Annex 2. LOSA DATA

It is important to note that all the analyses in Annex 1 are done using the accident/incident database, which does not have any exposure data recorded in it. This means that all results are about flights that ended in an accident/incident in the database. Whether a certain management deficiency is likely to be material in producing a given accident/incident and how many of those errors the safety management system has prevented before the accident happened can only be answered if exposure data are known. For this we need information from daily operation data.

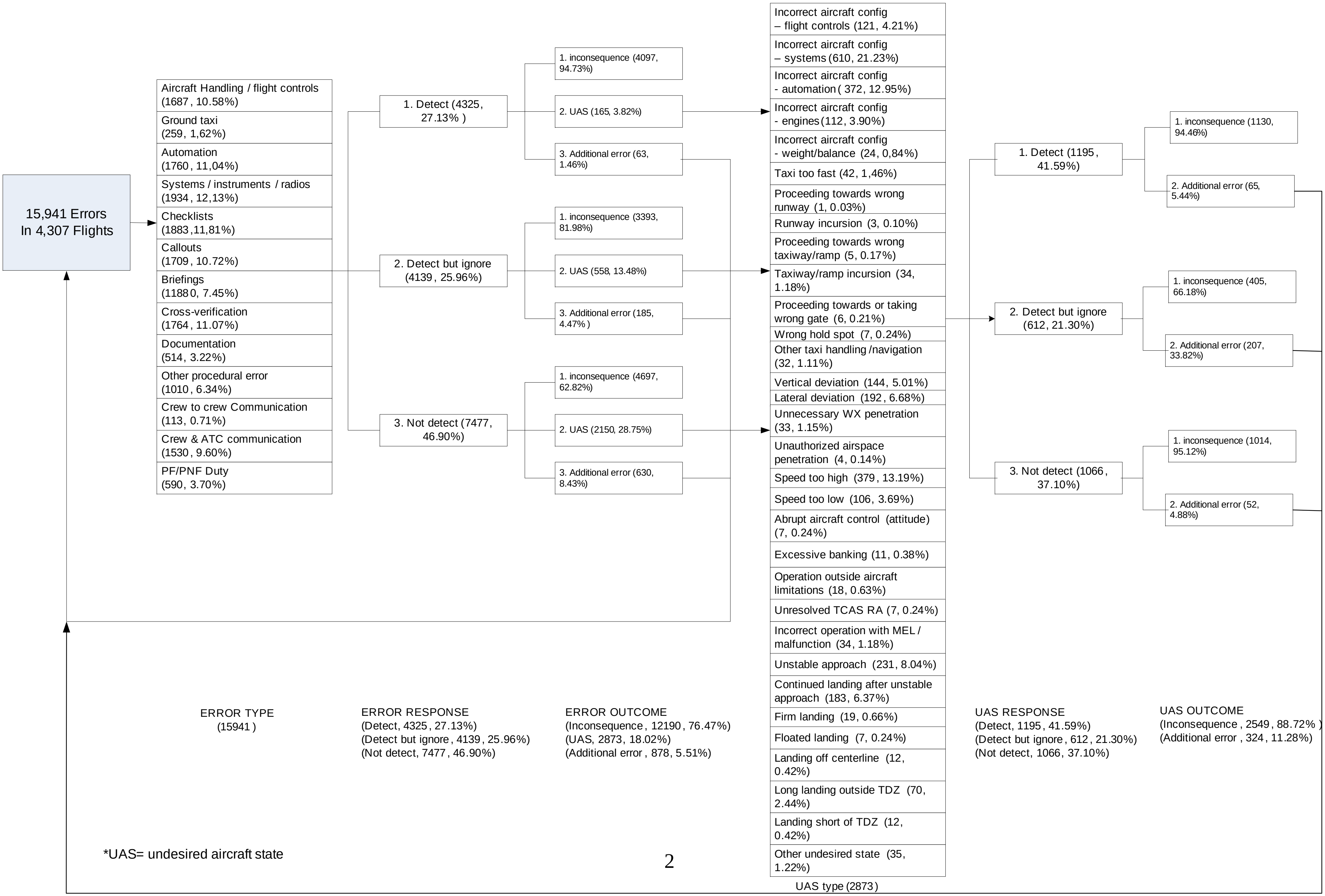
LOSA dataset

The LOSA Collaborative (www.losacollaborative.org) developed the Threat and Error Management (TEM) model for understanding operational performance in complex environments. In (Ashlegih, 2006), a threat (such as adverse weather, airport conditions, terrain, traffic, etc.) is defined as an event or error that occurs outside the influence of the flight crew (i.e., it was not caused by the crew), that increases the operational complexity of a flight, and that requires crew attention and management if safety margins are to be maintained. Events such as malfunctions or ATC controller errors can also place the aircraft in a compromised position; But in the LOSA taxonomy, these events are considered threats. They are not the result of actions by the flight crew

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. An error that is detected and effectively managed has no adverse impact on the flight; however, a mismanaged error reduces safety margins by linking to or inducing additional error or an undesired aircraft state (a position, speed, attitude, or configurations of an aircraft that results from flight crew error, actions, or inaction).

The data we had from LOSA Collaborative contains 15,941 errors from 4307 observations collected in 27 LOSA projects (shown in Table 2.1) from 2002 -2007. Appendix A shows the airlines who were participating in the audits which produced the database we were given. After analyzing the data, crew errors were recorded in around 80% of the flights observed, with an average of 2.96 errors per flight.

Follow the threat and error management model, figure 2.1 is the statistic analysis for LOSA dataset in this project.


15,941 Errors
In 4,307 Flights
Aircraft Handling / flight controls (1687 , 10.58%)
Ground taxi (259, 1,62%)
Automation (1760 , 11,04%)
Systems / instruments / radios (1934 , 12,13%)
Checklists (1883 ,11,81%)
Callouts (1709 , 10.72%)
