ISSUE 123

focus

ON COMMERCIAL AVIATION SAFETY

SPRING 23

The official publication of the United Kingdom Flight Safety Committee

ISSN 1355-1523

Contents

The Official Publication of THE UNITED KINGDOM FLIGHT SAFETY COMMITTEE ISSN: 1355-1523 SPRING 2023

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.

Editorial Office:
Unit C2b, Fairoaks Airport, Chobham, Woking, Surrey, GU24 8HU
Tel: 01276 855193
e-mail: admin@ukfsc.co.uk
Web Site: www.ukfsc.co.uk
Office Hours: 0900 - 1630 Monday - Friday

Advertisement Sales Office:
UKFSC
Unit C2b, Fairoaks Airport, Chobham, Woking, Surrey, GU24 8HU
Tel: 01276 855193
email: admin@ukfsc.co.uk
Web Site: www.ukfsc.co.uk
Office Hours: 0900 - 1630 Monday - Friday

Printed by:
Woking Print & Publicity Ltd
The Print Works, St. Johns Lye, St. Johns,
Woking, Surrey, GU21 1RS
Tel: 01483 884884
e-mail: sales@wokingprint.com
Web: www.wokingprint.com

Front Cover Picture: BAe Systems Jetstream 41 G-MAJD, operated by Eastern Airways, departing Aberdeen (photograph by James Ralph)

Eastern Airways, UK Regional Airline based at Humberside Airport UK, operates scheduled, charter and ACMI flights under a UK AOC and benefits from IOSA registration. The Aberdeen based Jetstream 41 fleet is predominantly used for Oil and Gas Producers & the burgeoning renewables sector with flying ranging from Sumburgh, Shetland Islands to Haugesund In Norway, commonly aligned to rotary transfers. The Jetstream 41 fleet is also utilised on a range of scheduled services including a new Humberside to Esbjerg, Denmark service and many bespoke corporate and sports charters given the appropriate capacity and flexibility of the aircraft type. The rugged durability, efficiency and dependability of the Jetstream 41 is ideal for regional operations, whilst Eastern Airway's growing fleet of ATR72-600s and Embraer E-Jets offer Eastern Airways unrivalled flexibility for all the duties required of a UK regional operator.

Notice to subscribers – General Data Protection Regulations

UKFSC retains contact details for individual FOCUS subscribers for the purposes of distributing the magazine; no other data is held. All personal data will be destroyed when we are notified that a subscription has ended.

focus ON COMMERCIAL AVIATION SAFETY

Coordination and Communication

by Dai Whittingham, Chief Executive UKFSC

One of the themes that has cropped up repeatedly over the last few years has been events or difficulties that would have been avoided had people thought to coordinate their actions with other affected parties. These all have their roots in the complexity of the aviation system, hence the need for a systems approach when any change is considered.

It does not matter which particular aspect of aviation you put under the spotlight, all can be equally affected. There was discussion recently of an issue with aircraft seats, or to be more specific, new seats; a similar discussion occurred around 8 years ago. Whilst an aircraft manufacturer will offer certain options to customer airlines, there will inevitably come the time when someone decides a change is in order, whether that be to achieve more luxury or increased seat density. This is normal business, and you should not be surprised when airlines decide to take advantage of new technology, for example to 'connect' fare-paying passengers to the rest of the world in flight or to make sure they can charge their personal electronic devices at seat.

That is fine, provided everyone is working to the same script. So, let's look at an example. Who buys a new aircraft seat? And who needs to know about it? In both the discussions referred to above, the new seats were the brainchild of the customer experience teams – after all, it is their job to develop the optimum offering that will induce potential customers to buy tickets and enjoy their flights so that they feel they have had value to the point where loyalty is earned. The only problem was the buyers kept the good news to themselves right up to the arrival of the new kit.

Unfortunately, there is rarely such a thing as a simple seat (unless the operator is military!). Seats need to be installed, maintained and operated, and that means people trained to do that. Cabin crew need to be able to show passengers how the seat works, and to fix minor problems where possible. The engineers need to understand physical and electrical connections and know which faults can be subject to a running repair and which require a swap-out. There is also the small matter of ensuring the seats are certified for use in the company's aircraft, which is a specialist airworthiness compliance task and not something you accept from a sales brochure.

Last, but not least, is aircraft weight and balance, which will inevitably be affected unless the new seat is identical in weight and distribution from the original item. Beyond the impact on Zero Fuel Weight, there is at the extreme the potential for the aircraft to be inadvertently configured so that it is operated outside its CG limits. Agreed, that is an extreme outcome, but the point is that it is possible and cannot be left to chance.

As a further example of uncoordinated activity, one operator reported an incident where a coffee flask had failed during cabin service, scalding an infant who was sat in the aisle seat. Whilst the injury should have led to an AAIB notification (it did not…), the investigation found several other flasks in service that were on the cusp of failure, and they were replaced with identical items. One of the new items promptly failed due to a manufacturing defect. When this incident was discussed at a UKFSC meeting, it became apparent the flasks had not been sourced through the conventional procurement system, cosmetic appearance had been a major factor in their original selection, and the end user community (the cabin crew) had not been involved in the process. Moreover, there was no published maintenance regime, and no clear understanding of whether these flasks were categorised as role or carry-on equipment, despite the presence of hot fluids being a primary hazard in the cabin.

The 'coffee flask' operator also reported the circumstances that led to a crew receiving a full-blown EGPWS "PULL UP!" warning on the descent towards a Cat C airfield in the Eastern Mediterranean. The crew reacted correctly, and the second approach was without incident. The investigation found the crew was on the right IAP profile and that the warning was spurious. The terrain/runway database – the usual suspect - was the latest issue, but the firmware was not.

Further digging revealed the firmware update had come from the OEM without any indication of urgency for installation, and the maintenance controller had therefore decided the work could be done in the following week when the aircraft was due for a hangar visit. Unfortunately there was no coordination or communication with the operations team, so the opportunity for all parties to share an awareness of the criticality of this firmware change was lost. The operator developed new procedures to ensure communication flows thereafter.

All the arisings mentioned so far have one thing in common: they all involve some form of change. The operators involved shared another common dimension in that they all had an SMS in place. Whilst we look on SMS as a tool for managing safety, it is actually a tool for managing any and all changes. One major British operator has taken this a step further by removing the 'S' – it simply has a management system.

Running any of these events through an SMS should have provided an opportunity to challenge assumptions and examine risks, but that requires people at all levels within an organisation to have understood that even small changes can have significant consequences which need to be properly considered and mitigated. It is self-evident that employees will only think about the SMS if they know it exists in the first place, which means you must educate and then train them in its operation.

If use of the SMS is to be effective, it must be accessible (in every sense of the word): the means of communication therefore have to be appropriate to the user. There is no reason why, say, a new member of the scheduling team should be able to extract trending information on the bird-strike issue at airport ABC, but they should be sufficiently aware that a change of arrival time is a change that needs managing, and that the SMS is the route for communicating on that change. They should not be having to think about ADREP coding or MOR timelines, which is a task for others, but they should at least be able to record the issue in the SMS. There will always be those who need the 'high technical merit' access and mastery of the system, but your occasional user is not one of them. Bottom line: make your SMS accessible.

One of the biggest changes ever to hit our industry was the challenge presented by Covid-19, which disrupted so many areas of business. Some organisations opted to manage their Covid response through their SMS, but many others simply jettisoned it: "We are not flying, so we don't have a safety issue, so we don't need the SMS". Decisions on staff retention, furlough and redundancies all had long and short-term safety implications, yet the SMS never featured so some of those implications – or risks – were never properly quantified and mitigated. For those organisations that ignored their SMS, it may well have been because the executive layer thought the circumstances were so extreme that 'all bets are off'. They may well have been right.

However, others managed successfully through their SMS. Ed Bastian, CEO of Delta Airlines, spoke at IASS 2022 of dealing with all Covid-related issues via their SMS. As an example, his SMS process had identified the business and safety risks of having staff being unavailable or working sub-optimally because of sickness. He also appreciated that his more junior staff might not have ready cash to pay for access to basic healthcare; his mitigation was to establish a fund of $1000 per head that his people could use when required. It was an inspired piece of leadership that, on the one hand, helped mitigate the Covid-related risk of staff absence and, on the other, sent the message that the company cared sufficiently about its employee health that it would fund basic care, so that there was no need for people to turn up for work when sick.

Lastly, there are other crises that ought to feature in the SMS, which include major accidents or incidents. Organisations should have an Emergency Response Plan, and this needs to be included as a mitigation measure in the SMS, against whatever risk you have chosen to call your major accident. Responsible companies will exercise their ERPs, stress-test them and improve them. However, all are vulnerable to decisions 'on the day' to drop the plan in response to a disruption or deviation, regardless of how well the rest of the plan is working. There will always be a need to find work-rounds for these disruptions, but the time to change the overall plan is after the event when you have ensured you have captured all the lessons. Any plan is better than no plan!

focus ON COMMERCIAL AVIATION SAFETY

Flight Path Management and Altimeter Setting Monitoring in Flight Data

by Rob Holliday, Chairman UKFSC

Flight Path Management Monitoring

Flight path management is under the spotlight following two high profile incidents.

See *https://www.aerosociety.com/news/faa-shifts-focus-to-pilot-manual-handling-skills/*

The FAA has issued an advisory circular on the subject with the purpose of providing guidance to operators to develop policies procedures and training in flight path management (FPM).

https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_120-123.pdf

Clearly to manage a flight path, knowledge of the desired flight path is required to be communicated, set up and monitored. If the flight path is not achieved knowing what to do about it and crucially when to do it, are key. The ICAO/IATA Pilot Competencies have been designed to cover all the skills to do this. These are being given greater attention in pilot training to complement traditional performance-based measures.

PC 0 Application of Knowledge

PC 1 Application of Procedures & Compliance with Regulations

PC 2 Communication

PC 3 Aeroplane Flight Management, Automation

PC 4 Aeroplane Flight Management, Manual Control

PC 5 Leadership and Teamwork

PC 6 Problem Solving and Decision Making

PC 7 Situation Awareness and Management of Information

PC 8 Workload Management

All of these are required for successful FPM. Monitoring features heavily in the subset of behaviours that sit below each one of these competencies. It is one thing to monitor effectively, the competencies downstream of monitoring are essential to correct any deviations in the desired flight path.

Flight data can be used to monitor standards of FPM. Events relating to FPM can be collated together to create a picture of how this is going in your operation. Of course, there is no context with flight data alone, but it can be used to flag something that requires further investigation or training focus.

Any data that involves insufficient or excess energy is FPM related such as airspeed and vertical speed events. Operation of systems or automation can be indicators of FPM, such as late or not setting the go-around altitude or VApp, speed brake deployed with high engine thrust, Mach to IAS transition in descent, TOGA pressed with the auto-throttle off with delayed thrust increase. Deviations such as loss of altitude after take-off, localiser overshoot, glidepath deviation, flap, and gear limit speeds. To name but a few.

Some of these will be investigated individually. They can also be collated together in a dashboard that may collectively be a valuable picture of FPM.

We can also look at data in areas that are infrequently monitored. We are familiar with the stable approach gate, typically at 1000' and sometimes at 500' in VMC, but what does the flight path look like upstream of that?

How often is the speedbrake used below FL100? How frequently is the landing gear down at 5000'?

As I have said before flight data has no context, there are certain to be a multitude of factors at play, but if an undesirable flight path is the result, the data will at the very least start an important and positive conversation bringing attention to the issue.

Altimeter Setting Monitoring

Do you have parameters in your flight data monitoring program to look at altimeter settings?

