempting to radio locate on 10 MHz is a very difficult bet. The strong point of the HF radio spectrum is radio communications and not radio location. The WSPR project itself is not a radio location project. Its main purpose is to enhance lowpower radio communication range using multipath to its advantage, by speculatively using any objects for reflection, including the Moon, meteorites, and airplanes. When the first document was published by Godfrey in 2019, there was a claim that the innovative weak signals method indicated that MH370 made many turns before ditching, thus contradicting all existing references [A1-A5].

The WSPR is a multistatic technology based on statistics and requires statistically significant data. How close can these data originate from the presumed MH370 trajectory? The final point of the flight, as calculated by our team [A3], is 1,500 NM away from the Australian coast and 2,700 NM from the African coast. The radio ham communities from Australia and Africa were too far away, and the Indian Ocean, together with Antarctica, is a large region of the world lacking any radio ham activity. Until proven otherwise, after the data is made available, the claims in [B9-B10] that WSPR technology can offer a location of the MH370 are grossly exaggerated.

> There was no image showing a debris field, which led to the conclusion that the impact trajectory was not very steep, and consequently, the speed of impact was not very high.

6. The controlled ditching theory

Larry Vance, a Canadian accident investigation expert, saw the flaperon recovered in Réunion, then immediately published his book entitled MH370: Mystery Solved [C1], advancing the idea that the integrity of the flaperon and the abrasion traces indicated that it was extended at the time of impact, and the ditching of the airplane was smooth, so it must have been controlled by someone in the cockpit. This theory quickly contaminated the Independent Group and Jean-Luc Marchand. As I noticed in my long teaching experience, bad ideas circulate much faster than good ideas in the exam room. Initially, a Boeing expert claimed that a fuel-starved B772 would spiral dive and crash at a very high speed, coming under a very steep angle or even vertically. If this hypothesis were right, the wreckage would have been found very close to the 7th arc. That is why the search operations were very intense in that region, and yet nothing was found. Moreover, such a high-speed impact would have generated a debris field which would be noticed in the satellite images many days after the crash, and the debris would look different. In our simulations we demonstrated that the vertical impact hypothesis was wrong for the particular mass – centre of gravity configuration of the MH370, so even without anyone at the controls, the impact angle would be still 7° or even less (the powerless glide simulation is stochastic, each run comes with a different result, due to the entropy of the flight dynamics of an aircraft with blocked controls). Jeff Wise and the Independent Group applied yet again a simple two-state logic: if the impact was not vertical as expected by some experts, then it must have been someone at the controls doing controlled ditching. Tertium non datur.

The theory evolved into a variant of a powered descent and ditching with the engines still running, not a powerless glide. Vincent Lyne in [A28] and the hefty reports published in 2025 by Jean-Luc Marchand and Richard Blelly [B20] support this early powered left turn, so the flight should have ended closer to the Australian coast. This is (a) incompatible with the evidence (the flight performance of a B772 and the Inmarsat pings); (b) the presence of a B772 in that area would have been detected by the Australian Jindalee OTH radar; (c) no debris were found on neither the Australian nor the Indonesian coast, so the place of the crash mush have been at a considerable distance from them both; (d) the special character of the 7th ping.

The 7th ping is late enough for the fuel to be already exhausted. In our [A3] paper, we compared the moment of the 7th ping of

the radio signal with the flight simulator calculation of the moment when the fuel ran down to zero. The two moments approximately coincided. Thus, there is not enough fuel remaining for a post-7th ping powered descent, and also, the 7th ping was interrupted, and the only valid explanation is that it was interrupted by a power blackout.

7. The acoustic signal of the impact

The researchers of the University of Cardiff announced a breakthrough in 2024 in using the acoustic signals captured by underwater hydrophones. Their assumption was that there was a high-speed vertical impact of the airplane (200 m/s), and the sound of it was recorded by the Cape Leeuwin CTBT (Comprehensive Test Ban Treaty) hydrophones. The kinetic energy absorbed by the crash is proportional to this speed squared. In reality, the above-mentioned fragmentation of the debris and the fracture mechanics do not concur with a high-speed vertical impact. On a glide slope of 7° to 11°, the impact speed was proportional to the tangent of that angle. Moreover, the horizontal speed of a powerless airplane is not the maximum speed, it is rather 80 m/s. In our case, the impact speed is 80 x tan(7°), below 10 m/s. So, instead of a sound proportional to the kinetic energy of around 175,000 kg x 200 m/s ^2 / 2 = 3500 MJ, we should expect a sound proportional to just 175,000 kg x 10^2 / 2 = 8.75 MJ. To understand what fragmentation results from a high-speed impact, check the fragmentation of the GWI 2592 aircraft in the pictures on the Internet. I know that this was rock, not water, but at 200 m/s, water behaves like concrete. Cape Leeuwin, at 1100 NM away from the alleged place of the crash, is probably too far to detect a 8.75 MJ impact.

