GroundEffects™

Reporting Maintenance and Groundcrew Error Reduction Efforts

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Editors Note: *This article was written by Mr. Manoj Patankar and Mr. James Taylor. The article deals with Structured Communication and The Concept Alignment Process. Good communication is vital to a safe operation and this article gives the reader a look at what is needed to ensure good communication in a working environment.*

References for the following article:

Bovier, Constance. "Debriefs: Removing the Veil of Silence," ***Flying Careers, February 1998, pp 8-13***

Patankar, M & Taylor, J. Corporate aviation on the leading edge: systemic implementation of macro-human factors in aviation maintenance. Technical Paper No. 1999-01-1596. SAE General, Corporate & Regional Aviation Meeting & Exposition, Wichita, KS. 1999.

Structured Communication As a Risk Management Tool

Manoj Patankar*, San Jose State University*
James Taylor*, Santa Clara University*

Introduction

In the original paper entitled, "Corporate aviation on the leading-edge: systemic implementation of macro-human factors in aviation maintenance" we presented three cases to illustrate the use of structured communication as a risk-management tool. That paper (Patankar & Taylor, 1999) was presented at an SAE General, Regional, and Corporate Aviation conference. This is an abridged version of the SAE paper to bring you the basic message with the help of one maintenance case.

The original research was based on results of field observations and inter-

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FlightSafetyBoeing Offers Free Maintenance Human Factors Seminar

For a limited time, FlightSafetyBoeing (FSB) is offering free seats in the 2-day seminar *Maintenance Human Factors Awareness Training for Managers*. This event is designed for airlines, heavy maintenance outfits, or other organizations that desire to implement a maintenance human factors program but are not sure how to begin.

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tel: (206) 662-7907
fax: (206) 662-8239
e-mail: **david.hanson@fsbti.com**

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AIR CANADA

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Help us to prevent accidents before they happen!

views of aircraft mechanics, cleaners, pilots, and managers at a corporate aviation department that used a specific structure and a process to facilitate team decision-making. That approach originated with a company called CMR, Inc. and is described in Bovier (1998).

Their structure was the required briefings among flight crews, among maintenance, and between the maintenance and the flight crews.

Their process was the "concept alignment process" (CAP) as a way of ensuring that all parties were acting on the same concept. If not, it provided a way of resolving ambiguous and/or conflicting viewpoints among the communicating parties in various briefings. This technique was used for preflight pilot briefings, post-flight pilot debriefings, maintenance shift turnover briefings, and briefings between the flight crew and maintenance personnel.

The Concept Alignment Process

This is a simple process that can be used to resolve inconsistencies held among individuals, departments, documents and even organizations. Six steps illustrate a simple-to-follow process to resolve differences in knowledge and to minimize the recurrence of similar differences. The following figure illustrates the process with its key steps.

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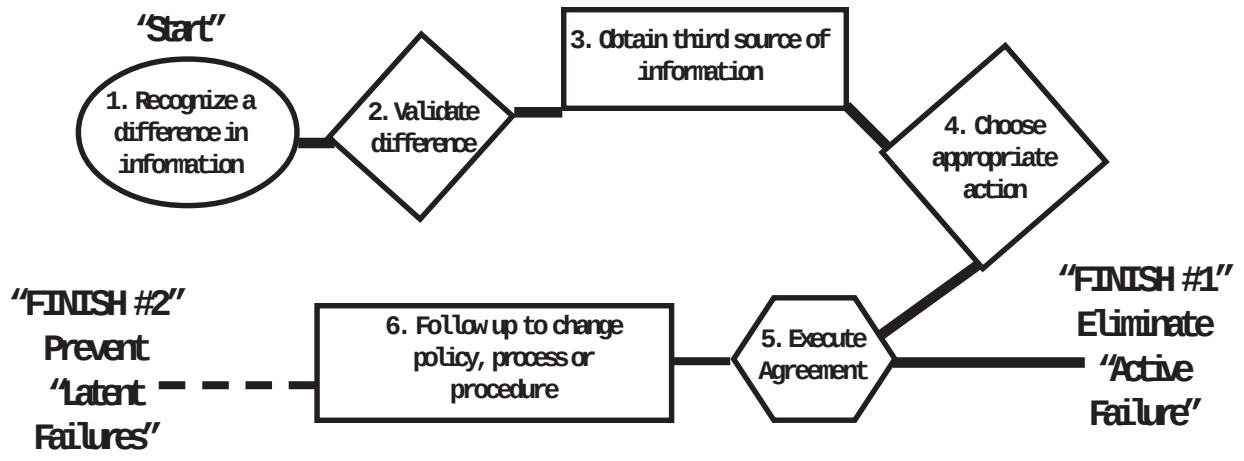

