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Editors Note: *This article was written by Captain Daniel Maurino of the International Civil Aviation Authority*

Human error in aviation maintenance: the years to come

***Captain Daniel E. Maurino**, International Civil Aviation Organizaiton*

Introduction

The retrospective analysis of actions and inactions by operational personnel involved in accidents and incidents has been the traditional method utilized by aviation to assess the impact of human performance in regard to safety. The established safety paradigm and prevailing beliefs about what constitutes safe and unsafe acts, guide this analysis in such a way that it traces back an event under consideration until a point in which investigators find a behaviours that did not produce the results. At such point, human error is concluded.

This conclusion is generally arrived to with limited consideration of the processes that could have led to the 'bad' outcome. Furthermore, when reviewing events, investigators know that the behaviours displayed are a matter of record. This is, however, a benefit the operational personnel involved did not have when they selected what they thought at the time were good or appropriate behaviours, and which would lead to a good outcome. In this sense, it is suggested that investigators examining human performance in safety occurrences enjoy the benefit of hindsight.

Furthermore, conventional safety wisdom holds that, in aviation safety is first. Consequently, human behaviours and decision-making in aviation operations are considered to be one hundred percent safety oriented. This is not true, and a more realistic approach is to consider human behaviours and decision-making in operational contexts as a compromise between production-behaviours to achieve the actual production demands of the operational task at hand may not always be fully compatible with the optimum behaviours to achieve the theoretical safety demands.

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MARSS Third Annual General Meeting

On April 26th, 2001 the Third Annual General Meeting was held in Richmond, B.C. Canada.

The Board members elected for a two year term were: R. Rorison, W. Foyle, P. Jenkins, S. Mikituk, J. Braund and A. Schellekens.

The opening remarks from our president were that we had a very successful and active year. We are now in our fourth year and to look back, we realize just how far MARSS has come. It was said that we now have a presence in the aviation industry and we are known as suppliers of Aviation Safety Products.

Currently, the Ramp Safety posters are available and we are now taking orders and sending these posters worldwide. If you or anyone you know are interested, please visit us on the web at **marss@marss.org.** We would be happy to send you a set of these fantastic posters.

We look forward to the next meeting for the newly elected officers.

GroundEffects™ would like to extend our thanks to the following companies for their generous contributions.

AIR CANADA

Help us to prevent accidents before they happen!

GroundEffects™ (ISSN 1094-0146) is the official newsletter of **MARSS (Maintenance and Ramp Safety Society)** and is published four times per year to discuss issues affecting maintenance safety. We offer practicable solutions to maintenance managers, regulatory authorities, and unions charged with improving safety and reducing costs.

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(Con't from page 1, Human error...)

> ***"Operational errors do not reside in the person, as conventional safety knowledge would have aviation believe".***
>
> ***- Captain Dan Maurino***

All production systems, and aviation is no exception, generate a migration of behaviours: under the imperative of economics and efficiency, people are forced to operate at the edges of the system-safety space. Consequently, human decision-making in operational contexts lies at the intersection of production and safety and is therefore a compromise. In fact, it might be argued that the trademark of experts is not years of experience and exposure to aviation operations, but rather how effectively they manage the compromise between production and safety. Operational errors do not reside in the person, as conventional safety knowledge would have aviation believe. Operational errors primarily reside in latency within task and situational factors in the context, and emerge as consequences of mismanaging compromises between safety and production goals, largely influenced by the shared attitudes across individuals (i.e., culture).

The compromise between production and safety is a complex and delicate balance and humans are generally very effective in applying the right mechanisms to successfully achieve it, hence the extraordinary safety record of aviation. Humans do occasionally mismanage task and/or situational factors and fail in balancing the compromise, thus contributing to safety breakdowns. However, since successful compromises far outnumber failures, in order to understand human performance in context the industry needs to capture, through systematic analyses, the mechanisms underlying successful compromises when operating at the edges of the system, rather than those that failed. It is suggested that understanding the human contribution to successes and failures in aviation can be better achieved by monitoring normal operations, rather than accidents and incidents. The Line Operational Safety Audit (LOSA), discussed in this paper, is the vehicle endorsed by the International Civil Aviation Organization (IACO) for this purpose.

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Strategies to understand operational human performance

Accident investigation

The most widely used tool to document and attempt to understand operational human performance in aviation, and define remedial strategies, is the investigation of accidents. However, in terms of human performance, accidents yields data mostly about behaviours that failed to achieve the balance compromise between production and safety discussed in the previous section. It is suggested that positive outcomes provide a more sensible, supplemental foundation upon which to define remedial strategies and subsequently reshape them as necessary, than do negative ones.

