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Technicians' Attitudes to Report Unsafe Practices in Aircraft Maintenance

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ABSTRACT

In the civil aviation sector, improper aircraft maintenance is a major contributing factor to significant aviation accidents and incidents. Numerous tasks still heavily depend on human hands-on intervention and are frequently prone to human error. A previous study found that several technicians are reluctant to report an unsafe practice that may violate the current safety guidelines imposed by aircraft maintenance organizations. This study systematically examines factors that influence the willingness of an aircraft maintenance technician (AMT) to report unsafe maintenance practices. Sixty-two AMTs actively practicing aircraft maintenance were interviewed to identify the main factors influencing their desire to report unsafe practices. The study revealed that many respondents chose not to report the violation despite their awareness of unsafe practices. The main factor is the workplace culture, in which the work culture and management style conspire to prevent employees from speaking up for fear of being reprimanded. Peer pressure inside the team is another factor cited in the report. Other common reasons include damage to relationships and retaliation. Many respondents did not personally experience retaliation in the workplace, but this fear of retribution dominates their working attitude. The findings of this study support the view in the literature that maintenance organizations should promote an employee-centric environment in which technicians can report unsafe practices. As part of promoting a safety-conscious work culture, workers should be encouraged to speak up regarding any unsafe maintenance practices, especially those that could lead to near misses or adverse incidents. Further research is necessary to determine cultural factors that affect the technicians' safety report commitment.

Keywords: Aircraft maintenance, Safety reporting, Unsafe practices, Human error, Safety culture

INTRODUCTION

Aviation is a safety-conscious industry by definition, not because of its high incident rate but because of the severity of the consequences. Considering aircraft maintenance, overhaul, and repair (MRO), putting safety first is crucial, and MRO organizations should prioritize safety. Safety culture is defined in aviation safety management systems (SMSs) as the attitudes, beliefs, behaviors, and values of employees regarding aviation safety and airworthiness (ICAO Annex 19 - Safety Management 2nd Edition, July 2016). In most local civil aviation authorities, such as in Hong Kong, MRO service providers

authorized by the Hong Kong Civil Aviation Department are obligated to adhere to the specifications laid out in document CAD 712 for the implementation of Safety Management Systems (SMS) (CAD 712 - Safety Management Systems (SMS) Issue 2, May 2016). Despite the mandatory adoption of SMS by all MROs and their legal obligation to report unsafe acts and near misses, these entities still record a lower number of near misses when compared to industry benchmarks (EASA Annual Safety Review 2023). Routine violations, skill-based errors, and mistakes are examples of unsafe behavior by aircraft maintenance technicians (AMTs) (Hobbs & Williamson, 2002a, 2002b). The commonly seen unsafe practices in aircraft maintenance include the following: a) failure to consult maintenance manuals or other approved technical documents, especially on familiar maintenance tasks; b) using unapproved tools to install or remove aircraft components; c) ignoring the checklist when starting up engines; d) pulling a circuit breaker without tagging it (Latorella & Prabhu, 2017; Hobbs & Williamson, 2003). SMSs can increase MRO safety consciousness, but a poor just culture[1] within the MRO can impede reporting and commitment to safety, and poor reporting cultures can restrict safety data collection, thereby impeding safety reporting (Gerede, 2015a).

Hence, previous research indicates that AMTs generally underreport unsafe acts, mainly due to group cohesion and collective culture (Aktas & Kagnicioglu, 2023). The contradictory relationship between safety culture and production conditions also influenced the safety reporting behavior of employees (Atak & Kingma, 2011). Manarvi and Raza (2018) indicated that most human errors committed during maintenance were attributable to poor work ethics rather than improper maintenance procedures. However, silent behaviors of employees can jeopardize aviation safety and result in irreversible accidents (Under & Gerede, 2021). This study aimed to conduct a systematic examination of the factors influencing the willingness of an AMT to report unsafe maintenance practices to provide practitioners and researchers with useful information on safety reporting culture improvement in aircraft maintenance, including training, procedures, and policies.

