

GroundEffects

Reporting Maintenance and Groundcrew Error Reduction Efforts

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Editors Note: *The International Civil Aviation Organization (ICAO) Annex Six Chapter Eight Amendments, when implemented, will require all contracting states or members of ICAO to provide Human Factors Training for the Maintenance Personnel of all approved maintenance organizations. The regulatory authorities of the contracting states will be required to either comply with the ICAO amendment or file a difference. We asked David Hall of the United Kingdom, Civil Aviation Authority (CAA) how he foresaw the CAA complying with the proposed amendments. In future issues we will ask the same question to the United States FAA and Transport Canada. The following article will provide you with a bit of background of the proposed changes which may have an impact on what you will train your maintenance personnel. This has been a long time coming!*

Changes to ICAO Annex 6 Chapter 8 could change our lives.

The International Civil Aviation Organization, better known as ICAO, sets the standard in aviation matters for its contracting member states throughout the world. ICAO's headquarters are located in Montreal, Canada. Any country which flies aircraft in its airspace and has an agency to control these flights, will normally be a member state who will have the option of complying with ICAO's set of rules or filing a difference explaining why it can't or won't comply. These rules are written up in a series of Annexes. For example, Annex 1 covers Personnel Licensing and the numbers continue on up to and past Annex 6. Annex 6 - Operation of Aircraft, is the one which will have the greatest impact on the training of maintenance personnel.

In a series of meetings held in 1996, the Air Navigation Commission proposed to amend applicable Annexes to include Human Factors Standards and Recommended Practices wherever possible. The proposed amendments will affect not only Annex 6 but also Annex 1 - Personnel Licensing, Annex 3 - Meteorological Service for International Air Navigation, Annex 4 - Aeronautical Charts, Annex 5 - Units of Measurement to be used in Air and Ground Operations, Annex 6 - Operation of Aircraft, Annex 8 - Airworthiness of Aircraft, Annex 10 - Aeronautical Telecommunications, Annex 11 - Air Traffic Services, Annex 14 - Aerodromes, Annex 15 - Aeronautical Information Services, and Annex 16 - Environmental Protection.

(Continued on page 2)

Maintenance And Ramp Safety Society MARSS

A series of meetings have been held in Vancouver BC to formalize the establishment of a society dedicated to the reduction of maintenance and ground crew errors. The society is the outgrowth of the 1993 industry group which worked as an advisory to Transport Canada in the development of the "Human Performance in Maintenance" workshop.

This "Industry Liaison Committee" as it was then called, was comprised of persons from the major airlines, regional airlines, helicopter industry, Canadian military, FAA, Washington State, Dept. of Transportation, Aviation Div., general aviation, an overhaul shop and a maintenance training school. From the work of this dedicated group came the first human factors workshop for maintenance personnel in Canada. The committee then moved on to promote the training it had helped develop and was responsible for the development of the "Dirty Dozen" posters which are now found around the world. The committee also provided the seed money to enable "Ground Effects" to develop. They were responsible for

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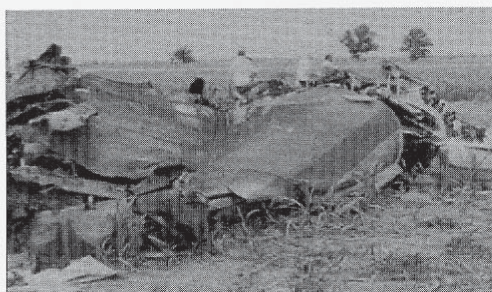


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(Cont'd from page 1, Changes to ...)

All member states and selected international organizations were sent copies of the proposed amendments for comment. All comments were to be received by June 1, 1997. Depending on the comments and work required to rework the amendments, it was intended to have the final draft completed this year. Contracting states would then be required to comply with the amendments or file a difference.

So what are the proposed changes to be found in Annex 6 that will have an impact on training of maintenance personnel?

The proposed amendment, amended once and still subject to change is found in Chapter 8 - Aeroplane Maintenance. In this chapter there is the 8.3 Maintenance Program.

8.3.1 (states): "The operator shall provide, for the use and guidance of maintenance and operational personnel concerned, a maintenance program, approved by the State of Registry, containing the information required by 11.4. The design of the operator's maintenance program shall observe Human Factors principles."

Note: Guidance material on the application of Human Factors principles can be found in Circular 216 (Human Factors Digest No. 1 - Fundamental Human Factors Concepts), Circular 238 (Human Factors, Digest No. 6 - Ergonomics), and Circular 253 (Human Factors, Digest 12 - Human Factors in Aircraft Maintenance and Inspection).

8.7 Approved maintenance organization

8.7.5 Personnel

8.7.5.4 (states) "The maintenance organization shall ensure that all maintenance personnel receive initial and continuation training appropriate to their assigned tasks and responsibilities. The training program established by the maintenance organization shall include training in knowledge and skills related to human performance."

Note: Guidance material to design training programs to develop knowledge and skills in human performance can be found in Circular 216 (Human Factors, Digest No. 1 - Fundamental Human Factors Concepts); Circular 217 (Human Factors, Digest No. 2 - Flight Crew Training; Cockpit Resource Management (CRM) and Line-Oriented Flight Training (LOFT); Circular 227 (Human Factors, Digest No. 12 - Human Factors in Aircraft Maintenance and Inspection).

