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FOCUS is a quarterly 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: A Merlin Helicopter and an F35 Jet operating to the deck of HMS Queen Elizabeth

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focus ON COMMERCIAL AVIATION SAFETY

Standards...

by Dai Whittingham, Chief Executive UKFSC

On 15 August, Captain Damir Yusupov and his First Officer, Georgy Murzin, were presented with a situation that only a very few pilots have faced, and which is never practiced in simulators. A multiple birdstrike damaged both engines on take-off from Moscow-Zhukovsky; one failed immediately and the other produced insufficient power for the A321 to remain airborne. Less than two minutes after the start of the take-off run, the aircraft was down in a maize field around 2.8 miles from the runway. All 233 people on board survived with no major injuries.

A Black Swan event? Not exactly, but it is nonetheless exceedingly rare. In the previous 60 years there have been just 4 similar occurrences, most recently Capt Sullenberger's 2009 ditching in the Hudson. The others include: the 1960 loss of an Electra (Eastern Airlines Flight 375); a B737-200 (Ethiopian Airlines 604) in 1988; and an MD-81 (Scandinavian Airlines 751) at Stockholm that ingested chunks of airframe ice. Whilst the Electra crew had little time to react, reaching just 200 feet before losing control and hitting the sea, the other crews had the relative luxury of some altitude and a short period of thinking time – both the Hudson and Stockholm crews reached 3000ft and the Ethiopian crew were on the downwind leg for an emergency return when their engines failed.

By contrast, Yusupov and Murzin only made it to around 800 ft before Yuzupov realised there was no prospect of an emergency return with the limited power being produced by the right engine. Details are still sparse and there has yet to be any formal reporting but, like Sullenberger and Rasmussen (at Stockholm), it seems that Yuzupov obeyed the golden rule – Aviate, Navigate, Communicate – and remained in control of his aircraft all the way down to contact with the field he selected for his forced landing. Some might argue he had no choice as to where he was coming down, but it matters not: he flew the aircraft as his priority and 233 people survived as a result. Transcripts of the comms with ATC show that after an initial brief PAN call, the next transmission from the aircraft was from the ground to request emergency services, much to the confusion of the ATCO who thought they were still airborne, further evidence that the crew had their priorities sorted.

What has all this got to do with standards? Within a few hours of the news breaking, the chat forums were alive with armchair critics and unqualified contributors offering comments ranging from suggested sainthood to ritual disembowelling for failure to follow procedure. The procedural crime? Yuzupov landed gear-up, whereas the Airbus QRH directs gear-down. And, worse, based solely on the evidence of a YouTube video it seems he may have omitted a 'BRACE!' call before impact. Disgraceful indeed.

It is open to question whether Yusupov and Murzin would have been able to find or recall and action the full QRH drill in the very limited time available to them. It was unlikely that they could have successfully started the APU before touchdown, and lowering the landing gear may have added unwanted drag - we don't yet know what they were looking at in terms of energy and glide angle. What is certainly not open to question is that this flight crew managed to pluck a successful outcome from the jaws of disaster and that all on board owe their lives to the skill they showed when it was most needed. If ever there was a time to throw procedures away and revert to basics, this was it.

Whilst the accidents above involved loss of power after take-off, there are others who found themselves with very quiet aircraft – the B767 'Gimli Glider' and the Air Transat A330 dead-sticked into Lajes come immediately to mind. All engines out is very unusual but it happens. So why isn't it practiced or demonstrated in a non-jeopardy simulator session? It need not be FFS, a fixed-base would do. One event in a career would be better than having to start from a position of no experience at all.

There have been other instances where crews have deliberately not followed SOPs or QRH guidance, most notably Captain Richard de Crespigny and his team on QF32. His story is well known: his A380 was crippled by an uncontained left inboard engine failure on departure from Singapore-Changi, the turbine fragments producing damage akin to that expected from a small surface to air missile. Engine and flight controls were damaged, along with fuel leaks, electrical and hydraulic failures, a small fire that self-extinguished, and there was structural damage to the wing, fuselage and landing gear.

Even with 5 pilots on the flight deck, QF32's crew was in danger of being overwhelmed by the volume of warnings being generated – 43 ECAM messages in the first minute and more thereafter – so the crew, through a solid CRM process, worked out which ECAM actions should be followed and which warnings could be ignored. In essence, the crew began to focus on what systems were remaining. Both outboard engines had reverted to degraded mode and the No 1 was not controllable; the only engine working as advertised was the No 3, and the crew elected to leave Nos 1 and 4 at a set power and control the approach speed with the No 3. De Crespigny managed to stop the aircraft on the runway at Changi but was unable to shut down the No 1, which was eventually extinguished by the fire crews flooding it with water. With an engine running, hot brakes and leaking fuel, it was decided the safest place for passengers and crew was to remain on board, albeit with cabin crew and passengers primed for an emergency evacuation. The last passenger left the aircraft via steps almost 2 hours after landing.

Despite an emergency scenario of unprecedented complexity, de Crespigny's team did not go entirely off script. Some SOPs remained in place, such as carrying out performance calculations and conducting a full approach briefing, standard call-outs and the like. Essential disciplines remained, and contributed to a safe landing.

There are reasons why we have SOPs and standards, which have often been written in blood. On one level they have a strong influence on generating shared mental models as, with strong compliance, you should know what the other pilot will do at any given stage of flight. Many SOPs have been written as a means of trapping errors, such as cross or independent checks on data entries, selection of go-around target altitudes and the like. Others allow operators to manage risk – stable approach criteria, for example, or 'still airborne past the TDZ markers = go around" as a means of mitigating the long landing runway excursion risk. Not surprisingly, compliance for many SOPs is tracked via FDM programmes. And there are clear benefits from training all pilots in the same processes.

History is littered with examples of accidents that could have been avoided with better SOP compliance. To name but a few, lack of compliance featured in the Asiana B777 accident at San Francisco in July 2013, in the Turkish Airlines A330 runway excursion at Kathmandu in March 2015, in the US Bangla Airlines Q400 LOC accident at Kathmandu in March 2018, and in Air Nuigini's B737 CFIT (sea) at Truk Lagoon in September 2018. Unstable approaches should be met with a go around, yet compliance on this is still less than 5% when viewed globally.

The Ural Airlines and QF32 experience offers good evidence that SOPs (and QRHs) don't fit all possible scenarios, but the laid down or published procedures form the bedrock of operational safety in that they provide guidance that, if followed, should keep you out of trouble most of the time. That said, most SOPs and QRH procedures develop over time.

The manufacturers go to great lengths to generate operating guidance on handling, normal and non-normal conditions, but these too may be subject to change in light of operational experience. And some operators have mixed fleets, so SOPs can be slightly more generic in the interests of commonality. Operators can choose for other reasons to ignore the manufacturer's preferred way of operating their aircraft in favour of a bespoke company procedure, though it is fair to say many operators that have taken this route are now reverting to a manufacturer recommended approach. This 'back to basics' move may owe something to the avoidance of liability in the event of an accident – 'operator did not follow the recommended procedures' is a simple defence.

In managing any change to SOPs it is always useful to consider the concepts of doctrine and dogma. In this context, doctrine is simply a collection of perceived wisdoms or as the essence of teaching in a particular discipline, whereas dogma is something that is presented as incontrovertibly true. Dogma has ground truth set in the proverbial tablets of stone from which there can be no movement, but doctrine allows for interpretation and growth.

Problems arise when those who wish to change, or resist change to, SOPs approach from a dogmatic stance. It can be especially difficult with smaller operators or fleets, where big fish in small ponds can be more prevalent. A new manager or management pilot might decide to change a process to his or her preferred option, using their positional power without necessarily considering all the relevant factors. That is fine if you are right, but if you are not, trouble beckons. There is also a training bill to settle and a standardisation process to change too. Far better to opt for management by committee in this case – avoid a single-source solution and put more than one mind to work on it, with the doctrine rather than dogma given proper consideration.

