SAFETY REPORT 2015

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52nd Edition

NOTICE

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Senior Vice-President Foreword

Gilberto Lopez Meyer
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Dear colleagues,

Commercial aviation is built on partnerships, and there is no stronger partnership in aviation than the one that unites us in our efforts to improve safety. By working together we have made flying the safest form of long-distance travel the world has ever known. For 2015, the global jet hull loss rate was 0.32 per 1 million flights, which was the equivalent of one major accident for every 3.1 million flights. This was a 30% improvement compared to the previous five-year rate of 0.46 per million jet flights, or one major accident for every 2.2 million flights.

Yet we were also challenged last year by what is for aviation professionals an unthinkable act: the deliberate destruction of an aircraft and all on board by one of the individuals entrusted with their safety. This tragedy emphasizes that we must always be alert to new and emerging risks. At the same time, we must listen to--and be guided by--what the safety data are telling us. In this way, we can be assured that our resources will be employed in those areas that will have the biggest impact in terms of further reducing the risks of an accident.

The accumulated learnings of our decades' long campaign to reduce the risk of an accident are enshrined in the global standards and recommended practices of the International Civil Aviation (ICAO). These in turn, are incorporated in the IATA Operational Safety Audit (IOSA), the only globally-accepted operational standard for commercial aviation. Ensuring that the IOSA process continues to reflect the rigorous quality standards that have elevated the industry's safety performance will be a key focus area in 2016.

It is my privilege to offer you this 52nd edition of the IATA Safety Report. I encourage you to share the vital information contained in these pages with your colleagues. I would like to thank the IATA Operations Committee (OPC), the Safety Group (SG), the Accident Classification Task Force (ACTF), the Cabin Operations Safety Task Force (COSTF) and all IATA staff involved for their cooperation and expertise essential for the creation of this report.

Chairman Foreword

Dr. Dieter Reisinger
Chairman ACTF

When looking at the accidents in review there is good news and bad news. The good news is that commercial air transport had a low number of hull losses in 2015 with a low number of fatalities (when excluding the deliberate acts). Compare these 18 hull loss accidents (10 jet/zero fatal and eight turboprop/four fatal) with 37.6 million annual departures. A year has 31.5 million seconds, so there is roughly one departure every second and in this context today's air transport is extremely safe.

The bad news: year after year, the Accident Classification Task Force (ACTF) runs into the same issues when analyzing accident statistics:

- Some parts of the world draw attention when it comes to accident rates. In particular Africa and Indonesia have been and still are areas of concern. What is being done differently in these countries that seems to compromise safety? Are the higher accident rates a result of individual, front-line actions; or are they a result of an attitude within a culture that stretches far beyond the individuals who operate the aircraft?
- The factual information that is available on an accident varies considerably in quality. In many cases the factual information is rather limited. It might be a coincidence that accidents with only a limited set of factual information typically occur in the above mentioned regions.
- A study conducted by members of the ACTF revealed that a large number of accidents over the past 10 years were not properly investigated. Accident reports were available for only 300 of the approximately 1,000 accidents that occurred over the decade. Furthermore, a considerable number of those 300 reports showed opportunity for improvement. Again, some parts of the world are better at this than others.

That said, if we wish to make air travel safer, it is not only about airline pilots and the equipment they fly. It is about regulatory oversight and the willingness of a State to conduct a proper and thorough accident investigation. It is worthwhile to ask whether accident investigations, with all their intricacies and challenges, should be conducted by individual accident investigation boards in each and every country, even the smaller ones. In a world of globalization and quick communication channels, it might be worthwhile to consider the establishment of regional or multi-state accident investigation boards, particularly in the world's more accident-prone regions.

I thank all members of the group for their dedicated work. I thank IATA´s data crunching department and graphics department for their inputs when it comes to new and meaningful data analysis.

Blue skies!

Safety Report 2015 Executive Summary

The IATA Safety Report is the flagship safety document produced by IATA since 1964. It provides the industry with critical information derived from the analysis of aviation accidents to understand safety risks in the industry and propose mitigation strategies.

SUMMARY OF CHANGES FROM THE 2014 SAFETY REPORT

In an effort to enhance the report and in response to a survey completed by people who downloaded last year's report, additional statistics and ways of presenting the data have been added to each of the report's sections:

- Each data section has been expanded and is now presented on two pages. New measures include:
  - Accident rates (previously only count and percent distribution was provided).
  - A map showing the number of accidents in each region by region of operator and region of occurrence.
  - Fatality risk, a metric already in use by industry safety professionals, which is related to the exposure of passengers and crew to a catastrophic accident where 100% of the people on board perish. The reader is encouraged to consult the section on "Fatality Risk" at the end of this executive summary in order to better understand how this metric is defined and how it should be interpreted.
- The 'Top Contributing Factors' box has been summarized to show only the most significant contributing factor for each of the different classification categories. For digital viewing of the report, a full list of contributing factors is available by clicking on the box. For hard copy readers, this list is found at the end of the Safety Report in Addendums A, B and C.

In order to account for potential latency in the reporting of accidents, a process has been put in place whereby IATA's accident database is regularly updated with accidents that may have subsequently come to light. Each of these accidents is reviewed by the Accident Classification Task Force (ACTF - see membership on Section 1) as part of its classification work. Therefore, accident counts (and accident rates) may vary when compared to previous reports.

SUMMARY RESULTS

This report is focused on the commercial air transport industry; it therefore uses more restrictive criteria than the International Civil Aviation Organization (ICAO) Annex 13 accident definitions (see Annex 1 for ICAO's accident definition). In total, 68 accidents met the IATA accident criteria in 2015. A joint chapter with ICAO providing analysis of the accidents that met the broader harmonized Global Safety Information Exchange (GSIE) criteria is also provided on Section 10 of this report. The criteria used by IATA excludes injury-only accidents with no damage to the aircraft.

	Total Number of Accidents		Total Accident Rate		Hull Loss Rate		Fatal Accident Rate		Number of Fatal Accidents		Number of Fatalities	
	Jet	TP	Jet	TP	Jet	TP	Jet	TP	Jet	TP	Jet	TP
2015	46	22	1.46	3.55	0.32	1.29	0.00	0.65	0	4	0	136
2014	40	37	1.35	6.10	0.27	3.13	0.10	1.48	3	9	517	124
Previous 5 Year Average (2010-2014)	46	44	1.67	7.16	0.47	3.95	0.23	1.86	6	11	353	151

TP = Turboprop

General Analysis

The accident rate continues its downward trend, not only in terms of overall accidents, but also for hull losses and fatal accidents. In 2015, accidents were at an all-time low:

- Overall Accidents: 1.81 accidents per 1 million sectors
- Hull Losses: 0.48 hull losses per 1 million sectors
- Fatal Accidents: 0.11 accidents per 1 million sector.

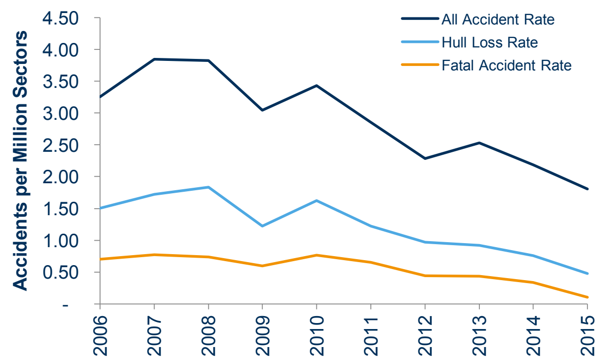
An interesting trend is the performance of jet accidents compared to turboprop accidents, particularly over the last four years.

While the accident rate for jets has been consistently lower than the rate for turboprops, it has seen no substantial improvement over this period. In fact, the jet category is showing a slight upward trend in the overall accident rate.

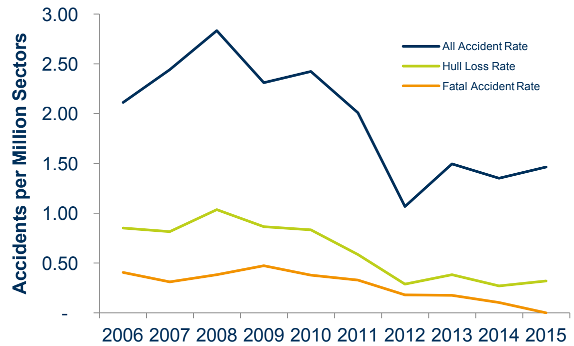
The exception are the jet fatal and hull loss rates, which have been consistently decreasing over the past eight years. This upward trend in the overall jet accident rate could be mainly attributed to an increase in the occurrences of 'Hard Landing', 'In-Flight Damage' and 'Undershoot' categories.

On the other hand, the turboprop overall accident rate has seen a substantial decrease in the past four years, dropping by approximately 50% since 2012. This downward trend, is also seen in the turboprop hull loss and fatal accident rates.

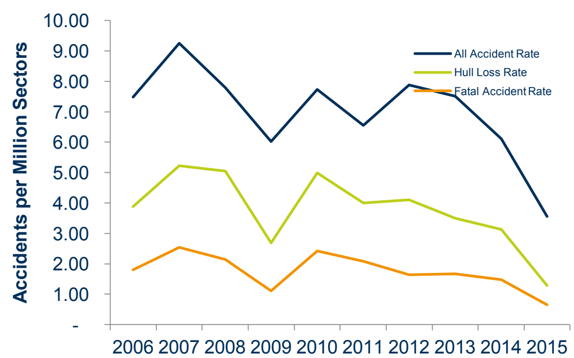
'Hard Landing' and 'In-Flight Damage' rates are also on the rise for turboprops, but significant improvement is observed in almost all other accident categories.



Jet ▪ All accidents



Turboprop ▪ All accidents



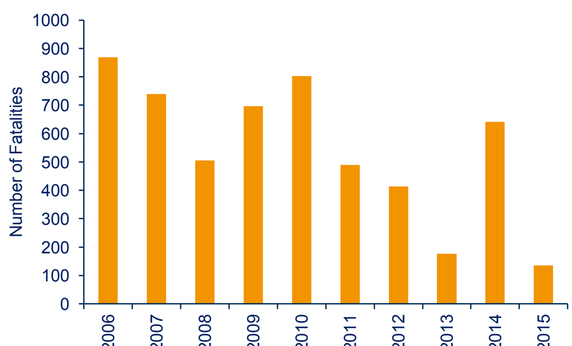
JET	2011	2012	2013	2014	2015
Runway / Taxiway Excursion	0.44	0.28	0.21	0.27	0.29
Ground Damage	0.40	0.07	0.28	0.20	0.19
Hard Landing	0.22	0.18	0.07	0.24	0.35
In-flight Damage	0.15	0.11	0.28	0.14	0.29
Gear-up Landing / Gear Collapse	0.26	0.07	0.17	0.24	0.19
Tailstrike	0.26	0.14	0.24	0.10	-
Loss of Control In-flight	0.11	0.07	0.10	0.07	-
Undershoot	0.04	0.04	0.03	-	0.13
Controlled Flight Into Terrain (CFIT)	0.11	0.04	0.07	-	-
Other End State	-	0.04	0.03	0.07	-
Mid-air Collision	-	0.04	-	-	0.03
Off Airport Landing / Ditching	-	-	-	0.03	-
Runway Collision	-	-	-	-	-

TURBOPROP	2011	2012	2013	2014	2015
Runway / Taxiway Excursion	1.12	2.30	2.00	1.32	0.97
Gear-up Landing / Gear Collapse	1.60	1.81	1.33	1.65	0.16
Controlled Flight Into Terrain (CFIT)	1.12	0.82	0.50	0.99	0.16
Loss of Control In-flight	0.80	0.66	0.83	0.66	0.48
Ground Damage	0.64	0.99	0.83	-	0.16
Hard Landing	0.48	0.49	0.33	0.49	0.81
In-flight Damage	0.32	0.16	0.33	0.66	0.48
Undershoot	-	0.16	0.33	0.16	0.16
Tailstrike	-	0.16	0.50	-	0.16
Off Airport Landing / Ditching	0.48	0.16	-	-	-
Other End State	-	0.16	0.17	0.16	-
Runway Collision	-	-	-	-	-
Mid-air Collision	-	-	-	-	-

2015 saw the lowest number of fatalities in the past 10 years, at 136.

It is important to note that the Safety Report only focuses on fatalities caused to people on board the aircraft, not on the ground or other aircraft not fitting into the accident criteria. Also, the Safety Report excludes accidents caused by acts of unlawful interference, as these are considered security issues, not safety issues.

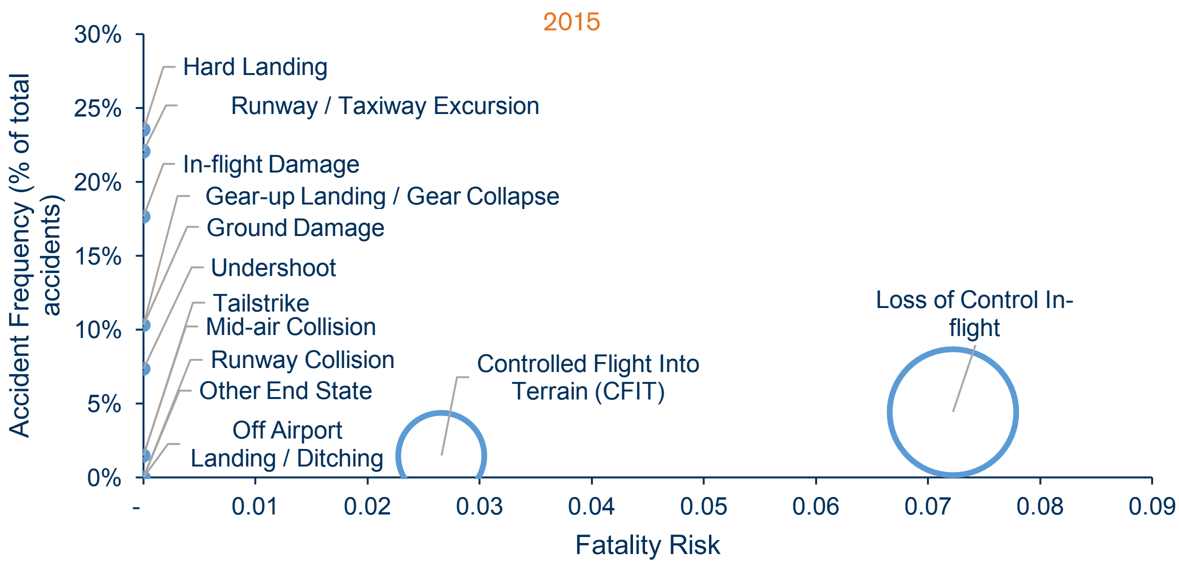
Germanwings Flight 9525 and Metrojet Flight 9268 are not included in the 2015 accident or fatality count. Germanwings for not fitting into the accident criteria and Metrojet for the uncertainty surrounding the facts that contributed to the accident. The ACTF found it prudent to wait for the final report to be released before taking a final position on Metrojet.



Accident Categories

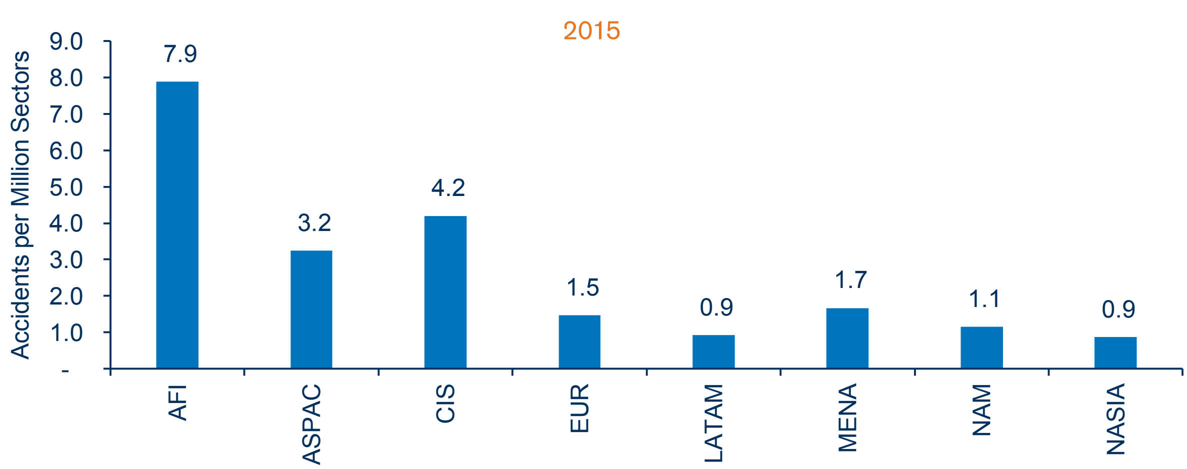
Hard Landing was the accident category that occurred the most in 2015, at 24% of the total, followed by Runway/Taxiway Excursion at 22%. Loss of Control In-flight (LOC-I) was the accident category that contributed not only to most of the deaths overall, but also to a higher ratio of people who perished compared to the number of people on board (represented by the Fatality Risk metric shown in the graph below). The fatality risk metric is explained at the end of this executive summary. An in-depth analysis of each of the accident categories is given in Section 4.

The graph below shows that Controlled Flight into Terrain (CFIT) and LOC-I were the only accident categories to experience fatalities in 2015. While LOC-I contributed the least to the overall number of accidents in 2015, it exposed passengers and crew to the highest risk of a catastrophic accident with no survivors, at a rate of about 0.07 accidents per million sectors. This translates into an exposure of one catastrophic accident for every 13.9 million sectors.



Regional Analysis

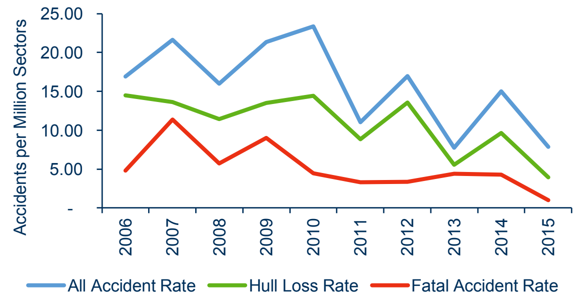
Africa (AFI), the Commonwealth of Independent States (CIS) and Asia Pacific (ASPAC) had the highest accident rates in 2015 at, respectively, 7.9, 4.2 and 3.2 accidents per million sectors, while Latin America & the Caribbean (LATAM) and North Asia (NASIA) had the lowest scores, at 0.92 and 0.86 accidents per million sectors, respectively.



Africa (AFI)

While Africa had the highest accident rate in 2015, at 7.9 accidents per million sectors, its overall accident rate has been trending downward, particularly since 2010. This coincides with the Abuja Declaration, where African states agreed to a series of safety targets.

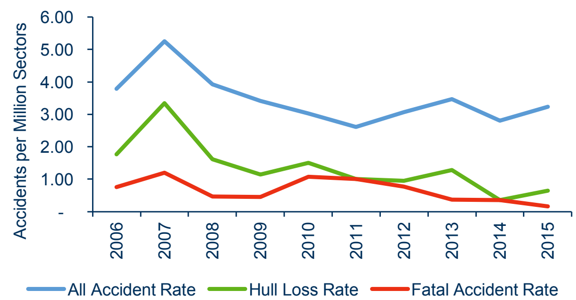
For more details on the Abuja Declaration refer to Addendum D of this report.



Asia Pacific (ASPAC)

The overall accident rate in ASPAC has been trending up slightly since 2011, after a period of consistent improvement between 2007 and 2011.

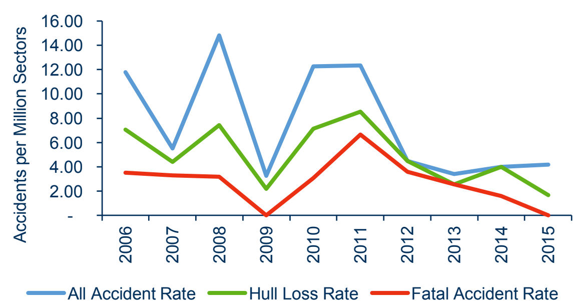
Counterbalancing this upward trend in the last five years, the hull loss and fatal accident rates have been declining.



Commonwealth of Independent States (CIS)

After a period of high volatility in the accident rate between 2006 and 2012, from a peak of 14.83 in 2008 to a low of 3.28 in 2009, the accident rate has stabilized at approximately four accidents per million sectors since 2012, with a slight upward trend.

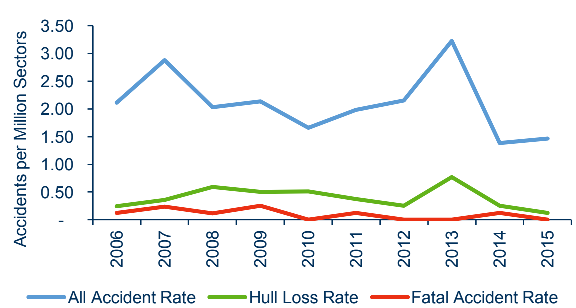
However, the hull loss and fatal accident rates have experienced a significant and steady decrease since 2011, with zero fatal accidents in 2015.



Europe (EUR)

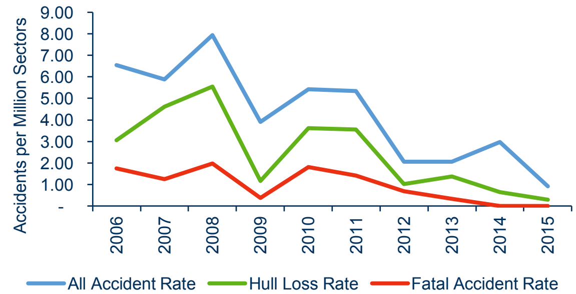
In 2015, Europe's overall accident rate was the third lowest, at 1.5 accidents per million sectors, and had a hull loss rate of 0.12 and zero fatal accidents.

All three rates were fairly stable compared with 2014 rates and down significantly from a peak in 2013.



Latin America & the Caribbean (LATAM)

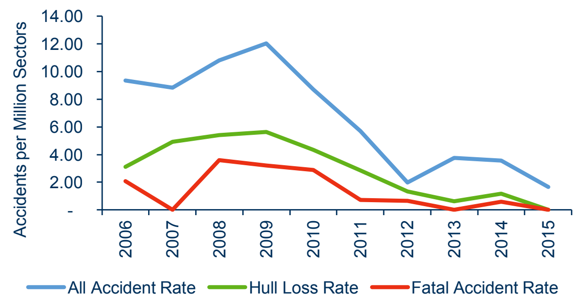
With the second lowest accident rate in 2015, at 0.92 accidents per million sectors, the LATAM region has experienced a fairly constant decline over the past seven years in terms of all three rates and has two consecutive years without a fatal accident.



Middle East and North Africa (MENA)

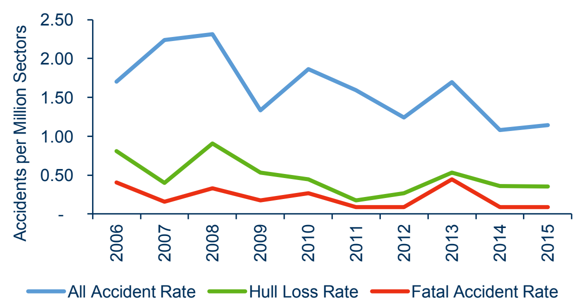
MENA saw no hull losses or fatal accidents in 2015 and had an overall accident rate of 1.67 accidents per million sectors.

All three rates have shown significant and consistent improvement since 2009.



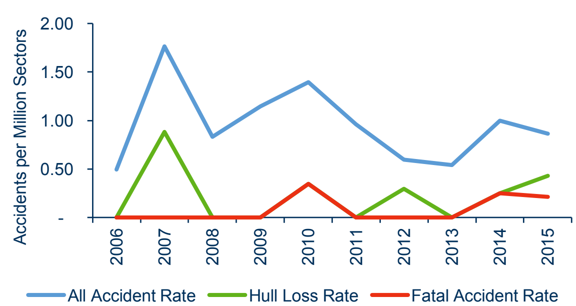
North America (NAM)

The overall accident rate in North America, at 1.15 accidents per million sectors in 2015, has been on a slowly declining trend over the past 10 years. This despite a slight upward trend in the hull loss rate in the past five years.



North Asia (NASIA)

North Asia had the lowest overall accident rate in 2015, at 0.86 accidents per million sectors. While there is a general downward trend over the 10-year period, all three rates (overall, hull loss and fatal) have trended up slightly during the past four years.



Cargo Accidents

The sector information was not available for accident rates to be calculated. This is as a result of the complexities in splitting the flight count into the different types of operation. Therefore, the Cargo section (see Section 6) focuses mainly on counts and percent distributions. The IATA team responsible for the accident database is working towards including cargo accident rates in future reports.

Cabin Safety

Measurement of cabin safety is a difficult task as it encompasses multiple aspects including, but not limited to, service of hot food and drink, security, handling of unruly passengers, turbulence, medical emergencies, contagious diseases, cabin baggage and enforcement of safety regulations. The most important role of cabin crew is to prevent any situation from escalating and leading to an incident or accident. As a result, while cabin safety does not contribute to the cause of any accident described in this report, the cabin crew's responses may have done. The Cabin End State classification used in this report (see Section 7) describes the end state that faced the cabin crew following an accident. It does not give an indication of how cabin crew actions may have influenced circumstances leading up to the event. In most cases, the causes of the accident were outside the control of the cabin crew.

Nevertheless, some useful conclusions can be drawn from the data. Foremost among these is that the data clearly demonstrate that cabin crew responses to an accident are most likely to have a positive impact on the survivability of aircraft occupants. Also, in 2015, fatalities occurred in just two out of 47 evacuations.

The world is constantly remitting more cabin safety data and cabin safety professionals are tasked with maintaining knowledge of many different areas and new initiatives. Fatigue Risk Management, Safety Management Systems, Auditing and Risk Assessments are all topics that feature regularly in the work of the IATA Cabin Safety Group.

IATA continues to help operators manage safe cabins by sharing best practice guidance and keeping its members informed of developments in cabin safety. The IATA Cabin Operations Safety Conference (www.iata.org/cabin-safety-conference) continues to grow and has become a useful and well-attended event for delegates to learn about recent updates and initiatives and increase their understanding of regulations and policies.

TAWS Analysis

An in-depth analysis of TAWS (Terrain Awareness & Warning System) events using data from different GADM (Global Aviation Data Management) programs is presented on Section 9 of this report.

IOSA

The IATA Operational Safety Audit (IOSA) program is an internationally recognized and accepted evaluation system designed to assess the operational management and control systems of an airline. All IATA members are IOSA registered and must remain registered to maintain IATA membership. The total accident rate for IOSA carriers in 2015 was nearly three times better than the rate for non-IOSA operators. As such, IOSA has become a global standard, recognized well beyond IATA membership. As at December 2015, 138 (34%) of the 402 airlines on the IOSA registry were non-IATA member airlines.

ISSA

In 2015 IATA introduced the IATA Standard Safety Assessment (ISSA) for operators not eligible for the IATA Operational Safety Audit (IOSA). ISSA is a voluntary safety program aligned with global best practices and created primarily for airlines that operate aircraft which have a lower maximum take-off weight (MTOW) than the 5,700 kg (12,566 lbs.) threshold for participation in IOSA. ISSA is also an alternative for operators, such as some private charters whose business model does not allow conformity with the IOSA requirements. ISSA is not a substitute for IOSA which remains a requirement for IATA membership.

More information can be found under www.iata.org/issa.

Fatality Risk

Definition

IATA has added another measure of air carrier safety to its annual Safety Report: **fatality risk**. This measure seeks to answer the following question: What was the exposure of a passenger or crew to a catastrophic accident where all people on board perished?

