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HUMAN FACTORS QUARTERLY

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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.



Considering the Design and Delivery of HF Training

Dr. Bill Johnson

Summary

The author has delivered a great deal of human factors training within the US and worldwide. This article is motivated by observations he has made of the industry-developed maintenance human factors training.

“We are starting/modifying our HF Training”

Nearly every week I receive an e-mail that starts with a statement that the sender is developing or modifying their maintenance HF Training. Often the request is accompanied by an invitation for me or a colleague from the FAA Civil Aerospace Medical Institute or an FAA Airworthiness Inspector to come and speak to their maintenance workforce. Of course, we are flattered by the invitation to visit an organization, to see maintenance or the manufacturing force at work, and then to deliver a portion or all of the training. If only we had the time and other resources we would be delighted to accept such invitations. However, we are increasingly convinced that we offer a better alternative. That is our website (www.humanfactorsinfo.com or www.mxfatigue.com) in combination with the organizational experience, creativity,

Human Factors in Aviation Maintenance



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and personal knowledge and culture you and your personnel can provide to your organization.

Our Invitation Counteroffer

I have been responding to the invitations by directing you to our website, (Figures 1 & 2) and to the website from the Civil Aviation Safety Authority of Australia (Google CASA Safety Behaviours) or to the [September 2013 issue of AMT Magazine](#). Once I get you to our FAA website I steer you to the training HF materials, the Maintenance Human Factors Training Presentation System, the Fatigue Awareness Training, and the fatigue movie entitled “Grounded.” All of these materials are in usable format and “open source” (code word for: free). The Maintenance Human Factors Presentation System is generic legacy HF training. Most users choose to supplement the generic training with discussions about safety culture, voluntary reporting, and other current topics that are organizationally relevant.

When I suggest these sites I often ask the requester to show me examples of the training that they develop. In many cases I get to see the products that are derived from those websites and other places. I am positively impressed. You have the ability to select the information, graphics, and media that work for your organization. It is especially excellent when you add pictures from your workplace and use data from your Safety Management System or recent safety-related events. Just last week I asked a respondent for permission to use some of the ideas and graphics that he added to the FAA and CASA materials. I went from being the trainer to being the student. Thank you for that!

Why You Should be the HF Training Developer or Trainer

Adult learning is called “Andragogy.” It refers to the training and education practices for adults/mature learners. Most adults, especially aviation maintenance technicians are very practical about what they want to learn and how to learn it most efficiently. Most adult learners seek immediate relevancy. For example, “tell me about good sleep habits and not about sleep theory”; “show me the fuel system and how to

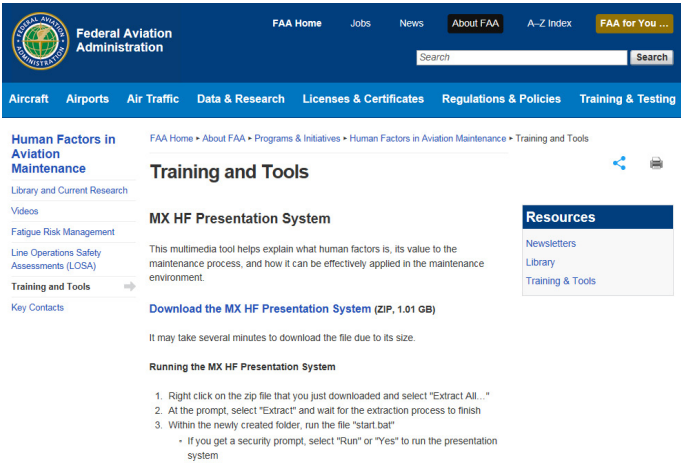


Figure 1. FAA HF Training Website Remains Relevant

troubleshoot a pump failure or how to service a filter rather than how fuel is refined.” Since you know the workplace and organizational challenges you can ensure training is relevant. You know what is important for your workers.

Because you can zoom on specific issues your training can be efficient and more likely effective. Since you know the general background of the student you are able to tailor the information to their knowledge and experience level.

If you, or a colleague, develop and know the human factors training materials it is easier to schedule training, as a formal class or even in short amounts at a shift meeting. You can ensure that recurrent HF training is precisely targeted at your workers.

