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Introduction of ramp-LOSA at KLM Ground Services

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Abstract

Airline ground operations are subject to the conflicting demands of short turn-around times and safety requirements. They involve multiple parties, but are less regulated than airborne processes. Not surprisingly, more than a quarter of all aircraft incidents occur on the ground. These incidents lead to aircraft damage and associated costs, risk of injuries, and can potentially impact in-flight safety. KLM Ground Services has targeted platform safety performance as an area for improvement. However, existing safety awareness programs have had limited effect. A direct link between safety culture surveys and safety performance has not been established, and therefore these are insufficient to give adequate feedback on interventions. Newly developed by the Texas University are the Line Operations Safety Assessments (LOSA), first targeted at cockpit operations. Variants are available since October 2010 for the platform and maintenance environments. The research group for Aviation Engineering at the Amsterdam University of Applied Sciences has used the original platform LOSA material and tailored these to the specific circumstances at KLM. Results to date show that with these modifications, platform LOSA is a useful tool to quantify safety performance and to generate trend data. The effect of safety interventions can now be monitored.

Background

Ramp Line Operations Safety Assessments (LOSA) are part of an audit system developed for airport ground operations (i.e. activities on the so-called platform or ramp) based on the cockpit LOSA system (ICAO, 2002; FAA, 2006). Cockpit LOSA has been effective in identifying areas to target to improve safety, triggering a 70% reduction of checklist errors and a 60% reduction in unstable approaches (Gunther, 2006). Both cockpit and ramp LOSA build on the threat and error management model (Helmreich et al. 1999) and adopt standard LOSA guidelines: peer to peer observations, anonymity, confidential and non-punitive data collection, voluntary participation, trusted and calibrated observers, union cooperation, systematic observations, secure data collection repository, data verification roundtables, targets for enhancement and feedback to workers. Ramp LOSA tools are available on the FAA website (FAA, 2010) in the form of a threat and error management model, threat and error codes, observation forms, software and training material.

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KLM Ground Services is the platform handling department of Air France – KLM at Amsterdam Airport Schiphol. The department consists of three operational sections which are controlled by a Hub Control Centre: Passenger Services, Baggage Turnaround Services and Aircraft Services. Besides the operational departments Ground Services operates six staff departments. Operational Integrity is one of these and handles amongst others ground safety. Activities on the platform that are executed under supervision of Operational Integrity include baggage services, pushback and towing, catering and onboard supply, cleaning, aircraft refuelling, and water and toilet services.

KLM Ground Services has a relatively high number of incidents compared to other divisions within KLM, leading to lost labour time, damages and delays. In the past, KLM Ground Services utilized so-called Ground Safety Audits to proactively manage safety, but these were discontinued because they did not deliver sufficient diagnostic data. Ramp LOSA seems to suit KLM because it focuses on the whole turnaround compared to the arrival-only scope of the Ground Safety Audits, it generates useful data, and supplements current safety initiatives at KLM Ground Services.

Theoretical foundation

Line Operations Safety Assessments are based on two theoretical concepts: the safety pyramid and threat and error management. The significance of ramp LOSA for safety improvement lies in the former. The theory of threat and error management is as yet insufficiently mature to perform as a framework for ramp LOSA.

Safety pyramid or iceberg

As in many safety-critical companies, KLM classifies safety related occurrences into four different categories: substantial (safety is not ensured, enhanced protective measurements are urgently required), high (safety is not ensured, protective measurements are urgently required), medium (safety is partially guaranteed, normal protective measures are required), and small (safety is largely guaranteed). The relative frequency of these for Ground Services is approximately[•] 1 : 100 : 500 : 1000. Because occurrences are reported ex post facto, the latter two categories are underrepresented: “occurrences” without consequences are only reported in isolated cases (Hobbs & Kanki 2008).

LOSA constitutes “a principled, data-driven approach to prioritize and implement actions to enhance safety” (ICAO, 2002). Ramp LOSA is a program for the measurement of human error in ground handling. The system captures the whole ground handling process in normal operations from arrival to departure using tools which are openly available. A LOSA report will include threats and errors that do not lead to occurrences and are not usually reported elsewhere. The well-managed turn-arounds that are also sampled are the frame of reference for the interpretation of

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[•] Exact figures are company confidential error data. According to the FAA, “LOSA provides unique data about an airline’s defenses and vulnerabilities [and] forms a unique and complementary tool to incident reporting and [existing] safety audits” (FAA, 2006). LOSA therefore identifies errors (or lack thereof) at the bottom at the iceberg. Interventions aimed at improving performance here will logically reduce occurrences throughout the iceberg.

