

Panel Presentation on Airline Maintenance Human Factors - Goglia

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National Transportation Safety Board (NTSB)

INTRODUCTION

Good Morning. It really is a pleasure to be here today. I think this is either the third or the fourth time I've addressed this group, and I've enjoyed it every time.

SAFETY SUMMIT

Before I start into the Human Factors presentation that we've prepared, I'd like to talk about the safety summit for a minute. It was a year ago January that about a thousand folks met here in Washington and heard the secretary announce zero accidents. I know I for one, and a lot of other people, looked at that with a very jaundiced eye. Because it's really an elusive goal. In fact, one that probably can't be met. But the effort to get there and the drive to have zero accidents or minimal accidents is in fact obtainable. After that meeting we all walked away and nothing went on. It looked initially like we were going to have a typical politician's announcement of the program -- all the fluff, we walk away -- it just sort of dies a quiet death and nobody mentions it anymore. But, this time something was different. And the difference was that the industry picked-up the mantle, not the government. And they have carried forward a number of programs, more than I'm involved with or aware of their presence. But, they have been carrying forth and doing yeoman's duty towards that goal of zero accidents.

When you look at the just the effort that has been undertaken within the ATA towards that goal, I don't know how much of their resources are devoted to it, but it's considerable. And most of the resources are also the industry resources that come to it. If you look at the talent the industry has put in place to address the specific problems or issue areas, some of the best talent this industry has to offer has been put in place to deal with it.

NOW IS THE TIME FOR CHANGE

I would bet five years ago, you could have probably gotten a million to one odds in ATA leading the charge. They actually want to use this data to better the system. Just amazing is an understatement. We see this throughout the industry, where people are really pulling together to try to reach a better accident rate. It really is an exciting time. Today is probably the most exciting time in aviation, in the entire history of aviation. Because never have we had so many diverse groups going in the same general direction. Never. Never have we had the level of cooperation. Before I took on this NTSB job, I could walk into the ATA and walk upstairs and walk into offices and talk with people openly. Just a few years ago that was impossible. It is a different era in aviation today than has ever before existed. We have cooperative efforts on all the major carriers between their workforces, even in the unionized workforce. You would expect that on Delta or other carriers that don't have union participation, but I'm talking about Uniteds and USAirs and Northwests. There is unprecedented involvement in trying to make our product better. This effort collectively by everybody can only lead to a lowering of the accident rate. Maybe we will never get to zero, but we're going to get better than we have been in the past. We all deserve a tip of a hat to ourselves.

HUMAN FACTORS

Human Factors can lead to improvements in our area. For the benefit of those in the back room, I was pinned moments ago by someone. It says: "Aviation mechanics keep pilots up". I think that's very true; if it wasn't for maintenance airplanes wouldn't fly. We in this industry fit together like a glove and a hand. Everyone of us is dependent upon somebody else. That's people-to-people skills, whether it be communications or working. Actually, there is usually more than one person working on accomplishing a task those are important. These people have not received the level of attention I think that they have needed in the past. When I look back on my many years in the industry, too many, as I hear Bill rattling off all those things, I was feeling older and older. But, when I look back and think how many times I've seen maintenance problems and then I've seen them repeated and repeated and repeated because we never fix them. We may have disciplined somebody -- given them a kick in the butt and sent them home without pay or whatever -- but we never fixed the problem. It was only in the last few years we finally started to focus in on fixing the problem, never mind what the individual did. In fact in many cases when we have some big mess ups, we are better off not even addressing what the individual did, but addressing the systemic problems that led up to it, so we can prevent it from reoccurring. Before I came to the Board, I was involved with an effort on USAir looking at aircraft damage. USAir, like every other carrier, experiences a fair amount of air craft damage on the ground -- people driving tugs going through the airplane, FOD -- I mean the whole litany of things or hazards that the airplanes encounter on the ground. All of those are generated by people. I bet this industry spends in direct cost three hundred million dollars a year in the aircraft damage, and there is indirect cost that come with that probably \$4 to 6 for every direct dollar. We are talking maybe over a billion dollars in cost that we have been unable to get a good handle on. These are people problems; these are human factors in the broadest sense that we need to address. Fortunately some programs are addressing that. I have totally deviated from what I was going to say today. But, all those areas are now finally coming to the top; we are finally looking at them in a different light and we are finally going to find ways to address them permanently. Not with a Band-Aid approach.

