The Art of Accident Classification

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Abstract

The reason we conduct accident investigations and will do so in the future is simple: we wish to gain knowledge about causes; share lessons learned and come up with successful prevention strategies to enhance air transport safety. When accidents are analyzed we search for similarities, common behavioral patterns and threads; if we wish to compare or run statistics we therefore have to come up with some sort of taxonomy. Official accident investigation reports often come with a level of detail that will hide the general picture. The writer (and even less the reader) of a detailed accident investigation report hardly ever draws parallels to other accidents, or puts the event in context with incidents. Often, the sequence of causal factors is therefore either lost in the detail or because the reader is unable to make the connection between multiple reports.

Introduction

The art and science of accident investigation is well established and to most of us it is rather astonishing how even the smallest details surface and fall together in a puzzle that make up the causal factors. Accident investigators are trained to put a microscope on the accident. But what about the larger, somewhat detached picture, that allows us to take a more general look

— see the big pattern rather than the minuscule detail? Here statistics plays a vital role and this sets the stage for accident classification.

More than 40 years ago the very first IATA Safety Report was published. Individuals of airlines and manufacturers, considered by many to be the finest experts in the aviation safety industry, gathered and created what is now a well accepted and widespread reference guide. Ever since, the safety report is published annually and while the founding fathers now enjoy retirement, it is still dedicated safety experts from manufacturers, airlines and air traffic control who share their knowledge and make their contribution. Safety recommendations and the accident statistics based on the accident data from the previous year make up a considerable part of the report. In order to be able to draw meaningful conclusions, and in particular to detect any correlations, IATA's Accident Classification Task Force (IATA ACTF) created a methodology on accident classification that will now be explained.

History of Accident Classification

A very natural thing to do is to group accidents by

- phase of flight (see Fig. 1)
- aircraft end states (see Fig. 2); or
- by looking at the components which failed, i.e. that were causal to the accident.

A good example would be an accident statistic which shows that a certain percentage of all fatal accidents happen during approach and landing; or that some other percentage of all flights end outside the confines of the runway, or that in a given number of cases an engine failed.

The beauty of such an approach to accident classification is its relative simplicity: the end state is obvious and so is the phase of flight. Accident investigators developed incredible skills and use modern technologies to find out which component(s) failed and in which order. But what about correlations? What about weaknesses in an organization that were created by managers long before the accident happened? How do we put such issues into statistics and create correlations?

The well known model of James Reason no doubt changed the attitude of many investigators and the causes of an accident were all of a sudden not seen within the confines of the accident site. The cause of an accident was seen in context with the organization and even further, the oversight (or lack thereof) of the regulator.

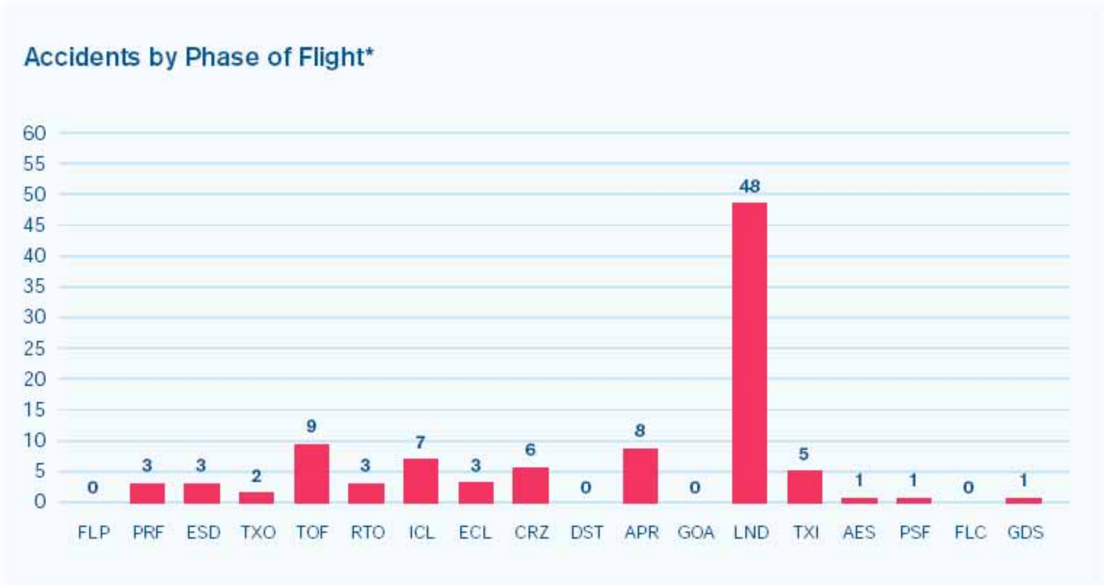

Fig. 1 Accidents per Phase of Flight [1]