Briefings (11880, 7.45%)
Cross-verification (1764 , 11.07%)
Documentation (514, 3.22%)
Other procedural error (1010 , 6.34%)
Crew to crew Communication (113, 0.71%)
Crew & ATC communication (1530 , 9.60%)
PF/PNF Duty (590, 3.70%)
1. Detect (4325, 27.13%)
2. Detect but ignore (4139 , 25.96%)
3. Not detect (7477, 46.90%)
1. inconsequence (4097, 94.73%)
2. UAS (165, 3.82%)
3. Additional error (63, 1.46%)
1. inconsequence (3393, 81.98%)
2. UAS (558, 13.48%)
3. Additional error (185, 4.47%)
1. inconsequence (4697, 62.82%)
2. UAS (2150, 28.75%)
3. Additional error (630, 8.43%)
Incorrect aircraft config – flight controls (121, 4.21%)
Incorrect aircraft config – systems (610, 21.23%)
Incorrect aircraft config - automation (372, 12.95%)
Incorrect aircraft config - engines (112, 3.90%)
Incorrect aircraft config - weight/balance (24, 0,84%)
Taxi too fast (42, 1,46%)
Proceeding towards wrong runway (1, 0.03%)
Runway incursion (3, 0.10%)
Proceeding towards wrong taxiway/ramp (5, 0.17%)
Taxiway/ramp incursion (34, 1.18%)
Proceeding towards or taking wrong gate (6, 0.21%)
Wrong hold spot (7, 0.24%)
Other taxi handling /navigation (32, 1.11%)
Vertical deviation (144, 5.01%)
Lateral deviation (192 , 6.68%)
Unnecessary WX penetration (33, 1.15%)
Unauthorized airspace penetration (4, 0.14%)
Speed too high (379 , 13.19%)
Speed too low (106, 3.69%)
Abrupt aircraft control (attitude) (7, 0.24%)
Excessive banking (11, 0.38%)
Operation outside aircraft limitations (18, 0.63%)
Unresolved TCAS RA (7, 0.24%)
Incorrect operation with MEL / malfunction (34, 1.18%)
Unstable approach (231, 8.04%)
Continued landing after unstable approach (183, 6.37%)
Firm landing (19, 0.66%)
Floated landing (7, 0.24%)
Landing off centerline (12, 0.42%)
Long landing outside TDZ (70, 2.44%)
Landing short of TDZ (12, 0.42%)
Other undesired state (35, 1.22%)
UAS type (2873)
1. Detect (1195 , 41.59%)
2. Detect but ignore (612, 21.30%)
3. Not detect (1066 , 37.10%)
1. inconsequence (1130, 94.46%)
2. Additional error (65, 5.44%)
1. inconsequence (405, 66.18%)
2. Additional error (207, 33.82%)
1. inconsequence (1014, 95.12%)
2. Additional error (52, 4.88%)
ERROR TYPE
(15941)
ERROR RESPONSE
(Detect, 4325 , 27.13%)
(Detect but ignore , 4139 , 25.96%)
(Not detect, 7477 , 46.90%)
ERROR OUTCOME
(Inconsequence , 12190 , 76.47%)
(UAS, 2873 , 18.02%)
(Additional error , 878 , 5.51%)
UAS RESPONSE
(Detect, 1195 , 41.59%)
(Detect but ignore , 612 , 21.30%)
(Not detect, 1066 , 37.10%)
UAS OUTCOME
(Inconsequence , 2549 , 88.72%)
(Additional error , 324 , 11.28%)
*UAS= undesired aircraft state

