Aviation Human Factors Industry News

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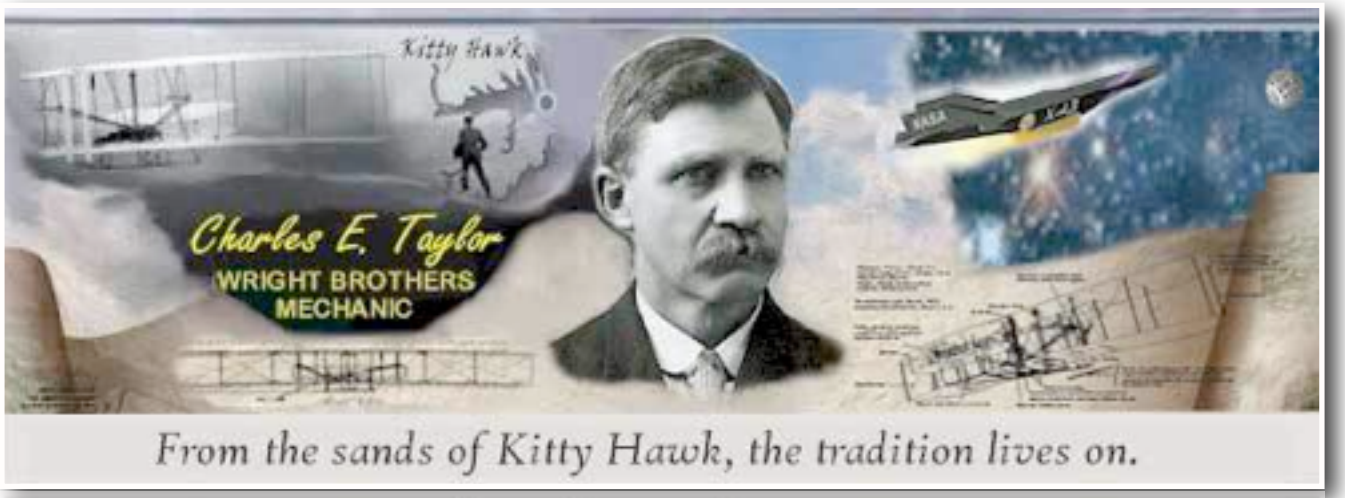


Hello all,

To subscribe send an email to: rhughes@humanfactorsedu.com

In this weeks edition of *Aviation Human Factors Industry News* you will read the following stories:

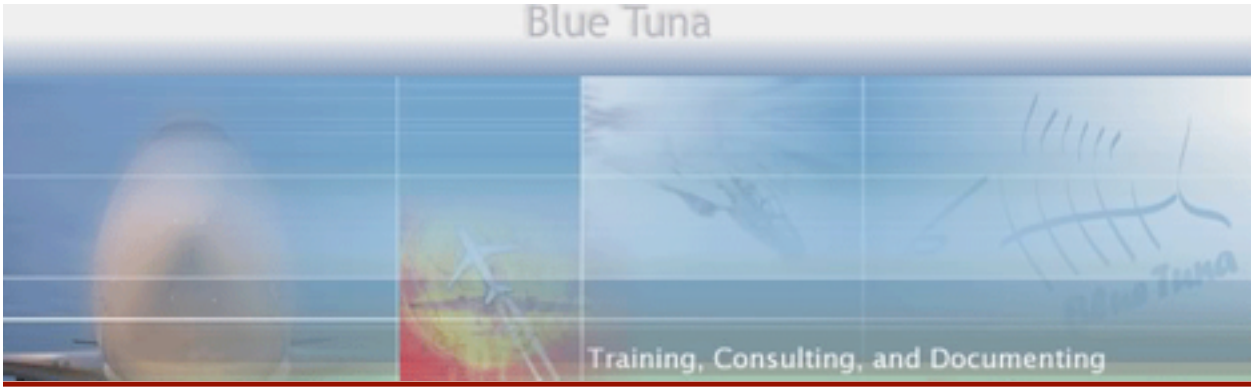
A319 Engine Cowling Separation In-Flight (Chile)

Sky Airline flight H2-112 returned to land at Santiago-Arturo Merino Benitez Airport in Chile after both engine cowl doors of the no. 1 engine broke off during departure. The Airbus A319 took off from runway 35R at 07:39 hours local time (10:39 UTC). After losing both cowlings on the no.1 CFMI CFM56-5B5/P engine the aircraft circled back and landed safely on runway 35L at 08:04 hours.

This incident is (at least) the 39th event of the loss of an engine cowl door on an Airbus A320-family aircraft. The U.K. AAIB issued several safety recommendations in their July 2015 report of an accident involving Airbus A319 G-EUOE that lost the cowling doors on both engine on departure from London-Heathrow,

https://youtu.be/fCFKs0ugUMY

Stress, Pressure and Fatigue aka the Aggravators



A few months ago we published a new Human Factors course called The Aggravators of Human Factors; Stress, Pressure & Fatigue.

There is no doubt the particular human factor trending is fatigue and it goes hand in hand with stress and pressure. I am trying to get the word out on these important topics because they are among the deadliest of the Dirty Dozen.
If you would like to use the “Aggravators” doc I attached please feel free.

About FAA Audits ……

Because we train so many repair stations daily we also pick up on the trending topics the FAA are focusing on in their audits. We have received many phone calls concerning EASA human factors compliance. FAA PMIs are focusing on repair stations with the EASA supplement. There are approximately 55 human factor topics. Several customers who use our training have requested info on how we align with the EASA requirements.
The Human Factors matrix is a guide on where our courses align with the EASA topics.

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(see page 21 and subsequent for details)

Jet Collapses During Routine Maintenance Check

A Singapore Airlines jet face-planted when its forward landing gear retracted on the tarmac at Singapore's Changi Airport Sunday.

The Airbus A330-300 was undergoing a landing gear check when the incident occurred, according to a Singapore Airlines statement.

Social media images showed the stricken plane, nose-down, at a gate.

