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Airline Safety is No Accident

The Line Operations Safety Audit (LOSA) - Closing the Quality Assurance Loop

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ABSTRACT

Airlines have many ways of attempting to understand safety. Whilst accident and incident investigation involve retrospective analysis of rare and dramatic events, the concept of The Line Operations Safety Audit (LOSA) uses a pro – active approach based on the premise that accurate analysis of daily operations can also provide a foundation upon which to define safety strategies.

Successful quality assurance programmes have built - in methods of measurement to check that changes are bringing about the improvements that are intended. Flight Operations Quality Assurance (FOQA) programmes have been around for some time and traditionally use data from Quick Access Recorders (QARs) and various types of pilot occurrence report to provide data. Whilst these sources tell "what" happened, they are thin on context and information on "why" things happened.

LOSA, which started out as a research project, has now developed into a powerful safety tool for the aviation industry that helps close this quality assurance loop between what happens and why. With 25 LOSAs completed to date, airlines are quickly recognising the value in this health check of systemic safety and are using it as a metric in their safety and quality assurance programmes.

INTRODUCTION

A typical line flight involves inevitable, yet mostly inconsequential errors. Errors are usually due to flaws in human performance (e.g. selecting wrong frequencies, incorrect read-backs, mishandling switches and levers etc). Whilst some errors are spontaneous, systemic shortcomings and external threats such as a late runway change, dispatch errors, or maintenance problems have a significant impact on the likelihood of error. Analysis of the threat environment provides the context which is an essential first step in risk analysis. By analysing these daily events, LOSA can help an airline discover how close it is to the edge of the safety envelope - without waiting for it to exceed that envelope.

LOSA AND THE UNIVERSITY OF TEXAS

Like many other safety initiatives, LOSA was conceived within The University of Texas Human Factors Research Project.

Heading the group (formerly known as the University of Texas Aerospace Crew Research Project), Prof Bob Helmreich has guided teams of researchers for more than 20 years. Amongst their many achievements, these teams have helped develop Crew Resource Management (CRM) from its inception through to its current philosophy – that of Threat and Error Management (TEM). The TEM philosophy is proving to be easily accepted by flight crews across many cultures because it is based on an accurate reflection of what flight crews actually do to maintain safety.

Hand in glove with the emergence of TEM has been the development of LOSA. Over the past 8 years, a team of researchers has been developing an innovative method of accurately measuring crew performance in managing threats and errors by observing crews in actual line operations. Early LOSAs conducted by The University of Texas were partially funded by the Federal Aviation Administration (FAA) and primarily focused on CRM performance. However, the current LOSA methodology is now completely based upon the TEM Model and LOSAs in their present form have been conducted since 1997.

Classically, most pilot training has been based upon minimizing error; the assumption being that some pilots are more error-prone or at fault than others and that recurrent training will identify and correct the problem. One benefit of LOSA is that when analysed at the system level rather than the individual level, patterns of error emerge and it becomes clear that it is only rarely that one pilot is more error-prone than another. Rather, it is the case that pilots put in similar environments will tend to make similar errors. For example, if a significant number of pilots tend to make the same automation or flight control error, it may be an indication of a flawed user-interface. Similarly, an "unworkable" procedure (overly time-consuming, vague or ambiguous, in conflict with other procedures etc) may foster the same non - compliance error in many crews. Understanding error prevalence rates is one way of identifying potential flaws in the system's defences.

The global nature of error is even more apparent when benchmarking data from other airlines are used. The fact that pilots from different airlines are making the same types of error provides further evidence that the operating environment (aircraft, airports, manuals, schedules, terrain, etc.) is more significant than any one individual. The LOSA Archive provides these benchmarking opportunities.

LOSA data show that typical airline jet transport flight encounters from three to six threats from such sources as weather, ATC, airport conditions and airline support functions. Managing this threat - rich environment adds to the crew's workload and fosters predictable errors. Threats and errors are therefore seen as an inevitable part of everyday operations and must be managed to maintain adequate safety margins. LOSA provides valuable data to airline management, not simply by listing threats and errors but in analysing how various crews manage these threats and prevent them from becoming consequential.