Finally, let us spare a thought for all those for whom there were no SOPs and where experience was the trainer. In June, we celebrated the centenary of Alcock and Brown's first non-stop transatlantic flight and, in July, the 50th anniversary of the first moon landing. From the Vickers Vimy to Apollo 11 in 50 years is remarkable progress by any standard. Nobody knows where the next 50 years will take us, but whatever the future holds, expect it to include SOPs in some form or another.

focus ON COMMERCIAL AVIATION SAFETY

A Look at Startle Effect

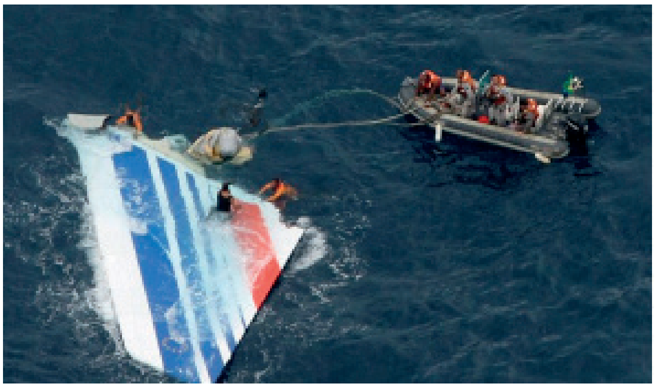
by Jacky Mills, Chairman UKFSC

All is calm in the flight deck, until that is an aural warning from the EGPWS sounds which doesn't match what the crew believe to be their position; or the Autopilot disconnects without warning accompanied by an assortment of Master Cautions; or perhaps the seemingly smooth landing bounces and results in anything but a smooth touchdown. These are all situations where Startle Effect can turn the peaceful flight deck 'upside down'.

Often good things in life have their downsides, their disadvantages, and somewhat surprisingly, the enduring reliability of the modern aircraft of today is no exception. This progress has unwittingly created a conditioned expectation of normalcy amongst today's pilots.

As aircraft have continued to become more reliable pilots are surprised, or startled, by some events and as a result may not take any immediate action, or possibly may take inappropriate action. These events have created undesired aircraft states, or unfortunately, in some cases, an accident. The Air France flight 447 is an extreme example of this, resulting in loss of control in flight.

On 01 June 2009 the Air France operated Airbus 330-200 on a scheduled passenger flight from Rio de Janeiro to Paris CDG crashed into the sea with the loss of the aircraft and all 228 occupants. It was found that the loss of control followed an inappropriate response by the flight crew to a transient loss of airspeed indications in the cruise which resulted from the vulnerability of Pitot Heads to ice crystal icing.



The Cockpit Voice Recorder (CVR) was ultimately recovered from the AF 447 and revealed that the flight entered the Atlantic Ocean at a tremendous rate without the crew ever fully understanding what was happening to them.

The expectation of novel or critical events is nowadays so low, that the level of surprise, or startle, which pilots encounter during such events is significantly higher than they would have experienced decades ago when things went routinely wrong.

The immediate impact of the startle reflex may induce a brief period of disorientation as well as short term psychomotor impairment which can lead to task interruptions, as well as a possible brief period of confusion.

Performance after a startle event can be affected to the detriment of safety of the flight, but greater concern stems from what the crew did, or did not do, during the conditioned startle response itself. This is where the decision making can be most significantly impaired, especially those higher order functions necessary for making judgements about complex flight tasks.

A period of time will certainly be required for reorientation and task evaluation and resumption.

So what is it? The Startle Effect in aviation is the flight crew's response to a sudden event and can be defined as an 'uncontrollable, automatic reflex elicited by exposure to an intense event that violates a pilot's expectations'. To 'startle' is the result of a sudden shock that can disturb or agitate the recipient; this is also know as the 'limbic hijack' or more colloquially as 'fight or flight'. It is a response to an unexpected stimulus.

The limbic centre is that part of the brain which rules reactions to things, typically, without the benefit of any additional logic or reason. The unwanted result of limbic hijack in the flight deck is the involuntary physical reaction, for example blinking of the eyes, an increased heart rate and an increased tension of the muscles and can induce a significant emotional or cognitive response. The emotional component influences how a person responds to the unexpected event. This can be confusion or fear or can even cause a person to simply freeze. Freezing, can of course, make the problem worse, not inputting the required corrective action.

If enough information is available to allow the pilot to make an accurate assessment rapidly then the responses fade away. However, if the situation remains unclear or ambiguous then these high levels of physiological and psychological stress can persist. It is thought that this is what the flight crew of AF447 experienced, possibly leading to some non-deliberate muscle activity (applying back pressure without being aware) and decreased cognitive capacity for situation assessment – thereby not rationalising that the aircraft was in a stalled condition.

The slower and more deliberate analysis of the situation sometimes takes place hours after the unexpected event. This is because the 'fight or flight' response creates a sense of urgency to take action and gives a perceived time pressure; so this mode inhibits slow and deliberate analysis.

Startle reflexes are more severe during very low or very high arousal levels. In addition to the physiological reflexes, the startle inhibits muscular activity, so a startled person stops what he was previously doing. On the flight deck the disruption can have detrimental effects, of course, particularly when this is elicited when the pilot is performing flight essential tasks. Situational awareness is also lost in full or in part, due to the distraction.

So startle in flight happens when something in the aircraft suddenly deviates from its expected performance, and results in this 'startle effect' response. This then leads to distraction or fixation, which can then lead to a tragic accident. One example was a Cessna 421 Golden Eagle which suffered a vacuum pump failure at FL270 on a night flight in Instrument Meteorological Conditions (IMC). The pilot took manual control of the aircraft, possibly due to autopilot malfunction, and in the confusion lost control and went into a vertical dive followed by an in-flight break up.

Startle Effect can be one of two scenarios – firstly without warning, a surprise that can leave the flight crew completely unaware of what is actually happening. The second is where several 'alarms' warning lights and sounds, are triggered which can be even more confusing than the problem itself.

The 'without warning' is insidious and can creep up on the flight crew whilst they have been lulled into complacency thinking that all was going well.

Another accident occurred on 28 December 2014 when an Airbus 320 crashed into the sea en route to Karimata Strait Indonesia. The crew took unapproved action in response to a repeating system caution after levelling at FL 320. The unexpected consequence was a degraded flight control system and obliged manual control. Gross mishandling led to a stall, descent at a high rate and impact with 20 degrees pitch attitude and 50-degree angle of attack minutes later. The subsequent investigation noted the accident origin as repetitive minor system fault, but the subsequent loss of control followed a combination of explicitly inappropriate pilot actions and the absence of appropriate actions.

Startle Effect can happen to anyone or any team and is not usually caused by making a mistake or a lack of knowledge. This is another area where our Just Culture, where learning from mistakes is actively promoted, so that our flight crew feel confident to admit both to themselves, and their Flight Safety team, that this has happened, so that others can learn what it may look or feel like and what the possible effects may be. These reactions and emotions should be looked at as very human reactions to abnormal events.

So now we know what the problem is, and how it has the potential to have a catastrophic effect on the flight, how can it be avoided, or at least managed? To investigate the training of Startle Effect Management immediately involves a paradox, because the very nature of the problem is that we don't know it is going to happen until thrust into the midst of the problem. There may be some level of scepticism within some areas of our industry as to how this can be achieved with any great degree of success.

No doubt this threat will be explored further by our professionals and if deemed appropriate and worthwhile, great training techniques developed which can be readily embraced. However in the meantime, it could be worthy of some thought and worth exploring some ideas that have already been developed in industry.

If the separate elements of the potential areas for training intervention are examined, it becomes clearer that some initiatives may be introduced to address the different elements. For example, practice could be exercised on influencing the appraisal of an unexpected event: is it a threat or not? Could concentration be introduced into some self-efficacy techniques to improve this and limit the effects of a fear-potentiated startle. By looking carefully at the individual elements and effects can some rationale be developed of where training interventions could be most effective and feasible.

Increased awareness has been proven to be beneficial – to learn from others mistakes is the ethos of why accident and incident reports are shared – so being aware of the possibility of Startle Effect will be helpful as an introduction. There are also skill sets which can be developed to limit the effects of startle.

Those who have good judgement skills may have advantages when dealing with unexpected situations, and these skills can also be enhanced by practicing the thwarting of rigidity and the use of intuitive decision strategies. Thereby, inexperienced pilots can become skilled in this area, and the more experienced can be upskilled accordingly.

It may be helpful to develop adaptive skills to enable expertise in performing well outside of the normal comfort zone. Practice at dealing with ambiguity and learning to understand how current beliefs and assumptions may affect the understanding of a situation. Developing the ability to monitor one's current level of understanding and adapting skills to decide when this is, and is not, adequate. So, real awareness of one's knowledge can be a skill to control and manipulate cognitive processes.

Of course, there is a belief that good judgement skills develop with an increase in expertise in the subject area. However, this is not well supported in accident and incident data. Undoubtedly, some moderate correlation has been seen with expertise and time, however, it is suggested that this does not occur for all people automatically. It is thought that the difference may be connected to the learning which takes place at an individual level, with two environmental factors, lack of time and proximity to colleagues, affecting this.

