FAA Aviation Mx
HUMAN FACTORS Quarterly

The Company

The Individual

SAFETY CULTURE

The Workplace

DECIDE. COMMIT. SUCCEED.

LOOKING BACK TO MOVE FORWARD

INSIDE THIS ISSUE:

Authors of this Newsletter

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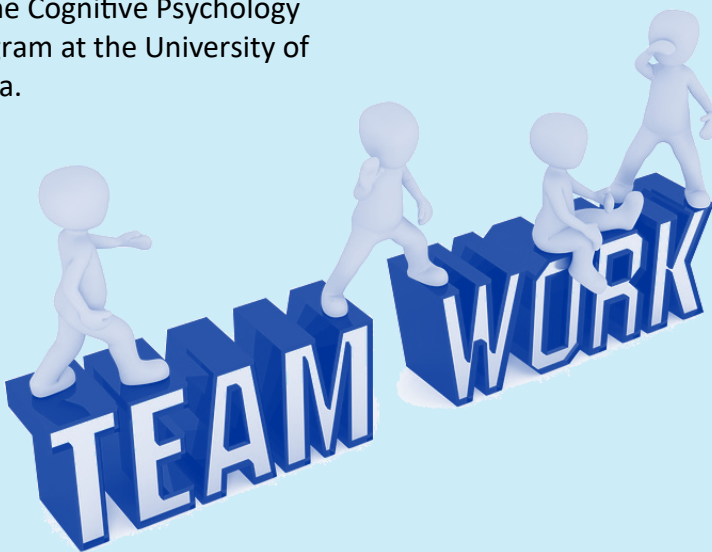
How to Maximize Opportunities to Learn from Accidents

Marc Szepan

Lessons learned from past accidents have been one of the key sources of improvement in aviation safety. The organizational ability to learn from accidents is a key safety driver for aviation and other safety-critical businesses. Maximizing the opportunity to learn from accidents, in turn, is contingent upon tapping into as broad a learning base as possible and putting into place organizational best practices that minimize safety risks arising from – in the context of the *Dirty Dozen Common Causes of Human Factors Errors* – complacency, lack of knowledge, and lack of awareness. The present article examines three key sources of learning and four best practices for maximizing opportunities to learn from previous accidents.
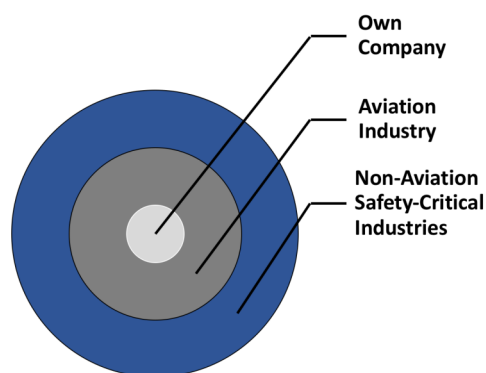
Three Sources of Learning

Across all segments of the aviation industry – and other safety-critical businesses for that matter – a significant share of accidents and safety-relevant incidents are "repeat occurrences", that is accidents or incidents that share the same or similar causes as those at the heart of previous accidents or incidents and unfold in comparable operational circumstances. Given the

Figure 1. **Learning Opportunity Sources**

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common nature of repeat accidents, aviation and other safety-critical businesses would be well advised to cast their net as widely as possible when trying to identify previous accidents that offer lessons learned relevant for their own operations. As shown in Figure 1, there are three sources for such learning opportunities: own company, aviation industry, and non-aviation safety-critical industries.

Own Company: Even the best aviation businesses and the best aviation professionals make mistakes. Learning from accidents that have occurred within one's own organization is the most obvious and often most straightforward way to avoid repeat accidents. After all, accessing reliable data, identifying root causes, and translating analysis into actionable lessons learned and safety reminders are likely to be a lot easier within than outside one's own operations, assuming that such are properly led (see also "Five Leadership Attributes to Encourage Workforce Assertiveness in Safety-Critical Businesses" in the FAA Aviation Mx Human Factors Quarterly December 2018 issue).

