노선 안전운항 감사 (LOSA)를 이용한 항공사 안전개선 프로세스

The Safety Change Process(SCP) with LOSA in an Airline

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I. INTRODUCTION

1.1 Safety

Safety is the state in which the risk of harm to persons or property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazards identification and risk management.(ICAO, 2006)

With the continuous efforts by the aviation society, the accident rate have been significantly declined. In the past it was focused to eliminate risk to zero. No one can guarantee to be absolute safe or free from risk.

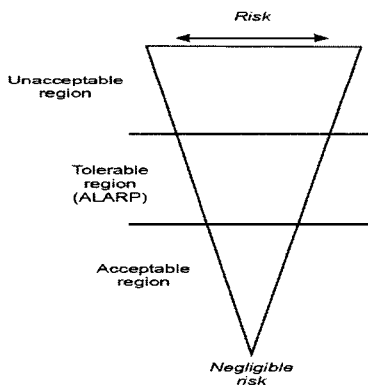
Figure 1-1 Tolerability of Risk (ICAO, 2006)

There is a need to manage the risk as low as practicable so the risk could remain in the acceptable region. The hazard can be identified through LOSA which is one of the effective proactive safety process to manage the risk to an acceptable level in the system. It is important to understand the accident and incident causation for effective safety management system(SMS). It is limited to learn from reactive safety process like accident investigation because the number of the accident and incident have decreased significantly. The

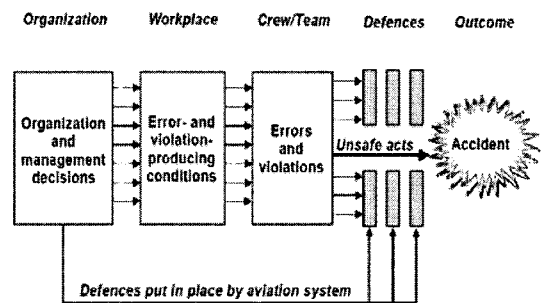LOSA provides proactive data which shows existing risks within the organization.

Figure 2 Accident causation model (ICAO, 2006) Adapted from Prof. James Reason

The failure of the defence in the system may cause the accident. The errors and violations which have immediate adverse effect are unsafe acts. The last defences in the system are persons in the front line.

There usually are precursors before the accident occurs. There are good opportunities to prevent tragic accident occurrence when we identify these safety deficiencies and weakness. When we know these errors and threats through proactive safety tool like LOSA, we could improve the system more effectively and precisely. The accident can be prevented when we identify why the accident or incident happen.

1.2 LOSA

Line Operations Safety Audit (LOSA) and Threat & Error Management (TEM) are integral parts of a Safety Management System (SMS). The human performance less than optimum caused the majority of the accident and incident even though there has been continuous effort of the aviation industry to improve the safety. LOSA is a proactive data collection system on crew and system performance to capture these

performance which is less than optimum during normal operations. The major objective of LOSA is to measure how the crew manage threats, errors and undesired aircraft deviations in the cockpit on day to day operations.

LOSA provides why errors happen and how the crew manage these errors while other conventional SMS like FOQA may provide only what happened. The other safety tools are using data from failed performance such as accident and incident while LOSA provides positive feed back, success story or outstanding performance that can be reinforced and trained.

LOSA has shown its success on the major improvement on many areas including the riskiest phase called the blue box, which is the busiest phase during approach and landing. 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 in checklist usages, unstable approaches and these were confirmed by FOQA data.

The propose of this paper is to introduce the safety monitoring tool of line operation safety audit (LOSA) according to ICAO DOC 9803 which is an integral part of SMS, and the safety change process.

II. SAFETY MANAGEMENT SYSTEM (SMS) and LOSA

1.1 The process of safety management

The safety cycle starts with identifying hazards when there are hazards in their environment, then takes actions through the control options and risk communication in systematic process as produced by ICAO.

There are unidentified latent unsafe conditions on our daily operation. The airlines collect data on these conditions to analyze the hazards. Safety management is based on evidences, so it requires actual data to identify hazards. If there is no data, then it is only an opinion. The priorities of unsafe conditions can be set to reduce the risk. The organization can assign responsibilities to implement these actions then evaluate the situation if these unsafe condition is managed to an acceptable level.
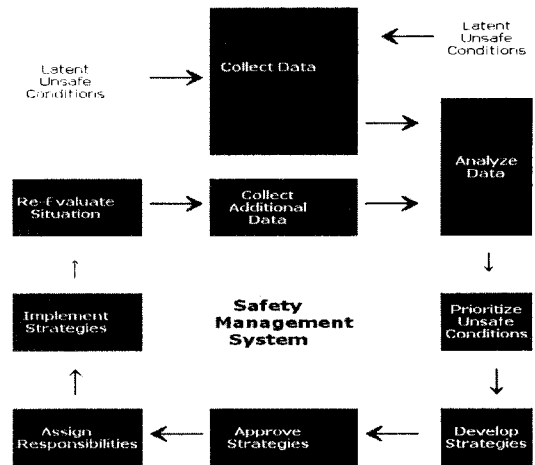

