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RESEARCH ARTICLE

ARE AIRLINER-COCKPITS' COMPUTER-BASED INSTRUMENTS A CAUSE OF AIRCRAFT ACCIDENTS? – AN OPINION

***Meer Ahmad, A.M.**

Meer Ahmad Health Consultancy, A317 Apt Selasih, Jln PJU 10/1C, Damansara Damai, 47380 Petaling Jay, Selangor, Malaysia
Previously, Royal Malaysian Air Force & Faculty of Medicine, MAHSA University, Malaysia

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****Corresponding author:***
Meer Ahmad, A.M.,

ABSTRACT

This opinion-piece is a discussion of the article in the Los Angeles Times titled "Lion Air crash shows cockpit computers are no substitute for pilot skills". The Article said: "When an altitude sensor failed on a Turkish Airlines Boeing 737 flight to Amsterdam in 2009, the jetliner's computerized flight controls erroneously cut the engine thrust. The pilots didn't understand what happened in time to prevent a crash. The accident had striking similarities to the recent Lion Air tragedy in Indonesia, which took the lives of 189 people. A failed sensor led flight computers to put the 737 MAX jetliner into a series of dives, based on the erroneous calculation. The crew didn't diagnose the problem, which could have been remedied with the flip of a switch, and the plane fell into the Java Sea." This author, who has been flying airliners in the Microsoft Flight Simulator since 1999 in a very good simulation of real-flight, describes how that the common airliners that he flies in the simulator can be flown totally by using the autopilot – takeoff, cruise, approach and landing. This author argues that flying these airliners in the manner he does cannot possibly cause the accidents in the manner the LA Times describes above. Additionally, this author recommends in a design, a parallel computerized auto-flight system that should take over when the primary auto-flight system fails – and, pilot-skills training should be enhanced to make certain a greater understanding in the use of these systems.

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INTRODUCTION

This opinion-piece is a discussion of a thought-provoking article in the Los Angeles Times titled "Lion Air crash shows cockpit computers are no substitute for pilot skills" (VARTABEDIAN R and MASUNAGA S FEB 04, 2019).

The Article did say:

"When an altitude sensor failed on a Turkish Airlines Boeing 737 flight to Amsterdam in 2009, the jetliner's computerized flight controls erroneously cut the engine thrust. The pilots didn't understand what happened in time to prevent a crash. The accident had striking similarities to the recent Lion Air tragedy in Indonesia, which took the lives of 189 people. A failed sensor led flight computers to put the 737 MAX jetliner into a series of dives, based on the erroneous calculation that it was losing lift and about to stall. The crew didn't diagnose the problem, which could have been remedied with the flip of a switch, and the plane fell into the Java Sea. The investigation into the crash is ongoing.

" *I'm a doctor in Aviation Medicine since 1982 and flying the Microsoft Flight Simulator (MS FS) off and on since 1999 – importantly using the autopilot for take-off, cruise and landing Since the time I had been using the FS2004 and now the current FSX version. Hence, my opinion here is not based on experiences in real flying. I regularly fly the A321, the 747, the 737, the Bombardier LJ45 and have previously flown the 777 and the A320 – usually flying by autopilot; take-off, cruise and approach/landing at airports of sufficient-length and with ILS (Instrument Landing System) runway-frequency. Prior to take-off, I file a (computerized) IFR (Instrument Flight Regulations) flight-plan comprising current and destination airports and the altitude chosen to fly at. And then, prior to take-off I request with the ATC (Air Traffic Control) to approve the IFR-plan (it is never not approved by ATC, unless your filed-altitude has mountainous-terrain higher along the intended flight-path). Once approved, you are in constant radio-communication with ATC all along the way, until approach and final-to-land. Fig 1 is a picture of the 747-console in FSX – and it is not likely to be not similar to the real 747. You could see the primary-display in the bottom-left corner, and the secondary-display at the bottom-middle. The GPS is at the top-left corner, and the autopilot-panel is at the right-upper middle to right. You could see on the auto-pilot panel (from left to right) the Auto throttle-toggle, the Speed-hold, the Heading-hold, the Vertical-speed Hold, the Altitude-hold, the Approach-hold and finally the Autopilot-master switch. The Throttle-quadrant with which the Flap-toggle is attached is not seen here, but could be*

