



Advisory Circular

Subject: LINE OPERATIONS SAFETY
AUDITS

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1. PURPOSE. This AC provides the rationale and procedure for conducting a Line Operations Safety Audit (LOSA) at an airline.

2. APPLICABILITY. A LOSA is a voluntary safety program. While the Federal Aviation Administration (FAA) encourages airlines to voluntarily conduct LOSA programs in the interest of safety improvement, a LOSA does not entail any requirement for FAA approval, acceptance, or monitoring. While an airline may elect to share the results of a LOSA with the FAA, there is no requirement to do so. This AC is intended to provide informational guidance on LOSA to airline personnel in flight safety, flight training, flight operations, and other interested industry parties.

3. CONTENTS.

a. Introduction. This AC introduces the LOSA process and distinguishes it from other proactive safety data programs such as Flight Operational Quality Assurance (FOQA) and the Aviation Safety Action Program (ASAP).

b. Data Collection. This AC also lists the various types of data collected via a LOSA and shows how they contribute to an airline's safety management system. Next, the personnel involved in a LOSA and their respective roles are described.

c. Implementation. This AC offers a detailed step-by-step guide to the LOSA process from initial planning to the final report. It concludes with the 10 operating characteristics that define a LOSA and which ensure the integrity of the process. Under the guidance of this AC, an airline wanting to implement a LOSA should abide by all 10 characteristics. The appendices in this AC describe the Threat and Error Management (TEM) model upon which the LOSA method was based (Appendix 1); provide more detail on the training and standardizing of LOSA observers (Appendix 2); provide a sample observation form (Appendix 3); a sample letter to the pilots (Appendix 4); and sample vignettes for training (Appendix 5).

4. DEFINITION OF A LOSA.

a. A LOSA is a formal process that requires expert and highly trained observers to ride the jumpseat during regularly scheduled flights to collect safety-related data on environmental conditions, operational complexity, and flightcrew performance. Confidential data collection and non-jeopardy assurance for pilots are fundamental to the process.

b. Using a medical metaphor, a LOSA is similar to a patient's annual physical examination. People have comprehensive checkups in the hope of detecting serious health issues before they become consequential. A set of diagnostic measures, such as blood pressure, cholesterol, and liver function, flag potential health concerns, which in turn suggest needed changes to the patient's current lifestyle. A LOSA is built upon the same proactive notion. It provides a diagnostic snapshot of strengths and weaknesses that an airline can use to bolster the "health" of its safety margins and prevent degradation.

c. LOSA is distinct from - but complementary to - other proactive safety programs such as electronic data acquisition systems (e.g., FOQA), and voluntary reporting systems (e.g., ASAP). However, these programs have two major conceptual differences.

(1) First, FOQA and ASAP rely on outcomes to generate data. For FOQA, it is flight parameter exceedances; for ASAP, it is adverse events that crews report. By contrast, LOSA samples all activities in normal operations. In these regularly scheduled flights, there may be some reportable events, but there will also be some near-events and, importantly, a majority of well-managed, successful flights. LOSA provides a unique opportunity to study the flight management process, both successful and unsuccessful, by noting the problems crews encounter on the line and how they manage them.

(2) The second major difference is the perspective taken by each program. With its focus on electronic data acquisition downloaded directly from the aircraft, FOQA can be said to have the "airplane perspective." ASAP provides the "pilot perspective" by using pilots' voluntary disclosure and self-reporting of events. ASAP reports provide insight into why events occur as seen from the crew's perspective. By contrast, LOSA provides a "neutral, third-party perspective" in that LOSA observers record contextual and flightcrew data on every phase of flight, regardless of the outcome. All three perspectives provide useful data to an airline's safety management system.

(3) A third, more pragmatic difference between the programs relates to logistics. FOQA and ASAP are continuous programs; i.e., they are set up to collect data on a daily basis. A LOSA is more project-based. The full LOSA process, from advance planning and observer selection and training, to data collection, analyses and final report, can take between 6 and 12 months. A LOSA is recommended every 3 years. Despite these differences, data from one program can be cross-referenced and used to guide data collection in another. For example, ASAP reports may highlight a problem with departures at a particular airport. This information can be fed to the LOSA steering committee, which can then target more observations out of that airport to understand the magnitude and specifics of the problem. As another example, a LOSA may identify a high incidence of unstable approaches, leading to a review of procedures and the

specification of new approach parameters. FOQA data can track adherence to the new specifications in the interim period leading up to the next LOSA.

5. IMPORTANCE OF A LOSA. A LOSA provides unique data about an airline's defenses and vulnerabilities. As explained in paragraph 4, a LOSA does not replace other safety-data sources such as FOQA or ASAP. Instead, it complements these programs and extends the reach of an airline's safety management system. The data collected during a LOSA can impact almost every department in an airline, as the following examples show. The data collected during a LOSA can help an airline:

a. Identify Threats in the Airline's Operating Environment. Observers note events in the operational environment (e.g., adverse weather, airport conditions, air traffic control (ATC) clearances, terrain, and traffic congestion, and how they are managed by flightcrews). High-prevalence threats and/or threats with higher mismanagement rates can be prioritized for further investigation; lower mismanagement rates signify areas of strength. For example, understanding the extent to which certain airports or ATC practices pose a problem for flightcrews, and capturing the strategies flightcrews adopt to deal with them, can lead an airline to develop special procedures or advisories to help its pilots manage the known threat.

b. Identify Threats from within the Airline's Operations. Observers note events arising from within the airline's own operations and how they are managed (e.g., operational time pressure, dispatch errors, aircraft malfunction/minimum equipment list (MEL) items, and problems with ground, ramp, maintenance, and cabin personnel). A high number of threats arising from dispatch or cabin might signal that these departments require attention, or that intergroup cooperation with pilots needs to be improved, or that procedures are inconsistent across departments. As above, prevalence and management rates provide cues for prioritizing action.

c. Assess the Degree of Transference of Training to the Line. Data provided by Advanced Qualification Programs (AQP), Line Operation Evaluations (LOE), and Line-Operational Flight Training (LOFT) can provide insight on whether training concepts are learned, but not whether they are actually practiced on the line. A LOSA provides that operational information, which can be reviewed from a training perspective to understand which areas of training, if any, are not transferring successfully to the line.

d. Check the Quality and Usability of Procedures. A LOSA provides insights about potential problems with procedures. For example, if 5 percent of observed crews make a callout error during descent/approach/land, there may be a problem with those crews. However, if 50 percent of observed crews make the same error, then the evidence suggests a problem with the callout procedure. Procedures can be ill-timed, over-long, confusing, and/or compete for the pilots' attention with other more important activities. A LOSA will locate problematic procedures and policies via poor adherence rates. A LOSA can also identify the extent of procedural deviations across fleets.

e. Identify Design Problems in the Human/Machine Interface. A LOSA captures aircraft handling and automation errors on different fleets that can highlight systemic flaws in design, interface, or adaptation. The rate at which certain errors go undetected and become consequential can also indicate potential design vulnerabilities. An airline can feed these LOSA findings back to the aircraft manufacturers, as well as writing standard operating procedures (SOP) to circumvent the flaws.

f. Understand Pilots' Shortcuts and Workarounds. With experience comes expertise; pilots learn ways to save time and be more efficient. These techniques are rarely seen in a line check, when performance is usually done "by the book." A LOSA provides a principled manner by which an airline can capture collective expertise from within the pilot group, and then share that information with all its pilots through formal airline communication channels. Using LOSA, false expertise — the adoption of a shortcut or workaround that is flawed in its safety assumptions — can also be identified and remedied.

g. Assess Safety Margins. Threats and errors that are mismanaged can result in undesired aircraft states, if sufficiently serious. Vertical and lateral deviations and unstable approaches are examples of undesired aircraft states, also known as accident and incident precursors. A LOSA provides data about the prevalence and management of these incident and accident precursors. Thus, an airline acquires data about how close it is operating to the edge of the safety envelope, without crossing the boundary into an incident or accident.

h. Provide a Baseline for Organizational Change. LOSA results provide baseline and outcome measurement data against which organizational interventions can be measured. Using the medical metaphor, this would be akin to the patient deciding to cut out fried foods upon learning of a high cholesterol count. The next checkup reveals, in quantifiable form, whether this strategy has been effective in reducing cholesterol or whether other actions are necessary. Similarly, a followup LOSA provides a new set of results that will show whether the organizational changes were effective in reducing certain threats, errors, and/or undesired states.

i. Provide a Rationale for Allocation of Resources. Because LOSA results highlight both the strengths and weaknesses in an organization, the results provide a data-driven rationale for prioritizing and allocating scarce organizational resources toward interventions.