So what does it mean?

(Cont'd on page 3)

Table of Contents

Changes to ICAO Annex 6 Chapter 8 could change our lives	1
Maintenance And Ramp Safety Society.....	1
International Requirements for Maintenance	3
Regulating Human Factors in Maintenance.....	5
The Miracle Videos	7
Historical Human Factors	7
Maintenance Risk Management.....	8
Remembering the Forgotten Mechanic.....	10
Passing the Baton.....	11
From the Editor.....	11

(Continued from page 2, Changes to ...)

It means that every contracting state will be required to legislate some form of human factors training into their regulations or file a difference. Given the number of accidents where maintenance has at least played a contributing role, I feel that the filing of a difference will be an unlikely option for most countries.

So what will the countries do?

Given the very broad requirement published by ICAO, each country will have a broad range of means to comply with the requirement. We have asked the three countries which jointly provide the annual symposiums on Human Factors in Aviation Maintenance: the United Kingdom; the USA; and Canada, to inform you the reader, with their likely response. In this issue you will find the UK response. We hope to have the USA response in the following issue and Canada's in the one following.

It has taken a lot of years but at last it will become a requirement to provide maintenance personnel with training which will assist them to avoid making the error they all live in fear of: THE HUMAN ERROR. The pilots have had this requirement for years. So you see, at last the world has recognized that: maintenance personnel are important too!



Gordon Dupont

International Requirements for Maintenance Resource Management

David Hall, Deputy Regional Manager, Heathrow UK Civil Aviation Authority

Key Points

- ICAO changes
- A UK perspective of introducing a requirement for MRM training
- Current JAA position on MRM training

A change to the International Civil Aviation Organisation (ICAO) Annex 6 has recently been adopted that should introduce human factors training as a requirement for all organisations involved in maintaining aircraft used for international commercial air transport. I use the word should because I am not at all sure if in reality it will happen, not in all countries and not for some time.

Most people in the aviation industry work within a regulatory framework provided by their respective Governments without realizing the basis upon which the Requirements are based. So before I deliberate on my concerns regarding the changes, it is worthwhile reiterating the international obligation Governments have in developing and enforcing safety requirements based on the ICAO Standards.

The purpose of the Chicago Convention, signed on December 7, 1944, was to ensure that aircraft engaged in international air transport could fly freely between countries. It achieved this in a number of ways but one of them was the establishment of the International Civil Aviation Organization (ICAO) whose functions include drawing up Annexes to the Chicago Convention which contain Standards and Recommended Practices (SARPS) on, amongst other things, airworthiness and operational safety.

Those States who are signatories to the Chicago Convention are known as Contracting States. Almost every country in the World is a member of ICAO (currently in excess of 180) and the Standards and Recommended Practices contained in the Annexes are expected to be applied universally by all of them. Each Contracting State can apply its own safety requirements providing they meet as a minimum the ICAO SARPS described in the Annexes. It is by this means we allow aircraft from other Contracting States to enter our airspace and land at our airports because we know, as signatories, they are complying with the minimum standards provided by ICAO.

Annex 6, Part I, is concerned with the international operation of commercial air transport aeroplanes, and of interest to those involved with human factors training is Chapter 8, Aeroplane Maintenance. Paragraph 8.7.5.4 is in the process of being amended to read:

"The maintenance organization shall ensure that all personnel receive initial and continuation training appropriate to their assigned tasks and responsibilities. The training programme established by the maintenance organization shall include training in knowledge and skills related to human performance, including coordination with other maintenance personnel and flight crew."

So we now have a change which introduces what is effectively Maintenance Resource management (MRM) within approved maintenance originations. In theory, Contracting States should now be busy writing new requirements to en-

(Cont'd on page 4)

(Cont'd from page 3, International Requirements...)

sure that their maintenance organizations initiate human factors training. In reality this is not happening and is not surprising as for many countries this is a new subject and time will be needed to come up to speed on what is required and to amend their legislation.

The Convention makes provision in Article 38 for States to declare differences between its own practices and those of the ICAO Standard. That is not to say that a Contracting State can ignore a Standard completely, but it can declare its need for time to bring its own regulations into full accord or declare how its own practices differ in a particular aspect. In such cases ICAO publishes a list of the States and their particular differences. For those of us convinced of the safety benefit MRM training will bring, a concern must be that many countries might try and use Article 38 to opt out of requiring the training, seeing it as too difficult or expensive for their industry.

In normal circumstances the UK CAA would now be changing its own national requirements to ensure that MRM is introduced and accomplished by the maintenance originations. However, as a member of the Joint Aviation Authorities the situation is more complex and amending our legislation is no longer a straight forward process.

The JAA is not a signatory to the Chicago Convention and hence not a Contracting State. It is in reality a 'club', currently comprising of 19 European Countries who have committed themselves to complying with a common set of codes. The JAA do not have to comply with ICAO Standards, it is however the responsibility of the individual JAA member countries to do so.

The CAA believe that the best way of addressing the new SARP is to amend the JAR 145 code to include MRM training. This would ensure that all of Europe adopt the change and has the advantage of efficiency and standardizations because the rule making activity could be facilitated by the JAA.

Unfortunately the JAA position at the moment is that they are not responsible for ensuring that JAR 145 meets the basic ICAO Standards and they expect the JAA Members to introduce their own additional national requirements to cover them.

