Promoting a safety culture in maintenance
Safety is of paramount importance in high risk industries, the concept of safety culture is of growing importance in these industries as a means of reducing the potential for large-scale disasters, and accidents associated with routine tasks.
Hayward, (1997: 2) notes that: “Aircraft and other industrial mishaps are now investigated with a view to comprehensively examine the systemic factors which may contribute to the occurrence and the context within which they occur.” Organisational and human factors are recognised as the two important factors in accident causation. This has led to a recent focus on identifying the elements that best represent safety culture.
The aviation maintenance environment
As the demand for global aviation increase, the air traffic grows and this effectively places a demand on aircraft utilisation, resulting in increased time pressures on maintenance engineers for on-time performance. Consequently the quality of maintenance output suffers, creating a gap in the safety system and an opportunity for human error (CAP 718, 2002: 1).
Definition of maintenance

“collection of complex activities requiring above average coordination, communication and cooperation between inspectors, maintenance personnel, supervisors and other ground support personnel.”
The CAP 718, 2002 document further highlights that, due to the increased global demand for commercial flights and constant financial pressures airlines are under, fleet replacement are very rare. This results in maintenance engineers having to maintain aircraft that are increasing in age. The maintenance engineer is now burdened with an older aircraft that require more intensive inspection due to airframe fatigue and other contributing deterioration aspects creating a stressful work environment. More concerning is that aircraft deterioration is a subtle process that may go undetected in the inspection process.
The fleet diversity, as well as the maintenance of older and newer fleet requires maintenance engineers that are highly skilled with a suitable educational background. Airlines thus have to ensure that their training is of a high standard. The local maintenance environment must also be considered. Lack of space, inadequate safety conditions or inefficient shift change procedures are major contributors to the non-completion of tasks. Task completion may run up against cross-organisational conflict including incompatibility of other procedures and terminology.
The aircraft maintenance engineer

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Today, aircraft maintenance engineers must be highly knowledgeable in terms of aircraft mechanical systems, avionics and aircraft structural components, be able to maintain a diverse selection of aircraft, perform complex tasks and interpret results of tests performed, and evaluate and maintain sensitive and automated systems. One misinterpretation could be fatal, not to the engineer but to passengers and flight crew. Trends in aircraft development are an indication of the skills required by aircraft technicians.
To promote a safety culture in maintenance we have to focus on two very important categories.

Organisational and Human factors
Organizational
Reporting methods and structures
SMS
ASQS
Human factors
In a high-technology industry like aviation the focus of problem solving is often on technology. However, the accident record repeatedly demonstrates that at least three out of four accidents involve performance errors made by apparently healthy and appropriately qualified individuals. In the rush to embrace new technologies, the fallible mortals who must interface with and use this equipment are often overlooked. The human element is the most flexible and adaptable part of the aviation system, but it is also the most vulnerable to influences that can adversely affect its performance.
The cost of maintenance error
It has been said that an airline is only as good as its safety record. If its safety record is in jeopardy, the airline will have little chance of surviving. The role of humans is the key to the safety management system. The ICAO 2003 document suggests that airlines have a choice of three approaches to human-factor interventions:
1. “Do nothing” approach: No initiatives are taken to counteract human-factor issues as problems are only addressed when they arise.

2. “Reactive” approach: Consideration of human-factor issues is left to very late in the development process.

3. “Proactive” approach: Human-factor issues are fixed before they become problems.
The nature of human error in maintenance occurrences

Recent studies have shown that human error in maintenance is on the increase; however, this phenomenon has been somewhat overlooked. In one of the first examinations of the problem, the UK Civil Aviation Authority produced a list of the most frequent maintenance errors in aircraft over 5,700 kg.
The top eight problems were as follows:
1. Incorrect installation of components
2. The fitting of wrong parts
3. Electrical wiring discrepancies (including cross-connections)
4. Loose objects (e.g. tools) left in the aircraft
5. Inadequate lubrication
6. Cowlings, access panels and fairings not secured
7. Fuel/oil caps and refuel panels not secured
8. Landing gear ground lock pins not removed before departure” (ATSB, 2001).
Even if not entirely preventable, human errors are controllable through the implementation of enhanced technology, suitable regulations and procedures and appropriate training courses.