SAFETY IS FOREMOST

Risking being redundant, I'll go through what I have written. Since taking my seat in the actual transportation safety board the question has arisen -- what my agenda will be. The first answer, of course, is transportation safety. Now some may say that isn't everybody's in this industry's agenda. Most certainly it is the agenda of everyone with whom I associate. Having been involved with more accident investigation that I care to recall, I found that experience means nothing if it is not a learning experience. Therefore, my agenda with the board will be to tackle those issues which I believe, based upon my experience, are the biggest threats to transportation safety. Human error in maintenance is just beginning to receive the attention it deserves Air safety statistics frequently list maintenance as a minor casual factor in the airline or transport accidents Not addressed in any of these statistics is the cost to the industry in delayed, diverted or turn around flights. The UKCAA reported that in a three year period some of the recurring maintenance problems included incorrect component installations, electrical wiring discrepancies including cross circuits, cross connects, loose objects, including tools, cowling in the access panels not secured -- those were in the top eight. Not exactly exciting stuff, but certainly items that could cause serious problems in the right (or wrong) scenario. Closer to home, Boeing conducted a study of safety issues involved in aviation incidents between '82 and '91. The number one issue came up to be control flight into terrain -- not surprising -- but the number two item came up as being maintenance and inspection. Now by this stroke count they had 2100-odd control flights in the terrain; they had 1481 maintenance issues, and further down on their list was another 200 or so uncontained engine failures. That moves maintenance right to the forefront, yet it hasn't received the attention nor the resources that controls flight into terrain have received.

Soon after my arrival at the NTSB I requested copies of any accident report that indicated involvement in maintenance in the cause. This sounds like an easy request but I found out otherwise. First off, accident reports are not categorized that way, and we had to go back through report after report after report trying to find it. We are still working on it. I think so far, we have identified eight or ten and have requested reprints of all of them. It's a chore to try to pull that data out. However, let me talk about a few of those incidents.

THE HUMAN + MAINTENANCE PROCEDURE EQUATION

Maintenance personnel are called upon to solve a diverse range of problems. Diagnosing a problem on a basis of a sketchy report by a pilot can call for creative thinking and experience, but creative thinking can sometimes create new and unexpected problems. In June 1990, the windscreen of a British Airways BAC111 blew out as the aircraft climbed through 17000 ft. The accident was traced to incorrect installation of the new windscreen during the night shift before the flight. The windscreen had been installed by maintenance with the wrong screws. I think most of you remember the pictures that were distributed world-wide with the captain hanging over the windshield while the aircraft was landing. That incident report is nothing more than a list. Since the aircraft didn't crash there was no major investigation and the report contains nothing more than a physical description of what happened. None of which assisted in our understanding of why those events occurred.

Closer to home, in May 1979 an American Airlines DC10 crashed shortly after take-off from Chicago killing 271 people. At rotation the one engine on pylon broke away from the wing severing the hydraulic lines as the aircraft climbed away. Hydraulic fluid was lost and the outward flap retracted on the left wing while the right wing flap remained extended. The aircraft rolled to the left and crashed into the ground. The engine pylon had failed as a result of a fracture that was attributed to maintenance practices at the airline. Although the manufacturer specified that the engine and pylon should be removed separately, the airline had developed a one-step maintenance procedure in which the engine and pylon were removed as one unit. This not only saved about 200 person hours of labor but also it was considered safer as it reduced the number of fuel lines, hydraulic lines and wires which needed to be disconnected. The procedure adopted by the airline involves support of the engine with the use of a fork lift.

The safe completion of the procedure relied upon the accurate movement of the fork lift to avoid damage to the pylon and its attached points. Unfortunately, the engineers who wrote the procedure were not aware that the fork lift could not be controlled with sufficient accuracy. The engineers never observed the entire process being performed by maintenance personnel and were not aware that the procedure was more difficult than planned. Not surprising, in the year before the accident, another airline using the same procedure had damaged an engine pylon, yet the damage had been blamed on a maintenance error. The cause of the problem was not fully investigated and the damage was not reported to the FAA. Given that time frame, I don't think that even if it had been reported to the FAA that they had the wherewithal to distribute that information to the industry so that we all could have benefited from it.

BY THE BOOK ISN'T ENOUGH

Many maintenance tasks are too large to be completed in a single shift and the result is a human factor typo; the result in the significant challenge to job quality. Paper work generally ensures a seamless continuity of work tasks, however, misunderstandings can still occur. Eagle Lake. Texas Continental Express. I am sure that anybody in here that has anything to do with maintenance remembers these incidents. I have a copy of the report, but essentially turn over procedures were the cause. What's really scary is that six months later the same airline and the same shift turn over procedures resulted in a near duplication of the accident. The plane didn't crash, the people didn't die, so we didn't get all the press coverage, but two incidents in the same operation in six months. It even gets scarier as I look this document. I just talked to the investigator in charge about that accident, many of the processes that we use for the turn over at the Express Carrier are used today in everyone of our airlines.

Nobody has benefited from the lesson of these two incidents, at least not in the large enough scale for it to be noticeable from the outside. We still conduct business the same way; we still have lousy shift turnovers. Those are people-to-people problems -- those are human factors problems. Maintenance merely driven by paper work. Although the maintenance menu and task cards specify that the procedures to be followed, specify that the procedures ought to be followed, there is a potential for divergence between procedures on the paper work and the way the job is actually performed. Reducing the gap between procedures and practices is not just a matter of making the workers do the work by the book, it also is necessary to ensure that procedures are realistic and as convenient as possible. In formal work practices on norms as Dr. Taylor has taught me to say -- "Often replace cumbersome, workable standard procedures because norms are not documented and rely upon assumptions about the way we do things around here." Deviation from an accepted norm can be as dangerous as deviation from a formal procedure. There is no simple way of ensuring that maintenance errors will not occur. However, an important step towards maintenance safety is the recognition that maintenance incidents may be indicators of wider organizational problems. Industry has and is aware of these problems and is working towards these solutions to the people issues.

