

The LOSA (Line Operation Safety Audit) and the ATC communication Errors

노선 안전 운항 감사 (LOSA) 운용 및 항공 교통 관제 통신 과실

최진국* (아시아나항공), 안경수 (성화대학), 정원경 (성화대학)
김철영 (한국항공대학교)

I. INTRODUCTION

1. ATC environment and the safety

There are a lot of air traffics increasing these days, and they create hazardous environment. These environment give flight deck and ATC crew more workload and complexity. ATC related accident and incident are not so much frequent as others, however these are fatal. ATC threat and errors induce crew errors and undesired aircraft state as Threat and Error management model explains.

About 70% of the first 28,000 reports made to NASA's ASRS were found to be related to communication problems (Sexton and Helmreich, 1999; Connell, 1995). From January 1985 and December 1997, there were 110 accidents and 69 incidents from NTSB data, and out of the 179 ATC-related accidents and incidents, 109 (61%) involved aircraft operating under FAR Part 91 flight rules (i.e., general aviation), and approximately (69) 33% involved aircraft operating under FAR Part 121 scheduled carrier operations (Colin G. Drury and Jiao Ma, 2002)

It was very difficult to measure how ATC communication effect on the crew in terms of threats and errors. LOSA can explain these threats including ATC threats and errors in detail with numbers. LOSA is spreading rapidly over the world to improve safety of the airlines using threat and error management system. LOSA has shown its success on the major improvement on many areas including the riskiest phase and busiest phase during approach and landing.

We can manage ATC threats and errors effectively, when we can identify the ATC threats and errors in detail through LOSA using TEM theory and improve the safety of the air.

2. LOSA

2.1 History of LOSA

The beginning of LOSA was initiated with Delta Airlines and UT to confirm the actual line application after the CRM training in 1994. TWA, US Airways, and American Airlines performed CRM audits with UTHF (The University of Texas Human Factors Research Project) after Delta. The first Threat and Error Management LOSA was developed in 1996 in collaboration with Continental Airlines. When they measured second LOSA in 2000, they found many improvements including 70% reduction in checklist usages. This success was recognized as industry best practice by ICAO.

2.2 AIRLINE PHYSICAL CHECK

LOSA data is confidential, non-punitive, and voluntary crew participation to ensure the pilots trust the observations so that they show normal operations instead of "an angel performance" in a check ride.

Every airline should do LOSA using TEM

regularly like physical check in order to find good and bad area of the flight operations and cure the symptoms. LOSA can give the numbers in detail in comparisons with other fleets and airlines for normal flight operations so the managers may know exactly what areas are weak and how bad it is in order to improve the safety systems and environment with the LOSA collaborative (TLC).

The insurance companies encourage and are very supportive of implementing LOSA as LOSA shows great successful results in other airlines, and recommended by FAA, ICAO, IFALPA and IATA. They give great value on the efforts to improve the system regarding flight safety.

IOSA audit team from IATA also recognize that LOSA is making great efforts to improve systems of flight operations and to implement new forms of line audits which can reveal normal line operations, threats and errors.

2.3 LOSA AIRLINES

There are around 27 LOSA user groups which airlines have done LOSA in the LOSA advisory board. LOSA airline share the experiences and information.

All the airlines which have completed LOSA were satisfied with the safety change process with specific findings of LOSA data and comparisons that gives managements which area should be focused to be improved in detail and what direction they should train the crew to minimize the occurrence of threats, errors and undesired aircraft states.

All the user group share the good spirit of LOSA of sharing information to keep our sky safer and help each other out and open the door to any airline who are interested to implement LOSA as TLC recommended. ICAO, IATA, FAA, and Numerous airlines

are sharing information through Archie with TLC.

II. THREATS AND ERRORS

1.1 THREATS

Threats are events or errors happened outside the flight crew's influence, but need to be managed to keep safety. Threats increase the risk during the flight regarding safety. Errors caused out side of the cockpit crew are regarded as a threat.

It helps flight crew to manage threats when we know kinds of threats and how they effect on causing errors through training and systems with LOSA. Threats originate but require their attention and management in order to maintain adequate safety margins. Pre-departure and taxi phase is the busiest phase of the flight for airline threats, however the approach and landing phase is the highest occurrence rate of the mismanagement.

There are average 4 threats per flight recently in 10 LOSA airlines according to TLC. Most frequent threats are adverse weather (26% of all threats) and ATC (21% of all threats).

