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FEATURED ARTICLES

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*Written by maintenance human factors professionals dedicated to identifying and optimizing the factors that affect human performance in maintenance and inspection.
Past newsletters @ humanfactorsinfo.com*

YOU AND YOUR AVIATION SAFETY INSPECTOR

DR. BILL JOHNSON

About the Author: Dr. William Johnson is the FAA Chief Scientific and Technical Advisor for Human Factors in Aircraft Maintenance Systems. His comments are based on nearly 50 years of combined experience as a pilot/mechanic, airline engineering and MRO consultant, professor, and FAA scientific executive.



Background with FAA Organizations and People

Prior to my formal employment I had numerous associations with FAA. I was a 50 year holder of FAA flight and maintenance certificates. I served as a Designated Mechanic Examiner, and spent numerous years as a contractor for human factors work. Those associations provided an outsider's view of FAA. For the past 10 years I have had the insider's view of FAA. Because of my Chief Scientific and Technical Advisor role, I have interacted with many of the FAA Offices, Directorates, Divisions, and Offices. That experience has been enlightening. It has permitted me to understand and appreciate the immense FAA employee knowledge, experience, and dedication to safety. A pessimist would say that Dr. Bill finally "Drank all the Kool-Aid." No he has not! However, I can recognize a good thing when I see it. This article focuses on the FAA Flight Standards Airworthiness Aviation Safety Inspector (ASI). The ASI can add immense value to your organization by cooperating with you not only for regulatory compliance but also for continuing safety and efficiency.

Qualifications of ASIs

The formal list of qualifications is available at the FAA website ([Google "FAA Inspectors"](#)). That formal list describes the job responsibilities and necessary prerequisite experience and certification. An initial impression is that an Airworthiness ASI must be a top technical expert on the aircraft, equipment type, and organization type for which they have shared oversight responsibility. There is an effort to place those with airline experience in airline inspector positions. Same is true for General Aviation experience. For the most part, technical knowledge and experience is a given. ASIs have experienced the rigors of aircraft maintenance work

ranging from a small shop to a major carrier. They are from MROs, manufacturers, and the US military. They know maintenance.

Aircraft technical knowledge and experience are only a part of the ASIs necessary skill set. Today's best ASIs must be particularly good with

INTERPERSONAL SKILLS



interpersonal skills. They must relate to each individual and organization as they partner in safety and

compliance. They must be able to manage conflict and overcome that impression of being only a compliance officer. When potential ASIs are evaluated the knowledge, skills, and abilities (KSAs) include such things as: risk management; workload management; communications; teamwork; and more (see Table 1).

Table 1. Evaluation of Knowledge, Skills, and Abilities for ASI Position

1. Risk Assessment
2. Evaluation
3. Workload Management
4. Information Management
5. Communications
6. Teamwork
7. Interpersonal Skills
8. Decision Making

You And Your Aviation Safety Inspector (Con't)

After an ASI is hired their industry knowledge and experience is supplemented with extensive training, mostly at the FAA Academy in Oklahoma City. ASIs receive about 1,000 hours of resident and computer-based training in their first two years of employment. That would be equivalent to the number of contact hours for about two years of college. That training



is usually supplemented with annual recurrent training. Suffice it to say that FAA ASIs have the experience and training to partner with you for continuing safety and efficiency in your maintenance organization.

The ASI is Just Like You

As I have lectured in Inspection Authorization Renewal courses and industry conferences you have heard me say, "Look in the mirror to see a potential Aviation Safety Inspector." In most aspects you and the inspectors have the same professional credentials. You share the dedication to safety in all of your aviation maintenance activities. You follow the regulations while the inspector occasionally checks your interpretation and compliance with the rules. When you combine your knowledge and skill with those of the FAA ASI then everyone benefits.

When I participate in an FAA-only class I am always impressed by the overwhelmingly positive comments that inspectors make about the organizations that they oversee. They relate to the importance of efficiency and to the challenges of economics. They are consistent in the opinion that regulatory compliance, doing the job properly the first time, and attention to worker safety helps ensure long term commercial vibrancy.