Step 1: Recognize a difference

When a maintenance team member first recognizes that a difference in information or knowledge exists between self and other, it is that team member's responsibility to present this difference to the other – individual or team. Then, it is the other's or the team's responsibility to address this difference with the member. This is stated as a difference in "concepts" and not as a criticism of one person by another.

Step 2: Validate the difference

Once a team member presents a difference to the other, all members involved are responsible for examining the validity of this knowledge or information.

Step 3: Obtain Information from a third party

It is quite possible that multiple pieces of knowledge (information) are true, but it is also possible that none of the pieces could be validated. Then a third party must be consulted. The third party can be a lead or supervisor, or anyone else that would normally be a source for accurate information. The third party could also be the Maintenance Procedures Manual, the aircraft maintenance manual, or even a computer. If only one piece of knowledge is valid, the team must choose it to make its decision. If multiple pieces of knowledge are valid, the team leader (lead or supervisor) must choose the one to apply (usually the most conservative one). If none of the pieces can be validated and decision must be made, the team must choose the most conservative (least risk) option.

Step 4: Choose an Action

Once an applicable option is chosen, the team must identify the possible concerns and risks. The team must determine whether that risk is acceptable. If the risk is not acceptable, the team must find an even more conservative approach.

Step 5: Execute (Action) Agreement

Execute the decision made in Step 4.

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Step 6: Follow-up

In this step, the team members should undertake follow-up actions that would minimize the recurrence of similar discrepancies. Examples of follow-up actions include revision of documents, change in company policies, and manufacturer's operating limitations

Case Study: Twin Otter Engine Mounting Bolts

Mechanics "Chip," "Bob," and "Vic" started changing the left engine on a Friday evening. The following day, the new engine was pulled from its crate on to the engine stand and the old engine was placed from the aircraft on to its own stand. While the new engine was on the hoist, the technicians removed shipping pads and installed engine mounting bolts. One of the mechanics noticed the old bolts from the old engine and pylon. They looked like (a) wrong bolts, (b) shipping crate bolts, and (c) they had only three threads holding the engine to the aircraft. Obviously whoever had originally installed the engine with those bolts did not attach the same significance to the difference.

Chip looked at the IPC and discovered that the aircraft had wrong bolts on it and they had only 7 of the required 12 bolts in stock. Bob & Vic went to the right engine and confirmed that some bolts there were incorrect as well.

Question: Should they obtain all the correct bolts (for both engines) even if it delays the Monday flight?

1. Recognize difference of agreement between self and other
One of the mechanics noticed some abnormality with the engine mounting bolts.

2. Validate that difference
He stated that abnormality to his team members and on observation they confirmed his view that there was a difference among the bolts.

3. Obtaining information through third party
As a part of the pre-agreed CAP process, Chip referred to the IPC (3rd party reference) and discovered that the aircraft had wrong bolts on it. He also noted that they had only 7 of the required 12 bolts in stock.. Now, Chip had validated that the aircraft had wrong bolts and that they did not have enough bolts in stock to rectify the problem and release the flight. Bob and Vic inspected the right engine and agreed with Chip. Since there is only one valid piece of knowledge in the discussion, the team must accept it and execute their decision.