The UK CAA remains convinced of the benefits and need for industry to conduct MRM training. We had hoped that by now we would have convinced the JAA of the need for a harmonized European approach to human factors training. As of writing this article, we have not. Therefore the CAA may have to require UK industry to implement MRM training whilst continuing its efforts to convince the JAA and its members by example.

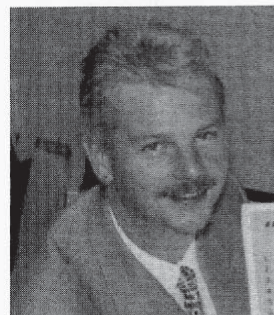
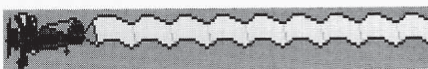
The exact form that the training will take in the UK, and who will be affected is as yet undecided but I cannot foresee that all maintenance organizations would be affected immediately. This would be a massive undertaking. I anticipate that we will probably have to focus first of all on those originations maintaining large transport aircraft. When this is established and working well, we could move on to require those maintaining the medium size aircraft and so on until we capture all those involved in international air transport. Issues such as CAA approval of the courses, qualifications of the trainers, acceptance of training standards from other countries, etc. will all have to be addressed and will take time if we are to implement it properly and maximize on the safety benefit the training will bring.

In summary, it appears the UK CAA will reluctantly have to file a difference with ICAO due to our inability to bring our own regulations into full accord immediately using JAR 145. We will however be confirming our support for the SARP change and providing a time scale by which we will meet this new and important safety standard.

"Stop the Press!"

Since this article was written, the world has moved on and the JAA Maintenance Committee has now been

convinced of the need to review the maintenance requirements regarding human factors. A working group of JAA members and industry should be established shortly. David Hall is now confident that Europe will move forward and change its requirements.



David Hall

David started his career in aviation as an apprentice aircraft technician with British Airways Overseas Corporation (BOAC) and after 10 years as a Licensed Aircraft Engineer he moved to Kuala Lumpur to work for Malaysain Airline Systems until joining the CAA in 1984 as an Airworthiness Surveyor.

David is currently the Deputy Regional Manager Heathrow, Aircraft maintenance Standards Department in the Safety Regulation Group of the Civil Aviation Authority. Since January 1993 he has also had the responsibility for being the Human Factors Coordinator in Aircraft Maintenance. David was the leading driving force in bringing the 12th Annual Human Factors in Aviation Maintenance Symposium to Gatwick, UK this year.

Regulating Human Factors in Maintenance – A European effort by the JAA.

By Evangelos Demosthenous IEng AMRAeS

Human Factors could be a difficult issue to regulate due to its “softy” nature and due to being a relatively new issue especially in the area of Aviation Maintenance. Nevertheless the JAA has placed some considerable effort and issued several regulations on Human Factors.

“Human Factors could be a difficult issue to regulate due to its “softy” nature.”

- Evangelos Demosthenous

This article will outline the following with reference to Human Factors (HF) in maintenance:

- *How are HF issues handled within the JAA?*
- *What current JAA requirements are relevant to HF?*
- *How existing requirements fit with the objectives of a typical HF Training Program, such as the Transport Canada HPIM Workshop?*

HOW ARE HF ISSUES HANDLED WITHIN THE JAA?

JAA (Joint Aviation Authorities) is a body that represents the NAA's (National Aviation Authorities) of most European States which have agreed to cooperate in developing and implementing common safety regulatory standards and procedures.

Maintenance issues are processed through the JMB (JAA Maintenance Board) and JMC (Joint Maintenance Committee). All current requirements on HF in maintenance have been processed through JMB and JMC.

JMB members come from NAA's as well as from the industry such as European Operators, European Manufacturers and AEI (Aircraft Engineers International). AEI is a non-profit professional organization representing the Aircraft Maintenance Engineers worldwide.

A huge contribution to the aviation HF issues derives from the JAA HFStG (HF Steering Group). HFStG is a permanent group of the JAA which reviews and develops requirements and procedures on HF in a large aviation spectrum e.g. aircraft design, maintenance, flight crews and cabin crews.

It has members from the NAA's and the industry. AEI has an active participation also in this forum being the only body that represents the aircraft maintenance engineers. The Group's Coordinator for the maintenance area is, currently, Mr. Marco Constantini from the RAI (Italian NAA). Representatives from the FAA have also been actively participating in the Group in an effort to harmonize FAA and JAA regulations on HF. It is unfortunate, though, that no such harmonization has yet taken place in the maintenance area.

The Group has been looking into the maintenance issues and last year prepared a document that identifies critical areas of maintenance that need HF regulation. This paper was presented to the JMC and a Working Group (WG) was formed, under the JMC, to develop further HF requirements. M. Constantini participates in this WG as well as David Hall of the British CAA, who has been very active in the area of HF and has been the man behind the effort of organizing the 12th HF Symposium in Gatwick last March.

WHAT CURRENT JAA REQUIREMENTS ARE RELEVANT TO HF IN MAINTENANCE?

