GroundEffects

Reporting Aviation Maintenance and Groundcrew Error Reduction Efforts

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Human Factors in Maintenance: An Emerging Training Requirement

Part 1 of 2

William B. Johnson, Ph.D.

Summary

There is a growing awareness within the aviation industry that new levels of safety and efficiency can be achieved through attention to the human factors in maintenance. The result is that many airlines are creating human factors training courses for maintenance personnel. At the same time there is a growing number of consultants offering human factors courses. This article is the first in a two-part discussion of human factors training. Part 1 sets the stage for human factors training. Part 2 will help the reader select from the many courses offered.

Creating the Demand

Human error causes 80% of aviation accidents and incidents, a number generally held by most of the industry. The personnel whose performance contributes to that 80% include designers, manufacturers, flight crews, cabin crews, air traffic controllers, dispatchers, ground crews, maintenance personnel, and almost anyone who comes in contact with the total aviation system.

Another safety statistic indicates that maintenance is the second highest cause of accidents, following controlled flight into terrain (CFIT). Clearly, these two statistics alone indicate that attention to

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Conference 1997

Plans are well underway for the third conference to be held in Toronto, February 18 & 19.

Scheduled Speakers include:

- **John Goglia,** NTSB board member, Keynote Speaker
- **Mike Doiron,** Regional Director, System Safety, "Ground Damage Costs"
- **David Marx,** Aurora Safety and Information Systems Inc, "Discipline and Human Factors"
- **Alan Hobbs**, BASI, "Why Accidents Really Happen"
- **Ms. Lee Norvell**, FAA Aircraft Maintenance Division, "Discussing Available Safety Posters, Video Tapes, and Courses"
- **William Shepherd**, FAA and **William Johnson**, Galaxy Scientific Inc. "Human Factors Guide"

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MAINTENANCE HUMAN FACTORS- ARE WE GETTING ANYWHERE?

William T. Shepherd, Ph.D

When I reflect back to my first awareness that aircraft maintainers might have some performance problems (Aloha, April,1988) it didn't occur to me then that a lot of us might soon be embarking on a trip that would continue to this day.

Right after Aloha, some rather agitated FAA officials came to the Office of Aviation Medicine and told us in no uncertain terms to get a research program going quickly to deal with the technical (and political) problems that were bubbling over as a result of that accident. The FAA's Office of Aviation Medicine (particularly its Civil Aeromedical Institute, CAMI) had a long history of studying human performance problems related to air traffic control so we were a logical choice to look at maintenance performance issues. As researchers usually do when confronting a problem they know little about, we checked the others for heavy work, but rarely in highly structured teams. Other industries (e.g. auto assembly, advertising) and the U.S. Air

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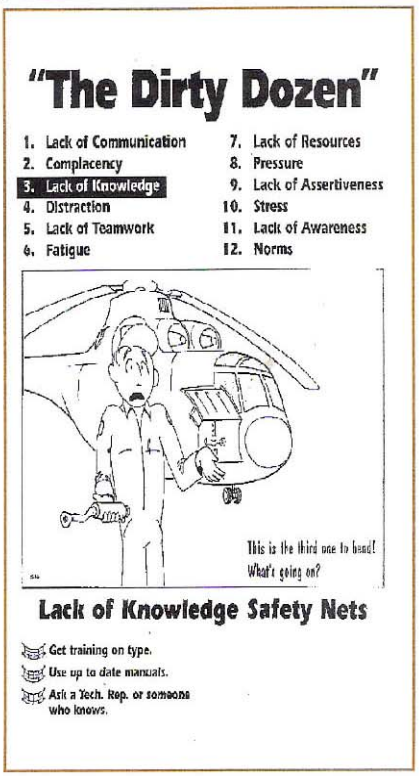

GroundEffects is published periodically to discuss issues affecting maintenance safety and to promote the Maintenance/Groundcrew Error Conferences.

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Training Requirements

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human factors in maintenance has a high potential to increase airline safety.

Safety is the primary objective of any airline. Yet, cost control and profit generation are a must for an airline to sustain operation. Incidents caused by such errors as damage during ground handling, forgetting to finish a reassembly, neglecting a procedure, or not communicating a difficulty are daily blunders that reduce profits. An airline can achieve considerable financial savings merely by reducing such human error. The goal of maintaining safety and controlling cost justifies the current demand for more human factors training for maintenance personnel.