Figure 3 Safety Management Process (ICAO)

2. 1 LOSA process in ICAO SMS DOC9859

ICAO endorsed LOSA as the primary tool to develop countermeasures to human error in aviation operations for monitoring normal flight operations to collect data. Hazards may be identified through LOSA which is the proactive safety process and captures the data which reflect actual day-to-day performance within the system of organization as adequate safety oversight.

LOSA monitors normal operations for accident prevention. LOSA facilitate hazard identification through the analysis of actual performance during the flight. The LOSA using TEM model analyse the threats and errors in the airlines by monitoring normal operations on the flight deck. LOSA identifies threats of aviation safety in order to understand crew performance, and human behavior, manage the risks which maybe generated by threats and identify errors of the crew to implement measures to manage human errors.

LOSA provide data to the airline on how the organization manages threats, operational risks and errors committed by crew in the front line to prioritize and implement actions to improve safety. LOSA also provide the data of successful behavior and the failure of the safety system. These successful outstanding performances can be used for the CRM training and refresher training.

III. SAFETY CHANGE PROCESS

1. 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.
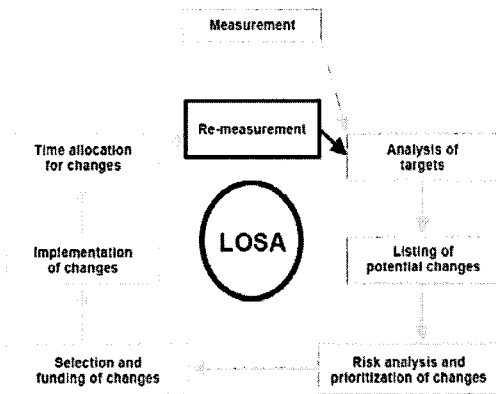

Figure 4 The safety change process(SCP)

2. Sample of 1st LOSA of the A airline

2.1 Frequent threats and errors

1) Most frequent threats : There are average 4 threats per flight recently in 10 LOSA airlines according to TLC.

> Categories : ATC, Adverse weather, MEL Item
> Phases : Pre-departure/Taxi-out, Descent/ Approach/ Landing

2) Major errors : There are average 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). 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 according to the archive.

> Categories: System/Instrument, Automation, Manual Flight, Cross-Verification, Callout, Procedure Error, Briefing, Checklist
> Phases : Des/ App/ LD, Pre-departure/Taxi-out, TO/Climb

3) Countermeasures

> The team climate: Crew effectiveness and leadership has the strongest relationship.
> The planning countermeasures: The stating of plans and contingency management were the highest rated.
> The execution countermeasures: monitoring / cross-checking, taxiway/runway management and workload management are considered crucial for error detection and error management.
> Review and modify countermeasures: Evaluating plans(unexpected threats)

4) Threats and error management of the crew

> The level of threats management as well as error management of the crew in the A airline were rated very high among the comparison groups.

2.2 SCP Target areas

1) Threats managements

> Adverse Weather operation, joint-CRM, MEL, and ATC threat managements

2) Error managements

> System/instrument, intentional non compliance error, and procedural errors
> Cross-verification errors, callouts, briefing, PF/PM duty errors, Documentation, and checklist errors
> Ground navigation errors

3) UAS managements

> Reduce UAS during DES/APP/LD

4) Threats and error countermeasures

> Enhance error detection by focusing on Monitor/cross-check, Automation, Workload, and Runway/taxiway management.
> Briefing, and leadership: Improvement of training and developing TEM and CRM countermeasures.

3. The success of SCP

1) LOSA as a part of SMS cycle

It is quite important to operate LOSA according to SMS process regularly, so that the safety of the system can be continuously maintained automatically. To implement LOSA as a part of SMS, the intervals and the process has to be documented in the company manual and has to be audited internally as other safety management tool. Like a health check, LOSA has to be implemented regularly, and the budget and the organization can be planned systematically.