The EASA Flight Data Monitoring Working Group B has started a discussion on monitoring altimeter settings in flight data.

This is to look for possible cases of incorrect altimeter pressure settings. The safety issue is self-evident notwithstanding the prevalence of approaches with vertical guidance.

To do this some of the data points commonly used are: -

- 1013 not set in the cruise above FL200.
- A difference between the captains and first officer's altimeter settings.
- The duration of the difference between the captains and first officer's altimeter settings.
- QNH not set at 100' after take-off and before landing.

The latter events add 100' to the airport elevation and compare the result to the altimeter. This is a point where radio altitude is reliable or if not available the algorithm can work it out from the touchdown or lift off points.

We decided to take a closer look at this with the latest analysis techniques to seek further insights. Our Data Scientists did an analysis of thousands of flights, comparing the altimeter setting to the QNH in the METAR current at the time of landing or take-off. The results aligned very well with the results from the 100' methodology. The small number of errors were in the METAR string or the machine reading thereof. The conclusion was that this would be a valid method for monitoring altimeter settings.

Creating the capability for the machine to read the QNH in the METAR and compare it to the altimeter setting in the aircraft allowed us to compare the altimeter setting at 2000' on the approach to the setting at 100' to see if there were any late changes to the barometric setting.

The results of this study are being collated and validated. All being well it may be possible to present the findings to the Safety Information Exchange at some future date.

What do we expect to SEE?

by Quintin Cairncross

It is a warm, humid evening in Port Harcourt, Rivers State, Nigeria, on Thursday, 11 June 2015. A Hawker Siddeley HS 125-800XP business jet makes an ILS approach to runway 13 as light rain is falling. The aircraft is on a short 50-minute flight from Abuja. The crew report the runway in sight at 6 miles and are cleared to land. The wind is calm and the runway surface is reported as wet. Perfect smooth landing conditions for what pilots refer to as a "greaser". The aircraft touches down, but it is positioned to the left of the runway. It travels straight for 300m before it is steered right, back towards the centreline. However, the nose gear has been severely damaged and collapses. Thankfully, the 3 crew and two passengers on board survive, uninjured. The aircraft has sustained substantial damage.

Background

The aircraft is operated by SWAT Technology Limited. It is a subsidiary of the larger JAFAC Group, which expanded into aviation two years previously, in 2013.

The aircraft is a 1999 Hawker Siddeley (Raytheon) HS 125-800XP with registration N497AG. All aircraft documents appear to be in order, however, the windscreen wipers are unserviceable.

The Captain is 44 years old with an ATPL licence and is the pilot flying (PF) on this flight. He has 4,180 flying hours with 2,752 hours on type and meets regulatory requirements to operate the flight.

The Copilot is 59 years old with an ATPL licence and is pilot monitoring (PM) on this flight. He has 16,744 flying hours with 147 hours on type and also meets regulatory requirements to operate the flight.

Flight Description

18:25Z - The HS125 departs Nnamdi Azikiwe International Airport, Abuja (DNAA) for Port Harcourt International Airport (DNPO), some 239 nautical miles (nm) to the South. On board this charter flight are 3 crew and two passengers. The aircraft climbs through the evening sky to its cruise altitude of Flight Level (FL) 280.

18:55Z - The aircraft is handed from Lagos air traffic control (ATC) to Port Harcourt ATC, who clear it to start its descent. It descends from cruising altitude and prepares to conduct an ILS approach to runway 21 at Port Harcourt.

19:00Z – The weather conditions at the airfield are as follows: Wind calm, visibility 5,000m, thunderstorms to the South East. Cloud broken at 700ft and few at 2,000ft. The temperature is 26°C and the dewpoint 24°C with the pressure 1011 hPa. No significant change is expected.

19:13Z – The crew report the field in sight at 6nm from touch down (about 1,800 feet above airport elevation). The flight is cleared to land by ATC with a caution: "runway surface wet".

At about 1,3nm to touchdown (about 390 feet above airport elevation), the aircraft flies through some light rain. The PM remarks "Okay….I got a little rain on the windshield". The PF responds "We don't have wipers sir….(laugh) Na wa o". (Na wa o = local parlance expressing surprise).

The aircraft approaches decision height (DH – about 220ft above runway elevation). The PM calls out "Minimums" to which the PF responds "Landing". (The PM later reported that runway edge lights were visible on the left side while on the right side they were missing except for the last quarter at the far end.)

The PM observes that the aircraft is slightly left of the centreline and calls "right, right, more right".

The PM states that at 50ft, the PF retards the power and turns slightly left.

At 40ft, the PM cautions "keep light in sight, don't go to the left".

At 20ft, the PM states, "keep on the right" and the PF responds, "are you sure that's not the centreline?"

19:16Z – The aircraft touches down 1,500m down the 3,000m long runway. It is actually positioned to the left of the runway, with the left main gear in the grass alongside and the right main gear on the runway surface. It travels a further 300m parallel to, but off the left edge of the runway, before steering right and regaining the runway surface. The nosewheel has sustained damage in this excursion and collapses. The aircraft comes to rest on the runway surface, 2,600m from the threshold.

After the aircraft has come to a stop, the CVR records the PF telling the PM that he mistook the brightly illuminated left runway edge lights for the runway centreline and apologized for the error of judgement, to which the PM responded "I told you".

The engines are shut down and all persons on board disembark, fortunately without injury. The aircraft is substantially damaged. Light rain is falling.

Analysis

Let us see what we can learn by considering the various role-players in this accident.

Airport - Technical

The Federal Airports Authority of Nigeria (FAAN) reports that an earth fault was experienced on the day of the accident, due to heavy rain. It was claimed that the Runway 21 left Edge Lights were ON, bright while the right edge lights were ON but at low intensity. Recall however that the PM reported that the left Edge Lights were visible while only the last quarter of the right Edge Lights were visible. So while the airport authority claimed that the lights on the right side of the runway were on at low intensity, the PM claims that for the first ¾ of the runway, they were not visible at all.

Airport - Communication

It is also stated in the report that the FAAN were aware that an earth fault "occurred during the day of the occurrence" which created a short-circuit of part of the runway edge lights shortly before the time of the occurrence. When did the FAAN become aware of the occurrence and when did they become aware of the "low intensity" condition of the first ¾ of the right-side runway lights? Was this ever communicated to the tower? We know from the CVR that the tower never relayed any information about runway lights to the crew. This unserviceability can be considered as a link in the error chain. It also illustrates how each individual in the wider aviation system can have a direct impact on safety. The responsibility of the airport electrical engineer is vital. Regular checks of airport visual and navigational aids can result in early discovery of faults. Furthermore, a robust reporting process can ensure that the tower is fully aware of the status of the airfield and can transmit this information to pilots. In this case, it could have made all the difference.

Operational

From a piloting perspective, any approach should be preceded by a briefing. The detail depends upon factors such as familiarity of both crew with the airfield (do you fly there every day, once in a while, or have you never been there before?) and prevailing weather. Something that is often overlooked in the briefing is a discussion of what we expect to see at minima. This information can be found on the relevant approach chart. The current Port Harcourt VOR DME ILS Rwy 21 approach chart 11-1 reveals that we should expect to see a High Intensity Approach Light System (HIALS) as well as a Precision Approach Path Indicator (on each side of the runway). Usually, most briefings only cover what is on the approach chart. It may be wise to review also the Jeppesen 10-9 Airport page or equivalent document (Included at the end as Figures 4 & 5). In addition to the useful airport layout information, we can see from this page that runway 21 is equipped with High Intensity Runway Lights (HIRL) or "edge lights", but that there are no Centreline Lights (CL) on this runway. Perhaps that vital bit of information, if reviewed during the briefing, would have made all the difference as the PF maneuvered the aircraft over the left edge lights, believing they were in fact Centreline lights. Brief what you expect to see.

CRM - What is seen?

Task sharing on approach is a topic that is usually well defined by larger airlines in their standard operating procedures but commonly neglected in general and business operations. It is an

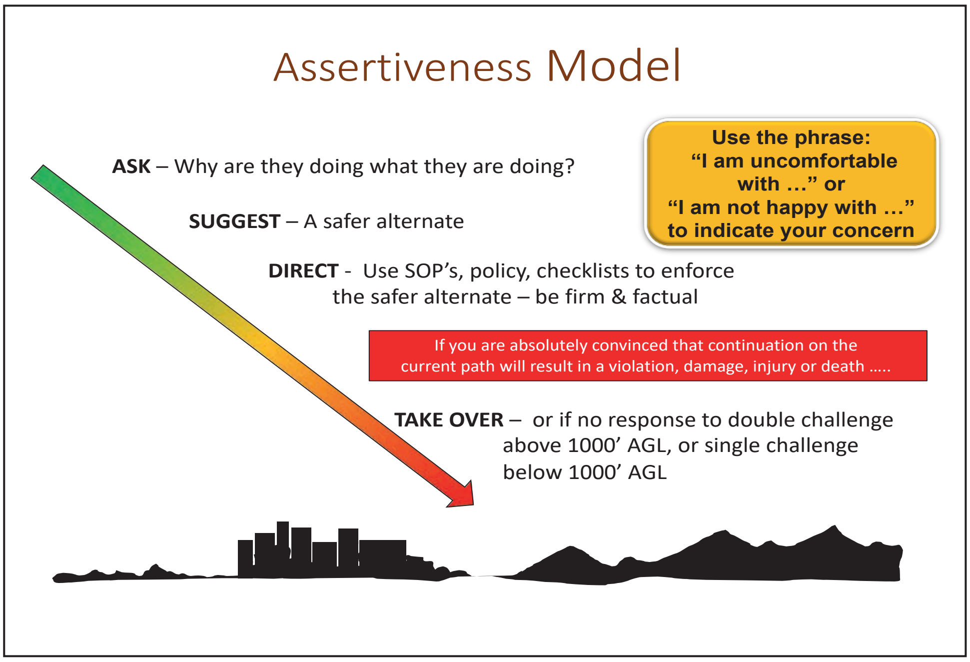


Figure 1 The Assertiveness Model (Credit: Lex Heemstra)

insidious oversight which has been a contributing cause in many accidents, with this one being no exception. Typically, the PF will remain mainly "head-in" during an approach, flying the aircraft with reference to instruments. The PM, will assist and follow the instructions of the PF while monitoring the flight path for deviations. During the approach, as the aircraft approaches minima the PM will, in addition to monitoring duties, begin to divide his attention, including looking outside (head-out) - in order to establish contact with the required visual references for the approach. The required visual references will typically be things like: elements of the approach lighting system, the threshold lights, precision approach path lights, runway edge lights. More importantly, it is good CRM to call out any discrepancies concerning what is seen. Can you imagine the benefit of a call on this night such as "Runway lights in sight – looks like there are no runway lights on the right side". This simple call could have helped to establish a shared mental model in the mind of the PF and assisted him to correlate what he was seeing with what he expected to see, during a high workload phase of flight. As soon as the PF concurs with the visual cues, he will then fly predominantly by external visual cues (head-out) while the PM now reverts to predominantly "head-in" monitoring of the flight path. The monitoring by the PM of flight parameters such as glideslope and localizer deviation, vertical speed, airspeed and spot wind can be vital in this visual phase of flight.

CRM – Deviation Calls

It is unfortunate in this incident that the PM appears to be the only one with a true understanding of the perilous situation which developed on short finals and during the landing, yet he was unable to adequately communicate the gravity of that situation to the PF.