Methods used to minimise human error is generally targeted at line managers or supervisors.
Line managers or Supervisors. Proper training to identify human factors. Organisational support to correct such factors.
The performance of technical staff including; pilots, air traffic controllers and maintenance persons is susceptible to factors influencing the workplace, including; regulatory, sociocultural, environmental and organisational factors (ICAO 2005:3-19).
Three strategies for managing human error
The first strategy is **error reduction**, which seeks to directly intervene at the source of the error by reducing or eliminating any adverse conditions that would increase the risk of error. Examples of error reduction include the improved maintenance facilities and ease of access or tools required to perform tasks.
The second strategy of error capture is an anticipating strategy which assumes the error has already been made. Error capture is distinguished from error reduction in that capture does not serve to directly eliminate the error from initial occurring, but rather to mitigate its effects. Examples of error capture strategies include cross checking to verify correct task completion and test flights include improving access to aircraft components for maintenance.
The third strategy of **error tolerance** refers to the ability of a system to accept an error without resulting in serious consequence. Examples of this include the incorporation of redundancy systems, for example aircrafts have multiple electrical systems or in the case of maintenance multiple structural inspection to detect weaknesses in the fuselage.
The concept of culture
Aviation safety goes beyond geographic boundaries or culture. The aviation industry has managed to standardise the industry according to aircraft types, nationalities and countries. However, identifying that people react differently to similar situations is not difficult. Interaction within the industry is affected by cultural differences and differences in backgrounds. Culture affects how individuals deal with various situations. Companies are affected by cultural influences at all levels of the organisation. According to ICAO (2005: 3 – 14), the subsequent levels of culture (national culture, professional culture and organisational culture) are applicable to accident prevention programmes:

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National culture differentiates the general characteristics and values of a certain nation as a whole. As an example one can look at the way different nationalities respond to authority, how people deal with uncertainty and how individual express themselves. Not all cultures focus on the collective welfare of the group, team or organisation. Inequality in terms of status and a high level of respect given to leaders is an accepted norm in collectivist cultures. These factors may however inhibit individual’s willingness to question decisions made by superiors. This is an important factor influencing Maintenance Resource Management (MRM) as the mixing of national cultures could affect output and team performance due to misunderstanding.
Developing a safety culture
An effective tool for improving a safety culture is to develop and maintain a positive safety culture. The challenge is how to develop a culture that is favourable to good safety performance.
Changing attitudes and behaviours:
Safe behaviours can be enhanced by capitalising on activities such as short talks, hazard signs and training. However, if things are communicated in the way that the work is easier, and the task can be finished earlier and thus rewarded with monetary incentive, employees will cut corners, may not observe safety rules, neglect to wear personal protective equipment, and ultimately not work safely.
Management commitment: Management plays a key role in promoting a positive safety culture. Management’s commitment can be demonstrated by efficient resource allocation, time management, walk-the-talk, inspections and by encouraging employees to contribute to committee meetings.
Employee involvement:
For a positive safety culture, employees’ involvement, ownership and commitment is necessary; in particular, empowerment creates a sense of self-worth, belonging and value. Employees should be involved in training, consulted about noise, machinery isolation, sound barriers, job rotation and wearing or purchasing of safety equipment.
**Promotional strategies:**
Promotional strategies to be used should include the following:

1. Posters of the mission statement and safety slogans so that all employees have access to read them.
2. Publishing safety statistics the airline’s safety statistics and safety promotional items on a safety notice board.
Training and seminars:
Training activities should include short talks, group meetings, training for personal fitness, hygiene, workplace stress and responsibilities towards safety (including compliance with rules and regulations, hazard identification and risk assessment, incident investigation and job safety analysis).
Promoting management commitment and employee participation in safety can enhance the organisation’s safety culture.
When employees become more aware of their responsibilities for incident and injury prevention, they will exhibit more interest in maintaining a safe and healthy work site.
1. Management commitment to safety
2. Management concern for the workforce
3. Mutual trust and credibility between management and the employees
4. Line managers and supervisors advance human factor training
5. Workforce empowerment
6. Continuous monitoring, corrective action, review of systems and continuous improvement to reflect the safety at the work site.
The goal is to add value and safety to all maintenance while reducing the stress factor.

Thank you.