Attitudes and Behaviour intervention selection tool for aircraft maintenance

Customer

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EXECUTIVE SUMMARY

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Aviation accidents are not often caused by a lack of knowledge and technical skills on the part of maintenance personnel but when it is the case, they find their origin in Human Factors. For that reason, the maintenance aviation training industry (as represented in the EAMTC) decided that attitude of maintenance personnel is an area that should be studied to improve the safety and efficiency.

Description of work

This paper presents the result of this study. Firstly, an informed understanding of attitudes and behaviours and the role they play in safe and efficient aircraft maintenance has been achieved.

This report is based on a presentation to be held at the World Aviation Training Conference and Tradeshow –WATS- in Orlando, Florida, April 21-23, 2015.

Secondly, the 'Attitude and Behaviour intervention selection tool' was developed to support improvement of safety and efficient maintenance. The tool is based on a system perspective.

Results and conclusions

Issues with safety behaviour cannot be solved by sending maintenance personnel to an off-the-shelf skill or HF training course. Training offered needs to have a close relation to the operational reality encountered by the technician on the job. The systems perspective and the intervention selection tool outlined in this study present an opportunity for the MRO and the training department to collaborate in solving safety behaviour and attitude issues.

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Summary

Aviation accidents are not often caused by a lack of knowledge and technical skills on the part of maintenance personnel but when it is the case, they find their origin in Human Factors. This paper presents the result of this study. Firstly, an informed understanding of attitudes and behaviours and the role they play in safe and efficient aircraft maintenance has been achieved. Secondly, the 'Attitude and Behaviour intervention selection tool' was developed to support improvement of safety and efficient maintenance. The tool is based on a system perspective. This implies that issues with safety behaviour cannot be solved by sending maintenance personnel to an off-the-shelf skill or HF training course. Training offered needs to have a close relation to the operational reality encountered by the technician on the job. The systems perspective and the intervention selection tool outlined in this study present an opportunity for MROs and training departments to collaborate in solving safety behaviour and attitude issues.

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1 Introduction

Few aviation accidents are caused by a lack of knowledge and technical skills on the part of maintenance personnel. That is why various industry meetings concluded that attitude may be an area upon which the industry could focus its efforts to improve the safety and efficiency of aircraft maintenance personnel's performance (EAMTC Green Paper, 2011).

Managing human factors (HF) is key to improving aircraft maintenance performance and even though human factors are now a well-established part of training and organisational regimes, they are still underestimated and will be of increasing importance in the future operational environment. As our understanding of the contribution of non-technical and cultural issues to the safety of the overall system deepens it is clear that training needs to achieve impact at these levels and not at the level of an individual technician's technical knowledge or manual skills. This implies a paradigm shift in the way training is approached, from an individual approach to a system approach.

The Attitude and Behaviour Working Group of the European Aviation Maintenance Training Committee (EAMTC) produced guidelines and recommendations on how to improve human factors competence and performance in aircraft maintenance and recommended how to train the knowledge, skills and attitudes (KSAs) related to the targeted improvements.

This paper describes the objective of this work, together with an outline of current theoretical approaches to attitudes and behaviour. In addition the methodology used to define the guidelines & recommendations and the role they play in determining safety and competence are described.

The output of this paper is an informed understanding of attitudes and behaviour and a new perspective on how to improve the safety of your organisation with help of an attitude and behaviour intervention and planning tool.

2 Objective and Methodology

2.1 Objective

The objective of this paper is to:

'Define training guidelines and recommendations for the industry in order to improve attitudes & behaviour within the aviation maintenance sector'.

In order to achieve this, the following research questions are defined:

- What is the state of the art on understanding of attitudes and behaviours?
- What role do attitudes and behaviours play in determining safety and competence?
- What are the potential areas of improvement with regards to competence and behaviour?
- What could a practical intervention selection tool, that can improve organisational support for competent and safe performance, look like?

2.2 Methodology

The guidelines and recommendations on attitudes and behaviours for aviation maintenance were developed by a group of experts which included representatives from three maintenance repair organisations (MROs), four training schools and four organisations specialising in HF for aircraft maintenance.