Research has also identified five personality traits which motivate individual learning: initiative, self-efficacy, love of learning, professional interest and professionalism. These characteristics may be worthy of development for training elements.

So having looked at Startle Effect and potential longer terms initiatives which may be able to give flight crew some tools to address this, we can look at some awareness strategies which can help in the short term. Forewarned can help to be forearmed...

Strategies for Improving Startle Performance - to reduce the negative effects of startle and help improve pilot performance during and immediately following a startle event:

- First and foremost be aware that this can happen to you
- Ensure your Pilot Monitoring is fully aware of 'HOW' you are going to fly the approach, with appropriate gates
- Know your aircraft – develop a sound technical knowledge of your aircraft type and maintain it with regular revision
- Maintain handling skills – be competent and comfortable flying the aircraft without the automation
- Know your surroundings – develop and maintain effective situational awareness skill-sets. Pilot Monitoring should actively monitor Pilot Flying and both should actively monitor the aircraft automation
- Avoid complacency – maintain a healthy expectation and suspicion for things going wrong
- Anticipate threats – utilise effective Threat and Error Management (TEM) strategies
- Have a plan – mentally rehearse or foster crew discussion of 'Plan of Action' for both common and non-normal events and for the rare 'out of the ordinary events' – such as a fire – adopt a 'What Would I Do If...' mindset

ATC Simulation: A Controller-Led Approach

by Juan Antonio Lombo Moruno

Does ATC simulation need to be as realistic as possible, with large-scale simulators? Or is it better to be as realistic as necessary, but continually adapted and adjusted around user needs? Juan Antonio Lombo Moruno describes a lighter approach to ATC simulation that retains the operational benefits, plus some other benefits.

Key Points

- Flexibility in simulation design and development is as important as cutting-edge technological features.
- ATCOs must be involved in simulation design and development from the beginning to create a system tailored to their actual training needs.
- The ATC Training Division at ENAIRE has been responsible for creating a new training system called Gammasim.
- Gammasim was designed and developed with and by controllers to provide an easy and flexible software solution to cope with unit training, refresher training, and conversion training remotely, for tower, en-route, and approach simulation environments.
- The approach allows adaptation to feedback from all stakeholders.

One of the challenges for any ANSP in ATC training is to cope with the increasing simulation demand for:

- Unit training
- Refresher training for ATCOs
- Conversion training (new ATC tools, airspace and procedure changes).

Simulation is an essential part of this training. There are benefits for the learning process, before, during and after on-the-job-training (OJT), and it gives students more self-confidence. As an instructor, observing students in simulated conditions means that you can test different scenarios for specific traffic, weather, or special circumstances. Additionally, since the simulator instructor is not responsible for the operational working position in a live traffic situation (unlike the OJTI), it is possible to focus on monitoring competency.

Besides practising ATC technical skills (phraseology, separations, vectors, clearances), ATC simulation is mainly about the non-technical skills, because the key part of the learning process is how we interact with pilots and colleagues. Simulation design needs be able to control the development of training sessions regarding interaction among people (instructors, trainees, and pseudopilots), the definition of exercises, and conditions for adequate observation of trainee competency.

The trouble with ATC simulation systems is that major investments are usually required. This is not only for the acquisition of new devices but also for the technical support needed for maintenance, implementation of new scenarios or features, as well as airspace and procedure updates. Furthermore, when you are dependent on a technological supplier, it is difficult to adapt your system to your evolving needs.

So we must assess the benefits and drawbacks of selecting either a highfidelity system (full-replica hardware and software), or a flexible software solution. It might be more effective to focus on the objectives by creating a sense of realism, instead of searching for the perfect re-creation of the system hardware and features.

User-led design

ENAIRE has faced the challenge of this increasing demand for simulation from a new perspective: controllers led the design and development of the simulator from the outset to create a system that fits their training needs.

We have started this project with controllers as a cornerstone because they are the ones who really understand:

- The most important aspects of the training objectives
- What actually works at each stage of training
- The necessary features to be developed
- The effectiveness of the exercises
- Controllers´ feedback.

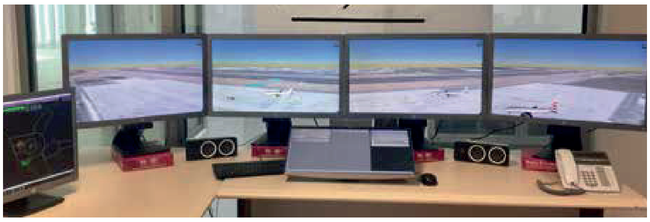
Human factors in design (ergonomics) has long emphasised the need for users to be at the centre of a design process. This is the way to optimise the interaction between people, procedures, equipment, and other elements of a system. In this case, the project has been developed by an interdisciplinary team of professionals at ENAIRE, starting and ending with air traffic controllers, in a continuous loop.

Gammasim

The ATC Training Division at ENAIRE has been responsible for creating a new training system called Gammasim, where all these concepts have been applied.

The main objectives for the simulator were:

- Quality tower, en-route, and approach simulation
- An easy to use and flexible system to cope with training needs
- Focus on unit training, refresher training, and conversion training
- Software solution, enabling remote use
- Quick scenario implementation.



After some months of research and development, Gammasim became a reality. It is currently implemented in several units such as LEMD or LEBL, where it is being used for unit, refresher, and conversion training.

Gammasim Features

The main features in the last updated version are:

- Easy operation
- Controllers and pilots can join the simulation from any location with a computer connected to the web
- One tool serves all ratings: independent or simultaneous tower, approach and en-route simulations
- Realistic 3D scenarios based on an efficient development using aerial photographs and animated 3D models of all aircraft types (airliners, general aviation, helicopters, military) and vehicles
- Visual effects (engine fire, different weather conditions, propeller movements...)
- Virtual tower systems
- Electronic flight strips or advanced flight progression management without flight strips
- Voice over internet protocol communications
- Simulation of degraded modes of operation
- User-friendly pseudopilot interface.

GammaSim

The stakeholders

The system is in a continuous development cycle involving several stakeholders.

This simulator has been developed by controllers with previous computing and engineering experience. The rest of the support team consists of engineers, computing staff and pseudopilots.

The team is located at the headquarters and is led by an operational ATCO who developed the first software version of the simulator. Additional ATCOs are involved in design, exercise development and training management.

Engineers and computing staff are in charge of maintenance, feature updates, scenarios and exercise computing. Pseudopilots have received training designed by ATCOs, and they are permanently in contact with the development team, influencing the design as users of the system.

ATCOs and instructors are the main users of the tool, and provide feedback to the heads of local training departments, who send the feedback to the team at HQ, thus closing the loop.

Besides pure training uses, the system can also be used by airspace designers and incident investigation users (ATCOs and engineers), who also give feedback for improvement.

Benefits

By operating the new system, we have achieved the following benefits:

- Internal development by ATCOs, engineers, computer staff and virtual pilots
- No external acquisition costs or support contract
- Technological autonomy and immediate operational scalability for further development and features
- Internal support (maintenance, updates, exercises, scenarios)
- Total adaptability and quick response to feedback request
- High performance focused on the controllers' training needs
- Additional uses besides training, such as airspace design and incident investigation.

It is widely recognised by controllers as a useful training aid, providing successful operational results, and is economically sustainable.

Juan Antonio Lombo Moruno is currently working at ENAIRE's Headquarters ATC Training Department as an expert for human factors. He is in charge of TRM training and CISM program implementation, and also assisting with the simulation department. His aeronautical operational background encompasses both ATC and pilot functions. Besides the operational side as a TWR and currently ACC ATCO, he was a former fighter pilot in the SAF (Spanish Air Force) for 15 years. jalombo@enaire.es

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Are airborne cockpit recordings protected from the media?

by Rupali Sharma & Ashleigh Ovland, Holman Fenwick Willan LLP

The Shoreham air disaster in August 2015 attracted widespread media and public attention both domestically and internationally. A pilot was performing a stunt in a 1950s Hawker Hunter aircraft before it crashed onto a motorway, killing 11 people on the ground. The pilot survived and was acquitted from 11 charges of manslaughter by gross negligence in March 2019.