The equation to calculate the fatality risk is **Q = V/N**, where:

- **N** is the number of flights or sectors conducted during the period
- **V** is the total number of "full-loss equivalents" among the N flights or sectors. The full-loss equivalent for a given flight is the proportion of passengers and crew who do not survive the accident. For example,
  - if a flight lands safely, the full-loss equivalent is zero
  - if a flight results in an accident in which all passengers and crew are killed, the full-loss equivalent is one
  - if a flight results in an accident in which half of passengers and crew are killed, the full-loss equivalent is 0.5

V is the sum of all full-loss equivalents calculated for all N flights. In other words, the fatality risk rate (Q) is the sum of the individual accident full-loss equivalents divided by the total number of flights.

Examples

The following chart illustrates two examples:

Case 1: There were a total of four accidents:

Accident	% of People-Onboard Who Perished	Full-Loss Equivalent
#1	0%	0
#2	100%	1
#3	50%	0.5
#4	50%	0.5
Total Full-Loss Equivalent		2
Number of Sectors		3,000,000
Fatality Risk		0.00000067
Fatality Risk (normalized per 1 million sectors)		0.67

In Case 1, there were a total of four accidents out of three million sectors. Of these four accidents, one had no fatalities, one was a complete full loss with all onboard killed, and two in which half onboard perished.

In total, there were two full-loss equivalents out of three million sectors, which equates to 0.67 full-loss equivalents per million sectors. In other words, the exposure of all passengers and crew who flew on those sectors to a catastrophic accident was 1 in 1.5 million flights.

Case 2: There were a total of six accidents:

Accident	% of People-Onboard Who Perished	Full-Loss Equivalent
#1	0%	0
#2	10%	0.1
#3	20%	0.2
#4	50%	0.5
#5	30%	0.3
#6	40%	0.4
Total Full-Loss Equivalent		1.5
Number of Sectors		3,000,000
Fatality Risk		0.0000005
Fatality Risk (normalized per 1 million sectors)		0.50

In Case 2, there were a total of six accidents out of three million sectors. Of these six accidents, five experienced some fatalities, but there was no complete full loss. The total of the full-loss equivalents was 1.5. This equates to a fatality risk of 0.50 per million sectors. The exposure, in this case, was of one catastrophic accident per two million flights.

When comparing the above cases, the risk of perishing on a randomly selected flight is lower in Case 2 despite the fact that there were more accidents with fatalities. Case 1 had fewer fatal accidents, but they were more severe. Therefore, the odds of a passenger or crew losing their life on a given flight (fatality risk) is higher in Case 1 than in Case 2.

Considerations

It is important to note that the calculation of fatality risk does not take into account the size of the airplane, how many people were onboard, or the length of the flight. Rather, what is key is the percentage of people, from the total carried, who perished. It does not matter if the accident was on a long-haul flight on a large aircraft where 25% of the passengers did not survive, or on a small commuter flight with the same ratio. The likelihood of perishing is the same.

Fatality risk, or full-loss equivalent, can easily be mistaken to represent the number of fatal accidents (or the fatal accident rate). Although fatality risk only exists once there is a fatal accident, they are not the same. While a fatal accident indicates an accident where at least one person perished, the full-loss equivalent indicates the proportion of people on board who perished.

Fatality risk provides a good baseline for comparison between accident categories. For example, Loss of Control In-flight (LOC-I) is known to have a high fatality risk, but a low frequency of occurrence. Runway Excursion, on the other hand, has a low fatality risk, but a high frequency of occurrence. It is possible, therefore, for the Runway Excursion category to have the same fatality risk as LOC-I if its frequency of occurrence is high enough so that the generally small full-loss equivalent for each individual accident produces the same total full-loss equivalent number as LOC-I (per million sectors).

Finally, as seen throughout the report, the aviation industry is reaching a point where the fatality risk and the fatal accident rate are converging. Much work has been done in improving aviation safety worldwide and, in most cases, the fatal accident rate has been dramatically declining over the years. The convergence of fatality risk and fatal accident rate may indicate, although it is not possible to confirm, that these accident mitigation efforts have done the job of removing the 'low-hanging fruits' that were causing most of the accidents. Even as accident rates reach historic lows, the work of the safety professionals across the commercial aviation industry continues to be as important as it was in the past.

2015 Results

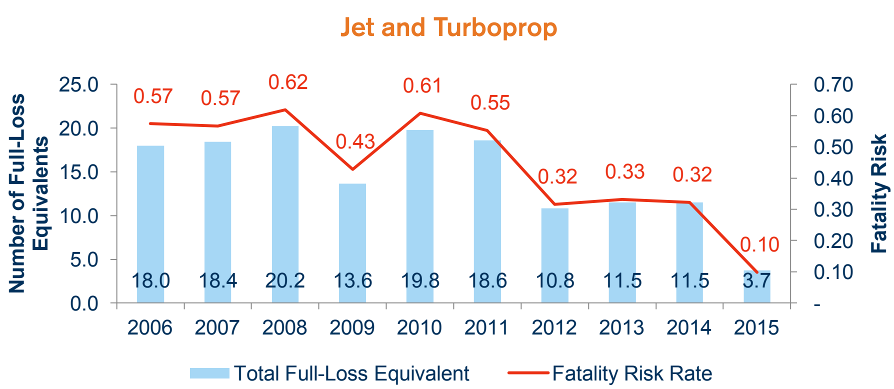
In 2015, there were four accidents with at least one fatality and the sum of the full-loss equivalents was 3.72. This translates to a fatality risk of 0.10 per million sectors or one per 10 million sectors. Put another way, if someone were to take a flight every day, he or she could expect to experience a catastrophic accident sometime within the next 2,700 years.

2015 marks a significant improvement over 2014, where the total of the full-loss equivalents was 11.49 and the fatality risk was of 0.32, and over the average for the past five years, where the total full-loss equivalent was 14.44 and the fatality risk was 0.42.

The significant improvement in 2015 can be attributed mainly to a major drop in the number of fatal accidents, of which there were only four. In 2015, there were no fatal jet accidents compared to 0.10 per million sectors in 2014. And, the fatal accident rate for turboprops fell by more than half from 1.48 per million sectors to 0.65. By definition, the fatality risk for jets was zero in 2015, and, for turboprops, it was 0.60 per million sectors.

By region, the 2015 fatality risk breaks down as follows:

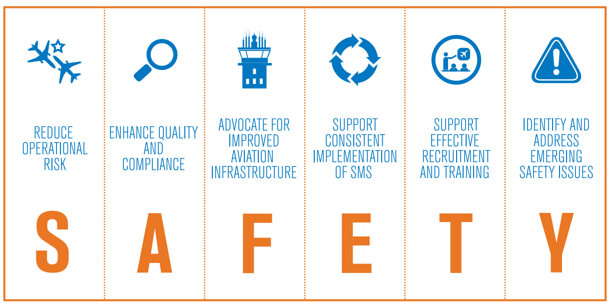
- AFI: 0.96
- ASPAC: 0.16
- NASIA: 0.16
- NAM: 0.09
- All other regions: . . . 0.00



IATA Safety Strategy

The IATA Six-Point Safety Strategy - 2013, was developed with much input and consultation by the IATA Safety Group, and was endorsed by IATA's Operations Committee (OPC) in October 2013. This strategy is a living document, subject to continuous review and revision to remain current and relevant.

IATA continues to use this safety strategy to drive its action towards an integrated, data-driven approach for managing safety risks to continuously improve aviation safety.



IATA'S SIX POINT STRATEGY

IATA's Safety Strategy is a holistic approach to identifying organizational and operational safety issues. Its key pillars are:

- Improved technology
- Regulatory harmonization
- Training
- Awareness

IATA will work closely with industry stakeholders to ensure each of these pillars is leveraged to address each of the six safety strategies, namely:

1. Reduce operational risk

2. Enhance quality and compliance

3. Advocate for improved aviation infrastructure

4. Support consistent implementation of SMS

5. Support effective recruitment and training

6. Identify and address emerging safety issues

Each of these six key areas breaks down into several sub-categories to address specific aspects of the strategy.

REDUCE OPERATIONAL RISK

IATA has identified three primary areas of risks: Loss of Control In-Flight (LOC-I), Controlled Flight into Terrain (CFIT) and Runway Excursion. The first two are the primary cause of fatal accidents, whereas runway excursions accounted for the majority of accidents in the last five (5) years.

Almost all LOC-I and CFIT accidents lead to both fatalities and hull losses, while other accident categories generated mainly damage to aircraft. For example, three percent (3%) of Runway / Taxiway Excursion accidents caused fatalities during the period of 2011 - 2015, and are the third source of fatal accidents. Nevertheless, Runway / Taxiway Excursions have become the main source of hull losses with 25% of all accidents during the mentioned period.

IATA continues to prioritize action in those three (3) areas of aviation safety – reducing the number of LOC-I accidents, reducing the number of CFIT accidents and improving runway safety. All of these actions will contribute to the main priority of IATA to continually reduce the global accident fatality rate.

IATA is also placing more efforts on Approach and Landing accidents, which are the most potentially critical phases of flight. They account for a substantial proportion of commercial accidents - 65% of all accidents from 2011-2015 occurred in the approach and landing phase.

Some of these resulted in CFIT, LOC-I or Runway Safety accidents. IATA is committed to reducing the number of these accidents and is focusing on the dissemination of safety information to prevent approach and landing accidents, as well as focusing its efforts in increasing the awareness of air operators' management and flight operations personnel on the factors which contribute to those types of accidents, thus helping the industry develop and prioritize safety intervention strategies that will reduce the potential for approach and landing accidents.

Loss of Control In-Flight

Loss of Control In-Flight (LOC-I) refers to accidents in which the flight crew was unable to maintain control of the aircraft in flight, resulting in an unrecoverable deviation from the intended flight path. Reducing LOC-I is a priority of IATA and aviation organizations across the globe. IATA has embarked on a number of initiatives to increase the attention devoted to this important area of concern:

- IATA developed different guidance materials and best practices to support the awareness and mitigation of LOC-I occurrences and provided easy access to these materials on a LOC-I webpage;
- Analyses of LOC-I range from considerations of aircraft design to pilot training and regulatory oversight to change management. The Loss of Control Prevention: Beyond the Control of Pilots document has been published to cover the

aircraft design/manufacture characteristics as well as the organizational/managerial aspects and their role in aviation accidents;

- IATA's Pilot Training Task Force has developed guidance material for Loss of Control training, especially focusing on operators, who wish to implement such a program;
- Through regional workshops, outreach and awareness initiatives, IATA shares LOC-I information, hazards, threats and mitigation strategy;

Together with the industry, IATA continues to address LOC-I threats in airline operations and has made progress in preventing such accidents and saving lives.

Controlled Flight into Terrain

Controlled Flight into Terrain (CFIT) refers to accidents in which there was in-flight collision with terrain, water or obstacle without indication of loss of control. The critical distinction in these types of accidents is the fact that the aircraft is flyable and under the control of the flight crew. CFIT accidents represented seven percent (7%) of total accidents but are responsible for 37% of all fatal accidents from 2011-2015. Like LOC-I, CFIT represents a significant contributor to the overall accident rate. Most CFIT accidents occur in the approach and landing phases of flight and are often associated with lack of precision approaches and loss of situational awareness.

There are numerous contributing factors to such an event. Typically, aircraft malfunction is not the main cause of CFIT accident; rather the accident's probable causes are often attributed to flight crew or human error, such as non-compliance with established procedures (SOPs), poor Crew Resource Management, inadequate flight path management, lack of vertical and/or horizontal position awareness in relation to terrain, unstabilized approaches, failure to initiate a go-around when a go-around was necessary and others.

IATA, together with the industry, continues to focus its operational safety efforts on reducing this accident category and employing mitigation strategies for CFIT prevention. IATA will conduct a study into the non-adherence to standard operating procedures (SOP) to see if there are effective mitigating factors that industry might adopt to reduce the number of CFIT accidents.

Runway Safety

Events such as runway excursions, undershoot, runway incursion, hard landings and tail strikes are a persistent problem affecting operators worldwide. Runway / Taxiway Excursion continues to be the most frequent accident category type.

While there is a slight improvement in the runway excursion accident rate, IATA Global Aviation Data Management (GADM) statistics show that runway safety remains an area of concern for the industry. Although runway excursions are the most common type of accident, the associated fatality rate is much lower than in other accident categories.

IATA recognizes the need for continued improvement in runway safety area which is one of the industry's principal risk areas.

IATA has embarked on the following series of programs:

1. IATA has developed different reports and guidance materials establishing best practices to support the mitigation of runway safety occurrences. In order to provide easy access to these materials IATA has developed a runway safety webpage. All these materials are available on www.iata.org/whatwedo/safety/runway-safety/Pages/index.aspx.
2. IATA Global Aviation Data Management (GADM) has produced airport analysis and accident analysis with the view of supporting Regional Aviation Safety Groups (RASGs), Runway Safety Go-Teams.
3. Through outreach and awareness initiatives, IATA shares information and lessons learned on runway safety issues, hazards and effective solutions with all industry stakeholders.

Together with the industry, IATA will continue to focus its efforts, attention and resources to reduce risk in the Runway Safety arena.

Fatigue Risk

The traditional regulatory approach to manage crew member fatigue has been to prescribe limits on maximum flight and duty hours, and to require minimum breaks within and between duty periods. It is a "one-size-fits-all" approach that does not reflect operational differences. A Fatigue Risk Management System (FRMS) is an enhancement to flight and duty time limitations (FTLs), enabling an operator to customize FTLs to better manage fatigue risk in its operation.

A FRMS allows an operator to adapt policies, procedures and practices to the specific conditions that result in fatigue risk in a particular aviation setting. For example, FRMS processes have been used to identify and mitigate fatigue risk within normal prescriptive flight time limitations, as well as providing flexibility for operations beyond normal prescriptive limits (e.g. ultra-long range operations) in a manner that assures equivalent or enhanced safety levels.

By applying the Safety Management System (SMS) principles of risk identification, assessment, mitigation and monitoring, FRMS provides a performance-based approach to manage fatigue risk. Like SMS, FRMS seeks to achieve a realistic balance between safety, productivity and cost.

A key feature of FRMS is that responsibility for managing fatigue risk is shared between operators and individual crewmembers, i.e., operators are responsible for providing rest opportunities while crewmembers have a responsibility to use rest periods effectively. FRMS also relies on the concept of an "effective reporting culture" with active involvement of all stakeholders, where personnel is constantly encouraged to report hazards whenever observed in the operational environment for the attainment of optimum safety levels and a continuous program improvement.

With the support of the IATA FRMS Task Force, IATA has developed and published guidance materials to support a globally harmonized implementation of FRMS. In 2014 we published the document "Fatigue Safety Performance Indicators (SPIs): A Key Component of Proactive Fatigue Hazard Identification". This document reviews different SPIs to help carriers develop processes and procedures to monitor the effectiveness of fatigue management approaches. In 2015 we published the "Common Protocol for Minimum Data Collection Variables in Aviation Operations" document. This document presents an overview of a common protocol for data collection and identifies a minimum set of fatigue related variables that would allow for the comparison of data across operational studies. The 2^{nd} Edition of the cobranded IATA/ICAO/IFALPA Fatigue Management Guide for Airline Operators is now available.

ENHANCE QUALITY AND COMPLIANCE

The importance of monitoring and oversight in the maintenance and improvement of aviation safety standards cannot be emphasized enough. Regulations must evolve as the industry grows and technologies change. The Audit Programs aim to increase global safety performance and to reduce the number of redundant auditing activities in the industry. The IOSA Program lessens the burden on the industry by representing a global standard that is utilized by numerous regulators to complement their oversight activities on commercial operators.

Auditing - IOSA

IATA's Operational Safety Audit program (IOSA) is generally recognized as the "gold standard" for operators. The initial goals of establishing a broad foundation for improved operational safety and security and eliminating redundant industry audits have been reached.

IATA Standard Safety Assessment Program (ISSA)

The ISSA is a voluntary evaluation program, produced at the request of the industry, to extend the benefits of operational safety and efficiency that emanated from the IATA Operational Safety Audit (IOSA) Program to the operators of smaller aircraft that are not eligible for the IOSA program.

The ISSA program offers the entry into an IATA Assessment Registry to operators that utilize aircraft with a maximum take-off weight (MTOW) below 5,700 kg. It also offers a one term registration opportunity to operators of aircraft with an MTOW above 5700 kg.

Auditing - ISAGO

The IATA Safety Audit for Ground Operations (ISAGO) improves ground safety and aims to reduce accidents and incidents and risk in ground operations. ISAGO is a standardized and structured audit program of Ground Service Providers (GSPs), that is, ground handling companies operating at airports. It uses internationally recognized operational standards that have been developed by global experts. The audits are conducted by highly trained and experienced auditors.

In addition to improving ground safety, ISAGO provides cost savings of up to 40% for both airlines and GSPs by decreasing the number of redundant audits.

Auditing - IFQP

The IATA Fuel Quality Pool (IFQP) is a group of airlines that actively share fuel inspection responsibilities and reports. The IFQP enhances safety and improves quality control standards at airport fuel facilities worldwide. All inspections are performed by IFQP-qualified inspectors who use a standardized checklist that reflects current industry regulations. This ensures uniformity of standards, performance levels, quality, and safety procedures for everyone.

Auditing - DAQP

The IATA DAQCP is a group of more than 100 airlines that audit De/anti-icing providers and share the inspection reports and workload at various locations worldwide. Its main goal is to ensure that safety guidelines, quality control recommendations and standards of the De-icing/Anti-icing procedures are followed at all airports.

ADVOCATE FOR IMPROVED AVIATION INFRASTRUCTURE

Working closely with IATA members, key partners such as ICAO, the Civil Air Navigation Services Organization (CANSO) and Airports Council International (ACI), state regulators and Air Navigation Service Providers (ANSPs), the IATA Air Traffic Management (ATM) Infrastructure department strives to ensure that ATM and Communication Navigation and Surveillance (CNS) infrastructure is globally harmonized, interoperable, and meets the requirements of the aviation industry. Advocating for improved aviation infrastructure is fundamental to addressing current and future operational deficiencies and safety risks.

By 2020, forecasts indicate that traffic is expected to increase by about:

- 50% in Asia
- 40% in South America
- 40% in the Middle East
- 11% in Africa

Supporting such traffic growth will require cost-effective investments in infrastructure that meet safety and operational requirements. The ICAO Global Air Navigation Plan (GANP) provides a framework for harmonized implementation of service level improvement enablers by aircraft operators and ANSPs.

The IATA Safety Strategy focuses on the following key priorities:

- Implementation of Performance-Based Navigation (PBN); particularly Approaches with Vertical Guidance (APV).
- Operational improvements and safety enhancements associated with the implementation of Aviation System Block Upgrade (ASBU) modules; e.g., Continuous Descent Operations (CDO) and Continuous Climb Operations (CCO).
- Collaborative Decision Making (CDM) to achieve safety and service level improvements.

Performance-Based Navigation with Vertical Guidance

At their 37^{th} General Assembly in September 2010, ICAO member states agreed to complete a national PBN implementation plan as a matter of urgency. The aim was to achieve PBN approach procedures with vertical guidance for all instrument runway ends by 2016.

Due to a low level of progress, IATA continues to engage States, ANSPs, and airlines to accelerate implementation of APV procedures and demonstrate the risks associated with the continued use of non-precision approaches.

Air Traffic Management

IATA has implemented the following ATM infrastructure safety initiatives:

- Promoted operational improvements and safety enhancements associated with the implementation of ASBU modules; e.g., PBN, CDO, CCO.
- Encouraged CDM to achieve infrastructure improvements.
- Encouraged the flexible use of airspace between civilian and military airspace users.
- Advocated for global interoperability and harmonization, especially with the Single European Sky ATM Research (SESAR) program and the NextGen programme in the United States.

SUPPORT CONSISTENT IMPLEMENTATION OF SMS

IATA continues to drive effective implementation of Safety Management in the Industry through various initiatives. In 2015, IATA SMS activities were focused on delivering the ICAO Annex 19 amendments, initial work related to supporting guidance material, as well as initiatives in anticipation of needs that would arise as a result of the Annex 19 amendments.

The amendments will become effective in July 2016 and applicable in November 2019. Three main areas emphasized in Annex 19 amendments are Safety data and safety information protection, Safety Culture and State Safety Programs (SSPs).

Subsequently, IATA Safety initiatives underway in 2016 have been centered on educating airline operators and other relevant stakeholders on the intent of new provisions and on initiatives that would facilitate operator compliance.

In addition to continuously monitoring IOSA SMS designated SARPs and developing supporting guidance and training material to address identified needs, IATA Safety has focused its efforts on following areas:

Annex 19 Amendments – Guidance Material

Through leading one of the working groups on the ICAO Safety Management Panel, IATA helps develop guidance material to support Annex 19 amendments.

Safety Culture - Addressing the Requirement to Measure and Improve Safety Culture

IATA Safety has created the IATA Aviation Safety Culture (I-ASC) survey to support an organization's safety management activities. The survey was developed through consultation with key aviation stakeholders and in collaboration with Cranfield University. Developed specifically for the aviation industry, I-ASC has been designed to provide participants with an impartial assessment of nine enablers of Safety Culture in their organization, together with identified actions for improvement.

Safety Data and Safety Information Protection

IATA is also working on initiatives with stakeholders around the world to not only raise awareness on the enhanced safety data and safety information protections, its disclosure and use, but also applying them in a practical sense.

IATA Safety Management Conference – A Decade in Review and the Vision Forward

Lastly, marking the first decade since the introduction of the ICAO Safety Management requirements, IATA is hosting a first of its kind conference to review the vision, intent and future of Safety Management. With the acknowledgement that Safety Management in the aviation Industry can only be fully realized through collaboration, the scope of this conference will enable all stakeholders under the purview of Annex 19 (airline operators, CAAs, airports, OEMs, ANSPs, etc.) to share experiences, challenges and lessons learned with SMS and SSP implementation, and identify key strategies to collectively move forward. The outcomes of this conference are intended to drive the direction of future IATA Safety Management activities.

SUPPORT EFFECTIVE TRAINING

IATA's safety training portfolio includes courses dedicated to improving specific competencies as well as diploma programs focused on safety management, workplace safety, and best practices for civil aviation.

The IATA Safety Strategy focusses on competency-based training for the following key areas:

- Multi Crew Pilot Licensing (MPL)
- Evidence Based Training (EBT)
- Cabin crew competency-based training

Training and Licensing

The IATA Training and Licensing portfolio seeks to modernize and harmonize the training of current and future generations of pilots and maintenance technicians. It is a multi-faceted portfolio that seeks to develop guidance materials and best practices to support the implementation of Multi-Crew Pilot License (MPL) training, Evidence-Based Training (EBT), Pilot Aptitude Testing (PAT), Instructor Qualification (IQ), Flight Simulation Training Device (FSTD) qualification criteria, and Engineering & Maintenance (E&M) training and qualification requirements.

Multi-Crew Pilot License (MPL) Training

Progress in the design and reliability of modern aircraft, a rapidly changing operational environment and the need to better address the human factors issue prompted an industry review of pilot training. The traditional hours-based qualification process fails to guarantee competency in all cases. Therefore, the industry saw a need to develop a new paradigm for competency-based training and assessment of airline pilots: Multi-Crew Pilot License (MPL) training.

MPL moves from task-based to competency-based training in a multi-crew setting from the initial stages of training. Crew Resource Management (CRM) and Threat and Error Management (TEM) skills are embedded throughout the training. The majority of incidents and accidents in civil aviation are still caused by human factors such as a lack of interpersonal skills (e.g., communication, leadership and teamwork), workload management, situational awareness, and structured decision making. MPL requires full-time embedded, as opposed to added-on, CRM and TEM training.

The global uptake of MPL is accelerating. In December 2015:

- 58 states had MPL regulations in place
- 19 states had Authorized Training Organizations (ATOs) running MPL courses
- A total of 3,450 students enrolled and 1,296 graduated.

The second edition and cobranded IATA/IFALPA MPL Implementation Guide was published in 2015 to support airlines during their implementation process.

Evidence-Based Training

Evidence-Based Training (EBT) applies the principles of competency-based training for safe, effective and efficient airline operations while addressing relevant threats. ICAO has defined competency as the combination of Knowledge, Skills and Attitudes (KSAs) required to perform tasks to a prescribed standard under certain conditions.

The aim of an EBT program is to identify, develop and evaluate the key competencies required by pilots to operate safely, effectively and efficiently in a commercial air transport environment, by managing the most relevant threats and errors, based on evidence collected in operations and training. The following documents published by ICAO and IATA will allow airlines to develop an effective EBT program:

- ICAO Manual of Evidence-Based Training (Doc.9995)
- Updates to ICAO Procedures for Air Navigation Services - Training (PANS-TRG, Doc 9868)
- IATA/ICAO/IFALPA Evidence-Based Training Implementation Guide
- IATA Data Report for Evidence-Based Training

Implementation of EBT enables airlines to develop more effective training programs while improving operational safety. In recognition of the importance of competent instructors in any training program, the EBT program provides specific additional guidance on the required competencies and qualifications for instructors delivering EBT.

Pilot Aptitude Testing

Designed to support aviation managers in the field of pilot selection, Pilot Aptitude Testing (PAT) is a structured, science-based candidate selection process. PAT helps avoid disappointed applicants, wasted training capacity, and early drop out due to medical reasons. Proven to be highly effective and efficient, PAT provides enhanced safety, lower overall training costs, higher training and operations performance success rates, a more positive working environment and reductions in labor turnover.

Instructor Qualification

Instructor Qualification (IQ) addresses the need to upgrade instructor qualifications to conduct multi-crew pilot license (MPL) and other competency-based training programs. Traditional entry-level training for airline cadets often utilizes low-time flight instructors (FI) who are employed inexpensively while accumulating flying hours for airline operations. FI turnover is high and continuity is low. In addition, legacy training for a commercial pilot license (CPL) was based largely on a prescriptive hours-based approach. Today, MPL training and EBT are competency-based programs, which represents a paradigm shift for many instructors who need to be trained.-

Flight Simulation Training Device Qualification Criteria

IATA fully supports the new ICAO Flight Simulation Training Device (FSTD) qualification criteria and urges prompt action towards their adoption by the National Aviation Authorities (NAAs) of the world. The FSTD qualification criteria were developed for ICAO by the Royal Aeronautical Society (RAeS) International Working Group (IWG), in collaboration with IATA. The criteria reflect international agreement for a new standard of global classification of airplane FSTDs (Types I-VII).

Engineering and Maintenance Training and Qualification Requirements

The aim of the Engineering and Maintenance (E&M) training and qualification program is to identify, develop and evaluate the competencies required by commercial aircraft maintenance personnel to operate safely, effectively and efficiently. This is accomplished by managing the most relevant risks, threats and errors, based on evidence.

E&M is geared toward individual student performance. The specification of the competency to be achieved, the evaluation of the student's entry level, the selection of the appropriate training method and training aids, and the assessment of a student's performance are key factors to the success of E&M.

International Pilot Training Consortium

IATA, ICAO, IFALPA and the RAeS have partnered to create the International Pilot Training Consortium (IPTC). The objective of the International Pilot Training Consortium is to improve safety, quality and efficiency of commercial aviation by developing common understandings on standards and processes for pilot training, instruction and evaluation to the benefit of the industry worldwide.

Cabin Crew Competency-Based Training

Upgraded cabin safety requirements as well as improved cabin crew training are key factors contributing to recent positive developments in safer aircraft operations. IATA actively participated in drafting the ICAO Cabin Crew Safety Training Manual (Doc 10002). The new guidance material is written with a competency-based approach to cabin crew safety training and includes important topics such as:

- Cabin crew safety training requirements and qualifications
- Training facilities
- Training devices
- Dangerous goods training
- Human performance
- Security
- Cabin health and first aid
- Safety Management Systems (SMS)
- Fatigue management
- Senior cabin crew training
- Cabin safety training management

IDENTIFY AND ADDRESS EMERGING SAFETY ISSUES

Techniques to improve aviation safety have moved beyond the analysis of isolated accidents to data-driven analyses of trends throughout the air transport value chain.

This approach is supported by IATA's Global Aviation Data Management (GADM) program. GADM is an ISO-certified (9001; 27001 certification in progress) master database that supports a proactive data-driven approach for advanced trend analysis and predictive risk mitigation.