It had been in service with Singapore Airlines since May 2009, and recently arrived in Singapore from Shanghai's Pudong Airport. It was due to depart for Hong Kong Sunday. An alternate aircraft was used for the Hong Kong flight.

"Maintenance work was being carried out to rectify a defect, and the gear retracted during the subsequent system check," the airline said.
"There were no passengers or crew on board at the time. One engineer who was on the aircraft was not injured.

"Singapore Airlines will be cooperating fully with the authorities in their investigations."

The statement said that details of damage to the aircraft were not immediately available, and that an assessment would be carried out after it had been removed from the gate.

The airline is widely considered one of the world's best flag carriers, and it recently scored highly in rankings published by aviation website AirlineRatings, which called it a "trendsetter."

All of its seating sections -- first, business, premium economy and economy -- were singled out for praise in the report.

The airline also has an excellent safety record, according to AirlineRatings.

Air Force pressed to make company pay $62M after fire traced to loose nut

A lawmaker is pressing the Air Force to make L-3 Communications Holdings Inc. pay as much as $62 million in damages from an aircraft fire that investigators linked to a loose nut that company maintenance workers failed to tighten in the plane's oxygen system.

The rear cabin fire on an RC-135 Rivet Joint intelligence aircraft during takeoff on April 30 at Offut Air Force Base in Nebraska aborted the training mission, risking the lives of 27 personnel. A picture in the official Air Force report on its accident investigation showed "a dark hole burnt through the center of the aircraft," according to the lawmaker, Representative Jackie Speier of California.Speier, the top Democrat on the House Armed Services oversight and investigations subcommittee, said in a letter Wednesday to Air Force Secretary Deborah James that her concern stemmed from Air Force documents about L-3's "mishandling of the RC-135 reconnaissance aircraft maintenance, which caused" the fire.

"Who will pay for the damage caused by this accident and any remedial actions taken as a result of it?" she asked. "Has the Air Force made any effort to recoup the cost" of the accident from L-3? the lawmaker asked.

L-3 Communications provides the RC-135, a specialized electronics intelligence aircraft, with depot maintenance including inspection, cleaning and re-installation of its oxygen system. The company worked on the plane in question in August 2013, according to Air Force accident investigators.

"L-3 has cooperated fully with the Air Force Air Combat Accident Investigation Board in the investigation," L-3 spokeswoman Jennifer Barton said in an e-mailed statement. "Questions regarding this matter should be directed to the U.S. Air Force."

While the Air Force had no immediate comment on Speier's letter, the service said in a recent statement about the RC-135 fire that "contractor liability is a complex subject that doesn't have a simple answer."

The service said the investigative report "does not suggest or recommend any actions, to include assigning accountability or liability." The Air Force said its immediate focus was "to partner with our civilian contractors to ensure the fleet is safe to operate, and we are confident that is the case. "

The accident board said in its report that the "preponderance of evidence" showed a "failure by L-3 Communications depot maintenance personnel to tighten a retaining nut connecting a metal oxygen tube to a junction fitting above the galley," allowing oxygen to leak.

The leak "created a highly flammable, oxygen-rich environment that ignited," according to the report. "The resulting fire melted the retaining nut causing the tubing to become detached from the junction fitting, feeding more oxygen to the fire, increasing its size, and causing severe damage to the airframe, galley, and mission equipment onboard the aircraft," it said.

"Even more alarming" were other maintenance failures "much more serious than one loose nut," Speier wrote. The accident investigation "found that L-3 had been using antiquated, substandard parts in the oxygen system, that some parts L-3 used were the wrong size, that only one of 11 nuts in that aircraft's oxygen system was property tightened and that L-3's mechanics were following vague and contradictory standards for maintenance of RC-135 oxygen systems," she said.

Speier said these details "are a cause for grave concern because other aircraft and crews' lives could still be at risk from this gross maintenance negligence."

L-3 was the U.S. government's eighth-biggest contractor in fiscal 2014, according to Bloomberg Government data, with $5.7 billion in contract orders. The Air Force alone has put more than $2 billion under contract with L-3 every year since fiscal year 2008, according to the data.

The Air Force spending includes more than $1 billion a year since fiscal 2013 on L-3's biggest federal contract, for the "Big Safari" program, which sustains and modernize specialized mission aircraft including the RC-135 Rivet Joint, according to Air Force documents.

Of Maintenance and Fatigue - John Goglia

I recently wrote about an accident investigation conducted by the British equivalent of the NTSB that concluded that maintenance errors were the probable cause. The accident was caused by the failure of mechanics to properly close and latch the engine fan cowl doors after routine overnight maintenance. Both doors of the Airbus A319 subsequently detached on take off from London's Heathrow Airport, substantially damaging the aircraft and resulting in an in-flight emergency.In that article, I focused on the routine maintenance manual deviations that were highlighted by the accident investigation board that led to such a significant and potentially catastrophic event.

I mentioned that fatigue was considered a contributing factor but did not discuss its impact at length. However, I do think it is important for mechanics to understand how fatigue can affect their performance. To me, it is as critical to understand *why* something happened as to understand *what* happened. So, here the human factors report addresses a number of the whys behind the conduct of these mechanics on this particular maintenance job.

One of the findings of the human factors analysis was that the maintenance technicians "were at an elevated risk of fatigue on the night of the incident, having worked a considerable number of hours of overtime in the preceding weeks." This was determined to be a likely contributing cause of one of the errors involved in the engine cowling doors not being closed – the mechanics returned to complete work they had interrupted but returned to the wrong aircraft. According to the report, this type of error is characterized as a "slip" – the mechanics intended to return to the correct aircraft but "their actions did not match their plan."

According to the analysis, slips are typically the result of automatic actions, "well-practiced activities that are not consciously monitored." Fatigue can make these types of errors more likely because it reduces conscious monitoring of activities.

There are two particularly significant issues here for mechanics. One is that fatigue can be cumulative. The report points out weeks of overtime hours potentially affecting the mechanics. While many workers either have no choice in working overtime hours – or welcome the extra pay – the important thing is for management and workers to acknowledge that that type of schedule can affect performance.