ASIs, especially in the human factors discussions, are very sensitive and considerate when they talk about crew and passenger injury or loss. They have the same sensitivity regarding worker health and

injury. I am proud of FAA ASIs colleagues when they talk about the human side of the people and companies they oversee. They take pride in your success. They are just like you.



Teaming with your ASI as a Partner in Safety Below are examples of the kinds of activities in which you can engage your ASI as a safety partner:

Seeking Information and Regulation Interpretation

Inspectors know the regulations and exactly where to find pertinent information. Count on that. The information sources that they access are mostly public. If you do your homework you can have the same sources that they have. They can show you how to do that. Of course, you will not be able to see proprietary data from other companies. FAA ASIs protect all proprietary data including information that you provide.

ASIs are very good at finding manufacturer's instructions, information about foreign aircraft and parts, and information about the European Aviation Safety Agency (if relevant to you). When you are stumped for information, call your inspector. It has worked for me, repeatedly. Just ask an ASI!

Voluntary Reporting



The Aviation Safety Action Program (ASAP) and other voluntary reporting systems are a critical means to obtain information to foster Risk-Based Decision Making (RBDM) and your Safety Management System. The ASI role as a member of the ASAP event review committee is critical. Their maintenance job experience helps them to relate to human error. They are able to empathize with erring maintenance personnel. ASAP is but one example of how ASIs demonstrate their commitment to maintenance personnel. Talk to your ASI about voluntary reporting options.

You And Your Aviation Safety Inspector (Con't)

Human Factors Information

ASIs receive more human factors training than any other regulatory agency in the world. Airworthiness Inspectors receive more human factors training than other FAA inspector categories. First of all, many come from commercial or military organizations where they have already received human factors training. Then, all Airworthiness ASIs receive a 3-day residential human factors class. Many are currently taking a recurrent class, currently offered by the Department of Transportation with the FAA Academy.

While human factors training and initiatives may not be regulated that does not mean your FAA Inspector is not interested. Show them what you are doing. Ask them to teach a segment of your human factors



class. ASIs receive a DVD with all of the FAA human factors training materials. They will give you a copy of the disc and direct you to additional FAA materials. If the

inspector does not deliver the information he/she may ask for assistance from the FAA Safety Team. Therefore ASIs can add value to your human factors initiatives including training.

Finding Alternate Approaches

FAA inspectors have the benefit of seeing multiple organizations thus they may be aware of multiple solutions to any of your challenges related to ensuring safety. ASIs also talk a lot of "Shop" when back in the office. Your ASI can seek multiple ideas for you. Take advantage of that experience.

Specifying Topics for Study



FAA research and development is supposed to be practical and driven by field requirements. Ideally, the FAA Technical Community Requirements Group (TCRG) elicits ideas from the field. That would be

from you and FAA personnel like the ASI. Topics are specified, planned, and presented to FAA management for funding approval. That means that you and your FAA ASI can submit topics that may be included in the FAA research portfolio. A motivated ASI, with the right management support, can make the system work as designed.

Reality Check



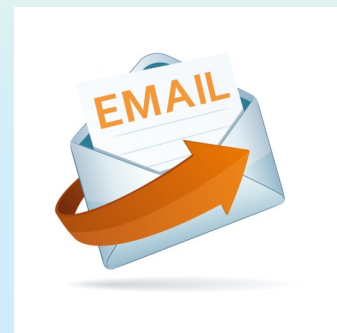
This article does not suggest that every ASI is a super hero. FAA strives for professionalism and trains for consistent application of prescribed safety standards. Of course, there is variance in human ASIs. Often you get what you expect. I

always anticipate high standards, knowledge, skill, and partnership from the hundreds of ASIs with whom I interact. I am pleased to say that I have never been disappointed.

Summary

The FAA Airworthiness Aviation Safety Inspector can be a high value addition to your organization. The ASI should be considered as an available highly experienced consultant. The ASI can partner with you to ensure flight safety. The ASI can not only help ensure regulatory compliance but also can contribute to organizational efficiency and worker safety. Let's face it. You have paid (taxes) for an outside safety consultant. You should capitalize on that partnership.

