This Month's Focus Is: **JUST CULTURE**
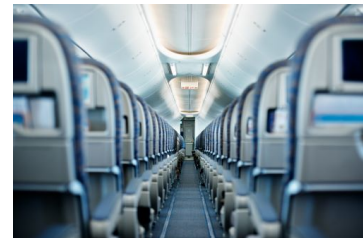
This Month's Topics

- *November's Aviation Safety Community - Safety Leadership Forum speaker*
- *A Look at Just Culture*
- *The Five Elements of a Positive Safety Culture*
- *The Just Culture Company - A Discussion of Just Culture*

This Month's Safety Leadership Forum Speaker

Last week, Grenville Hudson was the guest speaker at the Aviation Safety Community - Safety Leadership Forum for November 2022 . Grenville Hudson is the Director of the Aviation Safety Community*, and has an extensive background in aviation, road transport*

operations, and lean logistics support for the automotive industry. For the past 20 years, Grenville has been working in business aviation, fly-in/fly-out operations, regional airlines, and aeromedical flight operations in general management, safety and quality management roles. He has also been a lecturer at Swinburne University of Technology's Aviation Department for the past 22 years, lecturing in subjects such as Safety Management, Aircraft Aerodynamics and Performance, and Flight Operations.

With a passion for safety, Grenville started Flight Logics 12 years ago, which is a company focused on providing safety and quality management service to Australian aviation companies. Grenville is also a qualified lead auditor and is a current Quality Manager Form 4 holder for a number of Australian maintenance organisations.

Last week, Grenville spoke on the topic of The Beginner's Guide to Safety Policies and Objectives. He focused on matters such as the construction of safety policies, how to select suitable and measurable safety objectives, developing an SMS document suite, and more.

The webinar recording and presentation slides are now available on the Aviation Safety Community website, and can be accessed by Annual and Corporate Members.

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CLICK HERE TO VIEW GRENVILLE'S PRESENTATION

</div>

A Look at Just Culture

Any discussion of 'just culture' wouldn't be complete without a look at 'safety culture' in general in the workplace. Culture is generally defined as the the overall character of a business whether that be a small business or a large organisation. This character is made up of attributes like a businesses' values, beliefs, behaviours, goals, attitude, and work practices. The ideal 'culture' that all

businesses strive for is a positive safety culture where individual's ultimately feel happy, satisfied, and safe within that culture. Just Culture is just one of the five positive safety culture elements that were developed by James Reason. The other four culture elements include:

- *Informed Culture*
- *Reporting Culture*
- *Flexible Culture*
- *Learning Culture*

It's an ideal - and unfortunately, it is still out of reach for many workplaces worldwide. But there is more awareness now of its importance compared to years ago. This study study by RMIT University on creating a positive workplace culture *is also worth reading.*

What Makes Just Culture?

It is clear that some attributes found in a workplace's culture are also to be found in a workplace's overall safety culture which forms part of just culture. ICAO *argues that a successful just culture is vital to safety culture in aviation. The two-work hand in hand. So, what exactly then makes just culture? The standard definition is that just culture is comprised of a system of shared accountability in which organizations as a whole, not on an individual level, are accountable for the systems they've designed and for responding to the behaviours of their employees in 'a fair and just manner.' Just culture has been found to be successful in a number of different organisations worldwide.*

The concept of just culture originates in the 1980s in aviation where a systematic process was undertaken to make aviation safer and reduce accidents. The term 'just culture' was popularised in the lexicon by David Marx *who is widely seen as the father of just culture.*

The 3 Elements of Just Culture

For just culture to actually work in any organisation, there must exist the following three elements which make it actionable and practical on a day-to-day level:

1. Building Awareness → 2. Implementing policies that support just culture → 3. Building just culture principles into daily work (practices & processes)

Any organisation claiming to be practicing 'just culture' must have the three elements in place or else just culture is just an idea but not an actual practice. Keep in mind that in addition to these three elements there are also four behaviours which constitute just culture:

1. Human error – when an unintended mistake occurs

2. Negligent conduct – when a person fails to use a reasonable level of skill that is expected of someone engaged in the activity.

3. Reckless conduct – not-justified and a blatant conscious disregard of the obvious risks associated with an activity.

4. Intentional "willful" violations – when a person is aware of the unfavourable outcome that will occur through their acts.

Avoiding the No-Blame Culture

We must remember that only a very small amount of unsafe human actions is deliberate (e.g., criminal activity, substance abuse, reckless behaviour, sabotage). These deserve appropriate punishment. It would be wrong and unethical for any organisation to claim that such actions fall under 'just culture'. Just culture must never be abused and used as a scape goat to cover criminal and irresponsible human behaviour. This would then give rise to a 'no-blame culture' which must be avoided at all costs.

Sidney Dekker and Just Culture

In the world of aviation - pilot, professor, speaker, thought-leader and author Sidney Dekker is a household name and well known for his different views on safety culture and just culture. Dekker argues that just culture is inherently flawed as is practised by most organisations and can easily lead to a 'no-blame culture.' Dekker believes that for just culture to be effective, safety and accountability must be balanced along with a strong safety culture in place that's committed to reporting, taking responsibility, and improving safety. Many organisations fail big time at this, argues Dekker.

Check out Dekker's Restorative Just Culture Checklist.

Handling Blame and Punishment in Just Culture

Central to how just culture plays out in an organisation is the way in which blame, and punishment is handled and then managed. There must be an effective reporting culture in place where all safety incidents, no matter how minor, are reported in a timely manner. This way learning can happen, and safety improvements can be made. By integrating just culture in your organisation, reporting, safety and overall trust and accountability are improved. Each build on the other and missing an element leads to an incomplete just culture. Countless research conducted has shown time and time again that in organisations where just culture is improved along with the general overarching culture, individuals feel more encouraged to speak up, and are even rewarded, for providing essential safety-related information.

The 5 Elements of a Positive Safety Culture

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INFORMED CULTURE
Those who manage and operate the system have current knowledge about the human, technical, organisational and environmental factors that determine the safety of the system as a whole.

REPORTING CULTURE
An organizational climate in which people are prepared to report their errors and near-misses.

JUST CULTURE
An atmosphere of trust in which people are encouraged (even rewarded) for providing essential safety-related information, but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour.

SAFETY CULTURE

FLEXIBLE CULTURE
A culture in which an organisation is able to reconfigure themselves in the face of high tempo operations or certain kinds of danger - often shifting from the conventional hierarchical mode to a flatter mode.

LEARNING CULTURE
An organisation must possess the willingness and the competence to draw the right conclusions from its safety information system and the will to implement major reforms.
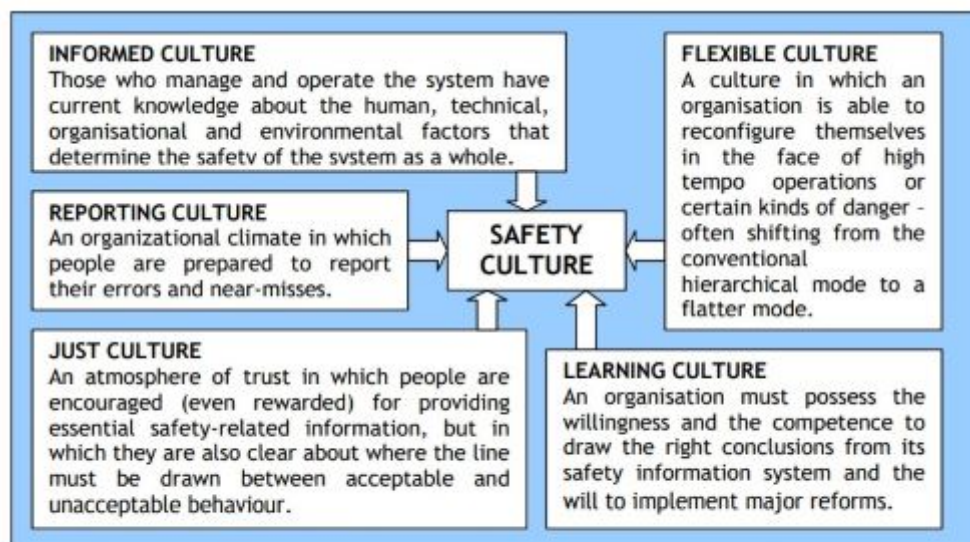
Figure 1. Based on Reason (1997) The Components of Safety Culture: Definitions of Informed, Reporting, Just, Flexible and Learning Cultures

The Just Culture Company - A Discussion of Just Culture

We recently had Jerry Allen, senior advisor at The Just Culture Company speak at our Safety Leadership Forum. Jerry has worked with organizations from a wide variety of industries globally to achieve better outcomes through the application of the Workplace Accountability, Root Cause Analysis, and Highly Reliable Outcomes models. He has three decades of experience and expertise in the high-consequence world of commercial transportation. This has earned him two international awards for his work in aviation safety and human factors. To find out more about Jerry, you can find him on LinkedIn and The Just Culture Company website. You can also listen to him on our Aviation Community Safety Podcast.