From the perspective of organizational interventions, there are limits to the lessons that may be extracted from accidents that might be applied to reshape remedial strategies. It might for example be possible to identify the type and frequency of external manifestations of errors in each of these generic accident scenarios, or discover specific training deficiencies that are particularly conspicuous in relation to identified errors. This, however provides only a tip-of-the-iceberg perspective. Accident investigation, by definition, concentrates on failures, and in following the rationale advocated by LOSA, it is necessary to better understand the success stories to see if their mechanisms can somehow be bottled and exported. This can better be achieved through the monitoring of normal line operations and associated successful human performance.

Nevertheless, there remains a clear role for accident investigation within the safety process. Accident investigation remains the appropriate tool to uncover unanticipated failures in technology or bizarre events, rare as they may be. More important, and in extreme terms, if only normal, daily operations were monitored, defining assumptions about safe/unsafe behaviours would prove to be a task without a frame of reference. Therefore, properly focused accident investigation can reveal how specific behaviour, including errors and error management, can resonate the specific circumstances to generate an unstable and most likely catastrophic state of affairs. This requires a focused and contemporary approach to the investigation. Should accident investigation restrict itself to retroactive analyses as discussed above, its only contribution in terms of human error would be increase industry databases, the usefulness of which in regard to contemporary safely remains dubious. Even worst, it could provide the foundations for legal action, the allocation of blame and punishment.

> ***"Incidents are more telling markers than accidents..."***
> ***-Captain Dan Maurino***

Incident investigation

Incidents are more telling markers than accidents, if not of operational human performance, at least on system safety, because they signal weaknesses within the overall system before the system breaks down. There are, nevertheless, limitations on the value of the information on operational human performance obtained from incident reporting system.

First, incidents are reported in the language of aviation and therefore capture only the external manifestations of errors. Furthermore, incidents are self-reported, and because of reporting biases, the process and mechanisms underlying error as reported may or may not reflect reality. Second, and most important, incident reporting systems are vulnerable to what has been described as normalization of deviance. Over time, operational personnel develop informal and spontaneous group practices and short-cuts to circumvent deficiencies in equipment design, clumsy procedures, or policies incompatible with operational realities, all of which complicate operational tasks. In most cases normalized deviance is effective, at least temporarily. However, since they are normal, it stands to reason that neither these practices nor their downsides will be reported to, nor captured by, incident reporting systems.

Normalized deviance is further compounded by the fact that the most willing reporters may not be able to fully appreciate what are indeed reportable events. If operational personnel are equipment, how could they recognize such factors as reportable problems? While these factors would arguably be reported if they generate incidents, there remains the difficult task of evaluating how they can create less than safe situations, and thus overcome the temptation to postulate the deviations explain incidents simply because they are deviations.

Incident reporting systems are certainly better than accident investigations to begin understanding system and operational human performance, but the real

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challenge lies in taking the next step - understanding the processes underlying human error when designing remedial strategies. If such interventions are to be successful in modifying system and individual behaviours, errors must be considered as symptoms that suggest where to look further. In order to understand the mechanisms underlying errors in operational environments, flaws in system and human performance captured by incident reporting systems should be considered as symptoms of mismatches at deeper layers of the system. The value of the information generated by incident reporting systems lies in the early warning about areas of concern, but it is suggested that such information does not capture the concerns themselves.

Training

The observation of training behaviours, such as for example during flight crew simulator training, is another tool to which aviation has ascribed inordinate value in helping to understand operational human performance. However, the production component of operational decision-making does not exist under training conditions. While operational behaviours during line operations are a compromise balance between safety and production objectives, training behaviours are heavily biased towards safety. In simpler terms, the compromise between production and safety is not a factor in decision-making , and operational behaviours exhibited are 'by the book'.

Therefore, behaviours under monitored conditions can provide an approximation to the way operational personnel may behave during line operations, and such observation my contribute to flesh out major operational questions, such as for example significant procedural problems. However, it would not be correct - and it might lead an organization into a risky path - to assume that observing personnel under training provides the key to understand human decision-making and error in monitored contexts.

Flight data recorder information

Digital Flight data recorder (DFDR) and Quick Access Recorder (QAR) information from normal flights can also be a valuable diagnostic tool (although the expense may prohibit its use in many airlines). There are, however, considerations about the data acquired through these tools. DFDR/QAR read out does provide information on the frequency of exceedences and the locations where they occur, but these data cannot yield information on the human behaviours that were precursors of the event. While DFDR/QAR data tracks potential systemic problems, pilot reports are still necessary to provide the context within which to fully diagnose the problems.