4. Choose an action — Consensual or Conservative Path
Choosing the conservative path, the mechanics should choose to delay the flight until the approved bolts are installed on the aircraft. The consequence of this choice would be that the scheduled flight may be delayed or cancelled. It may be possible for operations to schedule another aircraft for that flight or the passengers may have to be re-routed through another carrier. On the other hand, if the aircraft is released with the wrong bolts, it would be unairworthy and if the bolts fail, the aircraft would lose one or both engines in flight and result in a catastrophe. Not to mention that the mechanics may face certificate action. The risks are unacceptable. In this case, the decision would be to obtain the correct bolts and correct the discrepancy. The flight may have to be cancelled if the bolts cannot be obtained promptly.

5. Execute the action.
Declare the aircraft unairworthy and delay the scheduled departure until the aircraft is fitted with the approved bolts. Seek management support for the above decision and pursue the consensual follow-up action to minimize the recurrence of such incident(s).

6. Follow-up to minimize future occurrence
The maintenance department must contact the vendor who shipped the engine to explore the possibility of anchoring the engine in the crate with fasteners that cannot be confused with the approved bolts to attach this engine to a Twin Otter pylon. Technical training materials could also be amended to alert mechanics of the danger of confusing shipping bolts with aircraft-grade assembly bolts.

Conclusion

CAP is a simple communication protocol that can be used identify and manage risks in aviation maintenance. The process also helps to manage conflict that might otherwise impede communication and risk management if mechanics felt they were being personally or individually criticized. Another most significant effect of CAP is that it has the potential to address both active as well as latent failures.

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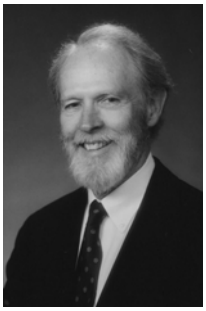

Dr. Taylor

Dr. Patankar

Dr. Taylor holds a Ph.D. in organizational psychology from University of Michigan. He has been studying the effects of Maintenance Resource Management programs in the airline industry since 1989. He has presented his research at several professional conferences such as the International Symposia on Aviation Psychology, the SAE Airframe/Engine Maintenance and Repair conferences and FAA/CAA/Transport Canada joint conferences on Human Factors in Aviation Maintenance and Inspection. Dr. Taylor's current research is funded through NASA Award #NCC2-1025 to Santa Clara University, as part of a cooperative research program between the Federal Aviation Administration Office of Aviation Medicine (FAA/AAM-240) and NASA Ames Research Center.

Dr. Patankar holds a Ph.D. in computing technology in education from Nova Southeastern University. He is an FAA certificated aircraft mechanic and pilot. He has been teaching in the Aviation program at San Jose State University since 1993 and has been working with Dr. Taylor since 1998. He has also presented his research at several professional conferences such as the SAE Airframe/Engine Maintenance and Repair conferences, the International Symposia on Aviation Psychology, and FAA/CAA/Transport Canada joint conferences on Human Factors in Aviation Maintenance and Inspection.

From The Editor!

Hello! Welcome to the last Volume 5 issue of GroundEffects, I hope that everyone had a safe and wonderful holiday season. In this issue we again discuss the very popular subject of communication with two very well know doctors, Dr. Taylor (Author of Airline Maintenance Resource Management Improving Communication) and Dr. Patankar. The other focus of this issue is to bring to you the ideas of Hong Kong in Human Factors. One article from Hong Kong is written by a regulator Kevin Baines and the other is written by Steven Lam, a facilitator. Please take a read through all these articles as they prove to be very interesting and informative. The 15th Symposium on Human Factors in Aviation Maintenance is happening 27 - 29 March, 2001 in London. This is the biggest Human Factors Symposium and you don't want to miss it. Unfortunately, I will have to miss it this year but I am sending my father so that he can let us know in the spring edition all about it. Be safe!

15th Symposium on Human Factors in Aviation Maintenance, 27-29 March 2001, London.