6. INVOLVEMENT IN A LOSA. When first exploring whether or not to conduct a LOSA, it is advisable to gather representatives from all departments that may be potentially involved, including flight operations, training, flight standards, the safety department, and the pilot group.

a. Departments. The flight operations and training departments typically know first-hand what is and is not working well. These departments often have specific areas that they would like the LOSA to focus on. Possibly the most important reason for their involvement is that, ultimately, many of the problem areas that are identified during a LOSA should be addressed by these departments. They will also be the recipients of the potential benefits derived from the LOSA. If these departments do not support LOSA, then there will be resistance to the findings; however, if these departments are part of the process, there will be a sense of ownership, and they will be invested in the results.

b. Pilots' Association or Group.

(1) The importance of having the pilots involved with and supporting the LOSA cannot be overstated. If the line pilots are convinced that their association or pilot group supports LOSA, they will be more willing to accept the presence of observers on their flight decks. Additionally, if pilots believe this process is beneficial to them and to safety, they will be forthcoming and candid with their views and safety concerns. On the other hand, if the pilots view LOSA as a management tool to “spy on their cockpits” and they respond with “angel” performance rather than typical performance, then the results will not be fruitful.

(2) Hence, where airlines have a formal pilots' association, leaders of the association should be involved in the LOSA process from the beginning. If no formal pilots' association exists, pilot representatives should still be included. The pilots' association or group can also help disseminate the results of the LOSA and inform the pilots as to the company's plans as a result of the LOSA.

c. LOSA Coordinator and Steering Committee. Because buy-in and support is crucial, consideration should be given to forming a LOSA steering committee drawn from the various departments and the pilots' association. The LOSA steering committee and/or the LOSA coordinator have many tasks and logistical responsibilities, including:

- (1) Publicize the upcoming LOSA in pilot newsletters to build awareness.
- (2) Distribute a letter to all line pilots explaining the purpose of the LOSA (Appendix 3 has a sample letter).
- (3) Decide the size and focus of the LOSA.
- (4) Select the observers, organize their schedules, and set up observer training.
- (5) Organize a secure site for collection of the observation forms and subsequent data analysis.

NOTE: All of these tasks are discussed in more detail in the “How to” section of this document.

d. Observers.

(1) LOSA observers should be carefully selected to ensure the integrity of the LOSA process. LOSA observers should be familiar with the airline's procedures and operations; the line pilots should also respect them. The observer team can include a small number of non-pilots as long as they can anticipate and understand flightcrew tasks and their surrounding operational context. However, the majority of the team should be active pilots from that airline.

(2) In airlines that operate more than one fleet, observers should be scheduled to observe across fleets other than their own. This adds value to the process in that the observer looks more at the “big picture” rather than the fine detail. For similar reasons, experience has shown that using a small percentage of external observers drawn from pilots with LOSA experience at other airlines adds value in the form of a “control group” for observations. External observers—typically 10 to 20 percent of the total observer team—will normally attend the airline LOSA training and will need to familiarize themselves with airline procedures. They are particularly useful in picking up systemic and organizational threats to which airline staff are often “blind” due to familiarity.

(3) A LOSA observer should be like a “fly on the wall,” able to occupy the cockpit jumpseat and capture data without being obtrusive or interfering with the crew’s performance. This involves creating an environment where the crew almost does not realize they are being observed. LOSA observers will observe errors and undesired aircraft states as part of their observations; however, they should only interrupt if they perceive the safety of the flight to be seriously and immediately endangered. A helpful rule of thumb is to ask observers to think of themselves as a guest riding in the jumpseat of another airline. This seems to help distance the observer from the flightcrew while still being able to politely point out safety concerns if they come about.

(4) LOSA observers should be scheduled in the status of “passenger,” “supernumerary,” or “observer” only (i.e., they should not be scheduled as a member of the legal operating crew). This assists both the crew and the observer to understand that LOSA observers are data collectors only, not evaluators there to critique crews. Observers do not have any responsibility for the operation.

e. Line Pilots. A LOSA cannot succeed without the full and candid cooperation of the line pilots, and there can be no cooperation without trust. Line pilots should be informed in advance about the purpose and planned implementation of a LOSA. They should receive a letter co-signed by credible representatives of both management and the pilot organization that assures them of the confidential and nonjeopardy status of LOSA data. The letter should also include a disclaimer giving all pilots the choice of declining a jumpseat observer at their discretion. Only by building in these guarantees and safeguards will the line pilots feel sufficiently comfortable to act normally in the cockpit in the presence of a LOSA observer. A final assurance should be an inhouse publication of a summary of LOSA results along with an outline of initial actions and proposed changes.

f. Data Analyst and Report Writer. The data analyst should have knowledge of the airline’s flight operations as well as database management and data analysis skills. However, an airline might choose a third-party analyst if expertise is not available inhouse or if line pilots have expressed reservations about the integrity of the LOSA implementation or objectivity of the final report. The data analyst and report writer work together to prepare a report of the findings to be presented to management and pilots.

7. WHEN TO CONDUCT A LOSA.

a. There are several factors to consider when scheduling a LOSA. Given all the personnel involved, a LOSA should be scheduled to fit with other operational priorities. For example, is there a particular time in the year when more observers will be available? Is there a better time for the scheduling department to roster these people? Also, is there a particular time that is more interesting from a safety or operational perspective? Some examples: bad-weather season, peak traffic season, after the introduction of an operational change such as new aircraft, altered routes, or a merger.

b. A LOSA should not be implemented immediately after a major incident or accident. The airline will be in a heightened state of awareness at this time and pilots will be overly sensitive to observation; hence, the chances of getting normal data will be diminished. At a minimum, airlines should wait at least 1 year after a major safety event before scheduling a LOSA. Once an airline has done a LOSA, a critical question is when to do the next one. LOSA data provide a baseline against which to measure improvements. A realistic timeframe to review LOSA results, develop and implement action plans, and monitor results is 3 years. Hence, to measure the effectiveness of organizational changes, a repeat LOSA every 3 years is recommended.

8. HOW TO IMPLEMENT A LOSA. This section presents a step-by-step guide to implementing a LOSA. Broadly speaking, there are steps associated with getting good-quality data from observers (data collection), and steps associated with ensuring that accurate and meaningful data are given to management and line pilots (data analysis and feedback). An airline can conduct its own LOSA by observing the following steps:

a. Data Collection.

(1) Form a LOSA steering committee and appoint a LOSA coordinator.

(2) Gather Information and LOSA Resources from other Airlines and Industry Groups. Before conducting a LOSA for the first time, the committee and coordinator should seek out information from other airlines that have already conducted a LOSA. Other airlines may be able to share observer selection and training techniques, observation forms, scheduling tips, and other logistical aids.

(3) Publicize LOSA within the Airline and Send a Letter to the Line Pilots. A first task is advance publicity via company publications to build line pilot awareness and acceptance of the upcoming LOSA. Next, the coordinator organizes and distributes a letter to all pilots explaining the purpose of the LOSA. This letter specifies the purpose of the audit, the fact that all observations are of a non-jeopardy nature, and that all data will be kept strictly confidential. The letter is signed by the highest level of management within flight operations, with the endorsement of other relevant personnel such as chief pilots and pilots' representatives (Appendix 4 has an example letter). The letter of announcement should precede the line audit by at least 1 month, with a followup alert 1 week before starting observations. LOSA observers should have copies of the signed letter to show crewmembers in case questions arise.

(4) Decide the Focus of the LOSA. The LOSA steering committee decides the focus of LOSA. One option is to sample broadly across the entire operation—this would be an effective strategy for a first LOSA. Alternately, the LOSA steering committee can focus on problems that have been identified by other data sources, such as FOQA and ASAP. This approach would schedule LOSA observations on particular routes, in certain regions, or into particular airports that have been identified as problematic. The committee can also focus a LOSA on a new fleet or other recent organizational changes.

(5) Decide the Number of Observations.

(a) Most airlines will find it cost effective to conduct a LOSA on a sample of their operation—the question is how big a sample? As a general guideline for a full LOSA, match the number of observations per fleet to the relative number of departures per day. For example, if 30 percent of departures occur on Fleet A, then approximately 30 percent of the LOSA observations should occur on Fleet A. Within each fleet, try to sample as many different crews as possible and, as a rule, conduct 50 or more observations per fleet. Below that number, there is the risk of not accurately capturing a representative sample.