The JAA issues Regulations named JAR's (Joint Aviation Requirements) which are usually associated with AMC's (Acceptable Means of Compliance) and IEM's (Interpretative/Explanatory Material). Below reference is made to JAR's as well as AMC's and IEM's. Current HF requirements can be divided for the sake of this article, into

two categories. Those which have been formulated as direct HF requirements and those which address indirectly HF issues. Some requirements that can be quoted under the second category are the following:

- JAR66.50, IEM66.50 Medical Fitness (of Maintenance Certifying staff)
- JAR145.25, AMC145.25 Facility Requirements (e.g. weather protection, noise and lighting)
- JAR145.30, AMC145.30 Personnel Requirements (e.g. sufficient personnel, competence and training of personnel)
- JAR145.45, AMC145.45 Approved (Airworthiness) Data (e.g. data that should be available to maintenance personnel)
- JAR145.60, IEM145.60 Reporting of Unairworthy Conditions.
- JAR145.65, AMC145.65 Maintenance procedures and quality system.

Requirements that address directly HF issues are mainly the following:

- JAR66 Knowledge Requirements Module 9 Human Factors.

These are part of the requirements for the issue of an Aircraft Maintenance Licence. They include the following 9 subcategories:

- General
- Human Performance and Limitations
- Social Psychology
- Factors Affecting Performance
- Physical Environment
- Tasks
- Communication
- Human Error
- Hazards in the workplace

It is important to note that the requirement for the above issues is to have “...knowledge of, and ability to, give description using examples to illustrate significance and limitations”.

The written exam for this Module will most likely consist of one essay and 30 multi-choice questions.

AMC145.30(d) Personnel Requirements.

(Cont'd on page 6)

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(Cont'd from page 5, *Regulating Human Factors...*)

This AMC refers to the training requirements of the Certifying Staff (Maintenance Engineers). The whole paragraph 2 of the AMC is quoted below:

“Continuation training should cover changes in relevant requirements such as JAR-145, changes in organisation procedures and the modification standard of the products being maintained plus human factor issues that have resulted in incidents. It should also address instances where staff failed to follow procedures and the reasons why particular procedures are not always followed. In many cases the continuation training will reinforce the need to follow procedures but could on occasions result in a change to a procedure where certifying staff can show the procedure to be incomplete or incorrect.”

This paragraph is very brief and it is hoped that in the future it will expand to include details on the content of HF training and other requirements that could be associated with it. Nevertheless it can be seen as an initial effort to address some HF issues within continuation training. It should be recognized that these important issues are addressed:

- HF issues that resulted in incidents;
- Following procedures;
- Feed- back from personnel ;

JAR M.90, IEM M.90 Maintenance Human Factors.

Requirements under these paragraphs refer mainly to the “people/task” relation. The WG mentioned above is currently reviewing these requirements so we will probably see this section becoming much wider in the near future. Some examples of the current section are the following:

- Not performing tasks with unrealistic time frames.
- Not pressurized to certify when safety is in question.
- Not certified if another person has

- questioned the safety standard
- Not certified unless able to inspect.
- Not distracted or stopped unless the intermediate stage is clear.
- Giving clear hand-over of work.

Here we see some effort to regulate some of the difficult issues of HF. If these can be regulated then many other can.

HOW EXISTING REQUIREMENTS FIT WITH THE OBJECTIVES OF A TYPICAL HF TRAINING PROGRAM, SUCH AS THE TRANSPORT CANADA'S HPIM WORKSHOP.

The first thing to note is that specific training requirements currently refer only to applicants for an Aircraft Maintenance Licence (see JAR66 Module 9), who in most cases are people who completed an approved training course (JAR 147).

The subject headings of Module 9 provide, generally, a good introduction into HF. The assessment as we have seen above is mainly through a written exam, which is probably sufficient if the objective is to provide “knowledge and ability to give description”. But should the objectives be limited to those?

For the rest of maintenance personnel the only requirement for HF training (see above JAR145.30) is a very brief and basic one. HF Training is one of the best and most essential tools of a HF program. Requirements should be expanded to include at least the following:

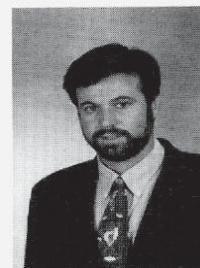
- a list of issues;
- objectives that are not limited to providing knowledge and developing awareness but in developing specific skills and attitudes;
- means of assessing the effectiveness of the training – means should be appropriate to the objectives ;
- requirements for instructors/facilitators.

Closing Remarks.

The aviation industry recognizes today the importance of HF in the area of maintenance. Although regula-

tion is just one ingredient of a HF system, it is a very important ingredient. The JAA has recognized this and has made some considerable effort in the right direction. A lot more should be done but it seems that the will is there.

Note: Opinions expressed in this article represent only the writer's and not the JAA's nor AEI's.



Evangelos Demosthenous
IEng AMRAeS

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He is a Qualified Facilitator/Instructor on Human Factors in Aviation Maintenance. He is also an IATA Certified Instructor specialized on Ramp Safety. He developed and delivers several training programs on Human Factors and on Ramp Safety within Cyprus Airways and for other organizations in Cyprus and other countries. He was invited to give lectures on Human Factors to major airlines of countries such as Norway and Finland.

He is the Human Factors Coordinator of Aircraft Engineers International (AEI), a non-profit professional organization. He is also a member of the JAA Human Factors Steering Group, representing AEI.

The Miracle Videos

There must be a power that intercedes to protect and help a group of non-actors, better known as hams, to put together a second and third in a series of safety videos.

