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A Study on Flight Crew Cabin Threats

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ABSTRACT

항공 사고는 첨단 항공 기술의 발달로 꾸준히 감소해 왔지만, 여전히 발생하고 있다. 조종사는 목적지 공항까지 안전하고 효율적으로 비행하기 위해 위협과 오류를 관리해야 한다. 조종사에게 영향을 미치는 위협은 환경적 위협과 항공사 위협으로 나눌 수 있으며, 환경사위협에는 객실 위협이 포함된다. 조종사와 객실 승무원은 정상적인 운항 중에는 협력이 필요하며, 비상시에는 안전한 비행을 위해 효과적인 협력이 절대적으로 필요하다. 조종사가 비행 중에 간섭이나 작업 흐름의 중단이 발생할 때 에러를 할 가능성이 높아진다. 항공사들은 안전 운항을 방해할 수 있는 객실위협의 종류를 적극적으로 식별하고 분석하여, 조종사들이 안전한 비행을 유지하기 위해서 위협을 관리하도록 절차 및 훈련을 개선해야 한다. 본 연구는 안전관리시스템(SMS)의 안전도구인 LOSA(Line Operation Safety Audit)를 기반으로 기내위협의 유형을 파악하고, 항공사들에게 조종실위협 관리를 체계적으로 개선하는 데 필요한 객실위협과 간섭에 대한 자료를 제공하고자 한다.

Key Words : Cabin Threats(캐빈위협), LOSA(Line Operation Safety Audit, 노선운항안전감사), SMS(Safety Management System, 안전관리시스템), TEM(Threat and Error Management, 위협 및 에러관리)

Ⅰ. INTRODUCTION

Even though the aviation industry has made great efforts towards effective regulation, a strong safety culture, and technological advances, accidents still occur. The yearly fatal aviation accident rate, according to 2021 data, is 0.04 per million flights (Airbus, 2022). Pilots must continually manage threats and errors to avoid unsafe outcomes and stay within flight operation safety margins (Maurino, 2005). While in 1903 approximately 20% of aviation accidents were caused by human error, surprisingly today 80% of accidents are due to human error by pilots, air traffic controllers, mechanics, and cabin crew (Rankin, 2007).

Pilots and cabin crew coordination is essential during normal operations, but absolutely crucial in emergencies. Lack of crew coordination can result in unnecessary risk, and possible injury, to passengers and crew members (FAA, 2000). This study discusses types of cabin threats and introduces Threat and Error Management (TEM). Various types of cabin threats are then analyzed by looking at actual occurrences listed in the Line Operations Safety Audit (LOSA) of Airline X to highlight ways to improve protocol for cabin threat management.

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II. CABIN THREATS

2.1 Understanding TEM

Pilots can anticipate, recognize, and recover from threats and errors by using the TEM countermeasures involved in the Crew Resource Management (CRM) process (Maritt and Klinect, 2006). The International Civil Aviation Organization (ICAO) has recommended implementing LOSA by monitoring CRM and crew performance on threats and errors which occur during normal operations (ICAO, 2002). Service providers should develop and maintain a process to identify hazards through LOSA, capturing safety data in the cockpit to improve personnel performance (ICAO, 2018).

The TEM Model in Fig. 1 indicates that pilots must manage threats, errors, and Undesired Aircraft States (UAS).

Pilots manage threats and errors in order to maintain the appropriate margin of safety in every flight. If threats and errors are mismanaged, pilots may inadvertently induce additional errors or UAS (ICAO, 2002).

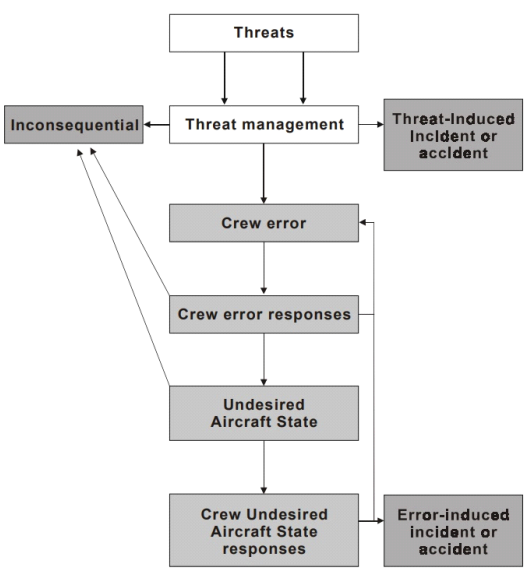

Fig. 1. Threat and error management model (ICAO, 2002)

2.2 Cabin Threats

Threats are defined as events or errors which occur outside the influence of the flight crew and increase the operational complexity of a flight by requiring the flight crew's attention (FAA, 2006). For airlines, threats can be divided into two categories such as environmental threats, which are outside an airline's direct control, and airline threats, which happen during flight operation.