(b) Modify the guideline slightly when focusing on a particular operation or region. For example, to sample international flights into a particular subcontinent, then regardless of what percentage they constitute of the airline's daily departures, still schedule at least 50 observations to ensure a good sample.

(6) Create an Observation Form. The observation form should be based on a conceptual framework that captures multiple aspects of normal operations, including the operating environment and flightcrew performance. It should provide categories and codes to streamline observations and save the observer's time, but it should also require a written description of the flight that captures the full context. Appendix 3 has an example of an observation form based upon the TEM model.

(7) Select observers.

(a) The observer team should have representatives from flight operations, training, safety, and the pilots' association. Some airlines employ a selection procedure whereby management and the pilots' association each put forth a list of acceptable observers, and then those who appear on both lists are selected.

(b) The number of observers needed depends on the size of the audit and the observers' workload. There is substantial work involved in completing an observation form and providing a detail-rich narrative for each flight; therefore, the recommended number of observations is 10 to 15 per observer, depending on routes and schedules. Hence, a LOSA that plans 150 domestic observations requires at least 10 observers, while a 300-observation LOSA that includes international flights requires 20 to 25 observers.

(8) Train observers.

(a) LOSA observers should be educated about the purpose and rationale of LOSA, and trained in the use of the observation form. LOSA observer training typically takes 2 to 3 days. To assist in the design of the training, members of the steering committee may want to attend LOSA observer training at another airline first or, if possible, attend an industry-sponsored LOSA conference for guidance.

(b) Observers should practice with scripted scenarios or videos until they are confident they can use the observation form correctly. At this point, they can be dispatched to the line; however, it is recommended that observers be brought back in after one or two flights to discuss their observations, correct any misperceptions, and coach them on areas that require clarification. Appendix 2 provides more detail on the objectives and content of observer training. Appendix 2 also addresses the standardization of observers and LOSA data.

(9) Schedule Observations. Plan no more than two observations per observer per day to allow sufficient time to complete the observation form and write a rich narrative. Schedule observers across fleets regardless of their type rating to encourage a more general, cross-fleet perspective of flightcrew performance. Build some flexibility into the schedule to allow for the unexpected. Finally, do not let the observations continue indefinitely—schedule all observations within a 1- to 3-month period if possible, or else the impact of LOSA will be lost.

(10) Decide on a Data Repository.

(a) The LOSA coordinator organizes a secure site for the data and oversees the receipt of the observation forms. The coordinator should be able to protect the identity of the observers and the observed to ensure complete confidentiality and nonjeopardy conditions. Under no circumstances should it be possible to connect individuals with particular observations.

(b) The observations can be kept inhouse if data management and analysis expertise is available and if data security can be assured. Alternately, the data can be sent to a trusted third party who will assume responsibility for data collection, cleaning, and analysis. The decision will depend on airline resources and pilot trust issues.

(11) Provide Logistical Support. Give the observers the name of a contact person, most likely the LOSA coordinator, who can be reached if there are any problems with scheduling or data collection.

b. Data Analysis and Feedback.

(1) Verify the Data. Convene a meeting of “local experts”—airline personnel familiar with the operation of each fleet (possibly fleet managers or member of the steering committee, but not any of the observers). The group’s task is to review and verify the observations against current manuals, policies, and procedures. For example, an observer might log a procedural error for failure to make an approach callout when in fact there is no written procedure in the airline’s flight operations manual. The data verification group would delete this particular

“error” from the database. This step is a data integrity check in that it ensures that events are correctly recorded in line with each fleet’s procedures and policies. It also builds ownership in the results and dispels any later criticism that the coding was not an accurate representation of the airline’s operations.

(2) Analyze Data.

(a) LOSA data reveal strengths and vulnerabilities in an airline’s operations. The data analyst should investigate the prevalence and management of different events and errors. Although certain types of comparisons will seem obvious, many analyses can and should be based upon hunches and theories derived from local knowledge of operations. If the analyst knows how fleets and operations are managed, comparisons that reflect this structure can be made. If the analyst knows the kinds of information that might be useful to training, safety, or to domestic or international flight operations, results can be tailored to these particular aspects of the operation. Feedback from various airline stakeholders is critical during this stage of preparing the report. The analyst should not hesitate to distribute early drafts to key people within the airline familiar with LOSA to crossverify the results. This not only helps validate derived trends, but it gives other airline personnel ownership of the report.

(b) Patterns will emerge as the data are analyzed. Certain errors occur more frequently than others, certain airports or events emerge as more problematic than others, certain SOPs are routinely ignored or modified, and certain maneuvers pose greater difficulty for adherence than others. These events and practices form the basis of suggested targets for enhancement.

(3) Prepare Report. The last stage of a LOSA is a written report that presents the overall findings of the audit. With a large database like the one generated from a LOSA, it is easy to fall into the trap of trying to present everything. The report should be concise and present only the most significant trends from the data. Along with the results, the report should provide an initial list of targets for enhancement. Targets need to be action-focused and data-driven. Some example targets that might emerge from a LOSA include:

- (a) Reduce the number of unstabilized approaches.
- (b) Streamline predeparture checklists.
- (c) Reduce SOP crossverification errors.
- (d) Understand automation errors on the new fleet.
- (e) Investigate conditions at airports X and Y.
- (f) Improve management of adverse weather threats.
- (g) Investigate high rate of MEL items on the ZZ fleet.

(h) Reduce dispatch errors at the hub.

(i) Develop an international flight operations guide.

(j) Develop a module on intentional noncompliance errors for captain upgrade training.

(4) Brief Management.

(a) The LOSA report should be presented to management in operations, training, standards, safety, and possibly other departments depending on the results. For example, representatives from ramp, maintenance, dispatch, and cabin may want to hear how their work is perceived from the pilots' perspective, particularly if it is problematic. A briefing to the pilots' association or group, as applicable, is also recommended.

(b) Once the various departments are briefed on the report, they will likely want to investigate the data more deeply themselves. The data should be available in aggregated form for them to review. Some flight narratives will also be of interest, hence the prerequisite insistence on deidentifying the observations.

(5) Brief Line Pilots.

(a) Line pilots should also be informed of the significant results in the LOSA report. To sustain the pilots' interest in the LOSA project, make an announcement at the end of the data collection phase that the LOSA observations have been completed, stating how many and on what fleets, and advise when the pilots can expect to see the results.

(b) When the report is ready, the highlights should be presented to the pilots, either as one LOSA debriefing event or spread over time in the airline newsletter or other safety periodical. Pilots will want to know what changes will be undertaken as a result of the LOSA.

(6) Monitor Safety Change Process.

(a) Historically, organizational safety changes within airlines have been driven by accident/incident investigation and intuition. Today, airlines must deal proactively with accident and incident precursors. To be successful, the safety change process must be data-driven. Measurement of daily operations is fundamental because unless an organization uses systematic measurement, the perspective it has on the strengths and weaknesses of its operations is largely based on anecdote and opinion.

(b) A LOSA provides specific and quantified results. To take full advantage of this specificity, the targets for enhancement that arise from the data analysis should go through a formal safety change process to produce improvement. A formal safety change process provides a principled approach to target limited resources and helps the airline avoid "turf" issues by clearly defining and prioritizing the issues that impact flight operations. The basic steps of a safety change process are:

- 1** Measurement (with LOSA) to obtain the targets.
- 2** Detailed analysis of targeted issues.
- 3** List of potential changes for improvement.
- 4** Risk analysis and prioritization of changes.
- 5** Selection and funding of changes.
- 6** Implementation of changes.
- 7** Time for changes to stabilize.
- 8** Remeasurement.

9. USE OF LOSA DATA.

a. A well-conducted and well-analyzed LOSA identifies strengths and vulnerabilities in an airline's operations. It provides this information in a quantifiable form against which targets can be specified and improvements can be measured. The following example briefly illustrates the step-by-step integration of LOSA data into the safety change process.

(1) An airline's LOSA results indicate that 16 percent of observed flights involved an unstable approach. Because observations were scheduled across the operation, and the number of observations exceeded 50 per fleet, the LOSA committee is confident that the percentage is an accurate representation of operations as a whole.