We asked The Just Culture Company (TJCC) for their thoughts on various aspects of Just Culture and here are their responses:

1. In your line of work and expertise, what would you say are patterns that you've personally seen that come up time and time again in aviation organizations/companies when dealing with just culture?

TJCC Response: Aviation places a great deal of emphasis on procedural compliance as a key basis for its safety system. When procedural compliance is not achieved (whether due to inadvertent error, or choice to deviate) there is often a felt need for a punitive response/sanction. Yet, our model of Just Culture advocates the concept that inadvertent violation due to error should not attract discipline or sanction. Also, there are times when a choice to deviate is justifiable based on the concept of a greater good being in play e.g., to save life etc.

2. In your opinion are there major differences in how 'just culture' is implemented between America and Australia in aviation? If so, please go into detail and if not, what should the two countries be implementing more of in your professional opinion?

TJCC response: Yes, there are differences (not sure if 'major' is the right descriptor or not). The roots of which were produced in the early adoption and recognition of SMS and human factors principles (and later HF/NTS training requirements) from CASA. The U.S. FAA has lagged behind in its' adoption and recognition of SMS and human factors principles. On a positive note, the FAA has updated its' compliance program guidance (to its' inspectors) to better recognize fundamental HF principles relating to errors and mistakes. There's a long road ahead towards an internationally recognized criteria for application of Just Culture. Progress is being made in the context of the recognition and adoption of SMS requirements and HF training, as well as in certain voluntary safety reporting programs in both the U.S. and Australia.

3. In a just culture environment after an incident, the question generally asked is, "What went wrong?" Is this the right question? If yes, why? If not, why?

TJCC response: The explanation of the "what's" and ultimately the "why's" of an adverse event should be fundamental to a good investigative process. We see that many

organizations still don't go deeply enough in their causal explanations - e.g., labeling the first observed error or violation as a "cause" and stopping the causal search. A good investigation should provide explanation and support for the reasons behind the choices people made on the day that got them to harm. This must include both systemic and individual performance shaping factors. It is only then that an organization is in position to apply Just Culture i.e., judge conduct.

4. Are the traditional three elements of 'just culture' - building awareness, implementing policies that support JC, and building JC principles into the processes and practices of daily work enough to make JC highly actionable and practical? Do we perhaps need a fourth element? or a totally different approach to the three elements?

TJCC response: All three are certainly important, and a part of the work that we typically do with an organization. There is a fourth element that we see as critical, which is governance. Just Culture has to be approached as a long-term effort to change the culture of the organization and ultimately, to improve it, therefore governance (over time) becomes imperative. This starts in the C-Suite. The three elements (1. building awareness, 2. implementing policies that support JC, and 3. building JC principles into the processes and practices of daily work) actually become tools through which the direction of the organization is influenced.

5. Is the implementation of just culture sometimes a struggle and challenge due to the very human trait/habit of 'inconsistency' which leads to being lax?

TJCC response: Perhaps 'lax' isn't the right term. Human nature dictates that people drift (into risky choices, into unpredictability, and into apathy). The challenge in any effort to change the direction and culture of an organization is to achieve and sustain buy-in that it's necessary. That is always a challenge. We applaud organizations that come back to us and say that they've been on the journey for multiple years and are still at it!

6. What are psychologists currently saying about just culture in safety-critical industries like aviation? Have there been recent reports or studies conducted that you know of and shed light on interesting data?

TJCC response: None that we have seen.

7. Just culture originated in the 1980s in the aviation industry and we know obviously that a lot has changed since then, especially in terms of technology but is there perhaps something from that era that's foundational to the way just culture is done and therefore should never be changed in your opinion?

TJCC response: Just Culture is really not influenced by technology. It's about people, fairness and equity. Putting an app on a phone won't change our natural tendency to judge others harshly! That said, there is ample opportunity for aviation and other high-consequence industries to continue to evolve in the way they view and apply Just Culture. It will always be a challenge to get people to stop ascribing higher culpability and blame to rule violations (see question 1) and aviation still has a tendency to do that, but as an industry sector, aviation is not alone. There's always room for improvement in the way Just Culture is done.

8. Do you believe that with the rise of technology and some would say heightened distractions and reduced concentration in this digital age that we are more at risk of being lax and complacent with just culture and general safety culture even when the stakes are so high, and duty of care should be at the forefront?

TJCC response: Technology-induced distraction and related complacency have been much discussed in the piloting world. This really just becomes another category of performance-shaping factors….identification of which should be accomplished through a post-event investigation (see question 3). Application of justice occurs only after an investigation has fully explained the facts and circumstances of a given event. What has to be cautioned against here is the tendency to label conduct with terms like "complacent, careless, poor airmanship, unprofessional" etc. These terms have no legal or broadly agreed definitions and therefore are unhelpful in the application of Just Culture.

9. Your internationally awarded tool (which is a wonderful achievement and you should be so proud of) that conducts effective safety investigations and risk mitigation - will it continue to evolve with the times and the feedback you get on it?

TJCC response: Thanks for the compliment, but the tool (if you're referring to the

Maintenance Error Decision Aid (MEDA) tool) is in fact the intellectual property of the Boeing Company.

10. Is it not possible that some unruly individuals (bad apples in the cart/airplane in this case) might exploit 'just culture' for their own gain e.g.: shift the blame off them when an incident is in fact their fault and not at all the organization's fault. Does this then expose perhaps a flaw in the concept of 'just culture?'

TJCC response: This can occasionally happen…it's infrequent but has been a historical characteristic of any voluntary safety program where some kind of incentive is offered in exchange for a safety report where it might not otherwise have been obtained. It's not an indicator of a flaw in the concept of Just Culture, but rather is simply an indicator of the less attractive portion of the human condition that desperately desires to protect itself, even occasionally at the expense of others!

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Till next month,
Grenville Hudson and the Aviation Safety Community team

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OUR VISION IS SAFETY THROUGH KNOWLEDGE

August 2022 - Edition #5

This Month's Focus Is: **SAFETY ASSURANCE**

This Month's Topics

•   *Next month's Aviation Safety Community Safety Leadership Forum speaker*
•   *An overview of safety assurance in aviation safety management systems*
•   *Interview with Grenville Hudson discussing aspects of safety assurance*
•   *Three things you should consider when auditing your safety management system (SMS).*
•   *The Aviation Safety Community releases new Automation module*

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● Access to past Safety Leadership Forum livestream recordings and presentations
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Next month's Safety Leadership Forum speaker

Our next speaker at the Aviation Safety Community Safety Leadership Forum for September 2022 will be Jerry Allen. Jerry Allen is a Senior Advisor at The Just Culture Company*, working with organizations from a wide variety of industries to achieve better outcomes through the application of the Workplace Accountability, Root Cause Analysis,*

and Highly Reliable Outcomes models. He has taught numerous training and certification courses to leaders looking to implement Just Culture accountability and learning systems in their organizations. He has three decades of experience in the high-consequence world of commercial transportation, earning two international awards for his work in aviation safety and human factors. Jerry has guided multiple Just Culture implementations across high-risk industries both as a member of two organization's leadership teams and as a Just Culture Company Senior Advisor.

In his industrial aviation work, he oversaw the strategic management, assurance, and continuous improvement of the Bristow Group's Safety Management System (SMS). His work included creating and implementing new groupwide Just Culture policies and Event Review Group (ERG) processes, including providing ERG support to regional leaders following training, and tele-coaching leaders to ensure new processes and tools were used consistently across the Group.

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Click here to book tickets for the Safety Leadership Forum

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WHAT YOU GET

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- Access to all Safety Leadership Forum events
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Overview of Safety Assurance in Aviation

At the August 2022 Safety Leadership Forum, we had a presentation on Safety Assurance and its role within an aviation safety management system. The video of

the full presentation and the presentation slides are available on *.*

Safety assurance (SA) is one of the four pillars of safety management systems, as such it plays a crucial role in aviation safety which cannot be ignored and must be present in every safety management system. It directly interacts with all aspects of the safety management system. Just like the other pillars, safety assurance is scalable to the size of an organisation and the safety resources available.

The purpose of safety assurance is to ensure that your safety management system is functioning the way it is expected and that safety levels within an organisation is improving. Three elements that make up safety assurance are:

1. Continuous Improvement

2. Management of Change

3. Safety Performance

Regardless of the size or complexity of an operation these three elements need to be present within the safety management system for it to function efficiently.