The other finding of significance to mechanics is that fatigue risk can be managed through appropriate systems. The report finds that the lack of a formal fatigue risk management system "meant that a key barrier to this type of error was not in place." While much focus has been placed on the impact of fatigue on pilot performance, much less focus has been placed on the impact of fatigue on maintenance workers. This accident – and the careful analysis of human factors in the accident report – could be the one that finally causes airlines and safety regulators to see that fatigue risk management is just as critical for mechanics as for other aviation workers.

The article can be found here: https://www.ainonline.com/aviation-news/blogs/torqued-routine-manual-deviations-can-have-major-safety-consequences.

To read the report's recommended strategies for combatting fatigue risk go to Appendix 6: https://assets.digital.cabinet-office.gov.uk/media/55a4bdb940f0b61562000001/AAR_1-2015_G-EUOE.pdf

Why Quality Assurance is Important

by Clint Lowe

I recently retired from the military after 38 years on aircraft ranging from the Minuteman III ICBM and F-4 Phantom to the F-16 Falcon and the C-21A Learjet. I spent about one-fifth of that time in Quality Assurance on '16's and Lears. On top of that, I was the director of maintenance, chief pilot, owner, and director of operations for a small air freight operation flying Cessna 402's and 206's. Director of maintenance means I directed the wrench onto the bolt, tightened the bolt, and signed off the work. It was a single-pilot operation.

During my QA time, I was deployed to the Mideast (including the summers!) with the Learjets and, after seeing some of the accidents and incidents that occurred at that high-operations-tempo base, I decided to write a note to our maintenance group so they might understand our purpose as Quality Assurance.

The note became rather lengthy and, it turns out, went well beyond the maintenance group. It went beyond the base. In fact, it was flashed across the Air Force and, in some maintenance units, became mandatory reading by some commanders. I got a lot of positive email traffic from the piece and thought I'd share it with *AMT* readers because it applies to aircraft maintenance everywhere — on fighters, cargo haulers, airliners, business jets, and light aircraft. I called it, "Understanding the QA Guy."Moving back into a former maintainer's mindset, I recall well my feelings at seeing QA arrive into my work area. Whether on the flight line, in a nuclear missile silo, or at a jet engine test facility, QA gave me about the same feeling I got when a police car pulled up beside me at a stop light. Suddenly, something I feel I'm good at is being judged. My standards and job performance are being scrutinized. As a member of QA here and at my home base, I'd like to help you understand your feelings. And why we're here.

Safety practices save lives

Long before two-level maintenance, a member of a jet engine test stand crew had been doing his job for several years when he arrived at a forward operating base.

The mechanic was well known not only for his troubleshooting abilities, but also for his disregard for basic safety practices. While he could fix an engine very well, he did it without using the books and often disregarded safety equipment—hiding behind an excuse of a high ops tempo.

The event came with an engine on the cell. The run screen had been forgotten at the shop and, citing a need to get done right away, the maintainer insisted the engine be fired up to get on with the job. As senior man on the crew, the other two did as they were told. While leak checking the engine at a high power setting, our man worked his way along the engine as he'd done dozens of times before.

Some think he tripped on one of the test cell stabilizing cables or slipped on the rubber coating of one of the engine connection cables; for whatever reason, while the technician was on the far side of the engine from the operator, he met his Maker. The operator, seeing only the shoes of our expert through the test cell structure, barely saw the shadow head for the intake. Almost instantly the engine started stalling — the operator did an emergency shutdown.

The guy who told me about this, my former supervisor, worked at the engine shop in Thailand during the Vietnam War era. The engine was a J-57 out of an F-101 Voodoo fighter. He said they barely stomached a cursory inspection of the intake and saw the blood, hair, and some clothing pieces ... the engine was quickly put on a trailer, wrapped, and sent to an engine shop in Japan where it was taken apart with oversight by a coroner. Rumor had it the compressor was wiped out and littered with pieces of bone, meat, and, well, you get the idea. The smell was unimaginable and the Japan maintenance members got sick every time another section was opened on the engine.

My 30-plus-year Air Force career is littered with first-hand observations and second-hand accounts of accidents caused by people not following the book. Some are humorous, some not so humorous.

Like an engine shop troop who went up the intake of an F-4 to blend compressor blades and the crew chief who didn't crawl the intake before he ran the engine. A few seconds after reaching idle the engine gauges started bouncing around; upon shutdown it was discovered the engine shop troop had left a rat-tail file on top of the Constant Speed Drive (CSD) housing. The result was a wiped out compressor and a de-certified crew chief.

Then there was Eric, the ICBM technician I worked with who found the lanyard he was using to be too short to reach everywhere he wanted to be, so he tied himself to a 50-foot piece of nylon rope. While cleaning around the top of the open, 90-foot-deep launcher, a gust of wind nudged him and he performed a free-fall into the hole.

Only because Providence was looking down on him did he miss the top of the missile, stopping only inches from a very immovable missile suspension arm at the top of the first stage booster. The guy who rescued him said his eyes were glazed and mouth open for the trip back up the hole. After that, he religiously only used enough lifeline to get the job done and didn't mind moving the lifeline from attach point to attach point.

Avoid tragedy

Tragedy I've known personally from unsafe practices include:

Two brothers, with families, digging in an 8-foot-deep water line without shoring up the sides of the hole; they died together in the same trench when the walls they didn't shore up collapsed on them.

Both suffocated and, according to coroner reports, had a bit of a time to think about it before the lights went out. I attended that funeral.

Last summer, a 23-year-old military member was riding a wheelie on his crotch rocket at an estimated 70 mph in heavy traffic when a car pulled out in front of him. While a helmet may not have done much in the resulting collision with the Cadillac Escalade, it would have at least prevented the mess I came upon immediately after the accident. The two teenage girls were not charged, since they couldn't see him because of his speed (30 mph zone), the color of his bike, and the fact his headlight was pointed up in the air. They will forever remember the gruesome scene the rider created.