The first one was done last year with the help of a group of fabulous and foolhardy people. It was called "Death of an Airline." A terrific amount of work was expended and a lot of fun was had by everyone involved. It was an absolute miracle that it all came together. The miracle man was Gordon Dupont who masterminded the second and third videos in the series.

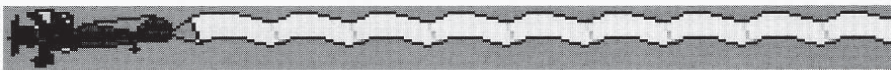
The second video, "Too Many Cooks" involved a minor problem on a Bell 206 which escalated into a total disaster caused by so many highly qualified persons on board creating extreme stress and chaos. They were trying to tell the low time pilot what to do and succeeded in causing the helicopter to crash into the icy water. One nice footnote is that no one was hurt but the aircraft was toast. There were over 20 amateur actors involved with this video.

The third safety video, unfortunately, did not have a happy ending. "DangerZone" was about a small jet aircraft, a BD-5J, that had a series of engine failures due to an intermittent electrical problem. The last flame-out ended in total disaster. There were seven amateur actors involved in this video.

These two safety videos bring home the importance of watching very carefully for the small details, for a very simple problem could end up becoming a very large disaster.

Again, none of these three videos could have happened without the hard work and dedication of one man, namely, Gordon Dupont. He had the patience of Job when he dealt with us as "wannabe" actors. Also, the end result could not have occurred if it weren't for the camera man, Roger Cranford and the sound man, Don Bishop. Their untiring efforts in shooting and completing the videos is much appreciated.

Keep up the outstanding work gang, and I am looking forward to the next nine videos in the series of safety videos.



Historical Human Factors

They say we should learn from our mistakes and yet time and time again we are doomed to make the same errors. Look at all the people who are married more than once...!

The Titanic was a classic example of what can result when pressing is pushed to the extreme and a Captain takes it on himself to risk all, in order to set a world record.

There is little doubt that there was company pressure to show the world that they had the fastest ship, but! Would he have been fired if he had decided to slow down?

I think not. And what about complacency? Read the following quote and judge for yourself.

"When anyone asks me how I can best describe my experience in nearly forty years at sea, I merely say, uneventful. Of course, there have been winter gales, and storms and fog and the like. But in all my experience, I have never been in any accident — of any sort — worth speaking about. I have seen but one vessel in distress in all my years at sea. I never saw a wreck and never have been wrecked, nor was I ever in any predicament that

threatened to end in disaster of any sort."

**-Edward J. Smith Captain,
R.M.S. Titanic
5th of April, 1912**

The R.M.S. Titanic struck an iceberg at 11:40 PM on Sunday, April 14, 1912, finally succumbing at 2:18 AM on April 15 with the loss of 1513 lives.

So likely complacency plus self-pressure contributed to the decision to run full steam ahead at all costs. What would you have done?

The collision of two Boeing 747s at Tenerife was an unthinkable tragedy brought about by poor communication coupled with pressure to get home and mixed with a dose of fatigue. I would hope that our rational mind would prevail and we would check again to be sure that the runway was clear.



Here's a story which is not only funny but "almost" has a ring of truth to it. We are economical and smart, right! It was reprinted with permission from Bell Helicopter's Heliprops Volume 10 #1 1998 from an Author Unknown.

Three pilots and three AME/AMTs were travelling by train to a conference. At the station the three pilots each bought tickets and watched as the three AME/AMTs bought only a single ticket. "How are three people going to travel on only one ticket?" asked a pilot. "Watch and you'll see" answered an AME/AMT.

They all boarded the train. The pilots took their respective seats but all three AME/AMTs crammed into a restroom and closed the door behind them. Shortly after the train departed, the conductor came around, collecting tickets. He knocked on the restroom door and said, "Tickets please." The door opened a crack and a single arm emerged with a ticket in hand. The conductor took it

(Cont'd on page 8)

GroundEffects

(Continued from page 7 Historical Studies ...)

and moved on. The pilots saw this and agreed it was quite a clever idea. So after the conference, the pilots (**recognizing the AME/AMT's superior intellect**) decided to copy them on the return trip and save some money. When they got to the station, they bought a single ticket for the return trip. To their astonishment, the AME/AMTs didn't buy a ticket at all. "How are you going to travel without a ticket?" asked a perplexed pilot. "Watch and you'll see" answered an AME/AMT. When they boarded the train the three pilots crammed into a restroom and the three AME/AMTs crammed into another one nearby. The train departed. Shortly afterward one of the AME/AMTs left his washroom and walked over to the restroom where the three pilots were hiding. He knocked on the door and said, "**Tickets please.**"

The following infamous incident has a maintenance chain of events in it. If this chain was broken, we would not have had the opportunity to learn from it.

Take the time to find the maintenance chain of events and think, "If I had been there, **would I have done the same thing?**"

And a Merry Christmas to You

It was Christmas Eve and the corporation's maintenance department was shutting down for the Christmas holidays. Joe was looking forward to this Christmas because his parents were coming to spend it with him and the children were old enough to enjoy the full excitement of present opening. It was going to be like old times.