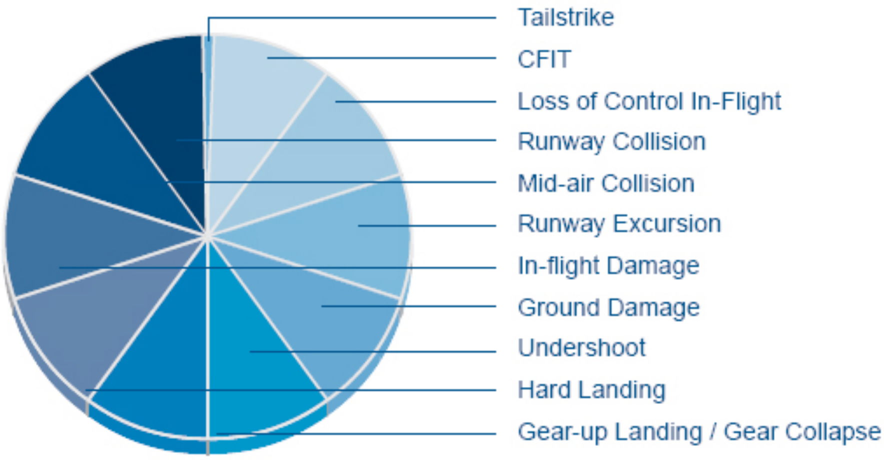

Fig. 2 End States [1]

As a result, new accident classification models evolved. With the more complicated accident models, a more complicated accident classification had to be created. Classification systems have, so far, been limited to describing the event in terms of "what happened" and this has proved very useful in reducing the number of high-risk events. Further benefit can be gained by analyzing "why it happened" in a similar way. One methodology (eBASIS) suggests a facility for factor classification, although not fully developed. It is therefore not used to any degree. It suggests classification using the following matrices (Thorne, 2008)

- Organizational influences matrix
- Supervision matrix
- Workplace/Environment matrix
- Individual/Team actions matrix
- Absent/failed defenses matrix

This (proposed) system replaces a general "risk area" with the main factor categories.

Another very good example of an expanded accident analysis is the model suggested by D. Wiegmann and S. Shappell (2003). Their methodology is based on the James Reason “Swiss cheese” model and flows in the following pattern:

– Organizational influences

– Unsafe supervision

– Preconditions for unsafe acts

– Unsafe acts

In the following, focus is given on the method that the IATA Accident Classification Task Force (IATA-ACTF) developed over the years and now uses.

IATA Classification

Over the past many years, IATA-ACTF has successfully created methodologies that help to classify accidents. With the advances in accident research, accident classification has changed.

In the very early safety reports, the H, T and E Factors were cited: each accident had a certain component of the human element (mainly interpreted as human error), and/or an environmental factor (such as bad weather) and/or a technical malfunction. With the aircraft systems becoming more reliable and the weather not changing over the years, the Human element gained more and more dominance to the point that at some stage 75 percent of the accidents were attributed to human failure. Such information, if not critically queried, might lead (and has led) to the misleading assumption that once technology is advanced enough to take the human out of the equation the system will be safe. Quite obviously, the accident classification was driven by the SHELL Model, which states that Liveware (the human) interacts with “software” and “hardware” as well as the environment.

Code	**Description**	**Example events**
H1	Procedural	Deviation in the execution of operator procedures and/or regulations. The intention is correct but the execution is flawed. It may also include situations where flight crews forget or omit relevant appropriate action. Examples may include a flight crew dialing a wrong altitude into a mode control panel, or a flight crew failing to dial an altitude in a mode control panel.
H2	Proficiency	Performance failures due to deficient knowledge or skills. This may be exacerbated by lack of experience, knowledge or training. Examples may include inappropriate handling of the aircraft, such as flying within established approach parameters, or of systems, such as the inability to correctly program a flight management computer.
H3	Operational decision	A course of action by the flight crew that compromises safety. This category may typically include the following: (1) the flight crew had options within operational reason and *decided* not to take them, or (2) the flight crew had time but did not use it effectively to reach or modify a decision. Examples may include a decision to fly an approach through known wind shear instead of going around, or to depart when the departure path will obviously lead through severe weather.
H4	Communication	Miscommunication, misinterpretation or failure to communicate pertinent information within the flight crew or between the flight crew and an external agent (e.g., ATC or ground operations). Examples include misunderstanding an altitude clearance and failure to convey relevant operational information.
H5	Intentional non-compliance	Deliberate deviation from operator procedures and/or regulations. Examples include performing checklists from memory or intentional disregard of operational limitations or SOPs.
H6	Incapacitation	Flight crewmember unable to perform duties due to physical or psychological impairment.

