

THE FAA HUMAN FACTORS PROGRAM IN AIRCRAFT MAINTENANCE AND INSPECTION

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The FAA's Office of Aviation Medicine once again welcomes everyone to another in our series of meetings on human factors issues in aircraft maintenance and inspection. The topic for this meeting is "The Work Environment in Aviation Maintenance," chosen because a growing body of research demonstrates the extent to which variables in the work environment affect the health, safety, and productivity of industrial workers. Also, as you can readily see, we chose Atlanta as the location for this meeting. Atlanta places us close to a major aviation maintenance facility, that of Delta Air Lines, and to the offices of a key member of the FAA Human Factors Team, Galaxy Scientific Corporation. I note that we have excellent attendance from each of these organizations today.

The FAA Human Factors Program has existed now for about two years. As you undoubtedly know, a major impetus for this program was the Aloha Airlines accident. Prior to that event, little had been done to examine the importance of human factors in aviation maintenance. Considerable time had been spent in studying the problems of pilots and air traffic controllers but maintenance technicians had been mostly the forgotten member of the aviation team. Hopefully the work we are doing and the contributions that you in attendance are making are doing much to rectify this situation.

The objective of the FAA Human Factors Program is to develop products that will be useful both for industry and for FAA personnel. We would like to define those crucial human factors issues that affect the performance of aviation maintenance technicians. We would like then to be able to provide industry with background information and with specific recommendations. A primary product of this effort will be a handbook which I have mentioned in past meetings. It is our desire that this handbook be an all purpose reference text of value for many different users, both in industry and in Government. For example, this text should help someone planning maintenance work schedules. It should provide information on how many hours a person should work at specific tasks such as inspecting identical items like rivets. The handbook also should provide information on features of the work environment such as lighting, temperature, noise, and other environmental parameters. We expect this handbook to be broad in coverage and, as I noted, of use both for industry and for the FAA. For example, we would like to provide useful data to the FAA inspection force which is working with industry in the oversight of air carrier maintenance.

We have gotten a considerable amount of valuable information for the handbook in the course of these human factors conferences. We are looking for additional input from today's attendees.

As I have done at previous conferences, I would like to set the stage for today's meeting by reviewing briefly the functioning of our research program, as shown in [Figure 1](#). The top three blocks show the input we receive from the aviation industry, from other Government agencies such as NASA and DoD, and from the private sector which includes professional and technical societies, academia and advocacy groups. All of these provide input into our program through the operation of conferences such as this, workshops, and through site visits. Many members of our research team have visited various air carrier maintenance sites and collected very useful information. All of this information comes to us in the FAA's Office of Aviation Medicine. We represent the focal point for the program. The research program directed by the Office of Aviation Medicine collects information and develops specific end products such as the handbook I was just discussing. We also, as shown in Figure 1, provide information to a variety of end users, ranging from academia to industry, which represent the full spectrum of groups concerned with aviation maintenance.

