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Contents

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FOCUS is a triannual subscription journal devoted to the promotion of best practises in aviation safety. It includes articles, either original or reprinted from other sources, related to safety issues throughout all areas of air transport operations. Besides providing information on safety related matters, **FOCUS** aims to promote debate and improve networking within the industry. It must be emphasised that **FOCUS** is not intended as a substitute for regulatory information or company publications and procedures.

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Front Cover Picture: Aurigny Air Services operates the ATR72-600 & Dornier 228NG aircraft types on scheduled services from Guernsey to the UK and Europe. We are the second oldest airline in the UK founded in 1968 and the first airline in the UK to completely ban smoking onboard in 1977. We historically operated the world's largest fleet of Trislander aircraft and continue to be a long-term supporter of our island community through our inter island operation undertaking scheduled and medical evacuation and repatriation flights from Alderney.

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focus
ON COMMERCIAL AVIATION SAFETY

Challenges, information, and big data

by Dai Whittingham, Chief Executive UKFSC

At the recent International Aviation Safety Summit hosted by the Flight Safety Foundation, one of the themes which emerged during discussions on a variety of topics was the importance of data. Regulators and operators need evidence if rules, policies and procedures are to be implemented and maintained, and safety relies on a systemic understanding of what is happening.

Regardless of the topic, the importance of context was very apparent, as was the observation that data comes in multiple forms and that we often needed to draw the distinction between data and information. This in turn leads to an appreciation that some data will be commercially sensitive - load factors, profit margins, third-party support contract arrangements, etc. – but other data could usefully be shared information without any such sensitivities. If you discover an operating hazard at a particular destination which is generating frequent missed approaches, why would you not share the information? If another operator did not disclose a hazard it had previously identified and which subsequently led to an accident involving one of your colleagues, would you consider that a reasonable position for it to take?

There is also a question as to whether you can have information without direct evidence or with only anecdotal evidence. Some would say that anecdote is just that, and should be ignored, whereas others might argue that it can be a useful indicator or a small signal of a problem. When the UK Laser Working Group was developing the proposals that eventually became the Laser Misuse (Vehicles) Act, policy staff objected to an extension of the provisions beyond the air domain as there was no evidence for the requirement. The rebuttal pointed out there was no established safety reporting system for road transport, hence no reports, but that there was an obvious safety hazard arising from dazzling or blinding the driver of (eg) a heavy goods vehicle. No direct evidence of harm, only anecdotal evidence for laser attacks on drivers, but successful inclusion of protections in the new law.

It is easy for people to declare information by default as being commercially sensitive, or another protective marking. If the data is indeed sensitive and relates to business intelligence, for example on market opportunities or pricing structures, this is an understandable move. However, when the data is safety-related, there is a compelling argument for sharing it.

Consider data on go-around trends. If your airline is experiencing greater than expected rates at airport ZZZ, it implies either a sudden change in training standards and adherence to SOPs, or the presence of an external factor that is likely to be affecting other operators similarly. If that data is shared via the regulator or another body (it is why the UKFSC exists!) it should be rapidly apparent where the source of the problem might lie – ie internal or external factors - and therefore the best route for mitigations.

As our industry becomes ever safer, the pool of data from incidents and accidents will shrink, and operators will face a choice between assuming all is well or collaborating with others to provide some degree of mutual assurance. Paradoxically, improving levels of safety performance can generate a different risk, namely that businesses elect to divert resources from safety activities on the basis that 'the job is done'. It will be hard to argue that the data is giving an incomplete picture of the safety landscape and that we still need to look for latent hazards and other weaknesses in the system.

The need for improved communication and collaboration will only increase in the coming years. Communication within organisations as well as between them will be crucial if safety information is to be shared and used effectively. Whilst there is already a deal of sharing of de-identified flight data (where aggregation of data is offering some interesting insights), there is scope for collaboration in many areas. As an example, the recent publication of the Global Action Plan for the Prevention of Runway Excursions (GAPPRE) was the result of collaboration that crossed continents and involved multiple stakeholders and experts. Inevitably in such an enterprise, there were differences of opinion, challenges to perceived wisdom, and compromises required to agree a plan, but a plan emerged that should be of benefit to all.

Collaboration and communication would be enhanced by use of a common language or, rather, common descriptors. There is more than one taxonomy to be had in the aviation domain, especially where risk management is concerned. Perhaps it is time we collaborated on agreeing terms that mean the same thing in all ICAO's contracting states even if, for the greater good, it means accepting an element of 'not invented here' or adopting a solution perceived locally as sub-optimal.

Challenge will also be necessary. You do not need to look very far back to a time when the established view was that compliance with regulation would solve almost every problem, but we now have a system where most would accept that mere compliance is not enough. And yet there are parts of the world where the use of an SMS is still not mandatory, where NAAs remain over-focused on compliance, and where just culture is a fragile concept. For regulators, manufacturers and operators alike, challenge – and the willingness to accept it – is an essential facet of being a 'learning organisation'. If we do not learn, we will not make progress towards matching industry growth with increasing levels of safety.

Communicate, collaborate and challenge!

Manual Flight Operations

by Rob Holliday, Chairman UKFSC

Introduction

The degradation of pilot's manual flying skills is acknowledged by regulators, trade associations, academia, and safety organisations; efforts to reverse the decline are of the highest priority. The subject was a major topic of discussion, with significant agenda time, at the Flight Safety Foundation International Aviation Safety Summit in Paris, 6-8 November 2023.

Loss of Control In-flight accidents are 8% of all accidents, 46% of fatal accidents and account for 63% of fatalities (2012 – 2021), manual handling was a factor in 38% (IATA Safety Report 2021).

Reliance on automation results in manual flying skill fade. From full automation to manual flight there are levels of automation, choosing the right option at the right time is key.

In 1967 D. P. Davies author of 'Handling the Big Jets' put it like this:

'If you decide that you are going to fly the aeroplane, and not let the aeroplane fly you, then you are off to a good start.'

He was concerned that if everything is prescribed and automated that the pilots just become passengers that over time this will degrade their ability to deal with things that go 'badly wrong'. Exactly the concern that we are facing today with automation dependence and manual flying skill fade.

You can only do in the heat of the moment what you have been trained to do. Especially in respect of pilot training. As Wolfgang Langewiesche (Stick and Rudder, 1944) puts it:

'The wing is an odd thing strangely behaved hard to understand, tricky to handle, in many important aspects a wings behaviour is exactly contrary to common sense.... In a stall or a spin and you are afraid of crashing into the ground, the only way to keep it from crashing is to point its nose down towards the ground as if you wanted to crash.... That the pilot must learn not to give in to his instinct of self-preservation but to substitute for it carefully trained reactions.'

Over the last twenty years there have been multiple academic and regulatory documents published promoting the value of training and practice to maintain manual flying operations proficiency.

Loss of Control Accident Reports

'Within any important issue there are always aspects no one wishes to discuss' *George Orwell*

An April 2023 article by captains John Leahy and Alex Fisher published by the Royal Aeronautical Society, called, 'FAA shifts focus to pilot manual handling skills' found an apparent contradiction in the recommendations from loss of control accident investigations.

They report, that in respect of the two B737 Max accidents: To mention, even softly, that the pilots of those two aircraft were in any way deficient due to their training became unspeakable.

But that following the US NTSB and France BEA reports that, we have finally broken the omertà and taboo of suggesting that very often our pilots could, given better training, have saved the day.

Captain Fisher has spent years documenting the reasons why more than 20 of the world's most recent air crashes have been the direct result, at least in part, of the lack of these (manual flying) skills. Links to captain Fisher's work are available in the April 2023 edition of AEROSPACE magazine.

The consistent finding is that complex detailed causal factors and recommendations are listed in the official accident reports that hide or fail to address *'the elephant in the room'* that the pilots were simply not trained to deal with what they faced.

'Accident reports seem to avoid allocating cause to persons (often the pilots) and choose to blame system failures. Yet the largest system that needs repair is the training system itself.'

"Assumptions are the mother of all [mistakes]." *(An SAS saying)*
(Nimrod Review, Charles Haddon-Cave QC)

The absence of training recommendations is in line with a statement by Chesley B. Sullenberger III, in a testimony before the Senate Subcommittee on Aviation Operations, Safety, and Security on 28th April 2015:

'The safety systems that the industry has developed and implemented over the last twenty years are based on the assumption of two fully trained, capable and experienced pilots in the cockpit, with each pilot able to be the absolute master of the aircraft in every possible situation at every moment.'

Flight Path Management

In November 2022 the FAA published Advisory Circular 120-123 Flight Path Management which is an expansion on the 2017 FAA Safety Alert for Operators 17007, Manual Flight Operations Proficiency.

It reports in respect of Manual Flight Operations (MFO) Proficiency, *'that operational data have shown that, on average, pilots exercise manual flight control for only a small portion of total flight time (usually only during take-off and landing). This somewhat limited operational practice in MFO may contribute to a gap between proficiency in MFO and the ability of pilots to perform manual operations when various situations require immediate manual control. It also records that: Analyses of operational, accident, and incident data show that degradation of pilot skills in MFO has been identified as a potential vulnerability to successful FPM.'*

The advisory circular is an excellent document that covers all the supplementary issues associated with training and preparation for more time spent in manual flight practice in line operations. It is much more than just about disengaging the autopilot more often.

What is the issue? If a machine does our job and as a result we stop thinking about it, over time our ability to manage the task either manually or by controlling the automation is degraded. The cognitive ability to operate ahead of the aeroplane degenerates. Whilst my knowledge of neurogenesis and neuroplasticity is pretty thin, I understand that the brain is a muscle that needs to be exercised to stay fit. So, it is not as simple as a loss of stick and throttle skills; it is more nuanced than that. Pilots don't forget the basic flight control inputs. Lack of practice degrades the cognitive ability to operate ahead of the aeroplane that can result in control inputs that are reacting to the aeroplane or 'behind' it. Ebbatson et al (2010) discusses three levels of manual flying, identified by McRuer and Jex (1967) as compensatory control strategy, pursuit mode and highest level, pre-cognitive that requires high levels of practice. In this latter, higher level of performance the lag between control inputs and aircraft response are anticipated to control the aircraft flight path with minimum control inputs.

Highly reliable systems also offer few opportunities to manage abnormal situations degrading the mental skill necessary to manage abnormal situations, to perceive a subtle mode change or understand a confusing system failure in timely manner before the situation becomes uncontrollable. A range of competencies are necessary recognise, troubleshoot, and solve an unusual scenario.

Aircraft control starts with the flight path. Knowing where the aircraft and its configuration should be now and using all these skills and the control inputs required to ensure that it is going to be where it should be in the future. The flight path is the centre of it.