In March 2001, it is the UK CAA's turn to host the joint FAA/Transport Canada/CAA Human Factors in Aviation Maintenance Symposium. The UK CAA have set themselves a challenge: to organise a symposium in a brewery - at least, in The Brewery conference centre at the old Whitbread Brewery headquarters near the Barbican, in London. he programme will take a similar form to the 14th Symposium held in Vancouver earlier this year, ie. 1½ days plenary papers, followed by 1½ 'interactive sessions', with the opportunity for delegates to do either the 1½ day 'introduction to human factors' session, or, alternatively, all three topical interactive sessions, of ½ a day duration. Each topical session will have 3 or 4 papers and time for questions, discussion and sharing of experiences, the themes being:

- Fatigue and duty time limitations
- Organisational factors
- Industry experiences

The theme for the symposium as a whole is "Practical Solutions for a Complex World", on the basis that we already know what the majority of the problems are and that now is the time to identify and apply solutions, whether these include training, organisational culture changes, implementation of maintenance error management systems, improvements to procedures and documentation, regulatory changes, etc.

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Editors Note: *This very informative article outlines not only what Hong Kong is doing in the area of human factors training but also how discipline enters into the picture. This may call for a company culture shift from what has be used in the past. Read on.*

Aircraft Maintenance Error Management in Hong Kong

Keven Baines

United Kingdom Civil Aviation Authority
Safety Regulation Group

The United Kingdom Civil Aviation Authority (UKCAA) are contracted to provide an Airworthiness Advisory Service to the Hong Kong Civil Aviation Department (HKCAD), an arrangement that has been in effect since the nineteen sixties. Of the many factors this contract includes, is the provision of advice regarding new or developing requirements.

For example, the CAA, in view of increasing evidence that UK industry were actively embarking on maintenance error management programmes as well as training their staff with regard to Human Factors, and an increasing number of "what if" error management related questions from its own technical staff, published Airworthiness Notice 71 (Maintenance Error Management Systems) in March 2000, as a means of advising industry on its policy in respect of such matters. You may not have seen it yet so I strongly advise you to do so. Both the UKCAA and the Hong Kong CAD believe it's a major advancement in setting the scene for error management to move forward. The opening paragraph of AN71 says it all: "CAA seeks to provide an environment in which such errors may be openly investigated in order that the contributing factors and root causes of maintenance error can be addressed".

So what has this all to do with managing error in Hong Kong you may ask? As mentioned earlier, having modelled its regulatory system on the UK example, the HKCAD has issued a similar Airworthiness Notice on error management systems in Hong Kong. What is of note however is that in the UK Notice 71 was developed largely to meet an industry need, whereas here, the Regulator is more actively 'promoting' the concept. In view of this CAD have embarked on a round of senior management presentations where the content of the notice is discussed in the context of that particular approved organisation and their own error data. With a number of the larger aircraft maintenance organisations being well advanced with regard to implementing MEMS the presentations to those companies tended to lean more towards CAD's 'policy' on error management. Nevertheless, the opportunity is taken to deliver the message that the Regulator is totally in support of these processes, and will make every effort to work with industry in securing the success of their MEMS programme. This is something of a departure in this region as in the past, as in many countries; the regulator has acted in a 'policing' role rather than in a 'management' or 'advisory' capacity.

It is worthy of note that the opportunity has been taken to study each organisation's maintenance error records by reviewing the Mandatory Occurrence Report database. Whilst this by no means represented the total picture regarding error rates and frequency within the organisation, it did provide opportunity for the HKCAD to openly discuss error scenarios in a meaningful way. It also provided allowed them to discuss issues regarding corrective actions applied, investigation techniques, and above all the appropriateness of disciplinary actions applied to personnel involved in these errors. I can only say that the discussions that followed were enormously productive to both parties. Stimulating debate often took place regarding which element of the 'maintenance system' was the source of the blame culture, a process traditionally associated with our industry when dealing with individuals involved in maintenance error.
The HKCAD spent half a day at each of the larger approved organisations, presenting what turned out to be an extremely emotive subject; that of error and violation. In our experience, at whatever level aircraft maintenance error is discussed, it always triggers similar responses such as, "we know how big our error rate is", "we have the right to manage our business as we wish and to sack whoever we want, whenever we want". Such comments reach to the heart of the thorny matter of error management and the company disciplinary process. Too often the view is taken that MEMS is somehow going to remove individual accountability, or worse restrict the company regard-

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ing options for managing under-performing staff. It is for these reasons that a significant element of CAD's presentations were devoted to explaining not only how disciplinary procedures should work (in an effective error management programme) but also how to manage the interface between effective error management and application of sanctions.