In 1988, about the time of the Aloha incident, Congress passed the Aviation Safety Act (PL100-591). Among a variety of safety-related rules was the mandate that the government conduct research on aviation human performance issues including maintenance and inspection. By the early 1990's an industry-government team wrote *The National Plan for Aviation Human Factors*. The National Plan prescribed a variety of maintenance human factors research projects. Since 1991 the FAA has initiated and completed many of these.

Throughout the early 1990's, there was a small band of researchers who preached human factors in maintenance to any aviation audience that provided a forum. That group was the vanguard for the wave of maintenance human factors activities in which we find ourselves today. This interest was not necessarily initiated by the many speeches. Rather, the attention to maintenance human factors was generated by accidents and incidents precipitated by human error. The industry is now responding with "there must be something to this human factors stuff."

Trends and products that are addressing Human Factors and Error

Most aviation maintenance professionals recognize that the FAA Office of Aviation Medicine has been the most prominent influence on maintenance human factors research during the 1990's funding numerous universities and consultants to study human factors in aviation maintenance. The entire aviation industry opened their doors to the FAA research team resulting in a cross pollination of ideas and disciplines. The first FAA workshop on Human Factors in Maintenance and Inspection attracted 30 people in October of 1988. By 1996, the 10th meeting attracted nearly 200 participants. That is the trend!

For a long time the National Transportation Safety Board (NTSB) has considered human factors in accident investigation. Previously, most of the human factors focus had been on the flight deck crews. The NTSB considered many other factors including: personnel selection, initial and recurrent training, toxicology, rest, personal factors, and crew communication. During the 1990's, the NTSB has paid additional attention to maintenance crew and maintenance factors. Maintenance human factors has found an excellent spokesperson in the appointment of the Honorable **John Goglia** to the Board. **Mr. Goglia** recognizes the importance of the human in the maintenance system, and has initiated many human-centered activities at his former employer, USAir, as well as throughout the aviation industry. His perspective, based upon years of airline maintenance work experience, helps to ensure that human factors R&D has the right mix of real-world applicability.

While the FAA team conducted research and development related to human factors in maintenance issues, the industry also began appropriate initiatives. Boeing Commercial Airplane Group created the Maintenance Error Decision Aid (MEDA) and trained over 28 airlines how to conduct investigations of maintenance error. Companies such as Aurora Safety and Information Systems, Inc. emerged with additional products to identify, analyze, and mitigate maintenance error. The airlines also developed and tested ways to improve human performance. British Airways

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created a means to study maintenance performance, called MESH, and Continental Airlines began human factors type training called Crew Coordination Concepts.

Because aviation maintenance technicians spend significant time using technical documents, there has been a great deal of attention given to electronic manuals. Airbus, Boeing, and Douglas have improved maintenance documentation and the interaction between maintenance and training documentation. Finally, the Air Transport Association established a working group dedicated to maintenance human factors. These are just a few examples of recent initiatives: there are certainly more.

Training for Human Factors in Maintenance: Questions for Part 2

The information above, and throughout this newsletter, has defined and discussed many aspects of maintenance human factors. In the next issue we will suggest the type of information that a training program for maintenance human factors should deliver. Key questions to consider include:

- What should such a course contain?
- Is Maintenance Resource Management enough?
- Is it only "touchy-feely" or can a maintenance human factors course be based on proven scientific and engineering principles?
- Who should teach a maintenance human factors course? Are there false prophets?
- Who should take such a course?
- How long should it last?
- How should follow-up training be conducted?
- What are the reference materials?

If you have other questions that you would like answered in the next issue, please send them to the Editor of GroundEffects, **Wayne Glover** (wglover@groundeffects.org) or to **Dr. William B. Johnson** at (bjohnson@galaxyatl.com). We are especially eager to receive questions (and answers) from consultants and airline personnel who are currently offering a course in maintenance human factors. Credits will be given where requested. Requests for anonymity will also be honored.

References

The Aviation Safety Research Act of 1988, Pub.L.No.100-592, 102 Stat. 3011 (1988).

Federal Aviation Administration. (1991). *The National Plan for Aviation Human Factors*. Washington, DC: The Federal Aviation Administration.

Dr. William B. Johnson is V. P. of The Information Division of Galaxy Scientific Corp. in Atlanta, Georgia. He is a licensed Aviation Maintenance Technician and a pilot. He has worked in Human Factors since 1976 beginning at the University of Illinois Aviation Research Laboratory.