As he locked up his tools, the Director of Maintenance approached him and asked if he would mind staying back a few minutes to clear a snag on 402 when it arrived. It was needed for a personal flight with the boss and his family, early the next morning, and Joe was the company's best AME. "D__", thought Joe, "but OK, I guess a few minutes won't hurt."

As the hangar emptied Joe felt the anger welling up inside him. "Why always me?" Dispatch wished him a Merry Christmas when he finally went up to find out why 402 was late and he found it difficult to respond in kind. Two hours later, Joe finally got 402 into the hangar: "About the same time everyone is sitting down to dinner without me" he thought. "Small problem my A__! The only way to properly fix this snag is to replace the turbocharger. D__! The special tools are locked away: Can't anything go right? Double D__! that last stud broke off and now I've got to pull the whole thing off again. I'll bet they're opening up their presents by now. There, the d__ thing is in and all I have to do is run it up. Look at that, it's snowing and there's only me to get this thing out of the hangar. To h__ with it! I'll just sign the logbooks and just maybe, someone will still be up when I get home."

They weren't and at 0630 the next morning the bedside phone rang in Joe's ear. The morning shift had loaded the plane with the boss and his family and he was not amused when the right engine covered the aircraft with oil on startup. The oil line to the turbocharger had not been tightened up. "My G__" thought Joe, "How could that have happened?"

Post script:

On his first day back to work, Joe was fired for his carelessness because as the Director of Maintenance said: "safety is our number one concern in our department".

Maintenance Risk Management

- Michael Murphy

Which Director of Maintenance, Quality Control Manager, Supervisor or Mechanic doesn't get a tight knot in their stomach when informed that one of their aircraft has suffered an accident? In the case of catastrophic accidents, that feeling can last for months while investigators determine the cause of the accident. If the investigators find flaws in the maintenance of the aircraft, those feelings can last a lifetime. Even in non-catastrophic accidents, or accidents in which you and your maintenance staff have been cleared of fault, the agony can be excruciating.

"What Mechanic doesn't get a tight knot in their stomach when informed that one of their aircraft has suffered an accident"

- Michael Murphy

It's safe to assume if you are reading GroundEffects that you are a conscientious professional who holds a responsible aviation maintenance position on the basis of that expertise. What more can you do to minimize the chances of an accident and thus reduce your exposure to allegations of negligence?

In the next few editions of GroundEffects, we will examine a management process designed to help you demonstrate due diligence in the execution of your maintenance responsibilities. This process has five major steps:

1. Definitions
2. Issues
3. Solutions

(Cont'd on page 9)

(Cont'd from page 8, *Maintenance Risk Management ...*)

4. Decisions

5. Controls

6. Definitions

You know what the old saying about assumptions go – they make an a** out of you and me; they are the mother of all *-ups; He thought she thought I thought . . . Wherever there is ambiguity or uncertainty there is RISK! The only way to reduce that type of risk is to identify your assumptions. Define your goals, describe what is at stake (e.g. deadlines or dead bodies – DC-10 engine/pylon change) and to define your sensitivities to loss (e.g. we can afford to lose a set of tires but not an aircraft) to probability (we are exposed to that type of risk on a weekly/monthly/annual basis) and how much money is required to fix the problem (not much, a lot, a whole lot, more than we can afford). Once you have these risk parameters bolted down, we can move to the next step.

7. Issues

On the operations side, everyone one knows that take-offs and approach/landings are the most dangerous phase of flight—so aviation safety experts tend to fixate much of their attention there, almost ignoring problems in other areas. The focus on a few problems to the exclusion of many is tantamount to saying you are confident that problems won't show up in those other areas – surely the quickest way to an accident. Is there a better way to get an even-handed feel for risks across the board – and before an accident, not after, when everyone can claim to be an expert. In the next issue, we will look at two simple yet powerful techniques that anyone can use to identify a broad spectrum of potentially dangerous maintenance issues clear across the organization – *operational proc-*

ess models (a.k.a. work flow diagrams) and *risk scenarios*.

8. Solutions

Once we have identified the risks, we can combat them with cost-effective counter measures. Once again, in a future edition of GroundEffects, we will explore a simple but effective checklist that you can run through to gain control over risks with remarkably inexpensive fixes. Your accounting department will be delighted to learn that you price all your solutions and that the cost is a tiny fraction compared to the losses they can prevent. It's also very possible to turn the solutions for your problems into a profit center for your company, offering your safety technology to others for a price that reflects the value of a catastrophe avoided.

9. Decisions

Now that we have a list of risks and several good solutions for each, we'll need to put all our risks in order – there is no way we'll be able to attack all of the risks at the same time. Military operations don't succeed when the front is 1,000 miles wide and only one mile deep – and neither does aircraft maintenance. Bin these risks into a risk box, or hang them at different levels in a risk tree, the most critical at the top. Now we can see which risk to deal with first, second and third – down to the point where we have either run out of resources or are comfortable with the residual risk – just as you are when you climb into your vehicle every day to drive to work. Many managers are pleasantly surprised to know that they are not expected to take action on every possible risk, but rather only on those risks that are the most serious.

10. Controls

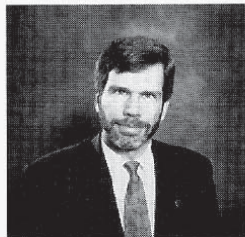
Finally, once all those counter

measures that have been approved by management and have been put them into place, there is a need to follow-up. This involves checking with subordinates to ensure that executive decisions have been implemented and are both within budget and providing the degree of protection expected. There is also the need to revisit the situation on a suitable schedule to scout out any new risks or solutions that have proven less effective.