The pilot had installed his own Go-Pro camera in the cockpit of the aircraft to record footage of the display for his own reasons. The footage showed the pilot performing a stunt called a 'Derry roll,' and captured the moment right before the accident. The pilot voluntarily disclosed the recording to the Air Accidents Investigation Branch (AAIB) for the purposes of their investigation, and also to the prosecuting authorities involved in the criminal investigation (pursuant to an order from the High Court).

During the pilot's manslaughter trial, which was held in open court without any reporting restrictions, the footage was played to the jurors. The media were keen to use the video as part of their reports and asked for it to be made available to them. This raised an important question about the competing public interests of full and fair reporting of criminal proceedings and the integrity of aviation accident investigations.

The BBC and the Press Association brought a claim for an order under the Civil Aviation (Investigation of Air Accidents and Incidents) Regulation 2018, SI 2018 No. 321 ("the 2018 Regulations") for the disclosure of the media footage.

Although the High Court recognised the need for open justice and proper reporting of criminal proceedings, it held that the safety implications were too grave to allow disclosure of the footage:

Integral to every investigation into an accident is the ability for people involved to co-operate with the AAIB investigation freely and without fear, and to be able to provide accurate information promptly and without judgment or blame. The purpose of accident investigations is to reach accurate conclusions about the causes of air accidents and incidents so that air safety in the future is achieved, and not to apportion blame or liability. Although the AAIB report itself is admissible as evidence in court proceedings, the evidence that is used by the AAIB is not and tends to be shielded by the formal written report. Allowing disclosure of all information sent to the AAIB to assist with the investigation cannot be in the interest of flight safety. Who would help the AAIB if their assistance could subsequently be known and available to the public? Information and news can readily be uploaded onto the internet and widely disseminated to the whole world at no cost and will remain there in perpetuity.

Industry insiders have been keen to emphasise that ensuring a safe environment for sharing information and evidence is paramount to preventing future accidents. Allowing the media to infiltrate this would diminish the impact that AAIB investigation reports could have on future safety investigations. Not only would it damage the culture of openness, commonly referred to as 'just culture' within the pilot community, but it would also lessen the AAIB's standing amongst the international air accident investigators with which it co-operates. These were the key and entirely understandable drivers behind the High Court's decision.

The AAIB is expected to comply with the terms and principles of Annex 13 of the Chicago Convention, which places a clear distinction between disclosure for such purposes that a competent authority may authorise, and disclosure to the public. The Chicago Convention recognises the damaging impact of disclosure of actual recordings to the public. If the UK derogates from Annex 13 then it risks tarnishing the reputation of the country and the AAIB in the international air investigation community. Air accidents commonly involve several national borders, and it is important that the AAIB remains in line with its international counterparts so that they may work together effectively.

Coverage of the Shoreham air disaster was widespread and readily available on the internet. The disaster had attracted and retained the attention of viewers from the moment the incident happened, right up until the conclusion of the criminal proceedings. Video content is more and more prevalent in online reporting and the public have come to expect it. Therefore, it is not surprising that the press would also want access to actual footage of what happened before this major accident. However, at what cost?

This decision from the High Court will be welcomed by aviation safety professionals and serves as an important reminder to the media of the purpose of accident investigations and the importance of ensuring future safety in civil aviation.

Infringements – ATC Perspective

by NATS Future Safety Team

The operating environment of the aviation world is changing rapidly. New airspace users are emerging and their safe integration with existing airspace users is a must. The recently formed NATS Future Safety Team are working to ensure safety evolves to support all the airspace users of the future. Everyone has a role to play in keeping our skies safe; but to do this successfully we must all understand the needs and perspectives of each other.

In this article we look at airspace infringements from the perspective of an Air Traffic Controller (ATCO).

What is an Airspace Infringement?

An airspace infringement occurs when an aircraft enters a volume of airspace that it doesn't have permission to be in. Airspace infringements often cause unsafe situations within the air traffic system which can result in aircraft being diverted, put into holds or held on the ground.

And what impact can they have?

The best way to explain the impact of an airspace infringement is to use an analogy.

Imagine you're driving your car on the motorway. A horse suddenly appears and walks slowly across the road into the middle lane in front of you. The horse's next movements are unknown to you and by the very nature that it is in a place it shouldn't be, its movements are unpredictable. Is it going to wander off, walk around in a circle, or head straight towards you? You don't know, but you have to do something.

From ATCO's point of view the experience is similar to our imaginary motorist who encounters the horse on the motorway. A controller doesn't know what the infringing aircraft is going to do next and it can be very difficult to manage the situation.

So what do ATC do?

ATCOs are trained to deal with infringements by trying to maintain a set separation standard from the infringing aircraft. Due to the unpredictable nature of the infringing aircraft, and for safety's sake, NATS ATCOs in the South East of the UK are required to maintain at least 3nm horizontally or 3000ft vertically from unknown infringing traffic. 3 miles sounds a lot, but with jet traffic operating at around 220 knots at the lower levels, this represents less than 1 minute to a potential collision.

Similarly, the displayed MODE-C altitude information received from unknown traffic must also be treated with some suspicion. It could be in error, but by what margin? The ATCO has no way of knowing and must act on what is displayed to them.

And the effects?

It's clear to see that it can become difficult to maintain separation, which may already be lost depending at which point the aircraft enters the airspace without a clearance. The increase in workload and stress levels for the controller involved is significant and the event can become very disruptive. Carefully vectored streams of aircraft can become difficult to manage as the controller aims to safely separate them not only from each other, but also the unknown infringing aircraft whose intentions can only be guessed.

When an infringement is more severe in nature and separation was not maintained, a controller will be removed from duty and may not be allowed to work again until the initial investigation is complete. In some cases further investigations are required.

So why do infringements keep happening?

Most pilots are conscientious and do their utmost to plan and fly safely. Notwithstanding this, errors are sometimes inevitable.

Whilst the vast majority of the infringements NATS' controllers see are indeed the result of slips, lapses and errors, there are a small number of more concerning events where a pilot has simply not planned their flight sensibly (if at all) and has flown the flight with what seems little regard for the adjacent airspace, often without any Air Traffic Services (ATS). **So what to do about it?**

NATS position has always been to contact pilots that have been involved in an infringement in order to learn as much as possible from the event, to the benefit of both the Air Navigation Service Provider (ANSP) and the individual pilot.

We encourage pilots to consider all threats when planning their flights, including the proximity of Controlled Airspace (CAS)., and to consider how they might manage any navigational errors that may occur.

NATS continues to make serious efforts to engage with the all the aviation community on safety and are welcoming drone operators and space launch operators into our safety activities.

CHIRP Reports for FOCUS

Extended duty without in-flight rest

Report Text: [Operator] has a daily flight from [UK] to [Eastern Mediterranean] and for us it is a 'there and back' which we can do with the hours available in extended duty without in flight rest, just. As the company expands from the [UK] base we are getting more and more flights that use the rules of extended duty, which most people believe is wrong. When it is once every 2 or 3 months you don't mind but now, as we have 3-4 extended duties per day, a mixture of 2 and 4 sector days, you can now expect 4-5 a month; this is likely to increase as we expand. More often than not you will have a duty either side of the extended duty as well so will just have enough rest to be legal, which after a 14-hour duty landing at 0130 in the morning is not enough.

Extended duties without in flight rest should only be used as a temporary basis such as rescue flights and not for scheduled daily flights. I think more people need to put in fatigue reports after the duty so the company will realise it might be legal on paper but in reality, it's not possible to do it all the time.

CAA Comment: While the regulations allow for pre-notified extended FDP's twice a week, we feel this highlights the issue of the impact of the surrounding duties and rest periods on the crew. ORO.FTL.110 places requirements on the operator to manage the pattern of work. Crew need to report the patterns that are generating fatigue, as it's not so much the extended duty that generates fatigue but the patterns of work.

We have used regular extended duties on a routine basis since 1990 but with more protections around rest surrounded the duties and 3 per 28 days. So how it's used, frequency and the types, lengths and circadian placement of the surrounding duties are the issues.

***CHIRP* Comment:** ORO.FTL.205(d) states the maximum daily FDP for acclimatised crew members with the use of extensions without in-flight rest:

(1) The maximum daily FDP may be extended by up to 1 hour not more than twice in any 7 consecutive days. In that case:
- (i) the minimum pre-flight and post-flight rest periods shall be increased by 2 hours; or
- (ii) the post-flight rest period shall be increased by 4 hours.

(2) When extensions are used for consecutive FDPs, the additional pre- and post-flight rest between the two extended FDPs required under subparagraph 1 shall be provided consecutively.