THE LOSA ARCHIVE

The increasing demand for LOSA led to the formation of The LOSA Collaborative in April 2001. In partnership with The University of Texas, The LOSA Collaborative maintains a user-group of airline safety professionals, researchers, pilots, and manufacturer's representatives tasked to implement LOSA and maintain the integrity of the LOSA process. The tally board now shows 25 LOSAs involving over 20 airlines with an archived dataset comprising almost 5,000 observed flights. The LOSA Archive is a database containing all the results from airlines that have conducted a LOSA with The LOSA Collaborative and currently contains data from the following airlines:

- Aero Mexico
- Air New Zealand

- Asiana Airlines (Korea)
- Alaska Airlines
- Braathens ASA (Norway)
- Cathay Pacific Airways (Hong Kong)
- China Airlines (Taiwan)
- Continental Airlines
- Continental Micronesia
- Continental Express
- Delta Airlines
- EVA Air (Taiwan)
- Frontier Airline
- Malaysia Airlines
- Mt Cook Airline
- QANTAS
- Regional Express
- SilkAir
- Singapore Airlines
- UNI Air (Taiwan)
- US Airways

LOSA QUALITY ASSURANCE

The basic methodology of LOSA is to put trained observers on the flight deck to observe crew performance. A question often asked is “Won’t crews be on their best behaviour if observers are present – just like a line check”? In order to avoid only seeing “angel behaviour”, LOSA goes to great lengths to win the confidence of crews by ensuring complete confidentiality and thus engendering the trust of the crews in the process. Much work is done leading up to a LOSA including consultation with the flight-crew association or union and providing a detailed explanation of the process to the crews themselves. The complete de - identification of data, confidentiality and non - jeopardy nature of LOSA are emphasised.

To ensure crew confidence and quality control, airlines wishing to undertake a LOSA conducted by The University of Texas and The LOSA Collaborative are required to undertake a five-part quality assurance process.

1. An agreement is reached between airline management and the pilot or flight crew union or association. This agreement assures that all data will be de-identified, confidential, and sent in encrypted form by the observer directly for analysis. It also states that once the final results are presented, both parties have an obligation to use the data for meaningful safety change.

2. The airline is assisted in selecting a diverse and motivated group of observers. A typical observer team will have representatives from a number of different airline departments, such as flight operations, training, safety and the flight crew association. A team of experienced external LOSA observers, who act as a control group and typically complete 15 – 20% of the total observations, augments the airlines’ observers. This leads to a balanced and unbiased set of observations.

3. The observer team receives five days of training in the Threat and Error Management model and LOSA observation methodology. After the initial training, observers conduct sample observations and then reconvene for recalibration sessions. During this time, observers are given one on one feedback on the quality of their observations and certified to continue as observers within the project. The comprehensive observer training and recalibration optimises inter – observer reliability and is considered essential for a standardised LOSA dataset. Subsequent observations are typically spread out over the following 4 to 8 weeks.

4. When the encrypted observations are sent to the secure data site, analysts examine data for accurate and complete coding of every threat and error. This data integrity check by experienced analysts is necessary to create a dataset that allows for meaningful airline comparisons within the LOSA Archive.

5. Once this initial data integrity check is complete, representatives from the airline (with fleet expertise) are required to attend a data-cleaning roundtable. The purpose of the roundtable is to examine every logged threat and error to see if they are congruent with airline procedures, policy, and expectations. After the roundtable is completed, airline representatives are required to validate the data set as being an accurate reflection of threats and errors. Only then does the analysis for the final report begin.

LOSA AND NORMAL BEHAVIOUR

The success of the LOSA Quality Assurance Process can, at least partially, be measured by the number and frequency of procedural violations observed. Very often, a violation of Standard Operating Procedure (SOP) – particularly if observed in several crews – may indicate a poorly written procedure, or a procedure that is incompatible with the operation. Yet such violations are seldom, if ever, observed on normal airline check flights – “Angel Behaviour”. By way of contrast, intentional violations are the second most prevalent of all errors noted on LOSA observations. This in itself provides an indication that LOSA is looking at crews operating within their comfort zones. As well as noting errors, the observers are trained to record error management including innovative and superior performance. Capturing normal behavior, the pluses and minuses, is an underpinning strength of the LOSA process.

