Keynote Address
10th Meeting on Human Factors in Aviation Maintenance and Inspection

Plan for Maintenance Human Factors

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INTRODUCTION

Good morning, everyone. Welcome to the Tenth FAA sponsored meeting on Human Factors in Aviation Maintenance and Inspection. My presentation today is in three parts. First, I will present a brief, oral history lesson, recalling the first successful identification and solution to a World War II aviation maintenance human factors problem. This will be followed by Part 2 which will be a briefing of FAA's action plan titled: Total Optimization of Performance in Aviation Maintenance, or TOP-AM for short. Then in Part 3 of this presentation, I will share with you a couple of personal observations on possible changes the FAA could experience in the near future-- and the impact of those changes on maintenance human performance research efforts. I will finish with a personal request to the aviation maintenance industry.

PART 1

Almost every one agrees that the "modern" science of human factors began over 50 years ago during World War II. When World War II broke out, the -- then -- brand new field of human performance research concentrated primarily upon eliminating certain common accidents related to cockpit design and aircrew performance under stress. Research papers on pilot fatigue, cockpit lighting, and similar aircrew-cockpit interface subjects continued to be published by scholars long after the war, giving rise to the new discipline of aviation psychology.

Regrettably, little was published dealing with specific aviation maintenance human factors problems. This doesn't mean that important work in addressing maintenance human factors problems wasn't being accomplished during the World War II years - it was!

Allow me to share with you a story told to me by Mr. Chuck Shaffer, a retired FAA airworthiness inspector. Chuck was one of those lucky individuals who personally participated in one of those first, but undocumented, "successes" in aviation maintenance human factors and performance. Back in 1942, Chuck was based at an Army Air Corps training field a little south of Midland, Texas. He was a B-24 flight engineer in training, who was also required to work part-time as a mechanic to keep his aircraft flying when he was not scheduled for classes. Along with this dual workload, his training unit was experiencing a high number of maintenance personnel accidents.

His company commander's leadership response to this loss of manpower and intolerably high accident rate was to get everybody up at 5 am, six days a week, for 1-1/2 hours of close order drill and intensive calisthenics using the 9-1/2 pound, M-1 Garand rifle.

While in today's society, the company commander's approach to a human factors problem seemed a little Draconian, the fix worked! In less than three weeks, the accident rate dropped below the Army Air Corps' average for B-24 maintenance personnel. Incredibly it continued to decline up until the day Chuck and his fellow trainees were shipped to their overseas units.

On the day before Chuck was shipped out, the company commander posted a letter on the company's bulletin board. His letter, in the form of a poorly veiled apology, explained his rationale for instituting the dreaded 1-1/2 hours a day exercise routine.

He narrated that when he first examined the company's lists of accident related injuries he found the vast majority of them were upper-body injuries, such as broken arms, sprained shoulders and wrists, and lower back injuries.

He then spent some time watching the men work and observed that most of his trainee flight engineers and mechanics were not physically strong enough in their arms and back to maintain 10 hour work days, 6 days a week. So the men got tired, sloppy, and hurt - in that order.

Briefly put, the company commander's human factors problem-solving process went like this:

1. Our accidents are caused by fatigue and lack of upper body strength.
2. The workload will remain the same or expand, so my men need stronger upper body muscles to cope.
3. I know exercise improves endurance and makes muscles stronger.
4. Solution: make these men exercise their upper body muscles with a readily available 9-1/2 pound weight and monitor results.

I think we can agree that the company commander's approach was a simple, perhaps crude, but nevertheless effective approach to solve one maintenance human factors problem. To the best of my knowledge and Chuck's, this solution was never published, never studied, and never implemented at any other Army Air Corps bases. Why not? My best guess, with the confusion of running a two-theater war not withstanding, would be that "maintenance," even aviation maintenance, is falsely perceived as a kind of a dry and colorless subject. Not at all the kind of research material that an aspiring Ph.D. or General would find interesting enough to explore.