In such a situation, direct commands, rather than prompts are probably more appropriate. We know that the PM made the following calls regarding the excursion from the centre of the runway; "right, right, more right", "keep light in sight – don't go left" and finally "keep on the right" to which the PF responds: "are you sure that's not the centreline?". Perhaps in such a situation, calls with pre-defined meanings would be more appropriate. For example "centreline" escalating to a louder "CENTRELINE!" and finally "GO-AROUND!". The landing flare is not the place to be entering into polite discussions to resolve confusion.

In CRM instruction we make use of an Assertiveness Model. (See Figure 1) When deviations from the briefed plan or flight path are detected, crews are taught to use an early, sequential, but escalating response. This involves: ASK – SUGGEST – DIRECT - TAKE OVER. Full use of the Assertiveness Model depends upon the time available and how long an observed deviation takes to develop. In this accident, deviation away from the centreline only occurred in the last 200 feet of the approach, so it is appropriate that the ASK phase of the model was discarded. We can see from the CVR data that the PM did in fact SUGGEST: "right right, more right" etc. but sadly, never moved to the subsequent escalated phases of the assertiveness model. The next steps should have been: DIRECT - "eg. GO-AROUND!" and if that did not work, TAKE OVER - "I HAVE CONTROL!"

(Again – standard callouts are very important – the call should trigger a learned response and set the stage for a second challenge or taking over control. This is no longer a debate). If the PM is convinced that continuation on the current path will result in violation, damage or injury, he takes the last step in the Assertiveness Model: *"I have control!"*.

Operational - Touchdown Point? And go arounds.

The accident report highlights a further glaring issue in the outcome of this flight which does not seem to have attracted any attention. The runway is 3000m long. The accident aircraft touched down 1500m or half way down the runway! Typically, the "ideal" touchdown zone is at 300m. This is the point that both visual and radio glide paths are calibrated to intersect with the runway.

We know that the runway landing markers are at a nominal 1000'(300m) from the threshold. Operators will sometimes specify what they consider to be an acceptable target zone for landings. 1,000' to 2,000' (300m – 600m) from the threshold is typical. Of more concern is that this parameter is often overlooked in the Operations Manual. An aircraft with a VREF of 130 KIAS will travel approximately 200 feet per second in the flare. Provided it initiates it's flare maneuver over the 1,000' landing markers, it needs to be on the ground within 5 seconds so as not to fly beyond the typical touchdown zone.

At no point during this landing did either pilot acknowledge the deep landing, which in normal circumstances, would itself have required a go-around/balked landing. Landings should be made on centreline, within the touchdown zone – it's as simple as that.

Human Factors – black hole effect?

The accident report cites "black hole effect" as a causal factor resulting in disorientation resulting in low level manoeuvre into the grass verge on the left of the runway. I do not believe this is entirely correct.

Black hole conditions exist on dark nights (usually with no moon or starlight), where there are no ground lights between the aircraft and the runway threshold. The black hole illusion fools pilots into thinking they are higher than they actually are, causing them to fly dangerously low approaches.

Perception scientists disagree as to the exact cause of this illusion and it is likely that no single theory fully explains the "black hole" approach, as there are many factors involved. The phenomenon was investigated by two Boeing engineers, Dr. Conrad L. Kraft and Dr. Charles L. Elworth, following a spate of "black hole" type incidents in the 1960s'. A series of night visual approaches were flown in a simulator by senior Boeing instructors. During the tests, most of these experienced instructors flew excessively low approaches and many crashed into terrain short of the runway.

Based on the disturbing data from these experiments, Kraft and Elworth developed the theory that pilots flying a steady three-degree glide path perceive a constantly changing view of the runway. While the aiming point on the runway will remain stationary in the field of view, the visual angle occupied by the runway is constantly increasing as the aircraft flies down the nominal 3 degree glide path. This can be seen in Figure 2. Note the increasing size of the angles at A, B and C as the aircraft continues down the approach.

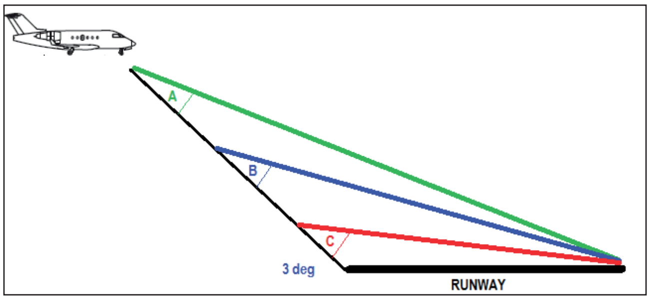


Figure 2. Increasing visual angle occupied by the runway on a constant 3 degree glidepath.

What Kraft and Elworth discovered, is that when other cues such as glideslope guidance are removed, pilots conducting a visual approach over featureless terrain at night tend to keep the visual angle occupied by the runway constant. (i.e they try to keep angles A, B and C constant). This is shown in Figure 3. Rather than maintaining the desired constant 3 degree glidepath, the aircraft now follows a parabolic path to the runway. This path dips below the ideal 3 degree glidepath in the latter stages of the approach.

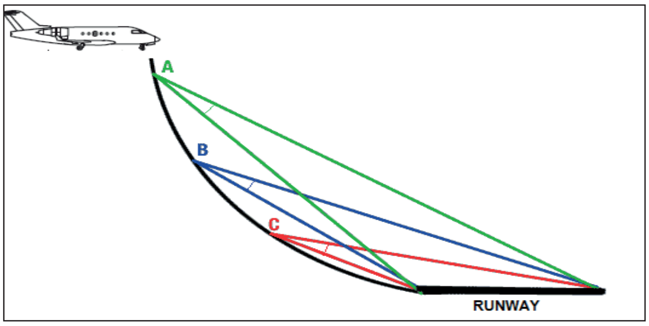


Figure 3. Constant visual angle occupied by the runway leading to parabolic glidepath.

There is nothing in this accident report to suggest that this crew descended below the ideal 3 degree glide path. Furthermore, this would not have caused a lateral deviation below minima.

Human factors – wipers and rain on windscreen.

Rain on the windscreen of our aircraft produces the effects of refraction and diffusion, both of which can have serious consequences if not properly understood.

Refraction affects light, passing through the medium of water, giving an illusion that the object we are looking at is displaced from its actual position.

Light passing through water as well as being refracted is diffused, or spread apart. Lighted objects, such as runway lights seen at close range, because of the diffusion of their light, will appear larger than they actually are.

In addition – and probably most significant in this case, is the distraction of rain drops on a windshield, which can cause difficulties in adjusting our focus to the appropriate place for the phase of flight. It is all too easy during a landing for our focus to drift in close, to the rain drops adhering to the windshield about 2-3 feet ahead of our eyes rather than where it should be – focused at "infinity" some distance down the runway. When this happens, the pilot becomes functionally short sighted and will subsequently find it more difficult to correctly assess any lateral or vertical movement during the flare and roll-out.

Was this a causal factor in this accident? Probably not causal, but the unserviceability of the windshield wipers leading to beading of rain drops on the windshield could probably be classified as a contributory factor, another small link in the accident chain. Did the engineer who signed this aircraft out with unserviceable windshield wipers realise that he could, in some small way, be contributing to an accident a few months down the line? I will leave that for you to decide.

Conclusion

We are not here to criticize the actions of this crew, but rather to learn as much as we can from this unfortunate accident. There are no new ways to crash aircraft, sadly, we seem to keep repeating the mistakes of the past. In conclusion, let's see if we can store away a few of the lessons from this accident. It may just help us to break the accident chain some time in the future.

Airport – Technical

The equipment, facilities and visual aids on the airport play a vital role in safe operations and should be checked regularly. There is a small amount of embarrassment when equipment goes unserviceable, but it is nothing compared to the embarrassment when it contributes to an accident.

Airport – Communication

Any unserviceability on the airfield must be communicated to the airport authority and ATC, who must in turn communicate it to the users of that airport.

Operational

Always be as prepared as possible. Know what you expect to see at minima and brief that prior to the approach to create a shared mental model.

CRM – Assertiveness model

Use the assertiveness model. When the other crew member starts doing something you don't understand or do not agree with, ASK. If that does not work and time is available follow the escalating steps of the model. SUGGEST – DIRECT – TAKE CONTROL. In situations where no time is available, discard the initial steps as required.

Operational - Touchdown Point

This one is simple. One of the most common causes of accidents is still runway excursion. Develop the discipline to land on centreline and within the touchdown zone. Otherwise, go around.

Human Factors – Black Hole Effect

Probably not causal in this accident, nevertheless, there will be many occasions, especially if you fly in Africa, where you will end up flying a "black hole" approach. Include this in your approach brief and ensure that the PM is fully aware that it is vital for him to remain predominantly "head-in" after the flight becomes visual, monitoring any deviation below the glidepath. Should there be a deviation, use standard calls such as "GLIDESLOPE", "LOCALIZER", "SPEED" and the CRM Assertiveness Model.

Unserviceability

We all fly aircraft that carry ongoing snags from time to time. The impact of those snags are not always apparent. Be aware of the distracting effect of a simple thing like rain drops on a windshield. We never know how a snag may contribute to an accident.

This accident shows how there are many factors that contribute to an accident. At the end of the day, we are all a team, trying to achieve the same goal of safe flight, from the engineer who maintains the aircraft, to the crew, to the engineer who maintains the airfield, to the ATC. We all have our role to play and the level of professionalism we operate at is what makes the difference.

Take care up there.

Quintin Cairncross served as a fighter controller in the South African Air Force before becoming a commercial charter pilot. He joined South African Airways in 1988, leaving in 1995 to join Emirates where he rose to the position of Deputy Chief Flying Examiner. He then worked briefly as Director of Flight Training for Grob Aerospace in Germany before moving to the ExecuJet Aviation Group in Zurich, where he was Group Operations Director. He now flies a private business jet in the Middle East and is also a consultant. Quintin has a Bachelor of Commerce Degree (Transport Economics), a Master of Science Degree (Air Transport Management) and qualifications in Training, CRM, Safety Audit and Quality Audit.