Aviation Industry: The aviation industry offers a broad range of high-quality data resources at industry level, which aviation businesses can use to derive lessons learned from previous accidents or incidents. In the U.S. these resources include the FAA Aviation Safety Information Analysis and Sharing (ASIAS) system, the NASA Aviation Safety Reporting System (ASRS), and the NTSB Aviation Accident Database and Synopses. These sources can easily be searched by any aviation business. Formal aviation accident reports are available via the NTSB web page as well (ntsb.gov). In addition, the FAA maintains extensive web resources that list lessons learned from civil aviation accidents (lessonslearned.faa.gov/index.cfm).

Non-Aviation Safety-Critical Industries: Other safety-critical industries offer ample of cross-domain opportunities to learn from previous accidents as well. In the U.S. formal accident reports for highway, maritime, and railroad transportation accidents can be found on the NTSB web page. Other safety-critical industries and non-business organizations that offer potential learning opportunities for aviation operations include nuclear power and the military. For example, some of the lessons learned from the Fukushima Daiichi nuclear disaster in 2011 or the collision of the Norwegian frigate *Helge Ingstad* with an oil tanker in 2018 are worthy of consideration by aviation businesses.

Four Best Practices—Learning Culture ABCD

Given the richness and ease of accessibility of resources for learning from accidents across different safety-critical organizations worldwide, aviation businesses would be remiss not to leverage these in the interest of preventing repeat accidents. What then are organizational best practices for maximizing opportunities to learn from accidents? I suggest what I call the repeat accident prevention-oriented Learning Culture ABCD (see Figure 2).

Figure 2. **Learning Culture ABCD**

A — **Assess broadly and systematically!**

B — **Beware of "NHH" syndrome!**

C — **Commit to honest & fact-driven analysis!**

D — **Disseminate widely!**

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Assess broadly and systematically: As suggested above, aviation businesses would be well advised to scan as broadly as possible and to learn from previous accidents both within and beyond their own operations. Assessing accidents involving other aviation businesses and organizations in other safety-critical business and non-business domains offers significant potential for deriving applicable lessons learned. Scanning broadly should not be an *ad hoc* reaction to a high-profile accident that might be prominently covered in the general media. Instead, scanning broadly should be an integral part of the standard process architecture and safety management system of any aviation business and should be performed on systematic and continuous basis by making full use of available industry-level accident databases.

Beware of "NHH" syndrome: Businesses that are characterized by bias that fundamentally favors internal over external ideas are said to suffer from "not invented here" (NIH) syndrome. In the context of maximizing opportunities to learn from accidents, aviation businesses should beware of what one might term "not happening here" (NHH) syndrome. NHH symptom is the explicit or implicit overconfidence that the caliber of one's own organization precludes the possibility of accidents occurring at all. NHH syndrome can be particularly pronounced in aviation businesses that have a track record of operational excellence and have not experienced accidents in the past. However, no matter how well managed an aviation business might be, falling victim to complacency and to NHH syndrome is unlikely to be a winning safety management approach. All aviation and other safety-critical businesses would be well advised to maintain an open mind with regards to learning from the mistakes made by others in the interest of avoiding repeat occurrences.

Commit to honest and fact-driven analysis: Learning from mistakes, especially those made in one's own operations, can be an undertaking that is about as enjoyable as replacing wing fuel tank sealant in areas furthest away from wing access panels. It can entail considerable personal and organizational embarrassment and potentially may have significant commercial implications. However, commitment to honest and fact-driven analysis is as much a hallmark of a world class aviation business as is commitment to a Just Culture that enables such learning in the first place. Whereas it might be tempting to engage in white-washing of accidents, doing so comes at the risk of loss of internal and external trust and – most importantly – loss of safety and repeats of accidents. At the same time, aviation businesses need to be well positioned to conduct in-depth and thorough accident analyses. Despite the (perceived) time pressures of modern social media news cycles, aviation businesses should resist jumping to premature and possibly counterproductive conclusions.

