

Chapter 4. Maintenance Human Factors Program Elements

This chapter provides a general description of the different elements of a human factors program and explains options for how they may interact. Additional information related to element implementation are contained within [\[Chapter 5\]](#), [\[Chapter 6\]](#), and [\[Chapter 7\]](#).

Once management and workforce commitment is established, there are several elements to consider when establishing a human factors program. The basic elements are training, error management, and ergonomics. Each of these can be linked with the other two, and to get the most benefit from a human factors program, each should eventually be incorporated.

4-1. Maintenance Human Factors Training

Maintenance Human Factors Training can encompass awareness training, Maintenance Resource Management (MRM) skills training, and specific human factors training focusing on areas that need improvement.

An organization may want to begin its human factors program with a human factors awareness course for all of its maintenance and engineering personnel. This awareness course should familiarize participants with basic human factors principles and how they can influence their job performance. There are several commercially available awareness training seminars, and many organizations have built their own awareness programs with the help of human factors professionals in the industry. The Federal Aviation Administration has also developed guidance material including The Human Factors Guide for Aviation Maintenance [\[FAA98a\]](#) and the Maintenance Resource Management Handbook [\[FAA98b\]](#) which includes an MRM Training Curriculum.

Maintenance Resource Management skills training is similar to **Crew Resource Management (CRM)** training for flight operations personnel. MRM training includes topics such as communication skills, team building, workload management, decision making and situational awareness. This training should be more hands-on than the awareness training, with more participation in exercises and examples including external case studies, e.g., the **Dryden incident** [\[Mohansky92\]](#) and personal or in-house studies.

Once maintenance error investigation data identifies specific human factors-related areas that need improvement, more focused training should be conducted in those areas. An example of this might be training on how to perform shift turnover procedures. Once this specific training is accomplished, audits may be used to determine its effectiveness.

4-2. Maintenance Error Management

Another part of the maintenance human factors program is an error management process that allows an organization to determine why maintenance errors occur and to develop interventions to prevent future errors. The basic elements of the error management process include: maintenance error reporting and investigation; error and contributing factor data analysis; and the implementation and validation of error prevention strategies based on investigation results.

The maintenance error reporting and investigation process should be structured and repeatable. Some error investigation processes are event driven, meaning that some sort of defined operational or maintenance event must occur to start an investigation. The event may be something as significant as an air turn-back, but can also be something not as operationally significant such as maintenance rework. The goal of the maintenance error investigation process should be to go beyond finding out who made the error and towards finding out why the error was made (or what were the contributing factors to the error). To obtain this information, trust is needed from all parties.

After an error reporting and investigation process is established and investigations are starting to yield data, the next step in the error management process is to analyze the data. Initially, this may be done using a manual process, but eventually as more data is collected, it may become necessary to incorporate a computerized data analysis tool. There are a few commercially available maintenance error data analysis tools, and some organizations have developed their own with good results [[Marx98](#)]. See [[Chapter 6](#)] for additional information.

Once an organization has started to analyze data for contributing factors, it is very important to implement prevention and/or intervention strategies to keep the errors and events from recurring. Interventions can be based on the analysis of data for just one event and error, or more global interventions can be developed based on the analysis of data across several events and errors. An example of an intervention based on one event would be a revision to a task card. An example of a more global intervention based on an analysis of several events would be additional technical training on a specific airplane system for an entire department.

4-3. Ergonomics

For a complete maintenance human factors program, ergonomic principles should be utilized and incorporated into the maintenance work environment. First, ergonomic audits should be conducted to determine what opportunities there are for making improvements to this working environment. Next, improvements need to be made and their impact needs to be monitored.

4-4. Program Element Interaction

The following block diagram shows how the basic elements discussed above might typically interact with each other within a maintenance organization. This diagram is not intended to be the only example of how the programs can interact. For example, some organizations have used their own maintenance error investigation results as a part of their awareness training. Also, having maintenance human factors awareness training first may help assigned maintenance staff to become more proficient error investigators.

Figure 4-4.1. Model of Typical Human Factors Program and How the Basic Elements Interact