Kind acknowledgement to SafetyFocus - Edition 38 - Sept 22 - Jan 23

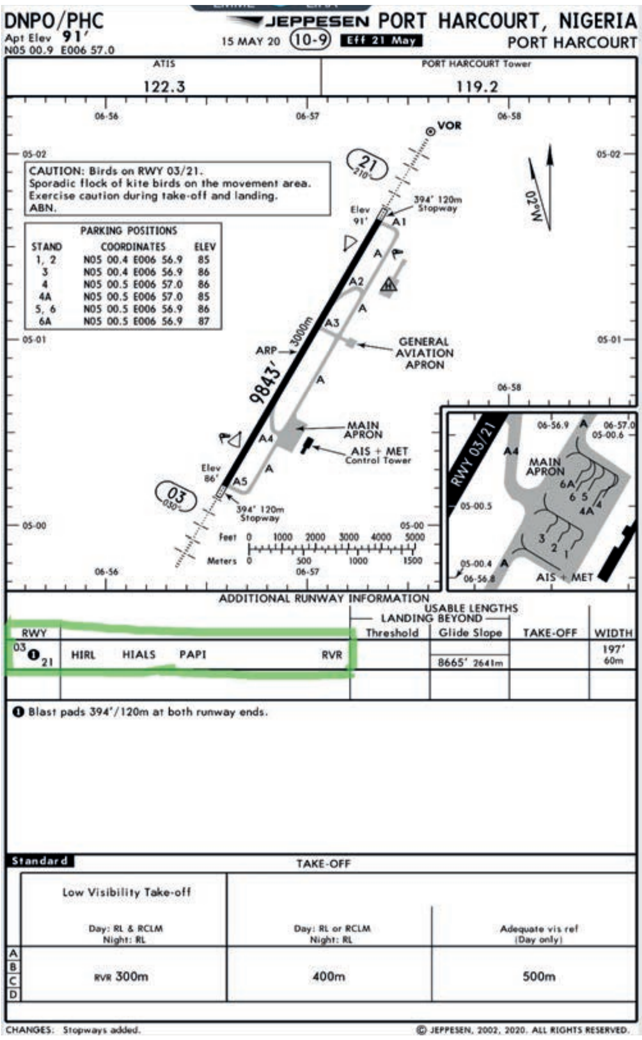


Figure 4 Airport Chart (note absence of centreline lights)

NOT FOR NAVIGATION

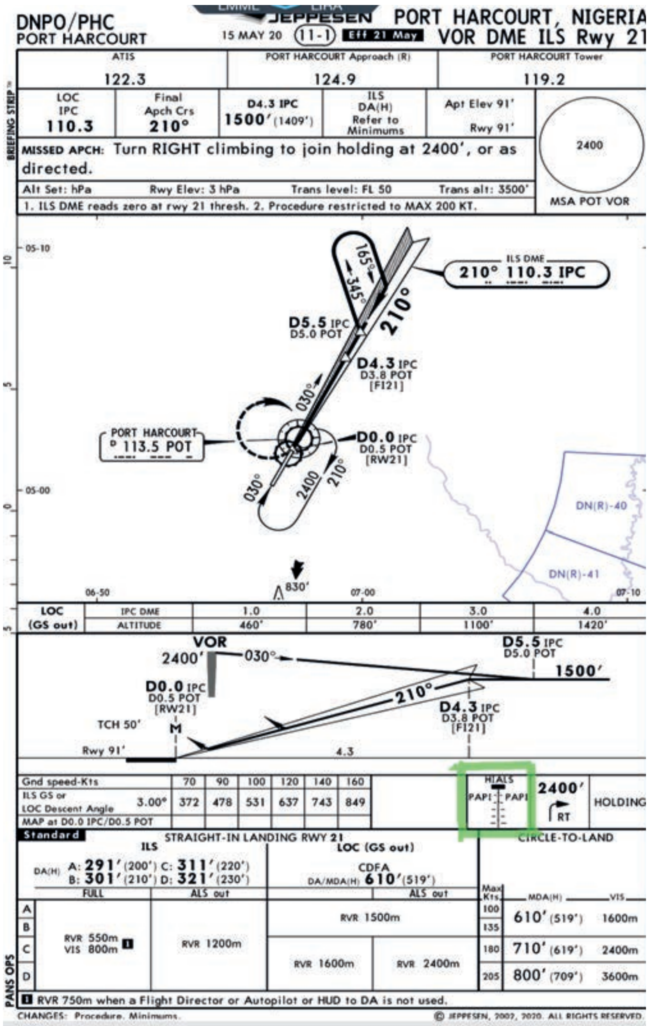


Figure 5 Approach Chart (see highlighted lights that a pilot should expect to see)

NOT FOR NAVIGATION

What do judges think that passengers should know about air travel?

by Edward Smith-Suarez, Holman Fenwick Willan LLP

The English High Court has recently been asked to take a view on what an "ordinary, reasonable passenger" might consider to be usual and expected during a flight. This is an important question because it has legal implications when passengers claim damages after an incident. Interestingly, the judge concluded that such a passenger would have experience of commercial air travel and knowledge of established or common airline practice. In this article, we explain how the decision came about and examine its implications.

The case in question is *Arthern v. Ryanair DAC*, handed down on 16 January 2023. It has provided welcome clarity on the issue of whether an incident which results in a passenger sustaining bodily injury, while in the process of international carriage by air, amounts to an "accident" for the purposes of the Montreal Convention 1999 (the "Convention").

The Montreal Convention and subsequent case law

Article 17(1) of the Convention provides that:

"The carrier is liable for damage sustained in the case of death or bodily injury of a passenger upon condition only that the accident which caused the death or injury took place on board the aircraft or in the course of any of the operations of embarking or disembarking."

The definition of what exactly amounts to an "accident" for the purposes of the Convention has been the subject of much case law around the world. The leading authority on what constitutes an "accident" for the purposes of the Convention is the US decision in *Air France v Saks* where the court held that an incident will only amount to an "accident" if the injury is caused by an unusual or unexpected event or happening that is external to the passenger (Ms Saks suffered an eardrum injury as a result of normal changes in cabin pressure, so no damages were awarded).

Subsequent English case law has followed the approach in *Saks*, holding that an "accident" must be *"a distinct event, not being any part of the usual, normal and expected operation of the aircraft, which happens independently of anything done or omitted by the passenger"*. *Barclay v. British Airways*, decided in 2010, is the leading English case on this point: a panel of three Court of Appeal judges denied damages to a woman who slipped on a plastic strip used to cover the seat tracking, after the airline put forward evidence that it was a standard part of the cabin floor configuration and was in full working order.

However, debate over what exactly should be considered "unusual and unexpected" has persisted and there have been a range of views as to whether this assessment should be a subjective versus an objective test, viewed from the airline or the passenger's perspective. For example, the decision in *Deep Vein Thrombosis Litigation* provided that when determining whether an incident is "unusual or unexpected", the question should be assessed from the passenger's perspective.

Facts of the *Arthern* case

The Claimant, Mr Arthern, was travelling on a flight operated by Ryanair. It was winter, the ground outside the aircraft was wet and the aircraft had recently been de-iced. During the flight, he made his way to the lavatories and slipped just outside them, sustaining injury. The Claimant alleged that he slipped on a large amount of fluid on the cabin floor. It was accepted by the parties that the liquid was a mixture of de-icing fluid and water which had been tracked in by passengers upon boarding the aircraft. The Claimant alleged that the incident amounted to an "accident". However, the County Court disagreed. Applying the principles in *Deep Vein Thrombosis Litigation* the court accepted Ryanair's argument that the presence of what was likely a combination of water and de-icing fluid, tracked in by passengers boarding the aircraft, would not be considered unusual or unexpected by the ordinary, reasonable passenger in the circumstances and therefore the incident did not meet the legal definition of an "accident". The claim was dismissed.

Mr Arthern appealed to the High Court, alleging that the amount of liquid on the cabin floor was unusual. This was disputed by Ryanair. In making its decision, the High Court examined the issue of perspective and with reference to *Deep Vein Thrombosis Litigation*, held that whether or not an event was "unusual or unexpected" should be assessed from the perspective of an ordinary, reasonable passenger. Crucially, however, they accepted the suggestion made by Ryanair's lawyers that an "ordinary, reasonable passenger" was one *"with experience of commercial air travel and with reasonable knowledge of established or common airline practice."* In this case, the expectations of such a passenger were set particularly high, suggesting that an experienced flyer should be aware that slippery de-icing fluid was a predictable on-board hazard in winter. The appeal failed.

What does this mean for the aviation industry?

The judgment in *Arthern* is notable in that it has clarified that the assessment of whether an event is "unusual or unexpected" is not a subjective one. In other words, the claimant passenger's subjective view of whether an incident is unusual or not, is irrelevant. A key distinction is that the circumstances which gave rise to the incident must be assessed from the perspective of a person with experience of commercial air travel and with reasonable knowledge of established or common airline practice. The practical effect of this is to narrow the gap between the passenger perspective that the law requires, and the airline's account of what is "normal".

Issues with using the unrestricted, subjective perspective of a passenger to determine whether an incident is unusual or unexpected, are not new. An example of this can be found in *YL v. Alternrhein Lufttfarht GnbH*, a relatively recent decision of the Court of Justice of the European Union (CJEU) from May 2021. In this case, a passenger claimed that she had sustained bodily injury as a result of a hard landing. She alleged that the landing was unusually hard. However, according to the aircraft's flight data recorder, it was well within the maximum tolerance of the aircraft, pursuant to the manufacturer's specifications. The passenger took the case all the way to the Austrian Supreme Court, which referred a question to the CJEU - Can a "hard" landing, which was within the operating limits of the aircraft, amount to an "accident"?

The CJEU in *YL* arguably went further than the High Court did in *Arthern* and held that the assessment of whether an incident amounts to an accident should not be taken from the passenger's perspective at all because it may raise issues whereby an incident which is unusual to one passenger might seem perfectly normal to another passenger. It held that whether an incident was unusual or not should take into account the normal operating limits of the aircraft rather than the personal perspective of the passenger.

While *Arthern* can be easily distinguished from *YL* in that in *Arthern*, the perspective of the passenger (albeit qualified to a passenger who is familiar with established or common airline practice) is necessary to determine whether an event is unusual or unexpected, YL is nevertheless another (limited) example of a case where the subjective opinion of the passenger was considered irrelevant and where the incident in question must be compared against established practice (and in the case of YL, tolerance limits).

These two cases, although different, are both demonstrative of a rejection of the subjective assessment of unusualness by a passenger and the increasing importance for airlines in evidencing how an incident compares against normal industry practice/tolerances in the context of ordinary air travel. If an airline can evidence that an incident, no matter how unusual it may have seemed to the passenger, is in fact within common airline practice or, as in the case of YL, within the tolerance limits of an aircraft, it should be able to mount a valid defence.

Key to defending such claims for airlines will likely be the disclosure of evidence from a flight safety perspective, evidencing common airline practices, safety parameters and operating limits. Airlines should therefore be prepared for their operating procedures, policies and practices to be subjected to judicial scrutiny. However, this decision provides some comfort that these policies will be judged by reference to relatively sophisticated standards.

A Project to Increase Human Resilience and Aviation Safety

by Ben Rimron & Sanjay Sudan

July 2022

"But why do pilots and ATCs speak so quickly on the frequency?", I asked Captain Sanjay Sudan. "Well, Ben," he replied, "probably a combination of factors including a sensation of workload intensity and pressure but, after 30 years of flying internationally, I have a strong feeling that it's unnecessary, frequently counter-productive, and a threat to safety".

We began to consider how we might gather our resources and utilise our networks to assess what impact we might make.

November 2022

"Dear Ben and Sanjay, Thanks for the presentation, which was one of the best received in ages. We'll be happy to support your goals in any way we can."

We had presented our ideas to the Royal Aeronautical Society's Flight Ops Group. We had hoped to engage at least some of the gathered industry experts, persuading them of the value of our key points. The response was more positive than we could have expected as we tapped into their passion for enhancing aviation safety through Crew (or Team) Resource Management, Human Factors, and Competence/ Human Resilience Training.

I'm from a linguistic background, not aviation operations, but I work within the industry as an ELP (English Language Proficiency) Tester and Examiner Trainer and have overseen thousands of ELP tests worldwide under approvals from UK CAA, EASA, & CASA Australia amongst others.

Sanjay is Fleet Captain of IndiGo Airlines, an Airbus 320 TRE/TRI, IndiGo's Training Manager, and a CRM Facilitator. We met when IndiGo employed my company to train their ELP Examiners, for whom Sanjay's a Senior Examiner. Talking to him about communications on the frequency, he had concerns beyond the scope of ELP testing in relation to a lack of clarity:

"I think that the rate of speech is being misconstrued as the level of proficiency of that speaker. This completely defeats the purpose of creating understanding for the listener, reducing efficiency, and increasing the risk of misunderstanding. Furthermore, when someone speaks to you with a rapid rate of speech, it is human nature to reply at that speed or a greater rate of speech which, on some occasions, can lead to some errors and a reduction in safety margins.".