Training, Proficiency and Practice

It is widely recognised that manual flying proficiency can be maintained through practice during training and line operations. This is a continuous process. The FAA (AC120-123) recommend that operators include in their policy how to regain proficiency after absences. Failing to practice until a simulator check is approaching is not recommended. The UK AAIB concluded in relation to a tail scrape incident in 2002. *'The root cause of this accident was the co-pilots desire (and perhaps need) to practice an instrument approach technique shortly before his ability to perform it satisfactorily was assessed in the simulator.'* (AAIB Bulletin No: 3/200 Ref: EW/C2002/03/02).

This and other incidents led to the publication in 2004 by UK CAA Flight Operations Department Communication to Aircrew (FODCOM 24/2004), to highlight the concern over practising manual flying in preparation for the simulator, encouraging crews to participate in manual flying provided it is in appropriate circumstances and properly briefed.

The FAA recognise this in AC120-123 recommending training of the PF and PM to recognise when the aircraft is not confirming to the desired flight path, degraded crew performance and the necessary intervention strategies. This is an important aspect because the Pilot Monitoring interventions in our system are not universally robust.

The FAA Advisory Circular comprehensively addresses all the skills and behaviours necessary for a comprehensive manual flight operations policy. Practice is described as maintaining proficiency through manual flying during line operations including to manually fly the aircraft including, at least periodically, the entire departure and arrival phases and potentially the entire flight.

Flight Path Management topics addressed in the AC include manual flight operations (MFO), managing automated systems, pilot monitoring (PM), and energy management.

All of this starts with situational awareness. Awareness in the shape of a clear picture of where you and your aeroplane want to be, where it actually is in relation to the intended flight path and how you use what is available to make it do what you want.

'Ensuring that the aircraft is on a safe and correct flightpath is the highest priority of all pilots on the flight crew. Ensuring the airplane is on the correct flightpath includes the actions necessary to check/verify that the flightpath is correct and to intervene as necessary if it is not correct.

Each pilot is responsible for:

Being fully aware of the current and desired flightpath of the aircraft, and

Being fully capable of manually flying the aircraft to achieve the desired flightpath.'

This is one of the most important statements in the AC. Knowing what you want the aeroplane to do and how to make it do it and how to correct it if it starts to deviate is so fundamental to everything under discussion here. You have to be ready and able to take out the automatics and make it do what you want at any time. If this feels like it goes against all the messaging to use the automation to reduce workload and operate more safely. Knowing when that is no longer appropriate and that it's time for manual intervention is vital.

State of the Industry

In 2020 the IATA Aircraft Handling and Manual Flying Skills Report found that 64% of respondents said their airline allowed manual flying with restrictions, the remaining percentage of operators either had no restrictions, no policy or followed the OEM FCOM.

24% of airlines had a policy that the *Autopilot should be engaged as soon as possible after take-off and should be disengaged as late as possible.* There are significant regional variations.

The IATA report concluded that automation has improved systems accuracy, reliability, and greater operational efficiency. With the caveat that a significant number of pilots have experienced a degradation of their manual handling skills, and a subsequent overreliance and dependence on automation. Operators must provide all their pilots, even the highly experienced ones, with opportunities, as appropriate, to hand-fly the aircraft. This general sense of lack of confidence in the pilots' manual flying skills can be reversed by encouraging pilots to fly manually whenever the situation permits.

"There are situations in flying when he who ducks is lost, he who flinches is lost." *(Wolfgang Langewiesche, 1944, Stick and Rudder)*

Confidence is a word that occurs in D. P. Davies book in 1967, the 2023 FAA AC and the IATA report. A lack of confidence causes hesitation in the application of skills, competences and behaviours. A delay to manual intervention can be significant as evidenced in the 2019 B767 accident to Flight 3591 which crashed less than a minute after the inadvertent activation of TOGA mode.

Aggregate large data confirms the findings of the IATA report that autopilot use is very dependent on the operator's policy. In addition, over the last five years (2019 to 2023), the average autopilot engagement height after take-off, has reduced by over 1000' and the average autopilot disengagement height before landing has also reduced by around 350'. Against this background the implementation of more manual flight operations practice to maintain proficiency in a controlled way, as recommended by the FAA, is a challenge for the industry.

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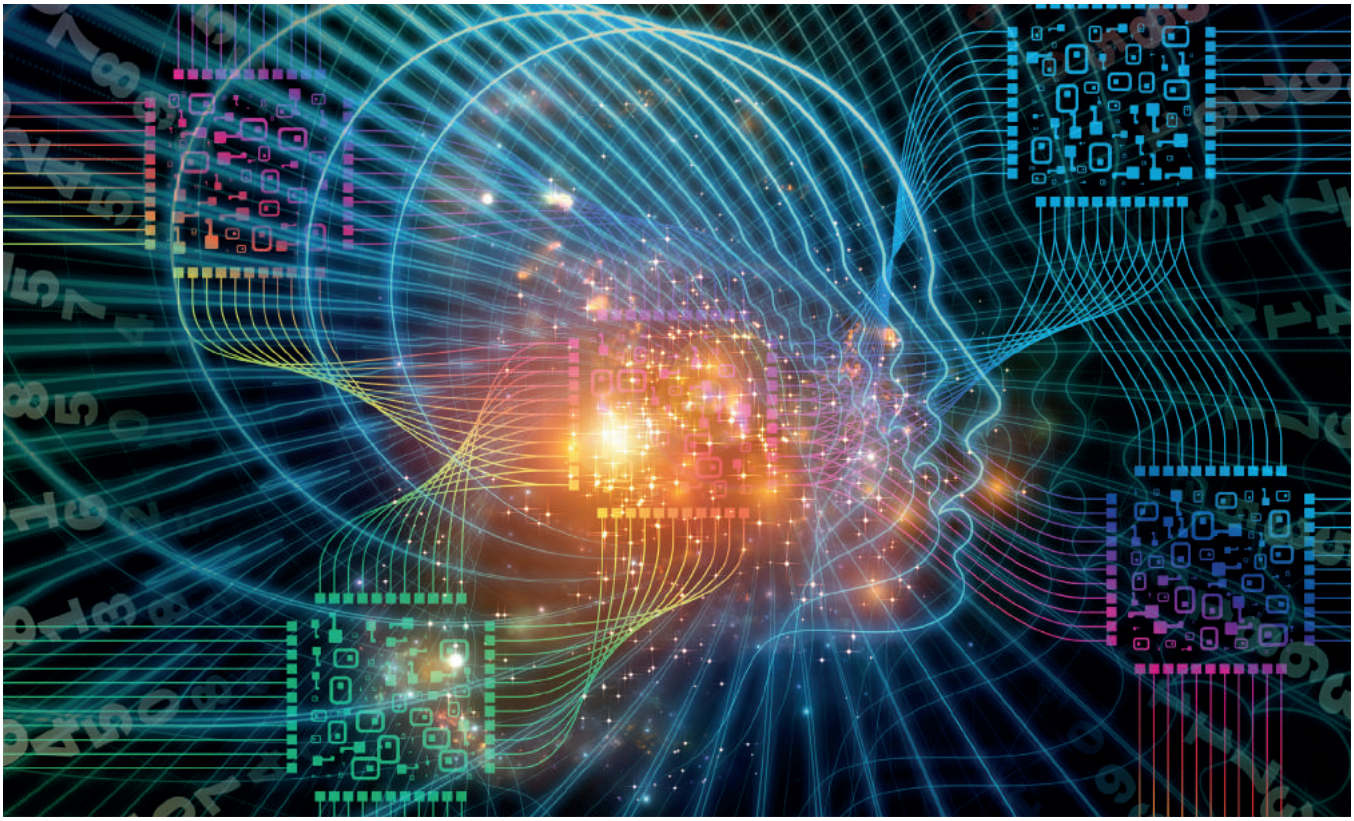
A Turing test for pilots

by Dr Robert Joslin FRAeS, Associate Professor, College of Aeronautics, Embry-Riddle Aeronautical University



There are many definitions of artificial intelligence (AI), most of which place deep learning at the top level whereby neural networks are employed to analyse images, video and large volumes of unstructured data to ensure a system acts appropriately in a nondeterministic (stochastic) uncertain environment.

The foundation of deep learning can be thought of as comprising of a baseline for simple deterministic (non-stochastic) programming for decisions, based on known scenarios (certain environment), ie if 'A' condition(s) exist, than execute 'B' action(s).

This baseline is enhanced by machine learning using computational methods that enable systems to learn without specific programming, using statistical, mathematical optimisation, and other techniques to find patterns in structured data sets through traditional algorithms, like linear regression.

Deep learning then goes one step further and employs neural networks that analyse unstructured data to make appropriate decisions in uncertain environments. Hence, with AI there is no longer any human decision-making or judgement involved. The neural networks are from AI and not a human's brain.

Use of judgement

Automated alerts from safety-critical systems designed to elicit pilot action often include provisions for human pilots to use their judgement to dismiss or modify the corrective/preventive cues and guidance provided by the automation design.

For example, the safety benefits of the pilot flying (PF) not complying with a Traffic Collision Avoidance Systems (TCAS) resolution advisory (RA) have been recognised in aviation authority guidance. "When an RA occurs, the PF should respond immediately by directing attention to RA displays and manoeuvre, as indicated, unless doing so would jeopardise the safe operation of the flight." In addition, "... it is particularly important that pilots maintain situational awareness (SA) and continue to use good operating practices and judgement when following TCAS RAs."

Another example is in the procedural guidance for a Terrain Awareness and Warning System (TAWS) alert that states that "only vertical manoeuvres are recommended, unless operating in visual meteorological conditions (VMC), and/or the pilot determines, based on all available information, that turning in addition to the vertical escape manoeuvre is the safest course of action."

Commission-omission thesis

An example of the disparity between human and automation decision-making and judgement in uncertain scenarios was exhibited in a recent accident involving an automated driving system (ADS) that detected something in its path moving across the road at night. The object turned out to be a pedestrian walking a bicycle across the road, not at a designated crossing point. However, the ADS never accurately classified it as a pedestrian, motor vehicle, debris blowing across the road, or something else, hence the automation's decision was to continue its current course without even braking, resulting in a fatal collision with the pedestrian. The automation's decision when confronted with an uncertain environment that it could not resolve was to 'do nothing.' This decision exemplifies an exercise of the Commission-Omission Thesis whereby an entity allows harm to occur by inaction (eg not changing the vehicle's normal path and causing harm) rather than actively causing harm by taking some action (eg avoidance manoeuvre resulting in harm to the vehicle occupants or a bystander). Of note is that the human safety driver intervened and made the instantaneous decision to execute a steering manoeuvre in an attempt to avoid the collision, but it was too late.