Nevertheless, DFDR/QAR data hold high cost/efficiency ration potential. Although probably underutilised because of both cultural and legal reasons, DFDR/QAR data can assist in filtering operational contexts within which migration of behaviours towards the edge of the system takes place.

Normal operations monitoring

The supplemental approach in this chapter to uncover the mechanisms underlying the human contribution to failures and successes in aviation safety, and therefore to the design of countermeasures against human error and safety breakdowns, on the monitoring of normal line operations. Any typical line flight - a normal process - involves inevitable, yet mostly inconsequential errors (selecting wrong frequencies, dialling wrong altitudes, acknowledging incorrect readbacks, mishandling switches and levers and so forth). Some errors are due to flaws in human performance, others are fostered by systemic shortcomings; most are a concatenation of both. The majority of these errors have no damaging consequences because (a) operational personnel employ successful coping strategies and (b) system defences act as containment net. It is about rather than continuing to focus on failures as the industry has historically done. Monitoring normal line flights, utilizing a validated observation tool, allows to capture these successful coping strategies.

There is emerging consensus within aviation that the time has come to adopt a positive stance and *anticipate* the damaging consequences of human error in system safety, rather than regretting its consequences. This is a sensible objective and a cost-effective way (in terms of dollars *and* human life) to achieve it is by pursuing a contemporary approach rather than updating or over-optimizing methods of the past. After fifty years of investigating failures and unless it is believed that the human condition is beyond hope - a somewhat misplaced safety emphasis in regard to operational human performance and error.

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(Con't from page 4, Human error...)

A contemporary approach to operational human performance and error

Progressing to normal operations monitoring, and thus to the implementation of LOSA, requires revisiting and adjusting prevailing views of human error. In the past, safety analyses in aviation have viewed human error as an undesirable and wrongful manifestation of human behaviour into which operational personnel somehow wilfully elect to engage. In recent years, a considerable body of practically oriented research, based on cognitive psychology, has provided a completely different perspective on operational errors. This research has substantiated in practical terms a fundamental concept of human cognition: error is a normal component of human behaviour. Regardless of the quantity and quality of regulations the industry might promulgate, regardless of the technology it might design, and of the training humans might receive, error will continue to be a factor in operational environments because it simply is the downside of human cognition. Error is the inevitable downside of human intelligence; it is the price human beings pay for being able to think on our feet. Error is a conservation mechanism afforded by human cognition to allow humans to flexibly operate under demanding conditions for prolonged periods without draining their mental batteries.

There is nothing inherently wrong or troublesome with error itself, as manifestation of human behaviour. The trouble with error in aviation lies with the negative consequences it may generate in operational contexts. This is a fundamental point: in aviation, an error the negative consequences of which are trapped before they produce damage is inconsequential. In operational contexts, errors that are caught in time do not produce damaging consequences and therefore, for practical purposes, do not exist. Countermeasures to error, including training interventions, should not be restricted to attempt to avoid errors, but rather to make them visible and trap them before they produce damaging consequences. This is the essence of error management: human error is unavoidable but manageable.

> ***"The trouble with error in aviation lies with the negative consequences it may generate..."***
>
> ***- Captain Dan Maurino***

Error management is at the heart of LOSA and reflects the previous argument. Under LOSA, flaws in human performance and the ubiquity of error are taken for granted, and rather than attempting to improve the human condition, the objective becomes improving the context within which humans perform. LOSA aims ultimately - through changes in design, certification, training, procedures, management and investigation - at defining operational context which introduce a buffer zone or time delay between the commission of errors and the point in which their consequences of errors, and the better the quality of the buffer or the longer the time delay, the stronger the intrinsic resistance and tolerance of the operational context to the negative consequences of human error. Operational contexts should be designed in such a way that allows front-line operators second chances to recover the consequences of errors.

An approach to human error from the perspective of applied cognition furthers the case for LOSA. Accident and incident reports, and existing database analyses may provide some of the answers, but it is doubtful that they will answer the fundamental questions regarding the role of human error in aviation safety. To what extend do flight crews employ successful coping strategies? To what extent do successful remedial strategies avert incidents and accidents? These are the questions for which a systematic answer is imperative in order to ascertain the role of human error in aviation safety, prioritize the issues to be addressed by remedial stategies, and reshape remedial strategies as necessary.

Managing change once LOSA data is collected

LOSA is but a data collection tool. LOSA data, when analysed, are used to support changes designed to improve safety. These may be changes to procedures, policies, or operational philosophy. The changes may affect multiple sectors of the organization that support flight operations. It is essential that the organization has a defined process to effectively use the analysed data, and to manage the change the data suggests.