(2) Following management briefings and extensive discussion, a specific target for improvement is created to "reduce the number of unstabilized approaches by 50 percent; i.e., reduce the number of unstable approaches from 16 percent to 8 percent or fewer of all landings."

(3) An action committee is formed for unstabilized approaches. They formalize the parameters and definition of an unstable approach, they review existing procedures and training, and they introduce changes in all relevant areas.

(4) A repeat LOSA is conducted 3 years after the first LOSA. The data, once aggregated and analyzed, show the new rate of unstable approaches to be 12 percent. The airline concludes that changes made to the operation were successful in reducing the rate of unstabilized approaches from 16 percent to 12 percent, an improvement of 25 percent. Upon reviewing the results of the second LOSA, the airline recommit to its original target of reducing the unstable approach rate to 8 percent or lower, and continues to focus efforts in this area.

b. Depending on the sophistication of an airline's safety management system, and the extent to which different safety programs within the airline are premised on the same conceptual

framework, data from a LOSA can be cross-referenced with data from the ASAP and/or FOQA programs, if the airline operates one or both of those voluntary programs. Each data source provides unique yet complementary evidence of the airline's safety status. In the above example, the airline might track unstable approaches through its FOQA program using new flight parameters decided by the action committee and then implemented into procedures and training. To see if pilots are incurring problems with the new procedure, the FOQA aircraft data can be cross-referenced with ASAP reports of events resulting from unstable approaches. This way, the airline does not have to wait until the next LOSA to learn if its interventions are being successful.

c. LOSA data are useful in another way. LOSA presents a broad view of operations; a repeat LOSA can maintain that broad focus. For example, did the changes that were introduced after the first LOSA improve results in one area, only to cause problems in another? Checklist adherence may have improved, but did error detection—the superordinate goal of improving checklist adherence—actually improve or is the new adherence simply cosmetic?

10. SUMMARY: THE 10 OPERATING CHARACTERISTICS OF LOSA.

a. Ten operating characteristics define and summarize the LOSA process. It is recommended that a LOSA observe all 10 characteristics to ensure the integrity of the LOSA process and the quality of the final product.

b. The 10 Operating Characteristics Are:

(1) **Jumpseat Observations During Normal Flight Operations.** LOSA observations are limited to regularly scheduled flights. Line checks, initial line indoctrination or other training flights are off-limits due to the extra level of stress put on pilots during this type of situation. Having another observer onboard adds to an already high stress level, thus providing an unrealistic picture of performance. In order for the data to be representative of normal operations, LOSA observations should be collected on regular and routine flights.

(2) **Joint Management/Pilots' Association Sponsorship.** In order for LOSA to succeed as a viable safety project, there needs to be support not only from the management side but also from the pilots. The joint sponsorship provides a "check and balance" for the project to ensure that change, as necessary, will be made as a result of LOSA data. When considering whether to conduct a LOSA, the first question to be asked by airline management is whether the pilots' association (or pilot group representatives) endorses the project. If the answer is "No," the project should not be initiated until endorsement is obtained.

(3) **Voluntary Crew Participation.** Maintaining the integrity of LOSA within an airline and the industry as a whole is extremely important for long-term success. To accomplish this goal, all LOSA observations are collected with voluntary crew participation. Before conducting LOSA observations, observers should first ask the flightcrew for permission to be observed. If the crew declines, the observer takes another flight with no questions asked. If an airline conducting a LOSA has an unreasonably high number of declines, this should serve as an indicator that there are critical "trust" issues to be resolved.

(4) Deidentified, Confidential, and Nondisciplinary Data Collection. LOSA observers are required to not record names, flight numbers, dates, or any other information that can identify a crew or individual. The purpose of LOSA is to collect safety data, not to punish pilots. Airlines cannot allow themselves to squander a unique opportunity to gain insight into their operations by having pilots fearful that a LOSA observation could be used against them for disciplinary reasons. If a LOSA observation is ever used for disciplinary reasons, the credibility of the entire safety program may be irreparably compromised.

(5) Targeted Observation Form. The LOSA observation form in Appendix 3 is predicated on the TEM framework described in Appendix 1. However, other conceptual frameworks can be used for LOSA data collection. Whatever framework is used, it should generate meaningful data on a variety of topics, including what the crews did well, what they did poorly, and how they managed each phase of flight. A narrative written by the observer should have sufficient detail to allow others to understand the flight and all its events. The observers need to describe the environmental conditions and events surrounding the pilots' behavior so that the crews' performance can be understood in full context.

(6) Trained and Calibrated Observers. Primarily, pilots conduct LOSA. Observation teams will typically include line pilots, instructor pilots, safety pilots, management pilots, and representatives of the pilots' safety committee. It is critical to select observers that are respected and trusted within the airline to ensure line acceptance of LOSA. After observers are selected, they are trained and calibrated in the LOSA methodology, including the use of the LOSA observation form. Observers' training in the concepts and methodology of LOSA will ensure that the observations will be conducted in the most standardized manner (see Appendix 2).

(7) Trusted Data Repository. In order to maintain confidentiality, airlines should have a trusted data repository. This site can be in-house, such as that used for other confidential data, or it can be offsite. The goal is that no individual observations will be misplaced or improperly disseminated through the airline.

(8) Data Verification. Data-driven programs like LOSA require quality data management procedures and consistency checks. For LOSA, these checks are done at data-verification roundtables. A roundtable consists of three or four department and pilots' association representatives who review all the raw data for possible inaccuracies. The end product is a database that is validated for consistency and accuracy according to the airline's standards and manuals before any statistical analysis is performed.

(9) Targets for Enhancement. The final product of a LOSA is the data-derived targets for enhancement based on emergent patterns in the data. It is then up to the airline to develop an action plan based on these targets, using experts from within the airline to analyze the targets and implement appropriate change strategies.

(10) Feedback Results to the Line Pilots. In order to ensure long-term success of LOSA, airlines should communicate the results back to the line pilots. Pilots will want to see not only the results of the audit, but also management's plan for improvement.

ORIGINAL SIGNED BY
CAROL E.GILES (for)

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APPENDIX 1. THREAT AND ERROR MANAGEMENT

1. Introduction.

The Threat and Error Management (TEM) model is a conceptual framework for understanding operational performance in complex environments. Originally created to capture the flightcrew's task in commercial aviation, the model is generic and can be applied to numerous work situations. The added value that TEM brings to other performance models is that it focuses simultaneously on the operating environment and the humans working in that environment. Because the model captures ongoing performance in its "natural" or normal operating context, the resulting description is realistic, dynamic, and holistic. Because the model can also quantify the specifics of the environment and the effectiveness of performance in that environment, it is also highly diagnostic¹.

There are several ways of using the TEM model, from focusing on a single event (as is the case with accident/incident analysis) to understanding systemic patterns in a large set of events (as with Line Operations Safety Audits (LOSA)). As a training tool, TEM can help individuals clarify their performance needs and vulnerabilities; and as part of a safety management system, TEM can help an organization measure and improve the effectiveness of its organizational defenses and safeguards.

2. The Model.

This section defines and provides examples of the various components of the TEM model.

a. Threats.

A threat is defined as an event or error that occurs outside the influence of the flightcrew (i.e., it was not caused by the crew), increases the operational complexity of a flight, and requires crew attention and management if safety margins are to be maintained.

There are threats from the environment—adverse weather, airport conditions, terrain, traffic, and air traffic control (ATC)—and threats emanating from within the airline—aircraft malfunctions and master equipment list (MEL) items, problems, interruptions, or errors from dispatch, cabin, ground, maintenance, and the ramp. The crew, for example, may anticipate threats by briefing a thunderstorm in advance; or they may be unexpected, occurring suddenly and without warning such as in flight aircraft malfunctions. Some threats are easily resolved and quickly dismissed from the crew's workload, while other threats require greater attention and management. A mismanaged threat is defined as a threat that is linked to or induces flightcrew error.

b. Errors.

¹ The rest of this appendix will talk about TEM exclusively in the aircraft piloting environment so as to provide specific examples and situations. However, it is important to remember that the TEM framework can be applied to other high-risk jobs. To do so requires task and situational analyses by subject matter experts to develop the relevant threat and error taxonomies.

Crew error is defined as action or inaction that leads to a deviation from crew or organizational intentions or expectations. Errors in the operational context tend to reduce the margin of safety and increase the probability of adverse events.