Comments – Send comments to Dr. Bill Johnson at Bill-dr.johnson@faa.gov



Aging, Hearing, and Managing Risk

Dr. James W. Allen, M.D.

About the author: Dr. Allen is a retired navy physician specializing in the prevention of health effects due to workplace exposures. He works on a consulting basis primarily to human relations and safety departments for government and corporations. Results of his clinical and environmental findings save companies lost work time, make them safer, comply with health laws, and improve workers' health. He can be reached through his web site www.WorkingHealthyAlways.com or email at jallen@workinghealthyalways.com.



Without adequate hearing, the workplace becomes dangerous. The hearing impaired individual may not understand instructions, respond to a warning, or localize a sound. Loss of hearing presents as both a major health limitation and a risk for a maintenance error. Similar to other Latent Medical and Environmental Condition (LMEC), hearing loss does not cause accidents; rather, they form a link in the accident chain (Figure 1). Viewing hearing loss as an LMEC illustrates how a Safety Management System (SMS) for Human Factors (HF) may be compared to and utilize an existing Health and Safety (H&S) program.



Figure 1: The red link is a LMEC in an accident chain.

Presbycusis



Presbycusis, the natural reduction in hearing is considered a signpost of aging. This assumption does not match with the medical observation.

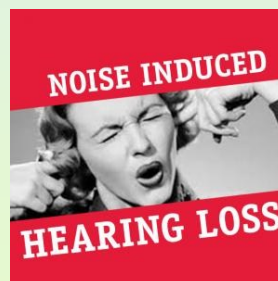
Everyone does not lose clinically measurable hearing sensitivity with age (1). Presbycusis can cause hearing loss but so can exposure from noise, solvents, and fuels, causing an Occupational Hearing Loss. Protection of an individual's hearing is a common goal for most hazard based H&S programs. The goal of a HF H&S program is aviation safety (2). While the goals appear different, both recognize the importance of

exposures in the workplace (Table 1).

Table 1: Goals for Health and Safety (H&S) Programs with Different Orientations

| | |
|------------------------|--|
| Work Hazard oriented | Personal health protections such as hearing conservation, fall protection, chemical safety |
| Human Factors oriented | Prevent the formation of LMEC that compromise air safety by increasing the risk of a maintenance error |

Hearing Loss Studies



Two industrial studies suggest that hearing loss is not an inevitable part of the aging workforce. The first, a study of firemen in Pittsburgh, showed a strong correlation between time spent on the job and hearing loss in the "severe" category (3). The second, a

study of a professional automobile race team, showed intermittent exposures to noise as well as fuels, solvents, and other chemicals which are known causes of hearing loss (4). In both studies the average levels of noise and airborne chemicals were below their recognized hazardous levels but short term exposures occurred. These workplace exposures rather than presbycusis are the major cause of hearing loss in older workers.

These same conclusions were echoed in an FAA Human Factors report on the site evaluation of 23 heavy maintenance environments during 1989 to 1990 (5). The noise levels were below those requiring ear protection but short periods occurred

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with high noise exposures. The FAA observed numerous instances where the operator's H&S program required wearing of safety equipment, such as hearing protection, but the requirement was not enforced in practice. Exposures below safety standard for noise and chemicals can result in hearing loss.

To more accurately determine the extent of hearing loss by industry a government study examined the hearing loss among 539,908 workers from 17,348 companies (1). Companies were coded by their industry or North American Industrial Classification (NAIC) code and hearing loss was identified by a decline or shift as seen on the workers' audiograms. Among manufacturing firms, NAIC 336 which includes airframes production, 22% of workers had a hearing shift. Among maintenance firms, NAIC 48 which involves in air, rail, warehousing, and pipeline transportation, 16% of workers had a hearing shift.

Based on these studies the SMS can estimate that 20% of the AMT workforce has evidence of a significant hearing loss. This level of hearing loss serves as a starting point for a self-assessment of how hearing loss can lead to maintenance errors. To sharpen the estimate, the SMS can use known risk factors (1) obtained from the H&S program to more accurately identify those AMT likely to have a hearing impairment (table 2).

