A PEAR Shaped Model For Better Human Factors

Maintenance human factors programs do not have to be complex, expensive, nor a burden. Dr. William B. Johnson and Dr. Michael E. Maddox consider the main HF topics and their relevance to safety management*. Once identified these topics can help in the development of a safety management system (SMS).

There are plenty of excellent resources available to help an organization tailor its human factors (HF) program. For nearly 20 years the Federal Aviation Administration (FAA) has provided extensive information on HF <www.hf.faa.gov/>. More recently the European Aviation Safety Agency (EASA) <www.easa.eu.int/> and Transport Canada <www.tc.gc.ca> have also published HF information. A recent Google search of the term ‘maintenance human factors’ delivered 11,300 hits. The real challenge is in converting the vast amounts of information into clear and practical solutions.

FAA recently published the ‘Operator’s Manual for Human Factors in Aviation Maintenance’ <www.hf.faa.gov/opsmanual>. This 25-page document, published in English, Spanish, and Chinese, offers guidance on the five most important components of a maintenance HF program: event reporting; use of technical documentation; HF training; shift and task turnover; and fatigue. In 2006 the FAA Administrator acknowledged the Manual, which takes a systematic approach to HF, with an award for its use of ‘plain language’.

**Mnemonic**

Application of the memory aid ‘PEAR’ makes recognition and mitigation of HF even easier. ‘PEAR’ has been used as a mnemonic for over a decade to characterize HF in aviation maintenance*. It prompts recall of the four important elements in PEAR—people, environment, actions, and resources. It emphasizes the importance of each element.

The second, less tangible, environment is the organizational culture. An excellent organizational environment is promoted with leadership, communication and shared goals associated with safety, profitability, and other key factors. The best companies guide and support their people and foster a culture of safety. We do not claim to offer the solutions to these organizational issues in this short article, but we acknowledge that environmental matters are every bit as critical as the other elements in PEAR.

**Environments**

There are at least two environments in aviation maintenance: the physical workplace on the ramp, in the hangar, or in the shop; and there is also the organizational environment that exists within the company. An HF program must pay attention to both.

The physical environment is perhaps more obvious and it includes ranges of temperature, humidity, lighting, noise control, cleanliness, and workplace design. Companies must acknowledge these conditions and cooperate with the workforce to either accommodate or change the physical environment. It takes a corporate commitment to address the physical environment. This topic overlaps with the Resources component of PEAR when it comes to providing portable heaters, coolers, lighting, clothing, and workplace and task design.

Successful HF programs carefully analyze the design of safety management systems (SMS). Aviation maintenance HF programs focus on the people who perform the work, addressing their physical capabilities, mental state, cognitive capacity, and conditions that may affect interaction with others.

In most cases HF programs are designed around the people in a company’s existing workforce. One cannot apply identical strength, size, endurance, experience, motivation, and certification standards equally to all employees and companies must match the physical characteristics of each person to the tasks they perform. A company must consider factors such as each person’s size, strength, age, eyesight and more, to ensure that they are physically capable of performing all of the tasks that make up the job. A good HF program will consider the limitations of humans and design the job accordingly.

An important element when incorporating HF into job design is planned rest breaks. People can suffer physical and mental fatigue under many work conditions. Adequate breaks and rest periods will ensure that the strain of the task does not overload their capabilities.

Another People consideration, also related to ‘E’, for Environment, is ensuring that there is proper lighting for the task, especially for older workers. Annual vision testing, supplemented with hearing tests, are excellent proactive interventions that will ensure optimal human physical performance.

Attention to the individual does not stop at physical abilities. A good HF program must address physiological and psychological factors that affect performance. Companies should do their best to foster good physical and mental health. Offering educational programs on health and fitness is one way to encourage good health. Many companies have reduced sick leave and increased productivity by making healthy meals, snacks and drinks available to their employees. Companies should also have programs to address issues associated with chemical dependence, including tobacco and alcohol.

Another People issue involves teamwork and communication. Safe and efficient companies find ways to foster communication and cooperation among the workers, managers, and owners. For example, workers should be rewarded for finding ways to improve the system, eliminate waste, and help ensure continued safety.

**Culture**

An example program that has a notable, positive effect on corporate organizational culture is the FAA’s Aviation Safety Action Program (ASAP) (www.faa.gov/safety/programs_initiatives/aircraft_aviation/asap/policy). ASAP is a cooperative arrangement where FAA joins with company management and its labor representation to report and correct errors as they occur. The result is a new level of teamwork that promotes non-punitive event reporting and clear communication to manage error and cost while ensuring continuing safety.
under Actions. A crystal clear understanding and use of job cards and technical documentation fall in as the basis for the company’s general maintenance manual and training plan.

As part of the company’s SMS, policies must be established, hazards must be identified and mitigated, and the system monitored for acceptable safety. An SMS must be formalized, documented, and become the key element of a company’s safety culture. The HF program, exemplified by PEAR, provides methods for identifying and controlling many of the potential hazards within an organization and should be an integral part of a company’s SMS program.

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* This article was prepared as a paper to guide HF training for the Aircraft Electronics Association.

** Lufthansa has used the PEAR model in training since 1995, since then the company has delivered it to 10,000 employees and several thousand customers worldwide.

Further Reading

Return on Investment of Maintenance HF
http://cat.texterity.com/cat/2006-4

WATS 2006 Maintenance Proceedings
- Taking HF to the Next Level of Maturity
- Operator’s Manual for HF in Maintenance


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