

# HUMAN FACTORS NEWS

Issue 17

November 2017

## THEME — AWARENESS



**HFTS** is pleased to announce the launch of our **Incident Investigation** training course. This program consists of three modules and is designed to help find the cause of incidents. Topics covered include: Gathering Information, Analysing Information and Report Writing.

Finding out why an incident occurred is the key to preventing it happening again and writing a good report about the findings helps others learn from the incident.

This course is available as part of the suite of training programs offered to monthly contract clients. Other operators can purchase this course for \$150.00 + GST per person. (Email: [info@hfts.com.au](mailto:info@hfts.com.au))

### The loss of Air Asia Flight 8501

Awareness played a part in the crash of Air Asia Flight 8501 in December 2014.

A tiny soldered electrical connection in the aircraft's rudder travel limiter unit (RTLU) was found to be cracked, likely for more than a year, causing it to intermittently send amber master caution warnings to the ECAM. The aircraft's maintenance records showed that the RTLU warning had been triggered 23 times over the previous year, but was always solved by resetting the RTLU system.

On the accident flight, the RTLU sent an amber caution warning on four different occasions. The first three times that the ECAM system gave the warning, the pilot in command followed the ECAM instructions, toggling the flight augmentation computer (FAC) 1 and 2 buttons on the cockpit's overhead panel to off and then on. This procedure cleared the amber master caution warnings for each of those first three warnings.

On the fourth occurrence of the RTLU warning during the flight, the Captain chose to ignore the procedure advised by the ECAM instructions and, instead, left his seat and reset the circuit breaker of the entire FAC, unintentionally disengaging multiple flight control systems, which needed to be turned on again by the pilots after the circuit breakers were reset. This circuit breaker is not on the list of circuit breakers that are allowed to be reset in flight, and disabling both FAC computers placed the aircraft in alternate law mode,



disengaging the autopilot and stopping the automatic stall protection.

To maintain situational awareness, a person needs to perceive cues, understand those cues and predict what will happen in light of that understanding. Despite repeated occurrences of master caution warnings, the only action by maintenance was to find a way of addressing the symptom (the master caution warning) rather than the underlying cause. They perceived the cue that the warning was tripping but they didn't comprehend that the warning was a signal to delve further into the situation to work out why it was occurring.

The flight crew didn't predict what was likely to happen in this event. Rather than noting the warnings as a precursor to something more dramatic, the Captain attempted to override the system in a non-standard way.

The result of decreased awareness by both maintenance and flight crew was the loss of 162 lives.

## Incomplete maintenance on Bell 407

On 11<sup>th</sup> July 2016, a Bell 407 helicopter crashed on approach to a landing site in Tennessee. A witness reported that at approximately 75 to 100 feet above the ground the main rotor tilted to the right. Immediately afterwards, the helicopter banked to its right and fell to the ground on its right side. The pilot was killed in the impact.



Initial examination of the wreckage revealed that the collective lever, which connected the cockpit collective controls to the main rotor, was disconnected from the pivot sleeve. The safety wire securing the screws to the pins was missing. The screws had backed out over time, resulting in the complete loss of collective control in flight.

An inspection of the condition of the flight control bolts and nuts was one of the maintenance tasks carried out shortly before the accident, but an inspection of the collective lever pins, screws, and corresponding lockwires was not included in that inspection.

**“No, I don’t remember doing it.”**

An engineer performed the 24-month inspection of the flight control bolts and nuts. When asked if he removed the collective lever pins, he responded: “No, I don’t remember doing it. If anyone would have done it, it would have been me, but I don’t remember doing it.”

The supervisor who inspected the work performed in the area of the flight controls reported that the removal of the collective lever pins “...was not part of the required

maintenance performed.” He was not aware that the pins were removed or that any lockwire was removed. He added further, “I could see why it could have been done. The 24-month flight control bolt inspection was being performed; why not pull them and look at them too. I’ve done it before.”

Two items stand out here:

The engineer’s statement: “I don’t remember doing it,” is a classic sign of lost awareness. If you are unable to recall a particular time or event, it is probable that you were switched off to what was happening around you at that time.

The supervisor’s statement: “Why not pull them and look at them too. I’ve done it before.” If removing the lockwires and pins wasn’t specified in the procedure, then the person doing the checking will not be looking at these items. Any error in this procedure will therefore go undetected.

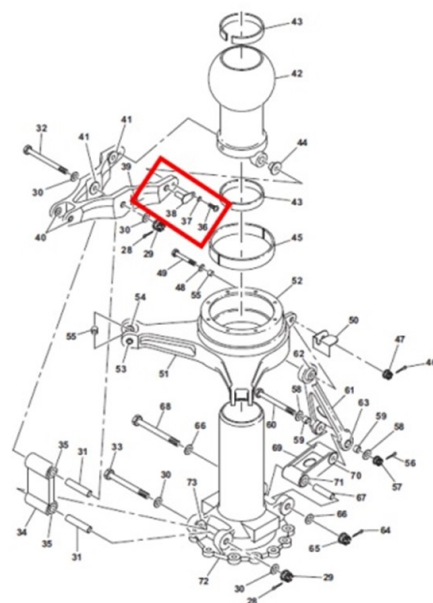


Figure 1 - Swashplate support assembly, with collective pitch lever attaching hardware outlined in red.

## Diminished situational awareness

This incident occurred on a recent A320 flight from Kolkata to Mumbai.