Disseminate widely: Identification of the root cause of an accident is a necessary but by no means sufficient condition for organizational learning. It is critical that insights are disseminated among your work force on as wide and easily accessible a basis as possible. Dissemination of applicable lessons learned from accidents should be integral part of the safety management system of any aviation business. For example, one leading MRO provider has an in-house magazine that discusses in great detail maintenance errors made in its own operation and by other MRO businesses. Magazine issues are distributed regularly to the entire work force, both in print and electronic formats. Similarly, another safety-critical aviation business sports a regular in-house safety newsletter that highlights lessons learned from aviation industry accidents.

One of the defining characteristics of a world class aviation business is not the absence of mistakes, but its leadership commitment and organizational ability to learn from its own mistakes and those of others. Aviation businesses can maximize opportunities to learn from accidents by tapping into a broad learning base both within and outside the aviation industry, and by putting into place suitable organizational best practices. The repeat accident prevention-oriented Learning Culture ABCD can be a helpful managerial tool to maximize learning opportunities from previous accidents.

Safety Culture: Where Do We Stand?

Kylie Key

This article is a follow-up of Dr. David Schroeder's March 2018 FAA Mx HF newsletter article titled "It Doesn't Happen Overnight! - Improving Safety Culture in the Workplace". The author would like to express her appreciation to Dr. Schroeder for his time, mentorship, and expertise on this topic.

It is well known that maintenance (Mx) errors are a contributor in many accidents, incidents, and personal injuries (Goldman et al., 2002; Marais & Robichaud, 2012). One way to reduce such errors is to promote safety culture, or employees' perceptions that safety is a high priority for the organization. In fact, safety culture has been ranked as *the top* human factors challenge in aviation Mx (Johnson, 2014). A culture where safety is a priority can help to decrease errors, violations or noncompliance, accidents, injuries, and even turnover (Fogarty et al., 2018).

But that's not all. A healthy safety culture can increase performance, willingness to report errors, SMS effectiveness, and productivity. Devoting resources to improving safety culture will ultimately make your workplace safer *and* more productive (McSween, 2003). Seems like a no brainer!

This article provides practical suggestions for how to assess and improve safety culture in Mx organizations. These suggestions are designed to be easy-to-use and

cost-effective, such that any organization, large or small, can use them.

It's important to note upfront that safety culture requires continuous improvement and commitment to safety. Everyone in the organization, from front-line technicians to the top CEOs, needs to be involved in all steps of the process.

This is illustrated by The Iceberg of Ignorance—that shows that only a small percentage of an organization's problems are above the water and known by top managers, while front-line employees have a fuller picture of the problems below the water (see Figure 1). Only the employees on the front line can tell the organization where improvements are needed. This requires an atmosphere of trust that focuses on learning from mistakes – a *Just* culture.

If you're still reading then promoting a healthy safety culture in your organization likely is a priority to you. Are you ready to learn the steps?

Figure 1. The Iceberg of Ignorance, adapted from Yoshida's 1989 presentation at the International Quality Symposium.

STEP 1: Assess Safety Culture in Your Organization

The most common method of safety culture assessment is a voluntary survey, wherein employees report their attitudes, values, and beliefs about the organization and their workplace. Like an iceberg, only a small part of an organization's problems are "above water" and easy for management to identify. A survey is a great way to peer into the iceberg to see what is going on "below the water" from the front-line employees.