Train the Trainer

While I encourage you to be the one to deliver the HF training, it is important that you or your HF trainer know some of the fundamentals of being a trainer. Just because you are a great aviation maintenance technician or maintenance supervisor does not qualify you as a human factors trainer. People always ask me “What are the qualifications of good



Figure 2. HF Training from CASA Australia

Continued from p. 2

maintenance human factors trainer?" The answer is never straight-forward. At a minimum they must be enthusiastic, have had some formal HF training, and know something about the aviation maintenance environment. That does not include being a certificate holder or even a college graduate. While an AMT Certificate, maintenance work experience, and college training may be helpful they are not requirements of a good HF trainer.

A Word about Training Providers

I would be remiss not to mention outside contract training providers. I must confess a positive bias for external human factors and other training providers, having spent many years in that role prior to the FAA. External providers have a broad view of the HF topic and yet they see many specific maintenance training organizations per year. They have many examples of maintenance challenges. External providers have the resources to train their trainers and always provide new materials matched to regulations and local requirements. They get in, get out, and get paid. There is much to be said about the efficiency of a consultant. Each organization must decide what works best for them.

Want More Advice?

Loads of new maintenance human factors training development and delivery advice is on its way

with 2017 publication dates. During 2016, the FAA accepted public comments on the proposed replacement for Advisory Circular AC 120-72 formally called Maintenance Resource Management Training. The public input, as always, added high value to the final document. The original AC will be replaced with a new, focused direction that will assist readers with new resources and HF training materials.

The newly revised Air Transport Association (now A4A) ATA Spec 104 Guide for Maintenance Training Development is the product of the A4A Maintenance Training Committee workgroup. The result represents the work of many airlines from all of the Americas. It is an excellent substitute for any textbook on maintenance training development and delivery. It will be available, for sale, from the Airlines for America website (airlines.org) and is a must for all airline training departments.

*This article also appears in AMT Magazine, April 2017, under the title Homegrown Human Factors Training: No FAA Speaker Required

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

The image shows the cover of the September 2013 issue of AMT Magazine. The cover features a large, bold 'AMT' logo in white. Below the logo is a photograph of a man with glasses and a mustache, wearing a blue shirt, looking down. The text 'Photo provided by Air BP Lubricants' is visible in the top left corner. The title 'CASA on Human Factors Training' is at the top right. Below it, 'Aircraft Maintenance Technology' is written in a white box. Further down, it says 'Written by aircraft maintenance professionals for the professional maintenance team' and 'Official publication for AMTSociety'. The date 'September 2013' is prominently displayed in yellow. The main headline 'Air BP LUBRICANTS' is in large, bold, yellow and white letters. At the bottom right, it says 'Talks HPC Class Oils page 18'. A blue banner at the bottom left contains the text 'Figure 3. Click on the picture to be taken to the September 2013 issue of AMT Magazine'.

Photo provided by Air BP Lubricants

AMT

CASA on Human Factors Training

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Figure 3. Click on the picture to be taken to the September 2013 issue of AMT Magazine



You Are What You Eat – Creating a Healthy Food Environment

By Dr. Jim Allen

We have all heard the cliché “you are what you eat”. From the physiologic viewpoint, eating is the primary input in weight control. And weight control is a fundamental aspect of obesity. Popular culture has taken this cliché in another direction; for marketing. A variety of diets are available not only to control weight but to sculpt the body. Restaurant menus with calorie counts and legal restrictions on sizes of sugary drink provide more evidence that controlling eating goes beyond physiology. Stripped of the marketing hype and in its simplest form, an individual's weight and ultimately their obesity, is the balance of intake from eating and output from exertion.

Weight control has a variety of facets. For example, the study of obesity in specific populations has highlighted some disturbing trends. In 1996 no state had more than 20% of their population in the obese category. Ten years later 49 of the 50 states reached this level of obesity. In the study “Too Fat to Fight” the US military identified youth obesity as a risk to national security. Among US workers 27 % are in the obese range.

Readers of this newsletter will recognize these statistics from an article on obesity in March 2015. As a review, Body Mass Index (BMI) is the measure of weight. Ratings of 18.5 to 25 represent average weight, 25 to 30 is classified as overweight, and obesity is a BMI greater than 30. Statistics from the population studies have public health professionals worried. The fear is that advances resulting in extended life expectancy will be undone by medical complications from an obese population (see Table 1).