Human Factors in Aircraft Maintenance and Inspection

FAA Office of Aviation Medicine R&D Program

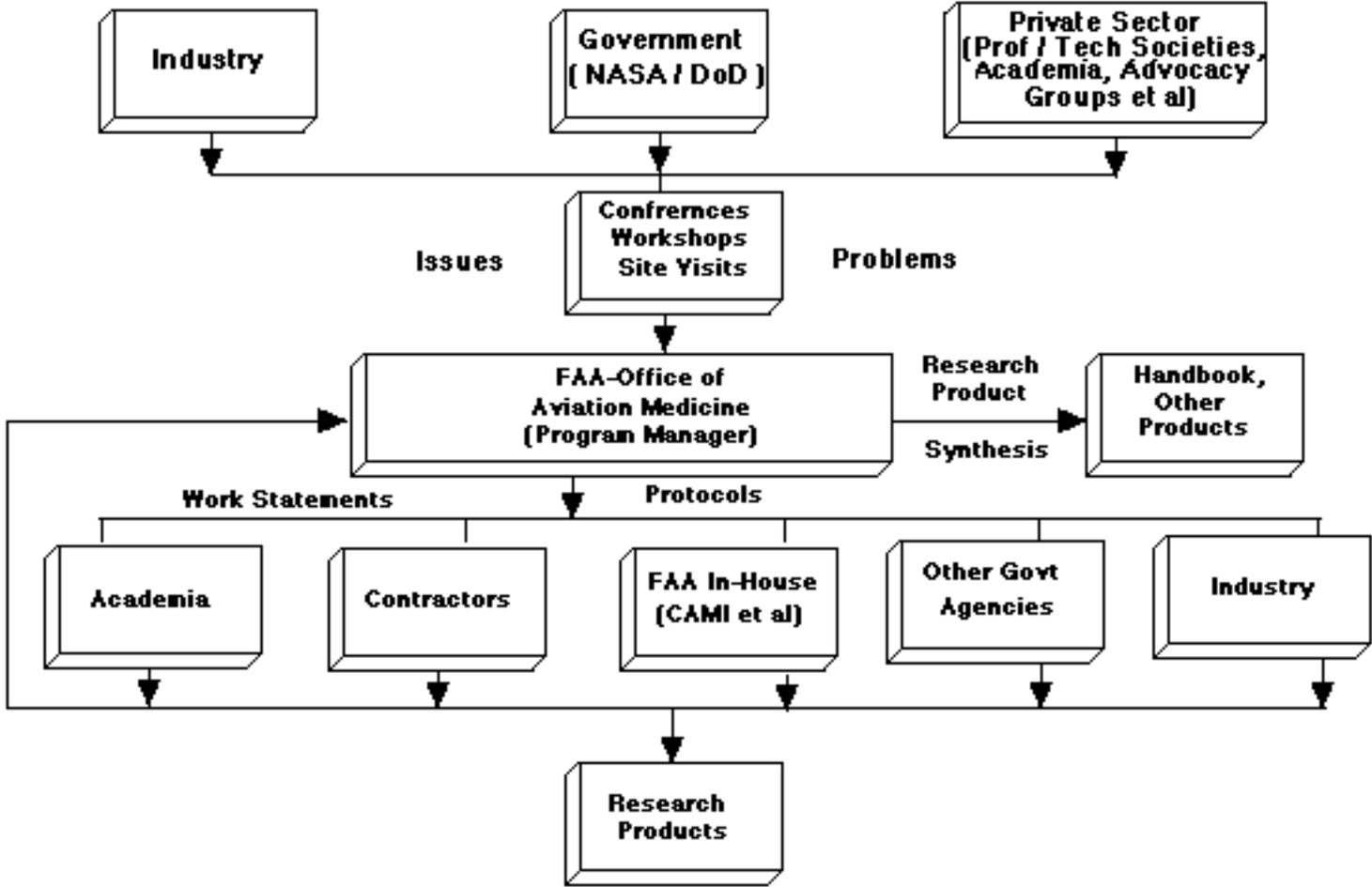


Figure 1

In preparation for today's meeting, I would like to have you consider some of the parameters underlying current maintenance operations, particularly those pertaining to maintenance costs. As you can see in [Figure 2](#), maintenance costs for U.S. air carriers continue to rise. In the two-year period from 1987 through 1989, this cost increase approached \$2 billion. Obviously, maintenance is not a cheap item. For the full U.S. air carrier industry, maintenance costs now exceed \$8 billion per year.