It's critical that organization-wide problems are identified so they can be fixed. Does the organization provide adequate resources to get the job done and minimize demands on employees? When you boil it down, Demands + Resources = Safety Culture. So, a good survey should include questions about resources provided to front-line employees as well the job demands placed on them.
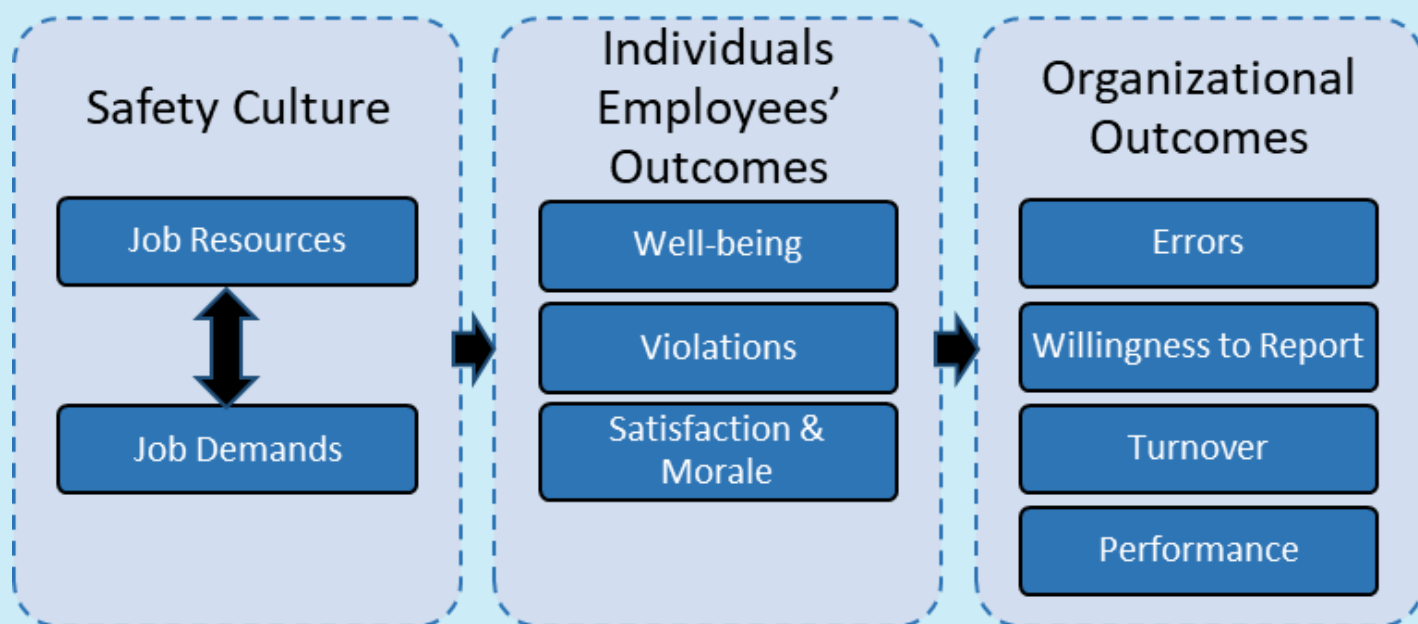
Job Resources
- Training, equipment, tools
- Adequate personnel and supervision
- Management commitment to safety
- Just culture
- Communication
- Autonomy

Job Demands
- Task overload
- Time pressure
- Pressure to compromise safety
- Group norms

Figure 2. Model showing how safety culture (job resources and job demands) impacts individuals' well-being and satisfaction, which then leads to organizational performance outcomes like errors adapted from Fogarty et al. (2018).

When surveys include questions about these organizational factors, the picture is clear (see Figure 2). The organization provides job resources and set job demands (in essence, safety culture), which influence the individual employees' well-being, satisfaction and morale, and motivation to be safe. In turn, the individuals contribute to the organization's overall level of safety performance (Fogarty et al., 2018).

One good survey is the Snapshot Survey, developed for military aviation Mx in Australia (Cooper & Fogarty, 2015). The FAA is developing a new tool, similar to the Snapshot Survey, but for civil Mx operations in the United States. This tool will be accompanied by scoring metrics and recommendations for how to improve safety culture based on the results. This tool will be freely available on the Human Factors in Aviation Mxwebsite by March 2020 or sooner, so stay tuned! [humanfactorsinfo.com]

A word of caution. Survey responses should be kept anonymous. Every employee in the organization matters equally and deserves the ability to make anonymous reports of problems that they see. No matter what the results are, they should NOT be used to punish employees. Instead, everyone should focus on continuous improvement and the idea that we can improve safety if we keep trying.

STEP 2: Score and Share the Results

Next, score the responses to determine the current state of your organization's safety culture, and which specific areas have opportunities for improvement. No organization has a perfect safety culture. So, the survey results will probably include areas that need more improvement than others. Some areas may already be in good shape. Mixed results are good—it helps the organization target where to go next. Remember that safety requires continuous commitment.

It's important to share the survey results with all employees. This serves two goals. First, it lets employees know that the results matter and management wants to hear from them (this increases trust). Second, it creates a shared vision of where the organization is right now, and where it needs to go. A shared vision is critical to the improvement process.