METHODS

This qualitative study examines factors influencing the willingness of an AMT to report unsafe maintenance practices. Qualitative research is preferred because it seeks to comprehensively explore the personal attitudes and responses, as well as awareness of any unsafe practices during aircraft maintenance, from a subjective perspective. As shown in Table 1, a questionnaire with 22 questions was constructed and derived from the literature and expert comments. The survey period is from 10 April to 26 June 2023.

The scope of this study is limited to currently active AMTs in civil aviation authority-approved aircraft maintenance working in repair and overhaul (MRO) organizations. Purposive sampling was used to select survey participants in MROs who had at least five years of experience in base and line

[1] *Just Culture* in Aviation Industry is a system that promotes continuous learning from previous mistakes and encourages staff to openly and freely share essential safety-related information.

maintenance. This survey has the approval of the MROs, and a letter of introduction regarding this survey and anonymity questionnaires were emailed to the respective AMTs who agreed to participate in this survey on 10 April 2023. The survey can be completed at work or at home, and the results were collected on 26 June 2023. Overall, 100 questionnaires were distributed across the two foremost MRO service providers in Asia-Pacific. For confidentiality reasons, the MROs have been de-identified and are referred to as MRO Company A and MRO Company B throughout this paper.

Table 1. Survey questionnaire for technicians' attitudes to report unsafe practices in aircraft maintenance.

Survey Questionnaire for Technicians' Attitudes to Reporting Unsafe Practices in Aircraft Maintenance
(Rev. Date: 10 April 2023)

i. This survey examines factors influencing an aircraft maintenance technician's willingness to report unsafe maintenance practices in aircraft maintenance, repair, and overhaul (MRO).
ii. Please submit it on or before 26 June 2023 using the same email address you received. If you have any questions, please feel free to email me at tzefung.lam@polyu.edu.hk.

Survey questions (Please circle your answer)

1. Are you working as an aircraft maintenance technician in BM or LM?
   a. Yes
   b. No*
2. Do you have equal to or more than five years of working experience in aircraft maintenance?
   a. Yes
   b. No*
3. In your current position, have you ever worked or been involved in acute aircraft maintenance tasks such as inspection, servicing, troubleshooting, repair, components removal and installation, etc.?
   a. Yes
   b. No*

** This survey is terminated if the answer to either Question 1, Question 2 or Question 3 is 'No'.*

4. Have you ever reported an unsafe practice in aircraft maintenance to people you felt may help correct the situation?
   a. Yes
   b. No
5. Who would you like to report unsafe maintenance practices to?
   a. Aircraft maintenance supervisor
   b. Aircraft maintenance engineer
   c. Maintenance controller
   d. Quality manager
   e. Other (Please specify) _____
6. Have you ever been conscious of unsafe practices in aircraft maintenance that you did not report?
   a. Yes
   b. No

(Continued)

Table 1. Continued.

7. What is the most important reason for not reporting unsafe practices in aircraft maintenance?
   a. I had no time to report.
   b. It was not my business.
   c. I did not know how to report.
   d. I did not expect anything to come out of that report.
   e. I was concerned about experiencing retaliation after reporting.
   f. Other reasons (please specify) _____
8. Have you ever reported the unsafe practices of an aircraft maintenance technician to a supervisor?
   a. Yes
   b. No*

** If the answer to Question 8 is "No," please jump to Question 10.*

9. If you have reported the unsafe actions of an aircraft maintenance technician, have you experienced retaliation?
   a. Yes
   b. No
10. Have you ever reported the unsafe practices of an aircraft maintenance supervisor to an engineer?
   a. Yes
   b. No*

** If the answer to Question 10 is "No," please jump to Question 12.*

11. If you have reported the unsafe actions of an aircraft maintenance supervisor, have you experienced retaliation?
   a. Yes
   b. No
12. Have you ever reported the unsafe practices of an aircraft maintenance engineer to the maintenance controller?
   a. Yes
   b. No*