Like fatigue, obesity has an impact in industry. Diabetes and cardiovascular disease are more common in individuals with a BMI over 30. Medical costs for insurance soar with an obese population of employees. Risk of occupation injuries and pain in knees, back, shoulder and hand are more common in an obese population (1). The March 2015 newsletter

presented a graph of the increasing in costs to industry from medical costs and loss of productivity (See Figure 2).

For the MRO attempting to control error due to human factors, the population statistics from Public Health (PH) studies and the financial effects on industries seem removed from the real concern. How does obesity influence the work of an AMT and what can the practitioner of HF do about it? Medical knowledge coupled with practical application is exactly the approach adopted by the newly released Advisory Circular on Maintenance Fatigue Risk Management. Its emphasis is not on a new regulation but on Fatigue Risk Management at the MRO level.

Obesity fits nicely into the PEAR model of predicting a human factor error in maintenance. The “P” in PEAR is for People who do the work (See Figure 1). Evidence is mounting that work-related impairments is more likely with increasing BMI (2). Job limitations that are most effected by obesity are not those that involve mental and interpersonal demands but are those with time and physical demands (3). The 24/7 work schedule of most MROs clearly place maintenance repair in the category of jobs with time and physical demand. In other words, obese AMT are likely to have difficulty performing job functions due to body size and associated physical limitations.

A popular term used in PH for reduced productivity is presenteeism. Productivity suffers when a worker is absent. Productivity also suffers when the worker is present but not functioning at an acceptable level. This concept of present at work but contributing at a reduced level, called presenteeism, sets the stage for a maintenance human factors error. Presenteeism is the PH equivalent to limitations of “P” in PEAR. For the practitioner of human factors, managing the risks presented by obese workers is becoming menacingly similar to those risks of fatigued workers. Practitioners who ignore either do so at their own risk.

The literature of effects on productivity from an obese workforce, like the effects of fatigue, is immense but the implications for risk management are similar. Controlling obesity in workers is a strategy to limit the occurrence of adverse maintenance events as well as limiting medical insurance costs. So what can the MRO do about it?

One strategy is to create a healthy worksite food environment. This strategy involves creating a worksite environment that promotes healthy eating (4). The first

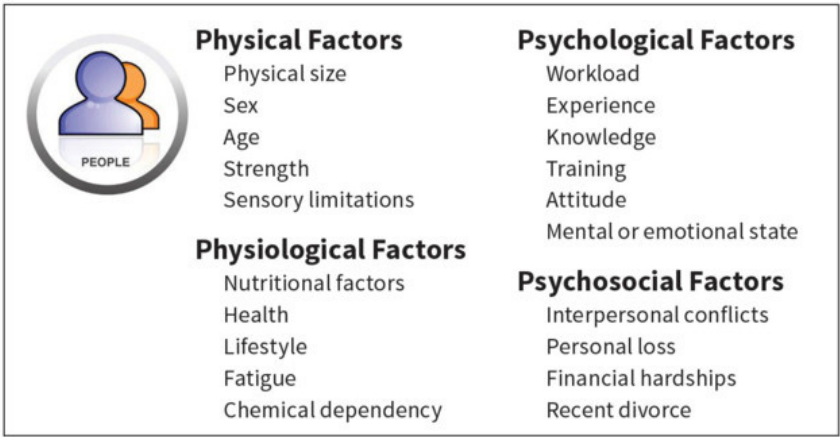


Figure 1. Example issues associated with people - The “P” in “PEAR” Model.