Sanjay, along with many operations experts who also work in ELP testing, have regularly cited concerns to me about speech rate and under-articulation as two linguistic variables that affect initial understanding on the frequency, and yet abilities to slow down or deliberately articulate clearly are ***not*** part of current ICAO ELP testing guidelines. Such abilities would be additional English skills of *more competent* frequency users.

In his current PhD research, Tyrone Bishop studied aviation professionals' perceptions of '*unhelpful* behaviours on the radio of speakers of English as a first language'. The data is revealing as can be seen from the graphic, around 80% of the 300 respondents cited speech rate as the main factor impacting communication.

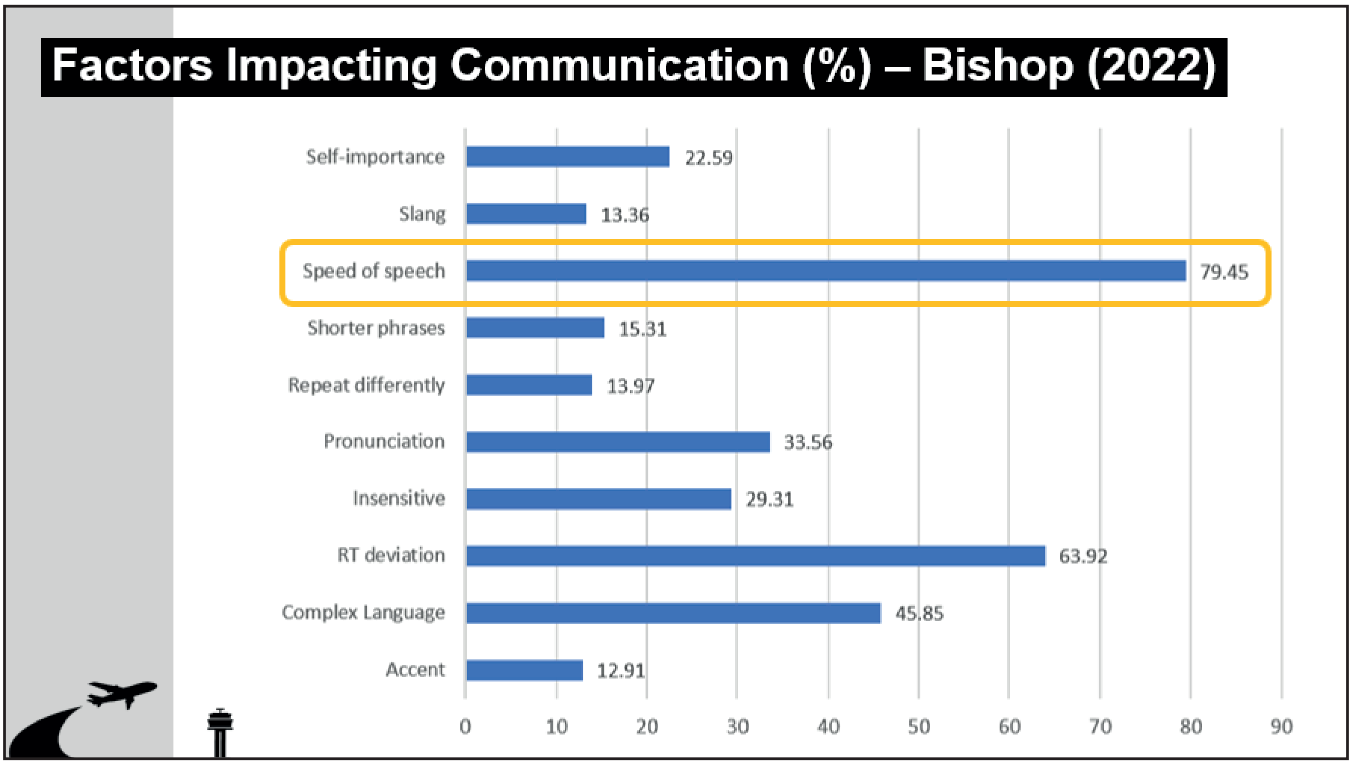
In fact, research is demonstrating continuously that both speakers of English as a first and as a second language *contribute* to the concerns around English intelligibility, so – again – the problems are not aligned to ELP alone. And there is plenty of work ongoing regarding supporting proficient speakers of English with the skills necessary to *accommodate others*.

It seemed at odds with modern approaches to personnel training, performance monitoring and observation that there might still exist such gaps in the system.

Modern Approaches to Increasing Communicative Competence in Aviation

Pilot-controller communications are such high-stakes interactions, ambiguity must be avoided as far as possible. All manner of known variables can affect the intelligibility of RT communications, from experience levels to noise to workload to information load to radio skills to ELP level. There are plenty of unfortunate examples in aviation history of accidents with language-related contributory factors.

As a result of such disasters, ICAO's ELP testing guidelines have encouraged all States to implement systems of plain English training and testing. But regulators and stakeholders must not make the mistake of believing that ELP testing is a catch-all solution for standardising or trusting communicative competence on the frequency generally (especially given the significant variation in quality and robustness of ELP tests internationally). For example:



- ELP testing does not cover RT proficiency (and very few States demand oral RT English testing).
- ELP testing does not assess accordance with standard RT.
- ELP testing does not demand that those with Level 5 or 6 proficiency can accommodate those with Level 4 proficiency.

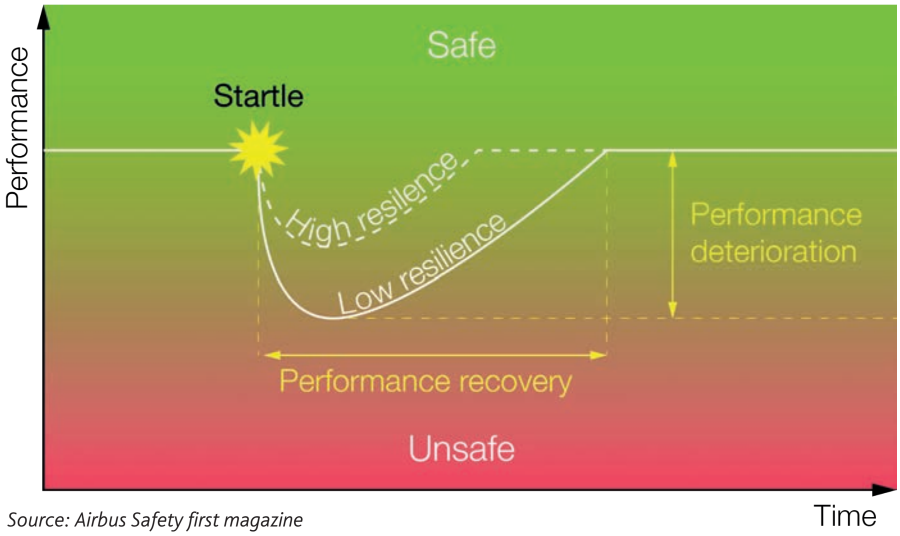
Aside from ELP efforts, the continuous striving for greater human performance within aviation personnel has led to the evolution of human factor and competence training approaches, with a degree of focus on communicative ability. In 2006, ICAO supported a performance-based approach to training with the publication of standards for the multi-crew pilot license (MPL), the first CBTA-compliant licence. In 2013, CBTA principles were extended to operator recurrent training with the publication of the ICAO Doc 9995, Manual for Evidence-based Training (EBT). In 2016, ICAO published Amendment 5 to PANS-TRG, general provisions for competency-based training and assessment. This defined the role of the pilot competencies in the context of Threat and Error Management (TEM) and provided a basis for the further development of CBTA. In 2020, ICAO published Amendment 7 to PANS-TRG. This formalized the global expansion and applicability of CBTA principles to all licensing training (ICAO Annex 1) and operator training (ICAO Annex 6).

One of the nine Competencies is Communication (COM) which is sub-divided into ten Indicators, or 'OBs' (Observable Behaviours), supporting personnel development of competencies and confidence

Task-Based Approach	Competency-Based Approach
→ Ever growing number of tasks to train	→ Finite number of competencies to train
→ Train only for predicted situations	→ Train for unpredicted situations
→ Isolated task training: difficulty to adapt	→ Multi scenario-based training: strengthens ability to adapt
→ More time spent on checking	→ More time spent on training
→ Generic training	→ Individualized training
→ Limited level of performance in complex and evolving environments	→ Increased level of performance in complex and evolving environments
LOW RESILIENCE	**HIGH RESILIENCE**

Source: Airbus Safety first magazine

and, in turn, their resilience. *Resilience Training* for personnel tries to target the impact of 'the startle effect' – when a flight crew is exposed to unexpected disruptions, they may experience an involuntary and uncontrollable physiological reaction, which may be accompanied by a momentary loss of situational awareness resulting in a temporary deterioration in performance. The goal of resilience training is to minimize this deterioration and to enable the flight crew to recover performance as quickly as possible (see image) – and communicative competence is considered critical to resilience levels generally.



Source: Airbus Safety first magazine

However, despite the implementation of these approaches, there has not - to our knowledge - been a targeted approach to standardising speech rates and encouraging greater clarity to increase communicative success and frequency efficiency. Since a COM criterion is an *ability to convey messages clearly*, Sanjay and I saw an opportunity to tie these threads together and consider doing something proactive to tackle his concerns in line with current human factor frameworks.

A Free Course

We want to encourage frequency users to be more aware and self-reflective, and consciously *"speak for the listener"* – whoever the listener may be. We will produce a free, self-access course to raise consciousness of the concerns about the potentially negative impact of a rapid speech rate, a lack of pausing, and a lack of careful articulation. We would like to be able to demonstrate 'the problems' to users through genuine RT samples alongside analysis by operational experts; and to make some suggestions of how to avoid such problems.

As Sanjay commented, *"If we can spread awareness of how reducing speech rate can enhance safety and make our systems more efficient, I think we can make a great impact"*. We aim to reach every radio user worldwide… Ambitious? Certainly, but if we can connect with the right training specialists and stakeholders to make them aware of the course, then there's every chance.

Special Interest Group

To create a network of the best professionals to build this course *(Project #1)* and to reach as many frequency users as possible, we have created **The COM Special Interest Group.** We want to bring together international experts in CRM, Human Factors and Communication to collaborate and improve COM-related competencies and resilience within aviation personnel.

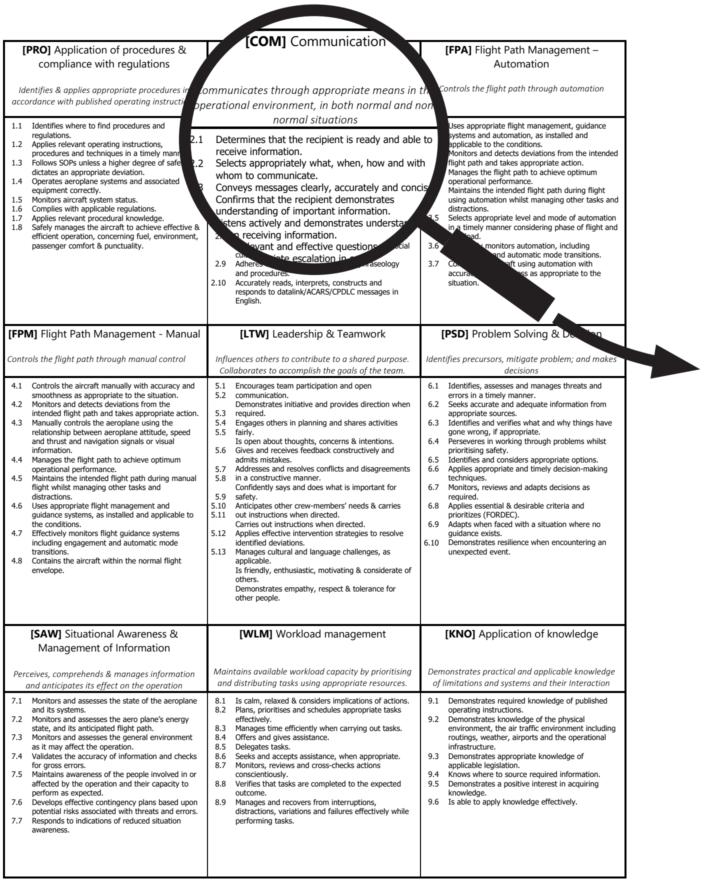
The COM SIG aim to facilitate expert discussion and develop initiatives and products which might become components of enhanced CRM and Human Factors training. Only through the support from industry organisations will the Group, and this initial course, have any impact. We need:

- ANSP Partners to supply (de-identified) Pilot-Controller recordings with which to demonstrate existing problems
- Commentaries from expert aviators on the identifiable intelligibility problems
- Our network to encourage all radio users within each organisation's reach to take this free course.