Threat and error management

The threat and error framework that ICAO and the FAA propagate is shown in figure 1 (ICAO, 2002; FAA, 2010). A threat is defined as an event or error that occurs outside the influence of the individuals being observed, increases the operational complexity of their task, and requires their attention and management if safety margins are to be maintained. A mismanaged threat is defined as a threat that is linked to or induces an error. Errors are defined as (in)actions that lead to a deviation from the individual’s or the organizational intentions or expectations. Errors in the operational context tend to reduce the margin of safety and increase the probability of adverse events. A mismanaged error is defined as an error that is linked to or induces additional error or an undesired state.

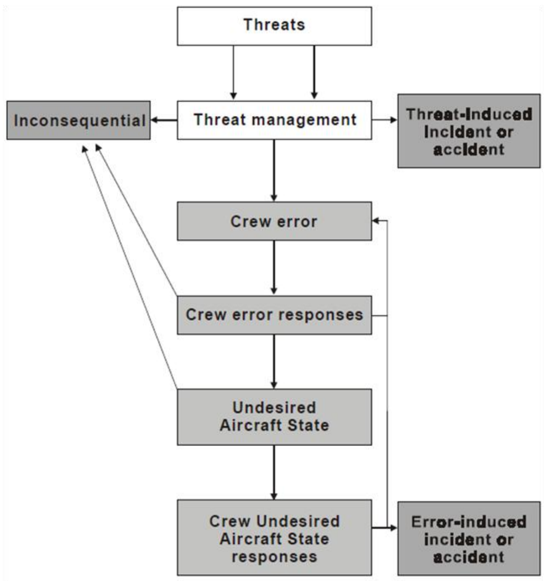

Figure 1. ICAO threat and error model

The model is based on earlier models developed at the University of Texas at Austin Human Factors Project (Helmreich et al. 1999). The schematic representation of the model and the wording in the ramp LOSA guidance material imply that errors are a result of external or internal threats, such as faulty equipment, adverse weather (external) or fatigue (internal). However, “errors can [also] be the result of a momentary slip or lapse” (Merritt & Klinect 2006) and therefore a threat need not necessarily precede an error. In fact, Klinect, Wilhelm et al. found for cockpit LOSA that less than 10% of crew errors had a threat as precedent (Klinect et al. 1999).

Similar low numbers (if not even less) are expected on the platform, where tasks are often executed with less adherence to formal procedures. As a consequence, the link between threats and errors is expected to be sporadic. The identification and resolution of threats may only have a limited effect on safety, despite the desirability for those being observed to focus on external factors to justify errors. Also, the identification of threats is susceptible to hindsight bias (Dekker 2006; Woods et al., 2010).

A model reflecting a less prominent role for threats has been developed by Delta Airlines (Delta Airlines 2007) and is reproduced in figure 2.