Broadly speaking, there are handling errors (flight controls, automation), procedural errors (checklists, briefings, callouts) and communication errors (with ATC, ground, or pilot-to-pilot). See the error management worksheet in the sample observation form, Appendix 3, for a more complete list of errors.

Understanding how the error was managed is as important, if not more important, than understanding the prevalence of different types of error. It is of interest then if and when the error was detected and by whom, as well as the response(s) upon detecting the error, and the outcome of the error. As with threats, some errors are quickly detected and resolved, leading to an inconsequential outcome, while others go undetected or are mismanaged. A mismanaged error is defined as an error that is linked to or induces additional error or an undesired aircraft state.

c. Undesired Aircraft States.

An UAS is defined as a position, condition, or attitude of an aircraft that clearly reduces safety margins and is a result of actions by the flightcrew. It is a safety-compromising state that results from ineffective error management. Examples include unstable approaches, lateral deviations, firm landings, and proceeding towards wrong taxiway/runway (more examples are noted on the observation form in Appendix 3). Events such as equipment malfunctions or ATC command errors can also place the aircraft in a compromised position, but these would be considered threats.

As with errors, UASs can be managed effectively, returning the aircraft to safe flight, or the crew action or inaction can induce an additional error, incident, or accident.

d. Threat and Error Countermeasures.

A description of a flight is not complete without noting what the crew was doing to anticipate threats and avoid errors, as well as managing those that occurred. The following crew behaviors are considered threat and error countermeasures:

- Planning countermeasures—planning, preparation, briefings, contingency management—are essential for managing anticipated and unexpected threats
- Execution countermeasures—monitor/cross-check, taxiway/runway management, workload, and automation management—are essential for error detection and error response
- Review/modify countermeasures—evaluation of plans, inquiry—are essential for managing the changing conditions of a flight

In addition to crew behaviors, TEM countermeasures also include equipment and procedural countermeasures. Warning systems such as ground proximity warning systems (GPWS) and weather alerts can be considered threat countermeasures, just as checklists and well-written procedures provide the means for error avoidance and error detection.

In sum, the TEM model captures the dynamic activity that is a flightcrew planning and executing a flight in real time and under real conditions. The use of the model is that it can be applied proactively or reactively, at the individual, organizational, and/or systemic levels.

3. Practical Applications of the TEM Model.

a. TEM as a Training Tool.

TEM has been found to be an effective tool for human factors training programs at a number of airlines throughout the world². TEM training emphasizes the value of threat anticipation and management, error avoidance, and error detection and recovery. The model allows pilots to analyze their own performance strengths and vulnerabilities.

TEM concepts can be trained effectively in the classroom in the absence of LOSA. However, TEM training can be enhanced if an airline has also conducted a LOSA. The LOSA results can help shape the training curriculum, and pilots can discuss the findings during training. Pilots are always interested in and respond well to data derived from their own operation.

It is important to clarify that TEM is not crew resource management (CRM) and should not be considered a replacement for it. TEM and CRM refer to overlapping but not equivalent activities. CRM refers specifically to activities conducted by the crew to optimize performance. These activities include threat and error countermeasures such as briefing, contingency planning, and monitor/cross-checking, but they also include higher-order concepts such as leadership and establishing open communication in the cockpit. Similarly, TEM includes crew countermeasures, but it also encompasses equipment, procedural, and regulatory countermeasures.

As a training tool, TEM can help individuals clarify their performance needs and vulnerabilities from a different perspective. Hence, threat and error management concepts could be introduced and explored as one component of CRM training.

b. TEM as a Reporting Tool for Incidents.

Reporting forms structured to the TEM framework instruct the pilots to describe the event at the level of threats and errors. The TEM format prompts pilots to report information about the threats that were present, the errors they may have made, how well the event was managed, and how the event may have been avoided or handled better. Preliminary work has shown that even pilots who have not had training in the TEM model are able to complete the reporting form, a fact that speaks to the intuitive nature of the TEM framework.

² The International Civil Aviation Organization (ICAO) has adopted the TEM model in its Human Factors Training Manual (ICAO Document 9683, 2002)

In the ASAP environment, TEM can “go inside the pilot’s head” in a way that LOSA as an objective observational tool cannot do and most assuredly does not want to do. With ASAP, pilots can report personal or historical factors that contributed to the event – information that is not privy to an observer. With LOSA, the benefit is that observers may detect threats and errors that the crews themselves do not detect. This is one example of how LOSA and ASAP data can complement each other at the system level.

c. TEM as a Systematic Observation Tool.

The TEM model was first conceived in conjunction with the development of LOSA; hence, its original application was as an observation tool. As of the publication of this advisory circular (AC), feasibility studies are currently underway to explore the transfer of the methodology to airline flight dispatch and air traffic control (ATC). In 2002, one major airline began exploring an adapted version of LOSA called Dispatch Operations Safety Audit (DOSA). Early results demonstrated that such a transfer of methodology is possible and could ultimately provide a 360-degree perspective on the interaction between pilots and dispatchers. In addition, ICAO has instituted a formal group of ATC subject matter experts from across the world to develop the Normal Operations Safety Survey (NOSS), a formal protocol to observe normal operations in ATC, based on the TEM model and LOSA methodology.

d. TEM as a Reactive Analysis Tool for Accidents and Incidents.

TEM can be used as an analysis tool to understand rare events, such as accidents and serious incidents. For example, the International Air Transport Association (IATA) Safety Committee has adopted the TEM model as an analysis framework for its incident review meetings, based on its ease of use and utility of the extracted data.

e. TEM as a Proactive Analysis Tool.

When TEM is used as the framework for safety data collection, a wealth of information can be extracted. An airline can use the data to understand patterns at the organizational level. The data can also be collected across the industry and analyzed for systemic trends.

An analysis based on TEM can:

- Quantify those aspects of the working environment that can pose a problem for the efficiency or safety of the operation (threat prevalence)
- Quantify the management of those threats as either effective or ineffective (threat management)

- Recognize high rates of threat prevalence and mismanagement as systemic vulnerabilities
- Codify and quantify the errors that crews commit (error prevalence)
- Codify and quantify the error management process from diagnosis to response and outcome (error management)
- Recognize high rates of error prevalence and error mismanagement as systemic flaws in procedures, policies, training, aircraft design, and or interagency coordination, and
- Locate strengths as well as vulnerabilities in organizational safeguards

4. Conclusion.

The TEM model is intuitive, practical, and versatile. More and more airlines are realizing the use of TEM, as exemplified in the following quote from an airline manager:

“Since our LOSA, we have introduced a 1-day TEM course for our pilots. The overwhelming response has been positive, and there’s a recognition among pilots that in TEM, the academic community is using language we understand and feel. Additionally we are using TEM as a debriefing tool for training events. Once again this makes sense to the pilots, and the common reaction is one of dawning; penny-dropping; eureka!”

APPENDIX 2. TRAINING AND STANDARDIZING LOSA OBSERVERS

This appendix details the training and standardizing of Line Operations Safety Audits (LOSA) observers. Some of this material appears throughout the advisory circular (AC); this appendix draws that information together and provides more in-depth information.

1. Observer Training.

Observer training typically requires 2 to 3 days of classroom training with a followup session after one or two line observations. There are five topics that need to be covered in observer training:

- LOSA rationale and etiquette
- Company policies and procedures
- Observation form
- Threat and Error Management (TEM) concepts
- Narratives

a. LOSA Rationale and Etiquette.

Observers will likely have a rudimentary understanding of LOSA when selected for the project; however, they will need to fully understand the safety rationale for conducting a LOSA at their airline. A “big picture” perspective will help observers understand the “why” of LOSA and will underscore the importance of their role in the LOSA process. Also, the observers will be ambassadors for LOSA while observing on the line, and it is important that they be able to explain the process fully, to answer any questions that the line pilots may have, and allay any fears or concerns.

Specifically, the observers need to understand the safety rationale for normal operations monitoring—a discussion of proactive vs. reactive safety strategies is recommended. The observers also need to know how the data collected from the LOSA will be used to understand strengths and weaknesses in the operations. An overview of the whole process from observations to data cleaning and analysis, to the diagnostic report and the development of targets for enhancement is recommended.

Of course, the observers will also need to know the “how” of LOSA, specifically the etiquette associated with being a LOSA observer. An observer needs to learn how to approach a crew, how to ask permission to observe a flight, how to walk away so that the crew can discuss it, and to accept without question any crew’s decision to deny access to the cockpit. The observer should also carry a copy of the letter of endorsement jointly signed by management and pilots’ association to show any interested crew.