LOSA data should be presented to management in at least operations, training, standards and safety, with a clear analysis describing the problems related to each of these areas as captured by LOSA. It is important to emphasize that while the LOSA report should clearly describe the problem the analysed data suggest, it should not attempt to provide solutions. These will be better provided through the expertise in each of the areas in question.

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(Con't from page 5, Human error...)

LOSA directs organizational attention to the most important safety issued in daily operations, and it suggests what are the right questions to be asked; however LOSA does not provide the solutions. The solutions lie in organizational strategies. The organization must evaluate the data obtained through LOSA, extract the appropriate information, and then deploy the necessary interventions to address the problems thus identified. LOSA will only realize its full potential if the organizational willingness and commitment exist to act upon the data collected and the information such data support. Without this imperative step, LOSA data will join the vast amounts of untrapped data already existing throughout the international civil aviation community.

Conclusion

There is no denying that monitoring normal operations through LOSA on a routine basis and worldwide scale poses significant challenges. Significant progress has been achieved in tackling some of these challenges. For example, from a methodological point of view, some early problems in defining, classifying and standardizing the data obtained have been solved; and consensus has been developed regarding what data should be collected. From an organizational perspective, there is a need to consider using and integrating multiple data collection tools, including line observations, more refined incident reporting and Flight Data Analysis (FDA) systems. This in turn poses a challenge to the research community, to assist airlines by developing analytic methods to integrate multiple and diverse data sources. But most importantly, the real challenge for the large-scale implementation of LOSA will be overcoming the obstacles presented by a blame-oriented industry, that will demand continued effort over time before normal operations monitoring is fully accepted by the operational personnel, whose support is essential.

Biography

Captain Dan Maurino is the Co-ordinator of the Flight Safety and Human Factors Programme with the International Civil Aviation Organization in Montreal, Canada. He started his flying career in the late Sixties. In 1974 he joined Aerolineas Argentinas, where in addition to his flying duties he held several management positions, including Flying Training Manager.

In 1989 he was seconded to ICAO and assigned the responsibility of developing and implementing the Organization's Human Factors Programme, a position he holds at the present time.

Dan is a member of the International Society of Air Safety Investigators (ISASI) and the Human Factors and Ergonomics Society (HFES). He sits representing ICAO at the IATA Human Factors Task Force. He is also a member of the Flight Safety Foundation's ICARUS Committee.

Captain Maurino is associate editor of the International Journal of Aviation Psychology (IJAP), and a member of the editorial board of the Human Factors and Aerospace Safety Journal. He is co-author (with Prof James Reason; Capt Neil Johnston and Dr Rob Lee) of the book Beyond Aviation Human Factors, published by Ashgate Publishing, and the author of over forty papers and articles on safety, prevention and training from the perspective of Human Factors.

Dan is the recipient of the Flight Safety Foundation-Aviation Week & Space Technology/Distinguished Service Award for 2000, for his work in Human Factors and Aviation Safety. He is also recipient of the 1999 Flight Safety Foundation/ Airbus Industrie Award for Achievement in Human Factors and Aviation Safety.

References for the following article:

Amalberti, R. (1996). "La conduite de systems a risques. ***Paris, Presses Universitaires de France.***

Klinect, J.R., Wilhelm, J.A., Helmreich, R.L. (in press) *Event and Error Management: Data from Line Operations Safety Audits.* In Proceedings of the Tenth International Symposium on Aviation Psychology, **The Ohio State University.**

Mauri Jo, D.E. Reason, J., Johnston, A.N. & Lee, R. (1995). *Beyond Aviation Human Factors.* Hants, England: **Averbury Technical.**

Periès J. (1996). Evolution of the aviation safety paradign: Towards systemic causality and proactive actions (pp 39-49). In Hayward B. & Lowe H. (Eds). *Proceedings of the 1995 Australian Aviation psychology Symposium.* Hants, England: **Averbury Technical.**

Reason, J. (1998) *Managing the Risks of Organizational Accidents.* Hants, England: **Averbury Technical**

Vaughan , D. (1996). *The Challenger launch decision.* Chicago, USA: **The University of Chicago Press**

Woods, D.D., Johannesen, L.J., Cook, R.I. & Sarter, N.B. (1994). *Behind human error: Cognitive systems, computers and hindsight.* Wright-Patterson Air Force Base, Ohio: **Crew Systems Ergonomics Information Analysis Center (SCERIAC)**

Editor's Note: Unfortunately, we could not get a picture of Captain Dan in time for printing. Look for it in the next edition.