STEP 3: Improve the Safety Culture

Improving safety culture begins with a shared vision that safety is a high priority in the organization. Just culture, or fair treatment of errors/mistakes when they occur, is also critical. Finally, remember the importance of continuous improvement and learning. If these things are not in place, any efforts to improve culture may fail.

So how do you create a shared vision? We recommend a short training on the importance of culture of safety such as the FAA's computer-based training, **Follow Procedure Training: The Buck Stops with Me.** This training highlights the concept that everyone in the organization is equally responsible for safety, and therefore must be a part of the solution. It also identifies 11 concrete safety champion tools for the workplace. The training is free and can be used directly from the FAA's website complete with an end-of course knowledge check at: followprocedures.com. It is available for free download from the Resources: Training and Tools link at: humanfactorsinfo.com.

Following training, everyone in the organization should have a shared vision and path forward, which can then be supplemented by interventions targeted at specific work groups. One way to improve safety is via supervisor communications that safety is critical (Zohar & Polachek, 2014). Incentives for front-line employees' safe behaviors, like monetary rewards or social recognition, are also effective (Stajkovic & Luthans, 2003).

These interventions need not be expensive or time-consuming, they just need to be consistent and ongoing. Culture change is a slow, tedious process that requires the continuous commitment of all employees. But safety culture is a critical precursor to workplace safety, so improving the culture should be a top priority for you and your organization!

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Recommit to Addressing Your Human Error
Bill Johnson

Author's Introduction

I have the pleasure/opportunity to make editorial contributions to many reports, speeches, monthly magazines, and Newsletters like this one. The short lead time and publication deadlines help insure timely information that is relevant to current safety issues. That is good news.

However, the writer speeds on to the next deadline and topic, sometimes not recalling what they wrote last week/month/quarter. That happened to me with the article below. Only, when I saw the title in the AMT table of contents did I recall the content, seeing that the author was me! When I took the time to read that short article, I admit that I said to myself, I like this article. I want to show it to additional readers. Therefore, with a few additions, and permission of the Endeavor Business Media, we decided to re-publish here.

I hope that you will agree that this piece takes the results of applied research and converts them into useful actions that promote worker and flight safety.

Summary of Article

The start of a new year is a good time renew your commitment to flight and personal safety. For an excellent 2019: Don't forget anything, don't make mistakes, don't hurt yourself or others, don't have communication errors, be safe, etc. That sounds like the too familiar vague advice from a Ph.D., like me? There are at least 2 reasons that the advice, as stated, is not very useful. First, it is too broad with no specific actions for the reader. Second, the advice ignores the fact that we are human. Human's are inclined to make the errors stated above. So, in theory the advice is valid but how do you implement it? This article offers practical and familiar methods to help minimize human error.

Addressing Human Error

We all know that human error contributes to about 80% of the negative events in aviation. That includes pilots, dispatchers, air traffic controllers, cabin crew, and of course maintenance/engineering personnel. Maintenance gets the "attribution" (aka. "blame") for an estimated 10-15% of major events. Then, 80% of the maintenance events are human error. So, there is a high safety payoff in reducing human error in maintenance work.

There are many reasons that the 80% figure has remained constant despite three+ decades of attention to the human factors topic. The continuing evolving reliability of new technology in aircraft means they break less often. They require less maintenance, which keeps human hands off. Simply stated, failed aircraft components are seldom the cause of a major event. Further, enlightened human factors-centered accident investigation methods/procedures are better at identifying human factors causes., previously gone unnoticed.

Increased worker knowledge about human factors is evidenced by the nature of the reports submitted as part of the Aviation Safety Reporting System (ASRS) and to other voluntary reporting systems like the FAA Aviation Safety Action Program (ASAP). That does not mean that human factors errors are up. Instead, understanding and resultant remediation is up. Further, good Safety Management Systems and enhanced Root Cause Analysis methods are recognizing the hazards/risk associated with human error.

Specific Action to Target Human Error

Below I offer five action categories to address common specific human factors challenges. Working to reduce our human error does not have to be overly complicated. You do not need more information to do the right thing. It is a matter of individual and organizational commitment. If you want additional information, the short suggestions are supplemented by guidance from the included websites. Most of the

website links are brief articles offering "how two" advice.