On the jumpseat, the observer’s behavior is best summarized as “a fly on the wall.” The observer needs to be unobtrusive, yet responsive to any queries the crew may have. The observer does not complete the observation form on the jumpseat—this would be a disconcerting distraction to the crew. Instead, the observer is encouraged to carry a small pocket notebook or

legal pad to jot down minimalist notes, just enough to jolt the memory when outside the cockpit and completing the full observation form.

LOSA observers should be trained to accept their role as observers, not evaluators—they are not check airmen. LOSA observers will observe errors and undesired aircraft states as part of their observations; however, they should only interrupt if they perceive the safety of the flight to be seriously and immediately endangered. A helpful rule of thumb is to ask observers to think of themselves as a guest riding in the jumpseat of another airline. This seems to help distance the observer from the flightcrew while still being able to politely point out safety concerns if they come about.

The LOSA observer is the only person in the whole LOSA process who has access to crew identities. It is essential, therefore, that observers are reminded throughout the training of their responsibilities in this regard. Confidentiality is paramount and observed crew behavior should not be discussed with anyone—not even other observers. Experience has shown that at the end of a flight, crews will often ask the observer to “debrief” their performance. In these circumstances, it is essential that the observer politely decline the invitation. This emphasizes the concept that the observer is not there to evaluate the crew, merely to record events.

LOSA observers should act in an unobtrusive and consistent manner so that line pilots have a similarly positive experience of LOSA, which in turn will favorably affect their receptivity to the final results and outcomes.

b. Company Policies and Procedures.

Observers need to be current with company policies and procedures so as to observe procedural adherence on the line and detect any deviations. Selecting active line pilots from the airline is one way to ensure this. Spending some time in the classroom reviewing procedures across fleets allows all observers to get “up to speed” on the fleets they will be observing. All observers should also be encouraged to review the manuals as homework.

c. Observation Form.

This subsection refers to the mechanics of correctly completing and submitting a LOSA observation form. During the training, the observers work to develop the needed competencies as defined by the observation form. Hence, observers should see the observation form as soon as possible after the training begins so that they have a clear sense of what is expected of them. With the observation form in hand, the observers can be led through the various sections, and then practice using case studies (see next subsection).

If the observation form is software-based, time should be spent ensuring that all observers have the necessary computer skills to open the form, enter and edit data, and submit the observation. Mastering these skills in the classroom will avoid potential loss of data later in the LOSA due to computer error. Observers should have the name of a contact person in case of computer problems.

d. TEM Concepts.

If the airline is using TEM as the basis of its LOSA, observers need to receive training in the framework. Specifically, observers need to be able to define, distinguish, and identify threats, errors, and undesired aircraft states. This is best achieved with a mixture of lecture, case studies, and review. Lecture material should include multiple examples of each type of threat, error, and undesired aircraft state, and case studies can take the form of scripted vignettes and/or actual accident and incident report excerpts. The distinction between threats, errors, and undesired aircraft states becomes clear with practice and observers are usually able to correctly distinguish examples of all three categories in 2 days or fewer of classroom involvement. Some training examples are provided in Appendix 5.

e. Narratives.

Observers need training in writing the flight narrative. If they understand the concepts underlying the observation form as well as the diagnostic rationale for conducting a LOSA, the observers will realize that a good-quality narrative is imperative. The observation form should contain several prompts to help the observer provide sufficient detail and observers should be encouraged to “overwrite” the flight rather than provide too little detail. In particular, observers need to record events that happened, such as threats, errors, or undesired aircraft states, the context in which they happened, and the crew’s response and management of the event. Observers are selected because they are experts at understanding flight operations and this expertise is best expressed in detailed narratives. As long as the observer provides a detailed narrative of the flight, any coding oversights can be remedied later in the data-cleaning process.

f. Training Objectives.

In sum, at the end of LOSA observer training, an observer should be able to:

- (1) Knowledgeably and confidently explain the rationale and process for conducting a LOSA at the airline;
- (2) Enact the LOSA observer etiquette in a professional and consistent manner;
- (3) Demonstrate knowledge of company policies and procedures;
- (4) Use the observation form accurately and comprehensively;
- (5) Understand the theoretical framework of the observation form. If the tool is based on TEM concepts, the observer should be able to define, distinguish, and identify threats, errors, and undesired aircraft states; and
- (6) Write detailed and comprehensive flight narratives from which others will be able to understand the full context of the flight and related events.

Members of the LOSA steering committee may want to attend LOSA observer training at another airline or attend an industry-sponsored LOSA conference for further guidance before designing the training.

2. Observer Standardization.

Standardization refers to the need to be sure that flight details are recorded in a systematic and consistent fashion. In LOSA, standardization is a multi-step process that involves standardizing the observers and conducting followup data-cleaning and coding of completed observations.

The first step in any observer standardization is good-quality training. To be sure observers understand the concepts, group discussions are encouraged. Focusing on the finer points of the model and the observation form, these discussions help calibrate the observers to a common standard. A test can be administered at the end of the training to be sure that all observers have grasped the necessary knowledge and can demonstrate the required competencies as specified by the training objectives. If observers complete this test satisfactorily, they can be released to the line to complete one or two “trial” observations.

The LOSA project coordinator or trainer should schedule time with each observer to discuss their trial observations. If the observer does a good job, as evidenced particularly by the quality of the narrative, the observations can be retained and used in the LOSA, and the observer can be sent back out to complete their observations. If the quality of the narrative is poor (e.g., lacking sufficient detail), the trainer can work with the observer to help draw out missing information. If the observer has forgotten details and cannot recreate the flight, the observation should be discarded, and the observer sent out to complete another trial observation. It is the LOSA coordinator’s decision to drop any observer from the observation team if that person fails to meet the required standard. For this reason, it can be a good idea to initially recruit and train more observers than needed, to allow for attrition, illness, and scheduling conflicts.

a. Data Standardization. There are several supplementary techniques that ensure good-quality standardized data are used in a LOSA.

First, observers are not asked to evaluate performance, but simply to observe it. From a data standpoint, this is the distinction between subjective judgment and objective observation. For example, observers are asked to note threats without any subjective judgment—if there is a thunderstorm, record it; if there is an aircraft malfunction or ground maintenance problem, record it. It is the same for errors and undesired aircraft states. Observers also note the crew’s response to the threats, errors, and undesired aircraft states and the outcome. The observer is not assessing crew performance or providing a subjective evaluation—the observer is telling the story of the flight.

Second, the data analyst always checks observation forms submitted by observers against the narrative. Observers are expert at describing a flight—they are not necessarily expert at assigning codes to the various threats, errors, etc., especially if it is their first time as a LOSA observer. While training is given in the codes, nonetheless it is realistic to accept that observers won't necessarily retain this information perfectly. The narrative is the “fail-safe” in the system in that it allows the analyst to read the events of the flight and match them to the observer's codes. Because the analyst *is* the expert with the codes, he or she can add any codes that were missed and recode anything that might not be quite correct. Hence, a good-quality narrative is the ultimate key to standardized data. Observers provide a comprehensive narrative, and the analyst ensures consistent and accurate coding.

A third step in standardizing the LOSA data prior to analysis involves verifying the data with a team of local experts—airline personnel familiar with the operation of each fleet (possibly fleet managers or representation of the airline's operations, member of the steering committee, but not any of the observers). The group's task is to review and verify the observations against current manuals, policies, and procedures. For example, an observer might log a procedural error for failure to make an approach callout when, in fact, there is no written procedure in the airline's flight operations manual. The “error” would then be deleted from the database. The data verification group acts as a check on the analyst's coding, ensuring events are correctly recorded in line with each fleet's procedures and policies. It also builds ownership in the results and dispels any later criticism that the coding was not accurate.

In sum, there are several methods that ensure that LOSA data are consistently and accurately recorded:

- Observers are trained, calibrated, tested, and recalibrated
- Objective observation, not subjective evaluation, is the basis and outcome of the observation
- The narrative is stressed as key to high-quality data
- The data analyst applies consistent coding to the observations
- The data verification group checks the analyst's coding against specific procedures

Following the above steps will ensure reliability and validity of the data analyzed from LOSA observations.