Since AI is implemented through complex hardware and software, then it should be expected to have some sort of Design Assurance Level as determined by the severity of the failure condition and its associated probability of occurrence. The current system safety analysis and assessment guidance for determining the classification for the severity of a failure condition considers if the required flight crew actions are reasonable and within their capabilities, but also states that a quantitative assessment of the probability of flight crew error is not feasible. Therefore, if AI is to be entrusted with the full decision-making process, then the Design Assurance Level should equate to that of a human's behaviour – which has yet to be defined.

The Turing test

Since human decision-making is unique to each individual and each scenario, it is not possible to provide an exhaustive list of tangible and intangible considerations (eg flight manual procedures, morals/ethics, self-preservation, kinetic energy, crashworthiness, liability, number of lives lost, etc.) that a human uses when making decisions involving safety-critical systems or conditions. One approach that has been suggested for the certification of artificial intelligence systems on autonomous motor vehicles that could be adapted for aircraft is a modification of the Turing Test.

Unlike many eVTOL manufacturers, Wisk - which is now solely owned by Boeing - is pursuing fully autonomous flight.

Originally postulated by the British philosopher, mathematician and cryptanalyst, Alan Turing, the test is a method for determining whether a computer is capable of mimicking a human response under specific conditions. Turing, who in the 1950s proposed the question 'Can machines think?' is considered by many to be the founding father of AI.

The original scenario to determine if machines can think involved asking a human interrogator to distinguish between two remotely located respondents: one human and one a computer. The premise was that if the interrogator could not distinguish the computer from the human, then the computer would be considered as having passed the test. A more recent application evaluated computer vision in autonomous motor vehicles, whereby a list of certain attributes of an image would first be hand-scored by humans. A computer vision system would then be shown the same image to determine if it was able to pick out what the humans had identified as attributes. For an aviation application involving a safety-critical system or condition a group of pilots could be presented with an uncertain collision avoidance scenario requiring judgemental decision-making. Their consensus decision could then be compared to that made by AI when exposed to the same scenario.

AI presents unique and still unknown challenges for an applicant/manufacturer showing compliance and a civil aviation authority finding compliance with the applicable certification criteria. However, if artificial intelligence is intended to be a valid and reliable surrogate for human pilots that mimics their behaviour, then the design and certification of safety-critical systems will have to address both philosophical and pragmatic considerations.

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Regulator and Courts work in tandem to enhance rights and safety of disabled air passengers

by Ashleigh Ovland, HFW

The UK media frequently reports stories of less mobile passengers being kept waiting unacceptably long for assistance to disembark; disabled BBC security correspondent Frank Gardner reportedly found himself in this situation four times in as many years[1]. Disability equality charity Scope has commented "*For a long time we've been concerned about disabled people being failed by airlines and airports. The impact is often degrading, stressful and anxiety-inducing and stops some disabled people from travelling altogether.*"[2]

The airline responses to these incidents often cite breakdowns in communication with third party service providers, shining a light on what can be a complex network of contractual and operational relationships.

Against this backdrop, improving service to less able or mobile passengers has become a policy priority for the UK government and, in turn, the Civil Aviation Authority (**CAA**).

Obligations towards such passengers are contained principally in Regulation (EC) No 1107/2006 Concerning the Rights of Disabled Persons and Persons with Reduced Mobility when Travelling by Air, generally known as "the PRM Regulation". The PRM Regulation was retained intact in UK law post-Brexit. However, earlier this year, the CAA launched a consultation as a first step towards creating an enhanced regulatory framework which would introduce a key set of standards to hold airlines to account. This was inspired by the successful UK-wide Airport Accessibility Performance Framework, introduced a decade earlier.

In the consultation document[3], the CAA reported that it had identified inconsistencies as to how airlines interpret safety rules which affect the carriage of disabled passengers, and suggested that they *"must do more to ensure that processes are used that adequately consider passengers' rights, balanced against safety considerations."* For example, they cited instances where the same passenger had been assessed as safe to travel unaccompanied by one airline but had been refused a booking on safety grounds by another, or situations where the urgency of aircraft turnaround times resulted in insufficient care being taken during disembarkation.

The consultation has now closed and work is underway on the detailed design and implementation of the new framework. The idea is that the CAA will assess every airline operating into the UK and award it a rating - Very Good, Good, Requires Improvement or Poor - against a set of fixed criteria for each aspect of its operations, from booking the ticket and arranging special assistance through to the onboard experience and post-journey complaints handling. Airlines assessed as "Requires Improvement" will be required to commit to meeting the criteria in a reasonable timeframe and provide evidence of progress. The individual ratings will be combined into one overall "score" and rankings will be published. The public availability of this information will enable consumers to make an informed choice of airline.

While no airline would dispute that ensuring the safety, dignity and comfort of disabled passengers is of the utmost importance, there are some concerns that the criteria extend too far beyond what the law itself requires and that the reputational stigma of a low ranking may have lasting commercial impact long after the specific failings have been addressed. The administrative burden of the audits is also a concern. Airlines are currently lobbying the CAA to reconsider the rankings approach and work with them towards a more nuanced solution which strikes a better balance between the rights of PRMs and the airlines' commercial and operational interests.

In parallel with the CAA's consultation, a case involving a disabled passenger has been working its way through the courts in Scotland this year, culminating in a judgment of the Scottish Inner House (equivalent to the English Court of Appeal) which has clarified the legal implications of attributing blame to third party ground handlers when failings occur.

Colin Mather was rendered paraplegic by an accident in 2009. He was a full-time wheelchair user but was still able to travel independently, with appropriate assistance, and was a frequent flyer in the course of his work as a consultant. In 2017 he took a flight on a low-cost carrier from the UK to Hamburg. He was aided during disembarkation by a German ground handling company, DRK, which was a non-profit organisation contracted by Hamburg airport. DRK had no direct contract with the airline. Unfortunately the front wheels of the airport wheelchair struck a raised edge at the junction between the airbridge and the terminal building and it stopped abruptly, causing Mr Mather to fall forwards. He suffered life-changing injuries and brought a claim against the airline for £1 million.

The claim was governed by the Montreal Convention ("MC99"). Under MC99, an airline is presumed liable for bodily injury sustained in the course of disembarkation, but it can cap the damages that it is liable to pay at 113,100 SDRs (approximately £146,000) if it can show that the injury was caused solely by the act or omission of a third party.

If the airline was able to cap its liability this left Mr Mather having to advance a separate claim against DRK in Germany for the bulk of of the funds that he needed to support his recovery and future life. From the passenger perspective, it is much simpler to deal with the airline only, particularly if other defendants are based outside the passenger's home jurisdiction. Delays and procedural complexities are felt particularly keenly by passengers already struggling with disabilities. After resolving the passenger's claim the airline and its insurers usually retain the right to recover their outlay from the wrongdoer further down the contractual chain should they so wish.

The airline's liability to Mr Mather for the full £1 million turned on whether DRK was the airline's agent for the purpose of MC99. If it was an agent then DRK's acts would be deemed to be those of the airline for liability purposes and the "act or omission of a third party" defence would not be available.

The term "agent" is not defined in the text of MC99 so the Court considered a range of international case law for guidance. It held that, provided that the activity in question was carried out "*in furtherance of the contract of carriage*" (the contract of carriage being the primary relationship between passenger and airline) the party carrying out the activity was the airline's agent, regardless of the formal contractual relationship. This was clearly the case when the activity was disembarkation.

The airline tried to argue that the PRM Regulation placed responsibility for assisting with disembarkation on the airport, not the airline. While this is indeed what the PRM says, the judges were clear that it was possible for two parties to have concurrent duties towards the passenger and commented somewhat sternly that "*It may be that [the airline] thought, optimistically, that the Regulation removed or diminished their responsibilities for PRM passengers under the Montreal Convention. If they did, then they were in error.*"

Interestingly, the airline also suggested that airlines' insurers would struggle to underwrite effectively if the loss records of destination airports and their subcontractors had to be taken into account when pricing risks. This argument was given short shrift: "*When setting premiums for airline's insurance, underwriters will (as they always do) have to apply judgement to appraise risk; they will do so on the basis that the airline's responsibility towards its passenger under the contract of carriage by air extends from gate-to-gate*"

This was undoubtedly a positive and fair outcome for Mr Mather and the decision fits well with the CAA's plans to hold airlines to account when they fall short in the care of PRMs. We will continue to monitor the development of the new Accessibility Framework as airlines and regulator work together to refine it.

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2. *Wheelchair user left to crawl off Ryanair plane in Sweden - BBC News*

3. *Performance framework for airline accessibility (caa.co.uk)*

Adjusting to New Realities

by Robert Wilson

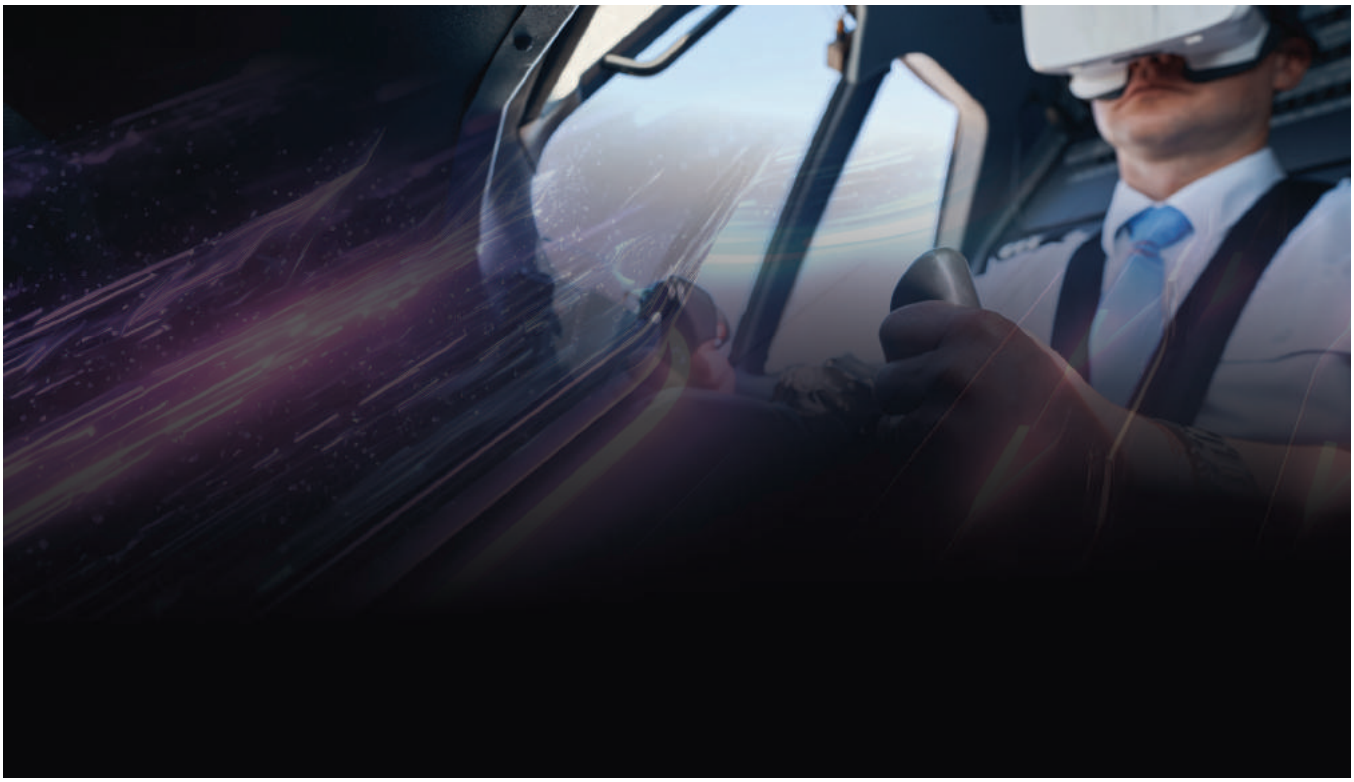

image: (modified) Adobe stock | AI Farm | Viacheslav Yakobchuk

The technologies of virtual and mixed reality are revolutionising aviation maintenance.