Time was taken to precisely detail what participation can be expected on the part of the Hong Kong regulator, following maintenance error. They were at pains to point out that they have every intention to drive the movement away from a culture of blame to one of a 'learning' industry, where both industry and the regulator can learn from error, and one where freedom to report error is at the heart. Moreover, the HKCAD made it clear that they have no intention to promote and drive a disciplinary 'witch-hunt'. In fact Notice 71 clearly states, "Maintenance Error is considered to have occurred when the maintenance system, including the human element, fails to perform in a manner expected in order to achieve its safety objectives". The regulator in Hong Kong, as in the UK views itself as an element within the maintenance system, and therefore equally capable of learning from it's mistakes.

Prior to the presentations to industry, the Hong Kong CAD Airworthiness Officers and managers received a two-day, residential training course similar to that delivered to CAA Surveyors and senior managers. The training included, basic Human Factors theory, error management techniques, introduction to the common MEMS tools, training in the use of MEDA as investigators and much more. The Airworthiness Officers (AO) of the HKCAD continue to receive training, updates and feedback on the subject and have appointed a Senior Airworthiness Officer (SAO) as their in-house specialist. The SAO will attend industry workshops, closely monitor worldwide trends in this subject and act as a focal point for the MEMS integration in the region. It is of interest to note here that the HKCAD has selected the Boeing MEDA tool as an essential element of its own internal investigation processes.

Returning now to the industry presentations, the final one of which will group together all of the smaller HKCAD approved organisations. Although it would not be prudent to discuss individual attendee error rates or scenarios, the intention is to discuss well-known, high profile errors in order to illustrate the same MEMS theory and to facilitate an understanding of the culture of blame and culpability. The presentation will conclude our initial objective of clearly and unambiguously stating the HKCAD position with regard to maintenance error investigation. Furthermore, we will have set the scene for the next stage, which is to offer to local industry a workshop on MEMS.

The target of the workshop is the users/drivers/practitioners of the MEMS within the approved organisation. Having, we believe, achieved successful senior management buy-in to the programme, the next objective is to provide the tools necessary for the organisation to continue to manage their errors. The workshop will be run over two days in May, and will include the following elements:

1. Basic principles and technology used in Maintenance Error Management Systems.

2. Various investigation tools that could support a MEMS.

3. Understanding the culture of blame and culpability.

4. MEMS practical exercises using MEDA and interviewing techniques.

The secondary aim of this workshop will be to create a forum for the exchange of experiences in Hong Kong. There is no doubt in our minds, we have some reasonably characteristic and unique error management issues, which need to be discussed and understood. It seems that everyone has a view, whether from experience or merely dogma, about the working practices and cultural difficulties faced in the Far East? There are certainly cultural issues in Hong Kong that require specific nurturing and consideration when embarking upon a MEMS programme, but to my increasing admiration over the last eighteen months, inability or unwillingness to discuss maintenance error, has not been one of them. Aircraft Maintenance Engineers, Supervisors, and managers alike will all (individually) candidly and honestly discuss every detail of an error, what they are not so keen on is discussing it with their manager or even less the Regulator. The question is, is this any different from the Western World? I would

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The HKCAD spent half a day at each of the larger approved organisations, presenting what turned out to be an extremely emotive subject; that of error and violation.