** If the answer to Question 12 is 'No', please jump to Question 14.*

13. If you have reported the unsafe actions of an aircraft maintenance engineer, have you experienced retaliation?
   a. Yes
   b. No
14. Are you familiar with the procedure for reporting unsafe maintenance practices via the online reporting webpage and safety reporting app within your MRO Safety reporting system?
   a. Yes
   b. No
15. Do you think the safety reporting system in your MRO is easy to report?
   a. Yes
   b. No
16. Have you ever reported any unsafe practices in aircraft maintenance via the online reporting webpage and safety reporting app within your MRO Safety reporting system?
   a. Yes
   b. No*

(Continued)

Table 1. Continued.

** If the answer to Question 16 is 'No', please jump to Question 18.*

17. If you reported unsafe actions in aircraft maintenance via MRO's Safety reporting system, have you experienced retaliation?
    a. Yes
    b. No
18. Do you know of an aircraft maintenance technician who has experienced retaliation in the workplace after reporting the unsafe acts of the aircraft maintenance supervisor?
    a. Yes
    b. No
19. Do you know of an aircraft maintenance technician who has experienced retaliation in the workplace after reporting the unsafe acts of the aircraft maintenance engineer?
    a. Yes
    b. No
20. Do you know of an aircraft maintenance technician who has experienced retaliation in the workplace after reporting the unsafe acts of the maintenance controller?
    a. Yes
    b. No
21. If you report unsafe practices in aircraft maintenance, do you feel the top management will take any proactive monitoring action and promote a safety-conscious culture?
    a. Yes
    b. No
22. Do you think your MRO Safety reporting system handles all safety reports confidently according to elaborate procedures to protect the reported staff's identity and the content of the occurrence?
    a. Yes
    b. No

DEMOGRAPHICS

A total of 62 responses were received from AMTs for this study. No AMT answered all the questions; thus, response rate percentages were calculated based on the number of responses to each question. All AMTs in this survey were Chinese. They were full-time workers for Asia-Pacific Aircraft MROs. A total of 90% of the participants were male (n = 56), and their ages ranged from 30 to 55 years old. The majority of participants were between the ages of 35 and 40 (n = 48), with an average age of 37. Years of experience among technicians ranged from <5 to 30 years, with an average of 18 years, with those aged 35 to 40 making up the largest portion of the participant group (n = 32). A total of 58% of participants (n = 36) worked in line maintenance for aircraft maintenance tasks performed at the apron for aircraft transits, while 42% (n = 26) worked in base maintenance for aircraft heavy checks, modifications, and overhauls.

RESULTS

Seventy completed questionnaires were collected; eight were excluded because the participants were not currently active AMTs (Question 1) or had less than five years of work experience (Question 2). A sample size of 62 was

deemed suitable for inclusion in this study. Table 2 outlines the total number surveyed from different maintenance categories across the two MROs.

Table 2. Number of respondents to the survey by maintenance category and company.

Category of aircraft maintenance	Number of Respondents	MRO Company A	MRO Company B
Aircraft maintenance technicians form base maintenance	26	15	11
Aircraft maintenance technicians form line maintenance	36	22	14
Total number of respondents	62	37	25

Table 3 shows the response rate for each survey question. A total of 19 (30.6% of participants) reported unsafe maintenance practices to those they believed could address the issue (Question 4), while the majority (43, 69.4%) stated that they had not reported unsafe maintenance practices. When asked if they have reported an unsafe practice, 12 out of 19 referred to reporting it to the quality manager (Question 5).

Only eight (13%) participants have reported or have been involved in reporting unsafe supervisory practices to an engineer (Question 10). Moreover, when asked if they had ever reported the unsafe practices of a technician to a supervisor, 13 (21%) responded yes, while 49 (79%) responded no (Question 8). By contrast, 48 participants (77.4%) understood the procedure for reporting safety occurrences in MRO Company A and MRO Company B (Question 14), and 36 thought the reporting system was easy to report (Question 15). However, only 20 participants (32.3%) reported unsafe practices in aircraft maintenance via the online reporting webpage and safety reporting App within the MRO Company A and MRO Company B safety reporting system (Question 16).