A Closer Look at All Three Elements of Safety Assurance

Let's take a closer look at the three elements of safety assurance and more specifically what each element means for aviation safety:
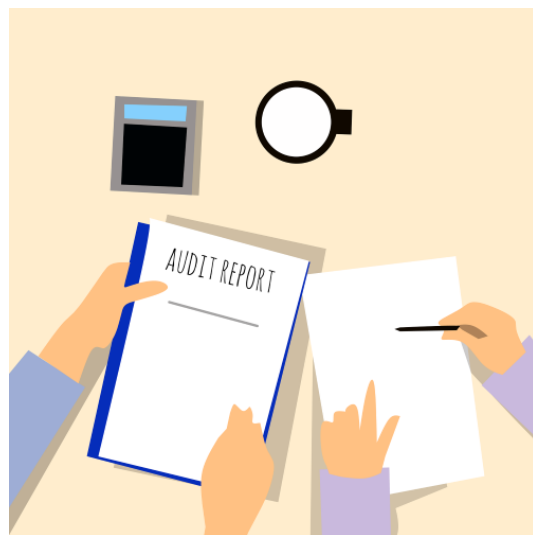
Continuous Improvement

The key activities that support this element includes the following:

- *Safety reporting and safety investigation*

- *Auditing*

- *Data analysis – e.g., Flight Data Analysis*

- *Process design Monitoring*

Change Management

The introduction of change within an organisation is also the trigger for introducing new risks into your operation. Management of a change will ensure that risks are assessed and managed through risk mitigation strategies, and it will reduce disruption to the business. Change can either be planned or forced upon an organisation. Change can be very dynamic in a small organisation as less people are impacted by the change and communication lines are typically short, it's what gives smaller organisations their operating edge. Communication is key in the management of change.

Safety Performance

Safety performance is the mechanism that identifies how successfully the organisation is at meeting the safety objectives that it has set within the organisation. The old quality management adage of "if you can't measure it then you can't manage it" applies here. Determining what should be used as a safety indicator is quite often easier said than done and the measurement of the performance indicator must have a tangible meaning.

Interview with the August 2022 Safety Leadership Forum speaker – Grenville Hudson

1. With your background and experience what would you say are the main issues impacting safety assurance in aviation?

I think that safety assurance quite often becomes the weakest of the four pillars in an operator's safety management system. Safety assurance impacts on all areas of an SMS, for example safety reporting, safety investigation, policy and objectives, hazard identification and risk management and safety promotion. Safety assurance is not just about auditing the safety management system. It is also about capturing relevant data related to your safety objectives and using your safety reports and investigations to drive continuous safety improvements. It also underpins the management of change within an organisation.

2. What would you personally like to see more of in safety assurance in aviation?

Safety assurance can be resource intensive so any systems that can be used to automatically facilitate data collection and presentation is a bonus. Also, when an organisation develops safety related procedures there needs to be implanted within that

procedure or process a means of assuring that it is doing what it has been designed to do, maybe safety software can help in this area.

3. With automation and newer technologies on the horizon like AI, how do you think this will impact and perhaps even totally change safety assurance?

There are software solutions out there to help an organisation with its safety management but I am not aware of the use of AI by any commercial safety management systems at the moment. AI is being used in some maintenance organisations as a means of predicting potential component failures based on real time data analysis, this does impact on safety without a doubt. Predictive safety is the safety Nirvana and it is data driven and is really an extension of continuous improvement which is one of the key elements of safety assurance. The challenge is capturing real time safety data.

5. ICAO states that the three elements of safety assurance are safety performance indicators, change management, and continuous improvement. Do you feel that these are enough or should there be more elements?

I rather like ICAO's approach to safety management systems, their published information is very good and it is always improving. The good thing about it is that it goes right across the aviation industry and ensures that there is a consistent approach by all operators and state authorities. These three elements of safety assurance really penetrate all aspects of an organisation's safety management system to give a good view of how the SMS is working.

6. Do you think in Australia with its high aviation safety record that overall aviation organisations and companies abide by ICAOs elements?

As you know the regulations relating what we used to call RPT, charter and aerial work are under change at the moment with the introduction of CASR Parts 119, 121, 135 and 138 which in turn aligns us more with ICAO and other State regulatory authorities. This is a huge challenge for the industry and the effect of having safety management systems in operation with all commercial operators is yet to be realised. In Australia there are about 720 AOC holders and of these only a small percentage currently have an SMS in place within their organisation. We should not be too smug about Australia's safety record, let's face it our traffic levels are low compared to the USA and Europe plus our weather is benign most of the time and we are a flat country with our highest mountain being a bit over 7300 feet.

7. If there's a breach in safety assurance does this instantly make it an aviation safety breach? Can you provide an example?

This is an interesting question. The various elements of safety assurance can be viewed as being defence barriers, if you remove a defence barrier then you are reducing your safety levels. If you looked at an organisation before it sets up a safety management system you will find the safety assurance elements are to an extent already in practice. This has happened through the organic growth of the organisation in complying with regulations and protecting themselves from going out of business, perhaps the term for this is their natural level of safety. By formalising the safety assurance elements and associated processes within the organisation you are lifting the organisations level of safety to a higher level.

8. Safety assurance in theory is supposed to identify hazards before they happen but isn't it also a fact that when hazards do happen they make 'safety assurance' stronger? (e.g.: With the sinking of the Titanic. As a result, all ships by law were required to carry lifeboats. The same goes for 9/11 and heightened security across airports. I am not endorsing hazards here, just making a point!

The hazard is always there, it is the consequences that may occur as a result of the hazards and other conditions that need to be managed, sometimes these conditions are not apparent and are termed latent conditions. The significance of the combination of the hazard and conditions is not always obvious unless you can connect them to a possible outcome (consequence). Once this connection is made then the risk can be assessed and then managed using one of the three controls – avoidance, reduction, segregation - which in turn is a means of achieving continuous improvement.

9. In safety-related investigations how much of a part does safety assurance play? Should it play a bigger part perhaps?

Safety investigation is part of the continuous improvement activity. Investigation within itself can become incredibly resource hungry, I don't think that it is possible to have enough resources when it comes to performing an investigation but the reality is that you are constrained. This constraint can quite often limit the depth and accuracy of the investigation. Organisations need to place a limit on the time and resources spent on safety investigation, you really need to be able to take advantage of the knowledge base within the organisation and not have the investigation hinge on just one person. By doing this you can expand your investigation capabilities. Another thing to consider is that as an organisation you may set safety investigation targets that are unachievable, for example,

you may want to fully investigate an event that has been risk rated at the intolerable level within three days of the event but this may not be possible because you have not got sufficient resources or your resources do not have the right skill set. Now we are entering into the region of safety performance another element of safety assurance.

10. Do you think that safety reports and reporting are comprehensive enough for safety assurance? How often are reports reviewed? Is there freedom of information restrictions around them especially after a certain time has elapsed?

Safety reporting is also part of the continuous improvement element. An essential part of reporting is being able to give the person reporting a confidential report option. If the report is confidential then it is the responsibility of the safety manager to ensure that the report is sanitised and deidentified so as the individual who made the report is in essence invisible. Confidentiality in a small organisation, say up to twenty employees, is very difficult as everyone usually knows what has happened and who it involved. So, the fundamental that will make a safety reporting system work is trust, if there is no trust then there will be no reporting. The person who has submitted a safety report should be acknowledged by the safety manager within the first 24 hours of receiving the report. The final findings associated with the report and any actions taken need to be advised to the person who submitted the report before the report is closed. Again, this enters the realm of safety objectives and safety performance and you may set safety performance indicators around the closure time on safety reports.

11. Is there anything else you would like to add that hasn't been covered here?

I think that one other aspect that we have not discussed is the use of external resources within your safety management system. As an example, you could use an external audit process to bring a fresh set of eyes on the operation of your safety management system. When we set up an SMS it is very hard to not get emotionally involved with its operation. Having someone from outside your organisation audit you separates out that emotional closeness and gives you a better idea of where the weaknesses are within your SMS. Also, the use of external investigators can help remove workplace relations issues by having an independent investigator that cannot be swayed by relationship bias and can just simply report the facts.

Three things you should consider when auditing your safety management system (SMS).

Safety auditing can quite often be shunned by an organisation, one of the main reasons for this is that it can be a resource hungry activity and it does require trained auditors with a level of knowledge of what they are auditing. Another is that in the early days of quality systems auditing had a bad reputation for being associated with punishment for not adhering to procedures. Today this attitude has changed and auditing is seen as a means of helping organisations and their personnel meet their objectives. Here are three things that you should consider when developing your company's auditing.