APPENDIX 3. SAMPLE LOSA OBSERVATION FORM

LOSA Observation Form

Observer Information

Observer ID (Employee number)	<i>3059</i>	Observation Number	<i>#1</i>
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Crew Observation Number (e.g., "1 of 2" indicates segment one for a crew that you observed across two segments)	<i>1</i>	of	<i>1</i>
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Flight Demographics

City Pairs (e.g., PIT-CLT)	<i>PIT - LAX</i>		
A/C Type (e.g., 737-300)	<i>B-757</i>		
Pilot flying (Check one)	CA	<input type="checkbox"/>	FO <input checked="" type="checkbox"/>

Time from Pushback to Gate Arrival (Hours:Minutes)	<i>4:55</i>	Local Arrival Time (Use 24 hour time)	<i>09:55</i>
Late Departure? (Yes or No)	<i>Yes</i>		

Predeparture / Taxi

Narrative	Your narrative should provide a context. What did the crew do well? What did the crew do poorly? How did the crew manage threats, crew errors, and significant events? Also, be sure to justify your behavioral ratings.
<p><i>The CA established a great team climate - positive with open communication. However, he seemed to be in a rush and not very detail oriented. The FO, who was relatively new to the A/C, tried to keep up but fell behind at times. The CA did not help the cause by interrupting the FO with casual conversation (marginal workload management).</i></p> <p><i>All checklists were rushed and poorly executed. The CA was also lax verifying paperwork. This sub-par behavior contributed to an undetected error - the FO failed to set his airspeed bugs for T/O (poor monitor/cross-check). The Before Takeoff Checklist should have caught the error, but the crew unintentionally skipped over that item. The FO noticed the error upon commencing the takeoff roll and said, "Missed that one."</i></p> <p><i>The Captain's brief was interactive but not very thorough (marginal SOP briefing). He failed to note the closure of the final 2000' of their departing runway (28R) due to construction. Taxiways B7 and B8 at the end of the runway were also out. The crew was marked "poor" in contingency management because there were no plans in place on how to deal with this threat in the case of a rejected takeoff. Lucky it was a long runway.</i></p>	

APPENDIX 3. SAMPLE LOSA OBSERVATION FORM (Continued)

Takeoff / Climb

Narrative	Your narrative should provide a context. What did the crew do well? What did the crew do poorly? How did the crew manage threats, crew errors, and significant events? Also, be sure to justify your behavioral ratings.
<p><i>Takeoff was normal. ATC granted a right turn VFR climb which was commenced at 600 ft. Climb to flight level 20000 with step climbs to 35000 ft. Eventually leveled at 31000 ft about 90 miles North. When established at FL200, ATC cleared the crew to FL270. They accepted and the First Officer dialed 230 instead of 270 in the MCP. The Captain caught the error on cross-verification.</i></p>	

Cruise

Narrative	Your narrative should provide a context. What did the crew do well? What did the crew do poorly? How did the crew perform during the handover?
<p><i>Crew stayed attentive to aircraft position throughout cruise.</i></p>	

APPENDIX 3. SAMPLE LOSA OBSERVATION FORM (Continued)

Descent / Approach / Land / Taxi

Narrative	Your narrative should provide a context. What did the crew do well? What did the crew do poorly? How did the crew perform during the handover?
<p><u>Briefing to TOD</u> - The approach brief much better than their takeoff brief. They expected runway 25L from the Civet Arrival for a straight-in visual approach. Jepp charts were out, contingencies talked about, and everything was by the book (outstanding SOP brief and plans stated).</p> <p><u>10000' to slowing and configuring</u> - ATC cleared the crew to 25L, but at 8000', ATC changed us to the Mitts Arrival for runway 24R due to a slow moving A/C on 25L. The CA changed the arrival and approach in the FMC, tuned the radio, and quickly briefed 24R. As soon as everything was clean, ATC called back and told the crew they could either land on 25L or 24R at their discretion. Since time was a factor, the crew discussed and decided to stick with the approach into 24R. The crew was flexible and the CA did a nice job assigning workload. FO flew the plane while the CA checked everything over one more time (outstanding evaluation of plans). The crew was also better monitors and cross checkers. However, their execution of checklists was still a little sloppy - late and rushed (marginal monitor and cross check)</p> <p><u>Bottom lines to Flare / Touchdown</u> - The approach was stable, but the FO let the airplane slip left, which resulted in landing left of centerline. Since the FO was new to this aircraft (1 month flying time), the observer chalked it up to a lack of stick and rudder proficiency.</p> <p><u>Taxi-in</u> - The crew did a great job navigating taxiways and crossing the active 24L runway. Charts were out and both heads looking for traffic. (outstanding taxiway / runway management). However, there were no wing walkers meeting the aircraft in a congested ramp area.. A common problem in LAX.</p>	

Overall Flight

Narrative	This narrative should include your overall impressions of the crew.
<p>Overall, the crew did a marginal job with planning and review/modify plans during predeparture. However, during the descent/approach/land phase, it was excellent. Their execution behaviors were marginal to good for the entire flight.</p> <p>While the takeoff brief was marginal, the CA made an outstanding approach brief. Open communication was not a problem. Good flow of information when the flight's complexity increased with the late runway change. They really stepped it up.</p> <p>During predeparture, the CA introduced an unnecessary element of being rushed, which compromised workload management. However, his decisiveness and coordination in the descent/approach/land phase kept his leadership from being marked "marginal."</p> <p>The big knock against this crew involved checklists, cross verifications, and all monitoring in general. They were a little too complacent during low workload periods (e.g., No altitude verifications during climb). The CA set a poor example in this regard. When the workload increased, the crew did a good job.</p>	

APPENDIX 3. SAMPLE LOSA OBSERVATION FORM (Continued)

Threat Management Worksheet

Threat ID	Threat Description			Threat Management	
	Describe the threat	Threat Type	Phase of Flight 1 Predepart / Taxi 2 Takeoff/Climb 3 Cruise 4 Des/App/Land 5 Taxi-in	Linked to flight crew error? (Yes / No)	How did the crew manage or mismanage the threat?
T1	Runway and taxiway construction on their departing runway (final 2000')	103	1	No	Threat mismanaged - CA failed to include the construction and closures in his brief. No plans were made in the event of a rejected takeoff, which is required by airline SOP.
T2	Late ATC runway change - changed runway to 24R from 25L due to a slow moving aircraft on 25L	101	4	Yes	Threat managed - CA reprogrammed the FMC, handled the radios, and placed emphasis on the FO to fly the aircraft.
T3	After a late runway change, ATC called back and told the crew that it was at their discretion to land on 24R or 25L	101	4	Yes	Threat managed - CA asked for the FO's preference. They mutually decided to continue the approach into 24R because it was already in the FMC.
T4	On taxi-in, there were no wing walkers meeting the aircraft in a congested ramp area in LAX	204	5	Yes	Threat managed - The crew called ground ops and wing walkers were dispatched to the airplane
T5					
T6					
Threat Codes					
Environmental Threats			Airline Threats		
100 Adverse Weather	103 Airport Conditions	200 Airline Operational Pressure	204 Ground / Ramp		
101 ATC	104 Heavy traffic (air or ground)	201 Cabin	205 Dispatch / Paperwork		
102 Terrain	199 Other Environmental Threats	202 Aircraft Malfunctions / MEL Items	206 Manuals / Charts		
		203 Ground Maintenance	299 Other Airline Threats		

APPENDIX 3. SAMPLE LOSA OBSERVATION FORM (Continued)

Error Management Worksheet

Error ID	Error Description			Error Response / Outcome		Error Management	
	Describe the crew error	Phase of flight 1 Predepart / Taxi 2 Takeoff/Climb 3 Cruise 4 Des/App/Land 5 Taxi-in	Linked to threat? (If Yes, enter the Threat ID)	Error Type	Crew Error Response 1 Detected 2 No response	Error Outcome 1 Inconsequential 2 Undesired state 3 Additional error	How did the crew manage or mismanage the error?
E1	<i>CA failed to brief a rejected takeoff for shortened departing runway due to construction.</i>	1	T1	403	2	1	<i>No error management.</i>
E2	<i>FO failed to set his airspeed bugs.</i>	1		304	2	3	<i>Linked to error #3</i>
E3	<i>In running the Before Takeoff Checklist, the FO skipped the takeoff data item.</i>	1		401	2	2	<i>Linked to UAS #1</i>
E4	<i>At FL200, the crew was cleared to FL270. They accepted and the FO dialed 230 instead of 270 in the Mode Control Panel.</i>	2		302	1	1	<i>Error managed - Captain caught the error on cross-verification.</i>
E5	<i>FO, hand flying, let the airplane slip a little to the left during the final approach.</i>	4		300	2	2	<i>Linked to UAS #2</i>
Error Type Codes							
Aircraft Handling		Procedural			Communication		
300 Manual Flying 301 Flight Control 302 Automation 303 Ground Handling 304 Systems / Instruments / Radios 399 Other Aircraft Handling		400 SOP Cross-verification 401 Checklist 402 Callout 403 Briefing 404 Documentation 499 Other Procedural			500 Crew to External Communication 501 Crew to Crew Communication 599 Other Communication		