The content of this document is based on literature reviews, best practice principles from the aviation maintenance industry, input and experience from members of the aviation maintenance training industry and input from the HF and educational science. In total four expert meetings took place and nine workshops were held with circa 60 instructors. During the workshops experiences were shared and possible training interventions to improve behaviours and attitudes were defined. After each expert meeting (intermediate) results followed acceptance procedures as followed by the EAMTC.

2.3 Assumptions

In order to come up with clear recommendations and guidelines for training and behavioural change in aviation maintenance four assumptions were made.

Firstly, maintenance technicians come to work to do their job conscientiously, (Dekker, 2013).

Secondly, deviations from procedures have primarily contextual causes (for example poor or inadequate procedures, lack of resources or time and/or top-down or peer pressure) rather than an attitude problem, Avermaete (2001).

Thirdly, safety related issues cannot always be traced back to an individual act, ICAO (2009). So, when we use 'behaviour' in this document we do not narrow it to an individual act. Not only could it be collective, it also concerns all layers of an organisation, including senior management.

Lastly, any training intervention which is not supported by organisation structure, policy and resources will be ineffective. At the same time, any organisational change or intervention (change in procedure, policy, manual, tool) which is not supported by the necessary information, knowledge and skills development (training) will be similarly ineffective, Bredewold (2014).

These assumptions are both scientific and experiential and form the basis of the terms of reference. They inform the decisions that were made in approach and the subsequent recommendations.

3 Attitudes, Behaviours and determining safety & competence

3.1 Attitudes and behaviours

An attitude can be defined as a positive or negative evaluation of people, objects, event, activities, ideas, or just about anything in your environment, Zimbardo et al. (1999). An attitude is an intention to behave in a certain way.

Having an attitude does not automatically result in behaviour. At least, knowledge and skills are needed to be able to behave in the intended way. Attitudes of people can be influenced by the national or, professional culture and/or the particular culture of a particular organisation.

Behaviour is influenced by the context in which it takes place. A technician can have a positive attitude about following procedures, and s/he can have the knowledge and the skills but this does not necessarily result in the behaviour that the attitude would suggest because the context did not allow for it.

Attitudes are undoubtedly an important mediating factor and they contribute to behaviour but they are less tangible than behaviour and they don't always predict behaviour accurately. For this reason behaviour is preferred as the basic building block for our suggestions and recommendations concerning attitudes. The aim is to improve attitude by leveraging the role of behaviour and context. We believe that by improving the context we can increase positive experiences so that behaviours and attitudes will improve as a result.

As such, we aim to improve attitudes by taking a systems approach and exploring what organisations can do to improve culture in order to achieve change in attitudes and behaviours. There is no point in training idealised behaviours that bear no relation to the operational reality encountered by the technician on the job. Similarly, there is no point in training a technician to think in a certain way without giving them the skills to transfer this attitude into competent performance in the operational setting

3.2 Competencies

Competence is about having an appropriate understanding of the work, possessing appropriate knowledge, skills and attitudes and being able to demonstrate these through performance in a particular context. This means that in order for a technician to be deemed competent, the context has to be such that the technician can demonstrate their competent performance.