12% of threats were mismanaged and linked with errors or undesired aircraft states. There are average 1 mismanaged threat on every 2 flights.

1.2 THREAT CATEGORIES AND ATC

There are environmental threats and airline threats. 2/3 were environmental threats and 1/3 were airline threats. 44% of environmental threats occur in Des / App / Land and 72% of airline threats occur in pre - departure according to TLC. These facts are shocking that so many threats occur even before the aircraft has departed. The

airlines are able to improve safety when they know these threats and the reasons through LOSA with TEM so that they could manage the threats.

- Environmental Threats
 - Adverse weather
 - ATC events / errors
 - Terrain
 - traffic
 - Airport conditions
- Airline Threats
 - Operational time pressure
 - Cabin events / errors
 - Maintenance events / errors
 - A/C malfunctions / MELs
 - Ground / Ramp events / errors
 - Dispatch events / errors
 - Ground crew events / errors

Most flight deck crew have thought that ATC is part of their routine job and is not important to manage effectively. ATC errors, Challenging Clearances, and late changes of ATC were 21% of all threats. ATC threats occurs on average 60% of the flight. It is quite notable that 17% of ATC threats were mismanaged in recent LOSA airlines. If we do not manage ATC errors, these will induce errors, undesired aircraft state and accident.

2. ERRORS

Error is an action or inaction by the cockpit crew that leads to deviations. Errors tend to reduce margin of safety and increase the probability of the accidents or the incidents.

The pilots are trained to trap and avoid errors. However, we make errors in the cockpit, because we are human and human is not perfect. LOSA helps in detecting errors in normal flight so we can learn from them.

There are more than 3 errors per flight in recent LOSA airlines according to TLC. Over 90% of flights in LOSA had observable crew

errors, and around 30% of errors are intentional noncompliance (Violations). Over 25% of the flights had mismanaged error that leads to an additional error or undesired aircraft states. Most often mismanaged errors are Aircraft handling during hand flying, speed and vertical deviations, decision errors and automation errors. Around 50% of the errors went undetected.

2.1 THE NATURE OF FLIGHT CREW ERROR (TLC)

- Intentional Noncompliance violations; Performing a checklist from memory
- Procedural - Followed procedures but wrong execution.; Wrong heading setting dialed into the MCP
- Communication - Missing information or misinterpretation.; Miscommunications with ATC
- Decision - Decision that unnecessarily increased risk.; Unnecessary navigation through adverse weather

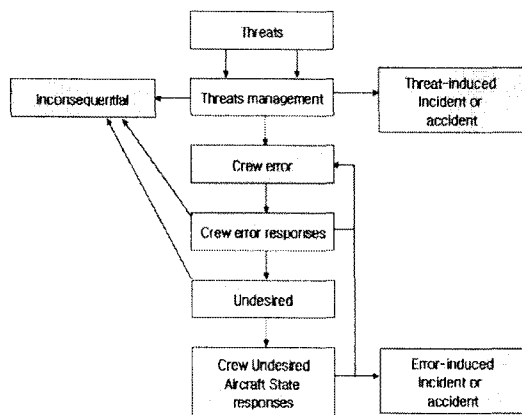
2.2 ATC COMMUNICATION ERRORS

Communication errors occur on average 27% of flights on recent LOSA airlines. Average 16% of communication errors were mismanaged. The most communication errors were related with ATC. Long range international fleets has higher rates of occurrence of communication error.

The most frequent errors are as follows.

- Misinterpretation of ATC instructions
- Wrong readback or callback to ATC
- Missed ATC instructions
- Incomplete call signs(intentional)
- Crew omitted ATC call

2.3 THREAT AND ERROR MANAGEMENT MODEL (ICAO)



3. UNDESIRE AIRCRAFT STATES

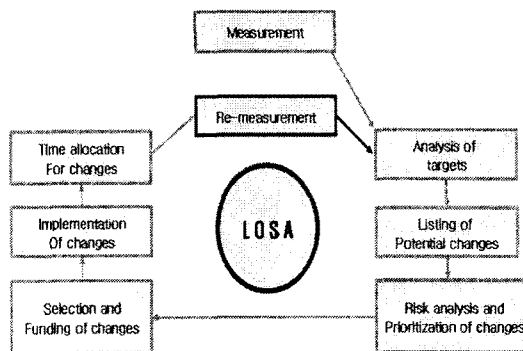
Undesired aircraft states (UAS) is a flight crew induced aircraft state that clearly reduces safety margins. Most often mismanaged undesired aircraft states is unstable approaches or speed deviations in descent / approach / land. Over 25% of the flights had mismanaged errors that lead to an additional error or undesired aircraft state according to TLC.