(3) The use of the extension shall be planned in advance, and shall be limited to a maximum of:
- (i) 5 sectors when the WOCL is not encroached; or
- (ii) 4 sectors, when the WOCL is encroached by 2 hours or less; or
- (iii) 2 sectors, when the WOCL is encroached by more than 2 hours.

(4) Extension of the maximum basic daily FDP without in-flight rest shall not be combined with extensions due to in- flight rest or split duty in the same duty period.

(5) Flight time specification schemes shall specify the limits for extensions of the maximum basic daily FDP in accordance with the certification specifications applicable to the type of operation, taking into account:
- (i) the number of sectors flown; and
- (ii) WOCL encroachment.

The extended duties described are therefore compliant with the numerical limits of EASA FTL but could still be fatiguing, notwithstanding the 4-hour extended rest allowance associated with them. This fatiguing effect would be exacerbated if the flights occurred during night hours and/or towards the end of a block of duties. That not more than 2 of these extended duties could be flown within a 7-day period implied that the regulations permitted them as a matter of routine and not, as the reporter recommended, for emergency or contingency use only. Before the introduction of EASA FTLs these flights would be "protected"; under EASA FTL the only protection is the extended rest period. However, many operators add protection by limiting the number of times pilots are rostered or by increasing the rest periods beyond the 4 hours required under EASA FTL.

A not very British solution to a very British problem

Report Text: I frequently detect a subconscious urge to be very polite whilst using the RT and especially by us Brits. It strikes me that this is an issue both on the ground and in the air. Just listen out for a few minutes and note how many good mornings, hellos, goodbyes and other greetings are mentioned by all and sundry as a prefix and or suffix to an ATC conversation. Although only a second or so at a time, it all adds to the bandwidth of noise.

My solution is to just STOP being ever so nice. What is the purpose of RT? This is not a social media surely? Purely an exchange of operational information and not just background noise for the sake of it? As mentioned in the two previous CHIRP editions:

"Listening out for one's own callsign amid a torrent of messages for other aircraft, frequently delivered in accented English, all competing for attention with other flight deck routines, noises and alerts, isn't the best use of pilots' mental capacity."

If CPDLC can help, then perhaps sticking to the essential message will also be an advantage?

"...This in turn allows the controller more thinking time to work out how to give continuous climbs and descent therefore saving fuel."

Just a thought. And it's a lot harder to do than you think.

***CHIRP* Comment:** In an increasingly busy operational environment, unnecessary RT exchanges add to workload and can be frustrating for other users. While some pleasantries may be acceptable if the situation permits, it is important that they are not allowed to interfere with operational efficiency. There is an obligation on users to listen and assess the general RT environment as part of their overall situational awareness before transmitting. Equally however, a desire to be as brief as possible must not be allowed to interfere with the correct transfer of information, since speaking too quickly may lead to requests for repetition and the exchange may ultimately take longer.

Lack of proper window blinds

Report Text: On climb-out (at 3,800 ft) we missed a large drone by about 150 metres. No big deal. However, many B787s are, out of necessity, flying around with all manner of cloths/newspapers etc. propped up to afford some protection from the sun as this type has only limited sun protection courtesy of small ill-fitting plastic devices.

Most types, ranging from Viscount to B747 have some form of retractable sun-blinds. The B787 is woefully lacking in this respect. I have voiced my concerns to the Company and Boeing. They do not seem interested.

The growing threat from drones should, in my opinion, make the requirement to produce proper sun protection a huge priority.

Operator's Comment: This is the first reported occurrence we have received regarding window blinds on the B787 fleet; the blinds fitted to the fleet are Boeing standard. On receipt of this CHIRP report and discussion with the B787 fleet team it was believed that the main issue may relate to the fact that the blinds are not easy to raise or lower.

We would like to highlight the following points:

1. Window blinds are not great on any aircraft type for the simple reason that any 'sun shielding' is limiting visibility.
2. The B787 side window is very big and of an unusual shape, making a blind difficult to construct and to be effective.
3. The B787 aircraft is fitted with a Head Up Display (HUD) that has an associated sun visor that can be used during all phases of flight (its use is highly recommended during climb and descent, but not mandated)
4. During critical phases of flight airmanship would dictate that restricting visibility out of the flight deck windows with the utilisation of a window blind should be avoided;
5. Pilots use of sunglasses during all phases of flight is common practice when conditions dictate
6. It is strongly advised that an avoidance manoeuvre associated with a visual drone sighting should be avoided. A violent control input may be of greater risk than the drone strike itself

***CHIRP* Comment:** Board members with B787 experience described the type as having better 'natural' sun protection in the flight deck by virtue of the structure design, although the sun blinds themselves are not necessarily better than on many other types. All sun blinds will restrict visibility and are probably not suitable for use in critical phases of flight such as the early climb phase. The B787 HUD visor is very good and can be used during all phases of flight.

It was noted that, although the reporter appears dismissive of the drone encounter, at 150 m the event was borderline risk-bearing and others may not share the reporter's view. The reporter was encouraged to file an Airprox report.

Contaminated wing for departure

Report Text: I was a passenger on flight departing from Innsbruck. I was seated with good visibility of the left-hand wing. During boarding and whilst in-seat awaiting the rest of the aircraft to board, I observed no walk around by any flight crew.

I observed patches of ice on the left-hand wing, and as the aircraft was nearly boarded and getting ready to depart at this stage, I quietly informed a cabin crew member that the wing was not clear, was the flight crew aware, and were we going to de-ice after boarding?

A reply came back via the same cabin crew member that the Captain was aware of the ice. I assumed they were going to de-ice after all the passengers were on board, and the aircraft closed-up. The doors were shut, the engines started, and the taxi commenced. There was no de-icing. As I am aware of the de-icing procedures at Innsbruck, having operated and checked pilots into there with my own operator, I knew there was not a remote de-icing location, and the taxi was going to be short. I again informed the cabin crew that there was still ice on the wing. The Cabin Manager, who came down to my seating location, aggressively asked me what was wrong, and I suggested he please inform the Commander that there was ice on the wing. I politely told him that I was a Captain with another UK-based operator. He went to the front, came back after speaking to the Commander and informed me that:

> *"The captain is aware of the Ice, it is acceptable, and he is happy to depart if I was happy".*

At this point we were lined up on runway 26, ready for departure.

As my own company does not operate this aircraft variant, there was now a seed of doubt in my mind that maybe there was some new limitations that permitted this variant to depart with some upper surface contamination. As I didn't know anything about this variant's limitations or procedures, and literally had seconds to answer with an aggressive cabin manager breathing down my neck, I informed him that if the Commander was happy to depart, then so was I.

At no point did I observe any flight crew members perform a visual inspection of the wings. The aircraft subsequently departed with contamination on the upper surface of the wings. Having subsequently discovered that there is no difference in upper surface contamination recommendation between this variant and my own, I should have trusted my gut and initial feelings and armed with an Aerodynamics degree, and 22 years learning experience on this type of aircraft, I should have asked to get off the aircraft.

Operator Comment: Without the specific details, it is not possible to respond comprehensively to the alleged incident, or to give the Commander the opportunity to respond. However, we can state that winter preparedness is something that is promoted each winter season to both pilots and cabin crew and covers both the operational and CRM aspects. Whilst the specific flight details of this occurrence are not known, procedurally in these circumstances, our operating requirements detail that a tactile check is carried out prior to engine start. Therefore, in this event, the feedback to the Commander should have prompted a re-assessment by the Commander before take-off. As previously mentioned, we cannot be sure that all the facts are known, but the issue highlighted in this report has been passed to the responsible manager for winter readiness as an 'example' to be used in the preparedness for winter 2019/20.

CHIRP **Comment:** It is important to note that the aircraft Commander has not been given the opportunity to comment. CHIRP's processes are confidential and no details of the flight were released to the Operator (other than the location) so no tracing action of the crew was possible or desirable. However, the report is of considerable interest as it is reminiscent of training scenarios that are used in CRM and command training courses. Indeed, accidents have occurred in the past as a direct result of similar warnings from passengers being ignored. In recent years, CRM concepts have been broadened to regard the entire crew and even passengers as resources which can all contribute to the safe operation of an aircraft.

Kathmandu Landing Accident - US-Bangla DHC-8-402

On 12 March 2018, a US-Bangla Q400 (S2-AGU) on a scheduled flight to Kathmandu crashed on the airport during landing, killing all 4 crew members and 47 passengers. There were 20 survivors, who were all seriously injured. The accident investigation revealed a catalogue of issues with CRM, mental health, SOP compliance, documentation, training and oversight. This article is based on the final report of the Accident Investigation Commission to the Government of Nepal dated 27 January 2019.

