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Implementation of Swiss Cheese for UniKL MIAT hangar

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Abstract. The aim of this review paper is to ensure the safety of aircraft maintenance personnel and students in hangar during ground handling by proposing the appropriate safety measures. The aviation organizations had put many efforts for the development and improvement of safety performance within these years to have a safety culture. The aircraft maintenance technicians need to have detailed knowledge of safety and risks that happen in hangar. This paper presents Swiss Cheese method that is proposed to be implemented at UniKL-MIAT hangar to improve the safety conditions.

1. Introduction

The impression that 'accidents are unavoidable' is strongly related to the aviation works that are high-tech and risky [1]. The connection between organisation's safety management processes and accident had been motivated due to the accident investigation reports from 1980 to 1990 [2-4]. The ways that can affect the conduct and dependability of safety systems are organisational practices where safety is managed in the aviation organizations, leading to either 'good' or 'lax' safety culture [5]. The care and concern of shared attitudes throughout the organization, and the commitment of observations by senior organization to safety contribute to the safety culture [6-7]. Safety has been defined as 'a state in which hazards and conditions leading to physical, psychological or material harm are controlled to preserve the health and well-being of individuals and the community' [8-9]. This is to avoid from any intentional or unintentional injuries, which should converge towards perception of protection from any danger.

The objective of this study is to ensure safety of the maintenance personnel and also students during the ground handling in the hangar, particularly the identification on how to reduce human error in the hangar during aircraft servicing and maintenance works. This is also conducted to increase the students' knowledge on the importance of safety by following the rules and also regulation while working in the aircraft hangar. The study is conducted through survey questionnaire that has been distributed to three categories of respondents: students, technicians and lecturers in University Kuala Lumpur-Malaysian Institute of Aviation Technology (UniKL-MIAT). The analysis of the responses from the questionnaire is taken into account to the recommendation made in this project.

2. Literature review

Although the aviation field is highly regulated and is the safest means of transportation, there are still accidents constantly happened and this can be disturbing and worrisome to several groups at any time. The supervision and cooperation of aviation regulators, air operators and service providers is necessary for the continued processing of a safe air transportation system within the complex and dynamic aviation environment [10]. Literature review done in this study provides some basic guidance in understanding the human error in hangar, including the impression of high hazard and concepts for high dependability, and the demonstration of the vitality of security in hangar. Issues of the human factors which influence the individual, working environment and tasks performed are also incorporated in this section [11].

The collaboration between people and machines understanding started as a system of ergonomic employment outline in the heavy industry. The three important segments for a security culture that have been examined are awareness, commitment and competence. This sense of duty regarding security must originate from top administration and work through the whole association [12, 13]. This notion has been repeated through with many risk management programs, which likewise require significant assistance from the masses. In security societies, it is required that the skills of people to be legitimately prepared and their tasks are proficiently performed. Lastly, the community within the system or process should be aware of the safety recommendations for any action and its subsequent effects to ensure the practice of the safety culture [14]. It has been asserted that 'awareness is the most crucial contributor to safe practice' [15]. This awareness is important in aircraft working environment because risk management depends on risk awareness to recognize things that are required to be handled. Practicing risk awareness in aircraft maintenance can lead to safety practices. Furthermore, the compliance to the requirements of the industry and federal regulation will facilitate the improvement in the practices of maintenance safety programs [13]. Development of maintenance CRM-type courses might help the understanding on the importance for the maintenance tasks to be carried out with minimum errors for the operational team [16].

2.1. Annex 19

Annex 19 contains the standard and recommended practices (SARPs) related to primary responsibilities and processes in relation to the safety management by the States. It was first accepted by the Council on 25 February 2013 in pursuant to the requirements of Article 37 of the Convention on International Civil Aviation (Chicago 1944) and designated as Annex 19 to the Convention [17]. The objective of proposing the SARPs in Annex 19 is to support the States in controlling the risks of aviation safety. Annex 19 still helps sustained development of a proactive strategy in improvising safety performance due to the high involvement of the global air transportation system to ensure safe operation in aviation activities. The basis of this proactive safety strategy is founded on the implementation of a State Safety Program (SSP) that addresses risks of safety systematically 18, 19].

SSP implementation will take time to be entirely completed and this could be affected by local and global air transportation system involvement and the realization of aviation safety oversight capabilities of the States [20]. The sources not only come from the current annexes regarding SSP and Safety Management Systems (SMS), but the Annex 19 is also a combination of safety usage of data elements and State safety oversight events. The advantages of combining these sources into a single annex in concentrating on the importance of consolidating the safety management activities and speed up the development of safety management provisions [21].