Simulation has been part of aviation since at least 1929 when Edwin Link built the first of the thousands of trainers to bear his name using parts from the floor of his father's musical instrument factory. But until relatively recently, aviation simulation meant flight simulation. That is starting to change, and the dividend is likely to be faster, more thorough training for engineers, greater safety in the hangar or on the apron and less opportunity for maintenance error.

Simulation in maintenance can potentially play a greater role than in operations, where its main use is for training and validation. The same technologies of computer modelling, high-definition 3D imaging and interactivity have the potential to change not just how the tasks of maintenance are trained but how they are done.

Engineers can now train for complex procedures in the same way surgeons do – computer systems can guide them through the job and experts can watch their progress, not just over their shoulders, but literally through their eyes.

Levels of reality: AR, VR and MR

Edwin Link's 'blue box' Link Trainer created a form of virtual reality with its piano and pipe-organ technology that reproduced instrument flight for more than 500,000 pilot trainees during World War II.

Modern information technology has allowed a much more immersive form of virtual reality, defined by NASA as the use of computer technology to create the effect of an interactive three-dimensional world in which the objects have a sense of spatial presence.

- Virtual reality (VR) can be created in a full-flight level D simulator, or with head position-sensing goggles, headphones and haptic gloves. It has 2 virtual cousins:

  - Augmented reality (AR) – simultaneous experience of the physical world with an overlay of digital elements. (Smartphone programs that display information about an exhibit in a museum or on a walking tour are an example.)

  - Mixed reality (MR) – simultaneous experience of the physical world with an overlay of digital elements, where physical and digital elements can interact. These interactions can be visual, audible or tactile.

Tool or toy? The evidence

Academic consensus is that virtual reality can be an effective teaching tool. A systematic literature review published in the Journal of Computers in Education in 2021 concluded, '[Virtual reality] conferred a learning benefit in around half of cognitive studies, especially where highly complex or conceptual problems required spatial understanding and visualisation.

'Encouragingly, most procedural tasks did show a benefit to utilising [mixed reality] and, furthermore, there was evidence that virtual skill acquisition could be transferred successfully to real world problems and scenarios.'

The review found 3 of the 4 studies that attempted to utilise VR as a means of teaching procedural skills, showed a distinct advantage over less immersive methods. 'One study on emergency fire response found that 70% of those who utilised virtual reality training were able to perform the correct procedure in the correct order,' it said. 'This was 50% higher than the control group who were exposed to a presentation and reading material only.

'The ability to repeatedly practise a procedure in a safe environment whilst expending little resources could be one of the most advantageous and intrinsic benefits of [mixed reality] technology.'

Another academic study found VR/AR training translates well into acquiring real-world skills.

'Skills acquired by simulation-based training adequately transfer to operative settings with firm scientific evidence of transfer from training in a virtual environment to realworld tasks,' Bettina Mrusek and Stephanie Douglas of Embry-Riddle Aeronautical University wrote in a 2020 journal article, citing several earlier studies.

Maintenance training

Aircraft maintenance is at least as much learned by doing as by reading or lecturing. The traditional way of teaching involved air force or airline schools maintaining non-flying obsolete aircraft which were dismantled, examined and reassembled innumerable times by generations of students. Composite maintenance training devices, which were full-scale mock-ups of real aircraft, were sometimes used.

Examinations took the form of students performing repairs and maintenance under the eye of an experienced instructor. This system was effective, but costly, and not without danger in the case of hydraulic or electrical systems.

The first digital/simulation training used desktop computer systems and was useful for learning procedures, rather than techniques. Virtual and augmented realities make it possible to simulate and reproduce situations that would be costly, complex, dangerous, or difficult to replicate in the physical world. De-icing (an operational procedure) and undercarriage testing are 2 examples.

Virtual reality creates a safe and inexpensive environment for skills to be honed while allowing visible consequences for mistakes and allows repeated practice until the process is familiar.

Maintenance training devices offer many advantages including:

- aircraft exploration through virtual aircraft
- component removal
- troubleshooting exercises
- lesson plan (reload any saved situation instantly)
- animated schematics
- simulation of built-in test equipment.

A hierarchy of devices has emerged: simulators and virtual trainers bridge the gap between the classroom and the aircraft, and augmented/mixed reality systems enhance training, ensure consistency and allow real-time support.

Canadian simulation specialist CAE offers Simfinity, a virtual maintenance trainer that creates a 'virtual aircraft' where systems familiarisation, maintenance procedural training and troubleshooting can be taught. The trainer offers the ability to display cockpit panels and instruments and save and recall layouts. It also includes a library of malfunctions and active schematics interacting in real-time in a high-fidelity simulated environment. Australian Defence Force engineers maintain the Sikorsky UH-60 Blackhawk and SH-60 Seahawk using the Simfinity system as part of the ADF's next-generation simulated aircraft maintenance trainer. This system trains maintenance technicians to diagnose and troubleshoot aircraft systems, avionics and flight control systems in real-time.

Viral and virtual

The viral circumstances of the 2020s have stimulated virtual reality training. When the grim reality of the COVID-19 pandemic prevented Boeing technicians travelling to Australia to service the Royal Australian Air Force's (RAAF) C-17A Globemaster III aircraft, mixed-reality devices replaced them.

In July 2020 the RAAF began a trial at Amberley involving mixed reality and a high-definition secure video connection, allowing the American engineers to observe as if they were not merely looking over the shoulder, but through the eyes of their Australian counterparts. Iris tracking in Microsoft HoloLens goggles enabled technicians in the US to see exactly what the RAAF engineers were seeing inside the aircraft.

Boeing C-17A field services manager Glen Schneider said the system would allow technicians to connect with the Boeing field engineering team while they are away on a domestic or international mission.

The first project was to replace the C-17's floatation equipment deployment systems panels, which consist of explosive components that deploy life rafts in an emergency.

Real benefits

Airbus says mixed-reality solutions have cut manufacturing time by a third for some components and systems while improving quality. Digital information, such as instructions or diagrams, can be overlaid on a real piece of machinery to aid in complex or hard-to-reach tasks.

Airbus designers now test their designs virtually to see if they are ready for manufacture. The group says mixed reality cuts the time taken for this step by 80%.

Since 2020, Rolls-Royce has offered its engine familiarisation course for the AE2100 turboprop (as used on the Lockheed C-130 Hercules and Alenia C-27J Spartan) as a virtual reality course. Students can log in from anywhere in the world to the training centre in Indianapolis, US, for a comprehensive overview of the construction, design and operation of the engine and engine systems using virtual reality. Rolls-Royce says, 'This creates an environment for students to "learn by doing", increasing their recall by completing multiple repetitions.'

The company also has developed a VR training course for the BR725 engine, as used in the Boeing 717 and, potentially, the upgraded B-52.

In late 2019, Qantas began a trial of engine ground run training for engineers. The project used HoloLens2 goggles and a virtual aircraft model instead of an actual aircraft. Using the goggles, Qantas engineers were able to train and practice this essential but potentially dangerous operation without the need to use a simulator or aircraft.

The safety case

For Lithuanian maintenance repair and overhaul organisation FL Technics, a major advantage of virtual reality training is safety.

'The first thing that comes to mind is how to show students what can happen in a real environment in risky places,' Ramunas Paškevičius, FL Technics' Head of IT and Innovations says. 'For instance, working on the emergency doors or something like that, there is a risk that if things are done in the wrong sequence, an explosion of the escape slide can be triggered within the hangar.

'At best, that will be a financial loss; at worst, it will injure the mechanic and other mechanics. We did not have such cases in our hangars so, while all of our staff know theoretically that there is a risk, they have not seen how that explosion and deployment of the escape slide would look if it happened in the real world. Virtual reality is able to show mechanics that event and for them even to feel it.'

Further information

- *Hamilton, D., McKechnie, J., Edgerton, E. et al. Immersive virtual reality as a pedagogical tool in education: a systematic literature review of quantitative learning outcomes and experimental design. J. Comput. Educ. 8, 1–32 (2021)*

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Air India Express B737-800 – Runway Excursion – Calicut

by Dai Whittingham, Chief Executive UKFSC

This hull-loss accident, which led to 21 fatalities and 76 serious injuries, occurred on 7 August 2020 and is significant because the investigation identified multiple issues regarding training, culture, cross-cockpit authority gradients, regulatory compliance, regulatory and operator oversight, commercial pressures, resourcing, rostering, self-medication, and airport standards. Almost all the factors contributing to the accident had been previously identified by an investigation into a very similar event with the same operator at Mangalore in 2010, with the loss of 158 lives.

Synopsis

The B737-800 (VT-AXH), callsign AXB 1344, departed Dubai an hour later than planned at 1000 UTC with 184 passengers and 6 crew on board; the flight was a repatriation for nationals stranded by the pandemic and occurred 3 months after Air India Express (AIX) had resumed limited operations. Calicut (Kozhikode) was designated as a Cat C destination and the approach, at night, was therefore being flown by the PIC with the FO as PM.

The airfield was affected by the monsoon and was reporting RW28 with moderate thunderstorms and rain, surface wind 270/14; required minima for an ILS for both runways was 1300 m. The runway was wet. Weather at the planned alternates (Cochin and Coimbatore) was significantly better than at Calicut.

The first ILS approach was hampered by the PIC's windscreen wiper which failed at 1800 ft, leading to a missed approach from minimums as the PIC was unable to see the edge-lit runway in the heavy rain. While in the climb, a departing aircraft requested use of RW10 and the DATCO promptly switched runways, although the westerly winds favoured RW28. On being told winds were now 260/05, the PIC accepted the offer of an ILS to RW10.