deployed, particularly in engaging various degree of Flap needed during the flight. The Radio-stack, which is not seen here, can be deployed too. To take-off, I first set the runway-heading on the Heading-hold after setting at Flap2. I then set 250 knots on the Speed-hold. And then, I set the altitude-filed (in the flight-plan) on the Altitude-hold (usually 25,000ft to 35,000 ft), and set the Vertical-speed (V/S) at 1800 ft/min. Following this, I click on the Heading-hold (button) to engage it, followed by switching on the Auto-throttle. And then, I release the Brake, and click on the Speed-hold (button). The 747 starts rolling (moving) on the runway. I observe at either of the Speed-indicators. When the Ground-speed reaches 150 knots, I click on the Autopilot-master to engage it, immediately followed by clicking the Altitude-hold (button) – the V/S-hold simultaneously engages on its own with the Altitude-hold. The 747 then takes-off at the appropriate Angle-of-Attack. I draw-in the landing-gear at 1500 ft AGL (Above Ground Level). Then at 5000 ft AGL, I disengage the Flaps and increase the Speed to 320 knots. The 747 then flies steady, and you only need to follow ATC-instructions all along cruise till Approach at the destination-airport where at Approach the ATC still give instructions on Heading and Altitude till near (Runway)Base, to Final-descent/Landing. All along you could observe your flight in the GPS, and request to graphically see Terrain on the GPS if required (this is also handled by ATC once an IFR-plan has been approved). All along, you need to set the Altimeter-setting (in calibrating the Altimeter against weather) also here, as read-out by the ATC.

During cruise, I click 'World' followed by 'Map' on the FSX Menu at the Top (not seen in this photo). The Map is the Map of the World, and a red-line is seen connecting the two Airports. You need to double-click on the runway pictured of the Destination-airport, (and double-click the name of the Airport when it appears). Data about the Airport appears – number of runways and runway-numbers (indicating compass-direction of runway), elevation of airport above sea-level, ILS-frequency of the runways, the Ground-frequency and the Tower-frequency among different additional data. To land the 747 fully-auto by ILS, you first need to enter the Ground-frequency in Com2 of the Radio-stack (and make it active; Com1 is still free for radio-com), followed by the ILS-frequency of the assigned-runway in Nav1 of the Stack (and make it active). After Approach-ATC at the destination-airport brings you near to the Base of the assigned-runway at the assigned-altitude, you are directed to communicate with the Tower who will instruct you to maintain altitude till you are "established on the ILS-localizer". At that time, you need to click to engage the Approach-hold. By now, I would have reduced my speed to about 170 knots, and gradually engaged Flap4.

The 747 slowly moves along the straight-line in the Heading you were finally brought to at near-Base by the ATC. Once the Approach-hold is engaged, the 747 turns sharply in the direction of the runway-heading and locks on to the runway-heading. The Approach-hold, being engaged, activates the Glide-slope for Final/Landing. The 747 descends slowly along the Glide-slope. You need not do more than slowly reduce the speed, along the Final, to the Landing-speed of 150 knots. The 747 lands on its own at the runway-apron. You only need then to switch off the Auto-throttle and Speed-hold, deploy the spoilers (air-brake) and then brake to bring the 747 to a stop on the runway, prior to taxiing out to park the 747. The simulation on the FSX is real as how the 747 is actually and really flown. In this manner, the 737 is not flown any different from the 747.Fig 2 is an Airbus A321 console. I engage the Approach-hold which activates the ILS-Localiser and Glide-slope to bring the A321 to touch-down in the same manner as the 747.Having described how I fly the 747, 737and the A321, it is difficult to understand the first two paragraphs of the Los Angeles Times article. It could not have happened if the plane was flown in the above manner – remembering though that fly-by-wire beyond the cockpit-instruments is also computer-controlled. At the slightest observation (discerning) of trouble in this manner, I should and would quickly disengage the Autopilot at its Master-switch, manually employ near-maximum power in the (manual) Throttle, and put the plane in a steady-climb at an acceptable Angle-of-Attack (preferably between 700 ft/min and 1000 ft/min till speed is steady well above the landing-speed of 150 knots, flying the plane manually till stable. Engaging Flap1 or Flap2 does help.

The Article continues to say: "Aviation experts say automated systems have made planes safer than ever and are a major reason why crash-rates have declined all over the world. The push to automate — which also reduces airlines' training-costs — is only growing stronger. Boeing has an ongoing research-project in the works to develop a fully-automated jetliner."

IFR-flying using the Autopilot, in the manner I do, allows for very precise changes in both Heading, Speed and Altitude and appears entirely safe – you could make changes in the Heading, Speed, Altitude and V/S precisely and in very small/large increments/decrease. But Murphy's Law could strike – "if anything could go wrong, it will!" Thus, there cannot be a place for full-automation in flying a jet-airliner. Such controls are not the only ones which could fail – many types of failures could happen (engine, controls, radios, systems, etc), besides fire-hazard and wind-shear. The greater the automation the better, but still two pilots and a flight-engineer in the cockpit would be best.