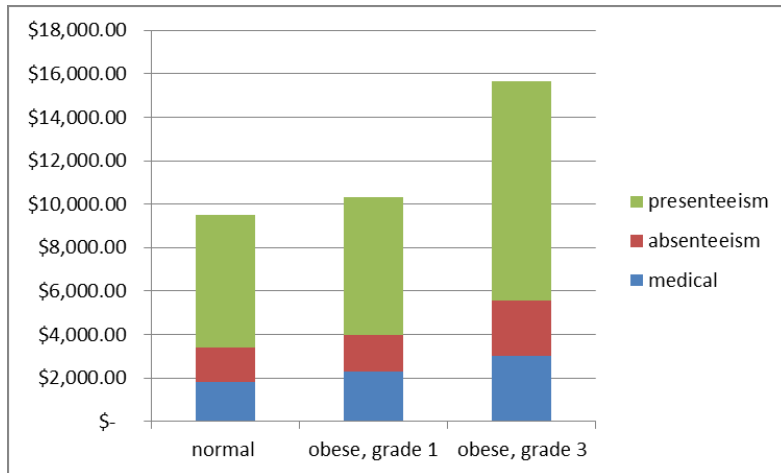


Figure 2. Per capita medical, absentee, and presentee-ism costs comparing normal weight workers with mild obese (grade 1) and severe obese (grade 3) workers. (source: reference 5, used with permission of Journal of Occupational and Environmental Medicine)

This article is from a draft contained in Dr. Jim's upcoming book titled "Working Health, Human Factors: Applying public health concept to ensure error-free repairs."

For questions regarding this article, please contact Dr. Jim Allen at jwallen748@gmail.com.

step is to determine what AMTs are currently eating. AMTs at work usually have limited access to healthy food and low sugar beverages. A good place to initiate an obesity prevention program is at the food dispensing machines in the workplace. Harvard's "Worksite Obesity Prevention Recommendations" (4) provides more specific recommendations. The concept is to integrate policies and programs to provide both a safe and healthy worksite (5).

The cliché "you are what you eat" has roots in physiology but has spawned many marketing initiatives increasing its popularity. For the MRO trying to streamline their business, the cliché presents an opportunity for a competitive advantage. Offering workers healthy eating choices translates into reduced medical costs and more productive workers resulting in a safer organization.

*Editor's note: This article is from a draft contained in Dr. Jim's upcoming book titled "Working Health, Human Factors: Applying public health concept to ensure error-free repairs"

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Weight Categories	BMI (kg/m ²)
Underweight	< 18.5
Healthy Weight	18.5-24.9
Overweight	25-29.9
Obese	30-34.9
Severely Obese	35-39.9
Morbidly Obese	≥ 40

Table 1. Weight Categories

LINKS TO HF MAINTENANCE POSTERS AND THE HF GUIDE

Posters

The Federal Aviation Administration has produced a series of educational posters designed to bring awareness to human fatigue in aviation maintenance (MX). Each poster is part of a MX fatigue themed series designed to improve awareness of fatigue related issues. The posters provide information on how MX personnel can change their lifestyle and work habits to improve safety and quality of life. These eye-catching posters provide helpful and practical tips to battle the problem of human fatigue. Print any size and display in work and rest areas.

Poster(s) are available in a high resolution PDF format. Print on your desktop, or for 11" X 17" size, send to commercial printer.

- Quantity of Sleep (PDF, 5.9 MB)
- Circadian Rhythm (PDF, 15.5 MB)
- Shiftwork (PDF, 5.4 MB)
- Quality of Sleep (PDF, 9.1 MB)
- Family & Social Life (PDF, 10.5 MB)
- Overtime (PDF, 4.4 MB)
- Illness (PDF, 2.5 MB)
- Time Pressures (PDF, 3.6 MB)
- Nutrition (PDF, 3.9 MB)
- Caffeine & Alcohol (PDF, 2.5 MB)
- Stress (PDF, 5.1 MB)
- Lack of Exercise (PDF, 3 MB)

The Human Factors Guide for Aviation Maintenance and Inspection (2006, 2nd edition), Federal Aviation Administration (PDF, 7.8 MB)



Human Factors Guide for Aviation Maintenance and Inspection

SEE SOMETHING MISSING?

Are you a regular reader of our Mx HF Newsletter? Do you see something we're missing? As always, please let us know! If you have ideas for future articles or would like to contribute, please contact our newsletter staff at:

crystal.rowley@faa.gov

MAINTENANCE HUMAN FACTORS RECENT AND UPCOMING EVENTS

HF Review Dr. Katrina Avers, Dr. Michelle Bryant & Dr. Tom Nesthus	March 1, 2017 Washington D. C.
IA Renewal Seminar Dr. Michelle Bryant	March 10, 2017 Wichita, KS
Human Factors Training Dr. Michelle Bryant	March 11, 2017 Enid, OK
International Conference on Managing Fatigue Dr. Tom Nesthus	March 20-23, 2017 San Diego, CA
Infoshare Dr. Katrina Avers	Date/Location TBD