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## HUMAN FACTORS

### QUARTERLY

#### A HUMAN FACTORS PROGRAM HEALTH CHECK LIST

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Drs. Bill Johnson and Michelle Bryant offer checklist ideas to assess the health of your human factors programs. Their ideas are mostly products from the past decade of publications and products from the FAA-funded projects at the Civil Aerospace Medical Institute (CAMI). A shorter version of this paper is published in the July 2015 Aviation Maintenance Technology (AMT) Magazine. For this check-up, there is no time wasted in waiting rooms and you don't have to complete health insurance forms. You are the doctor!

#### Why a Check-Up? Why a Checklist?

Writing this article we wondered while preparing if we were "plowing old ground." To quote the famous Yogi Berra, "It's like déjà vu, all over again." Johnson's list from

his 2001 "Human Factors Programs: Fact or Fantasy?" offers guidance on how to conduct an internal review of a Human Factors program. Borrowing from Shakespeare's *Hamlet*, he asked "Is not this something more than fantasy?" Fast forward fifteen years and human factors programs are not fantasy.

Today "human factors" is a household word/phrase in maintenance organizations and schools. Maintenance human factors content has evolved from early fundamental psychology class (that some called psychobabble) into human-centered and action-oriented discussions of hazards, threats, errors, and the ways to manage them. Voluntary reporting, like the Aviation Safety Action Program (ASAP), has

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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](http://humanfactorsinfo.com)

## HUMAN FACTORS TRAINING FOR FAA AIRWORTHINESS INSPECTORS (CONT...)

formalized how many people recognize and report human error. Schools, colleges, universities, governments, and industry have made attention to human factors a product and philosophy/organizational practice rather than something necessary to fulfill a requirement. A great deal of that effort is a result of the hard work of specialists, managers, labor, and researchers. They have built a case showing that human factors improves the lives of workers, the performance of organizations, and flight safety. This success continues to promote the cause of human factors in the workplace because it is in the best interest of all to ensure worker health/safety, flight safety, and organizational efficiency/profitability.

But with all the hype surrounding human factors, why should you care? Your engagement in human factors awareness and buy-in is so important because human factors errors occur at the human level. At the very core, human factors means, "What should be considered to make sure a behavior is successful?" This means that when you are asked, required, or otherwise perform an action you should be confident of success. But we're human. We make mistakes. It's

inevitable. When we say human factors then, what we are calling attention to is our ability to predict human mistakes before they happen, and design out the error. The intention of human factors then, is to make life better, easier, and more successful. How can we know if we have taken the appropriate steps to ensuring these goals are met? One way is to evaluate existing human factors programs.

Just as we have annual wellness visits to our physicians, an HF program check-up permits you to take the vital signs, suggest where improvements might be made, and identify ways to maintain the health of the human factors program. Just like a physician compares our current health to our past, we should examine where the HF program has been, how it may have changed, and if it is still on track for optimal well-being. Physicians use a check-list to ensure all areas are reviewed; this too would be beneficial in our programmatic well-visit. This article offers some sample questions that would guide such a well-visit ensuring optimal living for your human factors program.

### Asking the General Questions

Human factors programs, from one organization to another, have considerable differences. One organization may have fewer than 50 employees, all of whom work on the same day shift. Another may be a very large US carrier. Some MROs have one location while others have 10+ locations spread around the globe. For those MROs working 24X7, safety hazards are different from other shift schedules and require different human factors programs. There are many standard means by which to measure HF program health. Go to the Acceptable Means of Compliance from the European Aviation Safety Agency or to guidance material from Transport Canada and you will find such information. The international regulatory guidance specifies who should be trained as well as the minimum content areas that must be covered in a HF program. The FAA website, [www.humanfactorsinfo.com](http://www.humanfactorsinfo.com), likely has the most extensive HF information. These resources make it easy to check if you are meeting minimum guidelines. However, when

**Table 1: General Health Questions**

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Yes	No	General Human Factors Well-Visit Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Has everyone received initial HF training?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Is there a recurrent training program for everyone?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Has initial HF training content evolved to address Safety and Risk Management Systems and Safety Culture?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Is every worker committed to safety?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Can every worker define their role/contribution to organizational safety?

## HUMAN FACTORS TRAINING FOR FAA AIRWORTHINESS INSPECTORS (CONT...)

**Table 2: The Invasive Questions**

Yes	No	General Human Factors Well-Visit Checklist 2
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Do you assess the impact of the HF interventions? _____
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Do you annually update HF program content? _____
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Do you ensure currency of HF trainers and managers? _____
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Do you assess the issues surrounding evolving safety culture? _____

the HF program stands. Is it healthy? Are there areas of concern? Is a prescription necessary? Do we move forward with general suggestions for improvement without need for serious intervention? All of these questions require a look at the big picture and must address the following question: If our program were to continue as it is, would we have a serious illness with few options for treatment, or would we have some tweaks but overall a clean bill of health?

safety is at stake, it's more important to examine harder questions that have less concrete answers. That's where the check-up is important. Table 1 offers broad general health questions for your HF program. The right answers depend on your organization.