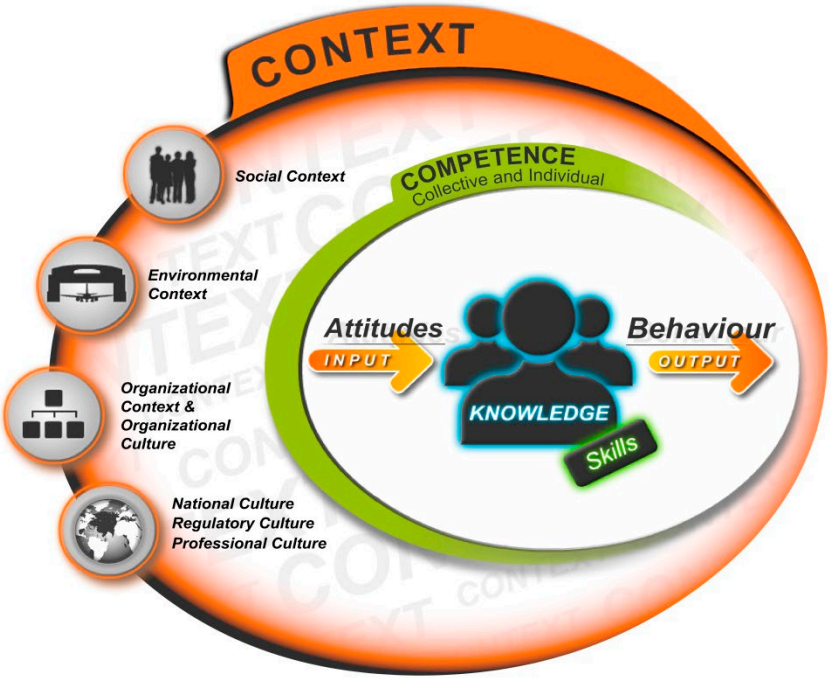

Figure 1: The context competence model

Figure 1 presents the working model of competence. This model is adapted from Liston's (2006) HF competence model and the NLR competence model (Abma & Van Bavelgem, 2006). Behaviour is the observable action (performance) in a certain context. It can be individual or collective and it is the output of skills, knowledge and, more remotely, attitudes. All these factors are then mediated by context. Behaviour is informed by attitudes which are an input to knowledge and skill which a worker uses to perform (produce behaviour).

Up until now the focus of training has been on knowledge, and to a lesser extent skills but it is clear that our focus needs to broaden to include the central role of context in allowing competent behaviour to emerge.

4 Potential areas of improvement

Behaviour does not take place in isolation and when engaging in any behavioural change, the whole of the organisation is implicated and appropriate leadership is key. Therefore a systems approach guides this document. For the purposes of determining areas and levels of interventions, including training, a modified model of Boeings Maintenance Error Decision Aid model (MEDA) was introduced. This model is an industry standard tool for maintenance error and incident investigation in which contributing factors towards error are hierarchically listed. Our modified model (Figure 2 below) contains 5 layers, the individual or collective behaviour of mechanic(s), the social context, the environmental context, organizational context - including organisational culture- and the last layer is the professional culture, national culture and regulatory culture.