During the approach, the crew discussed, and then opted for, the use of Flap 30 vice the planned Flap 40 because of expected turbulence. The autothrottle was engaged and maintained 150 Kts; the groundspeed was 175 kts. The AP was disengaged at 500 ft but a reduction in pitch attitude caused the descent rate to increase. This was cautioned twice by the PM, with the PIC acknowledging as correcting.

The aircraft crossed the threshold at 92 ft RA with a tailwind of 14 kts. The 1000 fpm rate of descent was being reduced but airspeed increased to 160 kts because additional thrust was being added manually despite the ATHR commanding a thrust reduction; N1 reached 83%, by which stage the aircraft was almost 1400 ft past the threshold and still at 20 ft RA. The PM called for a go around at 10 ft RA without verbal or physical response from the PIC, who continued to a landing 4438 ft into the 8858 ft runway at 150 kts CAS and a groundspeed of 165 kts.

The ATHR automatically disconnected 3 seconds after touchdown with the PIC already applying maximum manual braking, which over-rode the autobrake setting. Auto speed brakes had fully deployed within 1.2 seconds. The thrust reversers were commanded open at +3 seconds and were deployed by +5 seconds with the power increasing to 59% N1 but were then stowed.

The thrust reversers were deployed for a second time at +15 seconds (at 8200 ft past the threshold), maximum reverse thrust was commanded, and the engines began to spool up. At 9100 ft beyond the threshold, on the paved portion of the RESA and still with 60 kts CAS, the reversers were stowed again, followed by the speed brakes. The aircraft over-ran the runway end at 85 kts, overshot the RESA and hit the ILS antennae and a fence before descending approximately 110 ft from the table-top runway onto a perimeter road. The aircraft separated into 3 sections but there was no post-impact fire. Both pilots died, in addition to 19 other occupants.

Crew

The PIC (age 59) was ex-military and had held an ATPL since 1998, amassing almost 11,000 hours on various types including A310 and B777. He gained a B737-800 type rating as a co-pilot in 2010 and transferred to the B777 fleet in 2012. He subsequently failed a command upgrade and reverted to the B737 in 2014, gaining his command in December that year. His training records noted a tendency to lose concentration under stress, concerns about situational awareness, unstable approaches, and floated/long landings, including one beyond the touchdown zone. He had failed a route check in November 2014 for his flare technique, which had required intervention by the checking pilot, but there had been no incidents since. He was current on all training and checks.

The PIC had been diagnosed with Diabetes and grounded temporarily in 2016, later being declared fit to fly as PIC with a qualified and experienced pilot, subject to use of prescribed medication and specialist checks prior to routine medicals.

The FO (age 32) held a CPL and had gained a type rating in 2017; he had 1700 hours on type. His CAT-II training had lapsed because of the pandemic but he had been granted and extension by DGCA. Both pilots were adequately rested before the accident flight.

Aircraft

VT-AXH was manufactured in 2006 and had a valid Certificate of Airworthiness. It was a Short Field Performance Type 1 aircraft and had been stored for 2 months at the start of the pandemic shutdowns. The aircraft was fully modified and there were no deferred maintenance requirements. Fuel, mass and balance were all within prescribed limits on departure from Dubai.

The investigation found some evidence of company procedural drift in the reporting of defects in technical logs. Further, archived data for VT-AXH showed that right metered brake pressure had been incorrectly recording a constant 165 psi since the unit was installed 2 years previously, due to a fault with the pressure transducer that had not been identified.

The aircraft was assessed to be serviceable up to the point of its departure from the RESA.

Airport

Calicut opened in 1988, initially for narrow-body flights but began to take wide-body aircraft from 2002. The latter operations were halted by Airports Authority of India (AAI) in 2015 because of damage to the runway surface. Wide body operations resumed in 2018 after

re-surfacing and the imposition of operational mitigations which restricted permissible crosswinds for wet runways, and weights to sector fuel only, along with imposing minimum PIC experience levels and a requirement for thrust reversers and anti-skid systems to be fully serviceable. The runway is 'table-top' with steep falls at either end.

AAI had gained an exemption from DGCA for the requirement for a non-standard runway width (which was limited by the unfavourable terrain) but this did not incorporate the revised crosswind limits contained in the DGCA guidance material. The Mangalore inquiry had recommended the installation of colour-coded centre line lighting on table-top runways and the AAI response to the report had assured DGCA this would be completed at the next planned re-surfacing; for Mangalore, this is planned for 2024 and the airport is still operating with edge lighting only, 14 years on from the accident.

Although the Mangalore recommendation was known at Calicut, the opportunity to install centre line lighting was not taken during the 2017 resurfacing despite persistent requests from operators; the need was raised further during the investigation into an Etihad runway excursion on 20 June 2019. The use of colour-coded centre lights would clearly indicate the approaching end of the touchdown zone at a safety-critical airport such as Calicut.

A further Mangalore recommendation was for the installation of an Engineered Materials Arresting System (EMAS), which the manufacturer claims provides an equivalent level of safety to a full RESA per the ICAO and DGCA standards. The proposal was rejected as unviable apparently because: EMAS is predicated on a 70 kt entry speed and was not suitable for higher entry speeds; the repair time in the event of EMAS being used was an expected 45 days; post-entry repairs would generate a WIP hazard in the over-run area; and there could be challenges to the movement of ARFF vehicles. However, AAI had implemented a Mangalore recommendation on RESA dimensions at Calicut which extended its paved length (at the expense of runway available) but left the soft ground unchanged at 90 m.

Accident Response

An Airport Emergency Plan was in place and had been revised one year before the accident, though it contained some redundant or repealed references. Whilst the Airport Director was present at the crash site there was no command post established nor was there any video made of the rescue operations, both mandated by regulation. The duty doctor received notification through unofficial channels and had to walk some distance because of traffic congestion; the road was blocked by a combination of emergency and airport vehicles and taxis pressed into use during the rescue operation. There was no triage or prioritisation of casualties, and some were transferred to hospital by private vehicles before ambulances could reach the site. ARFF personnel were unable to operate the aircraft doors; according to statements provided by the Head of the Fire Department and fire crew members, they had received no familiarisation training for the B737. However, records were produced indicating training had been provided over the years despite DGCA audit observations and repeated requests for assistance from the HOD.

Several passengers sustained serious head injuries during the accident sequence when the loaded overhead bins failed. These injuries may have been less severe had the brace position been called at the early stages of the excursion, but it was unlikely the flight crew would have had the capacity to make this call in the time available before impact with the perimeter road.

Organisational and Cultural Factors

Post-mortem examination of the PIC revealed the presence of a second anti-diabetic drug as well as his single prescribed medication. His personal effects recovered from the crash site contained 4 different types of these drugs as well as an Ayurvedic anti-diabetic medication; all the blister packs indicated some degree of use, whether by the PIC or another person. The self-medication may have caused an element of hypoglycaemia and affected his cognitive functioning, but this was a subjective view.

The PIC, who was a Line Training Captain, was known to be goal orientated and comments had been made about 'cognitive rigidity' and 'vulnerability to stress' which was likely to have contributed to the breakdown in CRM evident to the investigators. The investigators also felt it likely the PIC had suffered from some attention coning during the latter stages of the unstable second approach but did not identify any overt incapacitation.

The FO's interventions lacked assertiveness, and this was attributed to a steep cross-cockpit authority gradient generated by cultural norms and markedly different experience levels. Observation of simulator training showed AIX FOs in the PM role were mainly restricted to routine procedures and callouts; active participation was not encouraged, and even routine procedures often required a nod of approval from the PIC.

It was evident from observations, informal discussions, and a review of records at the AIX Mumbai training facility that, whilst CRM training was being conducted, it did not address the reluctance of junior pilots to participate in decision making. The investigation team noted that having the same causal factors present in the Mangalore accident, an AIX runway excursion in 2019 and the Calicut accident showed that AIX had not implemented effective CRM training despite actions being recorded as complete.

AIX operates as a subsidiary of Air India and was supposed to have separate management structures. The arrangement whereby the AIX Chief of Safety answered to Air India as well as his own CEO diluted his authority. The investigation team felt that there was inadequate safety oversight by senior management which "...pushed the entire organisation to be more operation oriented than having the right balance between operations and safety..."

The investigation noted that AIX resourcing of its Calicut base was imbalanced, despite the preponderance of AIX flights being flown from Calicut rather than Delhi, only one permanent captain and 26 FOs were assigned, the rest (including the PIC) being Delhi-based. The rostering of the PIC for a flight to his home base the next morning was likely to have contributed to his evident focus on completing the landing.

The use of the OEM-provided EFB should have enabled use of the On-board Performance Tool to provide crews with rapid access to performance data in the event of a runway or weather change. AIX had not updated any information and the aircraft-mounted EFBs were used for camera surveillance only. The portable EFBs did not have the OPT application.

At the regulatory level, DGCA was failing to observe its own regulation by accepting audit findings as closed without any follow up. Audits between 2018 and 2020 showed findings and observations occurring repeatedly but were being closed by AIX. The operational audits had not identified the absence of the contaminated runway training mandated by AIX's operations manual, nor had they identified deficiencies in the performance of the simulator. Whilst the lack of ARFF familiarisation training at Calicut had been flagged in 2016 and 2018, the finding was simply amended to 'satisfactory' based on a report from AAI.

In addition, the investigation found that several strands of work arising from Mangalore recommendations, and accepted by DGCA, had not been addressed effectively. These included poor oversight of FDM programmes and the failure of DGCA staff to fly any check sectors into critical airports or on 'red-eye' flights.

The investigation team made over 50 recommendations in its final report.

Source: India AAIB Final Report dated 17 August 2021 (accessed via https://skybrary.aero/sites/default/files/bookshelf/32797.pdf)

CHIRP

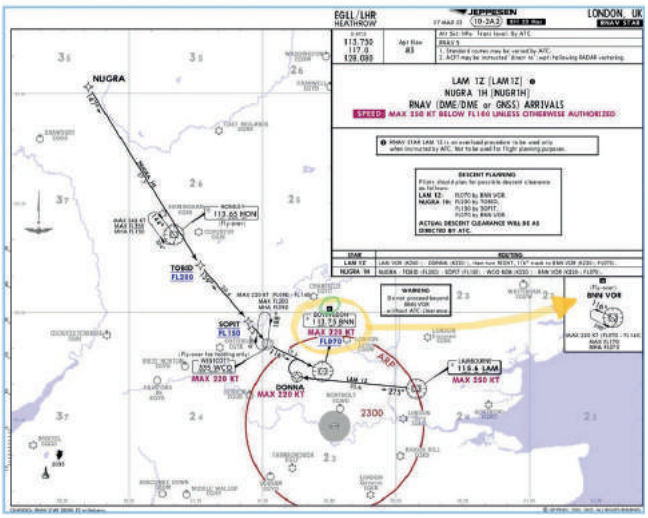
Confidential Human Factors Incident Reporting Programme

Report No.1 – FC5253 – Incorrect hold entry due to chart confusion

Report Text: On the descent into EGWU (Northolt) on the NUGRA 1H arrival we were told to expect holding for 10 minutes at Bovingdon (BNN). It was a very high workload phase of flight for us because not only where we constantly being vectored, we were also going in and out of very bumpy rain showers. The instruction given was just a few minutes prior to reaching BNN and was as follows: "Expect holding at BNN, 10-minute delay".