Table 1: Example of early accident classification — IATA Safety Report 2002

Later, the H, T and E categories were complemented by an O (for organization) and sub-groups were developed, such as H1, H2, H3, etc. With these sub-groups certain elements of the human behavior became more and more transparent, such as intentional breach of regulations (a violation) in contrast to a communication problem or a simple handling error due to lack of training. While this classification helps to work out more specific recommendations (i.e., instead of taking the human entirely out of the equation, recommend to enforce Standard Operating Procedures), see Table 1.

Note that Table 1 shows only one part of the accident classification — besides Human Factors (H), similar breakdowns for Environmental Issues (E), Organization (O) and Technical Issues (T) existed.

Over the years, the sub-categories were expanded (e.g., H6, “Incapacitation,” and spatial disorientation were added) and gradually the TEM framework of Helmreich, University of Texas, became the basis for this classification. The general philosophy, to break the classification into H, T, E and O Factors, however, remained the same. Obviously, with each change in the classification taxonomy it was not possible to compare data from previous reports and it was felt that changing the taxonomy too often would do more harm than good. The implementation of the TEM Framework in the IATA accident classification was a major step forward

In 2007, however, the group decided to abandon the old classification scheme altogether and use the TEM Framework with an adapted LOSA terminology (Klinect, 2005). The IATA Safety Report 2007, therefore, is the first report using this new taxonomy — “adapted” LOSA terminology because the LOSA concept was developed for normal operations, while accident classification obviously deals with a non-normal situation.

Figure 3 shows how the TEM Framework is used by ACTF. There are some subtle differences to the framework suggested by Helmreich et al.:

- Threats and Errors can occur at the same time.
- Latent conditions, by themselves, unless properly managed, can cause an undesired aircraft state.
- An error by itself, without any threat(s), can cause an undesired aircraft state, unless the error is properly managed.
- A threat by itself, without any errors, can cause an undesired aircraft state, unless it is properly managed.
- In a typical accident, a combination of the above will occur.
- Information about the management of latent conditions, the error management and the threat management is usually not available, unless the full accident report or pilot information is available.
- After the end state is reached (which by definition is un-recoverable), thought is given to which barriers could have prevented the accident, had these not been breached. While it is essential to learn more about how threats, errors and perhaps latent conditions were managed, the typical accident summary available to ACTF does not give sufficient detail.
- Post-crash scenarios are not considered for classification by the IATA ACTF. The logic behind this is that aviation is made safer if risk reduction mechanisms are created to help avoid accidents altogether, although an individual's chance for survival can greatly benefit through the study of and by enhancing post-crash and survivability aspects.

Unfortunately, there is not always sufficient information on some of the accidents to fill the entire classification based on such a TEM framework; very often, there is no information on latent conditions (LC). If one runs statistics to see how high the influence of LCs was on the accidents, the picture will therefore be biased. So far, ACTF classification did not place an "insufficient" for each of the categories where information is lacking. This is under discussion, however.

