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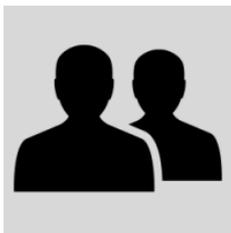   - john paczkowski
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#MH370: Tragic Flights of Fancy

April 10, 2014, 4:35 PM PDT

By Kyle Sanders and Brad "RenderMan" Haines, Combat Pilot and Hacker

The disappearance of Malaysian Airlines flight <u>MH370</u> has been tragic — and the grief of the families involved cannot be overstated. But adding to that sadness and bewilderment, another tragedy has taken place: An array of wild speculation and fallacious reporting of the event by news and popular media outlets around the world.

Perhaps the long search for evidence of <u>the aircraft's fate</u> has paid off. Perhaps not. In any case, now is a good time to look back at the coverage that has displayed a disheartening lack of respect for the families of the passengers and crew, whose grief demanded — and was too often denied — the consideration of due diligence in reporting. Here are some perspectives on just a few of the fallacious stories that surfaced during these recent difficult weeks.

A hacker may have gained control of the plane from the ground.

Modern airliners are an alphabet soup of radio communications systems: <u>ACARS</u>, <u>ADS-B</u>, <u>TCAS</u>, to name just a few. Given the array of technical details, it's not uncommon for laypeople to be confused about what can and cannot happen in this area, and many theories were reported — particularly during the early days of the investigation — suggesting that the flight was hijacked remotely and guided to destinations unknown.

To understand what's possible and what's not, it's important to note the airline industry's transition to a system generally referred to as <u>NextGen</u>, or Next Generation Air Traffic Control. A core part of this system is a move from radar on the ground to determine a plane's position to aircraft automatically reporting their position via GPS to air traffic controllers. This data transfer amounts to location information sent over radio using the ADS-B protocol. ACARS is a system to send short messages to and from the plane, usually weather updates and maintenance data.

Of the myriad of radio protocols on a plane, there is pretty much nothing that has the capability to "hook" into the system to control and remotely fly a plane — and lock out the pilots. Moreover, even if this were possible, pilots can simply disconnect the autopilot from the cockpit at any moment with the press of a button, or by pulling a circuit breaker within arm's reach to cut off power to the system. In the case of MH370, it's also important to note is that the various radio systems the pilots used went quiet within a few minutes of each other. Even if it were possible, it would be fairly difficult to remotely control a plane when all communication channels have been disabled.

It could be someone onboard with an Android phone.

This oddly specific speculation is based on a presentation made by <u>Hugo Teso</u> at the Hack in the Box conference in 2013. As part of <u>his talk</u>, he created a "test cockpit" from avionics systems and training software that supposedly used almost all the same code as an actual airliner. In this experiment, he was able to develop a system that an attacker could use while on a flight to interfere and inject commands into several of these systems. The brand-name phone angle comes from the fact that he was using an Android phone as a front-end to control a bag full of other equipment that actually performed the attack. But the Android phone was simply the interface. A real-life attack would require the perpetrator to be on the plane with a great deal of other equipment, powered up and running in checked or carry-on baggage, and focusing a great deal of attention on the task at hand. Getting onboard with that amount of equipment and a power source would probably draw a lot of unwanted attention to the attacker.

They should know where it is by now.

<u>Douglas Adams</u>'s description of space in "The Hitchhiker's Guide to the Galaxy" can also be applied to the ocean: It "is big. Really big. You just won't believe how vastly, hugely, mind-bogglingly big it is." Considering that voice and even digital communication from the plane to ATC and other aircraft only occurs periodically, one can imagine how searchers can end up with a massive target area even if a plane was on course. (Flight 370 appears to have deviated from its planned course and out over the Indian Ocean.) On top of that, of course, is the fact that planes are made of things that can sink. While there is often some detritus left floating, its coverage area is going to be a speck compared to the search area. A <u>visualization</u> created from real flight data shows how aircraft generally operate in specific "lanes" when over the ocean. (More on this later.) If MH370 deviated into an area well outside these lanes, the search area becomes a not insignificant percentage of the earth's surface, where traffic and monitoring simply don't exist.