1. Fitness for Duty Actions:

Let's start with this familiar topic. Physical and mental readiness is a primary target of opportunity to reduce error. That begins with proper sleep. Specific actions to ensure fitness for duty are:

⇒ Sleep for 7-9 hours per 24 -hour period. Record your sleep habits for 2 weeks.

⇒ Minimize excessive food and alcohol prior to sleep.

⇒ Shift workers should try to sleep before rather than after work. Naps help.

⇒ Find a sleep routine that works for you.

⇒ Beware of nights shifts, duty time over 12 hours, and extended days of work without a day off.

⇒ For long-term sleep issues see a medical professional specializing in sleep disorders.

Weblinks:

www.mxfatigue.com

www.youtube.com/watch?v=FNsXpG4J8AQ (FAA fatigue awareness training video)

www.faa.gov/documentLibrary/media/ Advisory_Circular/AC%20120-100.pdf

www.faa.gov/data_research/research/ med_humanfacs/oamtechreports/2010s/ media/201119.pdf

2. Procedural Errors:

The best way to avoid error is to combine fitness for duty with strict procedural compliance. ***Procedural noncompliance is the #1 cause of FAA administrative action***. Specific actions to reduce procedural error are:

⇒ Commit to 100% procedural compliance for everyone.

⇒ Act to fix every inadequate procedure.

⇒ Do not let time pressure or distractions interfere with using the procedures and checklists.

⇒ Recognize that familiar as well as unfamiliar tasks require checklists and documentation.

⇒ Set good example to work colleagues and always follow appropriate procedures.

⇒ Improve the procedure following culture

Weblinks:

www.followprocedures.com (FAA training launched in late 2018)

www.aviationpros.com/article/12434426/follow-procedures-training-launched-now-your-work-begins (Johnson article, AMT, Nov/Dec 2018)

www.faa.gov/about/initiatives/maintenance_hf/ library/documents/media/roi/ tech_pubs_workshop_report_final_9-12.pdf

3. Forgetfulness

How often do you forget to do something that leads to an unintended consequence? For me, I would say "too often". Forgetfulness is a generic issue that affects all life functions including aircraft maintenance. The solution to forgetfulness is related to Fitness for Duty and Procedural Errors? Specific ways to avoid forgetting during maintenance work are:

⇒ Be mentally fit for duty. "Keep your eye on the ball".

⇒ Strive to manage time. Rushing at the end leads to forgetting.

⇒ Always follow checklists and other procedures. (No regulation on forgetting but there is one on following procedures (14 CFR Part 43, Section 43.13 -1 B).

⇒ Do not rely on memory!

⇒ When distracted or interrupted go back a few steps.

⇒ Organize your tasks, tools, and environment, aka. Housekeeping.

⇒ Recognize the threat when you are doing multiple tasks on multiple aircraft.

⇒ If in doubt then double inspect

Weblinks:

www.bustle.com/articles/136946-how-to-stop-forgetting-things-for-good-with-7-helpful-tips

https://ryanbattles.com/post/the-art-of-remembering-small-tasks

4. Failure to Communicate:

Miscommunication often leads to negative events, including disagreements/arguments. Miscommunication can happen at shift change or even while working a specific task. Communication is critical for every aspect of life and work. Good teamwork goes together with effective communication. Many publications offer advice on good communication practices. However, the rush and loud environments of aviation maintenance makes effective communication an extraordinary challenge. Specifics actions for effective maintenance teamwork and communication are:

⇒ Discuss the entire task, in person if possible, before the work begins.

⇒ Assign and clarify responsibilities with individual as well as team expectations.

⇒ Identify the team leader (If everyone is in charge then no one is in charge).

⇒ Remember that communication requires clear, correct, complete, and concise transmission, reception, and feedback.

⇒ Reserve time for questions and clarification.

⇒ Recognize the environmental and mental challenges in many maintenance work scenarios.