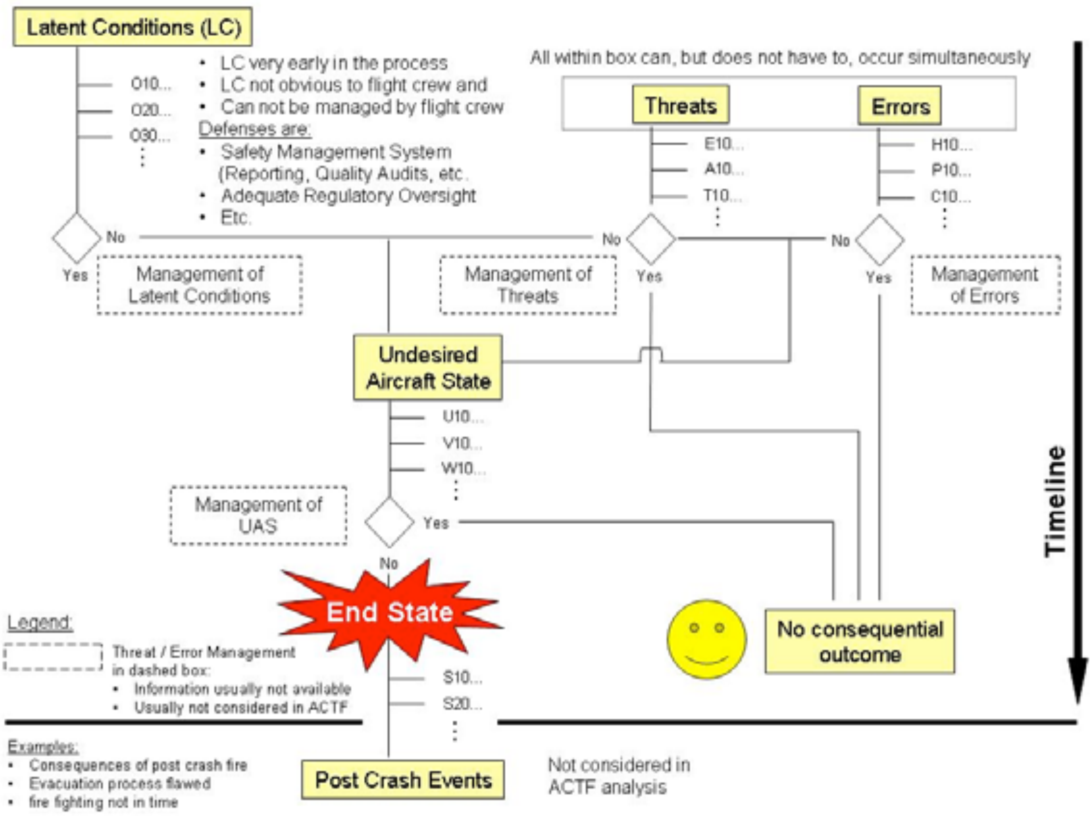

Fig. 3 TEM Framework as used by IATA ACTF

Tables A-1ff in Appendix 1 give a comprehensive list of classifications chosen by ACTF. Some airlines have adopted the taxonomy for internal use. The system is not only suitable for accident investigation but can be used for incident investigation as well.

Some Aspects of a Successful Accident Classification Methodology

- Easy to use, intuitive — does not require detailed explanation

- Based on a threat and error management framework
- Addresses latent conditions
- Not too detailed — general enough so that “educated guesses” are possible
- Not too detailed — anyone should be able to classify, not only the single expert who developed habits
- Follows the “state of the art” of human performance
- Detailed enough to allow for meaningful statistics

A good example of a rather complicated system is ADREP 2000. In practice, one trained person within an airline’s safety department would classify a report according to ADREP 2000 to avoid “mis-classifications.”

Data for the Purpose of Collecting Data

With today’s ease of collecting data it is tempting to take data just for the sake of having the data. Data is meaningless unless it is analyzed, put into correlation and finally interpreted. In the opinion of the author it is contra-productive if the regulator demands that an operator deliver reports on all kind of incidents. Unless put into context, these will be singular events to an outside observer.

What good does knowledge of the number of engine failures per period of time do, if the majority of incidents occurred in context with latent conditions within the maintenance organization?

The present accident classification was designed to enable a researcher to learn more about correlations. A good example is given in the IATA Safety Report 2007 where (among other things) runway excursions are addressed (Fig. 4).