**The Psychoanalytic Questions**

The Table 1 questions are high level and force a yes or no response. To drill down on some of those issues, a second series of similar questions may

be likened to a psychological part of the well-visit. Here, the goal is to examine the "why" behind the response to the first set of questions. There is no black or white answer to these tougher questions. "I don't know" is not an acceptable answer. Table 2 includes the harder questions.

**About the Data**

Following these questions, we can begin to bring the information together to understand exactly where

Part of ascertaining that the big picture reflects the daily activity of the program is to ensure synergy between those responsible for HF and those responsible of the Safety Management System (SMS).The combined force must not only review and benefit from post-event reactive data but also help identify and apply data from the SMS proactive and predictive data. Integrating HF

**Table 3: It is About the Data.**

General Human Factors Well-Visit Checklist 3
When have you last reviewed and recommitted to your voluntary reporting and just culture policy? _____
What proof do you have that employees really believe that they can report errors without punishment? Give more than one positive/negative example. _____
What is the growth rate of your voluntary reports over the past 3-5 years? _____
Are enough resources committed to analyzing and using data from voluntary reports? _____
Do you merely throw the data "over the fence" to ASRS or ASIAs, or do you crunch it yourself? _____
How do you know that you conduct sufficient root cause analyses on events? _____
How do you formally disseminate "lessons learned" from voluntary reports on event investigations? _____
Tell 3 success stories from voluntary reporting. _____

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## HUMAN FACTORS TRAINING FOR FAA AIRWORTHINESS INSPECTORS (CONT...)

**Table 4: Show me the Money-Safety**

Yes	No	Show me the Money-Safety Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does your event investigation and voluntary reporting data assign accurate \$\$ values to an event?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Are you sure that your root cause analysis is deep enough to identify valid and reliable contributing factors?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does your HF program continuously evolve to address the deep root causes of events?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Do you know the real cost of an hour of training per student to include development, delivery, evaluation, and more?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Do you use the FAA HF Return-on-Investment Model to decide whether to adopt a safety intervention?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	How do you demonstrate that a specific human factors intervention impacts the number or the cost of an event?

interventions and SMS activities within the company helps Engineering to ask the right questions and analyze the data accordingly. One example of collecting predictive data is the FAA-A4A Maintenance Line Operations Safety Assessment (MxLOSA). It capitalizes on peer-to-peer assessments during normal operations. Such systems make everyone a safety auditor.

A health checkup of your HF programs and your safety culture would not be complete without a serious, introspective review of your voluntary reporting system and Just Culture policies. To fully understand the many hazards inside of your organization you must ask the workers for their opinions. A good system will ensure constant worker involvement. To fix your hazards you must cooperate to identify, understand, and manage the hazard, threats, and errors. Table 3 has some questions for checking your HF data.

You do not have to be invested in the

FAA Aviation Safety Action Program (ASAP) to have a high value employee voluntary reporting system. If you don't know how to do this, there are plenty of qualified consultants that can assist. Your FAA inspector can draw on FAA personnel to show you how to implement a formal or even an informal ASAP.

### **The Economic Questions**

While the focus of the checkup, thus far, has been health-oriented you may also want to consider a financial checkup. That is, if your human factors program is doing what it should, workers will be more successful and therefore, produce a more lucrative organization. To more effectively connect costs to HF issues, you can ask some of the questions outlined in table 4.

### **Did you Pass the Check-up?**

Of course, it's not a big deal that you're not required to have HF training and related HF safety interventions. All companies want to ensure flight safety, protect their employees, and

make money. HF interventions are an important means to achieve those goals. These checklists make it possible for you to take a cursory look at the program you currently have and find some areas that may need attention before an accident occurs. How did you do?

**Comments** – Send comments to Dr. Bill Johnson at [Bill-dr.johnson@faa.gov](mailto:Bill-dr.johnson@faa.gov)



## MEASURING THE WORKPLACE: THE P WORKSHEET

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The June 2015 newsletter ended a series explaining four Latent Medical or Environmental Conditions (LMEC). These include reduced near vision (Sept 2014), reduced hearing (December 2014), limitations from obesity (March 2015) and consequences of workplace exposures (June 2015). LMEC form the **red** links embedded in an accident chain (figure 1). LMEC have existed as long as humans have repaired aircraft. The recent aging of the workforce has made them more threatening. Public health officials urge employers to assure that these older workers can demonstrate full job performance.