Each of the steps will be explored in further depth over the next few issues. The advantage of having a system like this in place is that it enables maintenance executives, managers and supervisors to ask his or her subordinates **five key questions** that will provide a widened margin of protection:

1. **What are the biggest risks in your area of responsibility?**
2. **What steps are you taking to counteract these risks?**
3. **When was the last time you checked to see if these counter measures were in place and working?**
4. **Assuming that these countermeasures fail, what is your disaster plan?**
5. **How can I help you with any aspects of your risks that you have found problematic?**

As we will see in the next few issues, the answers to these questions are the basis for managing your aviation maintenance risks. Along with some neat packaging and processing, you can get a real handle of maintenance risks. And while they shouldn't make you overconfident, they should help take that gnawing feeling out or your stomach should anything untoward ever come to pass. With your whole shop using the process under your tutelage and leadership, the chances that you will be involved in such an



Mike Murphy

Following an 18 year career of managing public transportation risk with Transport Canada, the last five as Regional Director General, Aviation, Michael Murphy returned to the private sector in 1996. Taking a one year assignment in Arlington, VA, he worked side-by-side with Dr. Vernon L. Grose, the internationally recognized authority on system safety.

Since 1997, Mr. Murphy has provided government and industry clients around the world with risk management advice and programs from his CADMUS office near Ottawa. No stranger to the media, CBC, CTV and Discovery have engaged him on-air to explain technical aspects of the TWA 800 and SwissAir 111 disasters. You can reach him at fmmurphy@cadmus.ca or through his corporate website: www.cadmus.ca

Editor's Note: I look forward to future articles on the important subject of Maintenance Risk Management



Remembering the Forgotten Mechanic

Through the history of world aviation
many names have come to the fore...
Great deeds of the past in our memory
will last,
as they're by more and more...

When man first started his labor in
his quest to
conquer the sky
he was designer, mechanic and pilot,
and he built a machine that would fly...
But somehow the order got twisted,
and then in the public's eye
the only man that could be seen
was the man who knew how to fly...

The pilot was everyone's hero,
he was brave, he was bold, he was
grand,
as he stood by his battered old biplane
with his goggles and helmet in hand...
To be sure, these pilots all earned it,
to fly you have to have guts...
And they blazed their names in the
hall of fame
on wings with bailing wire struts...

But for each of these flying heroes
there were thousands of little renown,
and these were the men who worked
on the planes
but kept their feet on the ground...
We all know the name of Lindbergh,
and we've read of his flight to fame...
But think, if you can, of his maintenance man,
can you remember his name?

Now pilots are highly trained people,
and wings are not easily won...
But without the work of the maintenance man
our pilots would be on the run.
So when you see mighty aircraft
as they mark their way through the
air,
the grease stained man with the
wrench in his hand
is the man who put them there...

(Continued from page 1 MARSS)

for the three conferences held in Canada to look specifically at **"Maintenance/Ground Crew Errors and Their Reduction."**

With the conferences now becoming an international affair in conjunction with the FAA and the CAA, the committee has looked for a role for it to play in the promotion of human factors training for both maintenance and ground crew personnel.

Thus MARSS was born to carry on the work started by the industry committee. It is not the intention to compete with the Flight Safety Foundation or Air Transport Association but to remain small and continue to work with anyone who is interested to help reduce maintenance and ground crew errors through the promotion of human factors training. Thus they will continue to work at developing safety posters, and maintenance error videos. A series of "Dirty Dozen" posters for ground crew is in the final stages of development as well as a set of "Magnificent Seven" posters to positively promote the professionalism of maintenance personnel. The website groundeffects.org will be used to provide further information on the working of MARSS. For further information please feel free to call at 604 207-9100 Fax 207-9101 or email us at marss@marss.org. By working together we can reduce maintenance errors.



Passing the Baton

by Wayne Glover

Almost two years ago I started the GroundEffects Newsletter, and soon followed with the website. The intent was to provide practical information to airline maintenance managers who were charged with reducing maintenance errors. During those two years I produced eight issues and a growing web site.

Growing a newsletter takes time and money - always more of both than I seemed to have. GroundEffects needed a home with an organization in for the long haul and with the financial backing to continue expanding GroundEffects. With the formation of the Maintenance and Ramp Safety Society (MARSS), a logical home emerged for GroundEffects. With MARSS, GroundEffects could grow with the organization. For this reason, I have turned GroundEffects over to MARSS.

Now that GroundEffects is part of MARSS, it belongs to the maintenance community. MARSS is a non-profit organization staffed by volunteer maintenance people who have worked hard for over 5 years to bring the organization to where it is today. With their dedication, GroundEffects will certainly prosper and serve the maintenance community well. However, for MARSS and GroundEffects to grow, the maintenance community must support their efforts.

There is no silver bullet for reducing maintenance error, no more than there is for other complicated human errors. Just as it is a collection of small errors that daisy-chain into incidents or accidents, it will be a collection of small victories and solutions which will mature into a series of coherent solutions for maintenance error. Each organization would then choose from this plethora of possible solutions. Ultimately, for maintenance-error solutions to be developed and implemented, the commitment must be there from both the mechanic and management. Unfortunately, at many organizations, this is an unlikely and distrustful marriage.