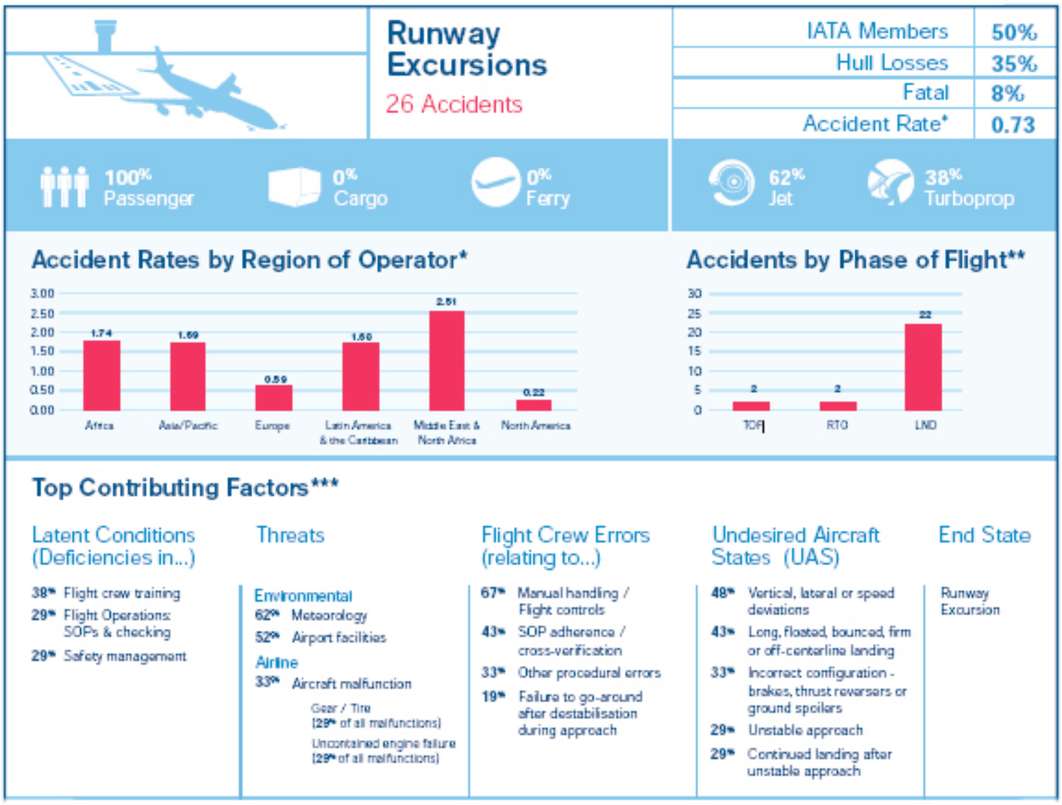

Fig. 4 Correlation Runway Excursion

Using IATA´s taxonomy the following correlations could be derived:

- In almost a quarter (24 percent) of runway excursion accidents, the flight crew continued to land after an unstable approach.

- In 31 percent of all runway excursions, there was a correlation between adverse weather and long, floated, bounced, firm or off-centerline landing by the flight crew.

- In 27 percent of runway excursions, a correlation was noted between non-adherence to SOPs by flight crews, and vertical, lateral or speed deviations prior to the accident.

In summary for 2007, the top contributing factors are (Fig. 5):

The framework in the 2007 Report is centered on the flight crew, e.g., threat is "*an event or error that occurs outside the influence of the flight crew, but which requires crew attention and management if safety margins are to be maintained*," or an undesired aircraft state is by definition *"a flight-crew-induced aircraft state that clearly reduces safety margins; a safety-compromising situation that results from ineffective threat/error management."*

This "flight crew centered" accident classification is first because the definitions of LOSA were used, but also it is perhaps that traditional accident prevention strategies put the pilot in the center of attention. The taxonomy, however, could be easily adapted and used when the focus is on other sectors, such as maintenance or ground handling.

Latent Conditions (Deficiencies in …)	1. Regulatory oversight 2. Safety management 3. Flight crew training
Threats	1. Aircraft malfunction 2. Meteorology 3. Airport facilities
Flight Crew Errors relating to …	1. Manual handling/Flight controls 2. SOP adherence/ cross verification
Undesired Aircraft States	1. Vertical, lateral or speed deviation 2. Long. Floated, bounced, firm or off-centerline landing 3. Unstable approach
End States	1. Runway excursion 2. Ground damage 3. Gear-up landing/Gear collapse

Table 2: Top 3 contributing factors in 2007 accidents

Fatigue

Sleep deprivation and fatigue cause degradation in all areas of human performance — this is a well known fact. A renowned researcher gives the following numbers regarding the degradation of human performance (Rosekind, 2008):

- Memory –20 percent
- Reaction time –25 percent
- Mood –100 percent
- Attentional lapses +500 percent
- Lethargy, apathy +50 percent
- Communication –30 percent
- Microsleep +100 percent
- Judgment decision making –50 percent
- Vigilance –75 percent

In addition, some 90 different sleep disorders, some of which are unknown to the individual who suffers from it. How does this affect accident classification? In the opinion of the author, fatigue-related categories are not yet well implemented in accident classification.

IATA-ACTF has previously used “H5 — incapacitation/fatigue” in order to account for fatigue. Unfortunately, the data which is available to the IATA-ACTF does not always give insight into pre-duty rest opportunities and whether they were used or not. The ACTF typically do not have any information about medical conditions that would support sleep disorders. Such information comes with a full accident investigation and even then, an accurate picture of the situation is not possible. Therefore, H5 was only used in rather rare cases. Klinect (2005) lists “fatigue” under error causation within aeromedical factors, together with spatial disorientation and hypoxia. The IATA Safety Report 2007 finally lists “fatigue” under “additional classification.”

Spatial Disorientation

While the cause for spatial disorientation/somatogravic illusion is different, there are some similarities to fatigue:

- It affects all humans.
- It can affect even the most experienced crewmember.
- It is difficult to prove in hindsight after an accident.
- A human cannot be blamed for getting disoriented — the origin lies in our physiology. Therefore, it cannot be considered an error, but it poses a threat.