Human Factors and aircraft maintenance training: A way to the future

Mairan J. Schuver-van Blanken and Jantiene van Bavelgem
National Aerospace Laboratory NLR

Introduction

The importance of Human Factors is becoming increasingly apparent in the field of aircraft maintenance, as is also reflected by licensing requirements with respect to Human Factors in JAR-66 of the Joint Aviation Authorities. Introducing Human Factors into the aircraft maintenance organization implicates a need for training, amongst other elements such as error reporting systems and error-tolerant aircraft design. This paper describes a way to the future for Human Factors training in aircraft maintenance, as it is envisioned by the National Aerospace Laboratory NLR. This way to the future is based on research and developments both in the field of aircraft maintenance as well as in the field of educational technology.

Human Factors training is considered necessary initially for Continuation Training, to offer the present certified staff the opportunity to meet the requirements of JAR-66. In the long term, Human Factors should be integrated with technical training, within the company as well as within vocational training. This integration of Human factors and technical maintenance training is expected to limit the extra time to training and increase the transfer to the aircraft maintenance practice.

Way to the future

The proposed path to the future distinguishes three phases (van Bevelgem, Schuver-van Blanken & van Avermaete, 2000)

Phase 1: Human factors training as 'add-on' training;

Phase 2: Human factors training and technical continuation training integrated

Phase 3: Human factors as a natural aspect of task performance

Phase 1: Human Factors training as 'add-on'

In the short term the requirements of JAR-66 can be met by setting up a separate Human Factors training and by adding this training on the current Continuation Training programme (*figure 1*).

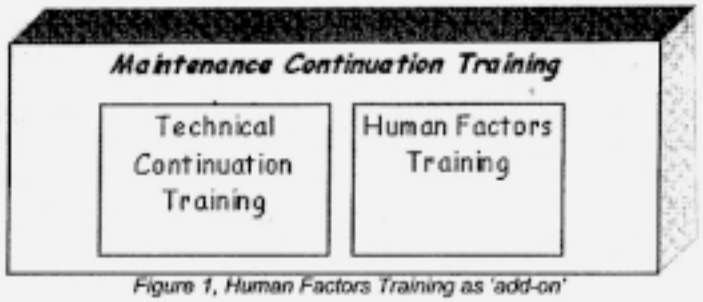

Figure 1, Human Factors Training as 'add-on'

Human Factors training in this phase is (ideally) a module of several days (at least 4 days) in which Human Factors knowledge is taught and skills are practised to some extend. Maintenance companies have already developed this kind of 'add-on' Human Factors training (which is often limited to one day), with the main focus of these courses is on communication, teamwork or individual related Human Factors. However, Human Factors training in phase 1 should focus on the complete scope of Human Factors, covering task and organization related aspects as well.

In this phase, tasks and context of aircraft maintenance form the point of departure from which the Human Factors are introduced. Current Human Factors training often has a theoretical viewpoint and the link between Human Factors and aircraft maintenance is difficult to identify. In addition, the training should be based on active involvement of the trainees. This means case-based learning (paper-based and/or video), in which trainees analyse and discuss cases and reflect on their own practices and in which theory is explained from the viewpoint of the maintenance situation. This way transfer of the Human Factors training to the actual task performance will be enhanced by the fact that not only knowledge is addressed, but also skills and attitude are dealt with.

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The effect of Human Factors training in this phase is expected to be a short-term effect because it is approached as an addition to technical training. After some time, Human Factors awareness and application of Human Factors skills will fade, reinforced by the fact that Human Factors training is often considered as additional training required by regulations.

Phase 2: Integration of Human Factors Training and Technical Continuation Training

To establish a more intense and longer-term effect of Human Factors training, Human Factors training and Technical Continuation training should be integrated (*figure 2*).

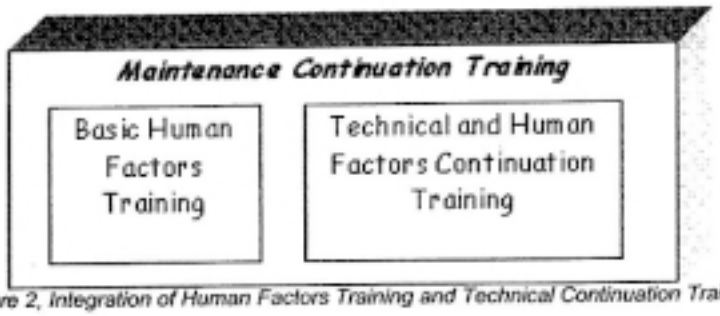

Figure 2, Integration of Human Factors Training and Technical Continuation Training

In this phase, for each technical subject, task or system to be handled within the Technical Continuation Training, the Human Factors aspects that play a role are addressed at the same time. Basic Human Factors Training will however be needed in order to maintain awareness of and to understand Human Factors in maintenance.