2.1.1. Safety Management System (SMS)

Certain state safety management roles required in Annex 19 might be represented to a regional safety oversight organization or a regional accident and incident investigation organization on behalf of the State [22]. Safety Management Systems as defined by ICAO is a method designed to manage and also conduct safety, including the structuring of organization, accountabilities, procedures and policies. This identifies the measurement of accepted level besides minimizing the risk in task, explaining the process that is applied to maintain safety [23]. A safety management system is a professional way to deal with security where an efficient, unequivocal and thorough process for overseeing dangers is implemented. Likewise, with all management system, a safety management system accommodates objective setting, arranging and estimating execution. By implementing the safety management system into the working structure of the association or organization, it will lead to a habitual safety practices by individuals while carrying out their tasks [24]. The adequacy of a safety management system relies upon the level of the engagement in the structure and practices of the association or organization on how the job or task has been carried out with the aim that a good safety and security culture is developed and monitored continuously [25]. Furthermore, SMS is an incorporated security framework by the top administration to account for all task safety techniques and dealing with a safe environment in a specific standard for the entire association to embrace in everyday activity [26].

Aircraft maintenance technicians give parts of their career to ground servicing and operating aircraft in hangar. They are also required to master the operation of the ground support equipment. Moreover, the maintenance technicians must have an exhaustive information of safety procedures used in aircraft servicing for the involvement of support equipment and the possible dangers present in aircraft hangar [27, 28]. Aircraft maintenance personnel should learn the importance of human factors to let them know how it influences the maintenance tasks done in hangar. Several areas could be considered such as Dirty Dozen even though many issues included when dealing with human performance [29]. Maintenance technicians must be made aware of how human factors can influence their working performance and the importance of safety in carrying tasks while doing maintenance practices in hangar [30].

3. Swiss Cheese method for UniKL MIAT hangar

Defences, barriers and safeguards occupy a key position in the system approach. The high technology systems have many defensive layers: some are engineered to rely on people while some others depend on procedures and administrative controls. The main target is to protect potential victims and assets from local hazards, which normally carried out very effectively but there are always will be weaknesses [31]. In an ideal world, each defensive layer would be intact. However, they are more like the slices of the Swiss cheese, having many holes—though unlike the cheese, these holes are continually opening, shutting and shifting their location. The presence of holes in any one "slice" does not normally cause a bad outcome. Usually, this happens only when the holes in many layers momentarily line up to permit a trajectory of accident opportunity—bringing hazards into damaging contact with victims, as shown in Figure 1.

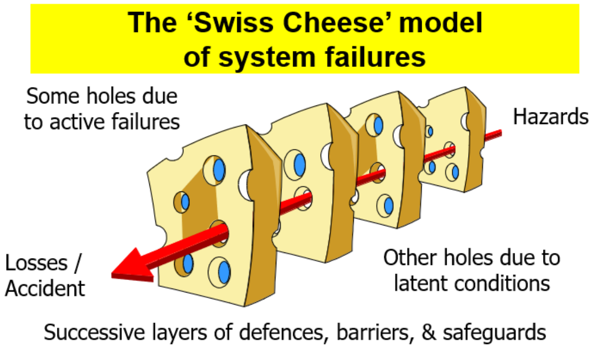

Figure 1. The Swiss Cheese model

Active failures and latent conditions are the reasons for the creation of the holes in the defences. A combination of these two sets of factors is normally involved in all adverse events. Active failures are the unsafe acts committed by people who are in direct contact with the patient or system, which could be in various forms such as slips, lapses, fumbles, mistakes and procedural violations. This kind of failures have a direct and typically short-lived impact on the integrity of the defences. For example, the technicians wrongly violated the maintenance procedures and skipped off few safety procedures, which immediately sparks high voltage of energy towards him that could lead to death. Followers of the person approach usually look no further for the causes of such adverse event once they have identified these proximal unsafe acts. Anyhow, as explained above, it could be seen that the causal history from such kind of acts can be clearly observed from slices of time to time of events. Meanwhile, latent conditions are the inevitable "resident pathogens" within the system. These could come from decisions of design engineers, technical service engineers, procedure writers and top-level management. Such decisions may be mistaken but they need not be. This mistaken decisions will eventually and potentially injecting pathogens into the system. Two kinds of adverse effect from latent conditions that will arise are: they can translate into error provoking conditions within the local workplace and they can create long-lasting holes or weaknesses in the defences. The pathogens may lie dormant within the system for many years before they combine with active failures and local triggers to create an accident opportunity. Latent conditions could be looked up, identified and solved before an adverse event occurs, unlike the active failures, which specific forms are normally hard to foresee. Understanding this leads to proactive rather than reactive risk management.

After some extremely discussion, the previous study from various researches have been reviewed and finalized according to the objectives. It is found that aviation industry is highly regulated industry with the safest means of transportation, but it is also at constant risk of major accidents that could happen anytime. Therefore, to achieve the safety of aircraft maintenance and students in hangar during ground handling and aviation personnel and to identify how to reduce human error in hangar during servicing of an aircraft, it is recommended from this study that the Swiss Cheese is the best choice for the implementation for UniKL MIAT hangar. A further detailed study on its implementation and also effectiveness is suggested for future work after this initial explorative study.

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