A drunk driver racing down a two-lane highway, passing everyone in sight when he crossed the double-yellow line on a hill crest where he collided head-on with a family in a pickup with a camper on the back. A hundred feet from the burning wreckage, we listened as a father screamed in pain from a hot engine pinned against his abdomen as rescuers tried to cut him free of the wreckage…it might be merciful he died before they could get him out.

So, you want to know why I work in QA? Because of these and many other tales of people who've taken short cuts, defied common sense, and disregarded the law. Under this QA hat is another hat I proudly wear the one with the "Dad" logo on it.

As a parent, for the parents

One of the most enduring lessons I've gained from my advancing years has to do with parenthood. Many of you fine airmen are parents and know the pleasure and wonder of seeing your child's birth, first birthday party, first day of school, and so on. Many of you have yet to gain the privilege of being a parent, but one day you'll probably get this greatest of all opportunities. But, as most of the older NCO's and Officers in this outfit will attest, it might surprise you to know parents don't forget those moments.

The feelings and concerns that start with a child's birth don't diminish as that child goes into the world, including those who join the Air Force.

And my fellow parents are one of the most important groups of people I'm working for.

You see, I've observed the caskets that occasionally cross the ramp here. I briefly envision the torment some of my fellow parents are feeling as each coffin moves toward its final destination. In most cases, the honorable sacrifices made by those cannot be helped but, there are too many times the flag-draped caskets are due to accidents and carelessness. Like the motorcycle rider. Like the drunk driver. Like the test cell guy.

So, you need to understand I'm looking out for you when I grab you for not wearing personal protective equipment. I'm looking out for your parents when I write you up for not wearing your reflective belt. I'm saving a loved one from days of dazed crying and gut-eating sorrow when I nail you for climbing on flaps or standing on top of a wing without a lanyard. I'm even saving you from sitting in a hospital bed wishing someone would come by to visit when I report you to your commander for a detected safety violation or unsatisfactory condition report.

So, understand when QA arrives in your work area we've got an honorable intent. You might say we don't like seeing sad faces at funerals or hearing of amputated limbs. And we'll hang you from the rafters if necessary to ensure you or your coworkers don't end up in a flag-draped box on the cargo ramp.

Runway Safety: Bluegrass, Ky - Loss of Situational Awareness

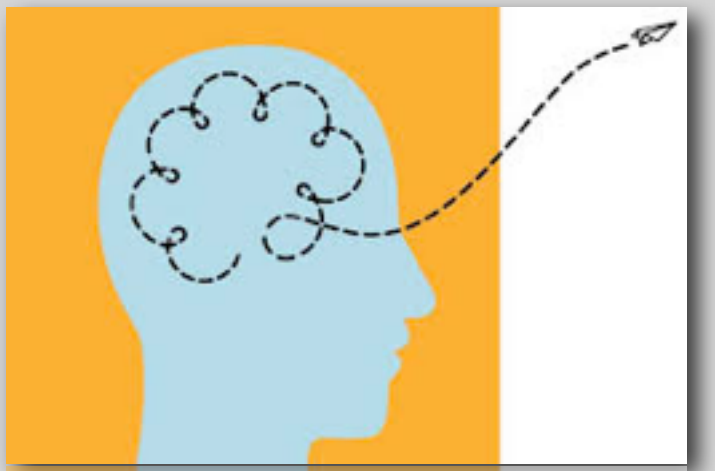
On August 27, 2006, just an hour before sunrise, the crew of a regional jet received a clearance to taxi to Runway 22 at Blue Grass Airport in Lexington, Kentucky. But in the pre-dawn darkness they taxied to the wrong runway for takeoff with dire results

. Watch the AOPA Air Safety Institute's accident animation to learn from this mistake...

AIRLINE PILOTS ADMIT THEIR MINDS WANDER

UNIVERSITY OF CALIFORNIA, SANTA BARBARA - Original Study

"This task of watching over a computer system while it works is incredibly trying, if not impossible, for a human being to do well," says Steve Casner. "You can try paying attention, and you can try taking brief breaks, but sooner or later you'll miss something important."



People are inherently bad at watching computers work, and unlikely to get any better, no matter how much training we get, new research with airline pilots shows.

"Our study really does suggest that vigilance is a very difficult task for people," says Jonathan Schooler, professor of psychological and brain sciences at the University of California, Santa Barbara.
"THIS IS A JOB FOR A ROBOT, NOT A HUMAN BEING."

"Extended uninterrupted monitoring can be draining. The antidote to that is interruptions that break up the monotony, but we also found that the interruptions themselves contributed to lapses. And people will spontaneously mind-wander, and that can also contribute to monitoring difficulties.

"So staring is draining, plus things come up which interfere with our ability to monitor, and our mind leaves the premises even when none of the other things are an issue. It's a trifecta of things working against effective monitoring."

[HOW A MILD ZAP CAN BOOST ATTENTION]

For the study, published in the journal Consciousness and Cognition, researchers examined why monitoring failures happen even among experienced and highly trained airline pilots. They asked 16 commercial jet pilots to monitor the progress of a simulated routine flight in which high levels of cockpit automation handled the tasks of navigating and steering the airplane.
Knowing that past experiments had shown monitoring-essentially sitting and staring at computer screens-to be a tiring process that quickly leads to fatigue and inattention, the researchers wanted to know how the pros do it: Did they have strategies to fend off the fatiguing effects of long watches?

They found that the cockpit environment is busy enough that pilots are often sidetracked by other tasks, such as talking to air traffic control or configuring the airplane's systems, which curtail fatigue. But they also discovered that these pop-up tasks could themselves cause pilots to miss important events during flight.

Most interesting, is what happened when the pilots weren't interrupted. Rather than focusing solely on monitoring the flight, they instead created their own distractions by engaging in what the researchers call "mind wandering."

When periodically asked what they were thinking about, pilots admitted to thinking "task-unrelated thoughts" up to 50 percent of the time-mental excursions that frequently led to missed events in flight. All in all, the pilots missed 25 percent of all altitude crossings they were charged with monitoring.