The Special Interest Group can be joined at www.COM-SIG.org

If you agree with the targets of this initiative, please share this article with relevant professionals in your network. Sanjay and I also are happy to be contacted by email: sanjay.sudan@goindigo.in | ben@lenguax.com

CBT > COM



[COM] Communication

Communicates through appropriate means in the operational environment, in both normal and non-normal situations

2.1 Determines that the recipient is ready and able to receive information.
2.2 Selects appropriately what, when, how and with whom to communicate.
2.3 Conveys messages clearly, accurately and concisely.
2.4 Confirms that the recipient demonstrates understanding of important information.
2.5 Listens actively and demonstrates understanding when receiving information.
2.6 Asks relevant and effective questions.
2.7 Uses appropriate escalation in communication to resolve identified deviations.
2.8 Uses and interprets non-verbal communication in a manner appropriate to the organisational and social culture.
2.9 Adheres to standard radiotelephone phraseology and procedures.
2.10 Accurately reads, interprets, constructs and responds to datalink/ACARS/CPDLC messages in English.

Response following the RAeS presentation:

The post-presentation was lively and resulted in some fascinating inputs, such as:

"We can build the best aircraft and have the best-trained crews of all time, but if they can't understand what is being said to them those defences are weakened markedly."

"If we turn off one accident as a result of your presentation today, although we may never know it, that will be something to be very proud of."

"Some native speakers have an ideology that because they are "native" speakers , their way of speaking is the "correct" one and non-native speakers must be the ones at fault during miscommunication events . All speakers must accept responsibility for their utterances and ensure that they are speaking as clearly and concisely as possible."

If you would like to read more about the reaction since the RAeS presentation, visit http://com-sig.org/news/

Using Emotional Intelligence to Help Deal with Stress

by Ana Gloria Arróspide

Since the global COVID pandemic, stress has become a significant issue in almost all industries, and the aviation industry is no exception.

The Oxford English Dictionary defines stress as: *"Mental or emotional strain placed on or experienced by a person as a result of adverse or demanding circumstances, esp. the pressures of or problems in one's life; a state of feeling tense, anxious, or mentally and emotionally exhausted arising from this.*[1]*"*

In this article, we will look at what happens to us as human beings in situations of stress, both physically and emotionally, and how improving our emotional intelligence (EQ) can help us to deal with this.

Chemicals that play a role in our brain when we are under stress include Cortisol, Adrenaline and Norepinephrine. Cortisol is an important chemical and it has a high role in or nervous system function. Adrenaline is responsible for increasing our heart rate and blood flow in survival situations as well as releasing the energy from the store resources in our body to facilitate immediate action. Norepinephrine is a chemical that acts as hormone but also as neurotransmitter, and like Adrenaline, it has a very important role in the "fight or flight" response. It boosts attention and also affects our mood, memory and wake up cycle.

What happens to the brain when these three key chemicals are at their highest levels? Our response system shuts down, because our brains like efficiency, and all our resources focus on surviving. When stress occurs, our brain sends a fight, flee or freeze signal.

What about our thoughts when we are under stress?
We can go from "I cannot do this", or "I cannot handle this" to "I want to shout at everybody around me" or "I need help but..."

What about the emotions we feel when we are in these situations? Our emotional reactions are more linked to our brain's assessment of whether we can cope with the situation. We might feel anxiety, fear, worry, vulnerability, anger, irritability, impatience (or all of them!), and this will lead us to not processing our emotions accurately and affect our decision-making ability.

How can the knowledge and practice of EQ help us to deal with stress?

In my previous article[2] we learnt about the concept of Emotional Intelligence (EQ), which addresses and measures intelligence regarding emotions, like IQ measures cognitive intelligence.

EQ is the ability to use emotions effectively. It involves the use of our brain's capacity and skill to perceive, assess and manage the emotions of oneself, others and groups. It is blending the emotional side and the rational side.

In the foundations of Emotional Intelligence, we find self-awareness at the core. This means being aware of our emotions, strengths, and limits, and noticing what we do.

One of the key tools and techniques in using your EQ is to identify your thoughts, feelings and actions (TFA).

Thoughts can affect feelings, like when you think about a problem with someone, you may feel upset. At the same time these feelings may influence your actions, like ignoring that person or saying something unpleasant.

Feelings can also affect our thoughts. If you feel sad, you may start looking for situations where that sadness is reinforced.

Actions can also affect thoughts and feelings. For example, when you play happy music, this will influence your emotions.

Copyright ©Six Seconds

There is no linear trend in our thoughts, feelings and actions. There is a dynamic interaction between them. So, how can we distinguish them from one another to use them for our benefit?

Let's first define thoughts. What are thoughts? They are an idea or opinion about a subject. A thought is an evaluative observation, like "I think she is not paying attention when I talk".

What are feelings? They are a subjective response to a situation, person, or thing. They are very personal and intuitive. This could be something like: "I feel ignored, unappreciated."

What are actions? An action is a thing done, a behaviour or conduct. For example, "I stopped talking".

Using the TFA EQ technique and the practice of noticing your feelings, thoughts and actions can help us to be better equipped to respond to our stress before it reaches us or has a detrimental effect on us.

So the next time you find yourself in a stressful situation, whether as a result of a single action, for example unexpected flight conditions or a delay, or as a result of a build-up of stressful circumstances, such an increase in workload, try to identify your thoughts, feelings and actions, and how they may impact each other. Allowing ourselves time to use our emotional intelligence in this way can be enormously beneficial.

1 https://www.oed.com/viewdictionaryentry/Entry/191511

2 [Issue 121, 2022]

Ana Gloria Arróspide is an Integrative Counsellor and Coach. She is a qualified EQ Assessor with the Six Seconds method. www.inspiriacounselling.com

CH!RP

Confidential Human Factors Incident Reporting Programme

Report No.1 – FC5196 – Inadequate crew bunks.

Report Text: Refurbished bunks in the [aircraft type] are very, very hard. So much so that it is hard to sleep; when one does fall asleep due to extreme tiredness one wakes up with pins and needles and subsequently can't get back to sleep. [Airline] don't listen to pilots concerns when this has been reported consistently via tech log and fatigue reports. In fact in the tech log it is signed off with 120 days rectification interval!

Company Comment: A number of reports have been received on this matter and are taken seriously. Flight Operations and Engineering have been assessing the situation. These aircraft mattresses have now all been replaced with our preferred alternate supplier in response to received ASR reports.

CHIRP Comment: The company informed us that the refurbished bunk mattresses mentioned in the report were different from the originals because the OEM had changed supplier due to problems with the original supplier. There's probably no specific standard or spec for mattress thickness/support but basic comfort must surely have been a factor in their procurement by the OEM one would have hoped. Although it appears that changes have now been made, the comfort of mattresses is probably somewhat down to personal perception as to their suitability, some crews were likely happy and some were not.

Report No.2 – FC5204 – Temperamental headsets

Report Text: There is an ongoing issue with [Manufacturer 1] headsets. These headsets are woeful. They have a tendency to fall off your head easily, under minimal acceleration, particularly relevant in a rejected take-off (RTO). I know of other ASRs filed by colleagues where this has happened during the take-off roll. However, another major issue is the mismatch between listen and talk levels - this seems to be worse on aeroplanes where one side is fitted with the older (better) [Manufacturer 2] headset and one side is fitted with newer (dreadful) [Manufacturer 1] headset. But it is also an issue with both sides fitted with the new [Manufacturer 1] headsets. I believe this to be a serious flight safety issue.

Company Comment: The concern relating to headsets has been under investigation by Flight Operations and Engineering for several months. A large scale trial of three headsets is underway across fleets to find a suitable replacement. There are a limited number of headsets available on the market which meet the specified requirements and include an ANR function. Additionally, some headset models requested by the pilot workforce have been specified by the aircraft manufacturer as not suitable for use. An alternative headset is also available to purchase for personal use if preferred.

CHIRP comments: Technical compatibility problems between headsets aside (which we're told is sometimes down to user adjustments), it seems that the stability problem with the new headsets is because they only have a single headband as opposed to the [Manufacturer 2] headsets that have a twin band and are thus more stable. Stability is a fundamental requirement in CHIRP's view given that there is no room for such distractions even during normal operations let alone potentially disastrous consequences during an RTO. We're heartened that the company involved have acknowledged the problems and are trialling alternatives; however, we wonder whether this issue is also prevalent in other airlines or fleets.

Report No.3 – ENG723 – Differences in corporate risk taking and application of the MEL

Report Text: Aircraft was flown to [Location] with multiple ADD's, including FMGC 1 inoperative, and no APU (air start and full ground service required). Inbound crew noted Engine 2 Overspeed Protection Fault appeared on shutdown. MEL consulted — no dispatch. I contacted [Base] engineering and informed them of the occurrence of a nil dispatch fault. Aircraft had previous history of ENG 2 OVRSP PROT ECM 3 days prior [Sector] in tech log. [Base] engineering initially dismissive that aircraft had a previous occurrence of the fault, despite being logged in tech log.

We were attended by 3 experienced [Same Type] engineers in [Location], being [a Foreign Operator's] main maintenance base. After approximately 2:30 hours of diagnosis and an engine run, the nil-dispatch fault remained on engine shutdown. The local engineers were convinced a bigger underlying issue was leading to the overspeed protection warning triggering when self-testing the

FMU on IDG 2 during shutdown. After the first engine run, the local engineers declared the aircraft AOG.

The final solution recommended by [Base] engineering was to disconnect the engine 2 generator, so that the self-test of the fuel metering unit would not occur. Another engine run could then be performed and the ENG 2 OVRSP PROT FAULT nil dispatch ECAM might not appear. This would add an engine 2 generator ADD but might prevent the ECAM caution to enable dispatch to [Base]. However, we would be unable to do this using MEL reference 24-22-01A because dispatch in accordance with that MEL procedure requires 2 operative generators, and the aircraft APU was already inoperative.

To the disbelief of the local engineering team, they were informed that the APU is only ADD'd because it had an oil leak that led to a fumes event. [Base] engineering required the engineers to check that if the APU oil leak is "only minor", then it "should be OK" to recertify the APU as only inoperative for air bleed and not for electrical generation. This would provide the second generator and get around the limitations of MEL 24-22-01A. By disconnecting IDG 2 and re-performing a second engine run, hopefully the ENG 2 OVRSP PROT FAULT ECAM would not reappear, and the aircraft could legally dispatch.