Pulling from a multitude of sources, GADM is the most comprehensive airline operational database available. These sources include the IATA accident database, the Safety Trend Evaluation Analysis and Data Exchange System (STEADES), IOSA and ISAGO audit findings, Flight Data eXchange (FDX), the Ground Damage Database (GDDB) and operational reports, among others.

In 2013, the IATA Safety Group launched the Hazard Identification Task Force (HITF) to develop and implement a process for emerging and new hazard identification for the industry that builds on airline hazard registries, industry expertise and an open forum such as the Incident Review Meeting (IRM), as well as analysis from IATA's GADM program.

The Hazard Identification Process (HIP) allows IATA to be systematic and holistic when identifying hazards. The process provides the promise that there is a "closed loop", permitting action, follow up and on-going monitoring of hazards. It aligns with SMS methodology used by the airlines and elsewhere in the aviation industry. IATA will use this process to validate that high-priority hazards facing the aviation industry are addressed effectively.

That being said, the HIP has limitations to be aware of:

- The process will only work when all parties are engaged.
- In some instances, IATA cannot directly address a hazard, but can only raise awareness and/or lobby other organizations for change. In this way, the HIP will help to focus the IATA Safety Initiatives, rather than aim to capture all existing hazards.
- The process is not meant to substitute for an individual airline's SMS activity. Therefore, the data produced in the Hazard Registry will not necessarily reflect an accurate risk position for all operators.
- Some hazards may be regionally biased while others will have a more generic application.
- Hazards might affect stakeholders differently. It remains the responsibility of the affected organization to mitigate the hazard and to monitor its level of risk. For this reason, risk ratings are not included in the Hazard Registry.

The HITF will take a phased approach to implementing the HIP, initially starting with identifying hazards through the IRM and inputting these to the IATA Hazard Registry. Once this first stage is completed, the HITF will broaden its scope to include hazards from other sources.

With GADM and through the HITF and Hazard Registry, the IATA Safety Department is able to provide the industry with comprehensive, cross-database analysis to identify emerging trends and flag risks to be mitigated through safety programs. IATA's safety experts investigate these new areas of focus and develop preventative programs. Some of the emerging issues the IATA Safety Department is working on are:

- Lithium batteries
- Hover boards

Lithium Batteries

There have been a number of developments with the carriage of lithium batteries in the last year. Not least of all, ICAO has issued addendum 3 to the 2015-2016 edition of the Technical Instructions to address the changes applicable to lithium batteries. Effective 1 April 2016, all lithium-ion batteries shipped as UN 3480 under PI 965, Sections IA, IB and II must be at a state of charge (SoC) not exceeding 30%. For Section IA and IB of PI 965 there are provisions for shippers to have lithium ion batteries at a SoC of greater than 30%, but this requires an approval from the States of origin and of the operator. This prohibition does not impact lithium-ion batteries packaged in, or with, equipment (UN 3481).

In addition to this, the ICAO Air Navigation Commission (ANC) concluded its review of the 25th report of the Dangerous Goods Panel (DGP/25) report and addressed the concerns raised by Council members with respect to the transport of lithium-ion batteries as cargo. Having taken into account information provided by the DGP, the Airworthiness Panel, Flight Operations Panel, aircraft manufacturers and comments from the Secretariat, the ANC concluded that the risks associated with the carriage of lithium ion batteries as cargo are not adequately controlled.

As such, the ANC recommended to the ICAO Council that lithium-ion batteries packaged on their own (UN 3480), be forbidden for transport as cargo on passenger aircraft, until adequate controls to reduce the safety risks are put in place. The Council has adopted this recommendation, effective April 1, 2016.

The Commission recognizes the need to have a clear work plan towards developing adequate controls in the near-term with the ultimate goal of removing the prohibition. This will include the development of the performance-based packaging standards, risk assessment provisions and associated guidance material.

As a result of these changes, IATA is revising various documents, in particular the IATA Safety Risk Assessment (SRA) on the carriage of lithium batteries, Lithium Batteries Risk Mitigation Guidance for Operators and the IATA position paper on the carriage of lithium batteries.

Hover Boards

There has been significant media attention on the issue of hover boards, with some very high profile incidents being reported. None of the reported incidents have been while the devices were in air transport, but rather have been primarily while the devices were being charged, with one reported incident while the hover board was in use. In considering specific recommendations to member airlines on hover boards there are two aspects for consideration:

- Carriage by passengers. The position agreed is that these devices are NOT classed as mobility aids but are, in fact, to be treated as "portable electronic devices" (PED). As such, they are covered by the existing provisions in the IATA DGR and ICAO Technical Instructions which limits the carriage by passengers based on the Watt-hour rating of the lithium ion battery. As many hover boards have a lithium ion battery with a Watt-hour rating in excess of 100 Wh, carriage in passenger baggage is subject to the approval of the airline.
- Carriage as Cargo. Based on discussion with members of the ICAO Dangerous Goods Panel, and subsequently confirmed in a notice to States issued by ICAO, the correct classification of hover boards when shipped as cargo is UN 3171, Battery-powered vehicle. These are subject to the full provisions of the IATA DGR and ICAO Technical Instructions.

Comprehensive instructions are contained in the notices produced by IATA Cargo for both carriage by passengers and as cargo. For passenger baggage, there has been additional recommendation for airlines as follows: "Operators should consider developing posters, notices or other material with pictures or images of these small lithium battery-powered vehicles for display on their websites, at self-serve kiosks and check-in counters, specifically at airports serving cities where these devices are available, to alert passengers to the conditions applicable to their carriage in checked or carry-on baggage."

"There is no stronger partnership in aviation than the one that unites us in our efforts to improve safety"

1

IATA Annual Safety Report

Safety is aviation's highest priority. Seventy years ago, the global airline industry came together to create the International Air Transport Association (IATA). As part of IATA's mission to represent, lead and serve its members, the association partners with aviation stakeholders to collect, analyze and share safety information. It also advocates on behalf of global safety standards and best practices that are firmly founded on industry experience and expertise.

A vital tool in this effort is IATA's Annual Safety Report, which is now in its 52nd year of publication. This is the definitive yearbook to understand and track commercial aviation's safety performance, challenges and opportunities. This comprehensive document includes accident data and analyses, as well as mitigation strategies.

The Safety Report is a valuable tool as aviation works tirelessly to improve its already superb record.

Image courtesy of Airbus

INTRODUCTION TO THE IATA SAFETY REPORT 2015

The IATA Safety Report has been IATA's flagship safety document since 1964. It provides the industry with critical information derived from the analysis of aviation accidents to understand safety risks in the industry and propose mitigation strategies.

The 2015 Report was produced at the beginning of 2016 and presents the trends and statistics based on the knowledge of industry at the time. This report is made available to the industry for free distribution.

SAFETY REPORT METHODS AND ASSUMPTIONS

The Safety Report is produced each year and designed to present the best known information at the time of publication. Due to the nature of accident analysis, some assumptions must be made. It is important for the reader to understand these assumptions when working with the results of this report:

- Accidents analyzed and the categories and contributing factors assigned to those accidents are based on the best available information at the time of classification
- Sectors used to create the accident rates are the most up-to-date available at the time of production

The sector information is updated on a regular basis and takes into account actual and estimated data. As new updates are provided the sector count becomes more accurate for previous years, which in turn allows for an increased precision in the accident rate.

ACCIDENT CLASSIFICATION TASK FORCE

The IATA Operations Committee (OPC) and its Safety Group (SG) created the Accident Classification Task Force (ACTF) in order to analyze accidents, identity contributing factors, determine trends and areas of concern relating to operational safety and develop prevention strategies. The results of the work of the ACTF are incorporated in the annual IATA Safety Report.

It should be noted that many accident investigations are not complete at the time the ACTF meets to classify the year's events and additional facts may be uncovered in the course of an investigation that could affect the currently assigned classifications.

The ACTF is composed of safety experts from IATA, member airlines, original equipment manufacturers, professional associations and federations as well as other industry stakeholders. The group is instrumental in the analysis process and produces a safety report based on the subjective classification of accidents. The data analyzed and presented in this report is extracted from a variety of sources, including Ascend FlightGlobal and the accident investigation boards of the states where the accidents occurred. Once assembled, the ACTF validates each accident report using their expertise to develop an accurate assessment of the events.

ACTF 2015 participants:

Mr. Marcel Comeau
AIR CANADA

Mr. Xavier Barriola
AIRBUS

Mr. Nicolas Bardou
AIRBUS

Capt. Denis Landry
AIR LINE PILOTS ASSOCIATION (ALPA)

Dr. Dieter Reisinger (Chairman)
AUSTRIAN AIRLINES

Mrs. Marion Chaudet
ATR

Capt. Robert Aaron Jr.
THE BOEING COMPANY

Mr. Richard Mayfield
THE BOEING COMPANY

Mr. David Fisher
BOMBARDIER AEROSPACE

Mr. Luis Savio dos Santos
EMBRAER

Mr. Don Bateman
HONEYWELL

Mr. Bruno Ochin (Secretary)
IATA

Mr. Michael Goodfellow
ICAO

Capt. Arnaud Du Bédat
IFALPA

Peter Kaumanns
IFALPA

Capt. Takahisa Otsuka
JAPAN AIRLINES

Mr. Martin Plumleigh
JEPPESEN

Capt. Peter Krupa
LUFTHANSA GERMAN AIRLINES

Capt. Ayedh Almotairy
SAUDI ARABIAN AIRLINES

Mr. Steve Hough (Vice-chairman)
SAS

Capt. João Romão
TAP AIR PORTUGAL

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Decade in Review

AIRCRAFT ACCIDENTS AND FATALITIES

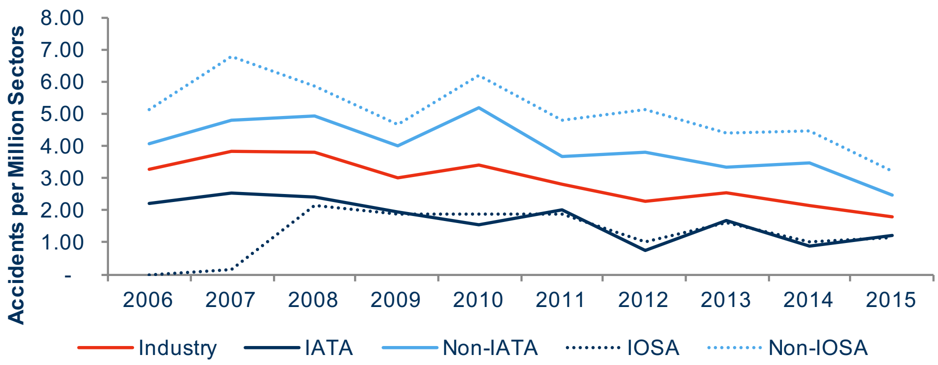
This section presents yearly accident rates for the past 10 years for each of the following accident metrics: all accidents, fatality risk, fatal accidents and hull losses, as well as general statistics on the number of fatalities and accident costs.

Image courtesy of Bombardier

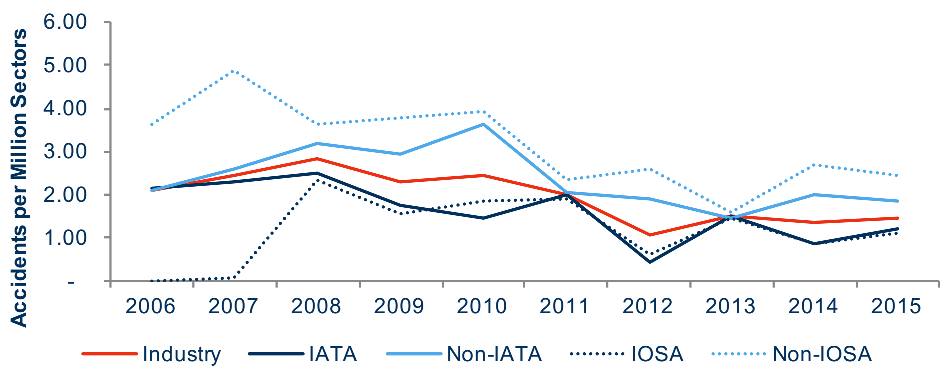
ALL ACCIDENTS

'All Accidents' is the most inclusive rate, including all accident types and all severities in terms of loss of life and damage to the aircraft.

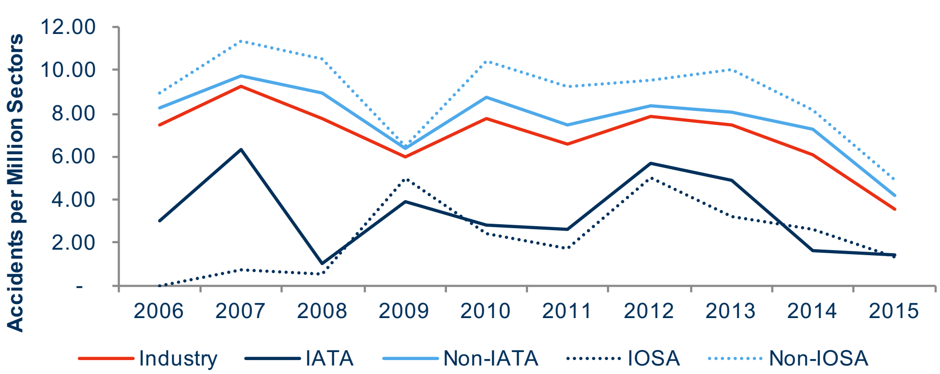
Jet & Turboprop Aircraft



Jet Aircraft



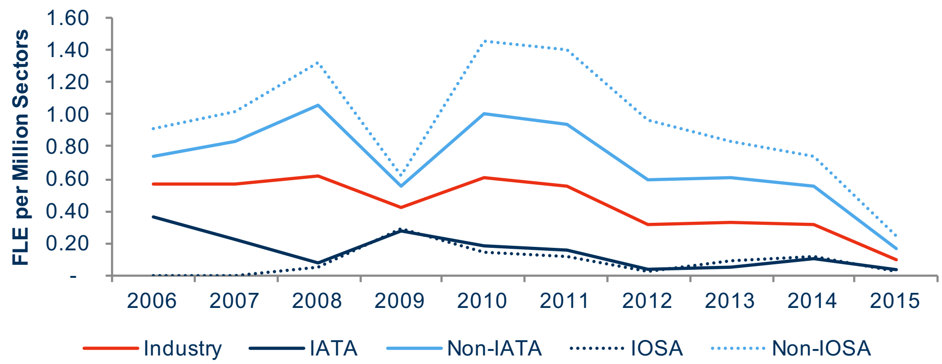
Turboprop Aircraft



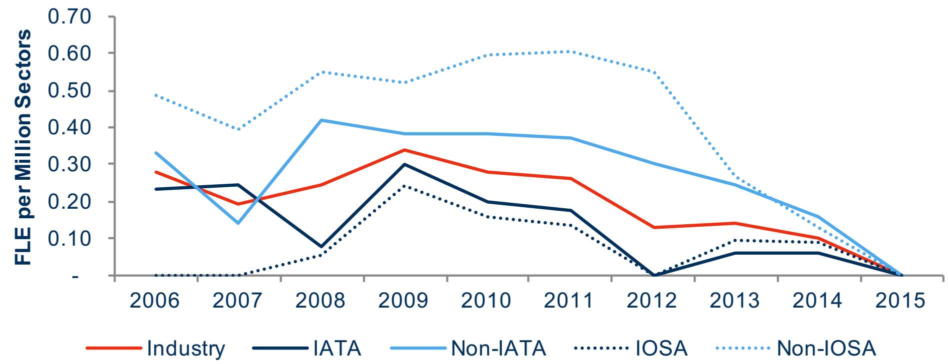
FATALITY RISK

Fatality Risk: Full-Loss Equivalents (FLE) per 1 Million Sectors. For definition of 'full-loss equivalent', please Annex 1.

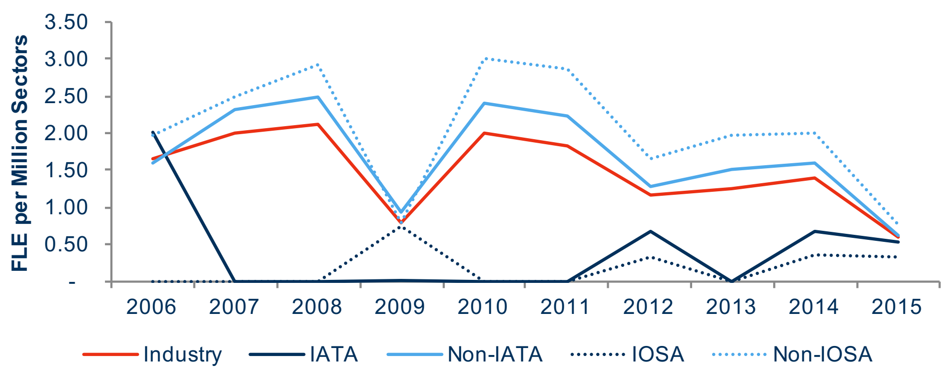
Jet & Turboprop Aircraft



Jet Aircraft



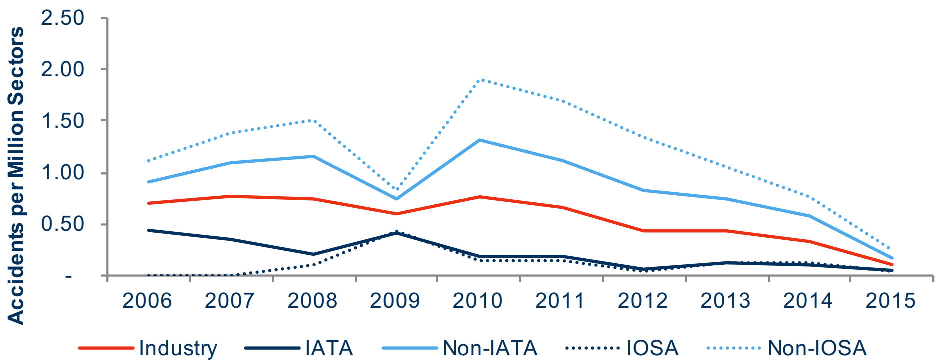
Turboprop Aircraft



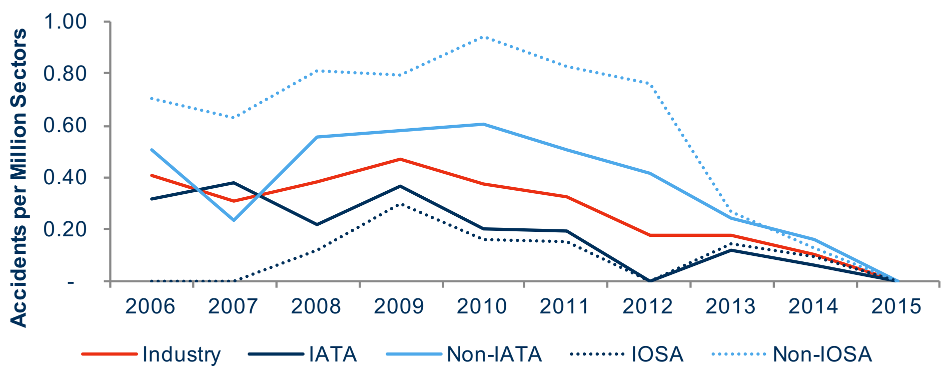
FATAL ACCIDENTS

'Fatal Accidents' refer to accidents with at least one person on board the aircraft perishing as a result of the crash.

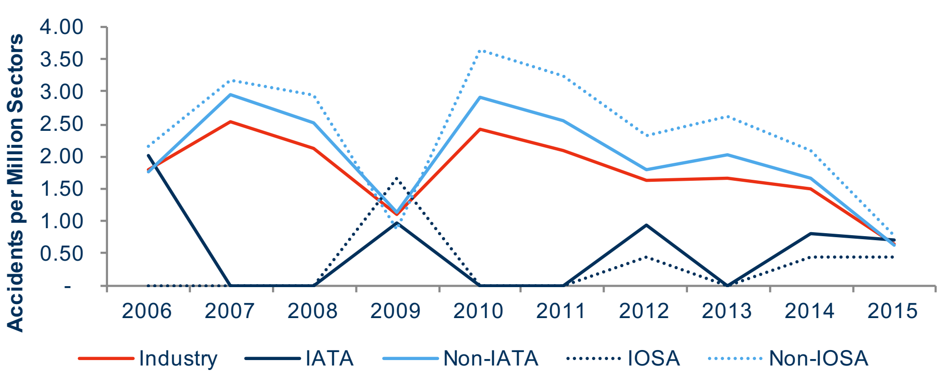
Jet & Turboprop Aircraft



Jet Aircraft



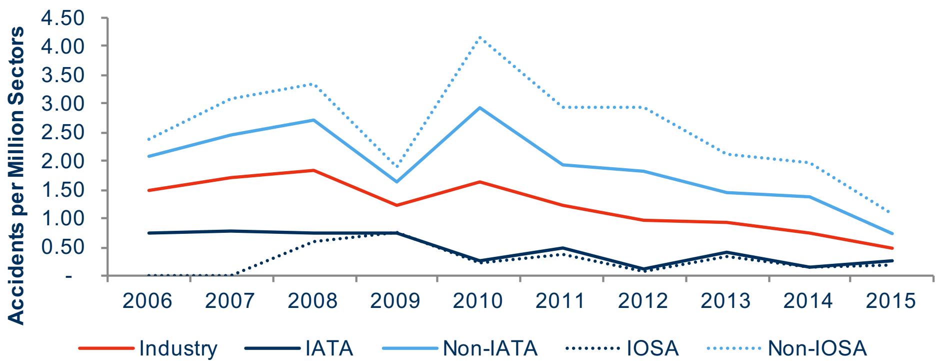
Turboprop Aircraft



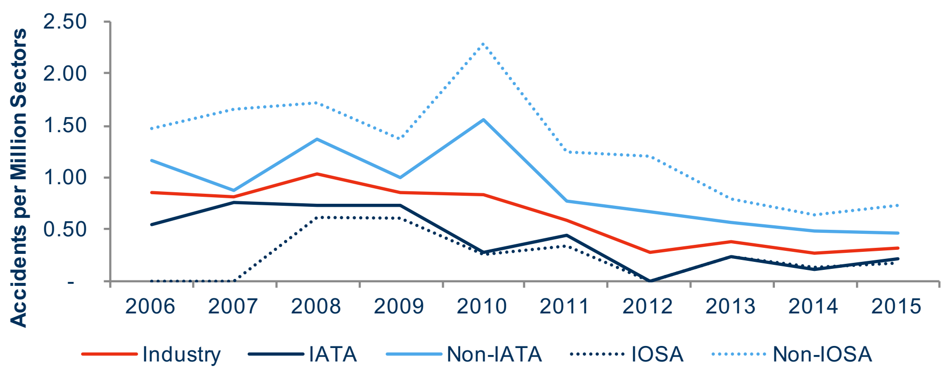
HULL LOSSES

'Hull Losses' refer to the aircraft being damaged beyond repare or the costs related to the repare being above the commerical value of the aircraft.

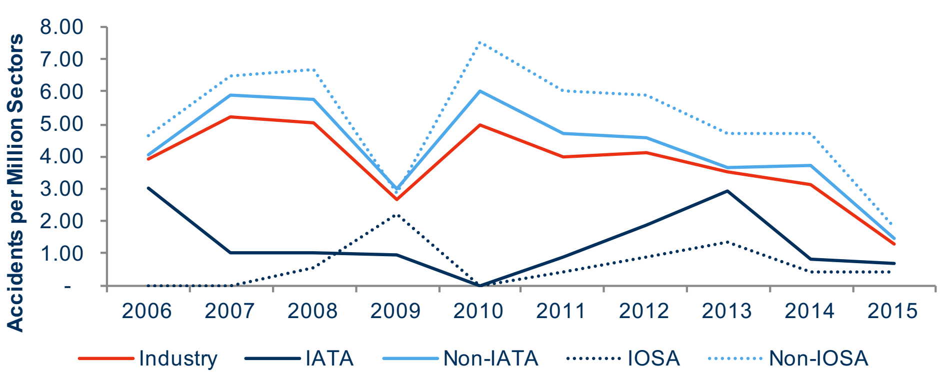
Jet & Turboprop Aircraft



Jet Aircraft



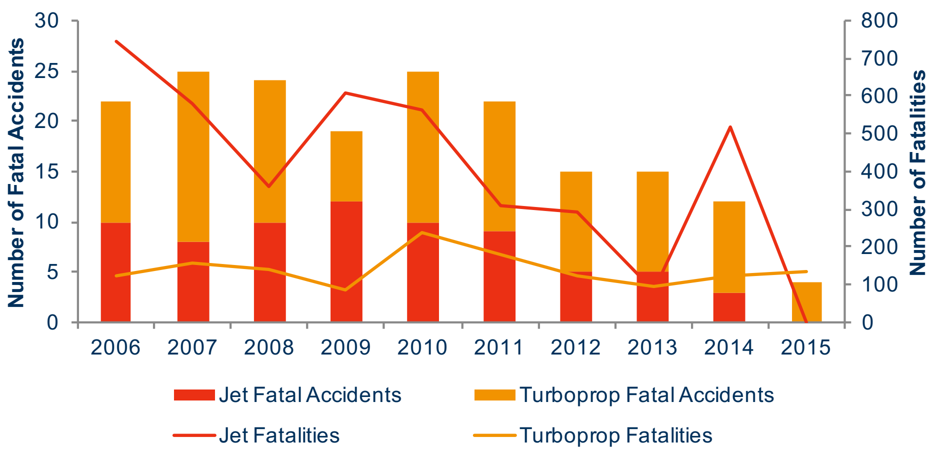
Turboprop Aircraft



FATALITIES

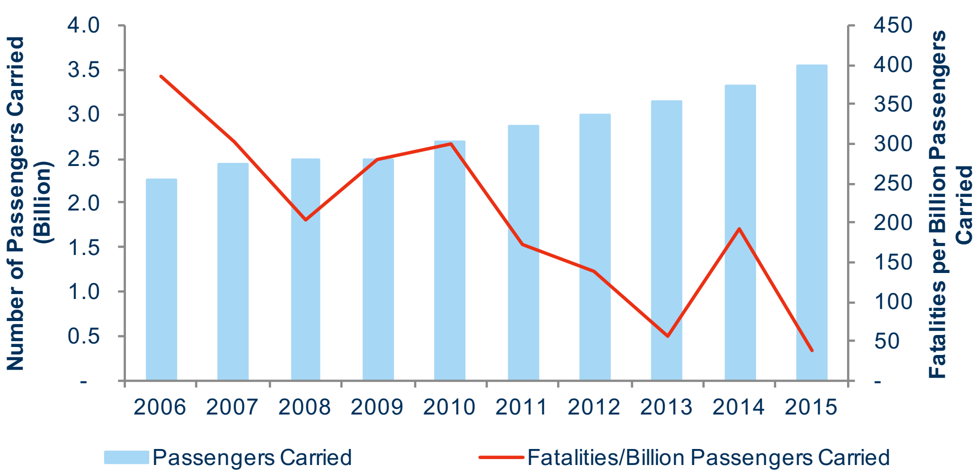
The graph below shows the total number of fatalities (line and vertical right axis) and the number of fatal accidents (stacked bar and vertical left axis) split between aircraft propulsion. The reader needs to be aware of the fact that the data is not being normalized by the aircraft flight count, therefore discretion should be used. Interpreting and applying this data should be used in reference to the accident rates graphs presented previously.

Number of Fatalities and Fatal Accidents



The graph below shows the constant increase in passengers carried over the year and a ratio metric related to the number of fatalities by the number of passengers carried on a specific year.

Number of Passengers Carried and Fatalities per Passengers Carried



Passengers Carried Data Source: IATA / Industry Economic Performance

ACCIDENT COSTS

IATA has obtained the estimated costs for all losses involving jet and turboprop aircraft over the last 10 years. The figures presented are from operational accidents and exclude security-related events and acts of violence.