The only changes that I have to recommend strongly is to have displays (displaying both digital and dial-with-pointer-needle in a circular-scale) immediately below the Speed-hold, Heading-hold, Altitude-hold and V/S-hold (buttons and toggles) such that in a possible incident of failures in these, the (even non-alert!) pilot could earlier observe the rapid changes in these - indicating failure that does augment different perception-inputs such as seat-of-pants, speed-perception, G-forces and gravity. Preferably, these displays are accompanied with a labelled warning-light (or illuminated caption) along with a warning-sound. The digits on the display should subtend at least 5 minutes of visual-arc when viewed. The control-ergonomics aspect of arrangements of controls used in reacting to emergency-needs of a stricken-airliner are probably already given due attention in airliner-controls design.

And the Article states: "But automated flight systems are also implicated in a series of incidents in which they made the wrong decisions and pilots did not fully understand the complex software that adjusts flight controls constantly during automated takeoffs, landings and high-altitude cruising."The Article in addition says, "A lot of the optimization that the computer is doing is not made clear to the pilot," said Douglas Moss, an instructor at USC's Viterbi Aviation Safety and Security Program. He is a former United Airlines captain and before that, an Air Force test pilot, as well as an attorney.

Fig. 1. The Boeing 747 Cockpit-instrument console

Fig. 2. The Airbus A321 Cockpit-instruments console

Fig. 3. The Airbus A321 Cockpit-instruments console

"The pilot is sitting there for 10 or 15 seconds trying to figure out why the computer is pitching up the nose or adjusting the throttle. I can think of thousands of times when the autopilot or flight management system would do something that caught me by surprise. Almost always, it is the right thing to do, but it is the pilot who is responsible for the safety of the flight."

The greater (more) that pilots understand every part of the aircraft and the manner it is flown, the better – but, I'm inclined to think that the flight-skills required to fly the plane IFR and ILS is not more than that (which) I describe above. What Douglas Moss said is true. But, computerized-instruments failure need be looked at (scrutinized) separately from failure of computers controlling fly-by-wire.

The Article continues: "Aviation experts say the pilots' authority, certainly outside of the U.S. and Western Europe, is being gradually encroached on by automated control systems that offer air-carriers lower training-costs and crew-expenses in an increasingly competitive international-industry. It has led to a decline in basic manual-flying skills, the ability to use the stick, rudder and throttle to keep a plane at the correct speed, pitch and altitude, a wide range of safety experts say."

Once again, automation to any degree cannot be a replacement for ultimate over-ride by pilots in deciding to switch to and engage in manual-flying – and, basic manual flying-skills cannot be dispensed with to any degree. Handling a flight in emergency should be honed to a finesse and required of every pilot – here, regular flight-simulator training and regular CRM (cockpit resources utilization)-training considered as being of utmost importance.

"Pilots are not being told or taught everything they need to know about their airplanes," said Chesley Sullenberger, the renowned pilot who made an emergency landing on the Hudson River a decade ago that saved every person on board."It is not easier or cheaper or requires less training to fly an automated airplane. It frequently requires more, because you have to have a deep understanding of how a system works, including the dark corners, the counterintuitive things it might do in certain circumstances. Many foreign carriers are trying to take people with zero-flying experience, put them in simulators and quickly put them in the right-seat of a jetliner. They don't have the experience, knowledge, skills and confidence to be the absolute master of the aircraft start to finish."

Captain Sully is not wrong here. And certainly, ICAO-regulations must forbid the recruitment of such under-trained pilots.

The Article in addition said: Dennis Tajer, an American Airlines captain and spokesman for the Allied Pilots Assn., agrees automated systems should result in more pilot training, not less. "It makes the aircraft a bit more complicated, so understanding that, being able to utilize it and making it a part of your safety standard is critical," he said. When a piece of equipment fails, it's incumbent on the pilot to keep control of the plane, he said, adding, "stick and rudder skills save lives."The U.S. airline-industry agrees, and Boeing doesn't dispute the value of pilots. "Company executives have questioned where global airlines are going to get all the pilots needed to fly the planes that are on a order and expected over coming decades. As air travel increases rapidly around the world, many foreign carriers are coming to depend on automated controls to help flight crews that do not routinely have the deep experience, military background and intensive training that is common among major U.S. and Western European airlines. American experts are growing increasingly concerned that such crews are reluctant to fly aircraft manually and lack the skills necessary to intervene when computers make the wrong decisions."

The world's population, as it presently is and as is projected to in the near-future, is expected to continue to provide the necessary manpower – thus, the airliners can be expected to be steadily supplied with pilots. In the manner I had said earlier, ICAO-regulations must forbid the recruitment of such under-trained pilots. In my observation, military-background does not appear to be a very important requirement in the training and recruitment of commercial-pilots.