The plane was deliberately flown off course.

The assumption at play here was that because the plane seemed to fly on a course to GPS waypoints (common points on a chart that define traffic lanes and are stored in the plane's flight computer), only a pilot who knows how to enter the five-digit waypoint names could have done so. But looking for malicious intent in months-old videogame save files is grasping at straws. The resulting crass accusations and scrutiny leveled at both pilots is premature and unwarranted, and may sully the memory of two competent aviation professionals.

Captain Zaharie Ahmad Shah is a pilot of 33 years with 18,000 flight hours of experience, an impressive achievement among pilots. This is an aviator on par with hero pilot Captain Chesley "Sully" Sullenberger, who famously landed on the Hudson River, with about 20,000 flight hours of experience.

One possible answer could be a simple one: That the pilots "fat-fingered" it. This happens all the time, which is why pilots must double check with each other when entering waypoints and coordinates. One wrong letter can send you thousands of miles away from where you intend to go. In an emergency or stressful situation, it would be easy to misspell an identifier while you were busy troubleshooting more pressing issues. Think of it as texting while driving — without an autocorrect function.

There was no continuous radar tracking.

This theory shows a lack of understanding of air traffic operations. Where are you going to put the radar dishes and associated power and communications relay equipment in the middle of the ocean? The previously discussed air traffic lanes exist because, at a distance of 20 to 50 miles away from coastlines, there is no radar coverage. These lanes represent an invisible highway system that ensures that planes don't cross paths, and that pilots stick to their lane and call out their position over radio for everyone to hear. ADS-B and NextGen are efforts to provide better location data to pilots and to Air Traffic Control, but these systems do not work if the plane or ATC is not yet equipped, which is the case in many countries, as the NextGen upgrades are not expected to be completed until 2020. In many cases, smaller airlines do not have the budget to equip all of their fleet all at once, so they're spacing out upgrades over several years.

Imaging satellites should be picking up pictures of debris.

In this age of Google Earth, everyone assumes that the entire planet is constantly under eagle-eyed scrutiny from space. This is far from the truth. First, many of the detailed images on Google Earth were taken by aircraft, and not by satellite. Second, searchers would, of course, like satellite images of the entire ocean if they could have them, but there are limits to satellite technology — memory, software, ground path and look angle to the area you want to search, among others. There are also optics equations that dictate the tradeoffs between image width and resolution.

Hypothetically, if enough satellites were available for use, you could slowly stitch together a composite of the ocean one image at a time. But then what? Someone would have to visually scan all those images one acre at a time. While crowdsourcing such an effort has been an interesting solution (note the 2007 search for missing Microsoft researcher Jim Gray), it would still take time for the right picture to be found. As an exercise, try using Google Earth — without labels or overlays — to try to find the Sydney Opera House. This should be an informative exercise, considering that the combined search areas are larger than the continent of Australia.

One more note here: Even if you knew where exactly where you wanted to look, competition is also a problem. You have to fight for priority to obtain satellites images against many paying governments and industries. Without knowing exactly where to look, and without someone to pay for it, it's not easy to commandeer all that data.

Some entirely new, mysterious and powerful force is at work on our planet.

Sadly — and not insignificantly — when it comes to popular media reports and the too many people who accept them whole-cloth, "disappearance" cases like this result in a slew of illegitimate and non-science-based theories. People like Mike Adams (author of "Natural News" and purveyor of alternative health products) and others offered up articles claiming the airliner was snatched from the sky by a super-weapon, kidnapped for secret governmental reasons, or had flown through a quantum "stargate." While some of these reports cover themselves in an "it's a possibility" cloak, it's clear that they suggest that unlikely (at best) conspiracies or supernatural forces are to blame. How could such positions possibly be taken seriously? It's surprisingly easy when you don't bother researching.