The pilots tried to limit their mind wandering to times when there were fewer demands on their attention, but ultimately found that even in circumstances with high demand their minds routinely wandered.

[KIDS PAY MORE ATTENTION ON THEIR FEET]

"We had anticipated that the longer people monitored that in itself would be associated with inferior performance, and we actually didn't observe that particular pattern," Schooler says. "But we had failed to appreciate how the solution-the interruption-itself compounds the problem. We were also surprised at the sheer number of times that pilots missed the altitude callouts and the high frequency with which they admitted to mind wandering.

"We should be very wary of relying on people to serve in a monitoring capacity-especially now, when we do have technology that can fill the monitoring role," he says.

Real-world monitors may be caught between a continuous-vigilance approach that is doomed to fail, a dynamic environment that cannot be fully controlled, and what may be an irresistible urge to let one's thoughts drift, says Steve Casner, a research psychologist with NASA.

"This task of watching over a computer system while it works is incredibly trying, if not impossible, for a human being to do well. You can try paying attention, and you can try taking brief breaks, but sooner or later you'll miss something important.

"This is a job for a robot, not a human being. It's time to rethink the way we design these systems. Let the people do the stuff they are good at, and let the computers handle the mundane chores."

Source: UC Santa Barbara

Automation, Intelligence & Autonomous Machines: The Human Factor

Moin Rahman

Principal Scientist, HVHF Sciences LLC

The inexorable rise of computing -- and its tsunami like push into the last bastion of what we thought was uniquely human, i.e., "intelligence" -- is unstoppable and is here to stay (see the "Three Eras of Automation" below).

Three Eras of Automation

If this wave of automation seems scarier than previous ones, it's for good reason. As machines encroach on decision making, it's hard to see the higher ground to which humans might move.

ERA ONE 19TH CENTURY
Machines take away the **dirty and dangerous**—industrial equipment, from looms to the cotton gin, relieves humans of onerous manual labor.

ERA TWO 20TH CENTURY
Machines take away the **dull**—automated interfaces, from airline kiosks to call centers, relieve humans of routine service transactions and clerical chores.

ERA THREE 21ST CENTURY
Machines take away **decisions**—intelligent systems, from airfare pricing to IBM's Watson, make better choices than humans, reliably and fast.

SOURCE THOMAS H. DAVENPORT AND JULIA KIRBY
FROM "BEYOND AUTOMATION," JUNE 2015

In our epoch, the efflorescence of computing has firmly placed it in a trajectory where self-driving cars to unmanned aerial delivery vehicles are likely to become as common as, say, hybrid cars and UPS delivery trucks. Autonomous vehicles have their computing consorts in Cloud, Big Data [Analytics] and Cognitive Computing; in addition to providing autonomy to machines they are also used to diagnose, predict and prescribe custom solutions for health, wellness or to maintain the health of machines (e.g., cars & planes) and critical infrastructure (e.g., power plants) before they breakdown.

Needless to say, red flags on the limits of machine cognition and a caution against the love affair with [perils] Big Data Analytics have been raised, as you might expect, by humans and not (AI) machines writing an essay on their own fallibility.

Now let me present a case study of a highly automated aviation system, which went awry due to unusual circumstances, resulting in a tragic accident.

Automation's Biggest Irony (after all these years): The Non-Surprise

Bainbridge (1987) in the "Ironies of Automation" observed automatic equipment seems to function best when the workload is light and the task routine; when the task requires assistance because automation is incapable of handling a novel situation, causing a spike in the operator's workload, this is when the automatic equipment is of least assistance. This is the 'irony' of automation.

This "irony" seems to have some relevance to the crash of Air France 447 as reported by IEEE Spectrum. In short, the pilot had no idea as to why the autopilot may have disengaged suddenly at cruising altitude -- a surprise (!) -- which resulted in inappropriate pilot inputs. (The pilots were unaware that all three air speed sensors (pitot tubes) were defective -- giving incorrect inputs to the flight computers due to the formation of ice crystals -- and as the autopilot didn't have airspeeds to work with, it automatically disengaged.)

The biggest irony of automation, after all these years of human factors research and design, should really be viewed as a "non-surprise" for the following reasons:

1. Automation is not fail-proof and it can result in dangerous consequences when the human operator is suddenly made-in-charge of an [automation] failure, thrusting him/her in a situation when the stakes are high and the time on hand is less.
2. A sudden failure in automation in a highly complex system, whose inner workings are opaque to the operator, may prove beyond the cognitive means of a highly stressed (panicky) operator to troubleshoot the situation and recover on time.

The above (#2) happens when a pilot is suddenly made to shift roles from a passive monitor ["out-of-the-loop"] to an active operator ["into-the-loop"] and is forced to grapple with the situation and grasp what is going on by rapidly developing a veridicial mental model of the situation). Furthermore, this ability could be impaired due to danger or stress-induced impoverishment of an operator's cognitive control (rational thinking) resulting in disorganization of thought and/or inappropriate responses. (The latter topic forms the intellectual underpinnings of “High Velocity Human Factors.”)

Years of experience have shown that invariably automation will abdicate its responsibility, when its performance envelope has been exceeded and bewilder the operator -- which should come as no surprise to the designers. So I will refer to it as a Non-Surprise.

Thus it behooves designers to provide "means" -- that are not mentally taxing, e.g., requiring cognitive transformations and inferential reasoning -- where a highly stressed operator can comprehend and take control of a non-normal situation. But what are the "means" to this end?

Making Smart Agents (human or machine) Smarter

As seen in the case study above, when novel situations or failures arise unexpectedly and at short notice, passive human operators (overseers of automated machines) find it impossible to jump into the situation and take control. One may also argue that it is possible that a novel situation may overwhelm a human operator. But more often than not, human operators (drivers, pilots) fail due to the proverbial nodding off at the wheel, which is usually caused by boredom (loss of vigilance), distraction, fatigue, or throughput pressures. Interestingly enough, on the rare occasion, a novel situation might be better and faster assessed by a human, as was the case with the miracle on the Hudson (landing of Flight 1549 on the river following a bird strike). But there is lot more to it besides human ingenuity alone -- and the machine in this case, an A320 and its designers, too, deserve a good amount of credit for enabling the survival of the crew and passengers.