SLOW BUT STEADY START

It is tough to broadly characterize the work that has been done, but in general it has not really jumped into the pool of people. However several carriers have started programs that have begun to address the issues. Five years ago almost to the day is the anniversary of Desert Storm. I was in Washington then and I was surrounded by a bunch of pilots. It was the National Aerospace Plan and for hours I listened to them. The recurrent thought that kept coming to me was "Why don't we have a similar program in maintenance?" Many of the techniques that they were and talking about we could benefit from in maintenance, but we didn't have such a program. We sat there for the better part of the day and into the night actually. I was doing what I do best -- thinking in a classy place -- thinking about the whole issue of CRM.

I went back and decided I'd like to try that with my employer, US Air. We can start taking a bite of that elephant. We have a labor organization; just try asking labor unions to do something pro-active -- the entire leadership in labor organizations is reactive. When companies do something they react, that's 99.9% of what they do. That guy from Boston is going to show up and ask them to take pro-active (I am in trouble here). But after a while I tried to do it and I was successful. I got them to agree to let us try a program in USAir. I had to go to Phase 2 now and to sell the plan to the company. I was blessed to have a VP in maintenance who was looking ahead. Fred Cocker presented it to him and he thought it was worthwhile to pursue. Now we had to do something that was out of the norm for everybody. In order for a program like this to succeed we need to have the FAA involved.

WORKING WITHOUT A NET

Throughout my working career, the FAA was never really noted for forward thinking and if it isn't in the book it doesn't exist. But we needed it. It wouldn't work without truly getting everybody together. So I had the honor of approaching Vince Laperra and if you know Vince, or have talked to him you would not think that this guy was a forward thinker. We got Clay Fuchey whom many of you know is the FAA human factors guru back a few years ago. He came in and gave us some guidance. By this point our little circle had expanded and I picked up Joe Kania and Dave Driscoll, who have done yeoman's duty and deserve a lot of credit for the success of the program. We were off and running. It was a rocky and sometimes tedious task to put a program in place where one had never existed before. There were no guidelines to follow; there was nothing. We wrote as we went. We were fortunate that Clay Fuchey recommended Jim Taylor to us, who we did not know at that time, who had done a little bit of similar work for Continental Air Lines. Their program was aimed at their management folks; US Air's program was aimed at the guy on the floor, the technician. We visited Continental. As a matter of fact John Stelley, who is here was very open and honest. They shared with us what they were doing, their successes and their failures. As a result, our program is built on Continental's program. I am going to bring up Joe Kania who is going to describe the maintenance resource management program here in just a couple of seconds, but I want to touch upon something I just picked up a few minutes ago in the schedule of today's events.

MAINTENANCE = CREW-ACCOMPLISHED TASK

We talked about someplace's maintenance resources management and someplace's technician resource management and to most that would seem rather transparent, but I think that we need to be a little careful. In today's environment when you talk about technician management you are giving the impression of talking about the individual, the singular person. Maintenance today, particularly in large maintenance organizations, is no longer a singular event; it is a crew-accomplished task. I think that maybe we should consider if we are going to put a tag on any of this activity that we call maintenance we should put our arms around the whole group and not give the perception that we are only going to talk about the individual. The individual may be perceived as being blamed or found to be at fault, when experience has shown that the fault is systemic. Right now the airline industry is expanding its people work in human factors. Northwest Airlines is going in this direction; I know that Dr. Trashier is in the audience and he has a lot to do with their work. United Airlines is moving down the path to a very exciting program for a number of reasons. I'll just mention two that I believe are the primary ones.

THE UNITED PLAN

The first is the stepping off in many ways from the USAir program so they have the benefit of the successful areas that US Air has worked in. And secondly, they have actually devoted some money, training money up front for cultural change. We encounter this in our shop or workplace wherever a "mechanic is a mechanic is a mechanic" is often heard. But mechanics training has changed; I went to school long time ago -- it was 1962 and it's a long time ago -- my training is different from the mechanics that have come out in the middle 1980s. My work experiences have been different. Some of the training takes the form of osmosis; it may be accurate and proper and it may not be. When we get on-the-job training we pick up the other guy's good habits as well as his bad so its a problem. United's approach has been up front -- to train everybody. They are going to bring everybody up to a standard whatever that standard is. This is probably the first time this has ever been done in this industry. Then they are going to step off from that point. I tell you this going to lead to numerous successes. I am very excited about what United has to do. I am not going to steal any more thunder from Darryl, but I think you all will agree with me after you hear it that it clearly is going to raise the level for maintenance technicians and raise the professionalism that they so deserve and desire.