The integration of Human Factors training with the Technical Continuation Training can overcome the adverse effects of the 'add-on' training from phase 1. The result of this combined training is expected to be a longer-standing effect of training than when Human Factors training is considered a separate training module. As a consequence of the 'hands-on' experience of Human Factors during the technical aspects of the training, the transfer step to the actual work practices can diminish.

Phase 3: Human Factors as a natural aspect of task performance

To make Human Factors a natural aspect of task performance, Human Factors should be dealt with earlier than in Continuation Training. After Continuation Training there is still a chance that personnel will fall back in their old habits. To avoid this, a full integration of Human Factors in Technical Training should take place in the long term (*figure 3*), in such a way that Human Factors awareness and skills become a natural aspect of task performance.

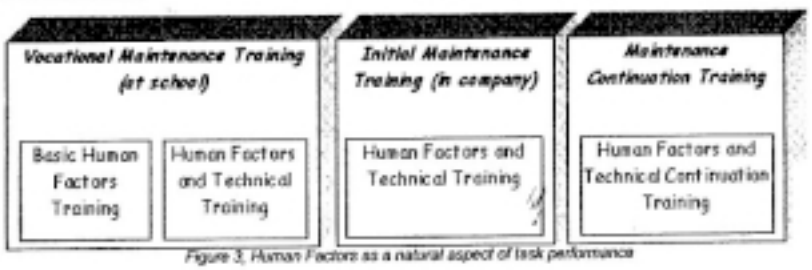

Figure 3, Human Factors as a natural aspect of task performance

Human Factors is integrated with technical training at both vocational education and the maintenance company. From the start, aspects of Human Factors (problems) are covered and learned in the theoretical subjects of the training and in performance of the maintenance tasks. This way, automatically an awareness of Human Factors (including errors) are inherent in human performance. In addressing Human Factors within vocational training, the learning process of technical maintenance skills and the amount of practical experience of the learners should be taken into account to avoid excessive cognitive load during the learning process. Next to that, a basic or introductory Human Factors module will be needed to expalin the concept of Human Factors and to put the concept in a wider perspective.

As a result of the early integration of Human Factors, the transfer of Human Factors knowledge and skills to the work floor will be high and Human Factors will form a natural aspect of Task performance.

Your opinion is needed

For integration of Human Factors both within vocational and technical training NLR has identified a set of opportunities and strategies for integration of Human Factors in technical training, which will be further specified and tried out in 2001. For the purpose of this project, NLR welcomes any comments, opinions or ideas with respect to the propsed way to the future of Human Factors and aircraft maintenance training as

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described in this paper. Please send your comments to MARSS and they will forward them to me.

Biography

Marian J. Schuver-van Blanken (blanken@nlr.nl) and Jantiene van Bavelgem (bavelgem@nlr.nl) are currently working as Educational Designers for the National Aerospace Laboratory NLR in the Netherlands in the field of training design and research. Next to activities related training in the domains of air traffic control and civil flight deck, they are involved in Human Factors training in the aircraft maintenance. They have recently been involved in the STAMINA project (Safety Training for the Aircraft Maintenance Industry), in which they designed and developed a Human Factors training for aircraft maintenance technicians (1999). In addition, they have carried out research to Human Factors within aircraft maintenance training and identified a way to the future (1999). Currently they are involved in the ADAOTIT project (Advanced Design Approach for Personalized Training - Interactive Tools), in which a method and tool for designing training for complex cognitive skills is developed, that is going to be tested within the fields of air traffic control and aircraft maintenance.

National Aerospace Laboratory NLR
Department of Human Machine Integration. www.nlr.nl

A Report on the 15th Symposium on Human Factors in Aviation Maintenance March 27 to 29, 2001 The Brewery Conference Centre London, UK

The theme for this historic conference was: "*Practical solutions for a complex world*" and this was one conference that worked hard to live up to it's theme.

It was reported that there were 333 participants from 35 different countries in attendance. Just the opportunity to meet with so many persons with the common goal of reducing maintenance error was well worth the price of admission.

Day one (March 27) started off with a welcome address by **Sir Malcolm Field**, Chairman of the UKCAA.

The keynote address was delivered by **Ken Smart**, Head of the Air Accident Investigation Branch in the UK. He felt that the aviation world is full of two kinds of people: Those who just talk about safety and those who strive to change and improve. Thinking back to the 14th symposium; what has changed? There are chronic problems with staff shortages, unrealistic timeframes, supervisors involved in actual maintenance instead of supervising and more. Adding to this problem is the ever-increasing use of contract labour. A knowledge of human factors is going to become ever more necessary.