Table 2: Risk Factors for a LMEC from Hearing Loss

Workers aged over 55 years (four times more likely to demonstrate a hearing loss than workers less than 25 year)

Employees with long tenure working in aviation

Development of a HF oriented H&S program requires a prioritized set of activities that will limit the potential for miscommunication during maintenance activities. Hearing conservation activities in a Hazard oriented H&S program limit individual's exposures as defined in safety regulations. Table 3 presents examples of activities for both programs. While information from both programs is of value to a SMS, HF based programs provide more detailed insight into the

formation of an LMEC.

Table 3. Activities Appropriate for a Hazard Based Health & Safety Program Compared to Activities for a Human Factors Oriented Program

| Human Factors | Hazard |
|---|--|
| <ul style="list-style-type: none">Assure all AMT have a basic level of hearingLimit conflicting noise in work areas that require team effortsEstablish commands familiar to all AMTMatch work assignments to personnel with known hearing loss | <ul style="list-style-type: none">Noise monitoring of work areasAnnual audiogram for overexposed AMTEmployee notificationRecord keeping |

Communication with the AMT is required when implementing any H&S program. As the FAA HF report showed, this communication must be backed up with management support. For example, if hearing protection is to be worn during line maintenance or no solvents are to be uncapped when in the hangar, then supervisors must enforce these requirements.

The assumption that old age causes hearing loss is false. A better assumption is that the SMS can use information from a HF H&S program that will limit adverse effects of poor hearing. By breaking the red links of LMEC, maintenance errors are reduced and air safety is improved. Hearing loss is common, but the red link can be broken, figure 2.



Figure 2: SMS can break the red link, an LMEC, formed by hearing impairment.

See references on page #7

Comments – Send comments to Dr. Allen at jallen@workinghealthyalways.com



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www.humanfactorsinfo.com



The FAA maintenance human factors site was launched in the late nineties. Its popularity grew tremendously over the years. Google hits reached in the hundreds of thousands yearly by 2010. Being over a decade since launched, the website was overdue for a "Heavy Check" to improve its search engine and public accessibility. Fortunately, the "Heavy Check" was not an "out with the old and in with the new." It continues to serve as an important dynamic repository of reports, conference proceedings, and other important MX HF materials. The new HF in Aviation MX website can be found at the original address hfskyway.faa.gov or under a

number of alias addresses like humanfactorsinfo.com, and mxfatigue.com. Take a look today and please pass this information to your colleagues.

If you have a story to tell that will help enhance aviation safety, please email katrina.avers@faa.gov or bill-dr.johnson@faa.gov. The editorial staff will help writers with layout and graphics.

If you would like to be added to our quarterly distribution list, please email joy.banks@faa.gov



Discussions about management or worker attitudes and ideas to enhance continuing safety are ideal. We know that we don't live in a perfect world. However, please be careful not to identify known safety issues that should be immediately addressed by an Aviation Safety Inspector. The Aviation Safety Action Program (ASAP) or other voluntary and/or whistle blower acts are the way to address the immediate safety issues.

We hope that this new section will generate dialog and contribute to human factors related safety.

Contributor's Professional Background

I've been training Human Factors since the 90's. I currently deliver a three day Human Factors workshop to a workforce of 3,500+ mechanics and support personnel that provide contract maintenance services to a fleet of 400+ aircraft. I hold both a FAA A&P and PPL Certificate along with a FCC License. My work experience includes Part 121, 135 (EMS) and 145 Organizations.

Organization's Human Factors Background

When I first started working at this company, I witnessed multiple and significant maintenance events; everything from main landing gear (MLG) departing the aircraft in flight up to and including dual in-flight engine failures. I suggested that perhaps they should do some Human Factors (HF) Training but the Safety Manager promptly and very emphatically stated “we tried that and it doesn’t work”. I was dumbfounded by that remark, so I said no more until one day the V.P. came down screaming about how the company was losing millions due to the constant ramp and hangar rash. I said it’s because you haven’t done any HF Training. You could have heard a pin drop. I was waiting for him to say “you’re fired!” because that was the mentality of this company at the time. The company refused to establish an ASAP and has terminated mechanics when they refuse to sign work off that they didn’t accomplish. That is the long and short of

how the HF program got started here.