The "Test Flight" of Human Performance in Maintenance Part 2

by **Gordon Dupont**

On September 18 and 19, 26 volunteers, bringing with them a total of 668 years of maintenance experience, came from all parts of the aviation industry to "test fly" the "Human Performance in Maintenance (HPIM) Part 2" workshop. This workshop is a continuation of the very successful HPIM Part 1 workshop being offered by many companies with good success.

The members of this all-important test flight were very diverse. From the Canadian Department of National Defense we had: Major **Bruce Baldwin**, Warrant Officer **Dan Bradshaw,** Chief Warrant Officer **Paul Jenkins**, and Sergeant **Jim Harper**. Members of industry included: **Joe Freydoz, Tom Wiley, Lenny Page, Ev Penzel, Jeff Leeds**, and **Wayne Gallimore,** United Airlines; **Dennis Froese** and **Paul Jansonius,** Canadian Regional Airlines; **Wayne Glover,** Aurora Safety and Information Systems Inc.; **David Hall**, Civil Aviation Authority, UK; **Bob Jackson** and **Jacques Tendland,** Bomardier Regional Jet; **Terry Kleiser** IAM&AW; **Steve Kock** and **Ray Myles**, AirBC; **Richard Komanarski;** Grey Owl Aviation Consultants, **Steve Moon**, Canadian Airlines; **Rob Rorison,** Bay Flightline Service; **Johnny Rush,** Washington Dept. of Transportation; **Albert Van Dyke**, ComAir; **Volker Wallrodt,** Lufthansa; and **Michelle Robertson,** USC ISSM.

For two days these valiant "test pilots" participated in the first flight of HPIM Part 2. The training was given at AirBC's training facility at Vancouver's South Airport.

After the usual coffee and donuts (often a maintenance person's typical meal) and getting acquainted, the participants found themselves grouped in six teams plus a table of observers. The objective remained the same as Part 1: "Examine the human role in maintenance in the chain of events that cause an aviation occurrence and develop ways to prevent or lessen the seriousness of the occurrence".

Part 2 started with an overview of part 1, considered a prerequisite for this class. From there we moved into five new areas of human performance.

First, a review and then a more in-depth look at "human attitudes" was then carried out. There was a brief overview of IQ (intelligence quotient) versus EQ (emotional quotient) along with a simple test to see where each person fits in with "I'm OK, You're OK". The session concluded with five steps to improve ones EQ or attitude to improve safety.

Next we reviewed personal case studies in which each

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Maintenance Human Factors

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Force have tried teaming and found success in terms of such measures as improved productivity and enhanced employee morale. We reasoned that team-based aircraft maintenance should show similar results and with research partners Galaxy Scientific Corp. and **Dr. Anand Gramopadhye** at Clemson University, created a study using Greenville Technical College and Lockheed-Martin Aeromod Center as resources. Team training was the focus of the study for this is what differentiates, at least at the outset, structured teams from similar sized groups of individuals.

In this study eight three-person technician teams were put together, of which four teams received team skills training. The remaining four non-trained teams served as a control group. All teams performed an identical turbine engine removal and installation task. Data, consisting of instructor evaluations and team member ratings, showed clear performance advantages for the trained groups in speed, accuracy and safety measures. Trained teams were found to be more effective and efficient. These results suggest team-based maintenance is an effective work technique in regular maintenance settings. We are also looking at related teaming factors in studies of Situation Awareness at Continental Airlines with **Dr. Mica Endsley** of Texas Tech and **Dr. Michelle Robertson** of USC. Additionally, we have put together team training guidance material, available on our CD-ROMs

The second project involved the study of computer-based instruction (CBI). Lots of maintenance training is accomplished via On the Job Training (OJT) or in classrooms, both of which can require careful scheduling of personnel or encumber others in the training process. CBI can be done at convenient times when trainees are available and need only involve the person being trained. Traditional (read old-fashioned) CBI was typically a slide-show presentation of instructional material followed by multiple choice, keyboard entry tests. If a student keyed in a wrong answer, a beep sounded and something like "wrong answer-try again" appeared on the screen. New technology CBI incorporates some really sophisticated software that deduces student problems and provides remedial instruction. These new trainers are called Intelligent Tutoring Systems (ITS).

One of our research projects was to develop and evaluate an ITS for a specific maintenance task. The task had to involve diagnosis and repair of a complex system and not be something relatively simple like sheet metal patching. After lots of consultation with industry experts we developed and tested an ITS for the Boeing 767 cabin environmental control system (ECS).