1. Structure your safety audits:

You need to develop an audit program that matches the resources you have available to you. The audit program can be spread over a two year time span and can be cyclical. Align your audit program with the four pillars of safety, i.e., try to audit each pillar as separate audit. This works best for small companies as you could spread four audits over two years. Larger organisations with more resources available could break out the elements in each pillar of safety and audit each of these over two years. If you want help developing a check list look at CASA Form 1591*.*

2. Use trained auditors:

You will get the best results from your auditing activity if you use people who are trained in auditing and have background knowledge of what you do as a business and operation. In other words use your people to be part of the auditing activities once they have been trained in auditing processes and techniques. Larger companies may require auditing to be performed by a team of auditors. In this case there will need to be a Lead Auditor to run the team, these people will require special Lead Auditor training.

3. Use External Auditors to get an independent view of your SMS:

It is a good idea to schedule one audit a year of your Safety Management System using an external auditor or auditing company. It will provide an unbiased view of your SMS and will give a fresh perspective of possible improvements you can make to your SMS. An annual external audit will improve the integrity of your safety management system.

The Aviation Safety Community releases new Automation module - Human Factors and Non-Technical Skills training program

At the end of July 2022, the Aviation Safety Community released its new Human Factors Training Module on Automation. With the ever-growing demand for air travel, automation in the aviation industry has become a necessity. While it comes with many advantages, it also has the capacity to pose significant risks. This presents a new set of challenges and modern pilots, flying modern aircraft, need to be trained accordingly and have the appropriate knowledge and tools to allow them to do this safely.

Through this module, users can gain a comprehensive understanding of the benefits and risks associated with using automation, and to learn the strategies that can be utilized to mitigate the risks of automation use. This module also covers the following topics:

• Automation dependency
• Automation complacency
• Startle Effect
... and more.

To view more information about the Automation module, click HERE. The Aviation Safety Community will continue to introduce new modules - visit our Human Factors and Non-Technical Skills training program course list HERE.

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Till next month,

Grenville Hudson and the Aviation Safety Community team

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This Month's Focus Is: **HUMAN FACTORS AND AUTOMATION**

This Month's Topics

- *Automation and Human Factors – Four Things to Consider about Automation*
- *Robot Co-Pilot*
- *Interview with Stephanie Workman*
- *Safety Reporting - Seven Key Factors that Improve Trust*
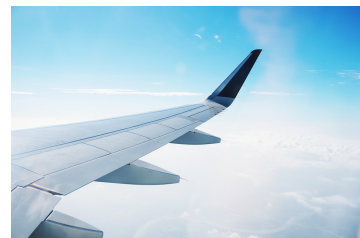
To ERR Is Human

It's well known in the aviation sector both here and globally that at least 70% to 80% of accidents are attributed to human error *like poor maintenance, fatigue, complacency, inadequate training or supervision and lack of proper communication. This percentage is alarmingly quite high and so quite disturbing. The discipline of human factors aims to reduce this percentage as much as possible and make aviation safer. Although we will never be able to completely remove human error from aviation unless we ground flights completely which isn't tenable as an industry, we must do everything we can in our power*

to reduce human error as much as possible in aviation. This attitude and strong stance apply to just about every industry on the planet as wherever there are humans there is bound to be error and accidents.

Fact: The Chernobyl accident in 1986 was a human factors issue. **A flawed reactor design that was operated with inadequately trained personnel who were also fatigued at the time due to lack of sleep caused one of the world's worst nuclear disasters of all time.**

AUTOMATION and HUMAN FACTORS

The aviation industry has seen a significant advancement in terms of automation, and in the upcoming years, it is only going to get bigger. Automation saves a lot of manual labour and is all about efficiency but it's not without problems and errors when it comes to human factors.

Four Things to Consider about Automation

1. Automation has changed the role of the pilot

In the early days of aviation - pilots were lauded for their daring, bravery and manual flying

skills. These days - air travel is considered one of the safest forms of transport. The job of the pilot is now heavily centred on monitoring the equipment that is actually flying the aircraft, which can do so with a high level of accuracy over a prolonged period of time. This has fundamentally changed the role of the pilot - improving safety in many ways, but also creating other challenges and risks.

2. Automation mitigates some risks, but introduces others

As technology has improved, flying has become safer, but human factors remain a stubborn constant. Automation can now fly evasive traffic manoeuvres, emergency descents, and land airliners more accurately than people can. Pilots monitor these complex and reliable systems over many hours, and given humans are not traditionally great at monitoring - a new set of challenges and risks are introduced. Automation complacency and dependency are two easy traps to fall into - and whilst malfunctions or unintended events might be rare, they can be significant.

3. Training needs to continually adapt to match emerging technology

Thanks to the changed role of the pilot and the introduction of new risks, pilot training should adapt to reflect this. This training needs to include proper use of the autopilot, effective monitoring techniques, and also address the loss of manual handling skills that comes as a result of prevalent automation use. Manual flying skills can be especially problematic in abnormal situations which require certain handling techniques that are rarely practised. An added complication is recognising that in-flight skills practise can affect the safety of the operation - so utilisation of simulators and clear and careful guidelines as to how this can be done as safely as possible is essential.

4. Sometimes - manual flying might be better…

There are different levels of automation - including basic flight director guidance, or fully managed guidance systems that can adjust various flight factors according to programmed information. The highest level of automation is not necessarily the most appropriate. Pilots can find themselves responding to unusual or unanticipated scenarios by trying to reprogram the flight guidance systems, when perhaps, disengaging the autopilot and manually flying the aircraft might be easier, and safer.

Robot Co-Pilot Successfully Flies and Lands Boeing 737

What requires a shift in perception for many in the airline industry, no matter how futuristic one may be, is a robot co-pilot that's managed to fly and land a Boeing 737 in a flight simulator as part of a US military-funded project. This happened in 2017 and there have been further flights. The Defense Advanced Research Projects Agency (DARPA), part of the US Department of Defense team responsible for the development of emerging technologies for use by the military, is a big advocate for the use of robots in their planes. The next few years will be interesting so do watch this space. Watch the YouTube video *below.*

Robotic Co Pilot ALIAS Flies and Lands a Simulated Boeing 737 - Uploader: Aero Vision

Speaker at the Safety Leadership Forum: Stephanie Workman

We were lucky enough to have Stephanie Workman as the guest speaker at our June Safety Leadership Forum, who

spoke on the integration of human factors into safety management systems. Stephanie has a rich and diverse aviation portfolio. She is an airline pilot, human factors trainer, flight operations safety officer, and flight data analysis program pilot. She is in the process of writing a new safety module on automated systems for the Aviation Safety Community Human Factors and Non-Technical Skills Training Program. She holds a Masters degree in Aviation Human Factors and a Bachelor of Aviation. In her spare time Stephanie enjoys time with her family and travels.

Interview with a Human Factors Trainer: Stephanie Workman

This month we were lucky to interview our guest speaker Stephanie Workman.

1. What would you like to say here about the integration of human factors into safety management systems?

Human factors integration is an essential part of any system relating to a complex and high-risk industry like aviation. If you are serious about improving safety, then it is important that you appreciate the role of the human in that context and design your system accordingly.

2. What are some of the biggest issues affecting human factors as a whole in aviation? What are some ways we can mitigate this?

I think one of the biggest challenges has been ensuring that pilot training is keeping up with the technological advances being made in aviation. Improvements in technology have certainly contributed to making flying safer, but it is important that pilot knowledge and training accurately reflects the challenges that flight crew actually face when operating modern aircraft.

3. What about automation and its role with human factors? Please feel free to provide both the pros and cons.

Automation plays an important role in the safe operation of complex aircraft, but it has also fundamentally changed the role of the pilot in the flight deck. In order for automation to be used safely, it is important that we have an accurate understanding of, and appreciate the risks associated with its use.

4. Do you think autonomous systems that use AI to manage SMS are or will make aviation safer in the long-term? Please feel free to provide pros and cons.

From what I understand, AI is showing promise in its ability to rapidly process large volumes of data, and therefore rapid risk identification - faster than humans are capable of. This certainly shows great potential in improving safety, but perhaps as a means to augment the role of the human, rather than replace it entirely.

5. My understanding is that you're in the process of writing a new safety module on automated systems. Can you share some information on this?

I believe knowledge is an important mitigation strategy when talking about human limitations, and there is plenty of research available with respect to automation and monitoring. This module aims to provide information on how automation is being used currently in the industry, some of the recognised risks associated with its use, and some resources and strategies that flight crew may find useful.

6. What's your vision and hope with this module for students?

As always - I hope that people find the module engaging and relevant, and that it helps get the discussion going with regards to the safe use of automation in their current operation.

7. Would you personally fly on a plane piloted by a robot or its co-pilot was a robot as Boeing has tested?

I think it will take a long time for the travelling public to accept a pilotless aircraft. Right now, I think there are too many variables for a robotic pilot to be a viable option, and there are still examples where we have relied on human input to successfully land an aircraft following failures that were unprecedented.