In figure 2.1, errors can be detected and well managed, detected but ignored, or not detected at all. However, any of those three states might lead to three mutually exclusive error outcome: undesired aircraft states (UAS), which means errors are not well managed and lead the position m speed, attitude, or configuration of an aircraft to an undesired state and clearly reduces safety margins; error can be not detect but does not cause any consequence (inconsequence), or lead to addition flight crew error (additional error). Once there is an additional error in any state, they have to link back to the error box and re-identification of the error type.

Based on figure 2.1, there are more statistic analysis done for LOSA dataset. The separate analysis and the information analyzed in figure 2.1 have been used to validate part of the Fault tree in the CATS model by DNV.

In contrast to the 5 flight crew errors types and 250 underlying causes classified in the ADREP taxonomy, there are 14 error types in the LOSA error classification in figure 2.1. The LOSA classification is based on aviation language, flight cockpit operation specific and the SOP, which is based on empirical observation of deviations and expert judgment. To integrate LOSA data and ADREP data it is important to be able to aggregate these data within a common taxonomic structure. However this does not exist in this field yet. Many scientific investigations use their own classification systems or taxonomies as a way of organizing knowledge about a subject matterand this has unfortunately led to different classifications and different causal pathways between ADREP and LOSA. Based on the Delft SMS model, we have developed a mechanism for mapping these different accident classifications onto our framework making the data analysis and comparisons possible. However, since the LOSA data have only just been made available to us we have not yet been able to compare them to the occurrence of the same deviations in accidents (ADREP).

Table 2.1 LOSA projects

AeroMexico – LOSA #1 (Mexico)	Delta Airlines (USA)
AeroMexico – LOSA #2	Frontier Airline (USA)
Air Freight NZ	Horizon Air (USA)
Air New Zealand	LACSA (Central America)
Air Transat (Canada)	Malaysia Airlines
Alaska Airlines – LOSA #1 (USA)	Mt Cook Airlines (New Zealand)
Alaska Airlines – LOSA #2	Regional Express (Australia)
All Nippon Airways (ANA) (Japan)	SilkAir (Singapore)
Asiana Airlines (Korea)	Singapore Airlines
Braathens ASA (Norway)	Skyway (USA)
Cathay Pacific (Hong Kong)	TACA (S America)
China Airlines (Taiwan)	TACA Peru (S America)
Continental Airlines (USA)	WestJet (Canada)
COPA (Panama)	

References:

LOSA Collaborative (www.losacollaborative.org)

Ashlegih, 2006, What is TEM? http://homepage.psy.utexas.edu/homepage/group/HelmreichLAB/ Publications/ pubfiles/TEM.Paper.12.6.06.pdf