8. The cover-up theory

Florence de Changy [C6] is a French activist and journalist who expressed early doubts that the search was conducted in good faith and in the proper places. She denied the idea that the flight went so far south, in the Indian Ocean. Jeff Wise and the Independent Group were also vocal in expressing similar doubts. In an 2024 interview [C10], Jeff Wise offered a relevant explanation why the classic scientific research has been replaced with new, disruptive ideas: "... the data that these scientists retrieved from the Inmarsat satellite system very clearly suggested that it had gone in Southern Indian Ocean, what's more, it suggested a specific place in the ocean, but when they searched that place, it wasn't there. And so this raises questions. Basically, we have to throw open all of our assumptions and ask them all of the other possible things that could have happened with this plane".

As a representative of the scientific community engaged in this case in 2014-2015, I was surprised that these new ideas, although highly anticipated by the public, have no scientific merit whatsoever (except for the idea of impact acoustics, which is valid, but fails by starting from implausible assumptions). The remaining three theories are promoted in the media as scientific, but they are not backed up by articles in any recognised scientific publications.

Epilogue

On 30 December 2025, Ocean Infinity started a new search for the disappeared MH370 flight, hoping to find the wreckage of the Boeing 777 on the bottom of the Indian Ocean. On 8 March 2026, the mission ended without success. It was the second such mission performed by Ocean Infinity after the official search ended in 2017. The previous mission off the coast of Western Australia took place in March-April 2025. Both missions were based on a $70 million no-find no-fee agreement with the Malaysian government. These new hopes of finding the wreckage were triggered by the popularity of the new ideas mentioned above. Ocean Infinity followed some of those new leads (for example, those published by Jean-Luc Marchand and Richard Bllely, or by Richard Godfrey at his precise location), but they were unfruitful.

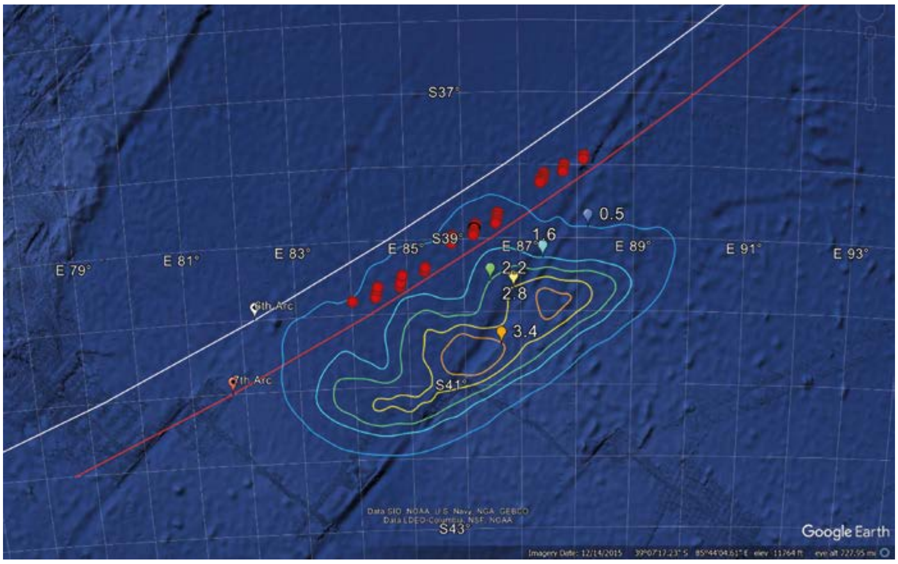

Figure 2 – The heatmap of the estimated MH370 crash positions, with iso-probability-density curves (from 0.5×10–4 to 3.4×10–4) [A27]