Jet Aircraft

Turboprop Aircraft

Source: Ascend FlightGlobal

3

2015 in Review

COMMERCIAL AIRLINES OVERVIEW

FLEET SIZE, HOURS AND SECTORS FLOWN

	Jet	Turboprop	Total
World Fleet	24,497	5,255	29,752
Sector Landings (Millions)	31.4	6.2	37.6

Source: Ascend - a FlightGlobal Advisory Service
Note: World fleet includes in-service and stored aircraft operated by commercial airlines as of year-end.

CARGO SPLIT BY YEAR-END

	Jet	Turboprop
Percentage of Operating Fleet in All-Cargo Use	7.5%	19.5%

Source: Ascend - a FlightGlobal Advisory Service
Note: World fleet includes in-service and stored aircraft operated by commercial airlines as of year-end.

REGIONAL BREAKDOWN

	AFI	ASPAC	CIS	EUR	LATAM	MENA	NAM	NASIA
Jet - Sector Landings (Millions)	0.57	4.72	1.06	6.88	2.55	1.69	9.39	4.54
Turboprop - Sector Landings (Millions)	0.44	1.45	0.13	1.33	0.71	0.11	1.95	0.08

AIRCRAFT ACCIDENTS

Note: Summaries of all the year's accidents are presented in Annex 3.

NUMBER OF ACCIDENTS

	Jet	Turboprop	Total
Total	46	22	68
Hull-Losses	10	8	18
Substantial Damage	36	14	50
Fatal	–	4	4
Full-Loss Equivalents	–	3.7	3.7
Fatalities*	–	136	136
For fatalities of people not on board the aircraft	*16*	*0*	*16*

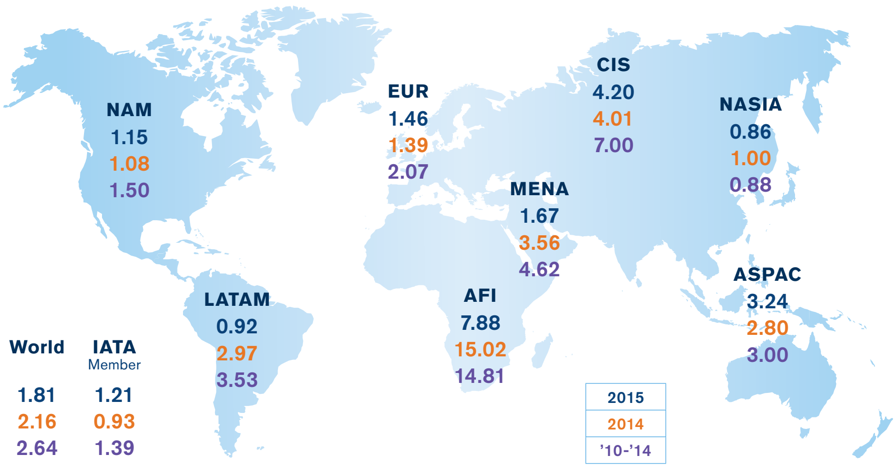
**People on board only*

ACCIDENTS PER OPERATOR REGION

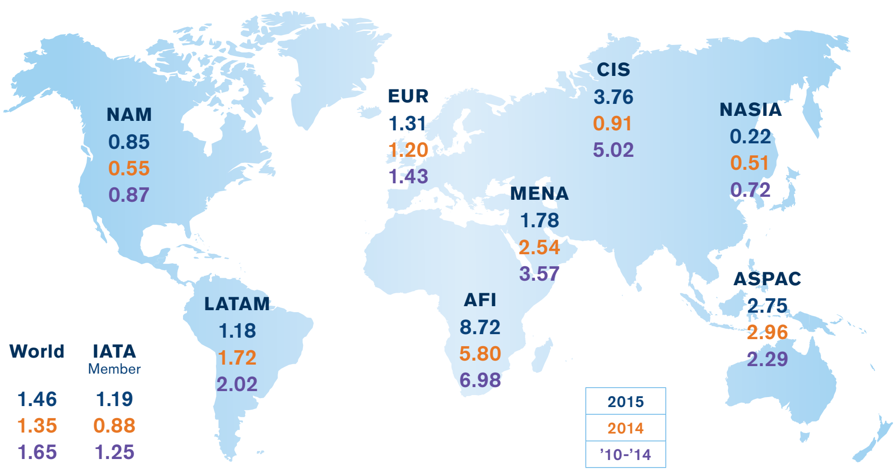
	AFI	ASPAC	CIS	EUR	LATAM	MENA	NAM	NASIA
Total	8	20	5	12	3	3	13	4
Hull-Losses	4	4	2	1	1	0	4	2
Substantial Damage	4	16	3	11	2	3	9	2
Fatal	1	1	0	0	0	0	1	1
Full-Loss Equivalents	1.0	1.0	0.0	0.0	0.0	0.0	1.0	0.7
Fatalities	37	54	0	0	0	0	2	43

ALL ACCIDENTS

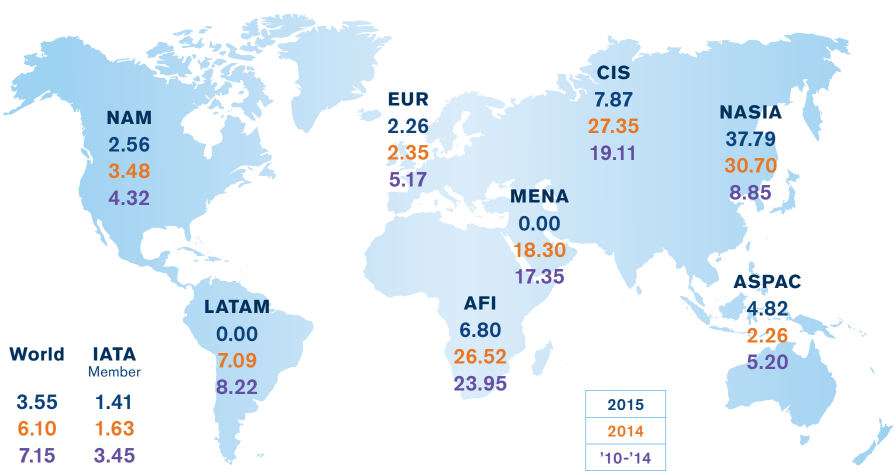
Jet & Turboprop Aircraft



Jet Aircraft

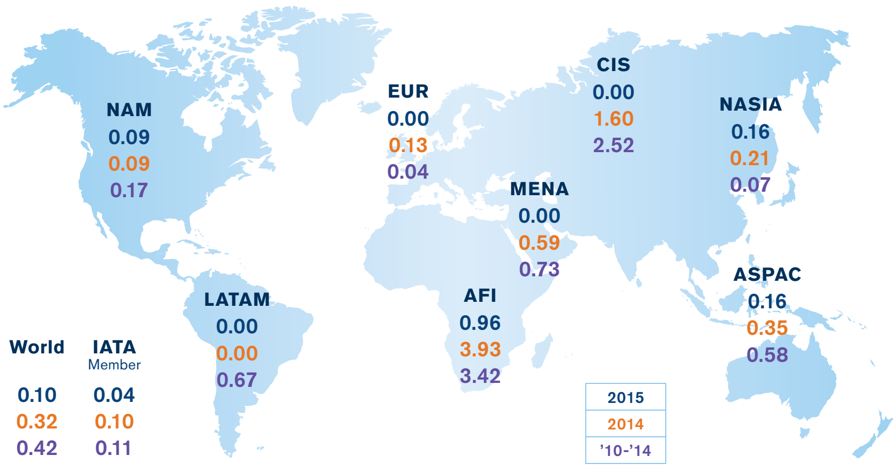


Turboprop Aircraft

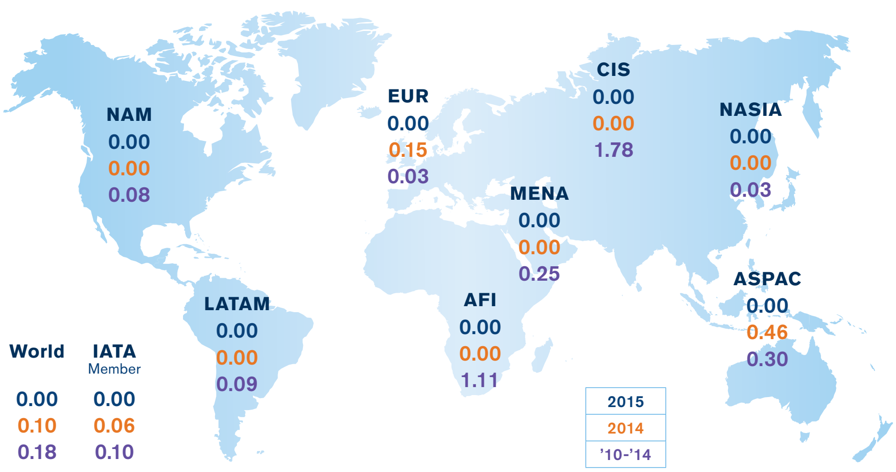


FATALITY RISK

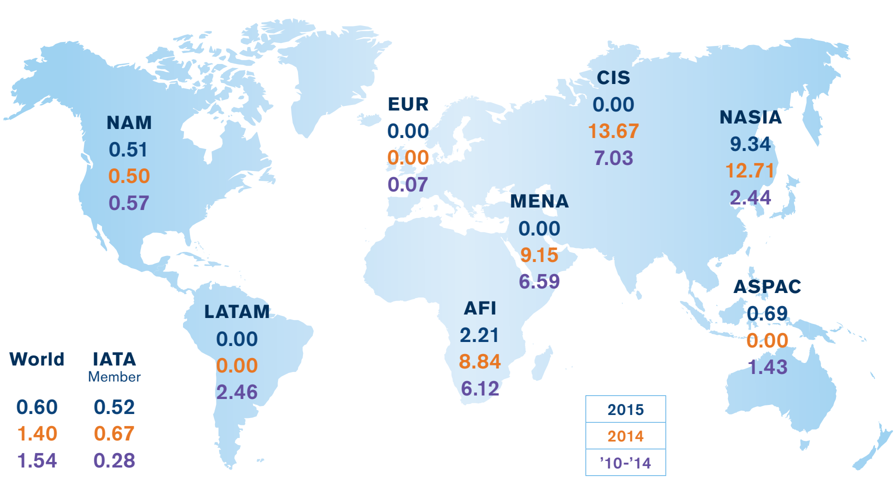
Jet & Turboprop Aircraft



Jet Aircraft

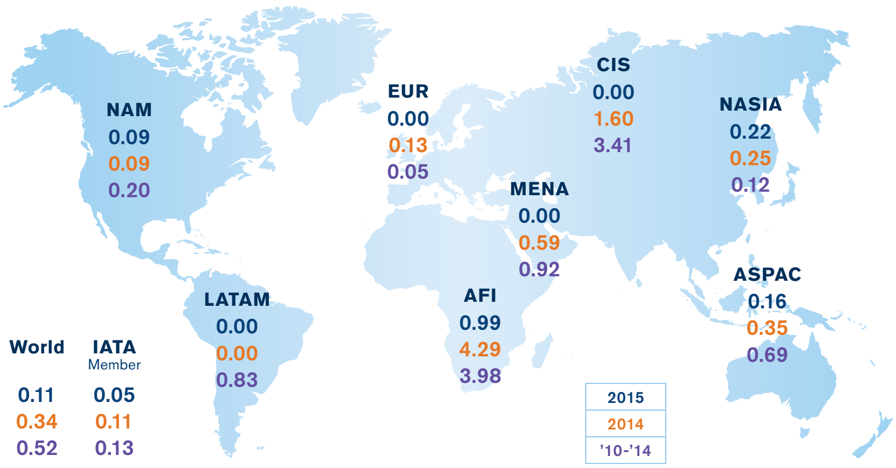


Turboprop Aircraft

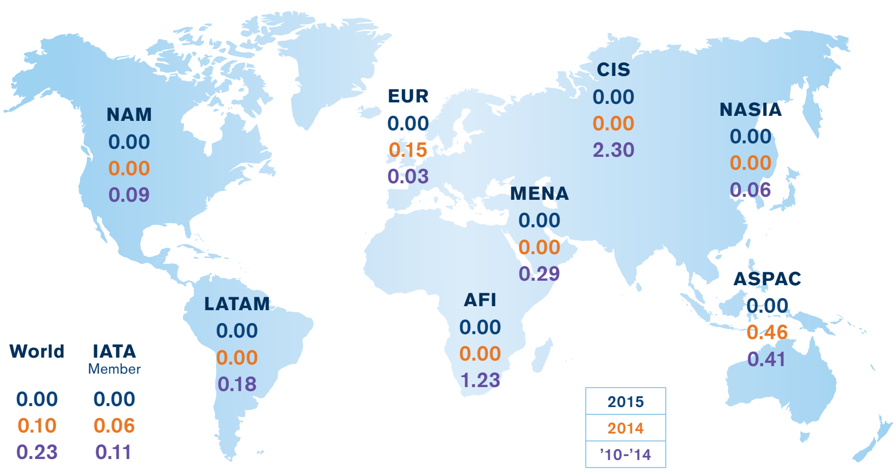


FATAL ACCIDENTS

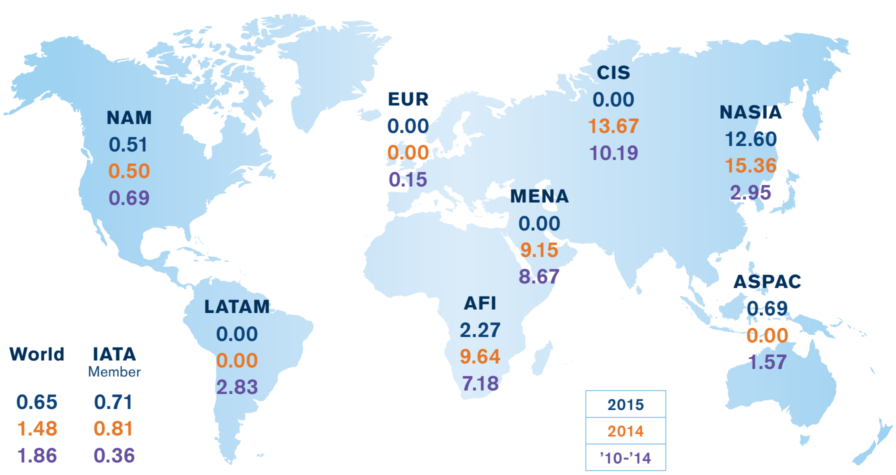
Jet & Turboprop Aircraft



Jet Aircraft

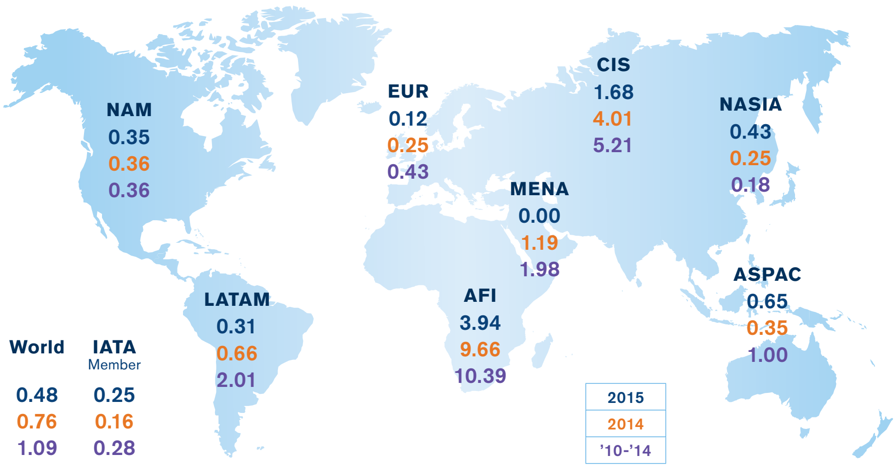


Turboprop Aircraft

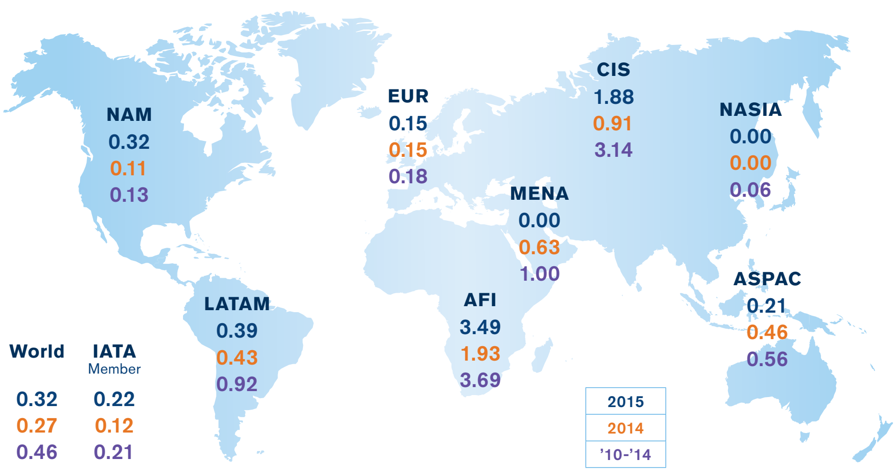


HULL LOSSES

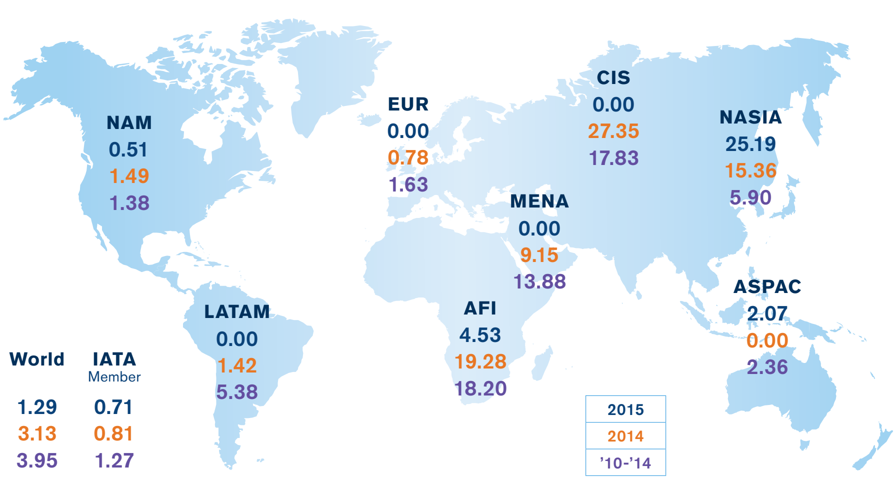
Jet & Turboprop Aircraft



Jet Aircraft



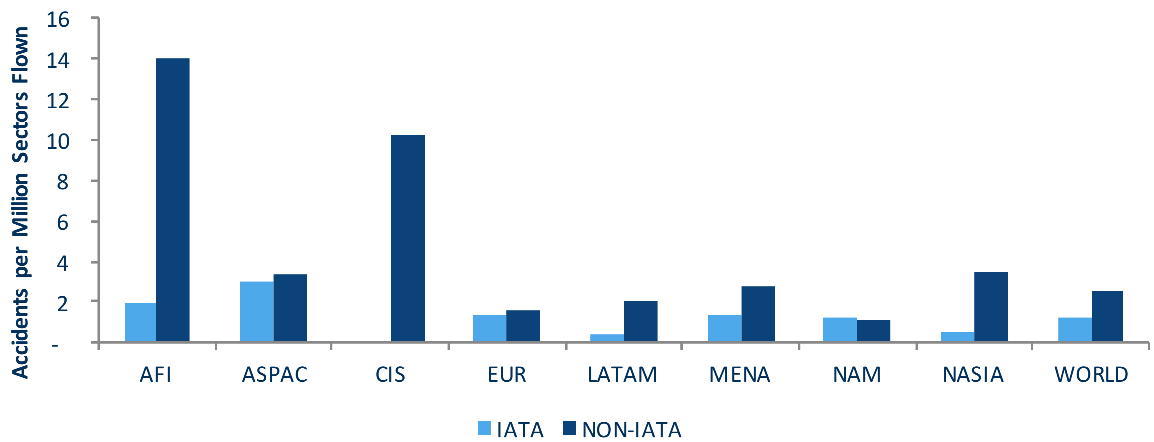
Turboprop Aircraft



IATA Member Airlines vs. Non-Members – Total Accident Rate by Region

In an effort to better indicate the safety performance of IATA member airlines vs. non-members, IATA has determined the total accident rate for each region and globally. IATA member airlines outperformed non-members in every region, with the exception of North America, where the rates are virtually the same. The IATA member accident rate was two times less than for non-members in 2015.

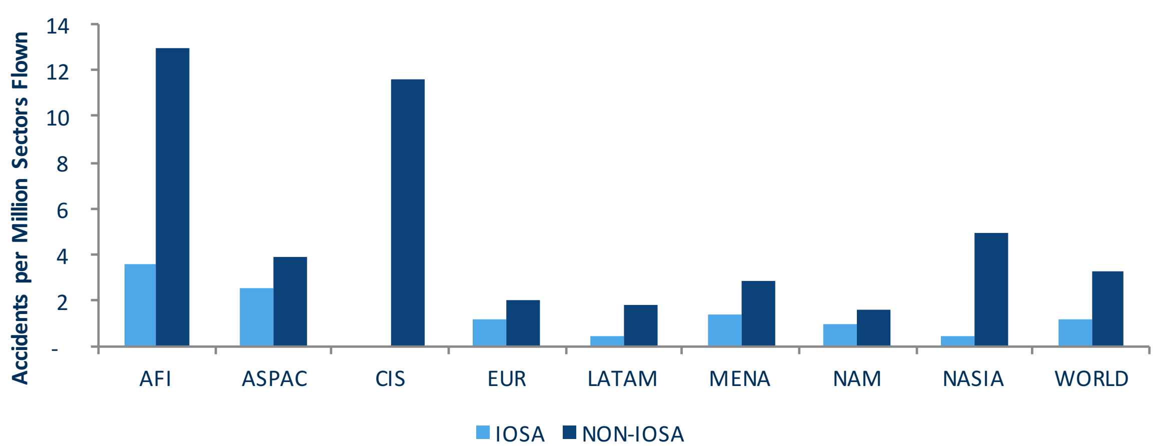
2015 Accident Rate: IATA Member Airlines vs. Non-Members



IOSA-Registered Airlines vs. Non-IOSA – Total Accidents and Fatalities by Region

In an effort to better indicate the safety performance of IOSA-registered airlines vs. non-IOSA, IATA has determined the total accident rate for each region and globally. IOSA-registered airlines outperformed non-members in every region. The IOSA-registered airline accident rate was three times lower than for non-IOSA airlines in 2015.

2015 Accident Rate: IOSA-Registered vs. non-Registered



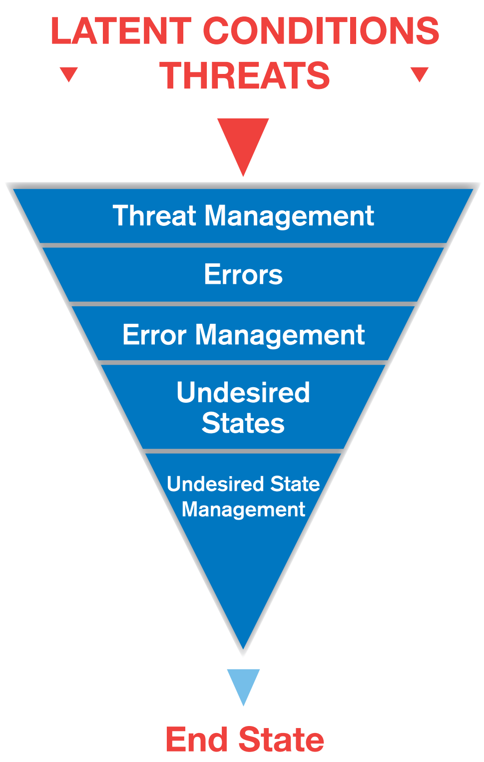
4

In-Depth Accident Analysis 2011 to 2015

INTRODUCTION TO THREAT AND ERROR MANAGEMENT

The Human Factors Research Project at The University of Texas in Austin developed Threat and Error Management (TEM) as a conceptual framework to interpret data obtained from both normal and abnormal operations. For many years, IATA has worked closely with the University of Texas Human Factors Research Team, the International Civil Aviation Organization (ICAO), member airlines and manufacturers to apply TEM to its many safety activities.

THREAT AND ERROR MANAGEMENT FRAMEWORK



DEFINITIONS

Latent Conditions: Conditions present in the system before the accident, made evident by triggering factors. These often relate to deficiencies in organizational processes and procedures.

Threat: An event or error that occurs outside the influence of the flight crew, but which requires flight crew attention and management to properly maintain safety margins.

Flight Crew Error: An observed flight crew deviation from organizational expectations or crew intentions.

Undesired Aircraft State (UAS): A flight crew-induced aircraft state that clearly reduces safety margins; a safety-compromising situation that results from ineffective threat/error management. An undesired aircraft state is recoverable.

End State: An end state is a reportable event. An end state is unrecoverable.

Distinction between "Undesired Aircraft State" and "End State": An unstable approach is recoverable. This is a UAS. A runway excursion is unrecoverable. Therefore, this is an End State.

"By working together we have made flying the safest form of long-distance travel the world has ever known"

ACCIDENT CLASSIFICATION SYSTEM

At the request of member airlines, manufacturers and other organizations involved in the Safety Report, IATA developed an accident classification system based on the TEM framework.

The purpose of the taxonomy is to:

- Acquire more meaningful data
- Extract further information/intelligence
- Formulate relevant mitigation strategies/safety recommendations

Unfortunately, some accident reports do not contain sufficient information at the time of the analysis to adequately assess contributing factors. When an event cannot be properly classified due to a lack of information, it is classified under the insufficient information category. Where possible, these accidents have been assigned an End State. It should also be noted that the contributing factors that have been classified do not always reflect all the factors that played a part in an accident, but rather those known at the time of the analysis. Hence, there is a need for operators and states to improve their reporting cultures.

Important note: In the in-depth analysis presented in Sections 4 through 6, the percentages shown with regards to contributing factors (e.g., % of threats and errors noted) are based on the number of accidents in each category. Accidents classified as "insufficient information" are excluded from this part of the analysis. The number of insufficient information accidents is noted at the bottom of each analysis section contributing factors in Addendums A, B and C. However, accidents classified as insufficient information are part of the overall statistics (e.g., % of accidents that were fatal or resulted in a hull loss).

Annex 1 contains definitions and detailed information regarding the types of accidents and aircraft that are included in the Safety Report analysis as well as the breakdown of IATA regions.

The complete IATA TEM-based accident classification system for flight is presented in Annex 2.

ORGANIZATIONAL AND FLIGHT CREW-AIMED COUNTERMEASURES

Every year, the ACTF classifies accidents and, with the benefit of hindsight, determines actions or measures that could have been taken to prevent an accident. These proposed countermeasures can include overarching issues within an organization or a particular country, or involve performance of front-line personnel, such as pilots or ground personnel.

Countermeasures are aimed at two levels:

- The first is aimed at the operator or state responsible for oversight: these countermeasures are based on activities, processes or systemic issues internal to the airline operation or state's oversight activities.
- The other is aimed at the flight crews, to help them manage threats or their own errors while on the line.

Countermeasures for other personnel, such as air traffic controllers, ground crew, cabin crew or maintenance staff are important, but they are not considered at this time.

Each event was coded with potential counter-measures that, with the benefit of hindsight, could have altered the outcome of events. A statistical compilation of the top countermeasures is presented in Section 8 of this report.