This V.P. came to one of my first HF Workshops and was so impressed he walked out and said everyone “will attend” this training. He saw “\$\$\$” saved through a reduction in ground damage and a happier workforce by reducing stress in the workplace. Unfortunately, he left the company before the upper management was forced to attend and the only reason the training continues today is because it is an ISO requirement. Sadly, as Drs. Jim Taylor and Manoj Patankar vividly pointed out , in the late 90’s, successful Human Factors Training and Program only last as long as the HF champion is the VP / GM. Driving a HF Program from the bottom up simply doesn’t work. Having said that, I am astounded at the number of people that have said they want more tools long after they had completed the training.

It was nothing short of a trap...

Case in Point (1): As an Inspection Supervisor I refused to sign off on a Work Process Card because it was so poorly written it was nothing short of a trap for Inspectors and Mechanics alike. Another Supervisor signed it off and the results were devastating; four Inspectors and six Mechanics got five days suspension without pay right before Christmas. Three that refused to take

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the suspension were terminated at Christmas.

Fatigue problem is still alive and well. People simply will not go to bed – herein is the problem – we live and work in a 24/7/365 society that both encourages and promotes fatigue. Without legislation it will not change.

Case in Point (2): An Inspector was terminated because he was pushing aircraft by destroying Aircraft Log Book pages. The company then rehired him as an Inspection Supervisor in a different location because he was an “ace” at pushing aircraft. In this new position, the oversight caught him authorizing the use of an unauthorized “bigger hammer” on his “say so” as an Inspection Supervisor. The company attempted to write it off as “just business” but the oversight thankfully stepped up to the plate and he is no longer employed.

In each workshop there are many that take the tools to heart and will say when I see them later they feel like a new person because they are getting 8 hours sleep and they turn their phone off when at home. They all will say the stress and fatigue tools they have learned and practice have “changed their lives”.

“If only I had had this training last year, I would not have spent 6 months in the hospital”

The Most Common Post Training Comments

1. We need more time, more information and recurrent training.
2. Where is upper leadership? Why haven't "they" been to this class?
3. Why has it taken so long to get this training?
4. I didn't want to come to this class, but now I'm glad I did.
5. This was a real "eye opener"!
6. These are tools I can use at home as well as at work.
7. This is the best training I have had in the 30 years working here.
8. Why don't we have a fatigue mitigation program?
9. I have learned more in these 3 days than any of the military ACC courses that I have completed in my 30 years of flying. The company would be miles & \$\$\$ ahead if they would do a full blown CRM Course for us (Pilots & Flight Mechanics).
10. Where are the Feds / Oversight?

I was incredibly saddened by this comment made by one very young AMT (early 20ish).

"If only I had had this training last year I would not have spent 6 months in the hospital - I fell asleep at 70 mph. I didn't know how to be assertive when the foreman told me I had to "just suck it up or get a job somewhere else". We were working a mandatory 12 hour shifts 7 days a week – my accident occurred on day 8. I have [permanent injuries]. I can't have the [dream] I promised myself and my [spouse]. The many doctors have all said it is a miracle you survived at all. Why didn't the oversight step in and tell this company that 12/7 doesn't work? Where were you Mr. [Trainer]?- Why didn't you teach me this last year?"

The AMT was in tears (along with most of the workshop). By the time the AMT had finished I had to put the class on break. I felt someone had ripped my heart out. I didn't have an answer.

Trainer's Comments on Stress and Fatigue Modules



I sometimes feel I've fallen into a time warp with these two modules and ended up in the 90's AGAIN! I have been chasing Fatigue and Stress around this workshop since the 90's and despite the dogged efforts of Dr. Johnson (and others at the FAA) the

Workshop Participants Comments

Communication

- I have learned to how to talk to my wife and she is really an awesome person.
- Since we started



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using our communication tools on our team we have less conflict and have increased our production level with fewer mistakes and rework.