-Kevin Baines

say not, but then Hong Kong is somewhat peculiar with regard to its standing and history. For those who are not aware, Hong Kong was a British Protectorate for in excess of 100 years, and is a leading financial worldwide institution. In many respects it is in the vanguard of aircraft maintenance activities due in part to the success of companies such as Cathay Pacific Airways and the Hong Kong Aircraft Engineering Company (HAECO) who employ 3,600 staff, have a 3 bay wide-body hangar at Hong Kong's international airport, Chek Lap Kok, and a component overhaul facility at Tseung Kwan O. HAECO has been a world leader in 747 Section 41, pylon modification and other heavy maintenance activities over the past five decades. We must not forget the fast-expanding line maintenance organisations such as China Aircraft Services Limited (CASL) and Pan-Asia pacific Aircraft Services (PAPAS).

Additionally, the establishment in the immediate region of Taikoo Aircraft Engineering Company (TAECO) in Xiamen, China and the Guangzhou Aircraft Maintenance Company (GAMEO) over the last ten years, has significantly added to the aircraft maintenance Approval work undertaken by HKCAD. One thing is certain industry is alive and well in Hong Kong and the region, accordingly so is the opportunity for maintenance error!

Returning now to the cultural issues, there is as I've said, a willingness to discuss maintenance error, what I believe local industry lack (again not dissimilar to the rest of our very peculiar industry) is an unwillingness to accept that most maintenance errors have their origins elsewhere in the organisation, not merely the last person to touch the aircraft. Now this is the thorny issue, as it is in most countries, once the 'lid is lifted' the organisation is compelled (as established in AN71) to do something about the systemic failures. Whilst we see great advances being made in this direction, particularly with the larger (more MEMS aware) organisations, we must all agree that it is not possible to fix everything.

Consequently, the HKCAD like the UKCAA is advocating as an essential element of any MEMS programme, the use of a MEMS database. As such, at the Hong Kong industry workshops we (thanks to the UKCAA) are providing a free of charge MEMS analysis programme on CD ROM. This programme has been developed from the (in my opinion) most active, integrated and effective MEMS programme alive in our industry today, that of BF Goodrich in Seattle. We are eager that (using this software) an organisation will analyse collective data, showing contributing factor trends and frequencies, to enable the full potential of the system when managing systemic errors.

Due to the advent of the JAR 66 Aircraft Maintenance Engineer Licence requirements in Europe and the adoption of the same code as HKAR 66 (due to become active in June 2001) many Hong Kong organisations have already embarked upon significant Human Factors training. In a number of cases (i.e. HAECO and Cathay Pacific) these training courses have been in place for in excess of eighteen months, and I can report are very healthy, active venues for maintenance error and human factors to be discussed in a two-way setting. As such the HKCAD are working closely with local industry in order to help to develop these courses, not only to meet the specific knowledge requirements of the new Hong Kong licence, but also to ensure that these courses assist in integrating the whole MEMS concept. Already a number of these courses have been further developed to include elements recommended by Notice 71.

So where are we now regarding managing maintenance error in Hong Kong and what's the next step? Hong Kong industry is undoubtedly open to new ideas and is keen to be at the forefront of beneficial programmes such as MEMS. Although the concept of error management is not a new one, the concept of integrating all the following elements into what we now term MEMS is a relatively fresh approach in this region:

Human Factors training and awareness among all staff in the maintenance system
Revision of the disciplinary boundaries

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Event investigation processes and tools
Training and education of staff and investigators
Application of corrective actions and analysis of collective data
Sharing data with industry and the regulator

What we have seen is that many, if not all, Hong Kong based approved organisations have one or more elements in place. However, with no exceptions, none have an overall integrated approach to managing aircraft maintenance error. Then again, never before has the local regulatory body been clear with its policy regarding the need for a systemic, MEMS style, approach, we are all learning together.

Here in Hong Kong, we have recognised that in order for MEMS to truly succeed it is dependent on full and free internal investigation of maintenance error without fear of action by the HKCAD. Accordingly the HKCAD has given a number of assurances via AN71, which we truly believe will place Hong Kong industry in a leading position in the region, whereby we can collectively commit to reducing the number of maintenance errors and to mitigate the consequences of those, which remain. Ultimately we seek to provide an environment in which such errors may be openly investigated in order that the contributing factors and root causes can be identified and addressed.