ANALYSIS BY ACCIDENT CATEGORY AND REGION

This section presents an in-depth analysis of 2011 to 2015 occurrences by accident category

Definitions of these categories can be found in Annex 2

Referring to these accident categories helps an operator to:

Structure safety activities and set priorities

Avoid "forgetting" key risk areas when a type of accident does not occur in a given year

Provide resources for well-identified prevention strategies

Address these categories both systematically and continuously within the airline's safety management system

2015 Aircraft Accidents – Accident count

Number of accidents: 68
Number of fatalities: 136

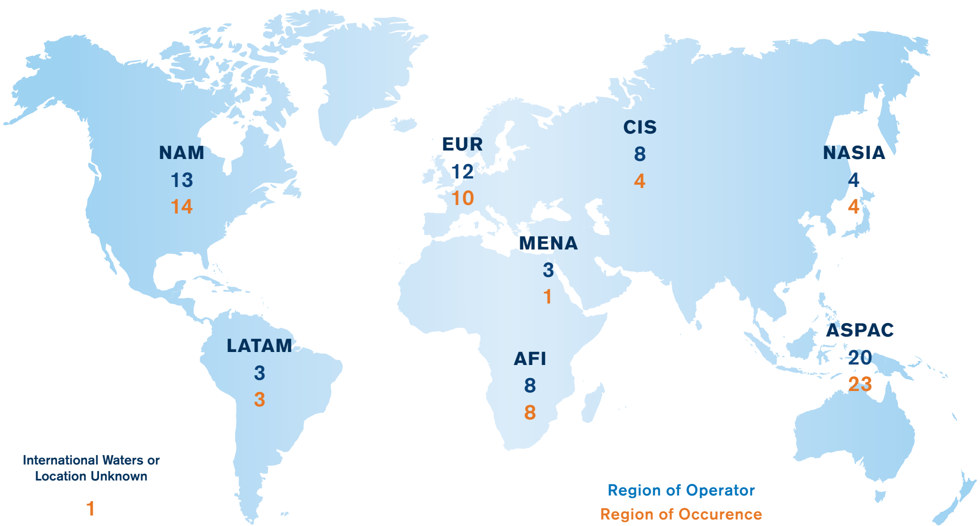
Accident Count % from total	2015
IATA Member	35%
Full-Loss Equivalents	5%
Fatal	6%
Hull Losses	26%

Passenger	Cargo	Ferry	Jet	Turboprop
82%	18%	0%	68%	32%

Note: the sum may not add to 100% due to rounding

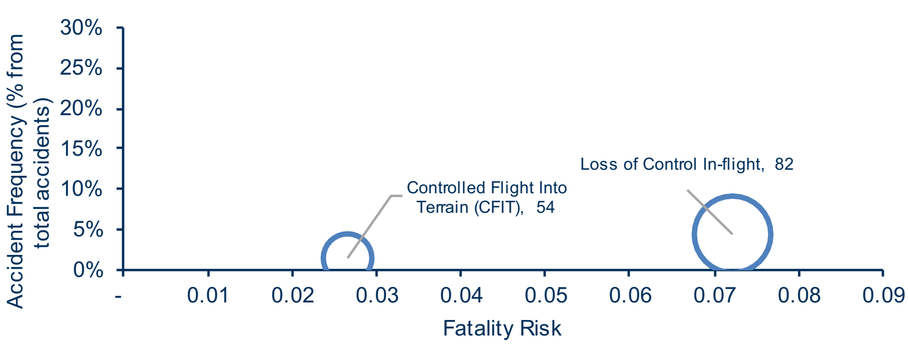
Number of Accidents per Region (2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)

Accident Category Frequency and Mortality Risk (2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
31%

Threats

Meteorology:
37%

Flight Crews Errors

Manual Handling / Flight Controls:
34%

Undesired aircraft state

Vertical / Lateral / Speed deviation:
31%

Countermeasure

Overall Crew Performance:
18%

➤ See detailed view

2015 Aircraft Accidents – Accident rate*

Accident rate*: 1.81

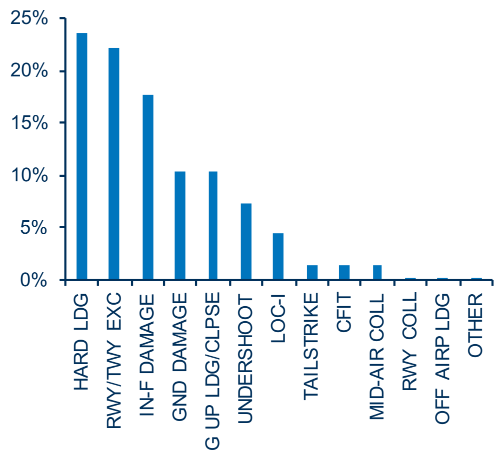
Accident rate*	2015
IATA Member	1.21
Mortality risk**	0.10
Fatal	0.11
Hull Losses	0.48

Jet	Turboprop	
1.46	3.55	Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2015)

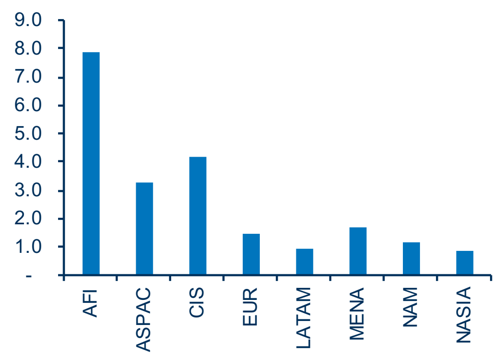
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

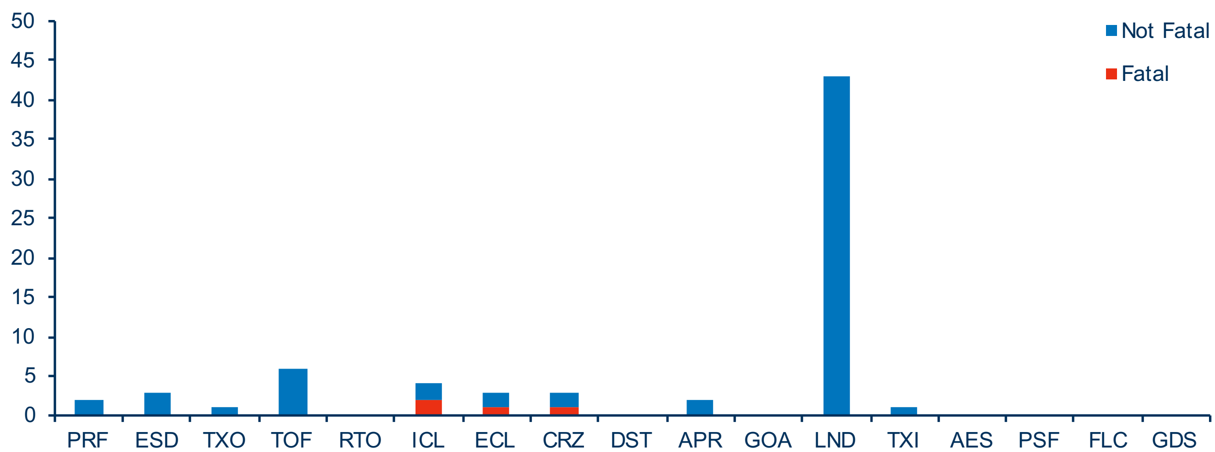
Regional Accident Rate (2015)

Accidents per Million Sectors



Accidents per Phase of Flight (2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



2011-2015 Aircraft Accidents – Accident count

Number of accidents: 407
Number of fatalities: 1858

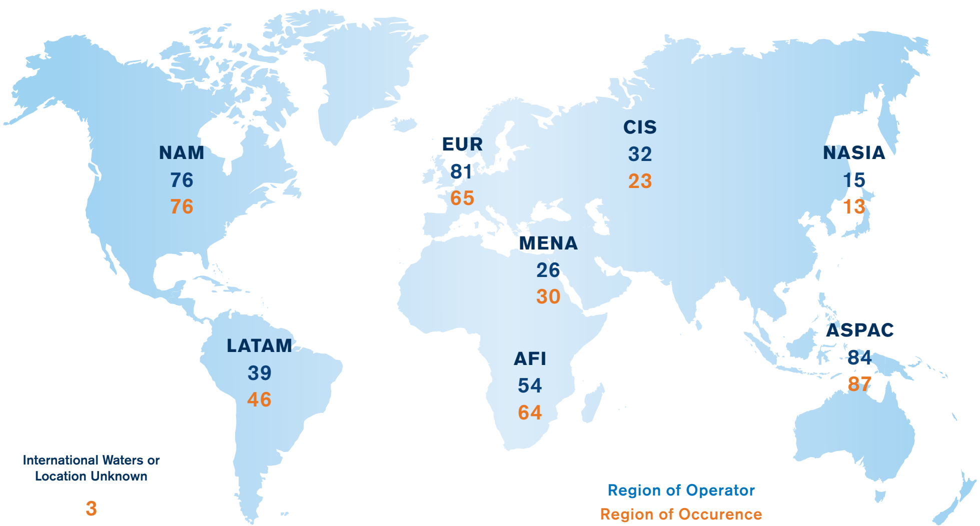
Accident Count % from total	2015
IATA Member	29%
Full-Loss Equivalents	14%
Fatal	17%
Hull Losses	37%

Passenger	Cargo	Ferry	Jet	Turboprop
78%	18%	3%	53%	47%

Note: the sum may not add to 100% due to rounding

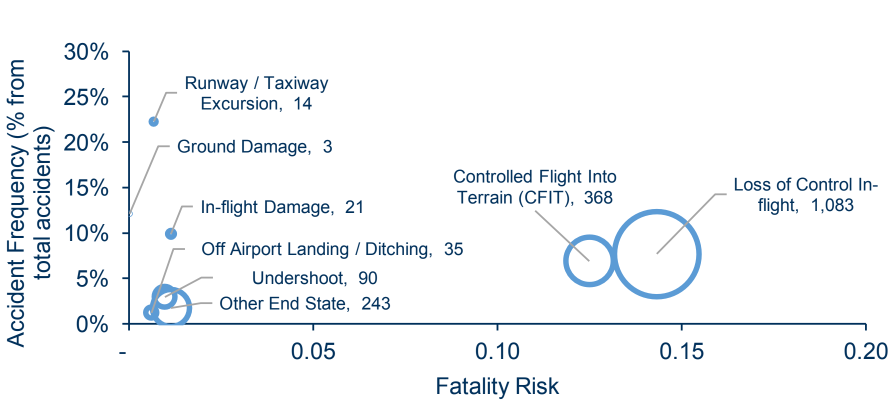
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)
B777 (MH370). Location: unknown
B1900, presumingly crashed near Sao Tome and Principe. wreckage not known to have been found

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
31%

Threats

Meteorology:
31%

Flight Crews Errors

Manual Handling / Flight Controls:
30%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
22%

Countermeasure

Overall Crew Performance:
24%

➤ See detailed view

2011-2015 Aircraft Accidents – Accident rate*

Accident rate*: 2.32

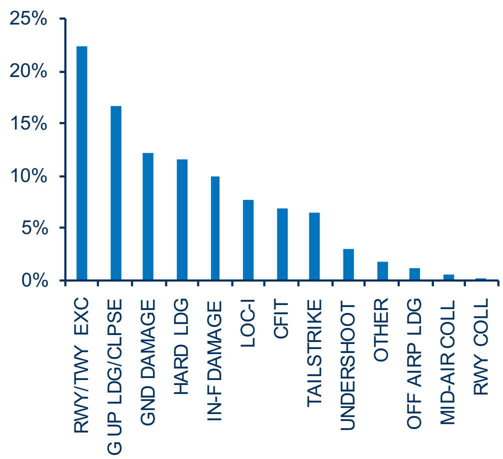
Accident rate*	2015
IATA Member	1.32
Mortality risk**	0.32
Fatal	0.39
Hull Losses	0.86

Jet	Turboprop	
1.47	6.31	Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011-2015)

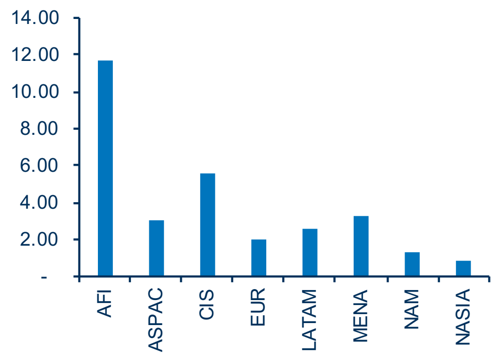
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

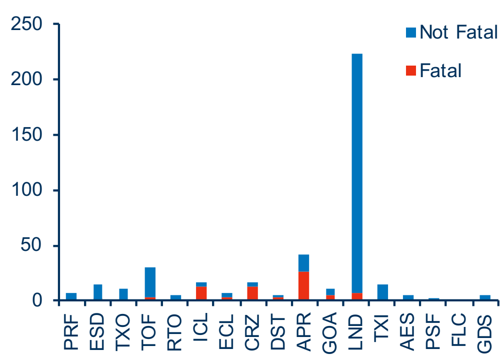
Regional Accident Rate (2011-2015)

Accidents per Million Sectors



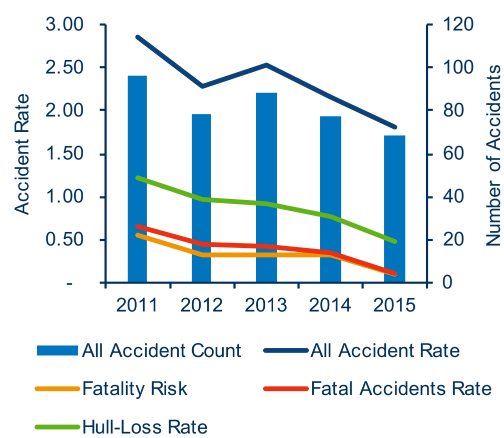
Accidents per Phase of Flight (2011-2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2011-2015)

See Annex 1 for the definitions of different metrics used



2011-2015 Fatal Aircraft Accidents – Accident count

Number of accidents: 68
Number of fatalities: 1858

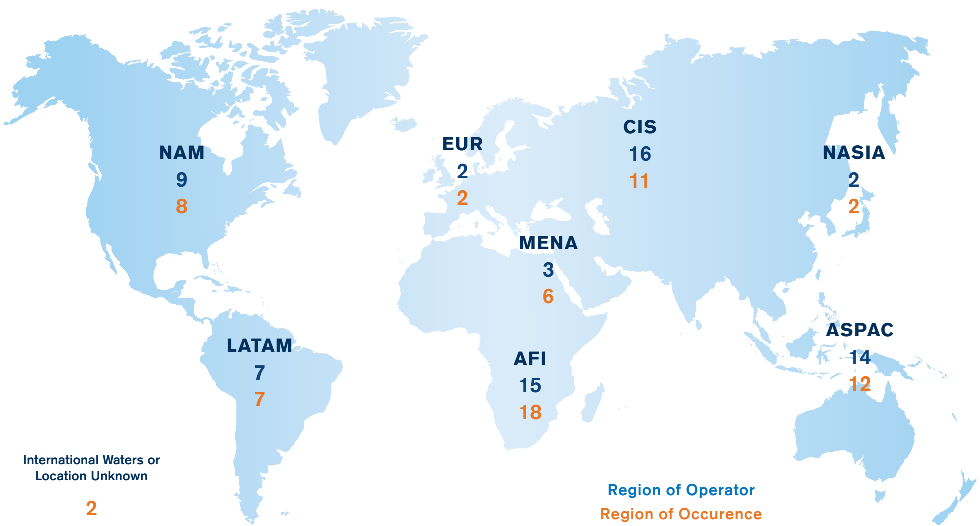
Accident Count % from total	2015
IATA Member	13%
Full-Loss Equivalents	83%
Fatal	100%
Hull Losses	100%

Passenger	Cargo	Ferry	Jet	Turboprop
62%	34%	4%	32%	68%

Note: the sum may not add to 100% due to rounding

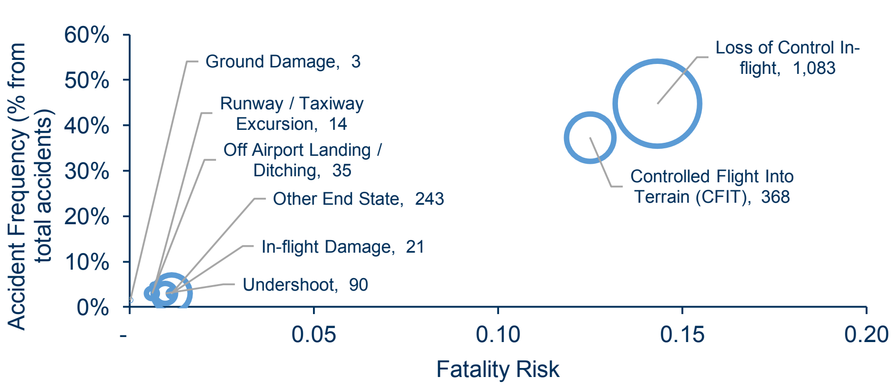
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: B777 (MH370). Location: unknown
B1900, presumingly crashed near Sao Tome and Principe. wreckage not known to have been found

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
56%

Threats

Meteorology:
44%

Flight Crews Errors

SOP Adherence / SOP Cross-verification:
40%

Undesired aircraft state

Vertical / Lateral / Speed Deviation
32%

Countermeasure

Overall Crew Performance:
46%

➤ See detailed view

2011-2015 Fatal Aircraft Accidents – Accident rate*

Accident rate*: 0.39

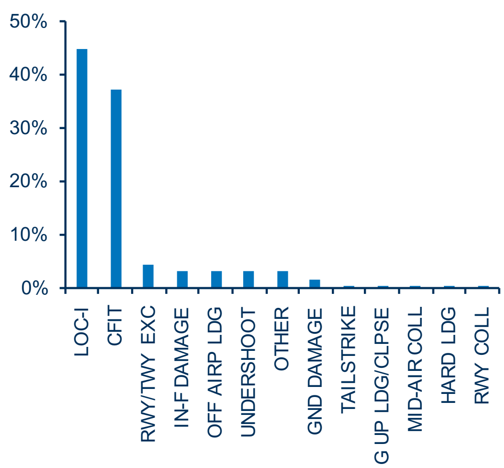
Accident rate*	2015
IATA Member	0.10
Mortality risk**	0.32
Fatal	0.39
Hull Losses	0.39

Jet	Turboprop	
0.15	1.50	Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011-2015)

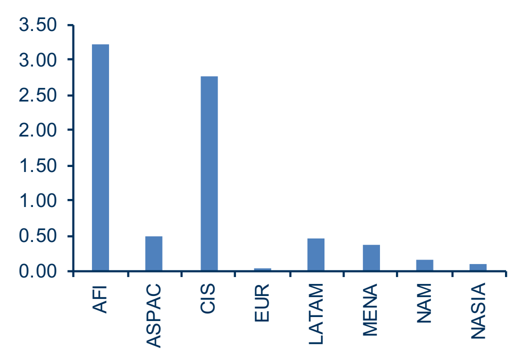
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

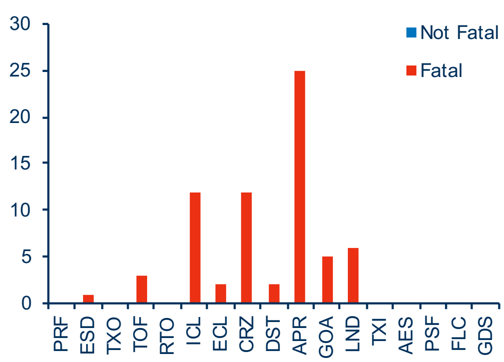
Regional Accident Rate (2011-2015)

Accidents per Million Sectors



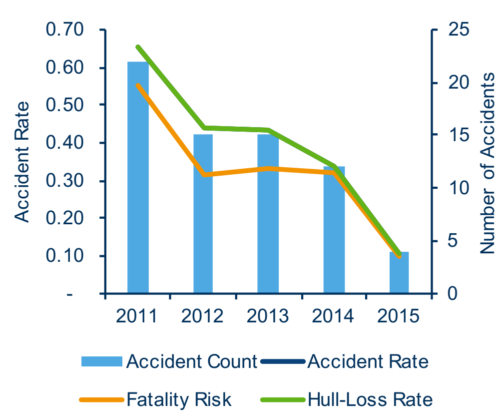
Accidents per Phase of Flight (2011-2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2011-2015)

See Annex 1 for the definitions of different metrics used



Note: The accident rate of fatal accidents and the hull loss rate share the same values

2011-2015 Non-Fatal Aircraft Accidents – Accident count

Number of accidents: 339
Number of fatalities: 0

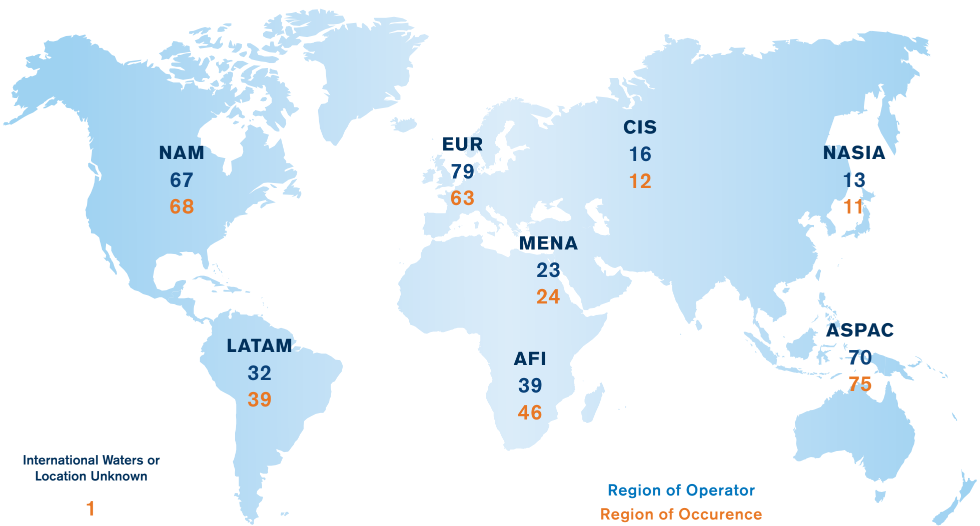
Accident Count % from total	2015
IATA Member	32%
Full-Loss Equivalents	0%
Fatal	0%
Hull Losses	24%

Passenger	Cargo	Ferry	Jet	Turboprop
81%	15%	3%	57%	43%

Note: the sum may not add to 100% due to rounding

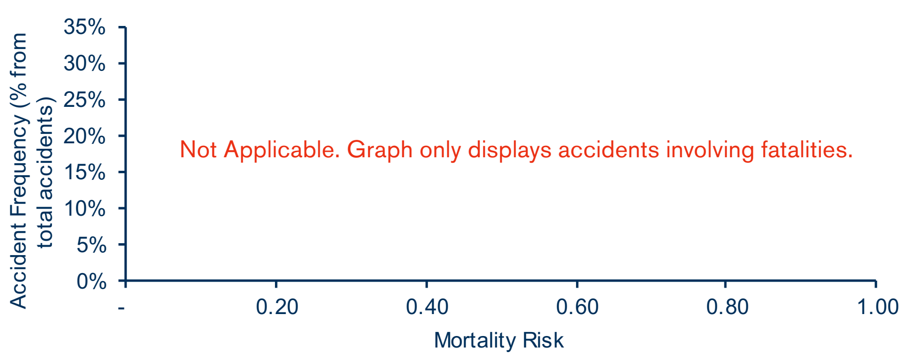
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)

Accident Category Frequency and Mortality Risk (2011-2015)



Top Contributing Factors

Latent conditions

Regulatory Oversight.
27%

Threats

Meteorology:
28%

Flight Crews Errors

Manual Handling / Flight Controls:
31%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land
25%

Countermeasure

Overall Crew Performance:
20%

➤ See detailed view

2011-2015 Non-Fatal Aircraft Accidents – Accident rate*

Accident rate*: 1.93

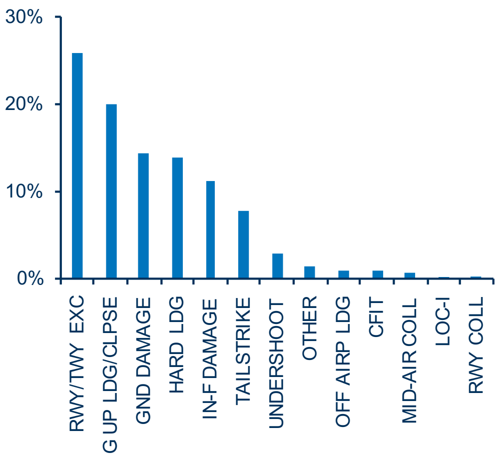
Accident rate*	2015
IATA Member	1.22
Mortality risk**	0.00
Fatal	0.00
Hull Losses	0.47

Jet	Turboprop	
1.32	4.80	Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011-2015)

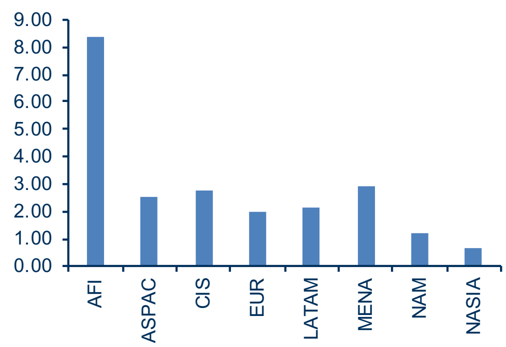
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

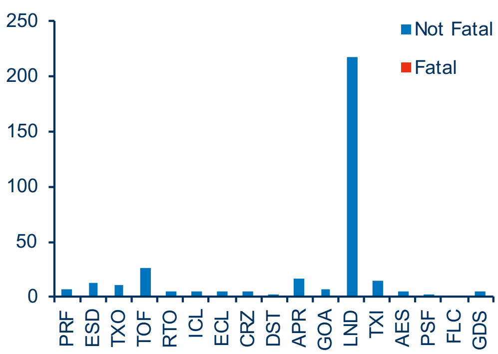
Regional Accident Rate (2011-2015)

Accidents per Million Sectors



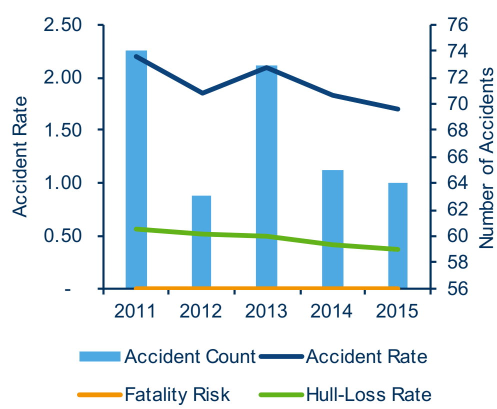
Accidents per Phase of Flight (2011-2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2011-2015)

See Annex 1 for the definitions of different metrics used



2011-2015 IOSA Aircraft Accidents – Accident count

Number of accidents: 158
Number of fatalities: 644

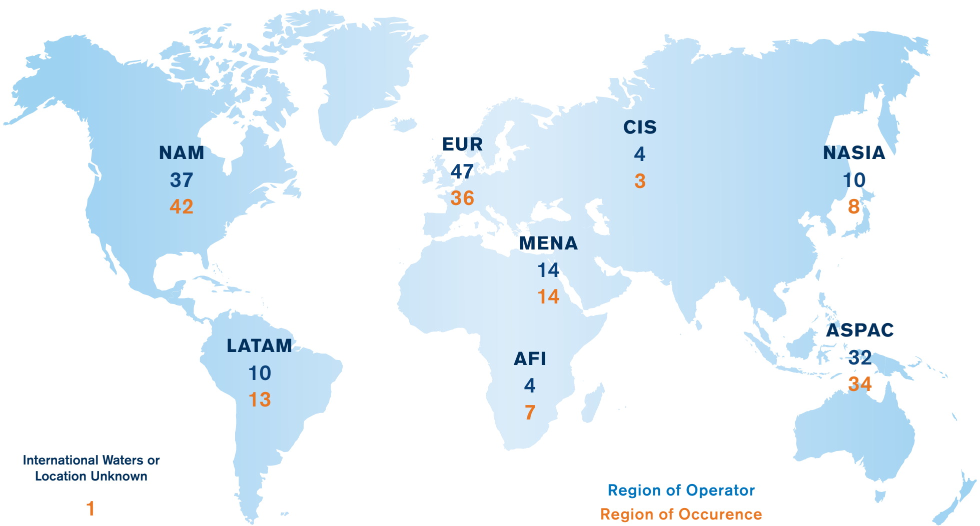
Accident Count % from total	2015
IATA Member	74%
Full-Loss Equivalents	6%
Fatal	7%
Hull Losses	17%