Psychology & Physiology



- a) Learning to use my emotions as tools rather than them driving me has lowered my stress levels.
- b) Learning how to see other people's paradigm was hard, but now by using the paradigm tools I see a new world.
- c) Knowing how my very own brain will lie to me was AWESOME!



Complacency

- a) I changed my route to work and I found I can remember the trip now.
- b) I started using the manual rather than the way the OJT guy showed me and now it takes me half the time and it passes all the tests, and inspection buys it the first time.
- c) I wish I had these tools last year when I missed a step that caused the accident when I was working at (omitted Part 145 name). I got fired and the [company] investigator said I was complacent – Now I know what complacency looks and smells like, I have safety nets so I won't skip any more steps. I really didn't want to come to this class because at (omitted Part 145 name) we had 1 hour HF training annually. I can't believe what I was missing.

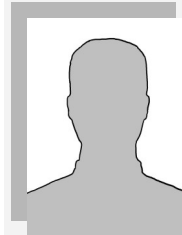
Assertiveness



Assertiveness

(This module has the most controversy, some times explosively due to the current company culture of shooting the messenger and burning all messages.)

- a) Are you nuts? If I tell the supervisor "no" he'll fire me!
- b) I just sign the log book "as per (supervisor's name)" That way I can't get into trouble.
- c) I told my supervisor the AMM said to replace the o-ring and supply was out he told me to reuse the old one – I did, the hydraulic pump failed and I got 3 days off.



Anonymous

We'd like to thank the contributor for sharing this Human Factors related story. We hope that you, our readers, will avoid the pitfalls and mistakes shared by this contributor. Keep Safety First!

To protect the contributors to "Keepin' It Real" and their organizations, their identities will remain anonymous.

If you have a human factors related story you'd like to share, please contact the co-editor, Joy Banks @ joy.banks@faa.gov.

Broadening the Reach of this Newsletter Involves You!

This Maintenance Human Factors quarterly Newsletter is in its fifth year. It started as the Maintenance Fatigue Focus Newsletter but after a couple of years it changed titles to include all of maintenance human factors. There have been a number of industry contributions to the Newsletter and that has helped readership to get a “Real World” perspective. The Newsletter needs more of that!

The frequent authors are Bill Johnson, Joy Banks, and Dr. Jim Allen from Working Safe Always. However, Newsletter writers do not have to have an MD or PhD after their name. We would rather see A&P or IA as important credentials.

You send me E-mails about critical maintenance human factors issues that you observe in your workplace or elsewhere in the industry. Those E-Mails are articulate. They tell an important story. They start a dialogue. We need more of that. Example applied topics could be: how you are using ASAP reports, how you discovered a maintenance error, or how a particular intervention was a big maintenance savings. We also extend an invitation for aviation maintenance students to send in a short article. Everyone associated with aviation maintenance is welcome to contribute to this Newsletter.

Here’s how article submission works. The writer submits an article to Ms. Joy Banks (joy.banks@faa.gov), from the Civil Aerospace Medical Institute. She reads and edits the document. She gets rid of the “big” words and long sentences. She makes it more readable and understandable before sending it back to the author for approval.

Article length can be from 500 to 1,200 words. That is a page or two. As you know, MS Word has a feature that counts words for you. This article has about 500 words. It is difficult to make a point in a short article. However when you know what you are talking about it, is an easier task.

When it comes to maintenance human factors, you know what you are talking about. Interesting high value articles do not always have a solution. They can highlight a problem and emphasize that a solution is necessary.

You don’t have to write the article first. Instead, E-Mail Johnson or Banks with your idea. We will get back to you on how the topic fits the Newsletter. We may offer some writing tips and will also give you the production schedule to be sure we can get your idea to the newsletter as quickly as possible.



Your Questions Answered

In this issue of the newsletter we have listed each author’s E-mail address. Send the author a comment or a question. If we get appropriate response we will feature a Q&A section in the next newsletter.

Sincerely,

Dr. Bill Johnson