So for almost 42 years after the end of WW-II, we mechanics did not share in anywhere close to the attention, notoriety, or veneration that is heaped upon our flying brethren by both academia and the media. But if the truth be known, we in the aviation maintenance community quietly enjoyed the anonymity.

Regrettably, that all changed on April 28, 1988, when on a routine flight between the Hawaiian Islands of Hilo and Honolulu, a Boeing 737-200, suddenly lost 20 feet off the top of its main cabin section, terrifying the passengers and resulting in the tragic death of a flight attendant. From that day forward, maintenance human factors was no longer dry and colorless. Scientists and the Federal Government began to direct more of their attention to solving these kinds of problems, and the research and development into aviation maintenance human factors and performance was accelerated.

From the beginning, the FAA's Aircraft Maintenance Division has supported research into human factors programs. We were here at the first maintenance human factors workshop, and every year since. In 1991 we participated in the development of the Aviation Medicine Human Factors Handbook. It's a very important document that addresses everything a repair station or an air carrier needs to know about creating the ideal work environment for maintenance technicians. We continue to support Aviation Medicine's research programs in maintenance human factors.

In 1991 and 1994 we started working on two major human factors and performance initiatives: the Maintenance Job Task Analysis, and AD Communication. "Job Task Analysis Project" was created in 1991 and is being worked by Northwestern University of Chicago. They will identify each task a maintenance technician performs and identify the scope and detail of the training for each of those tasks. The job task analysis is scheduled to be completed by the end of this year and, once completed, it will be used to develop state-of-the-art Federal Aviation Regulations for maintenance technician training.

In 1994, Northwestern University was also tasked with developing a project that will take the "confusion" out of airworthiness directives. The project is designed to improve AD readability and overall level of compliance. The "AD Communications Project" is scheduled to be completed by mid-1997.

PART 2

One year ago, as a result of a less than auspicious safety record in 1994, over 900 aviation industry, government and union aviation officials participated in an aviation safety workshop here in Washington, DC. From that January 95 meeting, the concept of "Shared Responsibility" was born. Shared responsibility means that both industry and the FAA are responsible for finding and solving aviation safety-related problems.

The published goal of this concept is "zero accidents." To help meet that clearly defined end, the maintenance workshop participants recommended: "that FAA Flight Standards Service should devote additional research effort toward human factors and performance for aviation maintenance, and focus the research on error-detection and prevention." The FAA's flight standards service responded to this specific industry's workshop recommendation by assigning the aircraft maintenance division as the lead organization to pursue that goal of zero accidents in the maintenance human factor area.

As manager of the aircraft maintenance division, I tasked two elements of the FAA's internal research community, the FAA's Tech Center's maintenance, inspection and repair section (AAR-433) and the Office of Aviation Medicine's research and special project staff, (AAM-240) to develop and implement an appropriate action plan. Their action plan is titled "The Total Optimization of Performance in Aviation Maintenance or TOP-AM" for short. It is a systematic, integrated FAA action plan for enhancing maintenance personnel performance by improving error-detection and prevention--- by applying human factors and performance principles.

Our TOP-AM plan addresses the following areas: work structure and function, equipment, job system design and development, and training and information delivery. The rationale behind the development of TOP-AM focuses on:

- Part 121 and Part 135 operators
- Maintenance, how it is tracked, how to enhance it, and how to insure a level of human performance which promotes our zero accident mandate
- How to enhance professionalism in maintenance performance
- New initiatives designed for short term implementation
- Prompt evaluation of the results of new initiatives
- And finally, directing limited FAA resources to areas that can be significantly improved.

Since TOP-AM is designed with the concept of shared responsibility, the two user groups -- FAA and industry -- will participate together in the TOP-AM committee. The TOP-AM committee was formed in April of 1995 and includes members from Flight Standards Service, Aircraft Certification, FAA Medical, and representatives of large and small air carriers.