So the biggest engineering challenge is not automation, autonomy or artificial intelligence in itself, but how can the (human + machine) system as a whole can be made smarter and less fragile? Amplifying the intelligence and mitigating the weakness.

Just handing off the "controls" to a smart machine may make humans less smart and, probably, dumb in an emergency due to panic. Or letting a human manually control a machine either directly or indirectly (teleoperation), which doesn't capitalize on some unique machine capabilities (e.g., RADAR, LIDAR, non-fatigue), is certainly a dumb decision.

The Way Forward

Computing power alone with its "set-piece play" algorithms are prone to serious failures due to a myriad reasons, which range from *confusing correlation for causation* to *Single Event Upsets (SEU)* in a microprocessor. Thus automation of safety-critical systems needs to proceed with caution, much in the lines of how Nassim Taleb has made the case for the application of the Precautionary Principle in the case of GMOs.

For now, we could at least consider utilizing the following heuristics when designing intelligent and autonomous machines in critical domains that may range from surface transportation, aviation & space exploration, utilities to healthcare. I present four heuristics for starters:

1. *Partnership* Design smart machines to be our partners and collaborators in creative problem solving, particularly during abnormal situations and time compressed emergencies. (Freestyle Chess is a great case in point.)
2. *Intelligence Augmentation* Design for bi-directional augmentation of intelligence (Human2Machine | H2M; Machine2Human | M2H), which take Human-Machine Interfaces (HMIs) beyond the current status quo.
3. *Epistemological HMIs* Multimodal *HMIs* (touch, voice, gesture, eye gaze) have come a long way. But they only operate at a perceptual level. We need H2M and M2H interfaces that give a better understanding of what the machine is doing, why the machine is doing what it is doing, and when the machine struggles to do something to the human collaborator and vice versa to the machine about what the human is up to or struggling with. In other words, a H2Mi and a M2Hi (**i**nterface) for reading the other agent's mind and/or to discover how we know, what we know ("epistemology" a fancy word borrowed from philosophy.)
4. *Love at first sight rule* Lastly, *Qualitative* data ≠ *Quantitative* data. Let me explain. It is still a mystery as to why we fall in love with someone. Big Data at match.com may help us in finding a mate, but it can't match the human capacity for *love at first sight*. This cardinal rule needs to be remembered and applied to enable the human factor exercise its full intellectual dominion when the machine is experiencing an irreversible LoC. (Loss of Control: e.g., sudden unintended acceleration caused by corrupted software or a sticky gas pedal in a car, or loss of both primary & back-up hydraulics in an aircraft in mid-flight.) Simply because only human intuition is the last bastion and has the intuitive knowledge to put the system back into equilibrium, if it can, in the nick of time.

The author, Moin Rahman is Principal Scientist at HVHF Sciences LLC and can be reached at moin.rahman@hvhfsciences.com.

http://www.research.ibm.com/cognitive-computing/#fbid=wMg_WwMbLPW

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https://hbr.org/2015/06/beyond-automation

Freestyle Chess

http://spectrum.ieee.org/riskfactor/aerospace/aviation/air-france-flight-447-crash-caused-by-a-combination-of-factors?utm_source=dlvr.it&utm_medium=linkedin

Proposed Rewrite Updates Maintenance School Rules

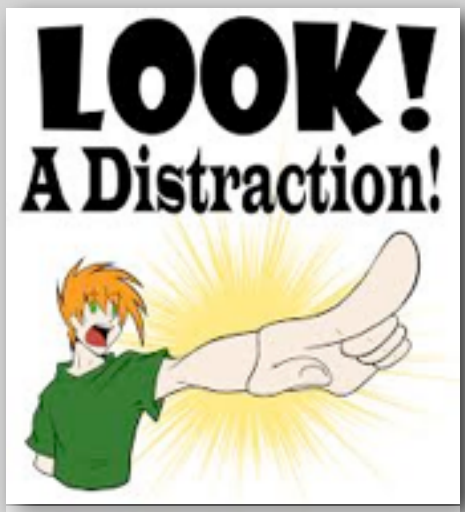
Part 147, the U.S. regulations governing the curriculum and operations of FAA-certified aviation maintenance technician schools, would undergo several major changes under a recent notice of proposed rulemaking (NPRM). These amendments would "modernize and reorganize the required curriculum subjects in the appendices of the current regulations," the FAA said. "They would also remove the course content items currently located in the appendices and require that they be placed in each school's operations specifications so they could more easily be amended when necessary."According to the FAA, existing curriculum is "outdated, does not meet current industry needs and can be changed only through NPRM and comment rulemaking." In addition, the proposed amendments would clarify existing requirements, remove gender-specific references and eliminate duplication found in some sections of the current rules.

While the agency has amended Part 147 several times since 1962, when they were re-codified from the CARs to the FARs, no curriculum changes have been made since 1992. Comments on the proposal are due by December 31.

http://www.gpo.gov/fdsys/pkg/FR-2015-10-02/pdf/2015-24841.pdf

Why lack of sleep makes us emotionally distracted by everything

Dark puffy eyes, a feeling of deep exhaustion, and a foul mood to match – we've all experienced the side effects of a lack of sleep. It's no wonder that sleep-deprivation has been used as a method of torture.



Our brains seem to lose the ability to distinguish between the innocuous and emotional in such circumstances, turning us into overreacting, exhausted wrecks.

We all know that a good night's sleep is vital for a day of clear thinking, but exactly why sleep is so important remains a mystery. Talma Hendler of Tel Aviv University in Israel is particularly interested in how lack of sleep leaves us with a short emotional fuse. "We know that sleep affects our emotional behavior, but we don't know how," she says.