This trainer was evaluated for its effectiveness in imparting knowledge in system diagnosis and repair, and was also rated by the students who received ITS training as well as classroom training. Classroom and ITS were about equally effective in providing knowledge and that alone would be enough to give the nod to the ITS for its time flexibility and lack of need for "live" instructors, classrooms and other resources. Using the ITS, students can be given needed instruction when it's convenient, not when classroom schedules dictate. Also, ITS are ideal for providing just-in-time training or refresher training prior to technicians performing the actual tasks. Another advantage of ITS is that they can be used as an aid in instructor-led classroom training should operators prefer the "live" approach. There are many areas of training and job-aiding that can be supported by computer-based systems. Our plans call for more research on electronic systems that can be used plane-side by technicians. The day is not far off when the technician will carry a portable computer to the aircraft along with his/her regular collection of tools, the computer being just one more tool, albeit a sophisticated one.

Research will continue on many different topics in convinced that any changes they make in their operations will make definite improvements in safety and efficiency. But yes, I think we (all of us concerned about maintenance human factors) are getting somewhere to answer the question posed in this article's title. If we've done nothing else but reveal the Cinderella secret of maintenance human factors, we'll have made substantial progress. But let's do more - let's do our best to make operations as safe as they can be by optimizing the work of maintainers. We can all make contributions, either as researchers or as technicians and supervisors trying to implement human factors concepts in the workplace. If we all pitch in there's no question in my mind that we'll be getting somewhere.

William Shepherd is the manager of the Biomedical and Behavioral Sciences Branch in FAA's Office of Aviation Medicine in Washington, DC. He is responsible for managing the Washington Headquarters part of the Aeromedical Research Program. Bill has Bachelors and Masters degrees in Aerospace Engineering and Ph.D. in Psychology. He is a commercial pilot with single/multi-engine land ratings.

Do you have a maintenance-related article you would like to contribute? An idea for discussion in this newsletter? Please send these articles or ideas to:

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Imagine If You Will...a Human Reliability Program

by **David Marx**

It has been nearly a decade since the Aloha Airlines disaster - the event that spurred the United States FAA to invest resources into maintenance human factors. Since that time, we have learned that maintenance error contributes to 15% of air carrier accidents and costs the US industry greater than 2 billion dollars per year. As an industry, we have learned much through the regulatory initiatives, Boeing's MEDA project, ICAO and IATA efforts, as well as the many industry committees dealing with the issue of maintenance error. The application of Crew Resource Management (CRM) principles from the flight deck has been well received by maintenance organizations and might easily be called the first cornerstone of any maintenance human factors program. Decision-making, crew coordination, assertiveness, stress management – all of these CRM issues have shown equal application to both flight and maintenance. Yet beyond the benefits of CRM, there has been little in the way of operational programs that have **demonstrated** an ability to reduce maintenance error.

For quite a few carriers, human error investigation systems have begun to form the second cornerstone to their maintenance human factors programs. From USAir's roundtable approach to event investigation, to the many carriers trained on Boeing's MEDA, to Northwest's embrace of Aurora's AMMS; event investigation coupled with maintenance resource management (MRM) training forms the two principle ingredients to the best of today's human error management programs. Nevertheless, today's human factors programs are in perpetual transition, required continuously to justify their cost effectiveness and actual impact on aviation safety. From budget battles to old-school skepticism of human factors, we have yet to find the program that will embed human factors into our daily operation.So what is the next step? The answer: A formal Human Reliability Program.

Consider the disparate treatment that we currently afford mechanical versus human reliability. On the mechanical side of the airline operation, nearly all failures are investigated, analyzed, and monitored for their effect upon the safety of the aircraft. Mechanical reliability programs, engine condition monitoring programs, shop findings - all of these efforts have contributed to make equipment failure a small piece of commercial aviation accidents. Yet while human error is the cause of 80% of aircraft accidents, there is not a carrier in the world today that can track and respond to human failures as they track and respond to mere hydraulic pump failures - even though the hydraulic pump will likely never cause an accident.

Now imagine a human reliability program sitting squarely beside your mechanical reliability program. By human reliability, I am suggesting a merger of the best of today's human error investigation techniques with the organizational processes embodied within today's proven mechanical reliability programs. A culture where technicians, pilots, and ground crew agents feel a duty to report their errors, participate in error investigations, and actively participate in the development of

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COMPLACENCY - THE HIDDEN LINK

By **Richard Komarniski**

One of the major changes to occur in the world of airline training over the past few years has been the emphasis on Human Factors. Originally focusing on the pilot community, Human Factors has now spread into the training sphere of maintenance technicians. One word appearing frequently in efforts to understand the chain of events that precede an accident is *complacency*. One human factor that can be dealt with without penalizing revenue is the insidious factor of complacency.