Right away my co-captain diverted his attention to trying to find the published holding at BNN and showed me the Jeppesen chart for the NUGRA 1H. It was NOT immediately clear what the published holding pattern was. I told him to query approach about what they wanted us to do because we were quickly approaching BNN. I wondered if maybe they wanted us to hold on the missed approach hold from the EGWU ILS25 because it was off a radial from BNN. My co-captain's query was "Do you want us to hold on the missed approach holding pattern off of BNN?" The reply we got was hold as published. At this point we should have asked for vectors because we couldn't find the published holding pattern at BNN. Instead, we entered a hold south with 1-minute legs, right hand circuits. Approach asked us if we had entered holding to which we replied yes. They must have realized we entered the wrong hold because the next instructions were vectors for a 10 minute delay.

When we got on the ground, I realized something had gone wrong and opted to call the EGWU Tower to get clarification on the holding. After a few minutes of discussion, I realized my mistake; the Jeppesen Chart had a bubble note indicating published hold for BNN but it was not printed close to point of the hold. Because of the way our charts are displayed in the cockpit you must find the bubble note in a different portion of the screen (slew the view to a different portion of the chart) and it was missed. I asked my co-captain if he had ever seen these notes before on other charts and he had not. Unfortunately, I knew about this subtle change but missed it because of the increasing workload. In the end this was good reminder that if you are unsure of a clearance not to accept it until you are positive you know the instructions. The airspace was very busy but asking for a vector hold would have prevented this incorrect hold entry.



CHIRP Comment: Ordinarily, crews inbound to Northolt do not hold at BNN and are given a vector for the approach so being asked to hold would have been unexpected. Furthermore, the Jeppesen charts for the procedure do indeed have the published hold pattern someway offset from the BNN location on the chart and so there is some sympathy for the crew (see screenshot with highlight arrow). However, as part of their arrival brief, the crew should have made sure they knew what any potential hold procedure would be as they approached BNN and, if not clear what to do when instructed to hold, they should have asked the controller for more information or requested radar vectors. Equally, although controllers were justified in assuming that the pilots would understood what was required when they were issued an instruction and did not query it, the controller could have asked whether the crew knew what was expected of them given that this was not a normal routing. Ultimately, the approach plate gives a warning 'Do not proceed beyond BNN VOR without ATC clearance' and so the crew ought to have conducted a self-briefing about what contingencies might result once they arrived at BNN in case they were not cleared to proceed beyond.

Report No.2 – ATC834 – Degradation of core safety values

Report Text: This is going to prove a very difficult issue to articulate as our unit safety performance remains very good and is arguably better than previous years. Unfortunately this is far from the whole picture. Management decisions and a seaming refusal to invest in core systems is simply poking more holes in our Swiss cheese.

Danger Areas
A report following a danger area (DA) infringement many, many years ago highlighted the need to improve our DA notification process and associated radar mapping - it should have resulted in the implementation of a system called LARA [Local **A**nd sub-**R**egional **A**irspace management support system]. In its infancy, iFacts, our area controlling tool, was supposed to provide conflict support to DA's. It seems implementation during iFacts was removed due cost and time constraints. LARA was expected and then seemingly parked in favour of our next system DPER [**D**eployment **P**oint **E**n**R**oute]. This was due into AC [Area Control] in 2019 I believe and is significantly over budget and late. It is likely any DA conflict detection may well be missing when and if it is ever deployed. 'Operational' date now unknown.

Our Supplementary Information Screen (SIS) is based on 1980/90's software and is hugely labour intensive to adjust, it is done manually by a human and there are regular mistakes. Attempts have been made to tighten up procedures but there are so many different

parties invested from Swanwick Military, Plymouth Military, Qinetic, Swanwick Civil, MABCC or L4M that I'm not sure we have improved things. Over the last three years we have suffered a significant number of danger area infringements for a variety of reasons but ultimately they can be aligned with the problems above. Human error, poor interpretation of information, poor display of information and lack of tools support. As traffic levels return, so will the mistakes I believe. We will only be lucky so many times before a serious incident occurs.

There is no sign of LARA, no sign of the DPER software that's already overdue, not that the latter would have significantly improved things to the best of my knowledge. Senior NATS management believe it will, but my operational colleagues believe the system is significantly 'dumber' than required to improve the current issues. It is an embarrassing mess.

Removal of simulator emergency training.
Over my [numerous] years I have performed [many of] the roles associated with our ART / TRUCE activities. We have improved the range of emergencies trained and also the training of staff behind the scenes who perform pseudo pilot and controller tasks BUT the actual simulator has in my opinion deteriorated year on year. It is, I believe, no longer fit for purpose. We do not resource it appropriately and therefore cannot simulate the full extent of our emergency catalogue and system fall-back scenarios properly. To make matters worse, simulator training has been suspended for the 2023-24 season. All newly valid controllers (of which we now have an increasing number) are expected to undertake simulator ART every year for the first 3 years, I believe this is agreed with the regulator. This year's suspension is still awaiting regulator sign off I believe but management are pushing ahead regardless of the overwhelmingly negative response they have received from the operational controllers and competency teams.

We learnt a lot from our handling of BA5390 in June 1990 [G-BJRT explosive decompression with commander partially sucked out of cockpit], but we are rapidly undoing all of the good work we did in the years afterwards to improve the standards of our emergency training. The holes in this particular Swiss Cheese are also growing in my opinion and I have grave concerns about our ability to handle a significant event, fortunately they are very, very rare but this probably exacerbates the problem really.

Finally, the operation at Swanwick seems to be being ignored in many other areas, which impacts morale and dictates operational performance to a degree. Our temporary ops room which we should have vacated in 2019 is a disgrace. Trip hazards from worn out carpet tiles, Radar arms that no longer meet DSE rules and regs, a permanently faulty ops room door that impacts our fire and security, inadequate TEMPORARY rest and kitchen facilities. The list goes on but.... the amount of space here limits further explanation.

NATS Comments: Thank you for the opportunity to respond to the concerns that have been raised, I hope the following helps to correct some of the inaccuracies which may be leading to the frustration shown by the individual and may provide useful information to all with regard to ongoing activities in these areas.

Danger Area infringement is recognised as a significant safety issue across our operation with an increased number of safety reports in recent years. The reporters comments regarding delays to the DPER system are accurate, however, development and implementation of LARA continues with ongoing improvements being made to the existing system. In the last 12 months, updates have been made to the radar mapping system used across upper airspace in the London FIR to improve information displayed on tactical displays. Although this does not provide conflict alert, it has improved the information available to controllers to allow them to make better informed decisions on the availability of direct routes and is part of ongoing works to simplify "flexible use airspace" and align procedures across a wide range of external agencies with whom we share these areas. In light of recent changes to the DPER delivery schedule we are in the process of reviewing other alternatives that, whilst not as good as the full DPER integrated solution, may offer an interim step to provide further support to our controllers.

The reporter's comments relating to the suspension of **simulator training** for the next year are inaccurate. Simulator training is being provided for both newly valid and experienced controllers as part of their ongoing emergencies training for 2023-24. As per previous years, a range of options are available to controllers to select from. This includes interaction with pilots and simulator sessions for those who wish to participate – it's not mandatory for all. We're always looking to make improvements to our simulator capability and would be keen to hear from the reporter directly if they feel there are areas which could be improved further. Their comments relating to improvements to pseudo pilot capability and the range of emergencies which can be simulated are welcomed and we'd welcome any further feedback they may wish to share with us in this area. Alongside this plan for the next year, we continue to evolve how we deliver all elements of training whether licence requirements or not. This will see us expand use of other technology to deliver training more flexibly and effectively and in line with modern learning methods. For our emergency training we are consciously moving away from reliance on a single simulator day once per year to regular drops of more interactive material which becomes more topical and timely and offers a mix of simulator, part task trainer, Computer Based Training and other multimedia systems in line with modern thinking on adult learning techniques.

As with many other companies, access to our sites (and specifically operational areas) was quite rightly limited for a significant period of time between 2020 and 2022. A reduction in the number of people allowed on site and the cancellation of works which weren't critical to service delivery has meant that planned works in recent years have been reduced and activities are only now starting to "catch-up" with activities that were paused during COVID. The reporter's comments regarding equipment no longer meeting DSE requirements are a surprise and not something which we recognise; this will be investigated further to ensure any specific concerns which individuals have can be appropriately addressed. We have various routes formally and informally to report and escalate and do not believe this has been raised through any of these. Works have taken place over the last 6 months and a plan is being put in place with our facilities contractor around general replacement and refurbishment of these areas. Although the main door into the Ops room has been out of service for several short periods it was quickly repaired each time and for each event alternative routes used that were both fire and HSE compliant. Having attempted these fixes with the supplier we took the decision that a new door was required and the process put in place to secure a replacement. The nature of the environment means that this needs a bespoke solution meaning long lead times but we expect installation imminently. Works are ongoing across the site as we continue to make improvements for all building users and it's unfortunate that the reporter doesn't feel that some of the changes already made have had a more positive effect on their own working environment.

We would welcome the opportunity to discuss any of the issues above directly with the reporter should they wish to do so.

CHIRP Comments: Notwithstanding the NATS comments above about ongoing expected improvements, the sub-optimal single-point of display of Danger Area information to controllers does not at present appear to be robust enough. CHIRP has previously commented on this following a similar report about Danger Area handling that we received about 2 years ago (ATC820) and that we had hitherto published in our Air Transport FEEDBACK Edition 140 newsletter (Report 4). After considerable correspondence with NATS at the time, we were advised that the LARA tool was unlikely to be fielded until late 2023 and that the NATS senior leadership had commissioned a 'Feasibility & Options' paper to identify potential avenues for improved Danger Area information systems that might provide mitigations in the interim. It seems that we are not much further down the road with Danger Area handling and we welcome NATS' further comments above about "*reviewing other alternatives that, whilst not as good as the full DPER integrated solution, may offer an interim step to provide further support to our controllers.*"

With regard to emergencies training and the use of the simulator, it has to be acknowledged that the simulator has also to be prioritised for other activities such as airspace changes and system refreshes. As a result, there is undoubtedly a high demand for simulator time, and NATS has to prioritise its use versus the various risks to operations from all of the demands. But, in this respect, it seems that the simulator is under-resourced to a point that, where possible, all courses or mandatory training are being shifted to other means. NATS say they are pro-actively managing simulator use, and, on the face of it, the move from a single simulator day per year to more regular focused simulator and computer-based training sessions may offer some positive opportunities.