Therefore, there was intense discussion among IATA-ACTF members about whether and how spatial disorientation should be included in an accident classification. The 2007 report does not cite spatial disorientation as a separate factor; however, recommendations were made to better address the topic in the forthcoming reports.

Summary

Accidents in aviation are very rare and singular events. The causal factors, when looked at in great detail, seem to be unique to each accident. In order to recognize similarities and to gain the most out of an accident it is recommended to classify an accident according to a threat and error management framework. The IATA Safety Report 2007 uses such a framework. Such a classification should always name the barriers which failed, but again, in general rather than detailed terms.

The drawback with accident classification is that some information will never be available to those who classify it, such as detailed knowledge on threat and error management strategies. Therefore, it is recommended to extend the classification system to incidents.

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Thorne, Alan: private communication, 2008

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Appendix 1 — Current ACTF Classification Taxonomy

Table A-1	Latent Conditions
Table A-2	Threats
Table A-3	Errors
Table A-4	Undesired Aircraft States
Table A-5	End States
Table A-6	Communication
Table A-7	Additional

Latent Conditions (Deficiencies in…)	Examples
Design	– Design shortcomings, – Manufacturing defects.
Regulatory oversight	– Deficient regulatory oversight or lack thereof.
Management Decisions	– Cost cutting, – Stringent fuel policy – Outsourcing and other decisions, which can impact on operational safety.
Safety Management	– Absence of safety office/officer, – Absence/deficient data collection / analysis mechanisms (incident reporting, FDA, etc.). – Absent or deficient Quality Management System
Change Management	– Deficiencies in oversight of change; in addressing operational needs created by, for example: expansion, or downsizing. – Deficiencies in the evaluation to integrate and / or monitor changes to establish organizational practices or procedures. – Consequences of mergers or acquisitions.
Selection Systems	– Deficient or absent selection standards
Ops Planning & Scheduling	– Deficiencies in crew rostering and staffing practices, – Issues with flight and duty time limitations, – Health and welfare issues.
Technology & Equipment	– Available safety equipment not installed (E-GPWS, predictive wind-shear, TCAS / ACAS, etc.)
Flight Ops: SOPs & Checking	– Deficient or absent: (1) Standard Operating procedures (SOPs), (2) operational instructions and / or policies, (3) company regulations, (4) controls to assess compliance with regulations and SOPs.
Flight Ops: Training Systems	– Omitted training, – Language skills deficiencies; – Qualifications and experience of flight crews, – Operational needs leading to training reductions, deficiencies in assessment of training or training resources such as

	manuals or CBT devices.
<u>Cabin Ops:</u> SOPs & Checking	– Deficient or absent: (1) Standard Operating Procedures (SOPs), (2) operational instructions and / or policies, (3) company regulations, (4) controls to assess compliance with regulations and SOPs.
<u>Cabin Ops:</u> Training Systems	– Omitted training, – Language skills deficiencies; – Qualifications and experience of cabin crews, – Operational needs leading to training – Reductions, deficiencies in assessment of training or training resources such as manuals or CBT devices.
<u>Ground Ops:</u> SOPs & Checking	– Deficient or absent: (1) Standard Operating Procedures (SOPs), (2) operational instructions and / or policies, (3) company regulations, (4) controls to assess compliance with regulations and SOPs.
<u>Ground Ops:</u> Training Systems	– Omitted training, – Language skills deficiencies; – Qualifications and experience of ground crews, – Operational needs leading to training reductions, – Deficiencies in assessment of training or training resources such as manuals or CBT devices.

Table A-1

Environmental Threats	Examples
Meteorology	– Thunderstorms
	– Poor visibility, IMC
	– Gusty wind, wind shear
	– Icing
Lack of Visual Reference	– Darkness, black hole – Environmental situation which can lead to spatial disorientation
Air Traffic Services	– Tough-to-meet clearances / restrictions, – Reroutes, – Language difficulties, – Controller errors, – Failure to provide separation (air or ground)
Birds / Foreign objects	– Self-explanatory
Airport Facilities	– Poor signage, faint markings, – Runway/taxiway closures,
	– INOP navigational aids
	– Contaminated runways/taxiways; – Poor braking action
	– Trenches, ditches, inadequate overrun
NAV Aids	– Ground navigation aid malfunction, – Lack or unavailability (e.g. ILS)
Terrain / Obstacles	– Self-explanatory
Traffic	– Self-explanatory
Other	– Not clearly falling within the other environmental threats