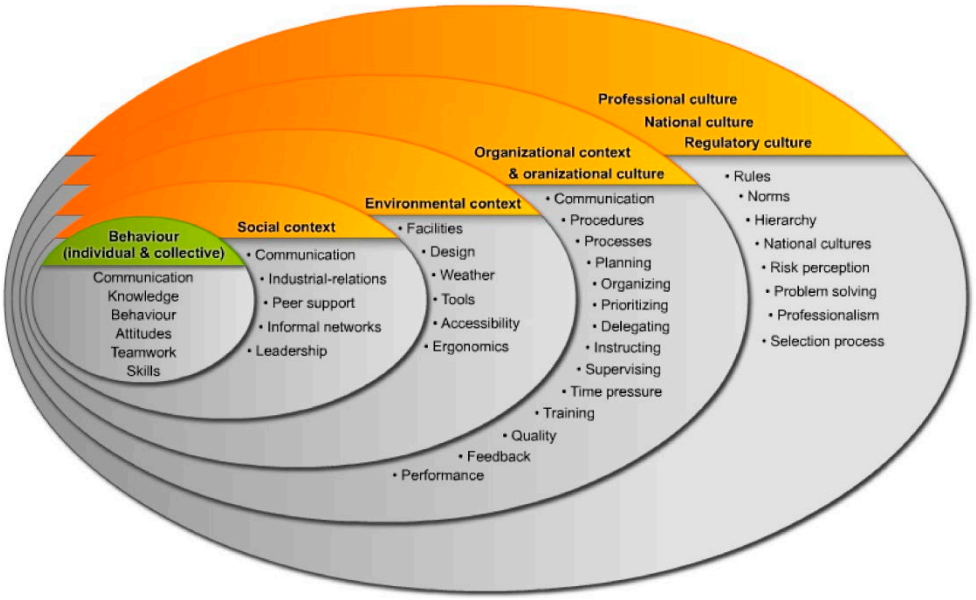

Figure 2: Onion model

In order to ensure that the Aircraft Maintenance Technician (AMT) is able to perform his job correctly we need to make sure that all the layers and their constituent items are actively supporting the task performance. The mechanic is at the sharp end of the operation and should not bear all the responsibility for safe performance because the immediate environment, supervision and the organization share this burden. If something goes wrong the question should not be 'who' is responsible but 'what' is responsible. Similarly engagement should be in looking forward, not in looking backwards, focusing on ensuring that the employee does not become a second victim of the incident (Dekker, 2013).

5 Intervention planning tool

To identify suitable interventions necessary to improve behaviour and attitude related to a certain topic or incident, an Intervention Planning Tool is developed. This tool guides the user through the various steps necessary to tackle the problem from a systems approach and ultimately guides the user towards a sustainable solution. The intervention selection tool comprises of 4 main steps:

- Analysis
- Intervention selection
- Smart objective/ implementation planning, and
- Evaluation

Step 1: Analysis

Find out what the problem is. This can be done by means of a '5 why' analysis as mentioned in the table below.

Table 1: Analysis grid

ANALYSIS		
Problem identification What is the triggering event or data?		
Problem behaviour		
5 Why analysis	**Why**	**Chatch words**
Extra analysis if needed		

Step 2: Intervention Decision Tool

Knowing the problem, the Onion model can help us decide in which areas of the context an intervention is needed. Once the interventions areas are defined, different short terms and long term interventions can be defined or selected.

Table 2: Intervention Decision Tool

Intervention Decision Tool		
Context	Problem	Intervention
Social		
Environmental		
Organizational		
Cultural		
Training		
Desired behaviour	Attitudes:	Training:
	Knowledge:	Training:
	Skills:	Training:

Step 3: SMART objective / implementation

If interventions are defined in the different areas the SMART[1] objective can be developed. This will help you set a common goal in the sense of time and quality for implementation.

Table 3: Smart objective definition

SMART OBJECTIVE* / IMPLEMENTATION

Step 4: Evaluation

After implementation the behaviour should be evaluated.

Table 4: Evaluation grid

EVALUATION	
Follow-up and observe	Short term Long term
On-going observations	

[1] SMART objectives are Specific, Measurable, Achievable, Realistic and Time based.

6 Conclusion

The appeal of off-the-shelf training solutions is obvious (no development costs, no tailoring costs, etc.) and this accounts for their popularity. However, the recommendation of a draft training syllabus for a vaguely-specified training objective will have little impact. Instead a tool proposed to analyse current or future problems to understand the whole system perspective of the problematic (not just the individual AMT's role) is more sustainable. The tool proposed herein demands research effort on the part of the MRO in order to analyse problems, refer the problem to the proper stakeholders, define solutions and follow-up the agreed solutions. In this context the solutions are likely to involve more than just training and the relationship between the MRO and the training organisation in resolving organisation or behavioural problems comes into play. Issues with safety behaviour cannot be solved by sending AMTs to an off-the-shelf skill or HF training course. There is no point in training idealised behaviours that bear no relation to the operational reality encountered by the technician on the job. Similarly, there is no point in training a technician to think in a certain way without giving them the skills to transfer this attitude into competent performance in the operational setting. As such the systems perspective and the intervention selection tool outlined in this paper present an opportunity for the MRO and the training department to collaborate in solving safety behaviour and attitude issues. The role of the training department is to support the MRO in identifying any underlying problems and suggesting solutions and to provide training in accordance with these solutions. The role of the MRO is to acknowledge the ownership of the problem and put the resources and support in place to accommodate solutions – to allow them to be feasibly implemented so that they can leverage impact in the operational context. As such it can be concluded that only customised training tailored to the specific identified issue, together with a commitment from the MRO to resource the training and the behaviours trained in the training will bring about effective change.

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