Dan Marino, Coordinator Flight Safety and Human Factors Programme ICAO, delivered an excellent presentation entitled: "*Human Error in Aviation Maintenance the years to come*," so we have made it the feature article of this issue. Likely by know you know what an excellent article it is.

Kathy Abbott, National Resource Specialist for Flight Deck Human Factors FAA gave an interesting presentation entitled: "*Safety, Human Factors and the Role of the Regulator.*" She outlined some of what the FAA is doing in the human factors field from the role of the regulator. She also touched on the shortage of skilled personnel that appears to be getting worse. The FAA produces recommended practices material as well as advisory material and lastly regulations to establish standards.

Don Sherritt, Director Aircraft Maintenance & Manufacturing, Transport Canada, delivered a presentation entitled: "*Evolving Directions: Transport Canada's Human Factors and Safety Management Initiatives.*" Much of what was presented is available in the Fall, 2000 edition of GroundEffects. The move is toward establishing a safety culture.

Jim Done, Head Aircraft Maintenance Standards Department, UKCAA presented: "*Back to the Future.*" Jim discussed the establishment of MEMS (Maintenance Error Management System) a voluntary reporting system that is hoped will help move errors from the "Blame" era to a "Just" era that is blame free. As part of this, workshops were delivered to 120 organizations. A Handbook has been developed and as a result of the 1998 ICAO Annex 6 requirement for human factors training, a NPA has been issued relative to JAR 145. Human factors training will be a requirement.

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After an excellent lunch, **Jean Marc Cluzeau**, JAA Ops-Maintenance Coordinator; Chairman JAA Maintenance Human Factors Working Group, spoke on "*Human Factors and proposed JAR 145 Maintenance Requirements.*" A working group is busy putting together the proposed training requirements. This in turn has to be accepted by a number of committees before it becomes law. It is a complex task.

James Reason, Professor of Psychology, University of Manchester gave an, as usual, spell binding presentation on "*Error Management.*" Jim is now doing a lot of work in the medical profession. We will try to get this presentation into the next GroundEffects. As he says: "If the devil wanted to invent a way to make errors he would have invented Aviation Maintenance." He also said that just because we have not had any accidents, we should feel a "chronic unease."

Alan Hobbs, Australian Transport Safety Bureau (ATSB)(and former BASI) spoke on "*The links between Errors and Error Producing Conditions in Aircraft Maintenance.*" Alan has written articles for us in the past and his presentation covered the types of errors and some error producing conditions. Some he listed were; 1) Excessive reliance on Memory, 2) Tiredness 3) Time Pressure and 4) Coordination traps (Unspoken assumptions). He also offered some very good solutions: 1) Provide Human Factors training, 2) Limit hours of work to reduce fatigue, 3) Pay attention to tools and ground equipment to ensure it is in good condition, 4) Refresher training, 5) Harvest error reports and 6) expand the "ETOPS" philosophy. i.e. Don't do the same work on both engines at the same time.

Jurgen van Avermaete, Netherlands Human Factors Advisory Group (HUFAG) spoke on "*Maintenance Human Factors from a European Research Perspective: results from the ADAMS project and related research initiatives.* The ADAMS project determined many interesting facts. One interesting one that stuck in my mind was in regards to procedural compliance = A whopping 34% said they completed work using other methods because it was quicker and easier. Another 10% had followed the manual without consulting it. Now that is an interesting one. It all came down to – More research is needed.

The final speaker of the day was **Hazel Courteney**, Human Factors specialist UKCAA; Chairman JAA Human Factors Steering Group who discussed "*Human Centred Design*"

Peter Hunt, acting in the capacity of Master of Ceremonies than entertained any questions from the tried assembly after an information filled day.

That evening a reception was held in the Brewery and what a full crowd was there. The symposium had numerous exhibitors there including MARSS. It was a wonderful opportunity to renew old acquaintances and make new ones. Aviation has certainly done its bit to make the world a very small place.

Day 2 (March 28), after a brief introduction by our Master of Ceremonies as to the events of the day, saw **Bernard Newton**, Technical Director, Britannia Airways give an thought provoking presentation on, "*A practical approach to Human Factors in Maintenance: a Board Members view.*" Bernard described the two day Awareness course that Britannia provides to all of its maintenance employees. He made a comment that all human factors trainers would love to hear and that was: he believed in the effectiveness of the program and was not looking for the monetary value. Now that is an enlightened board member all airlines could use.