Airline Threats	Examples
Aircraft Malfunction	– Technical anomalies / failures Note – See expanded technical factors category
MEL item	– MEL items with operational implications
Operational Pressure	– Operational time pressure, – Missed approach, diversion, – Other non-normal ops
Cabin Events	– Cabin events, – Cabin crew errors, – Distractions, interruptions
Ground Events	– Aircraft loading events, – Fueling errors, – Agent interruptions, – Improper ground support, de-icing
Dispatch / paperwork	– Load sheet errors, – Crew scheduling events, – Late paperwork changes or errors
Maintenance Events	– Aircraft repairs on ground, – Maintenance log problems, – Maintenance errors
Dangerous Goods	– Carriage of articles or substances capable of posing a significant risk to health, safety or property when transported by air.
Manuals / Charts / Checklists	– Incorrect/unclear chart pages or operating manuals – Misleading checklist layout, design
Other	– Not clearly falling within the other airline threats

A/C Malfunction (Technical) Threats	**Examples**
Extensive / Uncontained Engine Failure	– Damage due to non-containment
Contained Engine Failure	– Engine overheat, – propeller failure
Gear / Tire	– Failure affecting parking, taxi, take-off or landing
Brakes	– Failure affecting parking, taxi, take-off or landing
Flight Controls	– Primary Flight Controls: – Failure affecting aircraft controllability
	– Secondary Flight Controls: flaps, spoilers
Structural Failure	– Failure due to flutter, overload, – Corrosion / fatigue; engine separation
Fire / Smoke (Cockpit / Cabin / Cargo)	– Fire due to aircraft systems; – Other fire causes
Avionics, Flight Instruments	– All avionics except autopilot and FMS, – Instrumentation, including standby instruments
Autopilot / FMS	– Self-explanatory
Hydraulic System Failure	– Self-explanatory
Electrical Power Generation Failure	– Loss of all electrical power, including battery power
Other	Not clearly falling within the other aircraft malfunction threats

Table A-1

Aircraft Handling Errors	Examples
Manual Handling/Flight Controls	– Hand flying vertical, lateral, or speed deviations – Approach deviations by choice (e.g., flying below the GS) – Missed runway/taxiway, failure to hold short, taxi above speed limit – Incorrect flaps, speed brake, autobrake, thrust reverser or power settings
Ground Navigation	– Attempting to turn down wrong taxiway/runway – Missed taxiway/runway/gate
Automation	– Incorrect altitude, speed, heading, autothrottle settings, mode executed, or entries
Systems/Radio/ Instruments	– Incorrect packs, altimeter, fuel switch settings, or radio frequency dialed
Other	

Procedural Errors	Examples
SOP adherence / SOP Cross-verification	– Intentional or unintentional failure to cross-verify (automation) inputs. – Intentional or unintentional failure to follow SOP; – PF makes own automation changes; – Sterile cockpit violations
Checklist	– Normal Checklist performed from memory or omitted; – Wrong challenge and response. – Checklist performed late or at wrong time; – Checklist items missed
	– Non-Normal Checklist: performed from memory or omitted; wrong challenge and response. Checklist performed late or at wrong time; items missed

Callouts	– Omitted takeoff, descent, or approach callouts
Briefings	– Omitted departure, takeoff, approach, or handover briefing; items missed. Briefing does not address expected situation
Documentation	– Wrong weight and balance information, wrong fuel information,
	– Wrong ATIS, or clearance recorded
	– Misinterpreted items on paperwork
	– Incorrect or missing log book entries
Failure to Go-around after stabilized approach window	– Failure to Go-around after stabilized approach window
Other Procedural	– Administrative duties performed after top of descent or before leaving active runway – Incorrect application of MEL, incorrect application of normal or abnormal procedures

Communication Errors	**Examples**
Crew to External Communication	– Crew to ATC—missed calls, misinterpretation of instructions, or incorrect read-backs – Wrong clearance, taxiway, gate or runway communicated – Include Cabin, Ground, Maintenance and Dispatch crews
	– Errors in Flight Crew to Cabin communication or – Lack of communication
	– Errors in Flight Crew to Ground, Maintenance or Dispatch or – Lack of communication
Pilot-to-Pilot Communication	– Within-crew miscommunication or – Misinterpretation