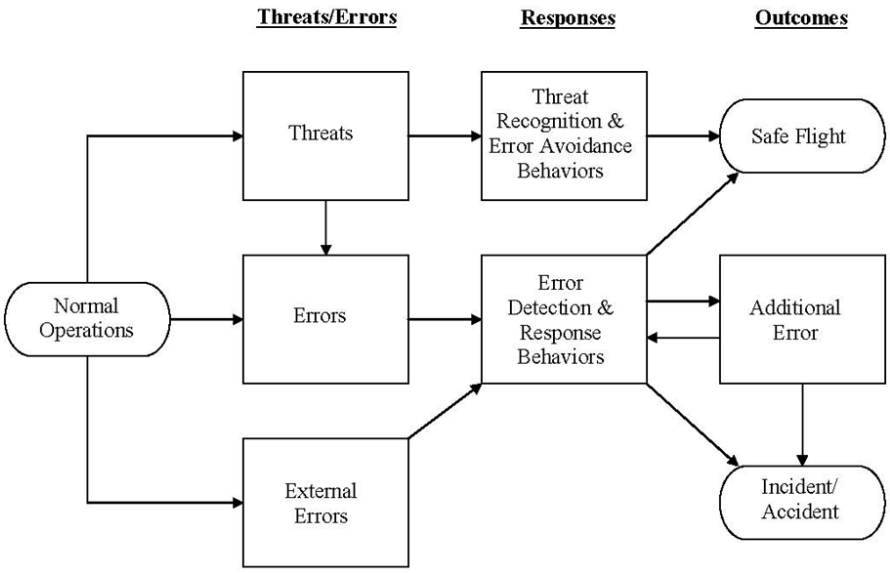

Figure 2. Delta Airline threat and error model

The figure shows how errors can be a consequence of threats and errors by others (external errors), but can also initiate from the ramp employees themselves.

Adaption of standard ramp LOSA

The Ramp LOSA tools that are available from the FAA website• include guidance material on threat and error management, threat and error codes, forms, software, training material, and instructions. These have been modified to suit the circumstances of KLM Ground Services at Schiphol Amsterdam Airport. A full report of the changes is available (Habekotté & Koncak 2011).

• Some of these tools are currently undergoing enhancements and are reportedly available again from November 15th, 2011

Error codes

To start observations as soon as possible the FAA provides a standard list of threat and error codes in their Ramp LOSA toolkit (FAA, 2010). While the threat codes are generic, error codes require customization to specific company and airport procedures. Because an error is defined as a deviation from a standard operating procedure, all error codes must comply with KLM operating procedures and Schiphol requirements, and missing codes have been added. Although laborious, this task had the added benefit of identifying inconsistencies and omission in the company and airport operating procedures. In total 25 relevant LOSA error codes were initially not supported by company or airport procedures. In cases where original error codes were irrelevant to KLM operations at Schiphol they were deleted from the list, for instance concerning marshalling. To keep the KLM version of ramp LOSA compatible with the original system, error code numbering remains as close to the original as possible so that future benchmarking can be done with other handlers. However, to keep error codes in a logical order some changes were needed. Additionally, we have identified inconsistencies with language at KLM and ambiguity in the original wording and have strived to eliminate these. For example, the FAA uses the verb ‘uploading’ instead of ‘loading’ and the verb ‘downloading’ instead of ‘offloading’. In total of the original 201 error codes, we have preserved 167 and added 12 new codes.

Checklist

The original set of observation forms consist of 41 pages of which 28 pages have to be filled in. The purpose of this form is to fill the form right after the observation. Evidently, observers are not expected to be able to fill in all 28 pages of the form for each turnaround (even though the ‘Did Not Observe’ check box can act as an escape). Unfortunately, the forms are published in an Adobe PDF file on the FAA Human Factors portal. The site does not provide the file to adjust the forms, like a MS Word document.

We prepared a modified observation form for the use of Ramp LOSA at Schiphol airport for KLM flights. The layout of the form has been kept as the original as far as possible, but the form has been split into a checklist to be used on the platform, and an observation form that can be filled in offline. The length of the form has been reduced from 28 pages to 8 pages for the checklist and 12 pages for the observation form. Various sections have been deleted and the demographics form has been shortened to one page. Many irrelevant checkpoints have been removed.

Observers and training

The quality of observers is a key element in the success of Ramp LOSA. This success is achieved by choosing the right observers and training them properly. To be able to collect sufficient data KLM Ground Services wishes to check a minimum of 5% of all flights on a continuous basis. This means that when the system has been fully implemented, approximately 17 observations should be conducted every day, divided over five intercontinental turn-arounds and twelve European arrival and departures. With an observer able to execute four observations a day and allowing for absences, this translates into an observer resource requirement of 4 full-time equivalents (FTE) for intercontinental operations and 2 for Europe.

It has not been easy to identify the right observers for LOSA at KLM Ground Services; several alternatives were considered. The choice has been to use operational staff (as advised by the FAA) complemented (due to cost awareness) with KLM ramp employees that temporarily require less physically demanding jobs due to medical circumstances. Rejected options included operational management, temporarily redundant workers from other departments, ramp employees from other ground handling companies, and students with experience in ramp operations.