Complacency is defined in the dictionary as the "unjustified self-satisfaction accompanied by a low awareness of the need for action or involvement", or as a psychologist would say, "a conscious or unconscious relaxation of one's usual standards in making decisions and taking action."

The "bogus" parts industry is relying on us to be complacent in our tasks and not be vigilant to the parts that are we are using. Admittedly, we cannot detect all bogus parts just by alertness and knowledge, but we can identify quite a number of counterfeit parts if we are vigilant. What causes us to become less vigilant, i.e. complacent, about the parts we are using or when performing repetitive tasks such as inspecting the wheel well for the 10th time? Psychologists explain it by saying "the subconscious or emotional mind (child ego state) creates complacency, while it should be the conscious mind/rational mind (adult ego state) who is in control to perform the task." Boeing studied the causes of 276 in-flight shutdowns due to maintenance errors. 94% of these investigations revealed that the contributing cause was probably the technician's state of mind (emotional mind) while they were completing the task, resulting in an incomplete or improper installation of a component, damage on installation, equipment not installed or foreign object damage. But only 6% of the errors were created when the technician was troubleshooting, i.e. using his/her rational mind state.

Ironically, the major contributors to complacency are the very factors that generally lead to a safe and uneventful flight. These include: reliable aircraft, faith in one's airline, familiar circumstances, familiarity of surroundings, and positive expectancy . And, because of the repetitive nature of a lot of aviation maintenance work, complacency is an ever-present danger. When a person becomes complacent he relies less on his rational (adult) mind and more on his irrational (child) mind. Consequently, his performance suffers. Complacency is an attitude – and attitudes govern the probability of our responding to certain incidents in a given set of circumstances. The good news is that like our other attitudes, complacency can be changed through a conscious and rational effort.

CHAIN OF EVENTS

Recognizing the symptoms of complacency will help us to respond accordingly. Some of the symptoms that should set off alarm signals are:

Accepting Lower Standards of Performance: One of the early symptoms of complacency is simply a lowering of one's standards. An example would be not completing or following an inspection sheet for the task at hand.

Erosion of Desire to Remain Proficient: The individual who does not make the effort to stay ahead in his profession is going to fall behind. It is like staying in shape physically, you don't simply get there and forget about it. The individual who loses this desire has symptoms of complacency.

Boredom and Inattention: If it is a chore to come to work day after day, or if we don't feel challenged by what we do and are not motivated to meet the challenges of our jobs, then look out for creeping complacency. We'll be performing with our emotional mind verses our rational mind.

Satisfied with the Status Quo. Typical of individuals who have become complacent about the status quo are perceptions that "things as they exist now are perfectly satisfactory." "Why change?" "Don't rock the boat." "Don't make waves."

Increased Feeling of Well Being. This is best described as the "couch potato," the individual who thinks everything is going well and is operating in his comfort zone 100% of the time. He has become too lazy to look for and recognize the risks in his lifestyle.

SAFETY NETS

We have defined complacency and described factors contributing to it; we are now in a position to discuss the safety nets available to us First, to develop positive methods of preventing complacency we must keep ourselves **aware.** One of the first defenses is to keep your awareness level peaked, primed and stimulated. I don't mean a once-a-year pep talk. Pep talks are short lived. There must be a long term commitment that constantly hammers away at complacency. Constantly ask yourself "Am I working with my rational mind?" Yes, we need to work with our emotional mind from time-to-time to be creative but we should finish the task in a rational state of mind.

Professional Involvement. Staying abreast of our profession is an effective method of fighting complacency and prevents us from becoming stale and outdated. The mechanics who are aware of what's happening in their industry, who are knowledgeable of the latest technology, who read professional publications, who belong to professional organizations are far less likely to become complacent in maintaining an aircraft. If you are doing an inspection for the 21st time on the wings of an aircraft make yourself aware of your task and what to look for. Call up the SDR or MDR for the aircraft model and area. Become aware of what other operators are experiencing with the same aircraft you are maintaining. Read the service bulletins, alerts and manufacturer communiqués. There is a great deal of information out there for our use as safety nets.