8. Where do you see the future of aviation when it comes to the overall safety and the role of human factors?

There has been extraordinary progress in aviation, and the improved safety of air travel reflects this. Our knowledge and appreciation for human factors in aviation continues to grow, and I believe that this can only help to make flying even safer.

Keep Those Reports Rolling In…

Safety reports are the life blood of a safety management system (SMS), without safety reports SMS will not be able to function and improve an organisation's safety. If safety reports are not submitted, the safety management system will not keep up with the ever-evolving nature of hazards and risks and will be ineffective without the constant flow of information provided in safety reports. It is essential that an organisation's management promotes safety reporting and must develop trust with its employees. Staff will report if they trust in the system. Trust and reporting go hand in hand, without trust staff will not report, and without reports management will not be able to improve processes which results in a breakdown of trust. Trust and reporting are an endless cycle - increased trust will lead to increased reporting, which in turn will improve safety outcomes. Trust can be maintained and improved by management taking observable and effective action when reports are received.

This trust is built on many things, and here are a few of the key factors that improve trust and promote safety reporting:

- *Just culture*
- *Simple and accessible reporting system*
- *Training*
- *Confidentiality*
- *Formal investigation (or review) relating to the safety report*
- *Implementation of corrective actions*
- *Written feedback to the reporter and all employees*

Just Culture

Just culture provides a foundation for promoting safety reporting within an organisation. Just culture ensures that there is a focus on systems and system failures, rather than individual 'failures'. An organisation with a just culture accepts that people make mistakes and that learning from mistakes is more important than blaming an individual or team for a mistake. A just culture will ensure that the outcome for an honest mistake is not to punish, its aim is to improve the employee's capability and standing through learning and training. In the case of acts of negligence, the employee may still be held to account for their actions. For a just culture to exist, the organisation should draw clear lines between what is they will accept, and what is considered negligence. Just culture has been associated with learning cultures and is known to foster learning as it takes into consideration 'how' unsafe acts occur (without focussing on 'who' performed the unsafe act).

Reporting Systems

It has to be easy to make a safety report. Paper system can work but simple low-cost safety software such as SHEQ2GO make the whole reporting process super easy. Most software solutions provide ready access to a report form either through a desktop/laptop computer or an electronic device such as a mobile phone, iPad android tablet.

Training

Training builds confidence and trust. When it comes to safety reports the most basic training is how you submit a safety report, what you should report, how just culture is applied and what the company does when a report is submitted.

Confidentiality

This can be tricky, especially within a small organisation where everyone knows when something has gone wrong, or not to plan. At all times the individual must be protected and reports will need to be deidentified. Building a strong team where there is a high degree of trust between team members can assist with overcoming confidentiality concerns and assist in promoting safety reporting. It's also important to note the difference between confidential reporting versus anonymous reporting, the former is always preferred (and sometimes mandated).

Formal Investigation

Once a report is submitted an acknowledgement should be sent to the reporter thanking

them for the report and advising them what course of action will be taken. Some reported events may not need to be investigated as they pose an acceptable level of risk within the organisation's operation. In this case you may file the report in your database for future reference and trend monitoring purposes, where no further action is required, the report may be closed out. Other events will need to be investigated as they pose an unacceptable level of risk. The person who made the report needs to know if you will investigate and it is also advisable that they are aware of any key outcomes after the completion of an investigation.

Implementation of Corrective Actions

It is essential that all the recommendations that come out of an investigation are acted upon by the organisation. The best forum for managing this is through the Management's Safety Committee, it needs to be a fixed agenda item within this type of forum. A formal review will determine what recommendations should be acted on and what corrective actions need to be taken (including by whom, and a due date). The implementation of all corrective actions can then be managed through the Safety Committee. The people who submit safety reports, and employees in general, want to see action as a result of them making the report.

Feedback

Closing the report loop means providing the reporter and all members of the staff with feedback of what was reported. They want to know what occurred and the root cause and contributing factors, they want to know what action the company has taken or will be taking. Without the feedback they will not feel motivated to make another report. This information can be relayed directly to the reporter and can be notified to all employees through a safety newsletter. This relates to lessons learned and is essential to maintaining a just culture, building trust, and, more often than not, encourages staff to continue reporting.

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Till next month,

Grenville Hudson and the Aviation Safety Community team

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This Month's Focus Is: **RISK MANAGEMENT**

Speaker at the Safety Leadership Forum - Natalee Johnston

This month Natalee Johnston, Director of Assimilated Safety and Skilful Decisions spoke on risk management. Natalee was the first female pilot in the Royal Australian Navy. She has extensive and unique experiences gained during her 24 years in the Navy in leadership, facilitation, and safety. She is a helicopter instructor, flight commander, executive officer, operations manager, auditor, and safety professional with an array of skills under her belt. She holds a Bachelor of Science degree in Physics, Post Graduate certificate in Accident Investigation and a Master's in Business among a number of other academic qualifications. Natalee is passionate about educating and sharing experiences to enhance organisational safety, risk management and the importance of setting a positive culture. You can access the recording of Natalee's presentation and her presentation material by signing up as an Annual or Corporate Member on the Aviation Safety Community website.

Risk Management & The Four Safety Pillars of SMS

Risk management is a central component of safety management systems and is one of the four pillars of a safety management system.

The risk management process can be found in all businesses, not just aviation. In aviation we need to formalise risk management and document it as part of our safety management system. Risk management does not require the complete elimination of risk though sometimes this is possible. In aviation we manage risks to a level that is "As Low As Reasonably Practicable" (ALARP).

Risks basically fall into one of three levels of risk tolerability based on their risk rating:

- *Intolerable Risks*
- *Tolerable risks*
- *Acceptable Risks*
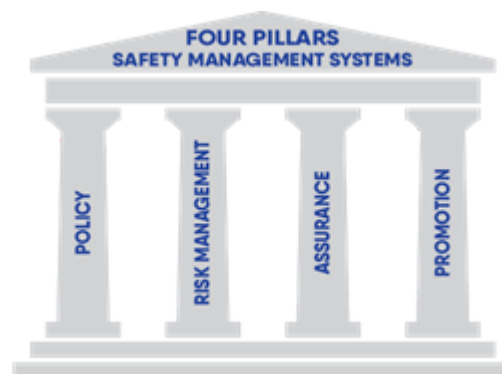
The risk management process is a cycle of Hazard Identification, Risk Assessment, Risk Mitigation and Risk Review. The cyclical flow chart above shows the process.

1.   Hazard identification – a hazard is something that has the potential to cause harm. For example, the wind blowing at an airport could be a hazard. If it is too strong or acting as a crosswind on a runway it may cause a landing aircraft to experience a runway excursion.

2.   Risk assessment - Identified hazards are assessed in terms of the likelihood and severity of a bad consequence occurring. The assessment process rates the risk in terms of a level of risk that is rated in terms of a number score, or a combination of numbers and letters taken from a risk matrix.

3.   Risk mitigation - If the risk is considered to be unacceptable, then control measures are taken to strengthen and increase the level of defences against that risk or to avoid or remove the risk, if this is feasible.

4.   Risk Review – Once you have reached a level of risk that is considered to be ALARP, review the remaining risk, your mitigation controls may need to change over time as the business changes.
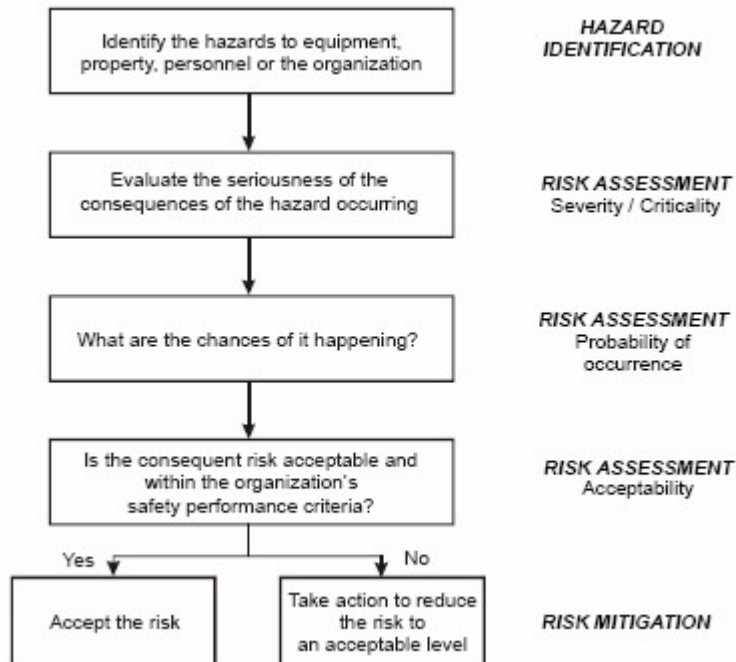
Risk Management process (extracted from ICAO Doc 9859 - Safety Management Manual)

The risk management process functions best when a team approach is taken. The more participants in the process then the greater the validity of the assessment and the more ideas on practical forms of risk mitigation are possible. Once the risk assessment and mitigation has been determined we are left with the residual risk.