The 52-year old PIC had 5500 hrs with 2800 on type, and was a TRE. The 25-year old female FO had 390 hrs total time with 240 hrs on type, of which 130 had been gained in the previous 90 days; she had been with the company for 18 months but was on her first Kathmandu sector. Both pilots had adequate rest periods before the flight.

The Event

The aircraft took off from Dhaka at 0651UTC with the PIC as PF. At 0807 the FO asked Kathmandu Control for descent and the flight was cleared to FL160, given an expected approach time of 0826 and directed to the hold at GURAS (17nm SW of KTM), which was subsequently selected on the FMS. The KTM weather was 6km with 3 octas at 1500 ft, winds westerly at 7 kts but the area was generally cloudy with some embedded CB. At 0816 the flight was cleared to descend to 11500 ft for the VOR approach to RWY 02. Airport elevation at Kathmandu is 4395 ft and the runway is 3050m in length with a 1.2% slope and PAPI plus standard high-intensity approach and edge lighting.

The crew omitted to cancel the FMS hold but this was recognised when the AP attempted to take the aircraft into the hold on arriving at GURAS. The PIC then selected a heading of 027M which gave only a 5deg intercept on the inbound 202M radial for KTM. The aircraft crossed the radial at 7DME and continued to deviate right of the final approach course, passing 2-3nm north-east of the VOR. KTM TWR then advised the crew they appeared to be heading for RWY 20 whereas their clearance was for RWY 02. Two minutes later, the controller asked the crew of their intentions, at which point the PIC replied that they would be landing on RWY 02, and commenced a right hand orbit. ATC instructed the crew to join downwind for RWY 02 and cautioned about another aircraft on finals but they continued to orbit right. They were then told to hold in their present position. After the other aircraft had landed, they were given the option of either runway but the aircraft continued to orbit right, this time to the northwest of the RWY 20 threshold.

Turning right through southeast, the PIC reported runway in sight and requested landing clearance, which was given. The aircraft subsequently appeared close to the RWY 20 threshold, not aligned with the runway and manoeuvring at very low level. It then pulled up in a westerly direction and turned left with a high bank angle, overflying 2 aprons and the ATC tower so low that the controllers in the VCR ducked, and then reversed to the right.

At 0834 the aircraft touched down on the left side of the runway about 1700m past the threshold with 15 deg of bank and misaligned by around 25 deg to the left of the centreline. It veered further southeast through the inner perimeter fence over rough ground and came to a halt 440m from initial ground contact; a fire erupted 6 seconds after touchdown which engulfed most of the aircraft. Impact forces were survivable for most of those on board. Fire crews were quickly on the scene and rescued 22 seriously injured passengers, though 2 died later in hospital.

The Analysis

The investigators rapidly established that there were no pre-impact structural, engine or system malfunctions. The crew members were properly qualified and certified, and there was no evidence of drugs, alcohol or other toxins that might have affected crew performance. The investigation therefore concentrated on human factors.

US-Bangla Airlines had been operating since July 2014. At the time of the accident the initial fleet of 2 x Q400 had grown to 4 x Q400 and 4 x B737-800 aircraft. The Q400 fleet had 11 qualified PICs (plus 2 under training) and 12 qualified FOs with a further 9 under training. Safety reporting was well-established but the company did not have a LOSA programme, nor was there a company doctor. Health-related issues were monitored by the DFO; crew were free to consult doctors as required and self-report any matters to the DFO if these would affect performance of their flying duties.

The PIC had flown fighters in the Bangladesh Air Force but was released on medical grounds in 1993 due to depression. He was declared fit to fly in 2002 after a detailed medical examination including a psychiatric evaluation, and a review of his subsequent medicals showed no mention of any depressive symptoms. However, he was known to have smoked on the flight deck during the accident flight in contravention of company instructions yet in his 2012-2014 medicals he declared he had never smoked, in 2015 he claimed to have given up in 2015, and in both 2016 and 2017 medicals he also declared he had never smoked. He had also not declared his history of depression at any of his medicals since 2012. He had flown with 2 other operators (Q400 and ATR72) before joining US-Bangla as a Q400 PIC, base, route and simulator check pilot in 2015.

The CVR showed that in flight deck conversations and in communications with Dhaka ground and company operations, changes in the PIC's vocal pitch and language indicated that he was agitated, experiencing high levels of stress, and was possibly "emotionally disturbed". The PIC "was talking almost non-stop throughout the duration of the flight with the FO being patient listener most of the times". He repeatedly returned to the topic of criticism of his instructional skills from a female colleague and said he planned to resign because of her behaviour.

CRM weaknesses were evident throughout. After initial contact with KTM, the FO asked repeated questions about frequencies, navigation requirements and the need for an approach brief. The PIC did not have the approach charts for KTM and used the FO's for an abbreviated approach brief before directing her to clip the charts on her side console; he therefore had no charts available to him throughout the approach. The FO's apparent confusion about the missed approach procedure was never resolved by the PIC. Three minutes prior to arriving at GURAS, the PIC lit the last of several cigarettes he smoked during the sector.

Although the aircraft should have been fully configured at GURAS to comply with company stable approach criteria, Flap 5 was was called for 2 miles past the fix, with Flap 15 and the landing checklist 2 miles later. The FO ran the challenge and response checklist but the PIC confirmed "gear down, three greens" without noticing they were not down and locked; this apparently also went unnoticed by the FO as when she called 10 mile finals the gear unsafe warning horn was sounding continuously. At 8 DME the PIC set the wrong minimums and called for the landing checklist again; the FO replied that it was complete, despite the warning horn, and prompted the PIC that he was 600ft high on profile. The PIC was having difficulty hearing the FO's words because of the high level of noise on the flight deck and made a 3rd request for the landing checklist, which she confirmed as complete even though the warning horn was still sounding.

The aircraft arrived at the missed approach point in VMC, descending at 1700fpm and off course, at which point the crew received EGPWS "SINK RATE" and "TOO LOW, GEAR" warnings. At this point the FO realised the gear was not down and initiated its extension on the PIC's instructions. From this moment onwards, all transmissions to ATC were made by the PF. He then requested the landing checklist for the 4th time. The crew conversations revealed the crew were unaware they had already passed the RWY 20 threshold and were 3-4nm NE of the VOR. As they continued to head NE they received continuous EGPWS warnings and the PIC started a right hand turn away from the rising terrain ahead of them. During the turn they descended to 175ft AGL at 35-40 deg AOB. During a further right hand orbit the PIC was constantly talking and admitted to the FO that he had made a mistake.

The PIC rolled out on 160M and both pilots were looking to see the runway in front of them, but it was clear from their communication that they had completely lost awareness of their actual position. When the FO finally sighted the RWY 20 threshold in their 3 o'clock at less than 2 miles (they were 1200 above airfield elevation), the PIC began to manoeuvre aggressively and overflew the threshold at 450 ft heading west and with 40 deg left AOB. After 2 further PIC demands for confirmations that the landing checklist had been completed, and with EGPWS bank and sink rate warnings sounding continuously, the aircraft cleared the hanger and domestic terminal by 45 ft (RA) before reversing right towards its final runway contact.

Conclusions

The investigation decided that the cause of the accident was disorientation and a complete loss of situational awareness on the part of the crew. The investigators also commented on the steep cross-cockpit gradient, the poor CRM exhibited, and the failure to adhere to SOPs. The role of ATC was also the source of comment, the investigators believing the controllers should have been more assertive when they recognised the crew were unaware of their true position. Recommendations to the NAA concentrated on licence renewals for medically grounded pilots and the need for psychological evaluation prior to training or entry to service. There were multiple recommendations for the operator on oversight, crew health and fitness, CRM, SOP compliance, rostering, documentation and training.

Hidden Change

by Nick Carpenter

Change is not always obvious, and changes can be hidden by their presentation or how they unfold. From a pilots' perspective, Nick Carpenter describes three examples of 'hidden changes' with implications for safety.