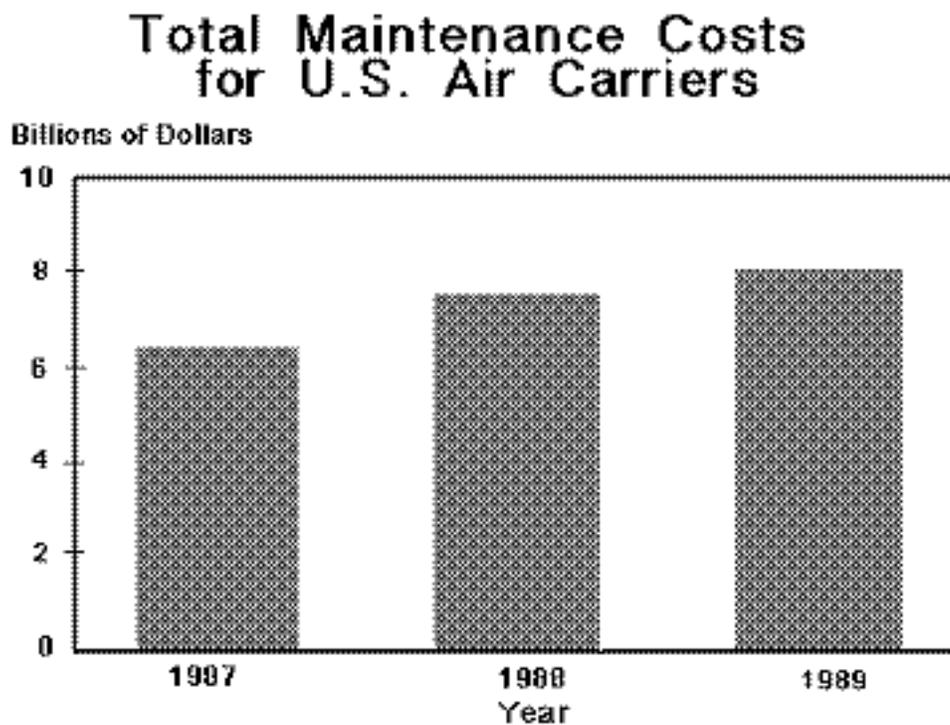


Figure 2

There are many factors contributing to rising maintenance costs. Among these is the fact that the industry is operating a large number of older airplanes such as 727's and 737's. These aircraft require a lot of maintenance. In addition, the FAA has been requiring some rather extensive modifications to some of these airplanes, all of which contributes to increasing maintenance costs. At the same time the industry has been acquiring new airplanes, producing a mix of old and new technology. The fact that both old and new airplanes are maintained by the same workforce also tends to increase maintenance costs.

An interesting feature is that, in the same two-year period from 1987 through 1989, maintenance costs increased as a percentage of total operating costs, as seen in [Figure 3](#). This percentage increased from 11.2 in 1987 to 11.8 in 1989. This does not sound like much, only about one-half of one percent. However, the significance of this increase can be seen when one considers that the savings to industry, had these costs been held constant over the two years, would be about \$165 million. This is a rather substantial number and, in fact, could have meant the difference between profit or loss for some air carriers.