Plan Ahead. Planning ahead provides a standard to measure progress towards a goal. With a plan you can determine if you are indeed going in the correct direction, and wards off complacency.

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Complacency

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Training. Initial and recurrent training, including human factors training, are fundamental to minimizing risk and preventing complacency. Training does far more than sharpen skills and refresh memories. Training can and should add to a mechanic's total experience by preparing him to handle routine maintenance tasks as well as emergency situations. Most companies provide their maintenance personnel with technical training. Companies now realize the importance of providing their technicians with *Human Factors Training* to address the 80% of accidents and incidents caused by human errors.

Create Challenges for Yourself. How many snags can I find tonight? Have someone check your work if you find yourself doing a tedious task. Dual inspections are cheap insurance. Ego has no place on the hangar floor.

Face Reality We all must recognize that in aircraft maintenance we have little margin for error, and mistakes can result in injury or worse. A healthy understanding of the risks we face – the people, the aircraft, the missions, and the environment – is essential to maintaining the proper balance to prevent lethal doses of complacency.

Check-sheets: Errors of complacency can be lessened by always following the aircraft manufacturer or approved aircraft inspection program checksheet.. Do not attempt to do work from memory and NEVER sign off work that you are not totally sure is complete. The checksheet is a safety net that assures our rational mind that we did complete the task. WE CANNOT COMPROMISE OUR STANDARDS.

In summary, complacency is clearly a significant contributing factor in accidents. It is important to recognize that the safety nets that prevent complacency are under our control. By developing and implementing safety nets we can prevent, rather than have to cure, complacency.

Richard Komanarski is President of Grey Owl Aviation Consultants. He has worked as an Aircraft Maintenance Technician for 20 years. Prior to founding Grey Owl he worked with Transport Canada for five years.

Reliability Program

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preventive strategies. A system where sophisticated analysis tools spot trends and develop systemic solutions to less critical errors while structured engineering and disciplinary approaches provide comprehensive fixes to errors endangering safety of personnel or safe operation of the airplane. A system where engineering and quality assurance groups put human error on the agenda for every reliability control board meeting. A system where the regulatory authority spends less time tracking down violators and more time monitoring the effectiveness of the carrier's approved error management program.

Does it sound improbable? Had I been asked six months ago, I would have said yes. Yet today, a number of US carriers, the International Association of Machinists, and the FAA are seriously considering the idea. Human Factors in maintenance has been a special project for long enough, now it is time that human factors be folded into our everyday work. A human reliability program may be the tool to do just that.

David Marx is Vice President of Commercial Aviation Systems for Aurora Safety and Information Systems, Inc. The material for this article was taken from a proposal asking the US FAA to facilitate the industry's development and validation of human reliability programs for aircraft maintenance.

HPIM Part 2

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person brought an example of a mistake they had made involving one of our dirty dozen. After a team discussion of each of these personal examples, one was selected to discuss with the class. The intent was to find the root causes and develop safety nets. It was generally agreed that this exercise was very interesting; however, it took quite a bit of time and may be shortened for the final class.

"Lack of Communication - The Written Word" was the next topic. The AME's distrust of the written word was discussed and solutions to help reduce this problem were developed. This section concluded with the teams rewriting an actual log book entry from the Dryden accident to improve its clarity. We believe these improved entries could have saved the 24 lives lost in this accident.

"Company Culture" was a topic which drew a lot of interest. We use the analogy of a tree with management being the trunk of the tree, the employees the branches, and the leaves being the end product of customer service or maintenance practices. The unseen roots of the tree are the company culture.

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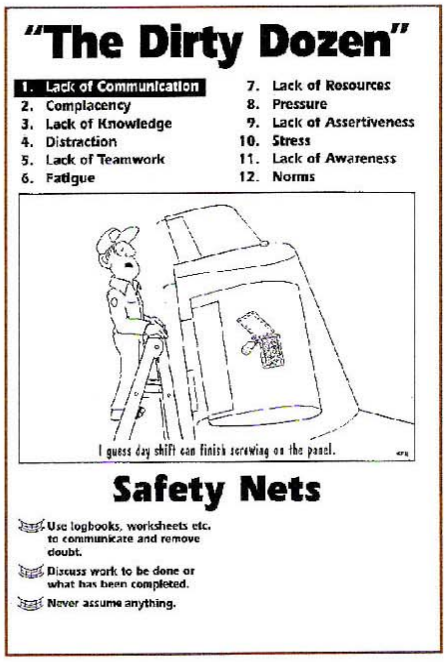

Human Factors Training at 19 Wing, Comox – Canada

CWO **Paul Jenkins**

In the fall of 1994 the 19 Wing Flight Safety Office invited **Gordon Dupont** and **Bill Foyle** from Transport Canada and the British Columbia Institute of Technology respectively, here to Comox. They were invited to introduce us to a new flight safety program for use with aircraft maintainers called "Human Performance in Maintenance;" little did I realize how this would impact my life. I was an old snarly Flight Engineer who had little time for "hug me, hold me" scenarios and looked upon this as nothing more than an attempt by others as another "make work" initiative. Now, looking back, I feel somewhat embarrassed by this response.