On departure, the captain called for the autopilot at about 600-800 ft. and the first officer complied. As the aircraft accelerated through 200 knots, both pilots noticed a loud noise that they thought was coming from airflow over a switch panel which they believed to be open. They continued the climb and the captain called for "flaps up, climb thrust, and after take-off checklist". The F/O completed the procedures and read through the checklist silently and then called "After Take-off Checklist Complete."

About five minutes after take-off, the autopilot disengaged. After several unsuccessful attempts to re-engage the autopilot, the captain chose to hand-fly the aircraft. At the same time, the F/O noticed that the Flight management system needles had disappeared from his primary flight display. He cycled the NAV selector to "green needles" and back to FMS and the FMS course reappeared for a few moments and disappeared again.

Passing through 10,000 feet, the F/O switched the "No Smoking" switch to signal to the Flight Attendants that they were through 10,000 feet. The switch did not chime. He tried the "Fasten Seatbelts" switch which also did not chime. He then called the flight attendants and advised that we were through 10,000 feet.

At this point the pilots began to notice they had extremely diminished climb performance and were not able to accelerate past 260-270KIAS. They knew something was wrong, but could not figure out what. The captain asked the F/O to begin reviewing all of the system status pages to see if there were any other indications as to the cause of the diminished climb performance. They also began calculating their fuel burn and discovered they were burning about 400lbs of fuel every 5 minutes. With about 5,000 lbs. of fuel and about 40 minutes of flight time remaining, they decided it was best to divert.

The captain continued to hand-fly while the F/O prepared the performance numbers and FMS for their arrival. Once established on finals, the captain called for "Gear Down."

The F/O reached for the gear handle and noticed that it was already down. At this point, he realized that he had never selected the gear up on departure.

He believed he became distracted and omitted to retract the gear. The noise generated by the landing gear was mistakenly attributed to an open panel. The pilots became further distracted by an autopilot that wouldn't stay engaged, switches that didn't chime, fluctuations in the FMS, and poor aircraft performance. They were overwhelmed by the cascading list of failures and were unable to make sense of their situation.



The crew were so rattled on finals that the maximum gear extended speed was exceeded by approximately 10 knots, there was a flap over-speed and the thrust reversers were not armed for landing.

When reviewing the incident, the F/O stated: "I will need to pay particular attention to all of my checklist items. It is one thing to miss a flow, it is another to read and verify a checklist and still miss an item - that is what the checklist is for. Additionally, once an issue is discovered in-flight, you must sit back and review even the most basic reasons why a problem is occurring. We failed to notice that our gear was down for the entire hour we were in flight."

***"We were very focused on other possible issues, and failed to sit back and evaluate the big picture."***

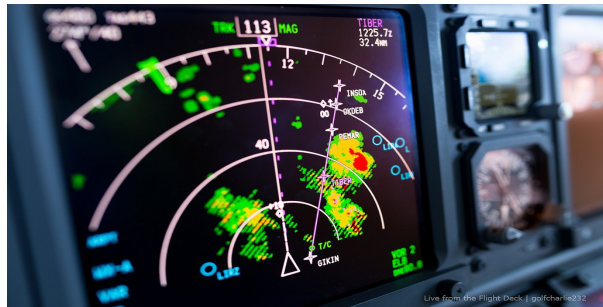


## Invisible thunderstorms

This event occurred in a Dreamliner 787 earlier this year.

At FL360, we entered a cumulous top that we were not aware of primarily due to our map scales being too large to see the radar return. We encountered moderate turbulence and strong up and down drafts. We scaled down our map displays and immediately requested a climb to FL370 and a course deviation, but only the altitude was approved. We were denied the course deviation due to traffic. We saw an immediate need to deviate to the right by only about 5 miles off course, which we did, and returned to our track after passing the threat. Also, due to the up and down drafts being as strong as they were, our altitude deviated by about 200 feet and we got 4 overspeed warnings. The weather cell was small, but intense and rising rapidly. The

whole event lasted around 3 minutes after which we checked on the cabin crew and found everyone to be okay.



The crew in this incident failed to perceive cues because the cues were too difficult to find. The scale setting on the radar meant that the small cells of intense thunderstorm activity were too small to be seen.

## Techniques that work

You can have better awareness by creating conditions that make it easier to concentrate and complete your work. Four simple techniques that work are:

**Drink enough water.** Individual water needs depend on many factors, including your health, how active you are and where you live. About 20 percent of daily fluid intake usually comes from food and the rest from drinks.

Your fluid intake is probably adequate if:

- You rarely feel thirsty
- Your urine is colourless or light yellow

**Consistently eat foods that support healthy brain function.** Signs of possible poor diet are brittle hair or hair loss, dry or scaly skin, swollen or inflamed gums, steady weight gain, slow wound healing, lowered immunity to illness, or irregular stools.

**Engage in aerobic exercise.** Aerobic exercise gets the heart pumping. For an effective workout, you should aim to keep your heart rate at 50% to 70% of your maximum heart rate for around 30 minutes. An estimate of a person's maximum heart rate can be calculated as 220 beats per minute minus your age. Proceed with caution and get medical advice if you have not exercised regularly.

**Get enough sleep.** You have usually had enough sleep if:

- you wake up without the need for an alarm clock
- you feel refreshed and invigorated at breakfast time
- you are in a good mood



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