Whilst the objective of risk management in aviation is to ensure that the risks are identified, assessed, and managed in the best possible way, the objective of residual risk is to accept an element of risk that cannot be eliminated but at best can be mitigated effectively with the right response and strategy. This is more realistic and practical than the total elimination of risk as previously mentioned.

One of the key elements of a safety management system's risk management process is the establishment of a Hazard Register. This register provides a snapshot of the risk profile of a business and must be reviewed on a regular basis, at least annually. It helps to categorise the hazards into categories such as:

- **Natural – weather, geographical, geophysical trauma, and pandemics**
- **Technical – aircraft, components and systems, equipment, and external systems**
- **Economic – cost of materials and equipment, growth, and recession**

The hazard identification, risk assessment, risk mitigation and risk review process can be greatly assisted using safety software solutions. There are many software platforms out there and which one you choose will depend on the size and complexity of your organisation

and the number of users.

What Does Fatigue Look Like From a Risk Perspective?

The risks that materialise from individual's being fatigued can vary significantly depending on individual factors and the work they are undertaking. Different people will respond differently to fatigue. Amazingly there have even been genes identified that mean some of us are more vulnerable and others are more resistant to fatigue. One of the most important things for organisations and their people to realise is that signs and symptoms look different for individuals. One person may yawn and have trouble with their vision, whilst others might have a mild headache or starting to take increasing risks.

There are some common signs and symptoms that shouldn't be ignored and as parts of the brain "shut down" once a time-awake threshold has been reached the first part of the brain to stop firing is the emotional centre of the brain.

Therefore, it is not uncommon to notice emotional signs of fatigue such as impatience, aggression, frustration, feelings of being overwhelmed, unmotivated. As we are well aware, fatigue is linked to performance impairment. What this looks like can link back to the signs and symptoms (making errors, poor hand eye coordination, risk taking, poor speed management) and depending on the task the risk profile will start to change.

Important Reminders about Fatigue

We also like to remind people that risks associated with a commute home (and indeed a commute to work) should also be taken into consideration when managing fatigue related risk. So, from a risk perspective, fatigue related outcomes can vary significantly and the types of errors that can be made due to fatigue should be identified as part of an

organisation's fatigue risk management (FRM) processes. Organisations should assess the types of errors and the associated outcome of these errors; this process of risk assessment will ensure appropriate risk controls are deployed.

Mitigating Fatigue in Workplaces – Best Practices

Because individuals vary in their sleep and fatigue profiles (i.e.: some need more/less sleep than others and may exhibit more/less impairment in their performance and may vary in fatigue tolerances), educating the workforce is essential. If individuals can identify their own signs and symptoms and begin to understand how their own body works, they can then take very proactive and effective steps in managing their fatigue and sleep. Unfortunately, the more fatigued someone is, the less likely they are able to recognise their fatigue – for individuals to be aware of this can start to shine a light on the nature and sometime non-intuitive nature of fatigue and fatigue risk management.

Education and information to employees undertaking work that may lead to a fatigue-related risk should be a high priority for organisations. Employees should not only understand the physiology and psychology of sleep but also, understand what risk controls the organisation applies to FRM and importantly, that all employees appreciate that for FRM to be successful, it has to be a shared responsibility, everyone has a role to play including leaders, rostering staff, supervisors, contractors, crew.

It's critical that FRM is a multi-layered approach, it has to be mitigated at multiple levels and angles. Some common controls include:

- *Self-assessments*
- *Biomathematical tools*
- *Medical assessments*
- *Education and training*
- *Promotion*
- *Governance and monitoring activities*
- *Reporting*
- *Roster monitoring activities (including planned versus actual analysis)*

Remember that FRM should aim to be data driven and risk based, therefore controls will continue to evolve as new data comes to light about risk exposure. Integrating FRM with a Safety Management System will improve the management of fatigue-related risk.

Interview with Natalee Johnston from Assimilated Safety and Skilful Decisions

For this month we were lucky to get an interview with our Safety Leadership Forum guest speaker Natalee Johnston and here is what Natalee had to say:

What is your aviation background and how many years have you been in the industry including your business Assimilated Safety?

21 years military aviation experience - fixed wing, single and multi-engine helicopter pilot, helicopter, and ground instructor. Civil - CPL (H), PPL, Grade 2 Instructor (H). In Aviation safety - Accident investigator, Human Factors and risk management facilitator, Quality auditor.

Assimilated Safety provides a service to all industries to review current practices and policies, assist in identifying areas for improvement. Then by using the principles of Non-Technical Skills (Human Factors) and Risk Management to improve organisational communication, leadership, followership/teamwork, and business functionality. Assimilated Safety offers an aviation and safety specialty service in developing/implementation and review of an SMS, including NTS and RM training, developing and/or refining safety reporting, safety event investigation, analysis, and review. Skilful Decisions - provides a service to improve decision making across industries, businesses and for individuals. Using risk management and human factor principles to improve emotional intelligence, understanding of bias and basic information processing.

What is your definition of risk management?

Risk management is a key pillar of an effective SMS, so you want to get it right. There are two parts to risk management: Preventing the event and Recovery controls. RM provides the implementation, management, and continuous improvement for an SMS. RM focus in an SMS should be as a proactive tool for the prevention of incidents/accidents. It can be likened to cars and driving. Prevention is stop signs and traffic rules and control is airbags and safety belts.

Do you think that 'risk' can ever be completely eliminated in aviation?

A safety-first mindset is something that sounds great on paper but in the real the real world there are so many factors, such as – money obligations, appeasing a client, general pressures, that it becomes hard to have and maintain safety. But if you have a good risk management process in place this can serve as your warning system. It's a red flag, your dashboard in your car telling you're your low on petrol. From here you can take the right steps in mitigating it. So, it's important to put time and money on good a risk management process that helps keep you safe and improves your reputation. It's an investment that pays off. You shouldn't cut corners and skip it. It's equally important to keep reviewing it consistently and improving and changing it as times change.

What is your view on ALARP as its being implemented today? Can be both good, bad, and neutral. Feel free to give input on how it can be better implemented.

Sometimes organisational policy creates the drive for people to start with the acceptable risk level then work in reverse to make the consequence and likelihood fit. Also, there can be a tendency to stop looking at the risk once you reach low or very low and not keep applying controls or mitigations to reduce the risk as far as it can reasonably go to. Achieving residual risk as Low should not mean you stop trying to reduce it further.

ALARP is reached when there are no further controls or mitigations, within the organisations control and/or ability, that can be applied to the risk/hazard. If mitigations or controls are identified that could reduce the risk further but are not within the control, ability of the organisation to apply it is worth noting these - as in the event finances, organisation ability changes it can be then added and reduce the risk further.

ALARP is an internationally recognised aviation safety term. In Australia the work health and safety (WHS) equivalent as required by the 2011 Work Health and Safety Legislation is the term "So Far As Reasonably Practicable". No difference between the two. You won't ever be able to completely eliminate risk in aviation. You cannot factor in every scenario as its

impossible. But you can design sound risk management practices that help you prevent or at least greatly reduce a fatality. Remember it is an unfortunate truth that if the right negative factors line up and a decision is made up it can be catastrophic.

What's your view on AI and risk management?

Even with modern technologies like AI you can't be complacent as things are still controlled by a human. You need to embrace changing times, as change is already here with so many aviation companies using AI. Much automation can make things easier in the aircraft and in ground jobs. We need to as instructors assist our students in managing the distractions, and incoming information. There's a shift in focus from person to machine to machine to person. You need to understand how it applies to the aviation industry as a whole and your part in it. But a branch of issues will come with it so be prepared.

Who do you think is doing risk management really well?

Australia but it's complicated for small players organisations as there is just so much to keep up with to stay compliant that it becomes really difficult. On the other hand, it's so much easier for big organisations like airlines. In Australia they have great safety and risk management processes in place. There needs to be a balance between the two. We are starting to see now that in America risk management has become mandatory for engineering companies like Boeing. Safety risk management didn't have to be in place before for engineering companies. Important to state that positive change comes out of accidents like tougher and better regulations and policies.

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Till next month,
Grenville Hudson and the Aviation Safety Community team

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flightlogics

This Month's Focus Is: **HUMAN FACTORS**

Welcome to our second edition of the Safety Flyer newsletter. This month, we are focusing on the topic of human factors. As we approach the end of 2021, we would like to thank all of you, our members, for supporting the Aviation Safety Community. Stay tuned for all our announcements coming very soon. Our next Safety Forum event will be on February 18th, 2022. We look forward to seeing you there.