Environmental threats include things such as adverse weather and problems related to the airport, ATC, or environmental pressure. Additionally to cabin threats, airline threats could involve problems related to the aircraft, airline management Pressure, dispatch information, ground conditions, ramps, maintenance, or instructional manuals (Maritt and Klinect, 2006).

The cabin threats could involve cabin events, flight attendant errors, distractions, and interruptions (FAA, 2002). LOSA data is strictly confidential, so detailed information on airlines is protected by the ICAO Doc 9803, and statistics are shown without the Airline's actual name. The LOSA data of Airline X shows the presence of one or more cabin threats on one out of every nine flights. Table 1 shows that cabin threats account for 2% of all threats and 8% of cabin threats were mismanaged.

It is notable that, according to LOSA data, Airline X's cabin threats are the highest among the six leading global carriers. Table 2 shows that the prevalence of flights with cabin threats for the LOSA Archive comparison Group showed

Table 1. The prevalence and mismanagement of cabin threats of airline X

Types	Rates
The prevalence of flights with cabin threats	11%
The percentage of cabin threats among all threats	2%
The percentage of mismanaged of all cabin threats	8%

Table 2. The comparisons of cabin threats with LOSA archive comparison group

Types	Rates
The prevalence of flights with cabin threats	16%
The percentage of mismanaged in all cabin threats	5%

16% which is 31% higher than Airline X however the mismanagement of cabin threats is 37% and lower than Airline X.

Table 3 shows the breakdown of LOSA data about cabin threats for Airline Z in which 47% of cabin threats are due to flight attendants interrupting pilot duties, 28% relate to flight attendants' errors, 11% because of cabin calls below 10,000 feet, 8% are miscellaneous cabin threats, 3% relate to the cabin being not ready when needed and 3% from the omission of cabin calls.

To make effective improvements, it is first necessary to identify and understand specific threats by analyzing LOSA data.

2.3 Interruptions and Distractions

Cockpit interruption or interference by flight attendants may cause the flight deck crew to make an error, so the improvement of regulations or standard protocols is required. Interruption on the flight deck may result from other causes within the aircraft, such as the occupant on the observer seat in the cockpit,

Table 3. The frequency of cabin threats of airline X

Threats	Prevalence of cabin threats
Flight attendant's interruption to pilot duties	47%
The error of flight attendants	28%
The cabin calls below 10,000'	11%
Other cabin threats	8%
The cabin is not ready when needed	3%
Omission of cabin calls	3%

the caution or warning lights, or the activation of the cabin crew call alert. A typical scenario is that the flight deck checklist gets interrupted by an interphone call from the cabin crew and an important action is inadvertently omitted (Skybrary, 2023).

Every member of the crew needs to understand that these kinds of situations can be an interruption or interference that leads to a threat, therefore these potential issues need to be anticipated and managed to reduce possible threats.

2.3.1 Categories of interruptions/distractions

Interruptions and distractions can result in the inadvertent omitting of action or deviation from Standard Operation Procedures (SOP). The Flight Safety Foundation's Approach and Landing Accident Reduction (ALAR) task force found 72% of accidents and serious incidents were related to interruptions and distractions between the years 1984 and 1997. Three categories of interruptions and distractions, as listed in Table 4, are communication, head-down work, and responding to an unexpected abnormal situation (FSF, 2000).

2.3.2 The effect of interruptions/distractions

Distractions such as minor equipment malfunctions can turn a normal routine flight into a challenging flight. The primary effect of inter-

Table 4. Three categories of interruptions/distractions

Categories	Examples
Communication	Receiving final weights while taxiing. Flight attendant entering the cockpit.
Head-down work	Reading the approach chart. Programming the flight management system.
Responding to an unexpected abnormal situation	System malfunction. TCAS (traffic alert and collision avoidance system). TA (Traffic advisory) or RA (resolution advisory).

ruptions and distractions is a disruption to the normal flow of patterns, actions, and communication activities in the cockpit. Table 5 lists the activities which could commonly be interrupted by type: SOP (Standard Operation Procedures), checklists, communications, monitoring tasks, and problem-solving (FSF, 2000).

Interruptions/distractions cause the flight crew to feel rushed and be confronted with complicated tasks. The flight crew must decide which task to perform first when confronted with competing tasks, and interruptions/distractions can result in several types of crew errors, as listed in Table 6 (FSF, 2000).