Well fine words, but do we see any changes? Yes most unequivocally! We hear aircraft maintenance engineers talk about circadian rhythms and being 'set-up' to get it wrong and office staff discussing contributing factors. We hear production planning engineers' talk about the likelihood of identification of cracks if they fail to break-up detailed visual inspection workcards into manageable chunks. Above all (at this relatively early stage) we appear to have entered into a partnership with senior management of the approved organisations, whereby discussions turn to long term corrective actions, systemic failures and safety nets!

What appears to have happened at this interim stage is that we have, as a collective industry and regulator partnership, created a common language and set of rules by which to discuss and manage maintenance error. It is for this reason that we believe we are well placed to move forward and to begin to share MEMS results across our industry.

Finally, we hope that by sharing such data industry and the regulators can continue to jointly develop a better understanding of maintenance error causation and jointly continue to develop more focused aircraft maintenance error reduction strategies that lead to a reduction in the fatal aircraft accident rate.

Kevin Baines

Keven started his career in aviation as an Aircraft Technician in the Royal Air Force, spending among the usual squadron tours, an enjoyable period maintaining the RAF's Battle of Britain Memorial Flight Spitfires, Hurricanes and Lancaster. After ten years in the RAF, Keven left to join British Airways, as an LAE maintaining Airbus A320, Boeing 757, 737, 747 and BAe 1-11's. Progressing through supervisory roles to a position in Quality Assurance, where he first became involved in HF and MEMS. He worked as a member of the multi-airline team helping to develop MEDA with Boeing. After a further 9 years, Keven moved on from BA and joined the CAA, where he is presently the Deputy Regional Manager in the Hong Kong Office. Since his involvement with the Boeing MEDA team Keven has remained active in the field and is a staunch advocate of the HF/MEMS philosophy.

Editors Note: *Here is an interesting article on the results of human factors training delivered in Hong Kong. The training does not produce a miracle but does have positive results.*

Human Factor Training in Hong Kong

By Steven Lam BEng(Hons), AMRAeS, AMIMechE

Human Factors training in Hong Kong aviation industry is developed and become very important. From the Human Factors training, it is important to realize not just what happened in the area of aircraft maintenance but why it happened, in order to determine the root causes and problems.

Key points

- **The view of the Human Factors Training in Hong Kong.**
- **The reaction and the feedback of the students during the human factor training course.**
- **How training was used on the job.**

The first class of Human Factors training course in China Aircraft Services Ltd (CASL) is delivered by the Gordon Dupont, System Safety Services and commenced on May 2000. Two trainers, Keith Au-Yeung and Steven Lam, completed the train-the-trainer program and have been approved to deliver the Human Performance in Maintenance (HFPM) Part 1 workshop.

The reaction and feedback of the students during the training course.

The Human Performance in Maintenance workshop began in June 2000 and to date Jan 2001, we had trained over 70 employees. During the training, most people are very interested in the case study of the world-wide accidents such as United Airlines FLT 173, Aloha Airlines FLT 243, Air Ontario FLT 1363 and some case studies such as BAC-111 windshield change and the price of a mistake. I found out that all the students are interested in what happen in the accidents and why the accidents happened during the training courses. All students agreed the factors of the maintenance errors of each case with the facilitators, share the experiences and analysis the factors from the different viewpoints.

How training was used on the job.

For the participants who returned the two and six months follow-up questionnaires, responses to the question of how they actually used the HFIM training on the job. The trainees' self-perception of behavior response fell into three categories: 1) "Better Listening," 2) "More awareness of others," and 3) "Dealing better with others." The first two categories show a "passive" improvement made within the person, while the last category shows an "active" response by direct interpersonal approaches. The below figure shows how these three categories of training use were reported two and six months after training. The percentage of respondents reporting "better listening" tended to decrease over time, while the other passive category, "be more aware of others," showed a more stable pattern over the two survey periods.

The active behaviors included in "deal better with others" rose substantially at six months.