On behalf of the Aviation Safety Community team, we want to wish you and your family a very safe and happy Christmas and New Year.

Overview into Human Factors

The term 'human factors' (HF) has become increasingly popular in aviation as the industry acknowledges that human error, rather than mechanical error is responsible for most aviation accidents and incidents. It's been estimated that approximately 80 % of airplane accidents are due to human error (such as pilots, air traffic controllers, and mechanics). This naturally poses a dilemma for the aviation industry and as a result many best theories, processes, and practices, have been put forward like fatigue risk management technologies some of which will be discussed here to help mitigate the human factors issue.

In aviation, human factors are about establishing how humans can most safely and efficiently be integrated with the technology. This can then be translated into

design, training, procedures, or policies, to assist humans to perform better. CASA has a whole chapter dedicated to human factors – chapter 8*.*

The 12 Human Factors

Psychologists have identified 12 main human factors which can act as precursors, to accidents or incidents. They are essentially 'risk factors'. Please keep in mind these are not just aviation bound, they can also apply to other industries. Please also note that as society evolves and changes and further research is conducted more factors will be identified. But for now, let's just focus on the 12. It's important for aviation to understand these human factors. It's only through understanding them that proper human safety training and risk management can be developed. Without further ado, here are the 12 human factors:

1. *Lack of communication*
2. *Distraction*
3. *Lack of resources*
4. *Stress*
5. *Complacency*
6. *Lack of teamwork*
7. *Pressure*
8. *Lack of awareness*
9. *Lack of knowledge*
10. *Fatigue*
11. *Lack of assertiveness*
12. *Norms*

Insider Knowledge – Since the 1960s Boeing has been a real pioneer in dealing with human factors as they employed human factors specialists, many of whom are pilots or mechanics to further help understand and mitigate risk and human error in aviation. Perhaps in the future, all flight schools and aviation companies world-wide will make use of such specialists.

Mental Health & its Impact on Human Factors

Mental health is such a huge and important issue which cannot be ignored in aviation. After all it has such a significant bearing on overall human factors, human error, and risk. No discussion of these would be complete without acknowledging mental health in its entirety. Thankfully in recent times mental health is being acknowledged more *in the aviation industry. However, it still does come with some stigma unfortunately mostly due to lack of proper*

understanding, education, and information.
But as society and paradigms change so does the way
mental health is addressed and dealt with. Our wish is
for mental health to be addressed and dealt with in a
most respectful and dignified manner. When it comes to
aviation specifically COVID-19 has been the single
biggest disruptor to the industry which has naturally
impacted mental health in a negative manner for many
aviation professionals. Even Post COVID, mental health
is still being impacted with the increasing uncertainty
and overall transitioning back to work after many
months off. A roadmap is being developed to navigate
this in the best possible manner.

If you or a colleague or a loved one is struggling with
mental health, please know that 1) it is part of the human
condition just like any illness 2) there is help available.
Please check out the following resources:

- *SkyFamilies (aviation specific)*
- *Lifeline*
- *Beyond Blue*
- *Black Dog Institute*
- *Men's Helpline*

Fatigue Risk Management Technologies

Biomathematical Models

The aviation industry continues to make major
investments in training, equipment, and systems to deal
with human factors. One of these major areas of
investment is in biomathematical models which have far
reaching implications for the global aviation industry but
also for other industries.

Biomathematical models are tools for predicting
crewmember fatigue levels, based on a scientific
understanding of the factors that contribute to fatigue.
They form an optional component of a broader FRMS.
All biomathematical models have limitations that must
be understood to ensure their appropriate use within an
FRMS. Some of these biomathematical models and
some are truly cutting edge. Which ones are you familiar
with? Which ones would you like to trial for yourself and
your company?

Boeing Alertness Model
Circadian Alertness Simulator
Fatigue Assessment Tool by InterDynamics
Fatigue Risk Index (FRI)
System for Aircrew Fatigue Evaluation
Sleep, Activity, Fatigue, and Task Effectiveness
Fatigue Avoidance Scheduling Tool
SAFTE-FAST Tool
Sleep / Wake Predictor (SWP)
Actiwatch
Psychomotor Vigilance Task (PVT)

Other Fatigue Risk Management Technologies & Incentives

Aside from the above biomathematical models we also want to bring to your attention some other fatigue technologies and incentives being developed to assist FRM. Perhaps you already know of these or at least have some idea about them. Some of these fatigue risk management technologies & incentives are:

• *Eye Tracking - sensory technology that makes it possible for a computer or other device to know where a person is looking. In the cockpit it can be used to track tiredness and fatigue of pilots.*
• *Baines Simmons three-day virtual training course on FRM*
• *Hypoxia Training – involves training aviation personnel at reduced oxygen levels (altitude hypoxia) to help mitigate loss of cabin pressurization as occurred with the tragic Helios Airways flight 522 which crashed because of hypoxia.*
• *Blood Test for Fatigue - a simple blood test can detect the pathology of fatigue in the human body, but more tests are required to get in depth information.*
• *Virtual Reality & Augmented reality – are still in their infancy when it comes to this topic so as such currently, they are not deployed for FRM but in other aspects of aviation. However, as technology evolves, they could well be deployed in this area.*

Extra Research on Fatigue in Aviation

Steven R. Hursh, Ph.D. President, IBR and Professor, Johns Hopkins University School of Medicine conducted a comprehensive research project back in 2001: SAFTE/FAST Evidence-based Aviation Fatigue Risk Management. Hursh argued that fatigue modelling tools must do more than just give a fatigue score. They must also estimate fatigue risk, reveal detail of each schedule, calculate fatigue factors, and provide context of conditions which lead to fatigue so mitigations can be implemented by an FRMS. He identified the following major fatigue factors:

• *Time of Day: between midnight and 0600 hrs.*
• *Recent Sleep: less than eight hours in last 24 hrs.*
• *Continuous Hours Awake: more than 17 hours since last major sleep period.*
• *Cumulative Sleep Debt: more than eight hours accumulation since last full night of sleep (includes disrupted sleep).*
• *Time on Task/Work Load: continuous work time without a break or intensity of work demands.*

Limitations with FRM Technologies

It is critical to remember that the FRM technologies discussed as well as ones being developed in the future make up just one slice of the risk control pie. They are

no 'silver bullet' in managing fatigue-related risk. But they can deliver some useful insights and when used appropriately in the right context. Using these tools, especially in conjunction with other data, can provide powerful risk identification and assessment that may otherwise have not occurred, and ultimately lead to managing the associated risk.

The reality is a multilayered approach is required to mitigate fatigue and the issue of human factors in aviation. Mitigations involve good education, awareness, governance activities, medical assessments, consultation activities, crew occurrence reporting, and more. Like with all technologies there is much prototyping and testing that must occur before they become an accepted and viable solution.

The 'Non-Human' Side of Human Factors

With technology developing at such rapid speeds its naturally got many futurists thinking and even predicting of non-human technologies to mitigate human factors. When it comes to aviation some of these non-human technologies consist of increased automation, pilot less planes, AI and even robot aviation personnel like robot cabin crew. It may sound like something straight out of science fiction but remember that all too often science fiction becomes science fact even if it takes many years to occur.

Hypothetically speaking even if pilot less planes and robot cabin crews became the norm in aviation it still does raise the issue of human factors. These technologies are designed after all by humans so you can't eliminate humans entirely from the equation. As with anything designed by humans there will always be limitations. In addition, it's fair to argue that most people will always want a human pilot and human crew on flights.

Interview with an Expert

Safety Flyer spoke with Dr Matt Ebbatson, Senior Lecturer and Human Factors Researcher at Swinburne University of Technology's Department of Aviation.

1. What would you say are the biggest hindrances/challenges regarding human factors when it comes to aviation safety?

I'd say enabling human and automation to work together reliably (and happily!) in complex systems is the biggest challenge we face.

2. How do we best navigate these?

We support high quality research and embed human-machine integration at the heart of everything we do.

3. What are currently the top technologies assisting the human factors issue in aviation?

That's a big question! I'd say the application of Artificial Intelligence (AI) to extract useful information from huge operational data sets is probably having the greatest operational impact right now, but that's at a very broad level and covers many specific application cases. Biometrics, which is basically measuring the human state and then using that information to control the automation of a machine and in turn optimise performance is coming close to being integrated into the cockpit.

4. Are these technologies universal or in your experience being used a lot across the UK, Australia, and New Zealand?

From my perspective it's the tools that allow us to do better research. Improvements in sensory technology have allowed us to better analyse human performance, and that is exciting. One particularly promising technology is eye tracking which allows us to analyse the position of a person's eye gaze and thus start to infer things about visual attention (and information processing).

5. Do you know of any emerging and perhaps not really talked about technologies that are being developed? (What is the research showing?)