**Figure 1:** Red link in an accident chain is LMEC

How does an MRO determine when **red** links exist in their workforce? The first step is evaluating aging workers for the presence of LMEC. This newsletter and the other in the series bring tools for completing this evaluation. Title of this series is "Worker Health IS Flight Safety" abbreviated WHISFS, pronounced like "whiffs", and displayed as an icon (figure 2). Expect to see

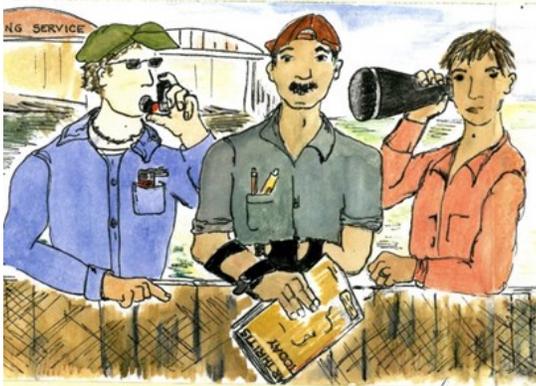
worksheets that offer fill-in-the-blank capabilities.

PEAR is a popular model used to determine the likelihood of a human factors type of maintenance event. Each component of PEAR - People, Environment, Action, and Resources, - represents a worksheet. This first article of the WHISFS series looks at

measurement of the P or "people" component of PEAR. This first worksheet quantifies workers at risk for forming a **red** link. Remember, the focus is always on flight safety rather than on individuals.

One method of determining the frequency of LMEC is to look at two studies of the aging workforce. One is from the AARP based on data from the late 1990s (1). The second is from the Center for Disease Control (2) based on 2009 data. Both examine health and safety issues arising from the aging workforce. Table 1 compares the five people factors discussed in these two studies.

Despite the 10 years difference between these studies, the findings concerning people are surprisingly similar. AARP projects that by 2008, 16.3% of the workforce would be older, defined as 55 years or greater. CDC states that in 2009, 19% of the US workforce was aged 55 years or over. Projections for 2015/2018 are higher for the CDC than the AARP report because of greater work force participation. On the other hand estimates of obesity, non-fatal injury rates, length of absence and musculo-skeletal limitation are very consistent despite the ten year difference in data sets. Conclusions from both AARP and CDC studies are that aging of the



**Figure 2:** WHISFS icon illustrates that Worker Health IS Flight Safety. (used with author's permission)

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## EXPOSURES IN THE WORKPLACE: LMEC FOR THE AGING WORKERS (CONT...)

workforce is occurring and has effects.

For the MRO the findings in table 1 have implications for identifying LMEC that may lead to maintenance events. Like the rest of the workforce, mechanics are aging. This increasing age and the co-morbidities that it brings limit specific repair processes. Consider these two rather obvious examples. Over 60% of work on aircraft involves visual inspection yet by age 52 workers have lost nearly all ability for unaided focus on near objects. 47% of workers over the age of 55 have arthritis or other co-morbidities of musculoskeletal injuries, yet aviation repair demands manual dexterity. The challenge for the MRO is to determine whether their workforce is similar to the averages depicted in table 1.

The P or people worksheet, table 2, looks at the same people factors as the AARP and CDC studies. The P worksheet counts the number of those workers who are over 55, obese, or have limited shoulder and back movement.

People factors counted on the P worksheet suggest LMEC. The bullets below summarize the relation between the LMEC and AMT's job performance.

- The number of workers over age 55 indicates the likelihood of poor near vision which can impact aircraft inspection
- Individuals in the obese category experience difficulty in performing work due to body size. These individuals are also likely to have physical limitations associated with joint related pain in feet, knees, back, shoulders and hand (4). These limitations impact aircraft repair.
- Mechanics must correctly position their hands to the work. Arthritis of the shoulder and degenerative disc disease of the back produce not only pain but physical limitations in correct hand placement.

**Table 2: People (P) worksheet for people factors.**

People	Number
Workers over aged 55	
Obese workers	
Limitations from shoulder movement	
Limitations from low back pain (degenerative disc disease)	

Is an employer legally permitted to collect information such as on the P worksheet? The obvious concern is age discrimination prohibited by the American with Disabilities Act (ADA). Once a worker is employed, medical inquiries are permitted as long as they are job related and consistent with business necessity (5). Current workers must be able to complete all aspects of their job.

Remember WHISFS. **Red** links compromise flight safety. The first step in identifying them is to find LMEC in the aging workforce.