I took early retirement from the regular Canadian Forces but was immediately hired back on in the Reserves as the Deputy Wing Flight Safety Officer. One of my primary functions was to start a Human Performance in Maintenance (HPIM) workshop for the aircraft maintainers working at the Canadian Forces base, Comox, on Vancouver Island in British Columbia. My boss shared in the implementation of this HPIM program in Canada whilst serving as a member of the Industrial Relations Committee, chaired at that time by **Gordon Dupont**. My initial reaction to my task was somewhere between "What am I doing here, ah well, it's a job," to "Well let's get on with it, but, what do I do, and how do I do it?" The latter reaction seemed to fit the bill and slowly, with significant help from **Gordon Dupont**, we built up a handbook, a presentation and facilitator notes. Two others helped with the course development: **Sgts Jim Harper** and **John Stewart**. They spent an enormous amount of hours in their spare time wading through military boards of inquiries to find suitable case studies for us to use. Additionally both had taken the seminar from Gordon and Bill and helped my understanding of the course.

When the required documents were compiled, we looked at how best to facilitate the program. Following my belief, "if it ain't broken, why fix it?" we decided to emulate the existing seminar. After all, they had run numerous successful seminars with their time-proven approach. We practised among ourselves the required dialogue, as well as the skits included in the seminar, checking for cohesion and time requirements. A number of concerns rested heavily on our minds. Would the Wing Commander approve using first names and wearing civilian clothes? We wanted this to be an open and frank discussion and felt that the deference to rank would impede the free flowing discussion so vital to this seminar. The Colonel agreed. (He did tell me he would attend one day; that's when we used "sir!")

Our seminars keep a format similar to that of Transport Canada. We discuss twelve human factors (the "dirty dozen") which affect the aircraft maintainer. These twelve are: communication, complacency (please see the complacency article by Richard Komanarski), knowledge, distraction, teamwork, fatigue, resources, pressure, assertiveness, stress, awareness and norms. We carry out a behavioural analysis to determine a person's characteristics and discuss how "we are what we are." Further, we attempt to demonstrate how we can strive to be the perfect "assertive" maintainer. In between, we conduct case studies to determine the actual causes of an aviation occurrence and the safety nets we would put into place to ensure a similar occurrence would not happen again..

The more we got involved, the more we learned, and eventually, we became very comfortable with our seminars. In all, we have trained over 250 maintainers. We have

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Comox

had visitors attend from six other Canadian Forces bases and three have started their own program. We even had two lads from the Canadian Navy take part and, although they had no aviation experience, they were an integral part of the class discussion. They went back to their home base intending to start a naval-oriented program. As word of our seminar spread, we attracted attention from many interested groups such as the Aero Medical Training School, Instrument Check Pilots School and the Canadian Forces School of Aeronautical Technology and Engineering. Their feedback was very positive and they have requested slots in future seminars. Recently the US Navy has been showing interest in the program and has requested further information. We have also taken our show "on the road" and held seminars at four other locations. One thing I have learned from the many positive critiques we have received, is the universal need for this human performance training. Time and time again, the aircraft maintainers tell us they wish they had taken this seminar years ago, had it been available. To ensure future maintainers will not share this lament, new recruit maintainers are being instructed in human factors in their basic technical courses.

It is obvious, although *official* causes of aviation accidents are available to all, very little information in aviation investigation reports tells us exactly what was going through a maintainer's mind at the time he/she allowed it to wander. Did that fastener not get done up correctly because the maintainer was still smarting at the bawling out his boss gave him, or maybe it's because of family or financial problems that he took his mind off the important task at hand? Or, how about the guy who works all night to complete a maintenance function and is suffering from pressure or fatigue? Accident investigation reports must dig deeper into finding the root cause of errors. Simply putting the cause as "inattention" may satisfy the record books, but why was the maintainer inattentive? That's where we must focus and then build on this information.