Many! But that's part of working in a university, I guess! I'm particularly interested in the area of cobotics and human-machine teaming (so many names for similar things!) which is exploring how humans may work directly alongside, and cooperatively, with intelligent machine systems. It's very relevant when you consider the ways in which future air vehicles might be operated. This is all linked to AI and we will no doubt soon see this technology applied to aircraft maintenance operations.

6. There seems to be a lot of "fatigue technologies" being developed to make aviation safer. What are your thoughts on these?

Fatigue is obviously one of the more significant threats to aviation safety, so it's good (and natural) that technology is being developed to tackle this threat. I have certainly seen some great technologies which have been around for a while and are reaching mature states. As with every technology though, the key will be how it is translated to the operational environment. It's one thing to detect a fatigue state, another to make a useful intervention (or indeed enable pre-emptive mitigation). Companies like Optalert have developed technologies around measuring blink rates and using specially developed algorithms to detect levels of drowsiness. While this is being used extensively in automotive applications it could be transferable to aviation applications.

Another company, Seeing Machines, has developed technologies that combine human factors and artificial intelligence. While this has been automotive focused, they have recently partnered with Collins to develop eye tracking

solutions for aviation applications. These systems are being placed in Synthetic Flight trainers to assist with pilot training.

8. What are your thoughts on the non-human factor (robots, pilot-less planes, etc) on aviation safety?

A nicely worded question. I watch this sector eagerly. I think perhaps the question should be the other way around though. Aviation safety is an engineered standard which cannot be compromised. So, for me, it's fascinating to see how various 'non-human' systems are being designed to meet those very exacting safety expectations.

9. Are there enough human factors specialists being employed to help with the issue? (Boeing has had a team of such specialists for several decades now)

It's great to see how many HF specialists there are across the industry (although often not under a HF title per se). They're found in a diverse range of roles too. But obviously I would always encourage more HF involvement, specifically at the product/process formation stage rather than incident recovery or redesign stage! (Although that is obviously important too!)

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Aviation
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OUR VISION IS
SAFETY THROUGH KNOWLEDGE

September 2021 - Edition #1

This Month's Focus Is: SAFETY INVESTIGATION

Welcome to our first edition of the Safety Flyer newsletter. Each month we will focus on a particular aspect of safety management. Our intent is to learn from the past, to look at what is happening in the present and to provide a glimpse into the future. We want to keep it light but informative and we are always keen for you to provide feedback through the Aviation Safety Community website.

I hope you enjoy our first edition with a focus on Safety Investigation.

Best Regards,

Grenville Hudson

Director of the Aviation Safety Community

Drone Technology Aiding Safety Investigation

Along with training and risk management, technology has resulted in huge improvements for safety investigation. Newer and ground-breaking technologies are making the investigation process easier and more efficient. Here we showcase one major technology aiding safety investigation: DRONE TECHNOLOGY.

Drones at the Forefront of Investigation

Drone technology, also known as remotely piloted aircraft

systems (RPAS), is increasingly being used for investigations across the globe. A lot of its full capability is still developing as the technology continues to evolve. We can say that drone technology could revolutionise how evidence is gathered, analysed, and then relayed to the wider safety community and the public.

Drones at Accident Sites

The use of drones at accident sites are invaluable for wreckage survey, wreckage search, tree/object height determinations, flight path reconstruction/visualisation, and site safety assessments. Their benefits are:

- Less expensive to operate than manned aircraft
- They can be deployed immediately on arrival
- Images and video viewed live on site
- 3D models of sites can be created
- Safety investigators have full control over images taken
- Drones can be flown close to trees and wreckage without disturbance from rotor down wash
- Operate in low cloud and low visibility conditions
- Drones can be programmed to take overlapping geo-tagged images for photogrammetry
- Large drones can fly long distances to remote or hazardous accident sites

Types of Drones Being Used to Aid Investigation

The most common drone is the DJI Phantom 4 which is very robust and can even be operated by beginners. The vast majority of drones are less than 25 kg. However, sizing does vary with many drones in the 7 kg range and others greater than 50 kg. As technology keeps evolving, we can expect to see smaller drones in the future which can complete more complex data collection. After all, we see this trend with so many technologies which start off big and then gradually become smaller — computers, phones, and televisions.

Equipment Used in Conjunction with Drones /or LiDAR and Drones

The payload capacity of the drone will determine what type of equipment will be used. Equipment can consist of extra cameras, sensors or even packages for delivery. In addition, we are seeing that LiDAR technology is being used with drones. LiDAR uses laser technology to make accurate three-dimensional representations of the earth's surface. In the case of aircraft accidents, it can be used to accurately map the wreckage debris field in a short time.

Its high cost has, in many cases, limited its use. However, like most technologies its cost is coming down over time. This will no doubt see an increase in its use in investigation and in other industries.

Compared to other aerial survey methods, drone-based LiDAR collection gives the highest fidelity data. This is invaluable for safety investigation. You can expect to cover up to 10 sq km (approximately 4 sq miles) per flight. Through LiDAR sensor thousands of laser rays are fired per second in a scanning pattern, rapidly sampling distances.

Emerging Technologies Reshaping the Flying Experience

Technological innovations have changed and will continue to change the flying experience for years to come. These innovations will also then impact safety investigation. Let's take a look at the top three emerging digital technologies that are revolutionising the flying experience.

Augmented Reality and Virtual Reality

The airline industry has started to make use of AR (augmented reality) and VR (virtual reality). Airports in particular are using these technologies to enhance the customer experience. For instance, Gatwick airport uses AR to help passengers navigate the layout of the airport. London City Airport has installed AR technology to help air traffic controllers with the crucial job of keeping planes safe.

Artificial Intelligence (AI)

AI for the most is still in its infancy, but it is gaining traction all over the world in various industries. One of them is aviation, where AI is currently being used in chat bots and AI powered voice technologies. When it comes to safety investigation, although its still too early to say we believe that AI will play a part in shaping investigation of the future. So, stay tuned!

Blockchain Technology

Blockchain technology connects non centralised data into time stamped packages of records that are linked through encryption. You normally associate blockchain technology with the financial sector but it is increasingly being used in a wide range of application in other industries such as logistics.

On March 11th 2021, Air France introduced blockchain technology for its health passport. This is an app for passengers to present their COVID-19 negative test. We expect to see more airlines following suit and use blockchain technology for other purposes- operational efficiencies, security systems, and passenger safety.

An Insider Look into Safety Investigation

We thought you might enjoy this snippet that takes an insider look into safety investigation. It comes from someone in the field of safety investigation who has worked many years in an airline environment.

A Method of Safety Investigation

For a safety investigation to be properly conducted vital information must be assembled such as:

- Flight data (daily downloads and analysis)
- Crew reports (safety occurrence)
- External reports (ATC, public)
- Safety occurrence reports (tarmac, baggage, transport)
- Routine analysis summaries (statistics which may trigger concern)

The Steps/Processes Involved

Generally speaking, the following steps/processes would be followed by the safety investigator which serve as a useful checklist for investigation:

- Assemble information
- Involve subject matter experts
- Develop and implement immediate response actions if required
- Establish investigation scope (Why are we investigating?)
- Provide timelines for preliminary report and final report
- Preliminary and Immediate actions if needed are followed
- Final-root cause and recommendations are set out if needed

Tools Used in Safety Investigation

There is a wide range of them, which can include fishbone, bowtie, and culpability matrix used to identify causal factors. In addition, flight data, interviews, radar replays, and observer reports are also used to aid investigation.

The Issue of Root Cause

There is a need to identify root cause(s) in safety investigation, and keep in mind there may be many. For instance, an engineering lapse leads to an instrument malfunction which leads to an inadequate crew response. This results in several areas to be examined/investigated.

An Example of a Safety Investigation

Event Description:

ATC deliver a cleared altitude   "ABC descend to flight level one six zero"

Flight Crew read back as "ABC flight level 160"

Pilot selects 150 on control panel (MCP) and the crew fail to cross-check as per Standard Operating Procedures

Aircraft descends to FL150 on autopilot

ATC file a violation report.

Event Analysis:

Analysis may include the following:

- Procedural drift (non-compliance with standard operating procedures) resulted in crew not cross-checking and confirming a critical instruction.
- Fatigue
- Recent crew performance markers
- Documentation (manuals include information that is clearly defined)
- Technical issues such as radio interference

SPOTLIGHT – This Month's Speaker at the Aviation Safety Forum

This month we are delighted to present Bill Holmes, our speaker for the Safety Forum. Bill has an impressive track record. He is a is a TEDx speaker, SMS specialist, CEO of RCA Rt and RCA2GO a software training company amongst other achievements. Watch his TED talk The Power of Why. On Friday, September 3 2021, he presented a number of tools that can be used in safety investigation. Visit the WEBINARS page on our website to watch his presentation.

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