The Flight Crew had concerns about operating an aircraft at night in thunderstorms with the combination of defects proposed. The aircraft would require air start, with no APU bleed from re-classified INOP APU, and be level-capped through bad weather enroute, only 1 AP/FD due to inoperative FMGC 1, without an ENG 2 generator. I also had concerns that [Base] engineering solutions involved masking the underlying technical issue, rather than operating within the spirit of the MEL. These concerns were compounded by the local engineering team stating that they would feel uncomfortable certifying that aircraft as fit to fly, and that it would be unacceptable for [Foreign Operator] aircraft to have that number of ADDs.

The Flight Crew were unable to contact [Base] operations or flight crew management via any number of provided phone numbers to express our concerns for over 2 hours. The only flight crew point of contact with [Base] was via Engineering, who informed the Captain "We are speaking with operations, but they are too busy to contact you". During a second engine run with the disconnected IDG 2, on shutdown the nil-dispatch ECAM reappeared, and the aircraft was finally declared AOG.

I had two primary concerns. Firstly, I now have a few years' experience at [Operator], but this was the first time I've encountered that level of dissatisfaction from local engineers. From their differing opinions on continuing the troubleshooting process, to the desire to dispatch an aircraft with that combination of ADDs. Secondly, I found myself unsure around the applicability of MEL nil-dispatch clauses. From my understanding, we were locking out a system to prevent a self-test occurring, which was producing a nil dispatch message. I had a conflict about whether masking a message is an acceptable use of the MEL.

CAA Comment: After reviewing the [Base] engineering/crew transcript it appears there seems to have been some miscommunication potentially in trying to get to the root cause of the defect, and whether it was caused by power transfer issues because the APU was INOP or another source. The repeat requests for engine runs would not have helped but it would appear that not all the information requested came from the first engine run attempt hence the further run requests from [Base] engineering to the Third Party maintenance provider.

[Base] engineering were trying to recover the aircraft and, from the reviewed transcript, were doing so in a methodical manner. [Operations] is the main contact point for the crew and it appears that they were unavailable despite the crews attempts to contact them. Staffing levels at the operators control centres are currently under review. The operator dispatched an AOG recovery team from [Base] with the fault being traced to an EEC. The spares were held up by Customs and the aircraft departed [a few] days later.

Regarding the number of ADD's, the CAA have weekly meetings with the operator and these are reviewed and discussed. There are industry-wide spares issues; however, the despatch reliability of this operator's particular fleet is one of the highest of all UK fleets and, fleet-wide, the ADD's are now below 2 per aircraft for this operator.

CHIRP Comment: Concern was the initial reaction on receiving this report. Trying to outwit a modern aircraft sometimes ends badly and often the aircraft decides it is not going anywhere, which is of course the safest option. The MEL should be designed to prevent the clash of carrying forward conflicting defects but this is not guaranteed. It is largely up to the engineer to consider possible conflicts before they hand the aircraft back to the Flight Crew who then review the situation, including operational implications. The CAA were confident that Base Maintenance Control had not acted in a cavalier fashion and had also sought advice from within their technical workforce. From a CHIRP point of view, we should be aware of the dangers of multiple remote organisations and departments working together and the risk of miscommunications or conflicting advice as a result. We are all aware of the importance of good communications as an HF issue, and the stresses of inadequate communication with Base Operations may possibly have affected the frame of mind of the Flight Crew by sowing seeds of doubt about the validity of what was being done in order to recover the aircraft. Ultimately, it's all about communication and if the Captain has doubts that the aircraft is safe to operate then the decision is clear; it's for the operator's engineering/operations teams to then convince them that it is safe through transparent and unambiguous advice and information to remove any uncertainty. This appears to have been lacking in this case, and the inability of the Flight Crew to contact base operations or flight crew management for their perspective for over 2 hrs is woeful.

Report No.4 – FC5203 – New Flight Planning System woes

Report Text: My employer has introduced a brand-new electronic replacement briefing and flight planning application. The purpose seems to be because a new back-end system has been introduced to our flight planning and the flight crew must switch briefing systems to be compatible. This system has a number of bugs and negative features that have been highlighted to the company by a huge number of flight crew. They include:

- Inadequate NOTAM presentation with significantly less filtering than previously
- Poor presentation of enroute weather
- Aircraft MEL items hidden in the OFP
- Completely new briefing flow

Flight crew have been required to self-brief on this new application with minimal, poorly designed CBT and no formal time allocated for them to do so. As an example of the major issues the company has had to release a 9-page notice on how to do fuel checks in the new app.

Although a limited parallel run was attempted, it was not available at all for some fleets, and on others the flight plans were on completely different routings so no possible training benefit could be realised.

As it stands the current application is inadequate. The company are aware of a number of bugs and have listed them as "improvements coming" but have elected to launch anyway. This has massively increased pilot workload and increases the risk of:

- aircraft dispatching with incorrect fuel
- aircraft dispatching without taking account of MEL items
- incorrect flight plan fuel being missed
- hugely increased time required to brief leading to pressure on other aspects of the operation.

I feel that note should have been taken of concerns raised by a significant portion of the pilot group across various types the airline operates and the launch delayed until those concerns were addressed. I would like this issue properly to be raised with the regulator who may not be aware of the concerns reported mainly via a dedicated company reporting form for this application rather than the ASR route.

Company Comment: The new flight planning and briefing system was a long term project, which included the provision of the following training material:

- **Differences Guide** – this document summarised all changes associated with the move to the new Flight Planning and Briefing system.
- **Access to the new briefing application** – available for all fleets from 10th Mar 2022 to 14th Jun 2022.
- **Live Microsoft Teams Demo and Q&A** – 24 separate events held over a 14-week period on a variety of days and times to enable multiple opportunities for flight crew to attend.
- **Recording of a Live Q&A** – available on our internal documentation app available on each pilot's iPad for those unable to attend a live event.
- **Bespoke email address created to ask questions** – over 500 emails received and responded to.
- **Internal company feedback form** – available for app development suggestions only.
- **Safety reports** – all to be filed via ASR as per normal (282 related ASRs received and responded to).
- **Specialists** – available in the home base crew briefing area for 4 weeks prior-to, and post cutover to answer any queries at crew report.

CHIRP Comment: Although the required functionality was probably all available and it was just a matter of getting used to the new system, this report seems to indicate that insufficient user-testing was conducted (using real first-time users and not those who developed the system), and that user-acceptance and user-confidence (i.e. buy-in from the users to increase their willingness to adopt the change) were not ensured before the new system and procedures were introduced.

Some system changes are so large that face-to-face training should be given rather than simply asking people to read online manuals, view VTC sessions and conduct computer-based training courses - this should be factored into the deployment of new large-scale safety-critical systems and procedures and is a key lesson from change management. Furthermore, the introduction of such a radical change might be questioned when most flight crew were flying their maximum hours during the summer-2022 ramp-up of operations with concomitant tiredness and likely lack of enthusiasm for large-scale extra-curricular self-study. There is a clear case in these circumstances for official time to have been rostered for the training, even if conducted as self-learning, and that that time should be scheduled for appropriate periods other than at the end of a tiring duty for example. All of these elements should have been highlighted by running the change through the company's SMS to ensure that it made sense, did not introduce unmitigated risks and was handled more empathetically overall.

Report No.5 – ATC825 – Use of Guard channel for Practice PANs

Report Text: As a commercial pilot I wanted to raise the issue of use of the guard VHF channel (121.50) for practice PANs, generally by GA aircraft. When flying across Europe, as a standard procedure my airline stipulates that we maintain a listening watch on the guard frequency, and rightly so. When this frequency is used by GA users for practice pans it adds to our radio traffic and we are often forced to stop listening/turn down our "box 2" in order to maintain situational awareness and comms on our primary ATC frequency.
My concern is that we therefore often forget to listen in again on the guard frequency after we think the practice PAN has finished, which means we could potentially miss genuine emergencies and attempts to contact us through loss of comms procedures. GA pilots need to be aware that every time they conduct a practice PAN they are being heard by commercial pilots and are blocking the emergency frequency for that time.

I would respectfully suggest that an alternative frequency be assigned and used for practice pans so that 121.50 can be used for genuine emergency and loss of comms situations.

CHIRP Comment: The issue of practice PANs causing problems for those who are required to listen out on Guard is not new and CHIRP has previously sought ways to introduce a training frequency for Practice PANs but this has foundered before because of lack of available frequencies. However, with the advent of 8.33kHz frequency spacing, more frequencies are now available and so there may be scope to address this again. CHIRP has engaged with the CAA and MAA on the possibility of setting up such a frequency but there will undoubtedly be hurdles in the way, not least of which being the cost of setting up the same auto-triangulation facilities that exist with the Guard frequency. We will continue to engage on this issue but would be interested in the views of the community regarding setting up a VHF Practice Emergency Training Frequency (PETF). To what extent are transmissions on Guard a problem? Do those affected report such incidents (or inform ATC that they are 'off Guard' due to it being too noisy) and, if not, why not? Current engagement with the CAA and NATS is coloured by the fact that a previous review into this showed few reports of any problems and so a change could not be supported. But a lack of reports is not the same as a lack of a problem and, not that we would advocate this, one wonders what might be the outcome if controllers were also listening on Guard whilst trying to control their own frequency. Ultimately, the number of interceptions of 'no-comm' aircraft by air defence units indicates that the turning down of Guard is a real problem and, although a bit simplistic, if only one such interception was prevented then the money saved would probably pay for any change.

Report No.6 – FC5206 – Aircraft V1 callouts

Report Text: I'm an [Airline] 737 Captain, having transferred from [other Boeing] fleet a few months ago. I was surprised to find a handful of the fleet don't have automatic V1 call-outs. Automatic V1 call-outs are a safety enhancement, however, having flown [other Boeing] aircraft for many years without them, this is fine too as one is conditioned to call it during every take-off as PM. Notwithstanding the small number of [Airline] 737s, many First Officers haven't flown commercial aircraft without V1 call-outs, nor have we received any specific training on it during our simulator training and it's notable the call is not always made in a timely manner, or sometimes at all. I have raised the issue informally with our fleet management, and the response was the regulator says it's ok and it should be a briefing item when discussing the aircraft status. From my point of view either the entire fleet should have that functionally or none of them should. The latter was the case on the [Airline] [other Boeing] fleet and it never seemed to be an issue. At the very least some take-offs without V1 call-outs during recurrent simulator checks would be appropriate as this is the most critical stage of flight and we're not consistently getting it right. To be fair to [Airline], the Aircraft Configuration Card (ACC) details the differences in aircraft fit and the company's suggested briefing format includes aircraft considerations. Only 1 or 2 out of [Airline] 737s are equipped as such and a lack of familiarity seems to be the core issue, so a recurrent simulator session would aid familiarity across the pilot workforce.

Company Comment: The 737 aircraft has a long history of evolution and development, and as new features have become available we have taken advantage of them. This has resulted in a long period where a mix of aircraft functionality, including aircraft with and without automatic V1 callouts, have been operated successfully. This mix of aircraft capabilities has been addressed by a comprehensive set of aircraft specific briefing cards which are automatically made available to pilots specifically for each flight via the flight planning app. There is a requirement for aircraft differences to be discussed during the pre-flight briefing. The normal procedure for all take-offs is to 'verify the automatic V1 callout, or call V1'. In the event that an automatic callout fails to be issued, pilots are required to make a manual call.