Weblinks:

www.right.com/wps/wcm/connect/right-us-en/home/thoughtwire/categories/career-work/10-Ways-to-Improve-Your-Communication-Skills

www.thejobnetwork.com/10-steps-to-improve-your-workplace-communication-skills/

www.humanfactorsinfo.com (FAA Website with Human Factors Training Modules)

5. Support Your Organizational Safety Culture

For some, the word "Safety Culture" is like "Motherhood and Apple Pie," is to US Americans. However, "Safety Culture" must be more than the right buzzword to describe the aviation industry or your company. A good safety culture is one that has a shared goal and values in the highest level of safety. Every worker in the organization should recognize and be able to verbalize their daily contributions to safety. Ideally, each worker should take professional and personal pride in their role regarding safety. We know how to do our jobs correctly to achieve safe work and safe flight. We must commit and strive to do that 100% of time!

Safety Management Systems (SMS) are a means to identify and mitigate safety hazards. A good safety culture reinforces the effectiveness of the SMS. The safety culture is less tangible that the SMS documents and meetings. What can you do to foster the safety culture? Specific actions that you can take to foster the safety culture are:

⇒ Be a champion to promote sections 1-4 above.

⇒ Take pride and satisfaction in your dedication to working safely and delivering a safe work product.

⇒ Speak up and communicate effectively when you see an opportunity for safety improvement.

⇒ Use voluntary reporting systems for both good and bad news

⇒ Strive to cooperate in the Safety Management System activities.

⇒ Know that every employee owns a piece of the safety culture.

Weblinks:

www.osg.ca/six-tips-to-help-you-build-a-positive-safety-culture-in-your-workplace/

www.aviationpros/article/12302375/got-safety-culture (Johnson article, AMT March 2017)

www.aviationpros.com/article/12424395/increasing-the-human-factors-in-maintenance-safety-management (Johnson article, AMT Nov/Dec 2018)

You Can Address Your Human Error

This action-oriented article has made the case that we have significant control over our propensity towards certain types of error. We can move forward to not forget, not make mistakes, not get hurt, not have communication errors, and to be safe. We all already know a lot about human errors. So, perhaps you can add additional actionable steps to the vague "Dr. Bill" advice.

Author Appreciation

We would like to extend our gratitude to the readers and authors for their continued support of this newsletter. We enjoy your reviews and look forward to future article submissions, keep up the good work! Our contributors are not primarily responsible for writing articles for this newsletter, however, the vast majority are experts in their fields when it comes to issues related to aviation maintenance. Most importantly, we value their input and reviews that bring interest and value to readers of this quarterly forum.

Our Request and Promise to You

Every submission will receive prompt feedback from our great editors! With your approval, we will go beyond the Microsoft grammar and spellcheck, followed by an author sign-off prior to the publish date. Newsletters are published every 3 months, yes quarterly, starting at the end of March. If you submit something to us by the middle of the quarter, then we can usually make the deadline.

If you would like to discuss your idea prior to the writing phase, please E-Mail Dr. Bill Johnson at bill-dr.johnson@faa.gov for guidance or recommendations. Send your submissions to Janine King at janine.ctr.king@faa.gov. If you have any interesting maintenance safety images, please include in your submission with an image caption. We appreciate your input!

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Upcoming Events

- MRO Americas: Atlanta, GA; April 9-11, 2019
  https://mroamericas.aviationweek.com/en/conference/about-the-conference.html

- ICAMET Conference: Miami, FL; April 11-12, 2019
  https://waset.org/conference/2019/03/miami/ICAMET

- Avionics Maintenance Conference (AMC) Prague, Czech Republic; April 29-02, 2019
  https://www.aviation-ia.com/conferences/avionics-maintenance-conference-amc

- 64th Business Aviation Safety Summit: Denver, CO; May 2-3, 2019
  https://flightsafety.org/summit-seminar/bass2019/

- NBAA Conference: Fort Worth, TX; May 7-9, 2019
  https://nbaa.org/events/2019-maintenance-conference/

- MRO BEER: Vilnius, Lithuania; May 21-22, 2019
  https://mrobeer.aviationweek.com/en/home.html

- Global MRO Procurement Expo: Messe Frankfurt, Germany; June 4-6, 2019
  https://10times.com/global-mro-procurement-expo-frankfurt