Training for the observers has been devised. The duration is one day and the training includes modules on the basics of observing, threat and error management, threat and error codes, and use of the forms and the software. The training does not include refreshing of procedural knowledge, although it envisaged that this will form a prerequisite to being accepted into the observer training. An important consideration is “calibration” or alignment of the observers such that they judge errors equally. This is achieved by allowing the recruits to perform three audits together with the ramp LOSA coordinator/lead trainer. As an alternative, videos of actual turn-arounds are being considered as calibration material.

Data entry and analysis

For the analysis of the observations, software is required. The FAA provides software (based on MS Access) to fit standard FAA forms, but this cannot be modified to suit the KLM error codes and observation forms. For the initial observations MS Excel has been used, but a MS Access application is being commissioned that meets KLM requirements but will allow data exchange with other parties. It is envisaged that the observers will input their observation records into the package immediately upon return from the platform. A tablet application (to be used directly on the platform) has been considered but not adopted at this point because some form of data screening before entry is thought to be beneficial. It is desirable that previous entries, forms and codes can be modified by an administrator. This edit function is not available in the FAA Ramp LOSA software.

Data validation sessions are planned. The analysis tool should calculate the prevalence and mismanagement index of selected errors and threats.

Communication and organisation

In addition to the modifications to the original ramp LOSA material explained above, the implementation at KLM Ground Services included the roll-out of a communication plan, the appointment of a ramp LOSA coordinator within the department of Operational Integrity.

Results

To date more than 100 safety audits have been conducted. The observations have been limited to the intercontinental / wide-body fleet of KLM at Schiphol Airport. On average, an arrival observation lasts 33 minutes and a departure observation has a duration of 56 minutes.

General

The results show that on average, 0.9 external threats and 15.8 errors are observed each arrival or departure (compared to 3 to 4 errors per flight for cockpit operations). A common discrepancy with the procedures was exceeding the speed limit at the airport (currently 6 kilometres per hour): this was observed in 70% of the assessments (vehicles for toilet servicing: 100%). Other common errors include neglecting to check for foreign objects that can damage the engines (FOD, 64%) and incorrect use of the Ground Power Units (different errors varying from 20% to 68%).

Arrivals

Coon errors in the arrival process included Ground Service Equipment not waiting in regulatory areas (68%), chocks not correctly placed (44%) and hearing protection not worn (37%). In 4% of the cases personnel was not available in time for the arriving aircraft, leading to delays, increased fuel consumption and higher workloads.

Unloading and loading

In all observed cases (i.e. 100%) the safety barriers alongside the conveyer belts leading up to the hold were not used. This led to baggage falling on employees and time-lost accidents in four specific cases. Other common errors included not checking hold after unloading (69%), setting conveyor height during driving (62%), and employees walking on a running conveyer belt (48%).

Departures

In 40% of the observations the chocks were removed before connecting the push-back vehicle. A pre-departure check was not performed correctly in 29% of the cases.

Conclusion

This paper presents the results of the introduction of Ramp LOSA at KLM Ground Services. The methodology as it has been made available by the FAA demonstrates some weaknesses, such as a questionable threat and error management framework, elaborate forms, and inflexible software. The error codes are necessarily generic. The original tools have been modified to make them consistent with KLM’s procedures at Amsterdam Airport Schiphol.

The initial results show that there high number of errors are observed in platform observations compared to cockpit operations. This probably reflects the less procedural context of platform operations, the less skilled labour content, time pressure and the high turnover of staff within this environment. Many of the errors are well-known problems, which have apparently not yet been tackled successfully. The feedback of the assessment results to the responsible managers has inspired them to intensify their actions. However, some errors may reflect excessive stringency of the regulations that are not compatible with the time pressures of the turn-around process for highly utilized aircraft, for instance setting the height of conveyor belts while driving. Other errors may reflect the insufficiency of technical aids to balance safety with effectiveness, like the safety barriers alongside the conveyor belts. Many errors do not impact flight safety as much as that they lead to personal injuries (e.g. hearing aids, walking on the conveyor) and may have been underemphasized in the daily operation. None of the LOSA findings have been recorded as occurrences in the airlines safety system. This shows the potential value of this tool in revealing safety issues.

Results to date show that platform LOSA is a useful tool to quantify safety performance at the bottom of the iceberg and to generate trend data. It inspired management actions and the effect of safety interventions can now be monitored.

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