Table 3. Response count and response percentage (%) for the survey questionnaire.

Survey questions	Response count	Response percentage (%)
4. Have you ever reported an unsafe practice in aircraft maintenance to people you felt may help correct the situation?	62	100
5. Who would you like to report unsafe maintenance practices to?	62	100
6. Have you ever been conscious of unsafe practices in aircraft maintenance that you did not report?	62	100
7. What is the most important reason for not reporting unsafe practices in aircraft maintenance?	38	61.3
8. Have you ever reported the unsafe practices of an aircraft maintenance technician to a supervisor?	62	100
9. If you have reported the unsafe actions of an aircraft maintenance technician, have you experienced retaliation?	13	21

(continued)

Table 3. Continued.

Survey questions	Response count	Response percentage (%)
10. Have you ever reported the unsafe practices of an aircraft maintenance supervisor to an engineer?	48	77.4
11. If you have reported the unsafe actions of an aircraft maintenance supervisor, have you experienced retaliation?	7	11.3
12. Have you ever reported the unsafe practices of an aircraft maintenance engineer to the maintenance controller?	33	53.2
13. If you have reported the unsafe actions of an aircraft maintenance engineer, have you experienced retaliation?	5	8.1
14. Are you familiar with the procedure for reporting unsafe maintenance practices via the online reporting webpage and safety reporting app within your MRO Safety reporting system?	54	87.1
15. Do you think the safety reporting system in your MRO is easy to report?	54	87.1
16. Have you ever reported any unsafe practices in aircraft maintenance via the online reporting webpage and safety reporting app within your MRO Safety reporting system?	53	85.5
17. If you reported unsafe actions in aircraft maintenance via MRO's Safety reporting system, have you experienced retaliation?	38	61.3
18. Do you know of an aircraft maintenance technician who has experienced retaliation in the workplace after reporting the unsafe acts of the aircraft maintenance supervisor?	58	93.5
19. Do you know of an aircraft maintenance technician who has experienced retaliation in the workplace after reporting the unsafe acts of the aircraft maintenance engineer?	54	87.1
20. Do you know of an aircraft maintenance technician who has experienced retaliation in the workplace after reporting the unsafe acts of the maintenance controller?	43	69.4
21. If you report unsafe practices in aircraft maintenance, do you feel the top management will take any proactive monitoring action and promote a safety culture?	58	93.5
22. Do you think your MRO Safety reporting system handles all safety reports confidently according to elaborate procedures to protect the reported staff's identity and the content of the occurrence?	54	87.1

When asked if they had reported unsafe aircraft maintenance practices while aware of them, 38 (61.3%) affirmed awareness of an unsafe practice situation but failed to report it (Question 6). Table 4 shows the response rate when asked to choose the primary reason for not reporting unsafe practices in aircraft maintenance (Question 7). Interestingly, the majority of participants (20 out of 38, 52.6%) expressed their concern about experiencing retaliation after reporting.

Table 4. Number of respondents to the survey question 7.

Survey question 7	Response count	Response percentage (%)
7. What is the most important reason for not reporting unsafe practices in aircraft maintenance?	38	61.3
Survey answers for Ques 7	**Response Count**	**Response percentage (%) based on the total number of Ques 7 survey respondents.**
a. I had no time to report.	2	5.3
b. It was not my business.	5	13.2
c. I did not know how to report.	2	5.3
d. I did not expect anything to come out of that report.	8	21
e. I was concerned about experiencing retaliation after reporting.	20	52.6
f. Other reasons.	1	2.6