A quick example: Some of Adams's suggestions are based on his representation of the flight data recorder, and how it should have transmitted data that would have quickly identified the location of the aircraft. First, the "black box" is not made of adamantium, a fictional indestructible alloy found in comic books. (It's also not black, by the way. It's orange.) The device is simply a solid-state hard drive, sealed in a protective steel or titanium case with the hopes that it might survive an impact intact — many of them don't. In optimal conditions, its water transmitter can "ping" up from a depth of around 14,000 feet, not enough to reach the surface from some Indian Ocean depths that can be near twice as deep. In any case, dozens of ships are combing the ocean for this signal as we speak, and again it is a large ocean. It took search and recovery assets almost two years to find the black box of Air France 447, which crashed in 2009.

We'll pass here on much of the other over-reported gibberish regarding aliens, et al, but suffice it to say that all these types of speculation dishonor the memories of those who perished in the disaster, and their families who are suffering from their loss.

What happens when they do find evidence?

Finally, before more guessing games begin, here are a few things to keep in mind when — indeed, if — evidence is located. Even when all accident debris is recoverable, critical evidence may have been destroyed. Moreover, the flight data recorder, if it survived, may not provide complete data. Extended periods in the ocean, impact damage and other factors can render the data from the device unrecoverable.

Once evidence is located, hundreds of government, military, industry and aviation professionals will be working around the clock to provide answers. While this process occurs, the information they find is privileged, out of respect for those who lost their lives. Until they have a confident picture about what happened, they will not feign an answer and risk tarnishing the reputation of the victims, families or the aviation community.

Perhaps most important: Know that the investigation process is vital to the industry and the future of flight safety. While the solemn motivation of the specialists involved is of course to provide answers to the families as soon as possible, their ultimate responsibility is to understand how such a tragedy can occur, in order to prevent it from ever happening again.

Kyle Sanders is a combat pilot with a background in space systems engineering. He is a graduate of the Air Force Academy and veteran of Iraq and Afghanistan, where he piloted the C-130E/H Hercules. Brad "RenderMan" Haines is a hacker and security researcher. A frequent speaker and trainer, he follows whatever security risks he can find to make the world a better place. Both Kyle and Brad are subject-matter expert advisers to Signal Media Project, a nonprofit organization that promotes and facilitates the accurate portrayal of science, technology and history in popular media.

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kateshifman   7 days ago
Kyle and Brad,

Thank you for the thoughtful and well researched article. It's truly disheartening to see how serious news reporting is becoming more and more sensationalist. It's ok when it is about Kanye & Kim's new pooch, baby or bling but totally not ok when reputations, feelings and lives are involved. Between the public and the media, everyone is in a popularity contest.

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lnes2   7 days ago
I think you have seriously jumped the shark on the Sulley analogy. Comparing that pilot to Sulley is like comparing the mayor of a small town to Bill Clinton. Not to mention that we already know that the co-pilot had some serious judgment issues inviting young women into the cockpit.

Sadly we have had no real data for weeks and yes it's horrible for the families. But just as conspiracy theories with no basis in facts are harmful so is this white washing of the facts so we can carry on with the fairy tale that it's all so accidental.

The fact is that a) the disappearance between Malaysian air space and Vietnamese air space is way too convenient a time to go AWOL b) the fact that the transponder was turned off at this time; c) the fact that the automated engine to satellite pings were disabled hours after this and sequentially means that only a fool thinks this was all accidental.

Now where the plane is...your guess is as good as anyone's.

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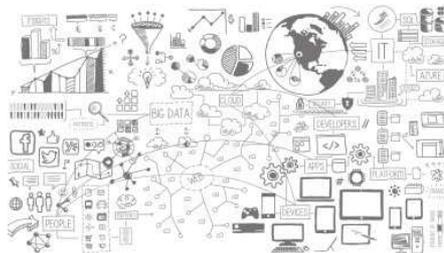
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