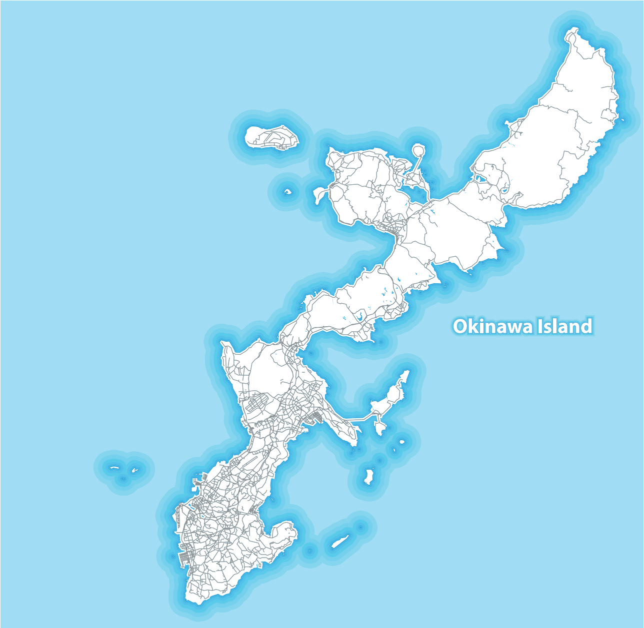
Key Points

- Change can take many different forms: planned and unplanned, slow and sudden, expected and unexpected, obvious and hidden.
- Identifying the unintended consequences of change is difficult, but thought must be given to this during the change process.
- Understanding the reasons for differences between work-as-imagined and work-as-done can help in change management.

Change comes in many forms. It can be planned, or it can emerge unexpectedly from situations. It can arise quickly, or occur slowly. It can be obvious or be hidden. Hidden change can be particularly troublesome because it is difficult to see and hard to understand. But in the technological world in which aviation has its roots, avoiding change is impossible, whilst making change can be essential for company growth and prosperity, and also for safety. In this article, I explore hidden change in the context of three examples that are relevant to aviation safety.

NOTAMs

In aviation, we have notices to airmen, or NOTAMs, which are meant to keep pilots up-to-date with short-term changes to airfields and navigational aids. An incident in July 2017, when an Air Canada A320 came within mere feet of colliding with a line of aeroplanes taxiing for departure, has raised the question of whether NOTAMs are an effective method of notifying crew members of the various small, but potentially important changes that they will face on a daily basis. The NOTAM system, which has been in use for many years was described by Robert Sumwalt, the NTSB chairman, as "a bunch of garbage that no one pays any attention to" (Trautvetter and Lynch, 2018). The danger of important details being lost in the noise of large amounts of information was discussed in a recent United Kingdom confidential human factors incident reporting programme (CHIRP) feedback (Dugmore, 2018). Experience with NOTAMs suggests that the risk of many small changes hiding important information is increased by poor presentation, making information hard to understand. The fact that aviators are not fully aware of all NOTAMs is not noncompliance. It reflects the lack of time available to prepare flights, the amount of information that



must be read and understood and the paperwork that must be completed before departure. Unsurprisingly, some information will be overlooked and some forgotten.

Precision Approach Radar approaches at Okinawa airport

Long-term or emergent changes can also be hard to see and can disguise hazards. In April 2014, a Peach Airlines A320 was approaching Okinawa airport in the southern part of the Japanese archipelago. The weather was poor and the captain considered that the ATC-suggested non-precision approach was inappropriate for the conditions. Instead, a Precision Approach Radar (PAR) was requested, approved and flown. In the course of the approach, the crew descended early, reaching an altitude of 241 feet three nautical miles from the runway before conducting a go-around.

The busiest single runway airfield in Japan, Okinawa airport is constrained by two American Air Force airfields nearby: Kadena and Futenma. The consequence is that approaches to the southerly runway commence at 1,000 feet, restricting approaches to either nonprecision or PAR. In a survey of pilots flying approaches there (Carpenter, 2018), it became apparent that many of them do not rely entirely on the instructions of ATC. Instead, they prefer to use onboard navigation systems to augment the ground controller's directions.

Historically, Okinawa airfield was an American air base only handed back to the Japanese Self Defence Force in 1982. PARs have only been conducted by civilian controllers in the last 5 years and

Okinawa is the only civilian airfield in Japan where these approaches take place. This historical background has resulted in two issues peculiar to Okinawa; a low platform altitude of 1,000 feet from which to commence the approach and the PAR itself. Training for both controllers and aircrew can only take place on the job because simulation is not available and, of course, PARs are rarely carried out. The change from military to civilian control has involved a gradual, and yet insidious change. Less well-practised controllers and crews conduct a complicated procedure for which they have limited on-the-job training under demanding real-world conditions. These issues, not identified in the official report, should be of concern. The fact that crews will consider using a GPS approach system in preference to an authorised PAR is, again not a reflection of undisciplined pilots. It is the by-product of a mismatch between design expectation and operational reality.

Carriage of lithium batteries onboard aircraft

In their book 'Nudge', Richard Thaler and Cass Sunstein emphasise the difficulty we have in judging the outcomes of change in areas where we are inexperienced or poorly informed, and where feedback is slow or infrequent. This is a common finding in human factors research. The unintended consequences of changes are masked, leaving latent problems in the system.

This can be seen in the industry change to allow the carriage of lithium batteries onboard aircraft. When the change was first made, some spoke out against the practice because of the associated problems. Lithium batteries carry their own oxygen, burn with extreme heat and create very little smoke, making them difficult to detect and extinguish. ICAO document 9481 'Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods' was amended so that some Group 9 cargoes, specifically RLI and RLM, lithium ion batteries and lithium metal batteries, had two, hitherto unmentioned, drill letters added. Group 9 drills carry 'no general inherent risk', but the two new drill letters F and Z meant that these particular cargoes were liable to catch fire, and once alight *aircraft fire suppression system may not extinguish or contain the fire*.

Discussions in the pilot community resulted in a general agreement that should lithium be on board, any indication of fire should automatically result in ditching. This was a radical suggestion and yet pleas to management to provide guidance on what should be done went unanswered. Where I work, promises were made to document the cargo and load it carefully whilst segregating it from other flammables. The unit load device containers designed by UPS to contain lithium fires were considered to be an unworkable solution because of the risk of damage to them. The Asiana Airlines accident over the Yellow Sea and the UPS freighter accident near Dubai, with the loss of their crews, focussed aviators' minds on the change to allow the carriage of lithium. And yet, as it stands today, lithium can still be carried on freighters but the Emergency Response Guidance has been changed to remove the troublesome wording regarding the inability of fire suppression systems to contain the ensuing fire. Fortunately, there have been no further incidents and as Thaler and Sunstein would have predicted, the issue has been conveniently forgotten.

Talking about change in human work

In all these cases, an open discussion with the front-line actors could have unveiled the hidden problems. However, front-line employees may fear that what is uncovered in such circumstances could result in a new bundle of procedures, requiring compliance with those that were already being worked around, and potentially, disciplinary action. The terms 'work-as-imagined', 'work-as-prescribed', 'work-as-done' and 'work-as-disclosed' (see Shorrock, 2016) help to reframe the conversations to reflect the fact that frontline workers understand more than policy-makers about the operational reality, but struggle to get their concerns heard, understood or acted upon. Their daily interactions make them more aware of the inconsistencies between current procedures and the difficulties of practically enacting them. Unless these concerns are understood and acted on, to reduce the mismatches, the underlying problems can grow until something dramatic occurs.

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Unstable

NTSB reiterates warnings, urges compliance with approach SOPs

by Linda Werfelman

Warning of the risks of an unstabilized approach, the U.S. National Transportation Safety Board (NTSB) is urging pilots of all classes and types of airplanes to comply with standard operating procedures (SOPs) and industry best practices for stabilized approach criteria as well as missed approaches and go-arounds.[1]

In Safety Alert 077, "Stabilized Approaches Lead to Safe Landings," issued in March, the NTSB reiterated past warnings that failing to maintain a stabilized approach could lead to a landing with too much speed or too far down the runway — and ultimately to a runway excursion, loss of control or collision with terrain.

The problem

- **Failing to establish and maintain a stabilized approach, or continuing an unstabilized approach, could lead to landing too fast or too far down the runway, potentially resulting in a runway excursion, loss of control, or collision with terrain.**
- **Regardless of the type of aircraft, the level of pilot experience, or whether the flight is being conducted under instrument flight rules or visual flight rules, a stabilized approach is key to maintaining control of the aircraft and ensuring a safe landing.**

Related accidents

- A Learjet 35A airplane departed controlled flight while on a circling approach and impacted a commercial building and parking lot. The two pilots died. Because neither pilot realized that the airplane's navigation equipment had not been properly set for the instrument approach clearance they received, the flight crew improperly executed the vertical profile of the approach. When the crew initiated the circle-to-land maneuver, the airplane was so close to the airport that it could not be maneuvered to line up with the landing runway under the company's stabilized approach criteria. Neither pilot called for a go-around, and the pilot-in-command continued the approach by initiating a steep turn to align with the landing runway. Radar data indicated that the airplane's airspeed was below the approach speed dictated by company standard operating procedures (SOPs). During the turn, the airplane stalled and crashed about 1/2 nautical mile south of the landing runway threshold. (CEN17MA183)

Security video image of the accident airplane at ground impact (CEN17MA183).