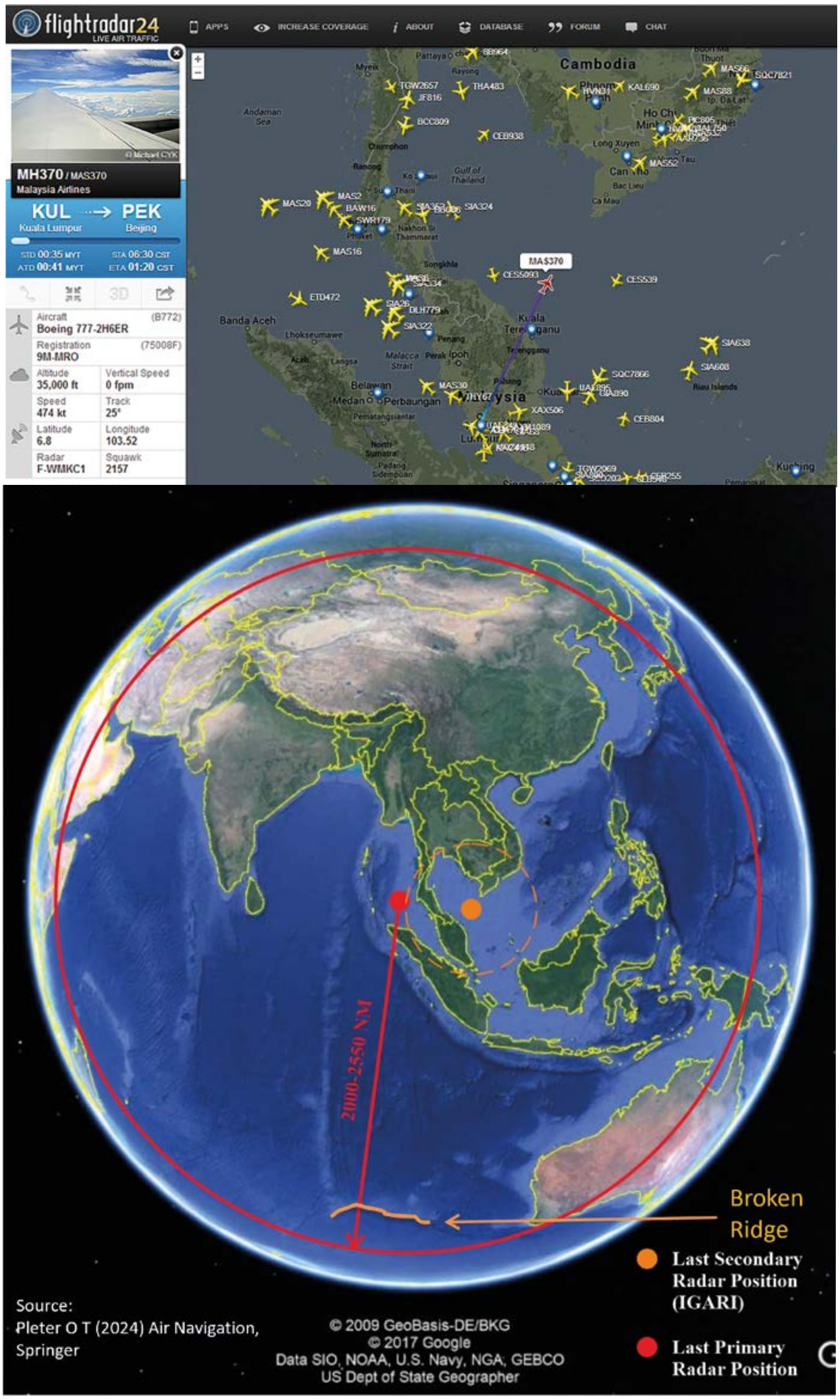

Figure 3 - FlightRadar24 snapshot of the MH370 at the time (above) - The initial search area (in orange) was extended after the satellite signals proved that the flight continued for 7 more hours (in red)

As to why the MH370 wreckage has not been found yet, and why I am sceptical about finding it very soon, there is this conclusion of the MH370 case in my Air Navigation book [A26]: “In comparison, in the AFR 447 case the crash location was fairly known (in the last 2-10 minutes of the flight ACARS reports were received by Air France HF antenna, vertical stabiliser spotted by Brazilian Air Force in 36 hours and debris and bodies were recovered within 6 days). Yet, it took almost 2 years for the underwater search to find the wreckage on the 5000 m deep ocean floor, after a 17,000 sq.km. search. The MH370 search covered ten times the surface, and the ocean depth is the same.” In the MH370 case, the trajectory of the flight can be calculated using the Inmarsat signals up to a point where the airplane was left without power, but the powerless glide trajectory is not known, and it could fly for up to 120 NM in any direction from that last point. The first piece of debris was found at a great distance in time and space, carried by the oceanic currents and winds. Add to that the lack of cartographic data on the bottom of the Indian Ocean, in sharp contrast to the Atlantic Ocean. The costs of the search operations, approximately €40 million per year, are the main deterrent for their continuation. Ocean Infinity has some marketing benefits of trying on a no-find no-fee basis, but also may monetise the cartography they produce during the search. We also need to mention that Ocean Infinity’s search technology is far superior to the one used in the initial 2014-2017 search. The probable crash area that was found in our [A3] paper was just partially searched at the time. Our new findings illustrated in Fig. 2 [A27] expand that area that has never been searched to the west and to the south. This could be the best bet for Ocean Infinity when they plan a new sortie in the future. Finding the wreckage would not solve the mystery. We may still wonder why such a horrifying mass murder happened, but at least there would be more clarity on what happened. ■

For further resources on MH370 visit https://inginerie.aero/index.php/en/mh370/

The Reference list is available at https://inginerie.aero/index.php/en/mh370-references/