2) Benchmark of LOSA Archive

There are more than 30 airlines have completed LOSA. We have visited EVA, QF, ANZ, SIA and MAS to benchmark LOSA. It is also quite beneficial to participate ICAO LOSA conference to get the most current information. We have good picture how to implement LOSA and make improvement on safety change. All of them whom we visited are satisfied with LOSA to improve managing errors. We shared our experience JAL and ANA when they visited us to benchmark the LOSA as other archive have done to us.

3) Training of the concept of SMS, TEM and LOSA to the management

Safety can be achieved when safety starts from top management. It is important to inform and train the concept of SMS, TEM and LOSA to CEO and the management. The CEO and the managements of A airline committed to participate in LOSA and share the information within the membership airlines after the 45th AAPA (Association of Asia Pacific Airlines) in 2001. It was very helpful to brief on LOSA and TEM to the top management, so that they do not misunderstand the errors of the crew during the normal after the LOSA data collection. The management may be surprised at receiving the final result without understanding the concept of LOSA and TEM. It was also beneficial to give ground school lecture on SMS and TEM to all the managers in every department of the airline.

4) Organization

To organize committee and designate the staffs are very important to implement SCP in efficient manner. The safety department is dealing with LOSA in most LOSA archive, and QA is dealing with LOSA in a few airlines. The support from other department is very important to have successful improvement of safety change process through monthly meeting. SCP Committee members are from safety, standards, flight operations, training department quality assurance and line pilots. It is great to have aviation psychologist and regulators to be part of the special committee members for the maximum benefits and their professional support.

5) Dedicated workshop

We held dedicated SCP workshop to analyse and discuss the area to be improved for a week as most airlines in the archive do after receiving the final report from TLC .

6) Practical development and implementation of TEM

In order to operate TEM in practical manner, it is absolutely mandatory to implement LOSA to find out the numbers and the specific threats and errors which are mismanaged in the airline. We are revising the procedures which reflect TEM philosophy. It is very important to train the pilots on TEM. It is quite effective to train the instructors and check pilots first and intensively than line pilots To implement TEM effectively, the check form and training syllabus should be modified.

7) The enhancement on Normal operation

Most training in the airlines are focused non-normal operations, LOSA shows that normal operations are as important as non-normal operation, because mismanagement of threat ,errors and undesired aircraft state may lead to an accident and incident. Modifying procedures or implementing new ones. Reviewing checklist to ensure relevance of the content and then issuing clear guidelines for their initiation and execution.

8) Efforts to reduce threats and errors.

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 air threats occur in pre - departure according to TLC. These facts are

shocking that so many threats occur even before the aircraft has departed. The A airlines are making improvement on safety by making efforts reducing threats because we know these threats and the reasons through LOSA, so that we could manage the threats. It is also helpful to reduce errors by re-defining tolerances for stabilized approaches. LOSA data shows that Leadership and the effectiveness of the crew has close relationships. When the leadership of the crew is excellent, the crew make less errors and better in error management. We can reduce errors by training leadership skills to the crew.

9) Cooperation with insurance Co. and CASA
It is beneficial to report voluntary efforts of the LOSA and the process of SCP(safety change process) to insurance company and CASA for their recognition and support.

IV . CONCLUSIONS

Reason's accident causation model explains the accident occurs when the weaknesses are present with other defence not functioning properly. These could be identified and corrected the weakness through the LOSA as part of effective tool in the SMS. ICAO ANNEX6 require aircraft operator must implement SMS by 31 Jan 2009.
We believe LOSA can help management to train and set up the system so crew could manage threats, avoid committing errors, and manage their own errors to control risks. LOSA is a non jeopardy proactive monitoring tool to assess the normal operation flights to identify hazard, and powerful tool of SMS. Re-LOSA can monitor the feedback after the training and procedures, and systems have been improved. we know LOSA is a scientific approach using TEM explaining why and how errors are occurring in the front line of defence. With LOSA, airlines could be able to set up effective TEM training since they provide exact threats and errors within the organization with narratives and raw data with metrics and comparison with other airlines. LOSA is the integral part of the SMS.
The trust from the line pilot on LOSA and the support from the management are the key for

successful LOSA. When there are pilots who does not trust LOSA, they will show fake performance instead of the natural performance in the cockpit according to TLC.
LOSA provides numbers of threats and errors in detail in comparisons with other fleets and airlines so the managers may identify why those happened to improve the SMS and the flight environment.
We had a valuable lessons through LOSA and able to make efforts to reduce airline threats for the crew and train the crew so that they can better manage the threats and errors. We have found that the runway management, checklist usages, briefings, leadership training, stable approach, automation philosophy, monitoring and callouts are so vital for effective TEM.

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