Maintenance Costs as Percent of Total Operating Costs

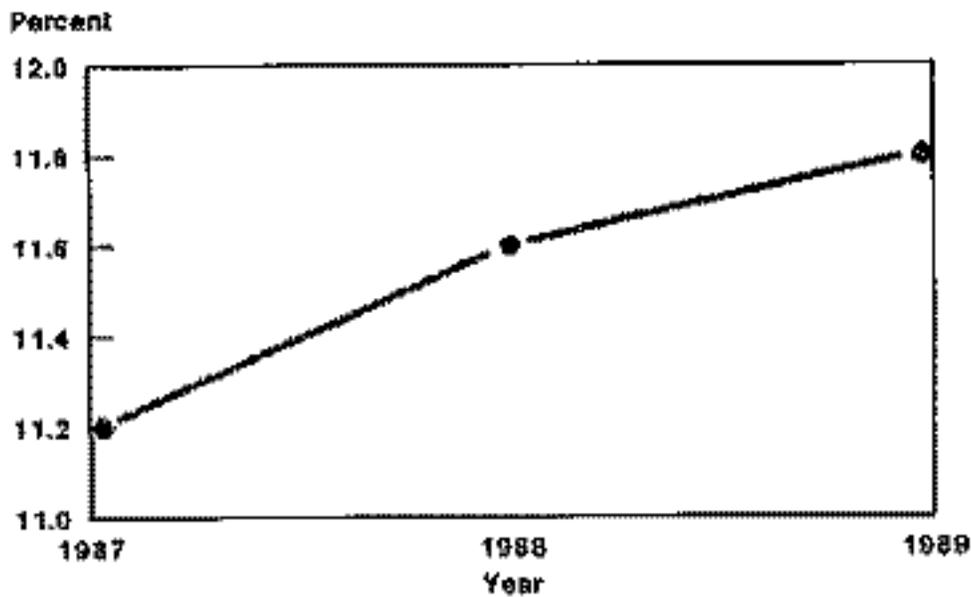


Figure 3

The fact that maintenance costs as a percent of total operating costs are increasing provides a powerful incentive to examine workforce productivity. If the performance of the maintenance workforce can be improved, productivity will improve correspondingly. While the primary interest of the FAA obviously is with safety, we are nonetheless concerned with industry productivity and would like to work with industry in this regard. In fact, it is difficult to separate safety and productivity. If one improves the safety of maintenance and flight operations, workforce productivity certainly will improve also. Many of the features of our research program that are targeting safety almost certainly will have a positive impact on productivity as well.

To deal with maintenance productivity we must understand the full maintenance process. [Figure 4](#) presents an overview of the principal elements in this process. In particular, it shows four major factors which impact the performance of an aviation maintenance technician. These include the working environment, characteristics of the aircraft being worked on, the training of the technician, and the information and data sources available to him.

Overview of Maintenance Process

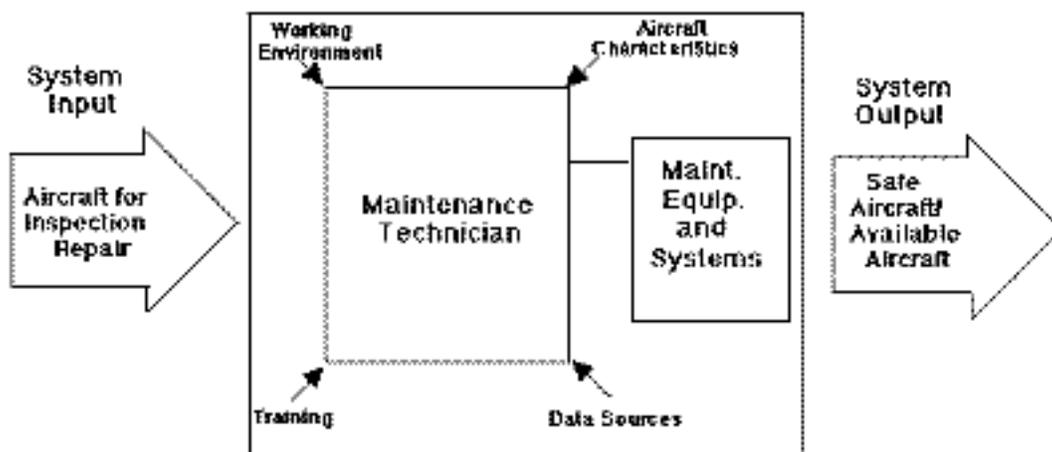


Figure 4

The theme of today's meeting is the working environment. You will see that we have a number of topics for discussion that we hope will be interesting, including some dealing with physical factors as well as those covering work factors. Again, we will cover issues affecting productivity such as job design and measurement. Also, we must not overlook the fact that the FAA, as well as the Congress of the United States, is involved in defining the characteristics of acceptable work environments. Congress is becoming much more active in examining the operations of the air carrier industry. At this time, this attention is directed mostly to areas other than maintenance, but I think we should expect that in the future Congress will give additional attention to maintenance activities.

I would like to note again that we require input from industry for our human factors program to be successful. Obtaining such information is a key goal. However, we also want to facilitate information exchange and communication among the people who are attending these meetings. I think, in fact, that we have been successful in that regard. Such information exchange and communication is almost a natural fall out from these meetings. From listening to presentations and the discussions afterward, the informal talks during breaks, and other discussions around the meeting, I believe that considerable informal exchange is taking place and that it is beneficial for everyone.

Finally, one important output from these meetings is found in the recommendations made both to industry and to the FAA. As I noted earlier, many of these recommendations to industry will be in the form of information to be presented in our human factors handbook. As we work toward this handbook, we will be requesting additional support and input from you people in the aviation maintenance community.

Again, I would like to welcome all of you to this fifth meeting and look forward to productive presentations and discussions over the next two days. Thank you.