The basic tenets under which the committee operates are:

1. The FAA's Aircraft Maintenance Division role in this partnership is the mentor and overseer of the TOP-AM action plan. We are responsible for all decisions on maintenance human factors and performance projects, and the accountability for ensuring that current and planned work meets industry and Flight Standards Service requirements. FAA's AAR-400 at our technical center in Atlantic City and Aviation Medicine will provide the majority of the research and development funds, and manage certain research tasks.

2. The FAA's Office of Aviation Medicine research and special projects staff will also administer research and development tasks and provide funding for these projects.

3. Air carrier representatives are responsible for a ruthlessly honest review of the TOP-AM plan and for providing the FAA with their expertise, coordination, and participation in current programs, as well as developing future maintenance human factors and performance initiatives.

Three Parts of the TOP-AM Action Plan

The first part is the executive summary handout, which is an overview of my briefing today and also includes a list of projects we are currently working on.

The second part is a strategic plan of action. This Part 2 of the TOP-AM Action Plan shows our overall objectives for improving human performance for the next five years. It is more cerebral in nature because it identifies broad research areas, the intelligence gathering methods to be used, and limits, if any, on the products or data produced.

The third part of the action plan will be what I call the Maintenance Human Factors and Performance Tactical Plan. For me it will be the most useful, because it will identify the current projects, the responsible organizations, the products to be delivered, and the project's milestones. This tactical approach is useful for two important reasons:

1. The TOP-AM plan stays flexible, current, and responsive to the plan's users, the industry and the FAA

2. I have just one document to review, to track the status of each human factors project and I will know immediately if I should hand out a bunch of "atta-boys," or dust off some M-1 Garand rifles.

So far I have briefly described the plan, its beginning, its design, the players and their responsibilities. But all this background information begs the question "What have we been doing since last January?" Again, as I mentioned before, in Appendix II of the TOP-AM Part I handout, you will find an overview of current and future human factor initiatives that the FAA and the TOP-AM committee has initiated in the past year.

PART 3

As promised, I will now close with some personal observations and comments. In October of this year, the FAA may be forced to go on a "SlimFast" budget! Current FY '97 budget projections estimate a 1.3 billion dollar cut from fiscal year 1996 allotment. Such a dramatic cut will have across-the-board cuts, and maintenance human factors' research may be adversely affected.

At this point in time, it is still too early to know how much, or in what areas of maintenance human factors and performance research will be impacted. I expect to work closely with the TOP-AM steering group over the next six months to make the potential budget cuts as painless as possible.

There are two major bills, that are FAA-specific, presently being worked in both Houses of Congress. One bill, HR 2276 addresses FAA re-organization, and the other concerns itself with the separation of the FAA from DOT.

We should know something concrete on, or before, the end of April; after both Houses meet in Committee and either agree to work out a compromise or agree to table both bills. If the FAA is re-organized or moved, the aviation industry will have to understand that some research projects presently in work, will be delayed, or canceled even if they were lucky enough to be funded in the 96 fiscal year budget. Part of this painful process of change is that existing manpower and resources will have to be juggled to meet the demands of the new working environment. No one is exempt from this process, including me.

CONCLUSION

My final comment takes the form of a request. In the past year I have reviewed a great number of maintenance human factors reports and proposals. It appears to me that in our 10 years of formalized research we have evolved to a point that we tend to place more emphasis and funding on major factors, bigger processes, and complex procedures and forgetting, or at least delegating, to second place, the immediate, limited, but no less important needs of the men and women on the hangar floor. Therefore, today I am asking industry to do all of us a real service. For the next 12 months, at every air carrier line station, repair station, and maintenance facility, I am requesting that each manager, supervisor, and technician concentrate on finding and fixing 100 small human factors problems that bedevil mechanics and technicians every day on the hangar floor.

I am convinced that if we get into the habit of concentrating on correcting all the small, myriad problems that plague our industry, the outcome would be that the big and ugly maintenance related human factor problems will be far fewer in number, and decades apart.