For a very different look at human factors, Richard Morris Executive Director, London South East, Shadow Strategic Rail Authority gave a very interesting presentation entitled "Organizational Safety Culture: Why Bother? He described how human error had lead to many rail accidents and what they were doing to reduce these errors. They have borrowed from aviation and are turning to simulators to drill, drill and drill again to help ensure the correct response in an emergency.

The next speaker spoke on a very common modern day problem in our industry and this is the problem of the merger. **Robert Giguere**, Executive Vice President Operations, Air Canada spoke on "*Canada's Airline Merger – Opportunity and Challenge.*" The merging of 36,000 employees, who for many years had regarded each other as "the enemy" is a major challenge. Good communication becomes very vital to reset change.

Bill Johnson, Chief Technical Officer, Galaxy Scientific Corporation, rounded out the presentations session with, "*Human Factors Programmes – Fact or Fantasy.*" As always, from a professional like Bill, by means of a questionnaire, he left the participants knowing if they were; "the doers or the talkers" of our industry and if they were "the talkers." WHY?

(Con't on page 11)

(Con't from page 10, A Report..)

The next day and one-half was devoted to workshops. The most popular was the 1½-day "*Introduction to Human Factors in Aviation Maintenance*" presented by **David Hall** and **David Marx**. It was well presented and of benefit to all who participated. Other ½ sessions included: "*Fatigue and Shiftwork*" by **Jean Watson** and **Steve Griffin**, Professor Drew Dawson and Richard Komarniski assisted on this important issue. "*Organizational factors*" moderated by **John Goglia** and assisted by **Gary Eiff**, **David Embrey** and **Steve Mason** was another excellent choice. The final choice was "*Industry Experiences: learning from each other.*" This session was moderated by **David King** and assisted by **Jeff Bongard**, **Jerry Allen** and **Bill Johnson**.

This symposium provided something for everyone and once more sent a very high standard for next year's symposium to meet. However Ms. Jean Watson appears up to the challenge when she announced, with great fanfare, that next year's symposium will be in San Francisco from April 2 to 4, 2002. Mark those dates down and don't miss it.

From the Editor!

Happy 5 th Birthday GroundEffects!

This issue of GroundEffects is a special issue as it marks the start of GroundEffects 5th year in publication. I have been your editor for now 3 years... wow! I have to say that I am still very pleased with the article conte in GroundEffects as it has started to progress with articles from around the world (not just Canada and the USA). Human Factors safety is an issue that affects people from as far away as Papua New Guinea to the people right here in Vancouver, Canada. It is a world wide concern for anyone and everyone. In the last five years, GroundEffects has grown from a 8 page publication to a 12 page publication... but it has not grown as much as I had hoped. I would truly enjoy and encourage anyone to send a letter to me (bad or good), just letting me know how we are doing. If the articles are of interest to you or anyone you know. I would love to see what topics are of great interest to you and your fellow workers! If one does not received feedback, then it is hard to judge how well one is doing.

I would like to give a big thank you to Captain Dan Maurino of the International Civil Aviation Organization and Marian J. Schuver-van Blanken and Jantiene van Bavelgem of the National Aerospace Laboratory for there very informative articles that are contained in this issue.

Captain Maurino states in his article, "human error is unavoidable but manageable". How true this statement is... No one means to cause an error with negative consequences but with the right training and reminders in place, error can be managed and lowered. Captain Maurino believes rather than attempting to improve the human condition, the objective becomes improving the context within which humans perform... Read his article starting on page 1 to learn more.

Mairan J. Schuver-van Vlanken and Jantiene van Bavelgem state, "This integration of Human Factors and technical maintenance training is expected to limit the extra time to train and increase the transfer to the aircraft maintenance practice'. This gives us something to think about... Read their article starting on page 7 of this edition.

I find that both of our major articles touch on the subject of recurrent training. I believe that recurrent training is very important as it tends to bring back practices and statements which we have forgotten or simply let fall to the wayside. When we leave Human Factors Training, we are very excited to put our new thoughts and beliefs to practise. We are positive that we now will never make a human factors error. But three months down the line, over half of what we were so excited about has been forgotten and we start to slip back to our old ways, not because we believe that our old ways are necessarily better but because the are familiar. I ask all of you to say to yourselves everyday, "today I will remind myself of the dirty dozen." If you do not have a set of posters yet, please visit the MARSS website: marss@marss.org and order a set or two... Not only do we have The Dirty Dozen Posters, Magnificent Seven Posters, we now have the Ramp Safety posters as well.

Ramp Safety does not seem to be as important in some people's minds as it is in others. What we need everyone to realize that all forms of safety are as important as others. The results of not practising safe, can be a very negative consequence, such as death of a loved one.

Please everyone practice safety at work at all times!

GroundEffects™

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