The Article continue: "Those concerns were at the forefront in the crash of an Asiana Airlines Boeing 777 at San Francisco in July 2013, which killed three and injured 187. The crew had inadvertently disengaged the auto throttle, which is akin to cruise control on an automobile, as it made its final approach. The airspeed and altitude varied widely over the prescribed glide slope and the plane's landing gear and tail hit the concrete sea wall at the far edge of the runway. Federal investigators blamed the accident on improper speed and altitude control, noting that Asiana Airlines emphasizes the use of cockpit automation. As a result of similar policies, many crews from nations around the world have limited hands-on manual flying skills."

Here, the cause of the incident appears to be pilot-error, without doubt. In such a situation of auto-throttle disengaging, the two pilots (should not have and) could not have taken them eyes off the Speed-indicator, particularly during Final-approach (descent) which could greatly help, together with visual and non-visual cues (such as seat-of-pant feeling, and speed-discerning ability) adding to such a help.

The Article states: "In the Turkish Airlines and Lion Air accidents, the pilots should have been able to manually fly the planes out of harm's way, experts say. In the Turkish Airlines flight, one of the aircraft's two radar altimeters reported that the plane was eight feet below the ground, leading the computer to think it was about to land and triggering an automatic reduction in the throttle. In fact, the aircraft was at about 2,000 feet and the crew was trying to reduce airspeed on the approach. But the crew did not realize the power settings had been cut to idle until it was too late, and the plane crashed a mile short of the runway. Nine people were killed."

Radar-altimeters (radio altimeters) measure and indicate the altitude Above Ground Level (AGL). But in my experience with the FSX, the AGL is not indicated anywhere among the cockpit-instruments (avionics console). Hence, the altimeters in the primary and secondary displays must be aneroid-altimeters (and not radar-altimeters) indicating the altitude above sea-level, as is the Flight Level (FL) assigned by ATC – thus, creating the need for altimeter-setting (calibration according to weather) during all phases of the flight all through a flight. And, since the altitude indicated in the autopilot Altitude-hold commensurate with the altimeters in the displays, it is reasonable to conclude that it is also fed by aneroid, and not radar. In the manner I fly as I describe

above, there is no need to 'meddle' with the power-setting and no possibility of the power-setting being inadvertently cut to idle.

The Article continues: "In the Lion Air accident, one of the plane's two angle-of-attack sensors, which measure the angle at which the wings are moving through the air, failed on takeoff from Jakarta. The aircraft's autopilot disregarded the good sensor and followed readings of the discrepant left side, or captain's sensor. As a result, it triggered software meant to offset the aircraft's tendency for the nose to pitch up."

If the plane was flown auto take-off in the manner I do as I describe above, there is no concern and worry over the Angle-of-Attack (sensor and) indicator since the V/S-hold has been set and engaged. The plane will assume an AoA of about 12 degrees at take-off when the V/S is set at 1800 ft/min. The pilots only need to be alert for (discerning) any of the autopilot-components becoming disengaged (if at all such happens in reality). When flying auto take-off, there will not be much for the pilots to do except be vigilant and alert in monitoring the auto-pilot components.

And the Article state: "Such a nose-high attitude can reduce lift and potentially stall the jetliner. But in this case, the software the maneuvering characteristics augmentation system, or MCAS was responding to wrong data and putting the plane into a dive.

It is similar to what is known as a "runaway trim," which can be caused by as many as five problems. Some experts say the crew should have known how to flip off the MCAS and manually fly the plane, which is what another crew had done the day before in the same plane. Instead, the captain repeatedly attempted to pull up the nose and never correctly diagnosed the problem."

This aspect appears to be a failure of the computers controlling the fly-by-wire system and not the components of the autopilot. Adequate skills in manually overcoming the emergency would have saved the plane. Once again, a strong pilot-error element.

One manner of overcoming computer-failure of both autopilot-components and computers controlling fly-by-wire controls, and thus preventing crashes caused by such, in a recommendation, is to have parallel computer-systems of both these on standby to take over from the primary-computers when an (similarly) in-built mechanism senses the failure of the primary-computers. But, the pilots must at all of a time be made alert (aware) of such happening, and be trained to be in control of the situation.

REFERENCES

Green RG. and Farmer EW. 1988. 'Altimeters, Current display trends, display principles, controls' in Ergonomics in Aviation Medicine (second Edition) by Ernsting J and King P. Butterworth Heinemann.

Vartabedian R and Masunaga S. FEB 04, 2019. Lion Air crash shows cockpit computers are no substitute for pilot skills. *Los Angeles Times. https://www.latimes.com/ business/ la-fi-lion-air-crash-20190204-story.html*

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