To investigate further, Hendler and her colleagues kept 18 adults awake all night. "It took a great effort," she says. "During the night, we repeatedly measured their sleepiness, and unsurprisingly they got more and more tired."The volunteers were put through two rounds of tests while their brains were scanned, both the day after a good night's sleep and after being awake for 24 hours. In one test, volunteers were asked to give the direction in which yellow dots moved on a screen. In each case, the dots were laid over a potentially distracting picture that was either positively emotional (of a kitten or a couple in love, for example), negatively emotional (such as a mutilated body or a snake) or neutral (such as a cow or spoon).When the volunteers were well-rested, they were quickest and best at telling the direction of movement when the background image was neutral. But after a night without sleep, their performance was equally bad whether neutral or emotional images were used.

That might simply be because a sleepless night universally impairs judgement, but it's also possible that the result hints at something more subtle – that lack of sleep makes neutral images suddenly provoke an emotional response, says Hendler.

Scanning the detail

To probe the link in more detail, her team conducted a similar experiment in an MRI scanner, which is used to measure activity in different areas of the brain.

Inside the scanner, volunteers were again shown potentially distracting neutral and emotional images while they tried to complete a task – and again, sleep-deprived people found all images distracting, whereas the non-sleep-deprived were only distracted by emotional images.

Moreover, a region of the brain called the amygdala, which is known to play a part in emotion, fired up in response only to emotional images when the volunteers had had a good night's sleep. But when they were sleep-deprived, it reacted to neutral images in the same way as emotional ones.

The team also found unusual activity in a frontal part of the brain called the anterior cingulate cortex (ACC), which is thought to regulate the amygdala and our emotions. In well-rested people, the two brain regions fired together. But they seemed out of sync when the volunteers were sleep-deprived, with the ACC tending not to fire when the amygdala did. As a result, this part of the brain doesn't seem as able to control our emotional responses when we don't get enough sleep, says Hendler.

Together, the experiments suggest that when we're sleep-deprived we tend to see normal, everyday situations as particularly worthy of our attention, says Hendler. "You lose neutrality," she says. "The ability of the brain to tell what's important is compromised – it's as if everything is important."

There is one obvious way to protect yourself from the effects of sleep loss: try to get enough shut-eye. Hendler thinks people might also be able to strengthen the connection between the ACC and amygdala using neurofeedback – a technique that uses brain-monitoring technology to allow people to record and watch their own brain activity and attempt to control it.

But Mary Carskadon at Brown University in Providence, Rhode Island, isn't sold on the idea. "Despite wishes some have to the contrary, we all need sleep," she says. "I don't want to stimulate the activity between my amygdala and frontal cortex – I want to get plenty of sleep."

Journal reference: *Journal of Neuroscience*, DOI:10.1523/jneurosci.1314-15.2015

https://www.newscientist.com/round-up/instant-expert-sleep/


Fatigue *is Trending*
In Aviation
Look Inside for . . .
Information
Training
Tools

The problems of stress, pressure and fatigue continue to trend in the aviation industry. In the quest to do more with less we often look to the human component to make up the difference. After all, our flexibility allows us to adapt quickly, but not necessarily efficiently or effectively.

"In the quest to do more with less, we look to the human component to make up the difference."

Pushing a person beyond their physical limitations will almost always result in a negative consequence. Often the results are difficult to predict. The aviation industry is fraught with accidents and catastrophic events brought on by too much stress, pressure and fatigue.

While the right amount of stress or pressure may produce a positive creative tension, (Eustress) there are just a few degrees of separation between these factors operating as aggravators or as mitigators.

From the Dirty Dozen of Human Factors, stress, pressure and fatigue emerge as the spoilers, the aggravators of human factors. When stacked on top of other human factors like norms, distraction, complacency, communication, resources, assertiveness, awareness, teamwork or knowledge, these factors may become distorted and often erupt into a mistake, slip, lapse, accident or catastrophic event.

Our internal clock seeks to trip the switch that brings us rest and relief on a daily basis. Unfortunately the pressure to ratchet up our performance can lead to an unhealthy situation where we ignore what our bodies are telling us. The desire to please others, to beat the competition, to overachieve and get ahead comes with a price.

Push the Go Button too many times and you may acc elerate straight into the ground. When you find yourself beyond your physical limits the following questions are very important. Where will you be when it happens? Behind the wheel of your car on your way home from work or in the Captain's seat on approach? What will you be doing when your body finally says, No More? Addressing this problem is not just a cognitive exercise, it is a call to action.

Eustress means beneficial stress - either psychological or physical.

Too few tasks and boredom creeps in, confusion and apathy impacts our work life. Too many tasks leads to stress that causes imparied judgment, inattention and burnout.

Living in the top of the bell curve optimizes performance and keep our stress in a good healthy state - Eu-stress:) Finding this balance at the top of the curve creates a sense of well being that draws us towards our goals.

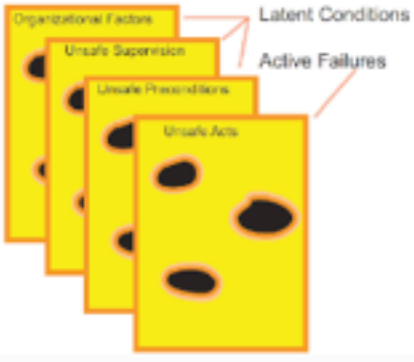
Education, training, recognition of the problems associated with stress are steps in the right direction.

What is an Aggravator?

From the Dirty Dozen of Human Factors 3 factors Stress, Pressure and Fatigue have been identified as amplifying, magnifying or aggravating the remaining human factors. For example, distractions on the flight line may be compounded by fatigue. A mechanic who is already behind in the work day may try to make up time by working from memory. Stress, Pressure or Fatigue combined together amplifies the mechanic's inability to maintain attention to detail (through lack of knowledge ie... Working from memory). The results may be a catastrophic event occurring anywhere within the sphere of the mechanic's influence, endangering others working around him or within the aircraft system itself.

The effects of stress, pressure or fatigue may amplify the consequences of other factors.