APPENDIX 3. SAMPLE LOSA OBSERVATION FORM (Continued)

Undesired Aircraft State (UAS) Management Worksheet

UAS ID	UAS Description		UAS Response / Outcome			UAS Management
	Linking Error? (Enter the Error ID)	Undesired aircraft state description	UAS Code	Crew UAS Response 1 Detected 2 No response	UAS Outcome 1 Inconsequential 2 Additional error	How did the crew manage or mismanage the undesired aircraft state?
UAS 1	E2	Wrong airspeed bugs on takeoff roll	1	1	1	<i>Errors mismanaged - The bug error should have been caught with the Before Takeoff Checklist, but the FO missed the item. The FO detected and corrected the error on the roll.</i>
UAS 2		FO landed left of the centerline.	86	1	1	<i>Error mismanaged - FO tried to correct but still landed left of the centerline. Approach was stable and made the first high-speed taxiway.</i>
UAS 3						
Undesired Aircraft State Type Codes						
Configuration States		Aircraft Handling States - All Phases		Approach / Landing States		
1 Incorrect A/C configuration - flight controls, brakes, thrust reversers, landing gear.		40 Vertical deviation		80 Crew induced deviation above G/S or FMS path		
2 Incorrect A/C configuration - systems (fuel, electrical, hydraulics, pneumatics, air-conditioning, pressurization, instrumentation)		41 Lateral deviation		81 Crew induced deviation below G/S or FMS path		
3 Incorrect A/C configuration - automation		42 Unnecessary WX penetration		92 Unstable approach		
4 Incorrect A/C configuration - engines		43 Unauthorized airspace penetration		93 Continued landing - unstable approach		
Ground States		44 Speed too high		94 Firm landing		
20 Proceeding towards wrong runway		45 Speed too low		95 Floated landing		
21 Runway incursion		46 Abrupt aircraft control (altitude)		96 Landing off CL		
22 Proceeding towards wrong taxiway / ramp		47 Excessive banking		97 Long landing outside TDZ		
23 Taxiway / ramp incursion		48 Operation outside aircraft limitations		98 Landing short of TDZ		
24 Wrong gate				99 Other Undesired States		
25 Wrong hold spot						
26 Abrupt aircraft control - taxi						

APPENDIX 3. SAMPLE LOSA OBSERVATION FORM (Continued)

Crew Performance Marker Worksheet

1	2	3	4
Poor	Marginal	Good	Outstanding
Observed performance had safety implications	Observed performance was adequate but needs improvement	Observed performance was effective	Observed performance was truly noteworthy.

Planning Performance Markers		Phase of Flight Ratings		
		Predeparture / Taxi	Takeoff / Climb	Descent / Approach / Land / Taxi
SOP BRIEFING	The required briefing was interactive and operationally thorough	2		4
PLANS STATED	Operational plans and decisions were communicated and acknowledged	3		4
CONTINGENCY MANAGEMENT	Crew members developed effective strategies to manage threats to safety	1		3
Execution Performance Markers				
MONITOR / CROSS-CHECK	Crew members actively monitored and cross-checked systems and other crew members	1	1	2
WORKLOAD MANAGEMENT	Operational tasks were prioritized and properly managed to handle primary flight duties	2	3	3
VIGILANCE	Crew members remained alert of the environment and position of the aircraft	3	3	3
AUTOMATION MANAGEMENT	Automation was properly managed to balance situational and/or workload requirements			3
TAXIWAY / RUNWAY MANAGEMENT	Crew members used caution and kept watch outside when navigating taxiways and runways	3		4
Review / Modify Performance Markers				
EVALUATION OF PLANS	Existing plans were reviewed and modified when necessary			4
INQUIRY	Crew members not afraid to ask questions to investigate and/or clarify current plans of action	3		3

Overall Performance Markers		Ratings
COMMUNICATION ENVIRONMENT	Environment for open communication was established and maintained	3
LEADERSHIP	Captain showed leadership and coordinated flight deck activities	3

APPENDIX 4. SAMPLE LETTER TO THE LINE PILOTS

To: All XX Airline Pilots
From: (Name) Senior Director, Flight Operations
(Name) Director, Flight Training and Standards
(Name) Director, Flight Safety and Quality Assurance
(Name) Chairman, Pilots' association Safety Committee
Subject: Line Operations Safety Audit (LOSA)

Beginning mid-October and continuing for approximately five weeks, this airline will conduct a Line Operations Safety Audit (LOSA). LOSA observations are no-jeopardy events, and all data are confidential and de-identified. LOSA data go directly to the XX Research Program for data entry and analysis.

We will use our own active pilots to conduct cockpit jumpseat observations. Be assured that these observations are not checkrides. Although some LOSA observers may be check airmen, they are not there to critique your performance - their mission is to be an unobtrusive observer and to fill out data collection forms after the flight is completed.

The ultimate customer of the audit is you, the line pilot. The audit should help us identify problem areas so that we can correct them and make your job easier. Did you ever see a procedure that could be done better, but didn't feel like you had a way to feed that idea into the system for possible change? Are some procedures better than others as far as helping avoid, trap and mitigate errors? LOSA should help us identify the strengths and weaknesses of our crew procedures, and with that information, management is committed to making necessary changes to continually improve the way that we do business.

In short, we're doing a LOSA so that we can improve the system to better support you. After the audit is completed, we're committed to telling you how it went, and how we plan to make improvements.

Please extend your usual professional courtesies to the LOSA observation team, and thank you for your unfailing cooperation.

Sincerely,

(Name), Senior Director, Flight Operations
(Name), Director, Flight Training and Standards
(Name), Director, Flight Safety and Quality Assurance
(Name), Chairman, Pilots' association Safety Committee

APPENDIX 5. SAMPLE VIGNETTES FOR OBSERVER TRAINING

Case Study One – Read the following and list all threats, errors, and undesired aircraft states as well as the flightcrew response and outcome.

Predeparture / Taxi-out – The Captain requested an extra 5000 pounds of fuel to be loaded. After ground confirmed the fueling, the First Officer alerted the Captain that they were 2000 pounds off. The Captain radioed back to ground and the missing 2000 pounds was loaded.

Solution – One threat, no errors or undesired aircraft states

Threat #1 – Ground Handling Threat – The ground crew failed to load the all 5000 lbs of requested fuel – The flightcrew response was the First Officer detecting and correcting the shortage. The outcome was inconsequential.

Case Study Two – Read the following and list all threats, errors, and undesired aircraft states as well as the flightcrew response and outcome.

Descent / Approach - While descending through 18000 feet, the First Officer performed the entire descent checklist from memory, which is against standard operating procedures. The Captain noticed the First Officer doing it but chose to ignore it. In the end, everything was set correctly.

Solution – No threats, one error and no undesired aircraft states

Error #1 – Checklist Error – The FO performed the descent checklist from memory. The flightcrew response was the captain detecting the error but failing to correct (ignored). The outcome was inconsequential

Case Study Three – Read the following and list all threats, errors, and undesired aircraft states as the flightcrew response and outcome.

Descent / Approach / Land – During a 30-degree bank on a visual approach, the Captain unwillingly allowed the aircraft to get 15 knots below minimum maneuvering speed. While it should have been detected sooner, the low speed was eventually pointed out by the First Officer. The Captain said thanks and immediately increased the speed.

Solution – No threats, one error and one undesired aircraft state

Error #1 – Aircraft Handling Error – The Captain allowed the speed to decay during a bank turn. No one detected the decay before it dropped below minimum maneuvering speed. Therefore, the error was undetected and linked to an undesired aircraft state.

Undesired Aircraft State #1 - As soon as the speed went below minimum maneuvering speed, the aircraft was in an undesired aircraft state that was detected by the First Officer and corrected by the Captain. The final undesired aircraft state outcome was inconsequential.