CHIRP Comment: A positive check and callout of V1 is one of the key safety activities during take-off, and ideally these days as an automated alert. That some aircraft do not have automated capability is a fact of life but, in these cases, pilots should brief manual callouts as we all know. It is certainly less than ideal for there to be mixed capabilities in the same fleet but, again, that's probably a fact of life and it would be detrimental to remove the capability from those aircraft that were fitted. But the corollary is that pilots must be aware of the modification state of the aircraft and the company should ensure that each aircraft's capabilities are prominently highlighted. Either way, and as the company comment above states, in mixed-capability fleets the pre-take-off briefing and TEM assessment should include a positive discussion/reminder as to whether calls will be automatic or manual in that particular aircraft and non-handling pilots should be monitoring speeds such that they are prepared to make check-point calls if the aircraft does not for some reason (or make the calls even if the aircraft does have an automated system as a mitigation for any potential failure). This is a key responsibility of the Captain to ensure that both pilots are aware of the aircraft's state and that the pre-flight briefing covers calls that will be made. Notwithstanding, we agree with the reporter that if there are differences in the fleet, then simulator training should cover this on a regular basis.

Report No.7 – ATC826/ATC827 – Participating in Zoom call whilst on duty

Report Text: Since the pandemic it has been customary at this unit to have weekly briefing from MATC & SATCO by a Zoom meeting on Friday afternoons. On this occasion, as per usual, MATC hosted from their office but for a segment concerning Professional Standards we were addressed by the SATCO broadcasting on a mobile device for approximately 3 minutes from an operational position. It was unclear whether SATCO actually had traffic on frequency.

CHIRP Comment: The unit was contacted and they informed CHIRP that the issue had been raised and addressed internally as a result of an earlier internal report about the incident. CHIRP agrees that actively engaging in ancillary tasks such as Zoom meetings is not acceptable when conducting controller duties, even if only monitoring a sector with no traffic. It would be one thing perhaps to be passively listening to a briefing during a quiet period on sector but even that would be less than desirable. That being said, it is recognised that controllers do conduct other non-operational tasks whilst monitoring quiet sectors (such as reviewing directives, reading documents or doing other tasks to keep themselves alert) and so there's a pragmatic compromise that must be reached when interpreting the regulations. Ultimately, in respect of things like Zoom or phone calls, CAP493 MATS Part 1 Appendix E 'Communications Technique and Standard Phraseology' states:

2. Distracting Conversations

2.1 Non-operational and other conversations have the potential to distract a controller from their primary task of providing a safe air traffic service. Examples include telephone conversations with external agencies, such as airline representatives, and discussions between controllers conducted on the telephone, intercom or, in some cases, face to face, following an unplanned traffic situation.

2.2 Non-operational conversations must not be permitted to interfere with a controller's operational duties. Procedures at units should ensure that non-urgent telephone calls from external agencies could be accommodated without prejudicing the controller's primary task.

2.3 Discussions regarding unplanned traffic situations, which may include incidents and alleged breaches of procedure, are not to be conducted from operational positions. If appropriate, only brief details of the occurrence should be exchanged between the controllers involved. If there is a need to discuss the matter further, this should be deferred to a time when all the personnel affected are relieved from their operational duties. Where staffing levels permit, unit management staff that are not working at an operational position should make arrangements for further discussions.

On Being Prepared to be Surprised: 20 Key Insights from David Woods

Over the last four decades, Professor David Woods has studied and advised government agencies, companies and accident investigation boards on surprises and unexpected events in industries including aviation, space exploration, healthcare, and software engineering. Steven Shorrock picks out 20 key insights from a conversation on being prepared to be surprised.

1. The process of surprise follows a familiar pattern

"Beginning with an initial signal, the process flows across a series of transitions from a physiological response, to a sensory response, to a more interpretive perceptual response, and an emotional response, to a more cognitive then cooperative activity. The whole transition needs to go smoothly and coherently across those stages. At some point we realise, *'This doesn't fit!'* This marks the transition to a sense of surprise: *'I'm in a different world. I am now in abnormal operations. There are unexpected, anomalous, and discordant indications to resolve.'* People can get thrown into a kind of incoherence along the way. You're thrown off track and it's hard to get back on track given the time pressure. That's when the response breaks down."

2. We confound surprise, the unexpected, and startle

"In the flight deck, the word 'startle' sometimes gets misused. Startle refers to a physiological response to threatening, sharp onset signals – a sudden dramatic shift. Startle delays response and can disrupt initial processes to monitor or scan, recognise, understand the event and what it means for response. But mitigating that is difficult. Startle is controllable in a very limited sense and in terms of very specific kinds of things, which don't work for everybody. There are significant individual differences."

3. Surprises can be situational or fundamental

"Surprise is about the unexpected. Surprises challenge our model of how the world works or should work. When surprised, we have to make sense of what doesn't fit. This can take the form of a situational surprise – how to minimise the implications of the surprise (just a little fine-tuning to restore the model). Alternatively, the response can take the form of a fundamental surprise where people engage in processes of revision and reconceptualisation."

4. The only certainty is uncertainty

"Sometimes, the only thing I know for sure is that there's high uncertainty. But this can be a definite signal telling me I have to get more information, and I have to create the possibility for swift action once I understand what's going on. The big question is, are you prepared to revise as more evidence comes in? You may have to back up and re-examine what's really going on in terms of what you can see and hear and feel. This is where the classic questions arise during automation surprises: *'What's it doing? Why is it doing that? What is it going to do next?'"*

5. The transition to scan after surprise is critical

"It is important to help support people to get back into a disciplined scan in the computerised cockpit. In the old analogue cockpit, experienced pilots had a very disciplined scan to make sure they were getting all the information relevant to understanding a potentially abnormal situation."

6. Simulator responses can be very different to real world responses

"Even though it's full scope and high fidelity, pilots know they're in a simulator, and the ability to respond to an abnormal situation is always faster than in the real world. So, you should always design and train with that in mind. It's a different world and a different tempo in the air. A five to 10-second response in the simulator might even double in the real world."

7. Therapeutic responses give crucial diagnostic information

"Actions can help you figure out what's going on (the unexpected part), while potentially helping to handle the situation (the abnormal part). You don't have to know immediately why the engine is losing power, but you do need to stabilise flight as power drops. The actions to respond are corrective, or therapeutic, as they help manage the situation. The very same actions also provide diagnostic feedback. How the aircraft and systems respond to actions reveals more about what is wrong and what does or does not explain the situation. Plus, what produces the surprise can lead to unexpected actions by automated systems. Tracking what the automation is doing or not doing can get difficult under time pressure. The classic view of a strict linear sequence from assessing information, building a diagnosis, then acting, doesn't capture how these are intertwined during surprise events."

8. Sudden collapse can happen at the system level

"In socio-technical systems, the processes that respond to surprise and coordinate responses across subsystems can degrade. We normally compensate, but we can run out of the capacity to continue to handle a growing problem or a deteriorating situation. As things get worse, the ability to continue to respond diminishes, leading to a sudden collapse in performance. In control systems this is the general problem of saturation. It is also how brittle systems fail. In trying to keep up with threats, the system needs the capacity to stretch and adapt to handle the effects of surprise and reduce the risk of brittleness. This is a special capability that experienced expert people provide."

9. The way that we think about probability misleads us

"Classically, people think of surprise in a probability sense. Surprising events are relatively rare events, in the tails of the distribution. The problem is, in real world probability distributions, the tails are bigger than we think. In other words, the probability of low frequency events as a class is much higher. It's not that surprise is rare. Surprise is always happening at the boundaries. After the Columbia accident, I said to Congress that, paradoxically, extra investment in safety is most needed when it's least affordable. You need to be prepared to be surprised and prepared to adapt."

10. It is necessary to focus on reliability, robustness and resilience

"You have to prepare for all three because they're so different. You can't know all of the things that will go wrong, and you don't have enough resources to prepare for all contingencies. Plus, the world will change. We rely on the pilot to understand and act constructively in a situation that doesn't fit what we thought we were prepared to handle."

11. Everything operates under limits

"It's not that designers are bad at their jobs. It's that everything operates under limits. Engineering design operates under limits. The machines that result have limits. People operate under limits. And the world keeps changing. Those changes will present surprises that highlight the limits of our decisions. What reasonable trade-offs will need to be readjusted as we appreciate the new information in surprise events? This was missing in the run up to the Columbia accident."

12. The act of compensating successfully hides what is difficult

"There is a law called known as the fluency law. It means you adapt successfully most of the time. As a result, you and others don't see the difficulty, or the trade-offs, or the dilemmas that arise, but are handled regularly. There is a source of strength in people that is hard to appreciate even though it is called into action regularly to handle the stream of small surprises in all systems with limits. Often, no one noticed that they were adapting to recover, demonstrating resilient performance. And we didn't notice that because people – in the end – handled it successfully, leaving the surprise and adaptation partially invisible."

13. We have to be prepared to be surprised, even by our own mitigations

"So, when we say, *'how to be prepared to be surprised?'*, we mean that your model of the world does not match the world you're really in. What we thought of as risk mitigation shifted trade-offs and exposed us to other risks. So rather than always getting better and the probability of something bad happening always going down, vulnerabilities actually change. We are more effective in some ways, but the system changes and we get surprises."

14. Adaptive capacity is future oriented

"We have to think about adaptive capacity as a potential to act in the future when things are different than planned. We know that we have finite resources, and we have to make compromises and trade-offs even as we pursue reliability and robustness. We know that challenges will arise, but the challenges will arrive in unfamiliar forms. Things work as well as they do because there are hidden sources of resilient performance to handle the regular occurrence of surprising events."

15. We need to understand how people handle surprises

"To some degree, we start to reveal fluency by getting people to share more information about how they do things. What makes you as an experienced controller different from a newer controller? If you're supervising a relatively inexperienced person, what do you bring to handling a situation that's different? As you recognise that a situation may become more difficult to handle, how do you make small adjustments in advance?"

16. People provide the ability to stretch

"Management must first understand that people adapt to handle surprises and other difficult situations. People provide an ability to stretch at the boundaries. It doesn't have to be people, but it turns out it is almost always people. Pilots, controllers, engineers and other actors provide a source of resilient performance; they adapt to make the system work. And we count on that."

17. Experience matters

"It is important to appreciate that there's great value in experience. This requires long-term planning to retain this critical asset for resilient performance. You need a balanced portfolio with a long-term approach to sustain the base and mix of experience."

18. You can't take past safe performance for granted

"In ultra-safe systems, there is a risk of taking past safe performance for granted. But again, a record of reliability does not guarantee future robustness or resilient performance. If you rely on a record of past reliability, you'll have less robustness than you think, and you'll cut out some of the critical human sources of resilient performance that help you handle surprises and other difficult situations."

19. The world will throw more surprises at us

"Today the world is going through transitions and changes that reverberate in unusual ways or ways that we don't expect. The world will continue to change in ways that will be surprising in terms of their tempo and impact."

20. Managers need to be agile

"By the time you put in your traditional change programme, the world has moved on twice! You need to be more highly adaptive in a turbulent world and that requires management to rethink things. In the new world we're living in, management has to learn to be agile. Management cannot be slow and stale. You must develop the potential to adapt in a changing world."

Read the full interview with David Woods in the Online Supplement to HindSight 34 on SKYbrary at https://skybrary.aero/articles/hindsight-34

Professor David Woods has worked to improve systems safety in high-risk complex settings for 40 years. These include studies of human coordination with automated and intelligent systems and accident investigations in aviation, nuclear power, critical care medicine, crisis response, military operations, and space operations. The results of this work on how complex human-machine systems succeed and sometimes fail has been cited over 33,000 times and synthesised in several books. He is Past-President of the Human Factors and Ergonomics Society and the Resilience Engineering Association. He has received several awards and has provided advice to many US and international government agencies, companies, research councils, task forces, and accident investigation boards.

Reprinted with kind permission of EUROCONTROL HindSight 34, Winter 2022-23.