Passenger	Cargo	Ferry	Jet	Turboprop
91%	7%	2%	80%	20%

Note: the sum may not add to 100% due to rounding

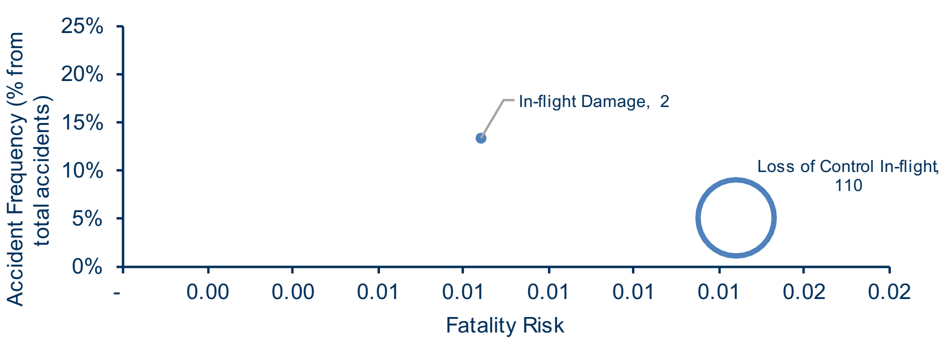
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: B777 (MH370). Location: unknown

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
17%

Threats

Aircraft Malfunction:
27%

Flight Crews Errors

Manual Handling / Flight Controls:
28%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land
20%

Countermeasure

Overall Crew Performance:
19%

➤ See detailed view

2011-2015 IOSA Aircraft Accidents – Accident rate*

Accident rate*: 1.33

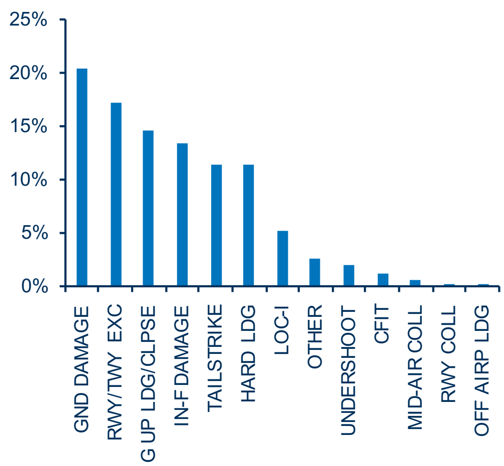
Accident rate*	2015
IATA Member	1.32
Mortality risk**	0.08
Fatal	0.09
Hull Losses	0.23

Jet	Turboprop	
1.18	2.76	Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown   **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011-2015)

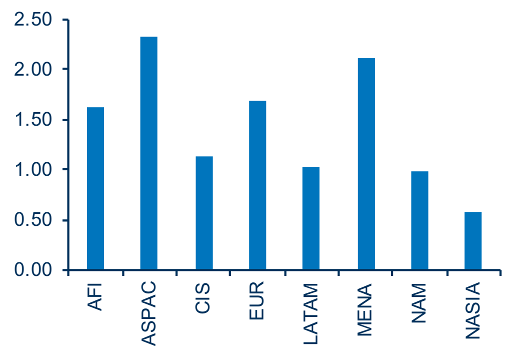
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

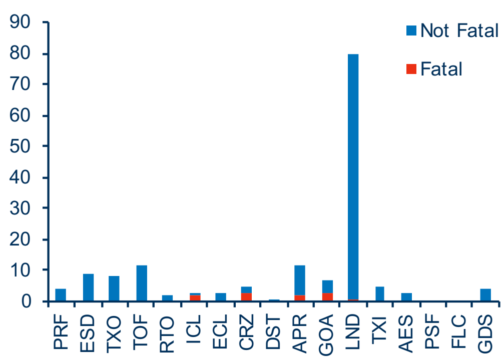
Regional Accident Rate (2011-2015)

Accidents per Million Sectors



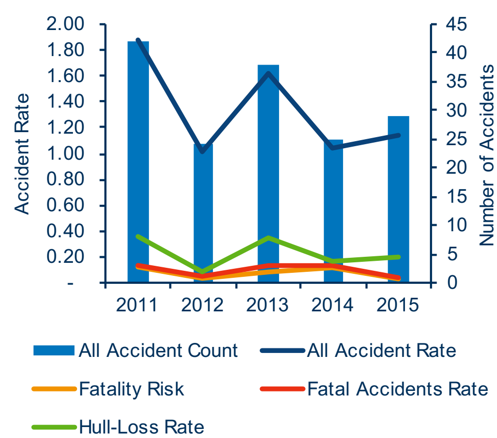
Accidents per Phase of Flight (2011-2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2011-2015)

See Annex 1 for the definitions of different metrics used



2011-2015 Non-IOSA Aircraft Accidents – Accident count

Number of accidents: 249
Number of fatalities: 1214

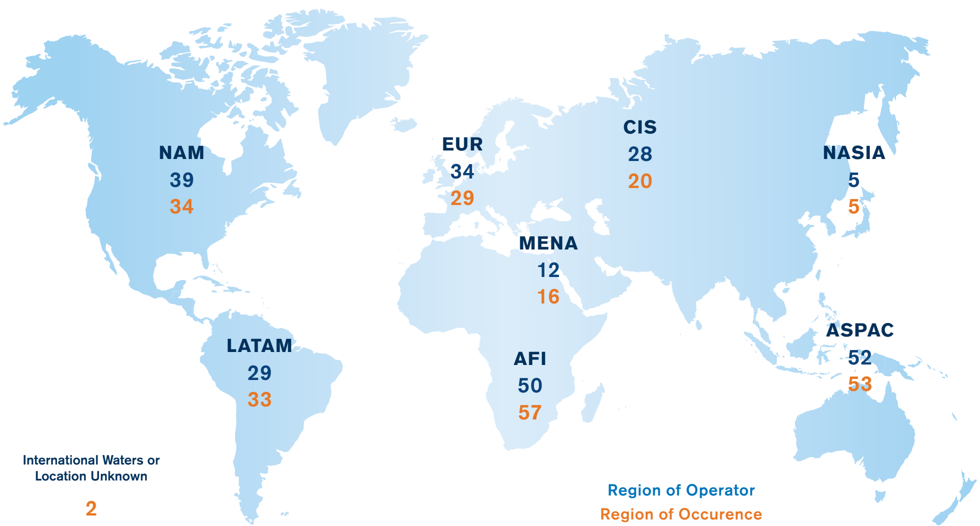
Accident Count % from total	2015
IATA Member	0%
Full-Loss Equivalents	19%
Fatal	23%
Hull Losses	50%

Passenger	Cargo	Ferry	Jet	Turboprop
70%	26%	4%	35%	65%

Note: the sum may not add to 100% due to rounding

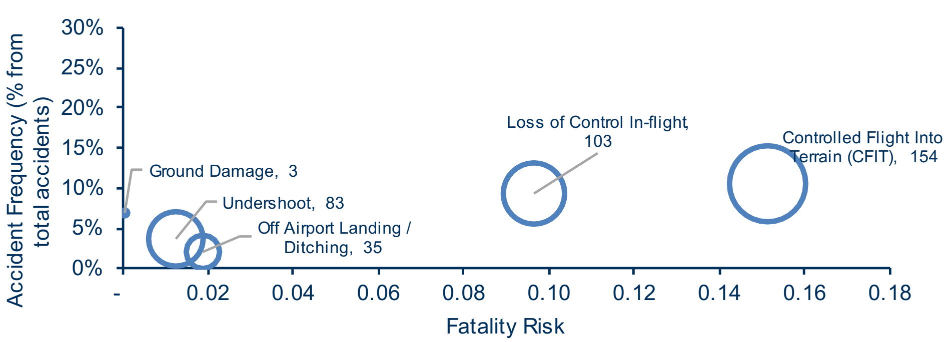
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)
B1900, presumingly crashed near Sao Tome and Principe. wreckage not known to have been found

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
42%

Threats

Meteorology:
34%

Flight Crews Errors

Manual Handling / Flight Controls:
32%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land
23%

Countermeasure

Overall Crew Performance:
28%

➤ See detailed view

2011-2015 Non-IOSA Aircraft Accidents – Accident rate*

Accident rate*: 4.38

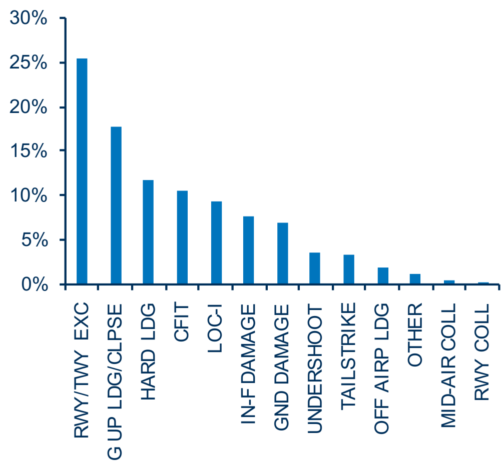
Accident rate*	2015
IATA Member	0.00
Mortality risk**	0.83
Fatal	1.00
Hull Losses	2.18

Jet	Turboprop	
2.32	8.36	Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011-2015)

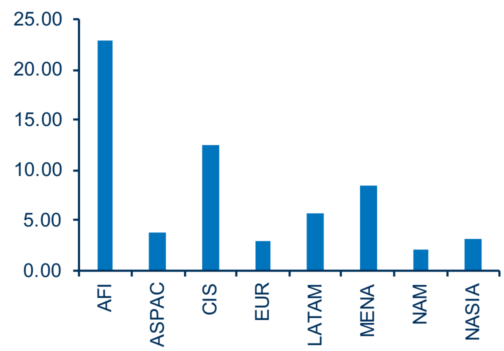
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

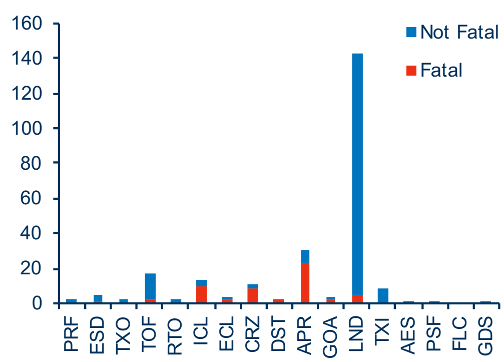
Regional Accident Rate (2011-2015)

Accidents per Million Sectors



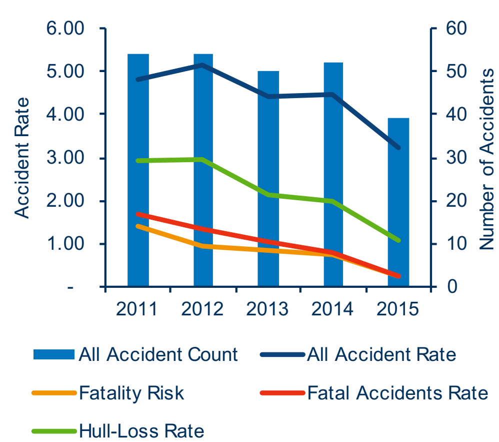
Accidents per Phase of Flight (2011-2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2011-2015)

See Annex 1 for the definitions of different metrics used



Controlled Flight into Terrain – Accident count

2015	Number of accidents: 1	Number of fatalities: 54
2011-2015	Number of accidents: 28	Number of fatalities: 368

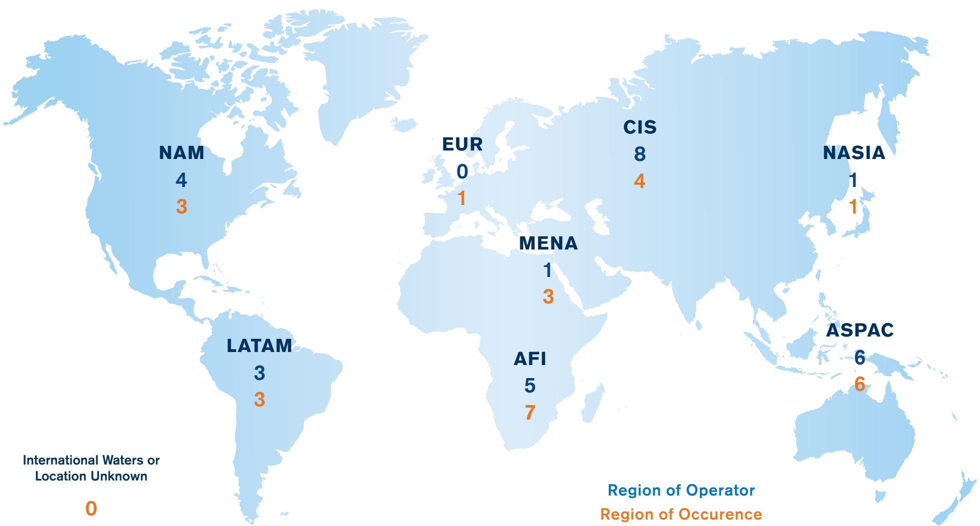
Accident Count % from total	2015	'11-'15
IATA Member	0%	7%
Full-Loss Equivalents	100%	78%
Fatal	100%	89%
Hull Losses	100%	100%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	100%	0%	0%	0%	100%
2011-2015	54%	39%	7%	21%	79%

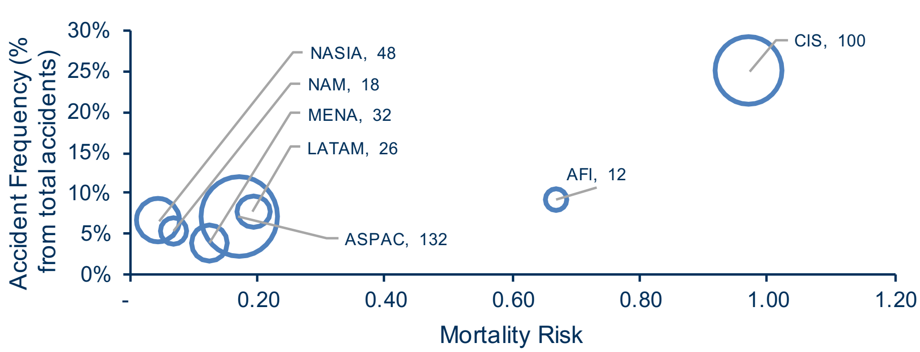
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
90%

Threats

Ground-based nav aid malfunction or not available:
60%

Flight Crews Errors

SOP Adherence / SOP Cross-verification:
50%

Undesired aircraft state

Vertical / Lateral / Speed deviation:
50%

Countermeasure

Overall Crew Performance:
50%

➤ See detailed view

Controlled Flight into Terrain – Accident rate*

2015 Accident rate: 0.03
2011-2015 Accident rate: 0.16

Accident rate*	2015	'11-'15
IATA Member	0.00	0.02
Mortality risk**	0.03	0.12
Fatal	0.03	0.14
Hull Losses	0.03	0.16

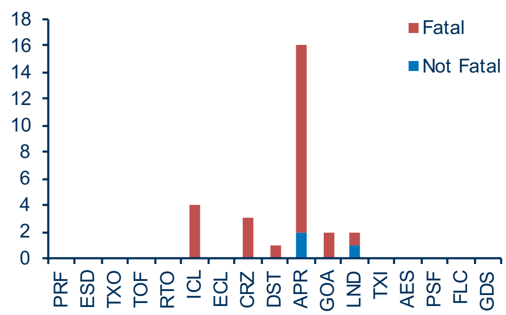
	Jet	Turboprop
2015	0.00	0.16
2011-2015	0.04	0.72

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

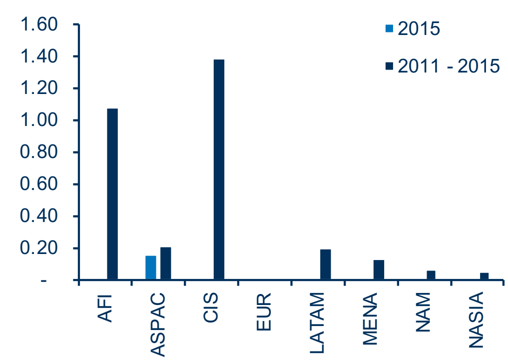
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



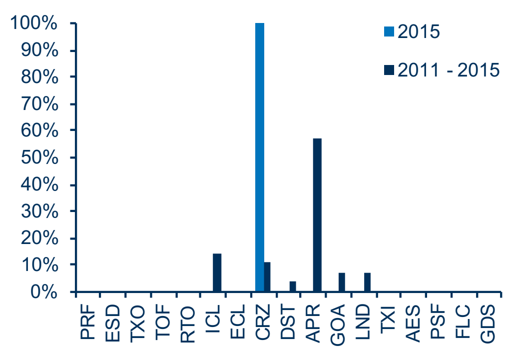
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



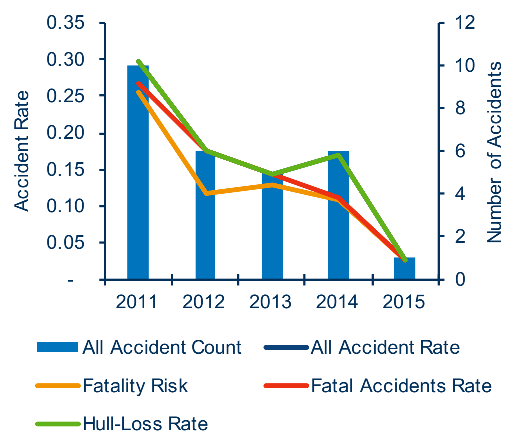
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Loss of Control In-flight – Accident count

2015	Number of accidents: 3	Number of fatalities: 82
2011-2015	Number of accidents: 31	Number of fatalities: 1083

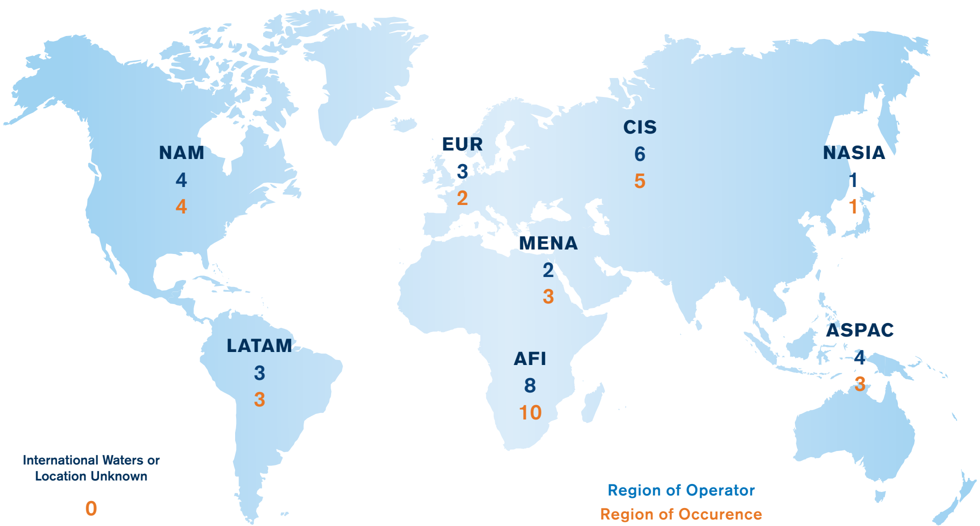
Accident Count % from total	2015	'11-'15
IATA Member	33%	16%
Full-Loss Equivalents	91%	81%
Fatal	100%	97%
Hull Losses	100%	97%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	33%	67%	0%	0%	100%
2011-2015	68%	32%	0%	32%	68%

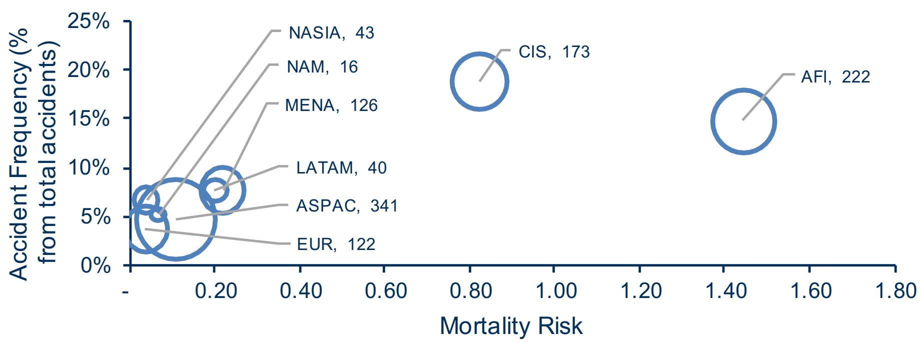
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Safety Management.
38%

Threats

Aircraft Malfunction:
42%

Flight Crews Errors

Manual Handling / Flight Controls:
38%

Undesired aircraft state

Vertical / Lateral / Speed deviation:
25%

Countermeasure

Overall Crew Performance:
46%

➤ See detailed view

Loss of Control In-flight – Accident rate*

2015 Accident rate: 0.08
2011-2015 Accident rate: 0.18

Accident rate*	2015	'11-'15
IATA Member	0.05	0.06
Mortality risk**	0.07	0.14
Fatal	0.08	0.17
Hull Losses	0.08	0.17

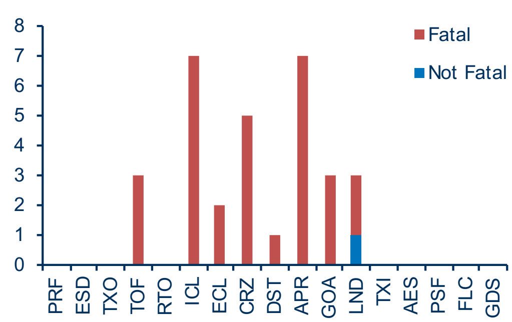
	Jet	Turboprop
2015	0.00	0.48
2011-2015	0.07	0.69

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

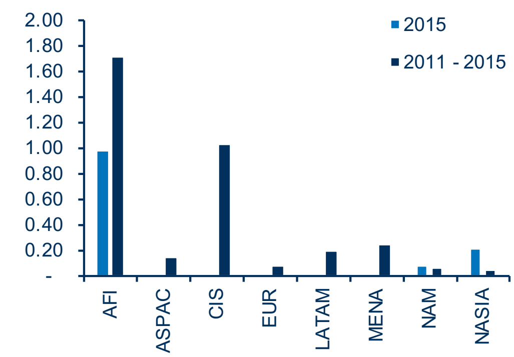
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



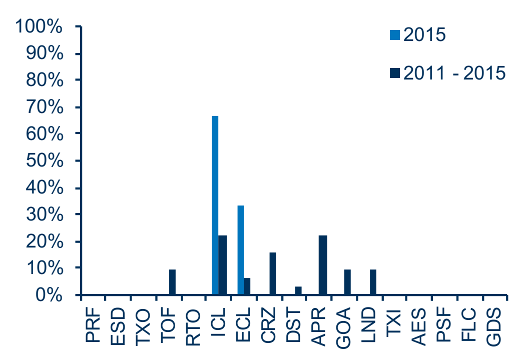
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



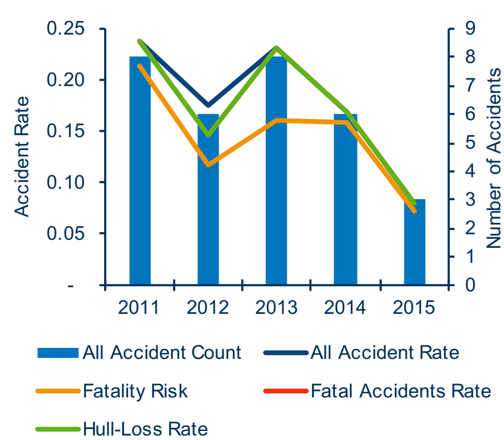
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



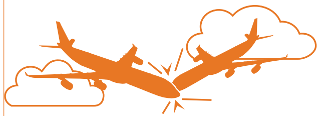
5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Mid-air Collision – Accident count

2015	Number of accidents: 1	Number of fatalities: 0
2011-2015	Number of accidents: 2	Number of fatalities: 0



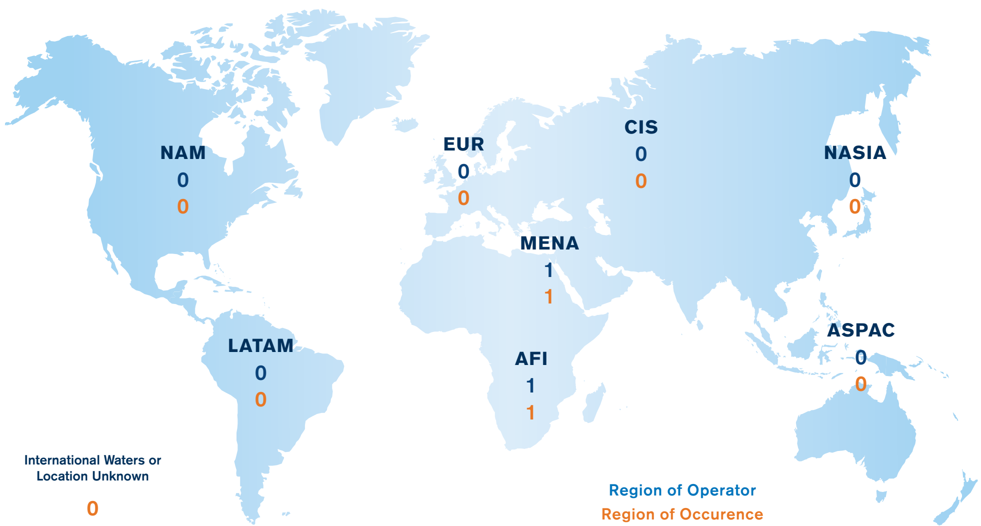
Accident Count % from total	2015	'11-'15
IATA Member	0%	50%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	0%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	100%	0%	0%	100%	0%
2011-2015	100%	0%	0%	100%	0%

Note: the sum may not add to 100% due to rounding

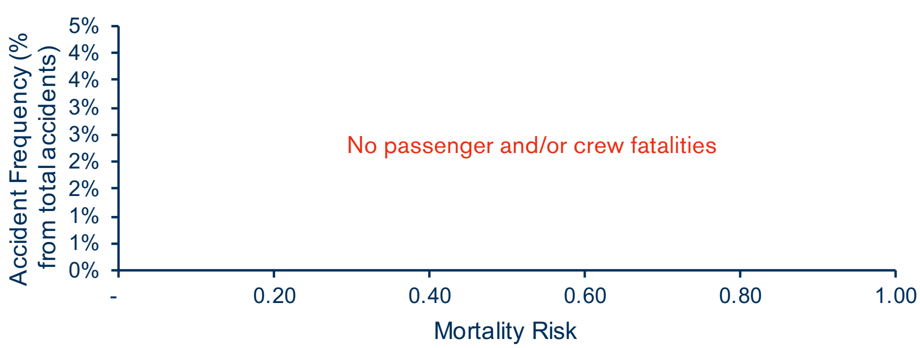
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: This report only considers fatalities on board of commercial revenue flights. However, it is important to highlight that in 2015 a mid-air collision involving a commercial jet and a non-commercial aircraft (HS-125 ambulance configuration) resulted in the crash and death of all onboard of the HS-125. The B737 suffered substantial damage.