When asked if participants were retaliated against for reporting unsafe maintenance practices of AMT, 8 participants out of 13 responded no (Question 9), nor did 25 respondents (40.3%) report awareness of an AMT who had been retaliated against after reporting the unsafe practices of another technician to their supervisor (Question 18). Three participants faced reprisals after reporting the unsafe practices of a supervisor to the aircraft maintenance engineer (Question 11). A total of 18 participants (29%) knew of a technician who had been retaliated against after reporting the unsafe practice to an aircraft maintenance engineer (Question 19). Similarly, three participants experienced retaliation after reporting the unsafe practices of the engineer (Question 13). A total of 16 participants (25.8%) knew of a technician who had been retaliated against after reporting unsafe practices to the maintenance controller (Question 20). However, none of the 38 participants (61.3%) experienced retaliation after reporting unsafe practices using the company's safety reporting system (Question 17). Responses relating to retaliation indicate that, compared with face-to-face reporting, retaliation was not prevalent when reporting situations through the company's safety reporting system. A total of 43 participants (69.3%) believed that the company's safety reporting system protects their confidentiality such that technicians might not be reported for fear of blame or reprisals against the reporter (Question 22).

In addition, when asked if participants felt that the high management of MROs would take actions in company policies and procedures for safety culture and awareness among aircraft maintenance personnel, 36 (58.1%) responded no. By contrast, 22 (35.5%) responded yes (Question 21).

DISCUSSION

The study revealed that personal behaviors have an impact on reporting unsafe practices or near-miss events during aircraft maintenance tasks. Consistency in safety reporting, which is dependent on the reporting staff's position in the MRO, is lacking; for example, a technician versus a supervisor, a technician versus an engineer. This inconsistency leads to the selective decision of staff on whom to report to minimize the reporting culture within the MRO. All the respondents are Chinese. Thus, good personal relationships with colleagues, a strong emphasis on hierarchy, and respect for authority can significantly impact workplace dynamics in Asian culture. Work culture and management style conspire against employees speaking up for fear of being reprimanded. These behaviors are also evident in this survey, namely the willingness of technicians to report unsafe practices (24, 38.7%).

Lack of understanding of the company's safety reporting system, complicated procedures, and technological barriers were not considered factors for non-reporting. AMTs understood how to report (48, 77.4%) and had no difficulties reporting unsafe practices using the system (36, 58%). Approximately 53% of technicians answered that fear of retaliation was the most important reason for not reporting. However, only 11 out of 62 said participants reported experiencing retaliation after reporting unsafe practices by staff at any level. The majority of ATMs in this survey reported no retaliation but knew of others in 59 cases who were retaliated against for reporting among peers, supervisors, and engineers within their MROs. Fear of retaliation and peer pressure against speaking out within the aircraft maintenance team are typical working attitudes of MRO technicians in Asia. This fear of retaliation dominates their attitude toward adverse events or near misses during aircraft maintenance practices. The results of this study support the previous research. Employees did not engage in voluntary reporting due to factors such as "non-engagement", "silence and acquiescence", and "fear and defensiveness" (Under & Gerede, 2021). Gerede (2015b) also indicated that the fear of punishment inhibits reporting. Failure to report is mainly due to the notion that reporting provides no benefits and a lack of mutual trust between staff and management.

The implications of this study support the literature, which states that maintenance organizations should enforce policies through an employee-centred approach, create a blame-free reporting environment, and avoid retaliation (Aktas & Kagnicioglu, 2023; Under & Gerede, 2021; Batuwangala et al., 2018; Gerede, 2015a; Gerede, 2015b; Atak & Kingma, 2011; McDonald et al., 2000).

This study has limitations in terms of sample size for data analysis. The sample population was obtained only from the targeted professional group of MROs in the Asia region, thus limiting the number of participants. Skewed responses for analysis may occur due to inconsistent answers to all questions by participants.

CONCLUSION

This study presents an overview of the attitudes of technicians toward reporting unsafe practices in aircraft maintenance and their unwillingness to report internally within organizations. The study highlights the importance of incorporating a work environment to encourage reporting and fostering a safety culture in aircraft maintenance, where technicians can express their safety concerns without feeling retaliated against. Speaking out against unsafe practices involves psychological and cultural factors. Thus, further research is needed to determine cultural factors affecting the attitude of technicians toward aviation safety reporting.

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