Understanding the Who, What, Where and When of Mistakes, Slips, Lapses or Errors plays a key role in the severity and / or timing of events. While latent conditions lay dormant in the system any active failure or error may trigger a catastrophic event.



Latent conditions may be found in the company organization, among supervisors or even in unsafe preconditions. These latent conditions are dormant until a front line operator (someone who has access to the system ie... Aircraft) like a mechanic, inspector, pilot or air traffic controller makes a mistake or creates an error. When the active failure occurs the severity of the consequences may be determined by the nature of the active error and latent conditions in the system.

Training For Trends

Control tower operators asleep while on shift, pilots tired from a lack of quality sleep and overworked tired mechanics are all scenarios that represent potential for problems. One strong line of defense is training. Understanding the problems of pressure, stress and fatigue will help supervisors who work on the front lines to identify these aggravators. It is imperative that all front line operators who interact with the aircraft on a daily basis receive training. While management is responsible for duty time cycles, it is the responsibility of all mechanics, pilots, inspectors, control tower operators and flight crews to police themselves.

First, take a honest appraisal of the stress in your own life. Remember a certain amount of stress is beneficial, it will keep you focused, alert and productive. Be smart about the pressures imposed upon you in the workplace and at home. Understanding where the stress is coming from and what it is doing in your life is key to maintaining a sharp - healthy focus.

Second, understand the need for quality rest and sleep. Without quality sleep, stress, pressure and fatigue are unavoidable. Your quality of sleep is a very basic step towards managing other parts of your life. Practice good sleep hygiene through practiced steps towards having quality nighttime sleep and full daytime alertness. (Sleep Hygiene is a study unto itself.)

Watch Dog

A new easy to use Blue Tuna app for your phone is on the way. **Watch Dog** will help you calculate your fatigue risk index per number of hours you have slept.

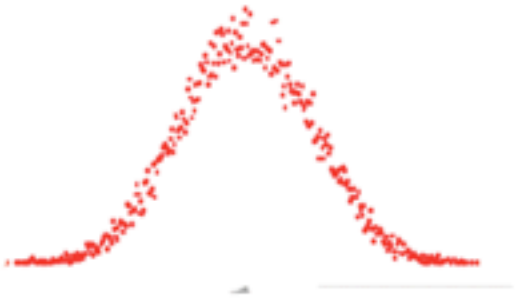
Watch Dog is coming soon and this dog will be free!

What Happens During Sleep

Hours 1-2 memory consolidation in the hippo-campus
Hours 2-6 memory movement to the cortex for long term storage
Hours 6-9 memory rehearsal in the cortex

When in REM (the sleep stage when we dream), related memories are linked together and emotional memories are processed. So, if you need to remember some important information for work or school, *we advise you to sleep on it!*

Sleep Bell Curve



People who sleep 6 to 9 hours each night reported having a higher quality of life and ranked lower for depression. In comparison people who slept less than 6 hours or more than 9 hours each night reported having a lower quality of life and had higher scores for depression severity.

Getting a good night's rest is easy for some and hard for others. This is no one answer. Over the next month we will be reviewing what goes into a good night's rest. Stay tuned in!

Watch Dog
Coming soon!

Blue Tuna Human Factors Courses
8.0 hours FAAST Team Approved
7 Courses Meeting EASA Requirements
Human Factor Intro
The Dirty Dozen
The Curse of Complacency
Driven to Distractions
Situational Awareness
FAA P.E.A.R. Model
The Aggravators

EASA Requirements	Human Factors Intro	Dirty Dozen	Situational Awareness	Curse of Complacency	Drivers to Distraction	The Aggravators - Stress, Pressure and Fatigue	PEAR Model
General/Introduction to Human Factors	x						
Need to address Human Factors and Statistics	x						
Incidents	x	x	x	x	x	x	x
Safety Culture/Organizational Factors Human Error							
Error Models and Theory	x		x				
Types of Error in Maintenance Tasks	x	x		x	x	x	x
Violations	x					x	
Implications of Error	x						
Avoiding and Managing Errors		x	x	x	x	x	
Human Reliability	x	x	x	x	x	x	x
Human Performance and Limitations	x						
Vision		x					
Hearing		x	x				
Information Processing			x		x		
Attention and Perception			x	x	x		
Situational Awareness		x	x				
Memory	x	x	x		x	x	
Claustrophobia and Physical Access							
Motivation	x			x		x	x
Fitness/Health	x					x	
Stress	x	x	x	x	x	x	x
Workload management			x	x			
Fatigue	x	x	x	x	x	x	
Alcohol	x	x					
Physical work	x	x				x	
Repetitive Tasks / Complacency		x	x	x	x		
Environment							
Peer Pressure	x	x					
Stressors	x	x		x		x	
Time Pressure and Deadlines		x				x	
Workload				x		x	
Shift Work		x					
Noise and Fumes	x						
Illumination	x	x					
Climate and Temperature	x	x					
Motion and Vibration		x					
Complex systems	x		x				
Hazards in the Workplace	x	x				x	
Lack of Manpower	x	x	x				
Distractions and Interruptions					x		
Procedures, Information, Tools and Practices	x	x					
Visual Inspection	x			x			
Work Logging and Recording	x	x					
Procedure – Practice / Mismatch / Norms		x	x				
Technical Documentation - Access and Quality	x	x					x
Communication	x	x	x				
Human Performance & Limitations Shift / Task Handover	x	x					
Dissemination of Information		x					
Cultural Differences						x	
						x	
Teamwork		x	x				
Responsibility	x	x	x				
Management, Supervision and Leadership	x	x	x				
Decision Making	x	x					
Professionalism and Integrity	x						
Keeping up to Date, currency		x					
Error Provoking Behavior	x	x			x	x	
Assertiveness.		x					
Organization's Human Factors Program	x	x					
Reporting Errors	x						
Disciplinary Policy	x			x			
Error Investigation	x	x	x	x	x	x	
Action to Address Problems	x	x	x	x	x	x	x
Feedback	x	x		x			