"Regardless of the type of aircraft, the level of pilot experience or whether the flight is being conducted under instrument flight rules or visual flight rules, a stabilized approach is key to maintaining control of the aircraft and ensuring a safe landing," the safety alert said.

As examples, the safety alert cited accidents involving airplanes ranging in size from a three-seat Piper J5A Cub to a Learjet 35A.

In the case of the Learjet, the airplane was on a circling approach to Teterboro (New Jersey, U.S.) Airport on May 15, 2017, when the flight crew lost control and the airplane crashed into a parking lot. Both pilots were killed in the crash, which destroyed the airplane (**"More Training,"** ASW, 3/19).[2]

"Because neither pilot realized that the airplane's navigation had not been properly set for the instrument approach clearance they received, the flight crew improperly executed the vertical profile of the approach," the safety alert said. "When the crew initiated the circle-to-land maneuver, the airplane was so close to the airport that it could not be maneuvered to line up with the landing runway under the company's stabilized approach criteria."

Neither pilot called for a go-around, "and the pilot-in-command continued the approach by initiating a steep turn to align with the landing runway," the alert added, noting that the airspeed was below that called for in company SOPs. The airplane stalled during the turn and crashed 0.5 nm (0.9 km) south of the runway threshold.

The NTSB's final report on the accident cited as the probable cause "the pilot-in-command's (PIC) attempt to salvage an unstabilized visual approach, which resulted in an aerodynamic stall at low altitude."

In a second example cited by the safety alert, a Piper PA-31 Navajo was destroyed in a controlled flight into terrain crash while on approach to University Park Airport in State College, Pennsylvania, U.S., on June 16, 2016. The pilot of the air taxi flight and his only passenger were killed, and the airplane was destroyed.[3]

According to the safety alert, radar data showed that during the last two minutes of the flight, the Navajo's rate of descent increased from 400 fpm to more than 1,700 fpm, "likely as a result of pilot inputs," then decreased to 1,000 fpm before radar contact was lost.

Company SOPs called for a missed approach in cases in which the rate of descent during an instrument approach was greater than 1,000 fpm. During this approach, however, "the pilot chose to

Accident photo of Piper PA-31 Navajo

continue an unstabilized approach in instrument meteorological conditions, exceeding the maximum rate of descent permitted by the operator's stabilized approach criteria, and subsequently descended into trees and terrain." His decision to continue the approach was cited as the accident's probable cause.

Maintaining Stability

The safety alert included several broad recommendations for maintaining a stabilized approach, calling on pilots to comply with SOPs and industry best practices, including "a normal glidepath, specified airspeed and descent rate, landing configuration (flaps, gear, etc.), appropriate power setting, landing checklists and a heading that ensures only small changes are necessary to maintain runway alignment."

Other recommendations called for the effective use of crew resource management or single-pilot resource management, beginning with an effective approach briefing and including a thorough understanding of hazards, approach conditions, missed approach procedures and other critical elements of the approach.

The safety alert also said that flight crews should be able to withstand pressure from air traffic control and passengers to land the airplane as soon as possible, and to be immune to *continuation bias* — defined as an unconscious bias to continue with an original plan even after conditions have changed.

If an approach becomes unstabilized, an immediate go-around is required, the alert said.

"Never attempt to 'save' an unstabilized approach," the alert said.

The document cited several additional sources of information, including the "Stabilized Approach" briefing note from Flight Safety Foundation's *Approach and Landing Accident Reduction Tool Kit.*[4]

In that document, published in 2000, the Foundation's Approach and Landing Accident Reduction (ALAR) Task Force said that unstabilized approaches often result when a flight crew conducts an approach without sufficient time to plan and prepare.

The task force found that unstabilized approaches were causal factors in 66 percent of the 76 approach and landing accidents and serious incidents that occurred worldwide from 1984 through 1997.

Of the unstabilized approaches in which the airplane was low and slow, most involved controlled flight into terrain [CFIT] "because of inadequate vertical-position awareness," the task force said. In contrast, unstabilized approaches involving high and fast airplanes typically resulted in loss of aircraft control, runway overruns and runway excursions; they also contributed to poor situational awareness in some CFIT accidents. Flight-handling difficulties - which typically occurred in situations involving rushed approaches, attempts to comply with complex air traffic control clearances, adverse wind conditions and improper use of automation - were a causal factor in 45 percent of the events.

Guidelines that accompanied the "Stabilized Approach" briefing note called for an immediate go-around if an approach becomes unstable below 1,000 ft above airport elevation in instrument meteorological conditions or below 500 ft above airport elevation in visual meteorological conditions.

Go-Around Project

In 2017, the Foundation followed up the "Stabilized Approach" briefing note with the publication of the "Go-Around Decision-Making and Execution Project," which included new guidelines and concluded that flight crews in only about 3 percent of unstable approaches actually comply with existing go-around policies. Improved compliance could significantly reduce approach and landing accidents, according to the project's final report.[5]

Research and analysis for the project, conducted for the Foundation by The Presage Group, found that the failure of flight crews to conduct a go-around was the primary risk factor in approach and landing accidents, as well as a primary cause of runway excursions.

The project was begun in 2011 to determine why go-around compliance was so poor, to understand the risks associated with go-arounds and to recommend ways of improving compliance and mitigating risks.

The research found that, based on an online psychological survey of 2,340 pilots that assessed nine psychological and social factors that make up aspects of situational awareness, "unstable approach pilots were significantly less aware of their emotional responses to threat, less able to anticipate risk, more overconfident in their ability to compensate for the instability and in less agreement with company SOPs, etc.," the report said.

Findings also showed that pilots who conducted unstable approaches indicated that they were more likely than pilots who conducted go-arounds to "feel crew pressure to land, to perceive a lack of crew support for a possible go-around decision, to feel discomfort in being challenged and in challenging others and to feel inhibited about calling for a go-around because of the authority structure in the cockpit," the report said.

"Finally, compounding this risk profile are the findings that unstable approach pilots score lower on 'company support for safety' and that fewer than 50 percent … believed they would be reprimanded for continuing an unstable approach to landing, while, at the same time, maintaining that their company's criteria for when to execute a go-around are not realistic."

When the responses of pilots who had conducted unstable approaches were compared with responses from those who had conducted go-arounds, those in the unstable approach group "rated their flight outcomes less positively, believed less often that they had made the right decisions, believed much more strongly … that they should not have made the decisions they did and, finally, agreed more strongly that they had engaged in needless risk," the report said.

The report's recommended solutions called on the aviation industry to increase its awareness of the problem of noncompliance with go-around policies.

The report also proposed new stabilized approach and go-around guidelines calling for the establishment of three distinct approach gates:

- *As an aircraft reaches 1,000 ft above ground level (AGL), the final landing configuration should be selected. (Depending on the aircraft, this altitude could vary.)*
- *At 500 ft AGL, the aircraft should be fully stable; and,*
- *At 300 ft AGL and below, a go-around should be initiated "without hesitation" if an approach is unstable.*

To achieve improvements, the report said, the industry must improve its awareness of the problem, and to accomplish this, "a shift in focus and cultural norms is required. … Significant improvement is attainable; however, the cultural shift will be much easier if the industry shifts collectively, as opposed to individual companies making changes on their own."

Notes

1. NTSB. Safety Alert 077, **"Stabilized Approaches Lead to Safe Landings."** March 2019.
2. NTSB. Accident Report NTSB/AAR-19/02, **"Departure From Controlled Flight; Trans-Pacific Air Charter, LLC; Learjet 35A, N452DA; Teterboro, New Jersey; May 15, 2017."** Approved March 12, 2019.
3. NTSB. **Accident Report ERA16FA215.** June 16, 2016.
4. Flight Safety Foundation. "FSF ALAR (Approach and Landing Accident Reduction) Briefing Notes; Briefing Note 7.1 – Stabilized Approach." **Flight Safety Digest Volume 19** (August–November 2000): 133–138.
5. Flight Safety Foundation. **"Go-Around Decision-Making and Execution Project."** March 2017.

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