Notwithstanding, CHIRP is told that the licensing-requirement days for simulator emergency training[1] have already been shortened due to lack of simulator staff from 4hrs of simulator time and an hour or two in the classroom facilitating discussion of hot topics, to 2hrs of simulator time (shared amongst 4-6 people so approximately 1hr in the hot-seat) and 4 hours in the classroom (normally hosted by a simulator assistant not a competency examiner as was the case in past). Whereas controllers used to run through five to six different emergency scenarios as tactical controllers during these days, now they are likely handling only one or two. Therefore, because the simulator day is now not offered annually to experienced controllers, they may practise only a couple of emergencies every 3 years. CHIRP believes that the reporter's concerns about the simulator's fitness for purpose and availability need to be addressed, and it is hoped that this report might be a catalyst for doing so.

Finally, many of these issues and NATS' responses hint at potential, or at least perceived, sub-optimal communication between the management and the workforce. CHIRP lacks sufficient insight into the NATS internal communications channels to make comment ourselves, but there may be a case for reviewing their efficacy, especially with regard to internal company newsletters or associated electronic channels for example.

1. *A simulator every year after validation until 3 years qualified, then once every 3 years (but able to attend annually in place of the alternative annual recurrent training options if desired).*

Report No.3 – FC5254 – Altitude deviation

Report Text: Climbing through FL200 for FL210 with the autopilot engaged, we received an altitude alert indicating that we were 1000' away from our level off. This was audibly acknowledged in the cockpit by both the PM and PF. At this point it is my belief that there was movement of the speed bug knob or heading bug knob which has a similar tactile feel and appearance as the altitude selector knob in this model of Falcon jet. This resulted in disabling the automatic altitude level-off function of the autopilot; upon realization of the altitude error, immediate corrective action was taken by the PF and a vector was given by ATC.

Apologies were made to ATC for the error. During the post flight debrief we discussed maintaining extra vigilance that the autopilot levels off at the correct altitude and that when changes are made moving flight guidance panel knobs, there is a corresponding indication on the Primary Flight Display.

CHIRP Comment: The fundamental factor in this incident was to remember that in this aircraft type at least, changes to some system settings would disable the automatic level-off function and so great care is required in doing so, especially when close to a critical event such as levelling off. It's easy in the heat of the moment to mistakenly move the wrong knob so, as the reporter infers, always check that the autopilot is still engaged in the expected mode, and responding, whenever making any changes to parameter settings.

Report No.4 – FC5250 – Stable Approach Criteria changed without notifying pilots

Report Text: At [Airline] we operate using e-manuals which are updated on a daily basis electronically. Periodically we are notified [by notification system] of significant change to operating policy, prior to specific manual upgrades. I attended a recent simulator check and, during the briefing, was informed by the trainer that the Stable Approach Criteria policy had been updated. This was quite a surprise as this is one of the most important elements of our operation, and you would expect this to come via formal notice. The trainer did not know exactly when the change occurred but suggested it was several months ago already. We have now received formal notification of the policy change; however, I know of at least one pilot who unknowingly breached the new policy during this period.

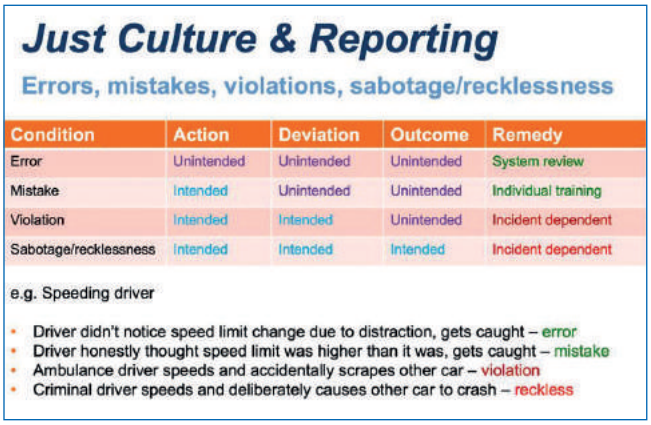
Many of us are concerned at the speed and volume that manual updates occur - the majority of them are small, insignificant and often irrelevant to role. We often only discover policy change through discussions on the flight deck. This also raises the question as to how a change to a fundamental element of our operating policy has slipped through without the chief technical or training pilot deciding / remembering / considering to promulgate formally.

Company Comment: Following a review of updated IOSA requirements, [Company] made two changes to our Stable Approach Criteria. These were related to ensuring that aircraft were stabilised on the correct lateral profile and that the landing checklist was completed by the 500ft auto-callout. The timing of these changes was immediately before a planned OM-A revision. A decision was made to include this change in the revision, rather than issue a notice making an amendment just days before a new revision was released which then incorporated it. An administrative error led to these two items not featuring in the revision's list of changes.

When feedback was received that the Stable Approach Criteria appeared to have been changed without notification, the situation was reviewed. At that point, a more significant change to the Stable Approach Criteria was about to be made. This followed standard process and the decision was taken to use this as the vehicle to also highlight the previous modifications. In the Ops Manual Notice (OMN) announcing this change, all modifications were highlighted to ensure pilots were aware of what had previously changed.

This incident led to the documentary update process being reviewed to ensure root cause identified and recurrence prevented.

CHIRP Comment: CHIRP has commented before on the need to have robust policies for a defined cycle of regular changes to documents rather than a series of ad hoc updates. The frequency of such updates depends on the nature of the change (routine, urgent, administrative etc) and, in this case, it seems that rational decisions about how to incorporate the changes were unfortunately derailed by an administrative error that led to them not being properly promulgated. One of the purposes of simulator checks is to refresh crews on recent changes and so this fail-safe activity worked in this case but it is concerning that some crews may have unintentionally been operating in contravention to their OM-A because they weren't aware of the changes.



CHIRP is heartened to see that the company is investigating why the administrative error was made, and also why the failure to promulgate was not evident. A change as significant as a revised Stable Approach Policy would hopefully have been considered within the company SMS processes and this should have highlighted the importance of robust promulgation channels. In any such investigations, it's important to distinguish between errors and mistakes: in 'Just Culture' safety terms, 'mistakes' are symptomatic of people misunderstanding the task and potentially requiring further guidance or training, whilst 'errors' indicate that there are systemic problems that induce people to do the wrong thing. It behoves all organisations to mitigate as many systemic inadequacies as possible so that errors are reduced; in the circumstances of this report, this may identify safeguards that could be introduced to ensure that critical documentation is not lost in the system but properly highlighted to those who use it.

Report No.5 – FC5240 – Online learning

Report Text: In 2018/9 the company were instructed by the CAA to roster a day of online learning to reflect the time that pilots were spending outside of their duty days completing tech quizzes, pre learning for simulator, aircrew notices etc. Once that happened the company added more study material to be completed before simulator sessions and took the SEP course entirely online (they did roster a day every other year for this item). The required pre reading for the simulator now covers 35 items.

All the courses that I used to attend a classroom to take part in are now done online in our own time and we are rostered a day of every year and a day off every other year to reflect this workload in our own time. At least we were. The company have now taken to rostering the online learning day in chunks, either before or after a duty. They have been challenged by the BALPA, their response is that it complies with the CAA request to record the time we spend doing online learning. My issue with this is that this is a cynical ploy to comply with the CAA requirements ignoring the spirit.

I was rostered an online learning block of 3 hours after an 8 hour duty. I was given 90 minutes to get home and then 3 hours online learning. This fails to take into account the fact that after a total of 9½ hours out of the house, a flight in bad weather at both ends and a commute in bad weather both ways the last thing I feel able to do is sit down and study. In the event I actually contacted crewing and asked them to put me down as fatigued for the online learning part of my duty. Whilst the company may well be complying with CAA requirements, rostering the time in blocks like this either before or after a duty is wholly inappropriate. It is nothing more than a paper exercise to make sure that pilots are available for the maximum number of days flying, over the years the time spent on courses has been pared down to the absolute minimum. A case of the company wanting to have its cake and eat it?

Company Comment: Shifting to online platforms has allowed us to streamline certain courses and provide more flexibility. The rostered activities, including online learning, are accounted for within the overall duty time but do not directly contribute to FDP calculations. FDP begins at report and concludes when the aircraft becomes stationary after the last sector. Therefore, while online learning may be added to a rostered day, it does not necessarily have to be completed during that specific period. Furthermore, the airline uses a dedicated time allocation for all required courses to ensure the time on roster is adequate. This also explains why the airline uses a different 2 year cycle for the hours allocation.

Lastly, the airline has entirely reviewed SEP training following feedback from our pilots where they felt that the classroom training provided little added value. As a result of this we made some significant improvements to our training delivery. As an example, our fire training now takes place in the simulator (using a simulated fire) in order to provide quality training for our pilots in the environment they are mostly likely to use these skills.

CHIRP Comment: The reporter's contention is that online learning is now rostered in chunks that are not compatible with other duties. As the company comment notes, such training is not part of FDP calculations and rostering them for a specific duty period is simply a device to ensure that the time spent is accounted for as a duty in its own right and therefore included within basic pay etc as appropriate. Although it was assigned a specific date/time, it did not mean that the

training had to be conducted at those times, and the activity could be done during reserve or standby for example, or whenever suited people best. Be that as it may, this was not clear to the reporter (and perhaps others), and so there is a case for the company explicitly stating within its training guidance that the timing of such online training is flexible provided it is completed within a predetermined date as applicable.

Report No.6 – FC5241/FC5251 – Absence policy

FC5241 Report Text: [Company] have released a disciplinary process for pilots reporting sick 3 times in 12 rolling months. I believe this will have a negative impact on the company's safety. I have already experienced flying with people of weren't fit to fly but have reported for duty as to avoid disciplinary meetings. This causes great concern for the airlines safety.

FC5251 Report Text: My Company has recently introduced a new Wellness & Absence policy. The policy is draconian and coercive.

Company Comment: The company has received a number of reports regarding the policy which has resulted in changes to the application of the policy. We understand that a one-size-fits-all approach may not be suitable for every situation, and the changes require managers to consider individual circumstances more and exercise discretion accordingly. This aspect is particularly important in the context of aircrew and, for our pilot community, the involvement of base captains and other pilot peers is included to ensure that the responsibilities and obligations of license holders are duly considered. Their expertise and understanding of the unique requirements of flight crew members contribute to a more comprehensive evaluation of each case.