I believe the key to reducing maintenance error will be a grassroots approach - approaching the person with the problem, the mechanic and supervisor, and helping them solve their own small problems. From these small victories will feed grow greater successes.

It has been over 10 years since the Aloha incident first focussed attention on maintenance error. During the following years, maintenance has received an increasing attention. However, maintenance people still have some gripes - pilots get more attention; in one dictionary, the second definition of 'grease monkey' is mechanic, etc. However, pilots were not always the glory boys. In early aviation, pilots, who were often mechanics, were thought of as kooks. However, 75 or so years later, no one can argue that pilots don't get the respect they want and deserve. Perhaps they simply view themselves, and their profession, more seriously than mechanics view their own. No one gave pilots respect - they earned it.

MARSS is an organization of mechanics and for mechanics. Make it grow and it will serve you well. Ignore it, and look forward to more years of little respect. Good Luck.

From the Editor

Hello and welcome to the tenth issue of *GroundEffects*. As mentioned in the last issue, Wayne Glover has stepped down and I, Renee Dupont am now the new editor of GroundEffects. It has been a very busy three months in-between issues. **M.A.R.S.S.** has been busy producing two new videos to be added to the growing series. The second and third videos are "Too Many Cooks" and "DangerZone" I was lucky enough to get my two or three minutes of fame when I starred in "Too Many Cooks". If you would like to know more about these videos please read the article on page 8. If you are interested in purchasing a copy of these videos when they are completed please contact the MARSS office. I would like to thank the many different authors for their contributions to this issue of GroundEffects. The article by Evangelos Demosthenous provides us with a look at how the Joint Aviation Authority (JAA) will be handling the human factors issue in Europe. In this issue I have included a Case Study from the Human Performance in Maintenance Part I workshop called "And a Merry Christmas to you". After reading this case study I urge you to take a few moments and list the chain of events for this incident. Then list some possible safety nets that could have been implemented to prevent this from happening in the first place. I hope that you find the articles on ICAO's Human Factor Amendments informative and of interest to you. I would love to hear your thoughts on this important issue. How do you see your company complying with this requirement when it comes into affect.? Please let me know! You can reach me at webmaster@groundeffects.org or write me at 5750 Cedarbridge Way Richmond, B.C. Canada V6X 2A7 Phone: (604) 207-9100 Fax: (604) 207-9101

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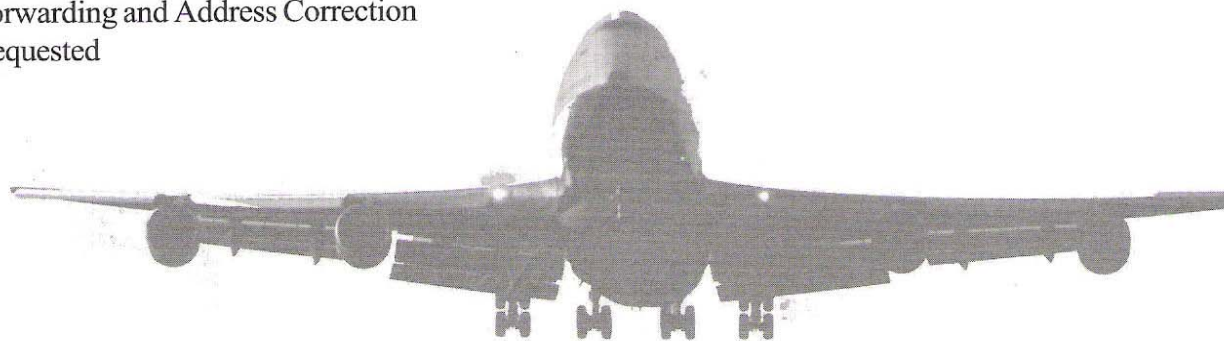
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THE HUMAN ELEMENT IN AVIATION

Our Programmes are designed to create a strong foundation for good communications by increasing trust and cooperation within the management group, within the flight operations team, within the maintenance team and between them all. They are ADAPTED TO YOUR NEEDS - scheduling, location, budget - and take into account your specific objectives and the particular circumstances prevailing in your group

TEAM EFFECTIVENESS IN THE MAINTENANCE DEPARTMENT: This programme helps create a solid psychological base for safety measures within the maintenance department, and **enhances safety, performance, and well-being**. It provides team members with practical concepts to explain personality and interaction, and their impact on the workplace: on safety, on the quality of communications, on the appropriate use of authority, and on stress. The programme **increases mutual support, open and comfortable communication**, willingness to give and to receive both appreciation and construction criticism among peers and across levels. Current relationship problems are addressed, as are **ways to improving operational effectiveness**.

THE SAME PROGRAMME IS AVAILABLE TO THE FLIGHT DEPARTMENT AS A WHOLE.

TEMPERATURE-TAKING: A short (two or three-day) process designed to provide information on how the talents and energy of the members of the department are being well utilized or dispersed, and how they perceive the climate and working environment of the department. **Individual meetings** with each member, followed by **feedback to the group** of the consultant's perception of the areas of satisfaction and frustration in the group, their strengths, their effectiveness in dealing with pressure and priorities, their amenability to appropriate change, and so on. This is a low-cost, low-risk intervention which is complete in itself.



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