Table A-3

Undesired Aircraft States	**Breakdown**
Aircraft Handling (U)	Abrupt Aircraft Control
	Vertical, Lateral or Speed Deviations
	Unnecessary Weather Penetration
	Unauthorized Airspace Penetration
	Operation Outside Aircraft Limitations
	Unstable Approach
	Unstable Approach below MDA
	Continued Landing after unstable Approach
	Long, Floated, Bounced, Firm, Off-Centerline Landing. Landing with excessive crab angle
	Rejected Take-off after V1
	Controlled Flight Towards Terrain
	Other
Ground Navigation (V)	Runway / Taxiway Incursions
	Proceeding towards wrong taxiway / runway
	Wrong taxiway, ramp, gate or hold spot
	Ramp movements, including when under marshalling
	Other
Incorrect Aircraft Configurations (W)	Brakes, Thrust Reversers, Ground Spoilers
	Systems (Fuel, Electrical, Hydraulics, Pneumatics, Air Conditioning, Pressurization/Instrumentation
	Landing Gear
	Flight Controls / Automation
	Engine
	Weight & Balance
	Other

Table A-4

End States	Definitions
Controlled Flight into Terrain (CFIT)	– In-flight collision with terrain, water, or obstacle without indication of loss of control.
Loss of Control In-flight	– Loss of aircraft control while in-flight.
Runway Incursion	– Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, person or wildlife on the protected area of a surface designated for the landing and take-off of aircraft.
Mid-air Collision	– Collision between aircraft in flight.
Runway Excursion	– A veer off or overrun off the runway surface.
In-flight Damage/Injuries	– Damage or injuries occurring while airborne, including: – Weather-related events, technical failures, bird strikes, serious/fatal injuries to crew or passengers and fire/smoke/fumes.
Ground Damage/Injuries	Damage or injuries occurring during ground operations, including: – Occurrences during (or as a result of) ground handling operations. – Collision while taxiing to or from a runway in use. – Foreign object damage
Loss of Control on Ground	– Loss of aircraft control while the aircraft is on the ground.
Undershoot	– A touchdown prior to the runway surface.
Hard Landing	– Any hard landing resulting in substantial damage.
Gear-up Landing / Gear Collapse	– Any gear-up landing / collapse resulting in substantial damage (without a runway excursion).
Tail strike	– Tail strike resulting in substantial damage.

Table A-5

Countermeasure	Definition	Example Performance
COMMUNICATION ENVIRONMENT	Environment for open communication is established and maintained.	Good cross talk—flow of information is fluid, clear, and direct. No social or cultural dis-harmonies. Right amount of hierarchy gradient.
LEADERSHIP	Captain should show leadership and coordinated flight deck activities.	In command, decisive, and encourages crew participation
	FO is assertive when necessary and is able to take over as the leader	F/O speaks up and raises concerns
OVERALL CREW PERFORMANCE	Overall, crew members should perform well as risk managers	Includes Flight, Cabin, Ground crew as well as their interactions with ATC
OTHER		

SOP BRIEFING	The required briefing should be interactive and operationally thorough	Concise and not rushed; Bottom lines are established
PLANS STATED	Operational plans and decisions should be communicated and acknowledged	Shared understanding about plans – "Everybody on the same page"
CONTINGENCY MANAGEMENT	Crew members should develop effective strategies to manage threats to safety	Threats and their consequences are anticipated; Use all available resources to manage threats
OTHER		

MONITOR/ CROSS-CHECK	Crew members should actively monitor and cross-check flight path, aircraft performance, systems and	Aircraft position, settings, and crew actions are verified

	other crew members	
WORKLOAD MANAGEMENT	Operational tasks should be prioritized and properly managed to handle primary flight duties	**Avoid task fixation;** Do not allow work overload
EGO **MANAGEMENT**	Flight Crew member reacts to assertive callout of other crew member(s); is not afraid to "lose face"	Captain performs go around after callout of F/O. Change of controls; PF allows other crew member to take over leadership (e.g. during spatial disorientation)
AUTOMATION MANAGEMENT	Automation should be properly managed to balance situational and/or workload requirements	Brief automation setup; Effective recovery techniques from anomalies
TAXIWAY/ RUNWAY MANAGEMENT	Crew members use caution and kept watch outside when navigating taxiways and runways	Clearances are verbalized and understood; Airport and taxiway charts are used when needed
OTHER		

EVALUATION OF PLANS	Existing plans should be reviewed and modified when necessary	Crew decisions and actions are openly analyzed to make sure the existing plan is the best plan
INQUIRY	Crew members should not be afraid to ask questions to investigate and/or clarify current plans of action	"Nothing taken for granted" attitude - Crew members speak up without hesitation
OTHER		

Table A-6

Additional Classification	Breakdown
Insufficient Data	Reserved for accidents that do not contain sufficient data to be classified
Fatigue	Crewmember unable to perform duties due to physical or psychological impairment.
spatial disorientation and spatial / somatogravic illusion	Self Explanatory

Table A-7