Some examples of undesired aircraft states are incorrect a/c configurations, vertical deviations of altitude, lateral deviations of heading, speed too high, speed too low, or abrupt aircraft handling.

The undesired aircraft states is as close to an accident. Mismanaging these undesired aircraft states may lead to an accident.

III. SAFETY CHANGE PROCESS (ICAO PROCEDURE)

1. MAJOR STEPS



2. THE FINAL REPORTS

TLC makes presentations to CEO and the managements of the airlines regarding the final reports after the round table data cleaning process and the final analysis. The final report should be presented to managements in safety, operations, training, standards, quality assurance and related department. It is so great to show the comparisons with other airlines in each threat and error categories and comparisons with other fleets to the management for the effective safe change process.

- Most frequent and mismanaged threats
- Most frequent and mismanaged errors
- Strengths and weaknesses of CRM performance
- Fleet and operational differences
- Comparison to other airlines on LOSA safety indices
- RAW DATA
 - Phase of flight and overall text narratives
 - Listing and coding of every threat and error observed
 - Responses from an in-flight pilot interview

3. SCP.

The final report should be presented to managements in safety, operations, training, standards, quality assurance and related department.

4. TYPICAL EXPECTED SCP ACTIONS (ICAO)

- 1) Modifying procedures or implementing new ones.
- 2) Redefining operational philosophies and guidelines
- 3) Arranging specific training in error management and crew countermeasures.
- 4) Reviewing checklist to ensure relevance of the content and then issuing clear guidelines for their initiation and execution.
- 5) Defining tolerances for stabilized approaches, as opposed to the "perfect approach" parameters promoted by existing SOPs.

V. CONCLUSIONS

Over 90% of flights in the LOSA Archive encountered threats. There are average 4 threats per flight recently in 10 LOSA airlines according to TLC. 12% of threats were linked with errors or undesired aircraft states. There are average 1 mismanaged threat on every 2 flights.

There are more than 3 errors per flight in recent LOSA airlines according to TLC. Over 25% of the flights had mismanaged error that leads to an additional error or undesired aircraft states. Around 50% of the errors went undetected.

Around 25% of flights had an undesired aircraft states. Mismanaging undesired aircraft states can cause accidents. It is very hard to believe that one out of four flights has at least one undesired aircraft state which is close to an accident everyday.

Flight deck crew have considered that ATC is part of their routine job and is not important to manage. ATC errors, Challenging Clearances, and late changes of ATC were 21% of all threats. It is significant that 17% of ATC threats were mismanaged in recent LOSA airlines. If we do not manage ATC errors, these will induce errors, undesired aircraft state and accident.

We believe LOSA using TEM can help management to train and set up the system for crew to manage ATC threats, avoid committing ATC errors, manage their errors, and manage undesired aircraft states. because we know these errors through LOSA which gives these threats and errors in detail.

REFERENCES

- [1] Anthony M. Pape and Douglas A. Wiegmann, Scott Shappell (2001) AIR TRAFFIC CONTROL (ATC) RELATED ACCIDENTS AND INCIDENTS: A HUMAN FACTORS ANALYSIS, International Symposium on Aviation Psychology. Columbus, OH: The Ohio State University. 2001
- [2] Colin G. Drury and Jiao Ma (2002) Language Error Analysis, Report on Literature of Aviation Language Errors And Analysis of Error Databases, University at Buffalo, Department of Industrial Engineering
- [3] Helmreich, R.L., Klinec, J.R., Wilhelm, J.A., & Sexton, J.B. (2001). The Line Operations Safety Audit (LOSA). In Proceedings of the First LOSA Week (pp. 1-6). Cathay City, Hong Kong, March 12-14, 2001. (UTHFRP Pub 255)
- [4] International Civil Aviation Organization (2002). Line Operation Safety Audit (LOSA), Document 9803. Montreal, Canada: Author
- [5] Klinec, J.R., Murray, Patrick, Merrit, A.C, & Helmreich, R.L.(2003) Line Operations Safety Audit The Definition and operating characteristics. University of Texas Human

Factors Research Project, Austin, Texas: The
LOSA Collaborative

[6] Klinect, JR., Murray, Patrick.(2004),
Human factors symposium, Line Operation
Safety Audit. The LOSA Collaborative
Austin Texas.