LOSA DELIVERABLES

The LOSA process is lengthy – typically 12 – 14 weeks from start to finish but airlines gain a comprehensive picture of their crews’ performance, benchmarked against other similar but de – identified airlines taken from the data set. Feedback indicates that this information will significantly augment any existing FOQA data as it effectively captures process - not just outcomes. FOQA/QAR data tells managers what is happening - LOSA captures the context and tells the managers why.

LOSA results can be presented at various levels. These range from high-level summaries for airline executives through to the most detailed raw data. Tables and charts provide the exact numbers and percentages upon which the

summary is based and provide an intermediate level of detail based on aggregated trends and patterns. The most detailed level is provided by the Raw Data Reports. Complete logs of observed Threats and Errors together with detailed information on their management provide information at the level of individual flights. Strengths as well as weaknesses are presented and benchmarking against other airlines in the LOSA archive helps provide specific targets for areas of enhancement.

LOSA can be regarded as the metric in a quality assurance process. As a result of LOSA, airlines may review and modify aspects of crew training, refine SOPs and focus on mitigating high threat aspects of their operation. After allowing time for these changes to occur and bed–in, airlines are now requesting repeat LOSAs – typically about 2 - 3 years after the initial LOSA. Experience has shown that airlines can take up to a year to digest the data, several months to implement changes and some months for crews to adapt to the changes. A follow up LOSA will measure the effectiveness of these changes in actual crew performance. Four of these follow-up LOSAs have been completed to date, with three more planned in the near future.

INTERNATIONAL RECOGNITION AND THE FUTURE

In 2002, ICAO produced a comprehensive document on LOSA (ICAO Document 9803) and formally endorsed the process. Whilst ICAO has kept LOSA as an open standard, it has carefully defined the LOSA process by ten operating characteristics. Whilst the majority of airlines prefer to use external facilitation, LOSA is not trademarked or copyrighted and airlines can obtain information on the process from various sources and, provided that they do not require benchmarking against other airlines, are able to conduct their own “internal” LOSA.

As well as ICAO, The International Air transport Association (IATA) and The International Federation of Airline Pilots’ Associations (IFALPA) also endorse LOSA. On present plans, normal operations monitoring will move from a Recommended Practice to an ICAO Standard in the future. Significant interest has also been shown by the military in several countries.

The author is currently undertaking a research project to tailor LOSA to suit smaller regional airlines. Regional Express (REX) in Australia and Mt Cook Airline (an Air New Zealand subsidiary) are the first turbo - prop regional airlines to become involved in the trial and initial feedback from the airlines is extremely encouraging.

“Sister Projects” are investigating the use of LOSA methodology in Air Traffic Control, Maintenance and Flight Dispatch. The medical world is also showing great interest in an adaptation of LOSA methodology with a view to reducing medical error in high workload/high risk small team situations such as hospital casualty departments (ER) and the operating theatre (OR). Presentations on lessons learned from LOSA in the airline world are proving popular at medical conferences.

A recent initiative by The New Zealand Civil Aviation Authority (NZCAA) is investigating LOSA as a national systemic safety tool. A conference was

recently held in Wellington with attendees from almost all national airlines where a wide range of issues including NZCAA support and the concept of a New Zealand National LOSA Archive were discussed.

In order to increase global awareness, LOSA/TEM conferences have been held by ICAO and The LOSA Collaborative, with the sponsorship of local airlines in Hong Kong, Panama, Dubai and Ireland. The last ICAO LOSA/TEM conference was also jointly sponsored by IATA and Boeing and took place in Seattle in November 2004. The next conference is planned for Kuala Lumpur in September 2005 and is jointly sponsored by ICAO, IATA and Malaysia Airlines.