Accident Category Frequency and Mortality Risk (2011-2015)



Top Contributing Factors

Latent conditions

At least 3 accidents required to display classification

Threats

At least 3 accidents required to display classification

Flight Crews Errors

At least 3 accidents required to display classification

Undesired aircraft state

At least 3 accidents required to display classification

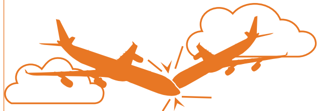
Countermeasure

At least 3 accidents required to display classification

➤ See detailed view

Mid-air Collision – Accident rate*

2015 Accident rate: 0.03
2011-2015 Accident rate: 0.01



Accident rate*	2015	'11-'15
IATA Member	0.00	0.01
Mortality risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.00	0.00

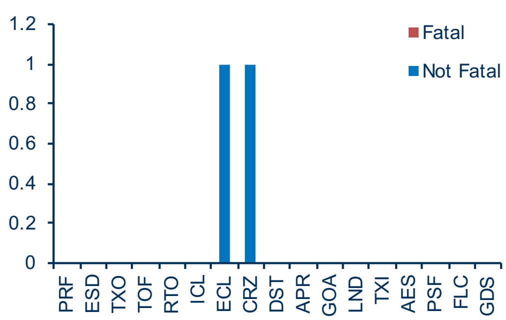
	Jet	Turboprop
2015	0.03	0.00
2011-2015	0.01	0.00

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

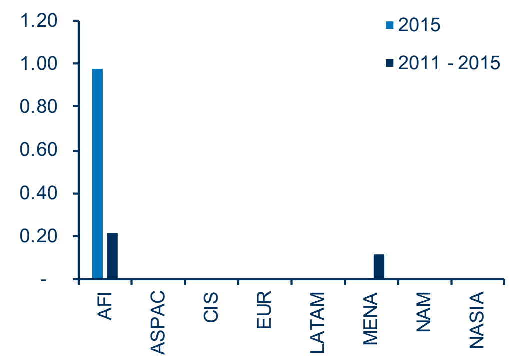
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



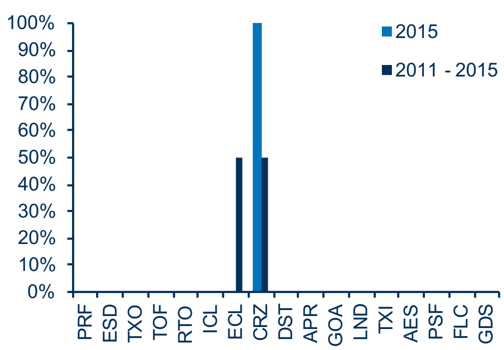
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



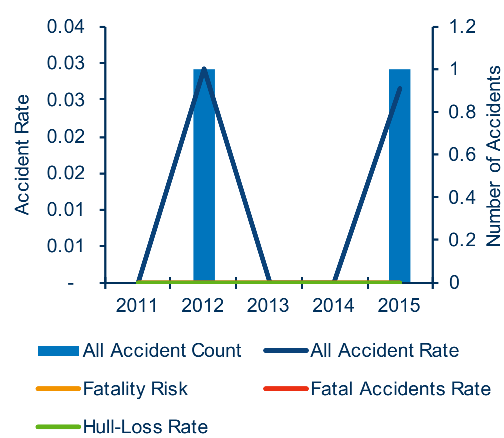
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Runway/Taxiway Excursion – Accident count

2015	Number of accidents: 15	Number of fatalities: 0
2011-2015	Number of accidents: 90	Number of fatalities: 14

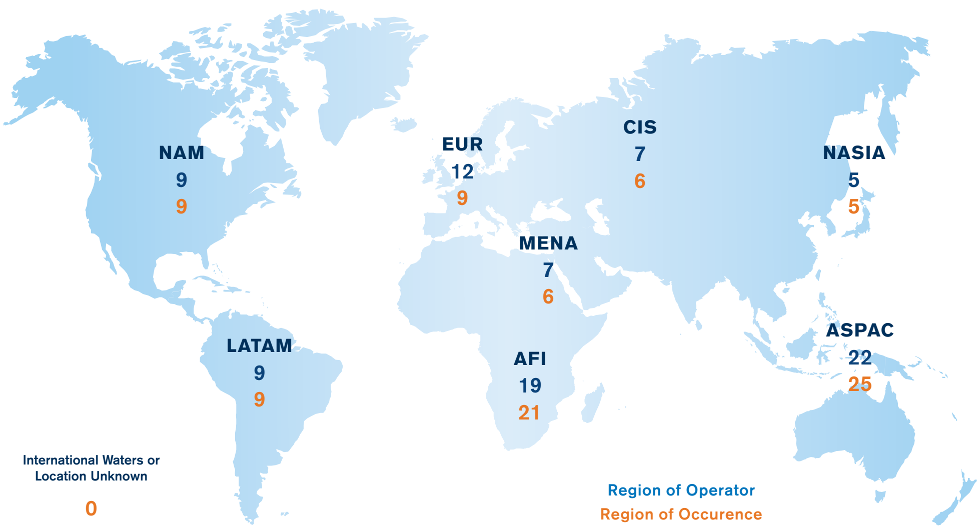
Accident Count % from total	2015	'11-'15
IATA Member	27%	23%
Full-Loss Equivalents	0%	1%
Fatal	0%	3%
Hull Losses	27%	41%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	67%	33%	0%	60%	40%
2011-2015	80%	19%	1%	48%	52%

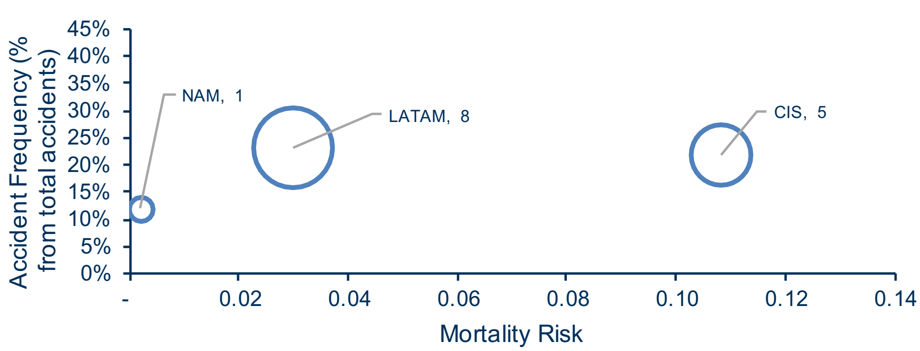
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
43%

Threats

Meteorology:
48%

Flight Crews Errors

Manual Handling / Flight Controls:
42%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
46%

Countermeasure

Overall Crew Performance:
33%

➤ See detailed view

Runway/Taxiway Excursion – Accident rate*

2015 Accident rate: 0.40
2011-2015 Accident rate: 0.51

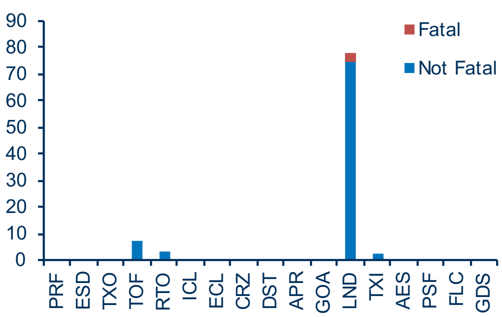
Accident rate*	2015	'11-'15
IATA Member	0.20	0.23
Mortality risk**	–	0.01
Fatal	–	0.02
Hull Losses	0.11	0.21

	Jet	Turboprop	
2015	0.29	0.97	Accident Rates for Passenger, Cargo and Ferry are not available.
2011-2015	0.30	1.54	

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

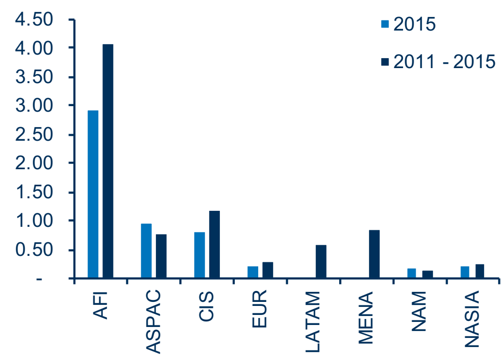
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



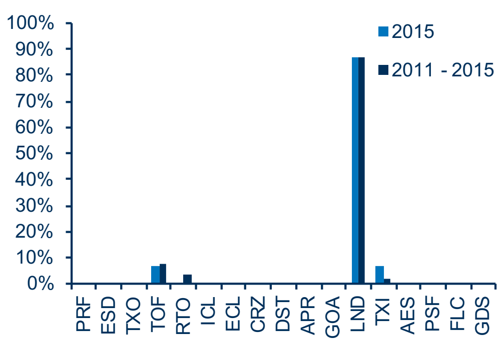
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



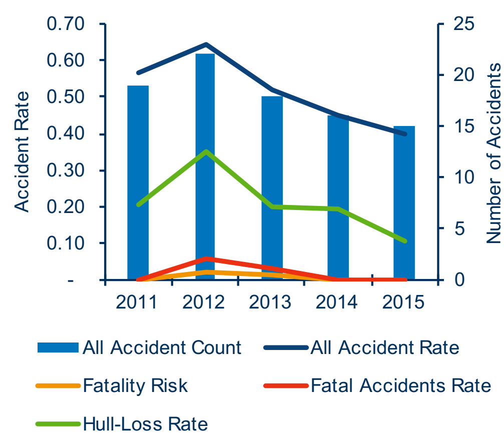
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



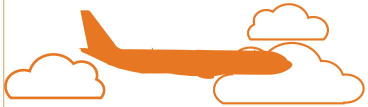
5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



In-flight Damage – Accident count

2015	Number of accidents: 12	Number of fatalities: 2
2011-2015	Number of accidents: 40	Number of fatalities: 21



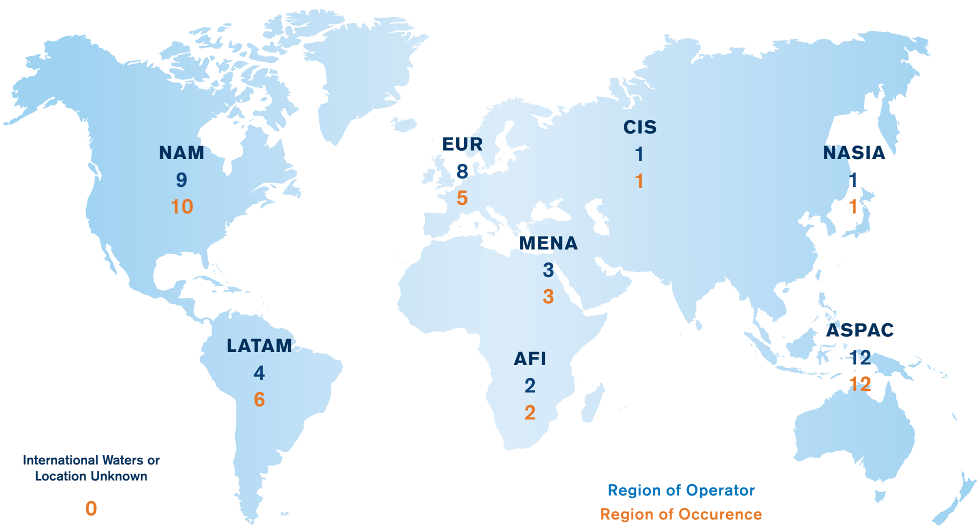
Accident Count % from total	2015	'11-'15
IATA Member	42%	40%
Full-Loss Equivalents	0%	5%
Fatal	0%	5%
Hull Losses	8%	15%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	83%	17%	0%	75%	25%
2011-2015	83%	15%	0%	70%	30%

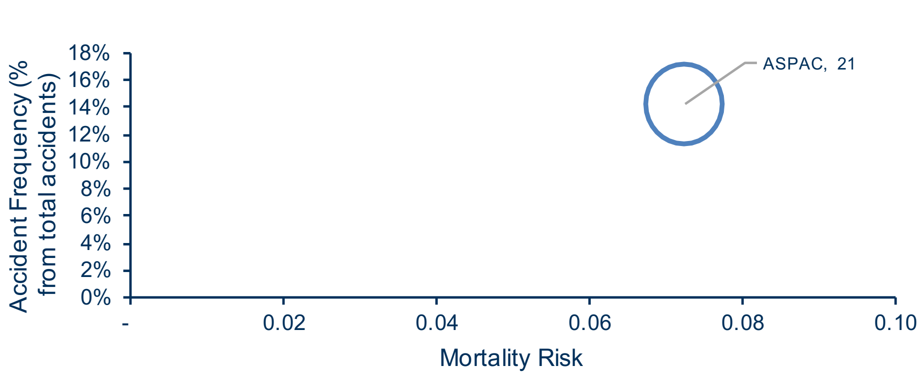
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
23%

Threats

Wildlife/Birds/Foreign Object:
36%

Flight Crews Errors

SOP Adherence / SOP Cross-verification:
13%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
10%

Countermeasure

Automation Management:
5%

➤ See detailed view

In-flight Damage – Accident rate*

2015 Accident rate: 0.32
2011-2015 Accident rate: 0.23

Accident rate*	2015	'11-'15
IATA Member	0.25	0.18
Mortality risk**	0.00	0.01
Fatal	0.00	0.01
Hull Losses	0.03	0.03

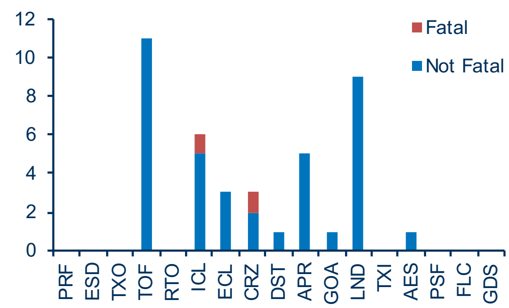
	Jet	Turboprop
2015	0.29	0.48
2011-2015	0.19	0.39

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

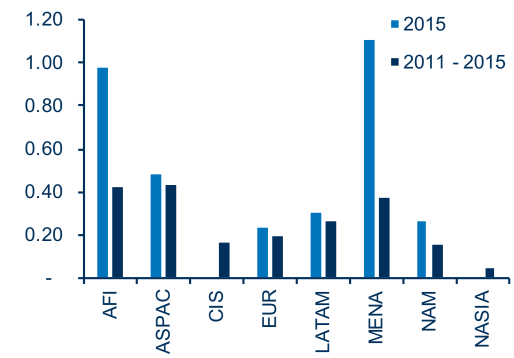
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



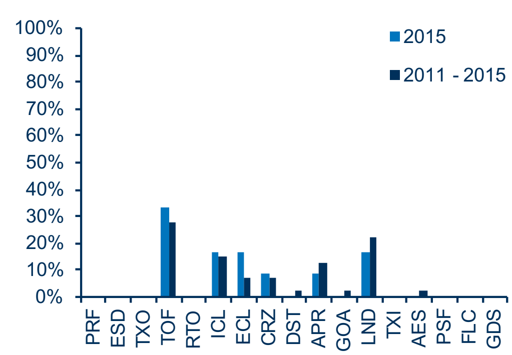
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



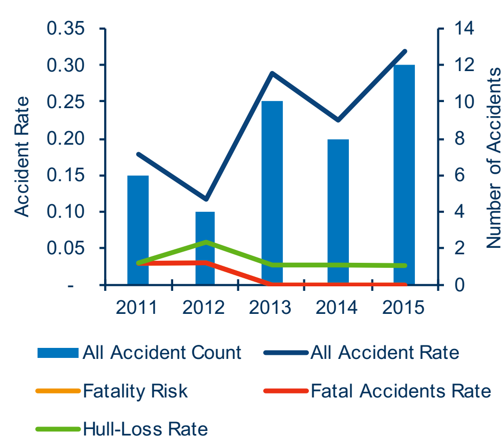
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



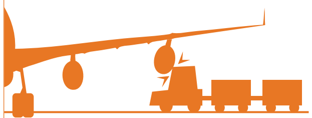
5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Ground Damage – Accident count

2015	Number of accidents: 7	Number of fatalities: 0
2011-2015	Number of accidents: 49	Number of fatalities: 3



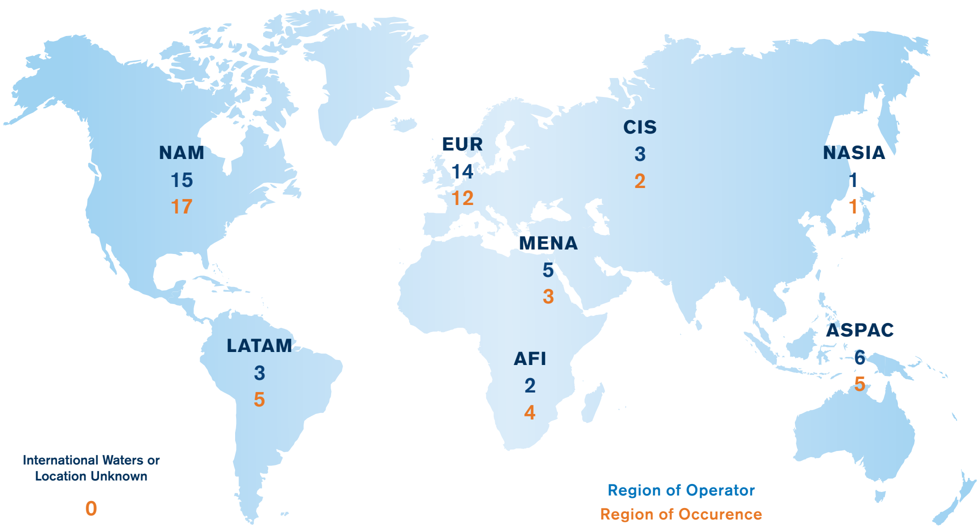
Accident Count % from total	2015	'11-'15
IATA Member	43%	43%
Full-Loss Equivalents	0%	0%
Fatal	0%	2%
Hull Losses	29%	16%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	100%	0%	0%	86%	14%
2011-2015	90%	4%	6%	67%	33%

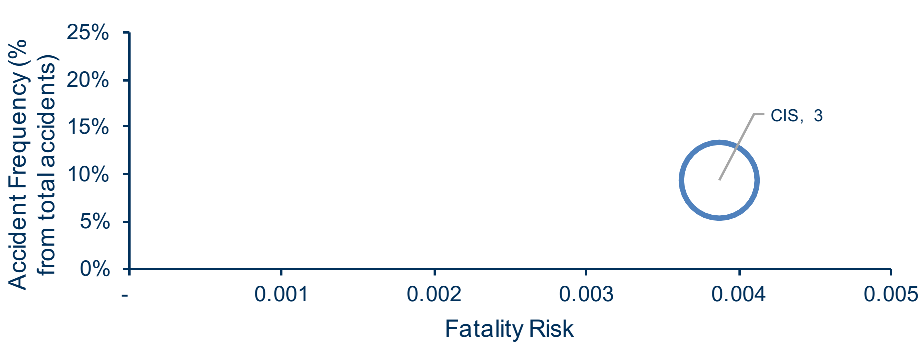
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
22%

Threats

Ground Events:
41%

Flight Crews Errors

SOP Adherence / SOP Cross-verification:
15%

Undesired aircraft state

Ramp movements:
20%

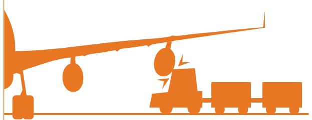
Countermeasure

Overall Crew Performance:
12%

➤ See detailed view

Ground Damage – Accident rate*

2015 Accident rate: 0.19
2011-2015 Accident rate: 0.28



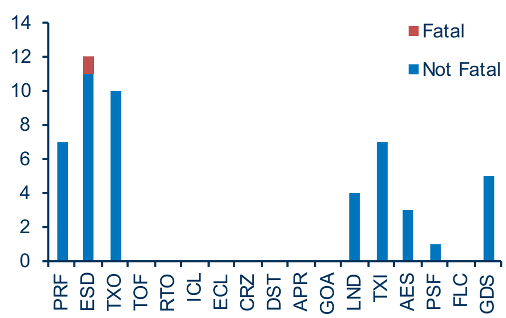
Accident rate*	2015	'11-'15
IATA Member	0.15	0.23
Mortality risk**	0.00	0.00
Fatal	0.00	0.01
Hull Losses	0.05	0.05

	Jet	Turboprop	
2015	0.19	0.16	Accident Rates for Passenger, Cargo and Ferry are not available.
2011-2015	0.23	0.52	

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

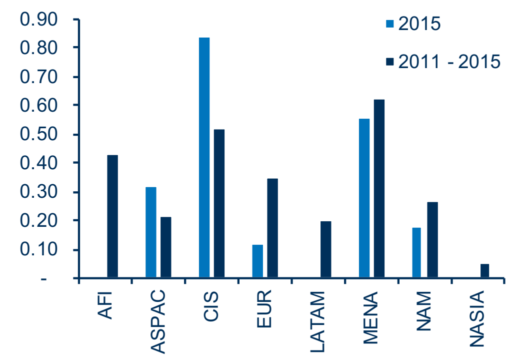
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



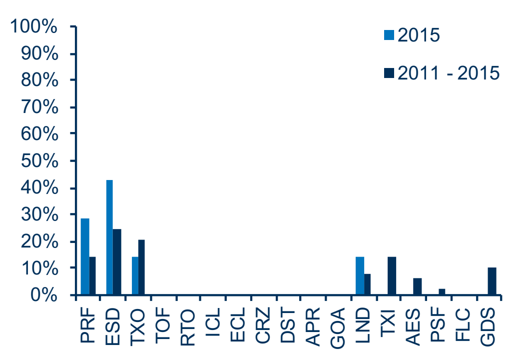
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



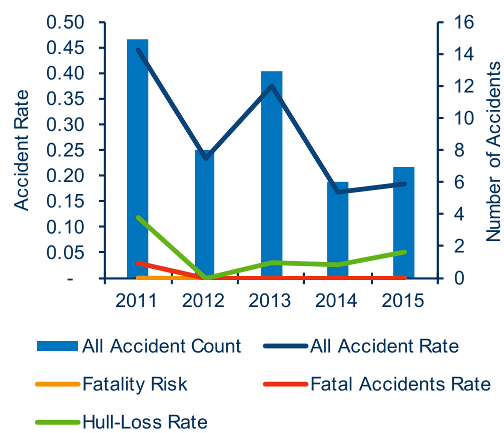
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Undershoot – Accident count

2015	Number of accidents: 5	Number of fatalities: 0
2011-2015	Number of accidents: 12	Number of fatalities: 90

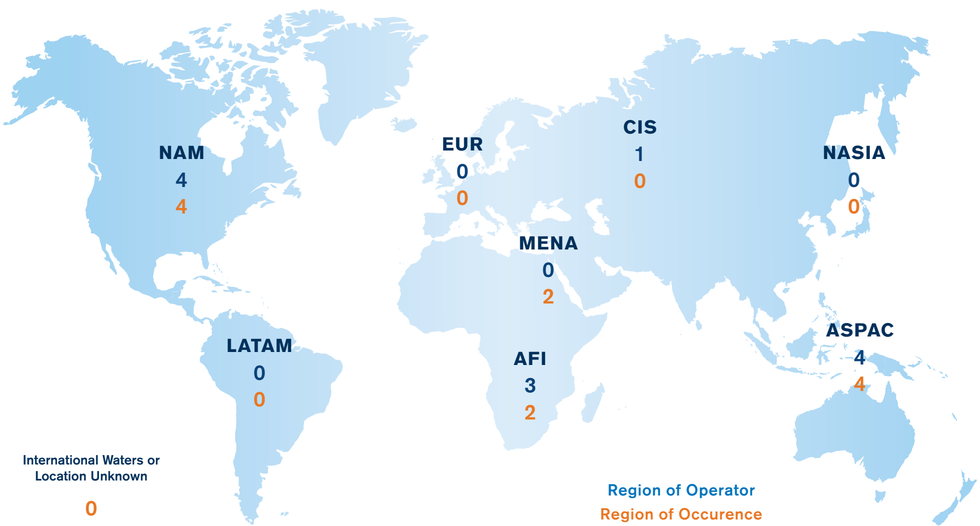
Accident Count % from total	2015	'11-'15
IATA Member	60%	25%
Full-Loss Equivalents	0%	14%
Fatal	0%	17%
Hull Losses	20%	50%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	80%	20%	0%	80%	20%
2011-2015	67%	25%	8%	58%	42%

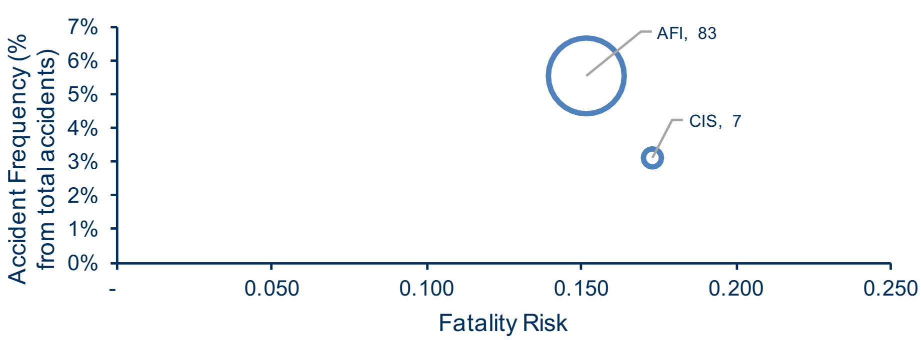
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
70%

Threats

Meteorology:
80%

Flight Crews Errors

Manual Handling / Flight Controls:
50%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
80%

Countermeasure

Overall Crew Performance:
40%

➤ See detailed view

Undershoot – Accident rate*

2015 Accident rate: 0.13
2011-2015 Accident rate: 0.07

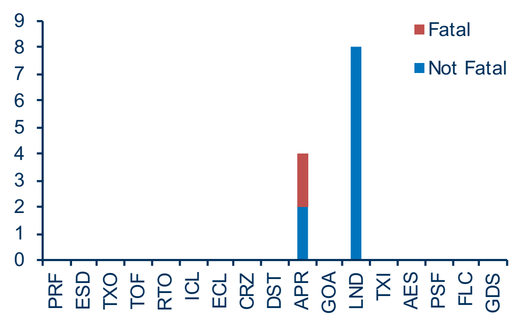
Accident rate*	2015	'11-'15
IATA Member	0.15	0.03
Mortality risk**	0.00	0.01
Fatal	0.00	0.01
Hull Losses	0.03	0.03

	Jet	Turboprop	
2015	0.13	0.16	Accident Rates for Passenger, Cargo and Ferry are not available.
2011-2015	0.05	0.16	

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

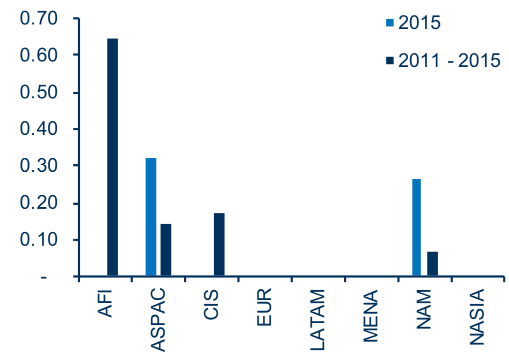
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



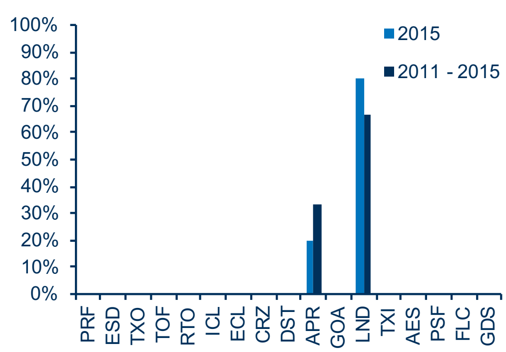
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