We, like those in industry, have difficulty finding the funds to keep up to date and run the seminars, but, we have found the actual cost of the seminars can be run for as little as $125.00 for supplies and material for the entire class, including a handbook for each student. The seminar can be successful with a minimum of fifteen people (this ensures enough interaction and personal experiences which are vital to this class) and a maximum of around thirty. Refresher training in the future is a must and should be anticipated and budgeted for during initial planning for human factors training.

None of the Comox instructors have had any "formal" training, either as facilitators or in psychology. A couple of interested individuals can be taught how to facilitate a similar HPIM seminar in very little time. The secret is to get people talking and once that happens, the rest falls into place. We hope that you are able to start an HPIM seminar of your own and begin to see the benefits.

CWO Paul D. Jenkins is the Deputy Wing Flight Safety Officer at 19 Wing, Comox on Vancouver Island. He has been in the Canadian Military for 31 years as a Aircraft Technician and a Flight Engineer.

HPIM Part 2

(continued from pg 7)

When something goes wrong at the fruit end, often all that is done is to prune (punish) the branch (offending employee). Because no systemic changes are made, the roots and trunk regrow a branch (rehire a person) similar to the one just pruned. No systemic change – a similar event is likely. Because the roots are underground and unseen, it is difficult to root them out as a contributing factor and develop solutions.

Only recently have the regulatory bodies begun to look further than the branch and delve into root causes by looking at factors such as company culture. What to do? The defense for company culture has to be a professional standard by the AME. Remember, no matter what the contributing factors: *We are still responsible for our actions.*

The next topic, norms, was a logical extension from company culture and provided some enthusiastic discussion. Again, the defense against negative norms falls back on you and your professional attitude.

The workshops were wrapped up with a case study on the Nationair crash of a DC-8 in which 261 people died as a result of low tire pressure leading to a tire explosion and wheel well fire. The contributing factors to this "simple" maintenance error cover 11 or the 12 "dirty dozen". The Continental Express accident in Texas will also be used, time permitting.

The 260 pages of evaluation sheets need to be carefully reviewed so that we can take advantage of advice from those 668 years of experience and ensure the workshop accomplishes its stated objective in the most effective way possible.

The results? Everyone felt that the material was worthwhile and only one would not recommend the workshop at this time but indicated that we should continue our work on this material. The others used comments like "highly recommended" and "Don't stop with us. We must all spread the education". That last statement is our goal. It is why we have worked hard to develop these courses and struggle to spread the word of maintenance human factors.

Gordon Dupont, Special Programs Coordinator, Transport Canada
Bill Foyle, CoFacilitator

PS The final version of HPIM Part 2 will be presented at the "Maintenance/Ground Crew Errors and Their Prevention" conference at Toronto on February 19, 1997. I hope to see you there.

Gordon Dupont is a Special Program Coordinator for Transport Canada. He developed the HPIM workshop in response to the F28 accident in Dryden, Ontario.

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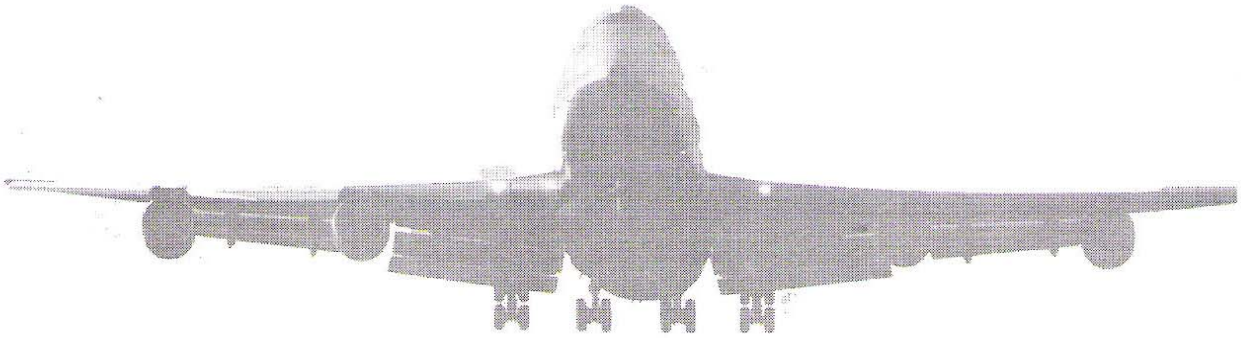

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