CHIRP Comment: Absence management within the airline industry is an issue of topical interest at CHIRP at the moment and we have been engaging with the CAA and a number of airlines in this respect. CHIRP thinks that the issue of flight/cabin crew absence management is something that needs to be reviewed across the industry in order to recognise that crews are in a different situation to those who work outside the aviation world because of the regulatory requirement on individuals not to operate if unfit to fly. As such, we are aware of a UK Flight Safety Committee initiative with the CAA to look at how absence management can be better codified across the aviation community to reflect best-practice. In fact, we majored on this topic in a recent editorial in our Air Transport FEEDBACK Edition 144 Newsletter commenting that the aim should be to produce best-practice protocols that operators can adapt to their own requirements not just for flight/cabin crews but also for other safety-critical staff such as ATC, engineers and others who must not conduct their tasks and should not be induced to work when not fit to operate (be it flying, controlling, engineering etc).

Report No.7 – FC5230 – Trainer fatigue

Report Text: For all training duties on the line it is expected that crews report early. As a Line Training Captain the day must be carefully planned, as you cannot expect support from the trainee. A safe duty requires the trainer to complete Captain, FO and Trainer roles. These duties are rostered as per any other flight duty, 1 hour prior to STD and 30min after landing. As a trainer, the real report is 1:30 before STD, and 1hr after landing which includes debrief. Additional report writing, on average, takes an hour. Each training duty therefore requires an extra 2 hours of duty. I have raised this and have been told it won't change. There is also resistance from rostering when I do have the energy to change off-duty times. The accumulated fatigue over a year of nearly constant training approaching 900 hours is extreme. A training duty has additional stress from the workload, and to consider these to be "normal flights" is unrealistic. We have had incident reports of tail strikes, and balked landings. I don't feel the company safety management system of fatigue and rostering is capturing and controlling trainer fatigue. Apart from an internal confidential fatigue report, the only other person contacted was a pilot manager who was not interested.

Company Comment: Our thanks to the reporter for raising this report to CHIRP. Trainer fatigue is a known industry issue and we are constantly monitoring it proactively and reactively through surveys, predictive and actual fatigue reporting, occurrences and hazard reporting and trend analysis. This is also an issue that is being discussed at FOLG subgroups [Flight Operations Liaison Group – an industry-wide forum for airline operations directors], which we also attend. While there is always scope for improvement, our fatigue management program has recently proven its effectiveness through actions taken on the back of fatigue reports. Crew, trainers included, are encouraged to submit fatigue reports (actual and predictive) should they experience a fatigue related event and/or concern. All our reports are handled confidentially and in accordance with our Just Culture.

While there is no evidence that fatigue has been a factor in any of our safety occurrences happening during a training flight in the past 12 months, our Crew Training team is already working on simplifying the report writing process, which can currently be quite time consuming for our trainers. Other actions are also being discussed and will be communicated to the trainer community once agreed. In the meantime, we would like to reiterate the importance of reporting fatigue related concerns and events through our fatigue reporting program. Reporting allows us to identify issues and trends and in turn enables us to address them. Each report can also be submitted anonymously should the reporter wish to protect their identity even further.

CHIRP Comment: Notwithstanding this report came to us in the post-COVID recovery period when training flights were regular and frequent, the fundamental issue boils down to whether trainers should be given an extra time allowance to accommodate the additional planning and briefing/debriefing training activity. Some companies do allow extra time for the training activity within their reporting/check-in time allowances and it seems to CHIRP that this represents best practice.

More fundamentally, although to some extent the extra burden of training is all part and parcel of being a trainer, in times of increased training flows this can soon mount up and become very challenging; being constantly rostered for frequent training duties can be extremely fatiguing and does not represent best-practice even if additional time is allowed for the training activity. The problem is likely to be seasonal for many companies and so it is vitally important that they monitor the potential for trainer fatigue especially during the Spring/Summer period when increased numbers of training flights are more likely. On a personal level, if as a trainer you feel you are becoming fatigued then do submit fatigue reports to highlight this, multiple if necessary – without data and trend information, safety management systems are unlikely to address issues that may not be apparent to them as endemic rather than just a one-off situation.

Out of Line

A 757 crew focused on their descent, disregarding visual cues that they were heading for the wrong runway

by Linda Werfelman

The pilots of a FedEx Boeing 757 were fatigued as they neared Tulsa (Oklahoma, U.S.) International Airport just after 0400 local time and failed to recognize visual and auditory indicators that they were on approach to the incorrect runway, the U.S. National Transportation Safety Board (NTSB) says.

The captain told incident investigators that he realized their error after touching down on Runway 18R and hearing the "3,000 feet remaining" call from the 757's runway awareness and advisory system (RAAS). Runway 18R is 6,101 ft (1,860 m) long, some 3,899 ft (1,188 m) shorter than the 10,000-ft (3,048-m) Runway 18L, where the flight crew had intended to land. The captain, who had been the pilot flying, braked heavily and the airplane exited the runway using the final taxiway.

Neither member of the flight crew was injured in the June 8, 2022, incident, and the airplane was not damaged.

The NTSB said the probable cause of the incident was the crew's "misidentification of the intended landing runway" and cited as contributing factors their "failure to perceive and correctly interpret' electronic guidance and other visual and auditory indicators that they were approaching the wrong runway, "which was likely the result of a degradation in cognitive function brought on by working within their window of circadian low,[1] increased workload and fatigue."

The NTSB also cited the air traffic controller's "failure to monitor the arriving flight after issuing a landing clearance." The report noted, however, that because the controller "had a reasonable expectation that the flight ... would approach and land on the assigned runway," she performed other tasks rather than continuing to monitor the approach."

'Couldn't ... Sleep'

The crew reported to Ontario (California, U.S.) International Airport at 1850 local time on June 7, 2022, and flew to Fort Worth (Texas) Alliance Airport, arriving at 0030. After performing post-flight procedures, each pilot obtained a crew rest room. The first officer (FO) said he slept for about 30 minutes, but the captain told investigators he "couldn't get to sleep," the report said.

Around 0330, they departed for Tulsa with the captain as the pilot flying.

At 0351, they began the descent to Tulsa and briefed the visual approach to Runway 18L, backed up by the instrument landing system. At the time, they were flying in instrument meteorological conditions, but soon descended beneath them. Weather conditions included 10 mi (16 km) visibility, broken clouds at 5,500 ft above ground level (AGL) and few clouds at 4,300 AGL.

The report said the FO told investigators that, once below the clouds, "he could not see the runway but did visually acquire the ... airport beacon and said it 'looked like a normal downwind.'"

They were cleared for a visual approach to Runway 18L and then cleared to land; around 0410, they disengaged the autopilot, configured the airplane for landing and performed the before landing checklist.
The FO told investigators that although the glideslope indication appeared to be normal, the 757 seemed to be low on final, "and he brought that to the captain's attention," the report said. The precision approach path indicator (PAPI) lights indicated they were below the runway's glidepath, and the deviation bar on the horizontal situation

indicator (HSI) was deflected to the left (indicating that the airplane was to the right of the runway centerline); the FO did not mention the HSI deflection to the captain at the time, the report said.

The captain adjusted the descent rate to place the airplane on visual glideslope indicated by the PAPI and continued to focus on the PAPI lights rather than the HSI, which he noted was "slightly off to the left," the report said. When the airplane was at 800 ft on a 2.8-nm (5.2-km) final, an RAAS callout said "approaching 18R"; there was other communication on the flight deck at the time, and neither pilot remembered hearing the callout.

"The captain stated during a post-incident interview that he applied the brakes and 'came on them harder initially because he was confused'," the report said. "After slowing the airplane, the captain asked the FO, 'are we on the correct runway?' and then stated, 'we landed on the right(hand) runway.'"

They told the controller they had landed on Runway 18R and received taxi instructions to the ramp.

Sleep Records

Both pilots held airline transport pilot certificates. The captain had 5,544 flight hours, including 1,632 hours in 757s, and estimated that he had flown intoTulsa at least 100 times. The FO, with 2,217 flight hours, including 1,478 hours in 757s, said the incident flight as his second into Tulsa since he started working at FedEx two years earlier.

In the days before the incident flight, the captain said he slept for seven hours the evening of June 5 and then was awake for six hours before a two-hour nap; after the nap, he was awake for another six hours and then had a 4.5-hour rest period before reporting for work at 0225 on June 7. After that flight, he slept five hours and then had no more rest before the incident flight. He said he had been awake for 15.5 hours before the flight.

The FO reported sleeping about nine hours the night of June 5; he was awake for 12 hours, then took a four-hour nap before reporting for work at 0225 on June 7. After that flight, he slept seven hours, ate lunch and napped for 30 minutes before reporting for the incident flight. At the time of the incident, it had been three hours since his nap and 12 hours since his last lengthy rest period.

Visual Cues

The NTSB report said that, because the approach was flown in visual meteorological conditions, visual cues "should have enabled the flight crew to distinguish one runway from another." Among those cues were the differences in runway length and lighting, the report said, noting that although both runways had precision instrument markings, high-intensity edge lights and a four-light PAPI, Runway 18L, where the crew intended to land, also had medium intensity approach lighting system approach lights. Runway 18R had runway end identifier lights.

On the flight deck, both pilots had a primary flight display (PFD) and navigation display (ND), and the captain also had a head-up display (HUD). They had noted during the approach that the HSI deviation bar on the FO's PFD and the captain's HUD localizer both indicated that they were off course to the right. However, the report said, "the flight crew appeared to discount the information their instruments were providing in favor of the view they had of the runway and understanding of their circumstances. The flight crew focused on their flight path and descent rate for the runway they had already visually acquired, and the multiple visual cues that they were misaligned were not recognized."

As the approach continued the flight crew "proceeded with the landing without engaging in further confirming acts" the report said describing their behavior as "consistent with the psychological phenomenon of plan continuation bias, which is the unwillingness to deviate from a previously determined course of action, despite the arrival of circumstances precipitating the need for a change."

Plan continuation bias typically is made worse by fatigue, and in this case, although the captain said he was not fatigued, he had been awake for more than 15 hours and "was likely experiencing fatigue due to chronic and acute sleep debt due to limited sleep in the days preceding the incident," the report said.

The FedEx scheduling process includes calculating the risk of fatigue according to two separate scales. In this case, the calculations included the assumption that both crew members would nap before the flight. Because the captain ended his nap attempt early, after he was unable to sleep, the absence of that nap pushed his fatigue score from within limits to high risk, the report said.

This article is based on NTSB Incident Report DCA22LA126 and related documents.

Image: NTSB/Google Earth

Note

1. *The window of circadian low is defined as the time (from 0200 to 0600 for individuals on a typical schedule in which they are awake during the day and asleep at night) when the body is programmed to sleep and when alertness and performance are degraded.*

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