Ref:

1. Rix SE. Health and Safety Issues in an Aging Workforce. Washington, DC: AARP Public Policy Institute; 2001.
2. Center for Disease Control, "Nonfatal occupational injuries and illnesses among older workers – United States, 2009" MMWR April 29, 2011, 60(16) 503 - 508DC 2011 April 27, 2011
3. Gu JK et al, "Prevalence of Obesity by Occupation Among US Workers, the National Health Interview Survey 2004 to 2011", JOEM May 2014, 56(5) 516 - 528
4. Ott U et al "Stages of Weight Change Among an Occupational Cohort" JOEM 57(3) March 2015 270 – 276
5. Rothstein MS "Innovation of the American with Disabilities Act" JAMA 313(22) June 9, 2015 2221 - 2222

**Table 1: Comparison of people factors taken from 2001 and 2011 studies**

People Factors	AARP - 2001	CDC - 2011
Older works as % of total workforce short term projection	16.3% in 2008	19% all workers in 2009
Intermediate term projection	19.6% in 2015	25% all workers in 2018
obesity	1 in 4 men, 1 in 3 women aged 55 - 65	27% national average (3)
Non-fatal injuries & illnesses injuries	No increase in accidents with age	Older workers - similar or lower rates compared to younger workers.
Length of absences afternoon-fatal occupational injury or illness	5 days for total work force 10 days for workers >55 yrs	11 days median off work 55-64 12 days median for recovery for over 65
Activity limitation – Musculo-skeletal limitations	among the most common	47% those over 55 yrs have Arthritis



KEEP THE E-MAILS COMING

We don't receive many E-Mails to our Newsletter Team. One hundred percent of the mail is positive to this point. Your e-mails are poignant and reflect an operational knowledge of maintenance human factors. Thank you for that. We would like to publish a reader letter every issue but we need more feedback to do that. We can publish your name or not. The author of the letter below should add "writer" to his aviation credentials. He asked us to withhold his name and the employer name.

Editor

23 January, 2015

To whom it may concern:

I have a real concern about safety of flight and everyone's personal safety on the job and at home if the Human Factors Training at our company is discontinued. After attending the 3 day initial Human Factors Training, I feel the HF Toolbox should be issued to every employee from the Director level down to the lowest person. This training is just not for mechanics and inspectors, these tools are directly applicable to everyone; Stores (BA 5390), Cleaners / Painters (Aeroperu 603), Ramp (Alaska 536), even HR and Payroll. Here is the truth: Anyone that works at an aviation company has either a very direct or indirect effect on flight safety.

As you know, we attend many classes each year, such as FOD prevention, Hazmat, General Safety, and Ethics, just to name a few. All of this information is very important in helping each of us conduct business and do our respective jobs, but also this information is very important in conducting our daily lives. I feel that Human Factors Training goes hand in hand with the other classes we receive.

Many posters have been placed on the walls of the hangers as well as in offices to remind us daily of the information we have learned in classes that is essential for conducting our jobs safely. It is well known that disuse is one of the main factors in forgetting important information. These posters serve as a reminder of this information, but I feel without the fundamental and initial Human Factors Training these posters are only "just another poster" without true meaning.

True examples of FOD and safety issues are leaving a hammer in the tail boom of a helicopter, causing a flight control jam, resulting in an emergency landing. A mechanic having their hair pulled out while standing too close to a turning tail rotor driveshaft or even a person texting while driving and running off the road. Human Factors Training deepens the meaning of how distraction and lack of awareness can cause these accidents to occur. The "Maintenance Dirty Dozen" posters, now hanging on the walls, are posters without true meaning if we don't have background information.

In my thirty eight years of aviation as an Mechanic, Instructor Pilot (IP), and Maintenance Test Pilot (MTP), I have attended many classes. I feel the training I received in Human Factors is an essential tool needed by everyone within our industry.

I realize the expense of training is great, but the necessity is equally as great with benefits in producing a safe aircraft and a safe environment for our personnel. As it was once said "If you think training is expensive, try ignorance" No one gets up in the morning and says to the mirror – "Today is the day!" - "Today I'll make my big mistake" – Today I'll forget to install a cotter key (Sundance). It happens. It happens to all of us; we forget to stop at stop signs, we loose our SA, walk in front of a turning engine and go home in a box. If we use the tools and Safety Nets we learned in Human Factors, we have a significant chance of arriving home to the people that need us.

It is apparent to me there are many people that share this sentiment. At the bottom of each Dirty Dozen poster there are over 40 large, well known, corporations that supports Human Factors training. I contacted one of these corporations and spoke with the senior personnel training manager. He told me that not only does his company teach initial training, they do recurrent training each year. They too feel the training is worth the cost.

In quoting the maintenance dirty dozen posters "The best safety net for all the dirty dozen is human factors training on how to avoid the error you never intend to make". As I said, this holds true for our jobs as well as our daily lives.

Thank you sincerely for your time and consideration.

Respectfully

If you have a story to tell that will help enhance aviation safety, please email [michelle.bryant@faa.gov](mailto:michelle.bryant@faa.gov) or [bill-dr.johnson@faa.gov](mailto:bill-dr.johnson@faa.gov).  
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