The main reason why cabin threats must be managed well is that interruptions and distractions cause flight deck crew members to panic and make errors.

Table 5. The primary effect of interruptions and distractions on flight activities

Types	Flight deck activities
SOP	Standard operation procedures
Checklist	Normal checklists
Communications	Listening, processing, responding
Monitoring tasks	Systems monitoring, pilot flying/pilot monitoring cross-checking
Problem-solving	Problem-solving activities

Table 6. The poor results caused by the interruptions and distractions

Types	The examples of poor results
Not monitoring flight path	Altitude deviation, course deviation, CFIT (controlled flight into terrain)
Not hearing or misinterpreting ATC (air traffic communication)	Traffic conflict, runway incursion
Failing detection and correction	Interrupted during a normal checklist
Uncertainties unresolved	ATC instructions or an abnormal condition

2.4 Reducing and Managing Interruptions/Distractions

The first step in mitigating potential errors and accidents due to interruptions and distractions is to understand that steps can be taken to reduce the likelihood of inadvertent cabin threats. Interference from cabin crew or Air Traffic Communication (ATC) can be eliminated if crew actions such as SOPs and initiation of normal checklists are scheduled during periods of typically minimum disruption. The flight crew can also reduce interruptions/distractions by complying with the sterile cockpit rule, compliance during taxi-out and taxi-in requires mindful discipline because the taxi phase can appear to be a relaxing time with a low workload. The sterile cockpit rule needs to be exercised among all crew members including cabin crew except in emergencies or if safety-related issues arise (FAA, 2006).

2.4.1 Managing interruptions/distractions

The first step in managing interruptions/distractions is recognizing them and identifying when they happen. The second step is to re-establish situation awareness by following a process: identify, ask, act. This process involves three questions: What was I doing? Where was I interrupted? What decision or action shall I take to get back on track? Finally, if interrupted or distracted during the checklist task, the crew member should demarcate the area of the checklist immediately when the disruption happens, so they can resume from the point they were at before the disruption occurred. Strategies in the decision-making process can be classified as prioritize (aviate, navigate, communicate, and manage), plan, and verify. The most effective error prevention strategies individuals can all follow include adherence to SOPs, golden rules, sterile cockpit rules, and recovery techniques (FSF, 2000).

It is important to first recognize that an interruption is a cabin threat as it happens, establish awareness of what is being interrupted, and finally decide what action is required by prioritizing correctly.

Ⅲ. DISCUSSION

The data on cabin threats from LOSA showed 11% of flights have cabin threats in daily flight operations. Cabin threats account for 2% of all threats, and 8% of them were mismanaged, which is higher than the LOSA Archive comparison airlines. Threats caused by interruption or interference can cause flight crew to commit errors when performing SOP, normal checklists, communications, monitoring tasks, and problem-solving activities, so managing cabin threats well is essential. These threats can lead to flight crew making errors in monitoring flight path or coordinating with ATC. It is notable that 11% of cabin threats were cabin calls below 10,000 feet, which requires the sterile cockpit rule, and 28% were the error of flight attendants, indicating the need for improvement in procedures and training for safer management.

Cabin threats are one area of aviation safety that has not been considered thoroughly or regulated with systematic protocol. However, through LOSA data, we can quantitatively identify how many errors the flight crew makes and determine what amount is due to mismanagement of cabin threats. Training pilots to identify, recognize and appropriately manage interruptions/distractions should be a high priority. Incorporating this understanding into training programs and methods such as EBT (Evidence Based Training) can provide the core competencies to help crew manage interruptions or distractions more effectively, such as effective communication, teamwork, situation awareness, workload management, application of procedures, and flight path management (ICAO, 2013).

The principle of safety management is to foster the needed adaptability to facilitate the successful performance of normal operations, anticipate threats and events in advance, and effectively respond to inevitable surprises (Hollnagel et al., 2015). The Safety-II is a new perspective that focuses on ensuring as many things as possible go correctly instead of merely focusing on reducing the number of things that could go wrong. The Safety-II concept helps the airline industry actively look for what is being done right during common events and errors while still maintaining awareness of possible mismanagement or failure. Safety-II orientation helps improve thoroughness and efficiency and serves as a positive balance to the previous era of safety management.

Airlines can become more proactively resilient to inadvertent human error by implementing LOSA, as it is a helpful way to collect data on normal flight activities and analyze both the factors that increased and mitigated cabin threats, so resultant safety changes can be made to effectively prevent interruptions and distractions.

Follow-up studies on flight crew errors that affected the performance of the cabin crew may be a further help to finding effective ways to stop the issue of errors and risks related to interruption and distraction cabin threat.

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