This figure reported use of the training

How Training Was Used on the Job for Two, Six Month Follow-up

Conclusion

Performance success together with the training influences the employees attitudes who perform more safely and with greater dependability. Many of students' report changing their behavior in the months following the training to take full advantage of what they have learned. The survey data continue to be collected in the months following the training, thus larger samples sizes and longer time periods will become available for further analyses. The company will began to provide recurrent HFIM training for all maintenance managers, licensed engineers and mechanics as well. Based on the results presented here, we expected to see even stronger evidence for power and effectiveness of the HFIM training in improving safety in the future.

Steven Lam

BEng(Hons),AMRAeS, AMIMechE

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Steven Lam is a Technical Trainer, holding CAAC aircraft maintenance license. He started his career in aviation as aircraft technician trainee with Hong Kong Aircraft Engineering Co. Ltd (HAECO) on Base and Line Maintenance for 8 years. Now he is working for China Aircraft Services Ltd (CASL) on Training & Development Section for 1 year. He is a qualified facilitator on Human Factors in Aviation Maintenance. He developed and delivers several training programs on Human Factors with the CASL

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The Symposium will open with a welcome address from the UK CAA Chairman, **Sir Malcom Field,** followed by a keynote address by **Ken Smart,** Head of the UK Air Accidents Investigation Branch. The first plenary paper will be from **Dan Maurino,** of ICAO, who will talk about ICAO's approach to human factors and maintenance, followed by updates on what is happening in the USA, Canada and the UK by **Cathy Abbott** of the FAA, **Don Sherritt** of TC, and **Jim Done** of the CAA respectively.

Jean-Marc Cluzeau, Chairman of the JAA Maintenance Human Factors Working Group will present a paper on the work of that group, including a proposed standard training syllabus and objectives for human factors in maintenance, and any other likely regulatory implications. Continuing on the European theme, there will also be a presentation on the work of the ADAMS consortium (Aircraft Dispatch and Maintenance Safety) and an update on work arising from this project.

Design for maintenance is an important issue and this will be discussed in a paper by **Hazel Courteney,** Chairman of the JAA Human Factors Steering Group and the UK CAA Design and Production Standards human factors specialist. It is also hoped that representatives from both Boeing and Airbus will be at the symposium, as well as other delegates involved in design ad production, if previous years' attendees lists are anything to go by.

On a more international note, **Alan Hobbs** from the Australian Transportation Safety Bureau will present the results of a survey of all Australian maintenance engineers, and **Bill Johnson**, of Galaxy Scientific, will be giving a thought-provoking paper based on North American experiences.

One of the important issues in any human actors initiative is to get support from the top, and it is planned to have two presentations from industry on this theme, one of these being from **Bernard Newton,** Technical Director of Britannia Airways.

The interactive sessions have already been mentioned but a few of the speakers who will be contributing to these include: **Drew Dawson,** expert on fatigue research, from the University of South Australia , **Steve Mason,** HSEC and **David Embrey,** Human Reliability Associates, to name but a few. **Dave Hall,** Deputy Regional Manager Heathrow, CAA, will be running the "introduction to human factors" course, with the assistance of well-renowned experts in the field. This session would be appropriate for anyone relatively new to human factors, but also to those who are likely to be responsible for establishing training courses within their organisations.

Previous symposia have attracted delegates from around the world, from various countries, organisations and backgrounds, including civil/military, commercial/academic, regulators/accident investigators, etc. Over 400 delegates attended the Vancouver symposium, and it is expected that there will be a similar or greater level of interest in the London symposium (although you are advised to book early as numbers are capped, due to the size of the venue, at 340).

The symposium will be run on a non-profit making, non-sponsorship basis and the cost for the three days, including a social event on the first evening, will be £399 + VAT. Delegates may select accommodation to suit their budget, and details of a few hotels in the vicinity are given in the flyer.

The detailed programme will be published in early 2001, but a copy of the interim details can be found on [website address], or a flyer can be sent to you on request. For further details, please contact Fiona Belton, at [contact details].

If you can only afford the time or the budget to attend one event next year, make sure it is this one. This is run for you, to enable sharing of best practice and up-to-date knowledge.

We look forward to seeing you there!

GroundEffects™

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