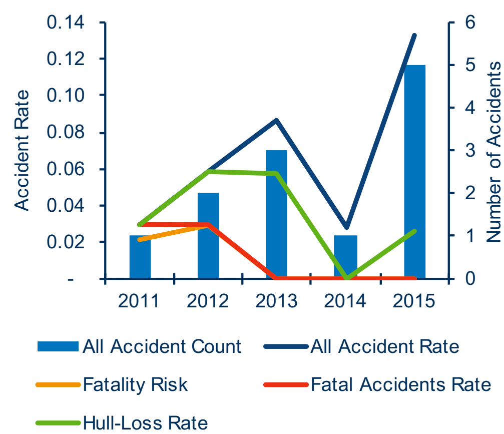
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Hard Landing – Accident count

2015	Number of accidents: 16	Number of fatalities: 0
2011-2015	Number of accidents: 47	Number of fatalities: 0

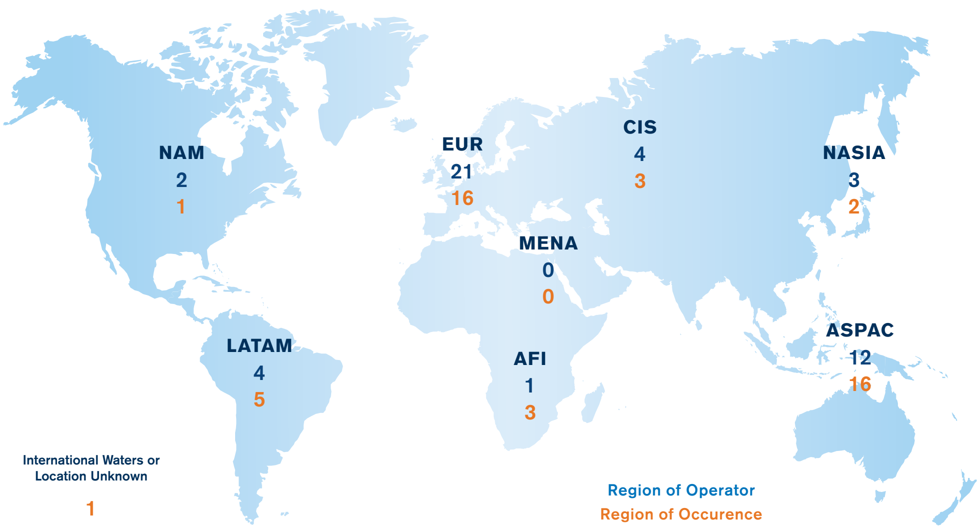
Accident Count % from total	2015	'11-'15
IATA Member	38%	28%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	19%	23%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	88%	13%	0%	69%	31%
2011-2015	87%	9%	2%	66%	34%

Note: the sum may not add to 100% due to rounding

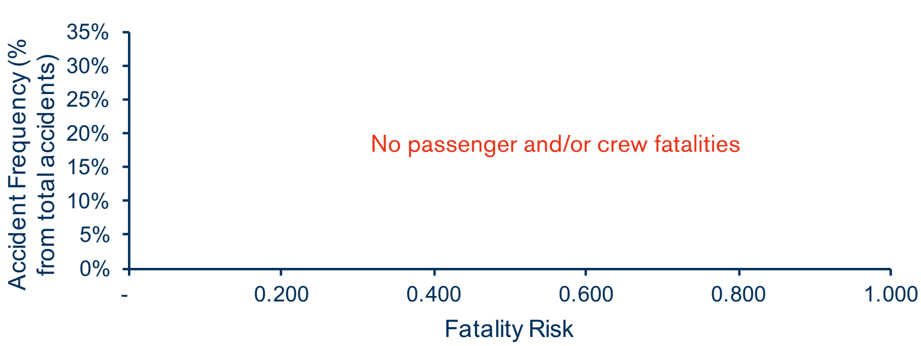
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations.
28%

Threats

Meteorology:
49%

Flight Crews Errors

Manual Handling / Flight Controls:
74%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
63%

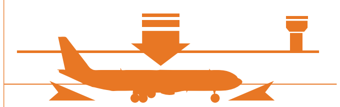
Countermeasure

Overall Crew Performance:
35%

➤ See detailed view

Hard Landing – Accident rate*

2015 Accident rate: 0.43
2011-2015 Accident rate: 0.27



Accident rate*	2015	'11-'15
IATA Member	0.30	0.15
Mortality risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.08	0.06

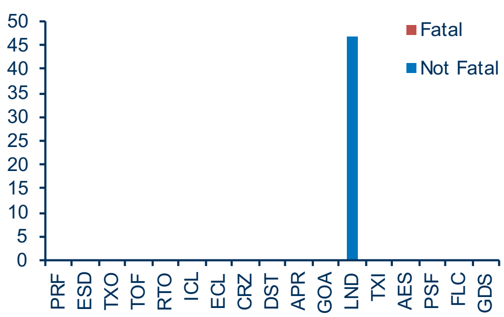
	Jet	Turboprop
2015	0.35	0.81
2011-2015	0.21	0.52

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

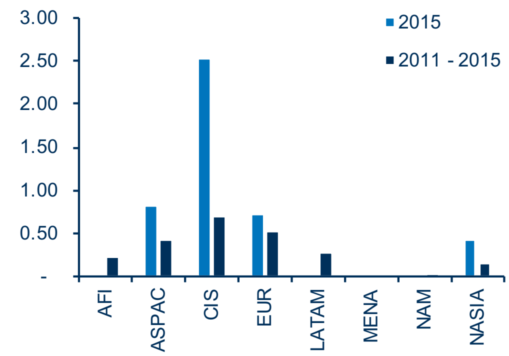
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



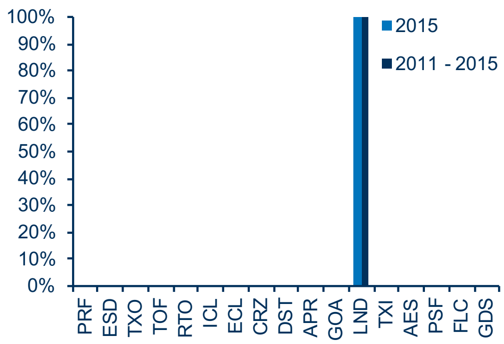
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



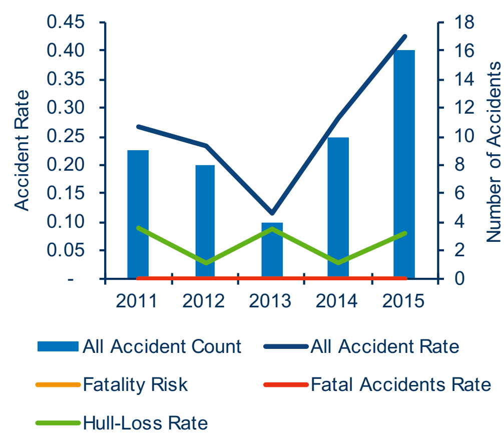
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Gear-up Landing/Gear Collapse – Accident count

2015	Number of accidents: 7	Number of fatalities: 0
2011-2015	Number of accidents: 67	Number of fatalities: 0

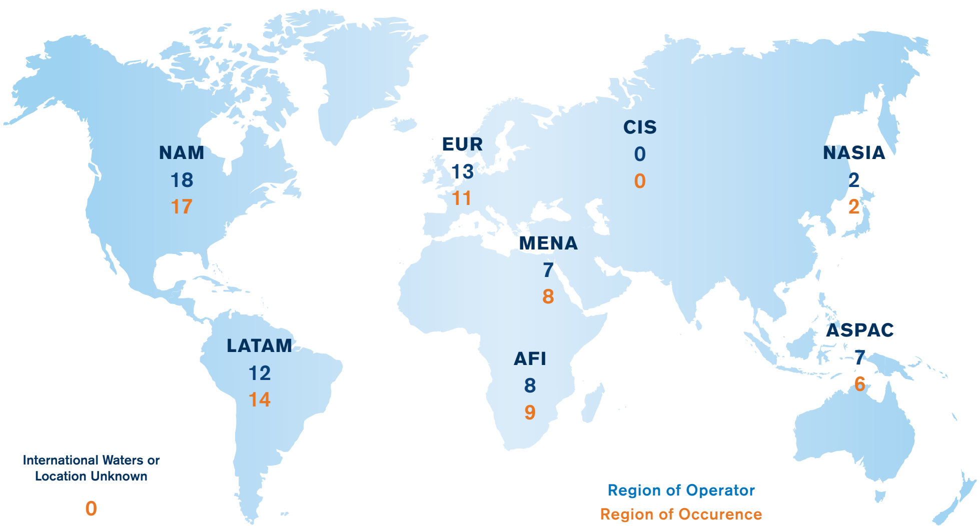
Accident Count % from total	2015	'11-'15
IATA Member	29%	25%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	43%	21%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	100%	0%	0%	86%	14%
2011-2015	75%	21%	4%	40%	60%

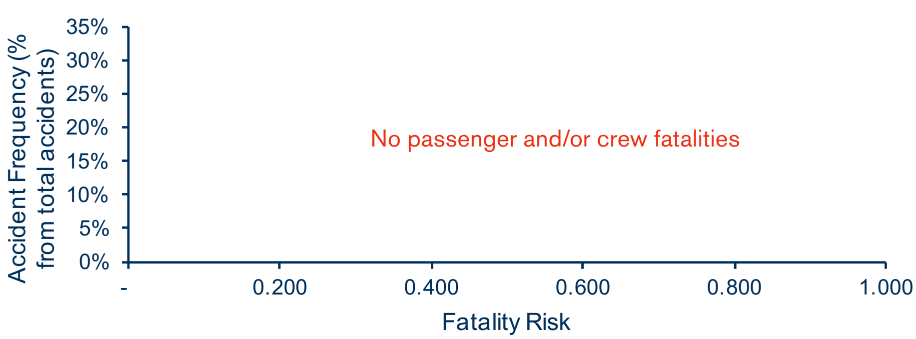
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Maintenance Operations.
30%

Threats

Aircraft Malfunction:
81%

Flight Crews Errors

Manual Handling / Flight Controls:
4%

Undesired aircraft state

Landing Gear:
6%

Countermeasure

Overall Crew Performance:
2%

➤ See detailed view

Gear-up Landing/Gear Collapse – Accident rate*

2015 Accident rate: 0.19
2011-2015 Accident rate: 0.38

Accident rate*	2015	'11-'15
IATA Member	0.10	0.19
Mortality risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.08	0.08

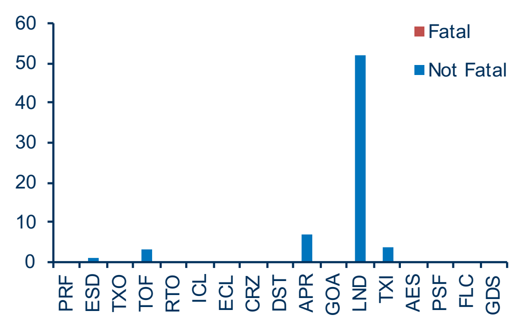
	Jet	Turboprop
2015	0.19	0.16
2011-2015	0.19	1.31

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

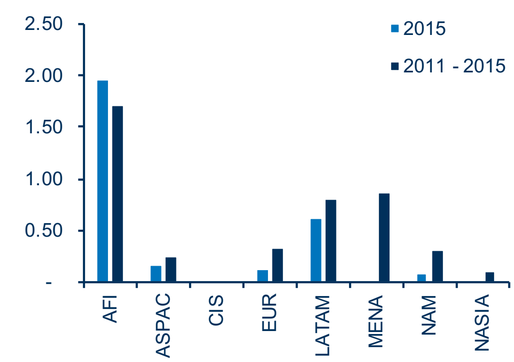
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



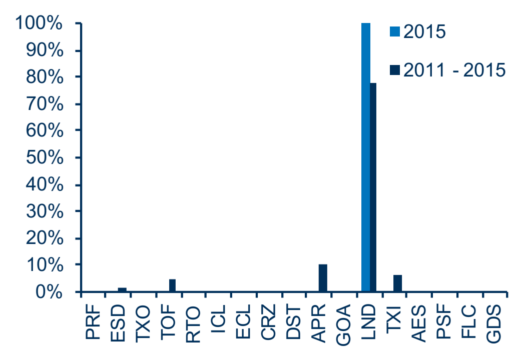
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



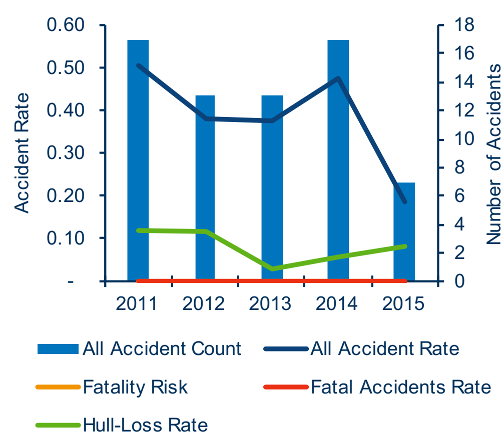
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



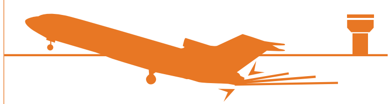
5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Tailstrike – Accident count

2015 Number of accidents: 1 Number of fatalities: 0
2011-2015 Number of accidents: 26 Number of fatalities: 0



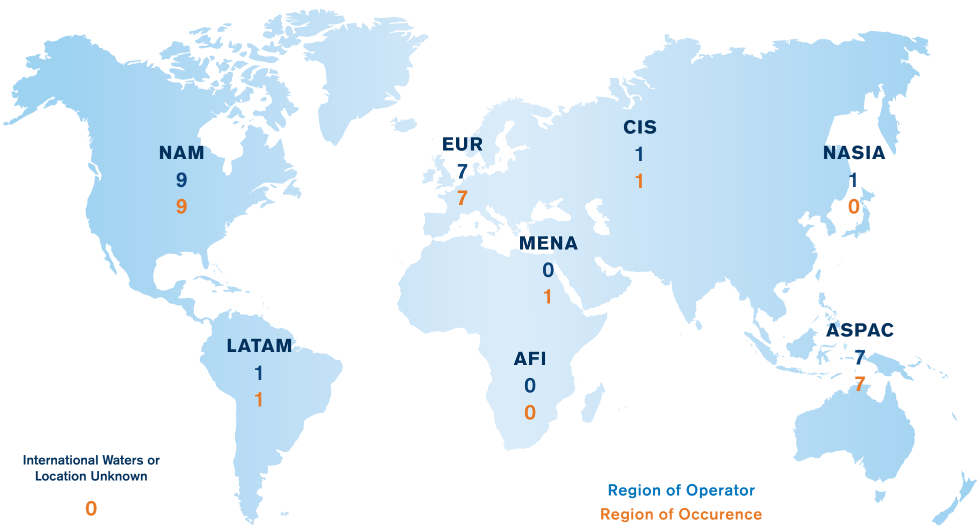
Accident Count % from total	2015	'11-'15
IATA Member	0%	62%
Full-Loss Equivalents	0%	0%
Fatal	0%	0%
Hull Losses	0%	4%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	100%	0%	0%	0%	100%
2011-2015	85%	15%	0%	81%	19%

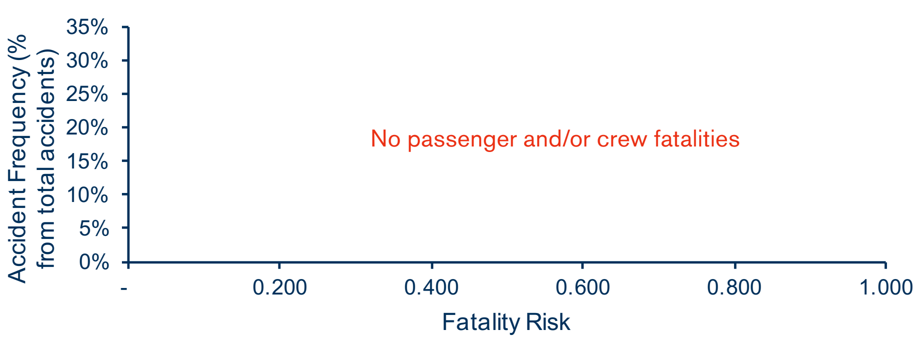
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations.
18%

Threats

Meteorology:
32%

Flight Crews Errors

Manual Handling / Flight Controls:
73%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
36%

Countermeasure

Monitor / Cross-check:
18%

➤ See detailed view

Tailstrike – Accident rate*

2015 Accident rate: 0.03
2011-2015 Accident rate: 0.15

Accident rate*	2015	'11-'15
IATA Member	0.00	0.18
Mortality risk**	0.00	0.00
Fatal	0.00	0.00
Hull Losses	0.00	0.01

	Jet	Turboprop
2015	0.00	0.16
2011-2015	0.14	0.16

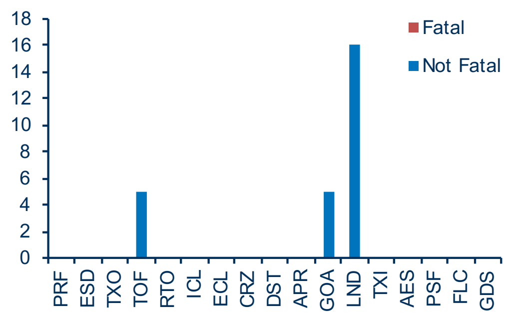
Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown

**Number of full-loss equivalents per 1 million flights

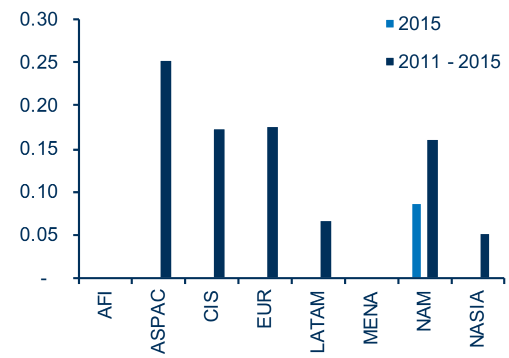
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



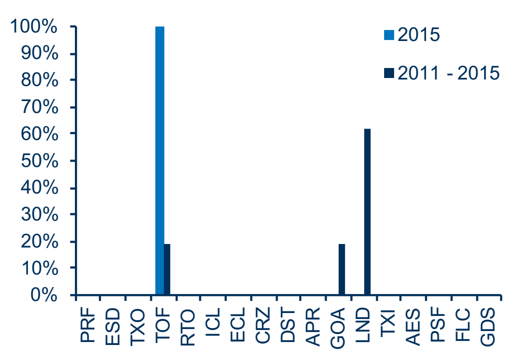
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



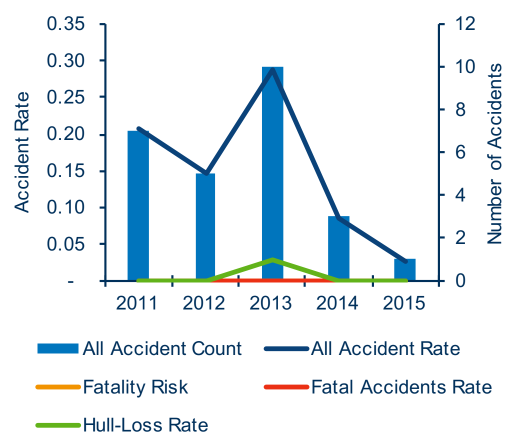
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



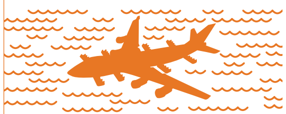
5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Off-Airport Landing/Ditching – Accident count

2015	Number of accidents: 0	Number of fatalities: 0
2011-2015	Number of accidents: 5	Number of fatalities: 35



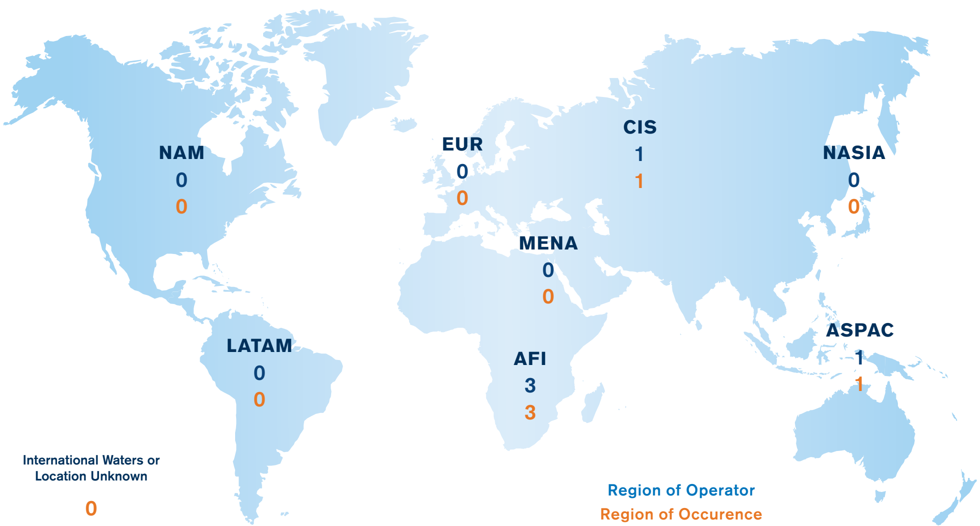
Accident Count % from total	2015	'11-'15
IATA Member	0%	0%
Full-Loss Equivalents	0%	21%
Fatal	0%	40%
Hull Losses	0%	80%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	0%	0%	0%	0%	0%
2011-2015	60%	20%	20%	20%	80%

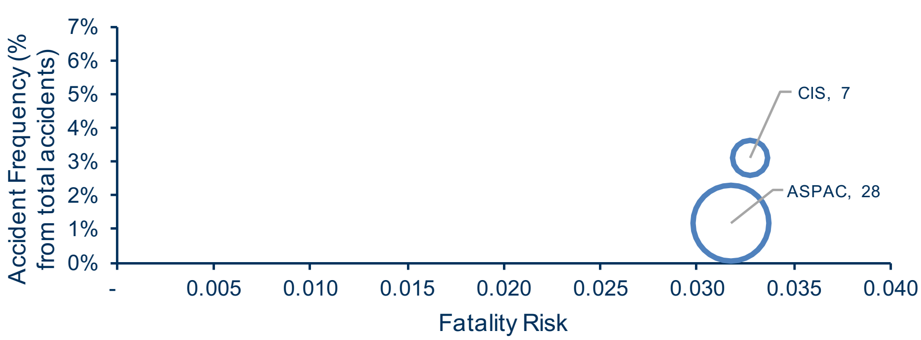
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations.
67%

Threats

Maintenance Events:
67%

Flight Crews Errors

Manual Handling / Flight Controls:
67%

Undesired aircraft state

Engine:
33%

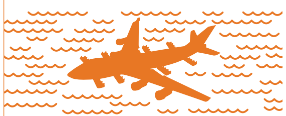
Countermeasure

Overall Crew Performance:
67%

➤ See detailed view

Off-Airport Landing/Ditching – Accident rate*

2015 Accident rate: –
2011-2015 Accident rate: 0.03



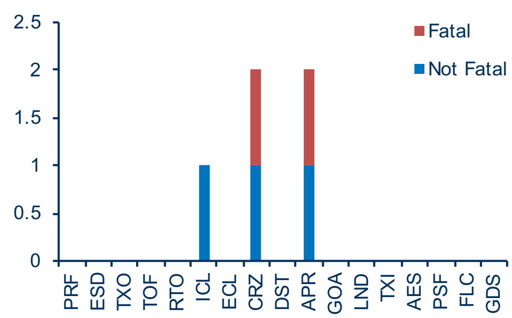
Accident rate*	2015	'11-'15
IATA Member	0.00	0.00
Mortality risk**	0.00	0.01
Fatal	0.00	0.01
Hull Losses	0.00	0.02

	Jet	Turboprop	
2015	0.00	0.00	Accident Rates for Passenger, Cargo and Ferry are not available.
2011-2015	0.01	0.13	

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

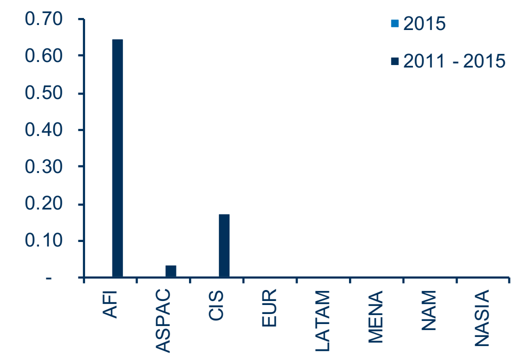
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



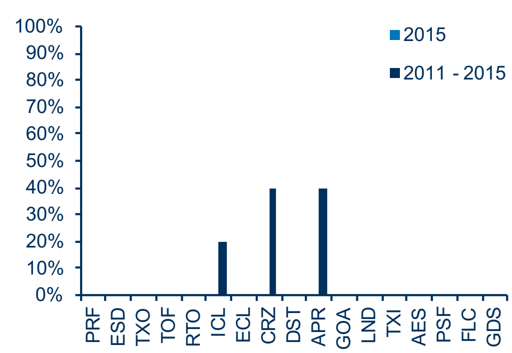
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



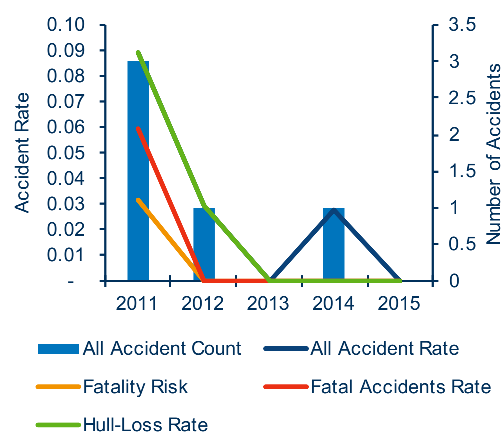
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Jet Aircraft Accidents – Accident count

2015	Number of accidents: 46	Number of fatalities: 0
2011-2015	Number of accidents: 214	Number of fatalities: 1203

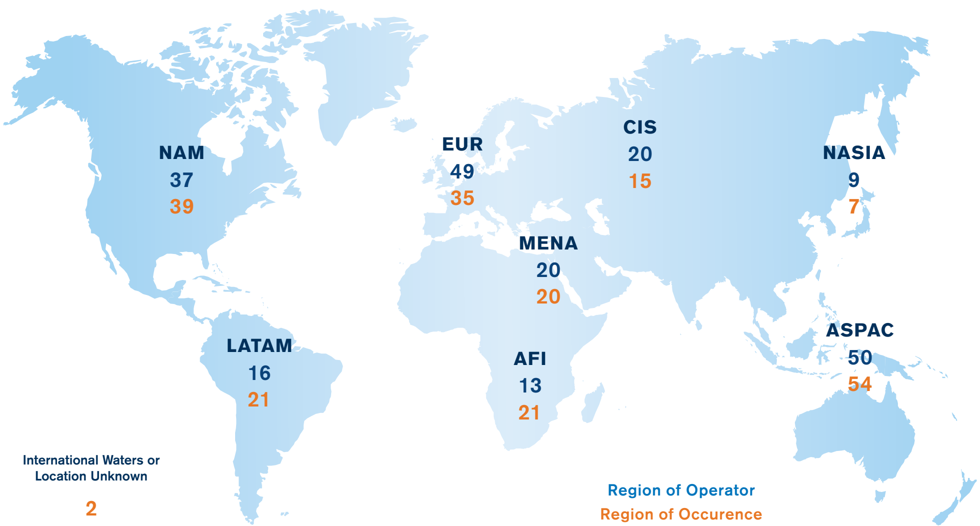
Accident Count % from total	2015	'11-'15
IATA Member	48%	47%
Full-Loss Equivalents	0%	2%
Fatal	0%	10%
Hull Losses	22%	25%

	Passenger	Cargo	Ferry
2015	91%	9%	0%
2011-2015	85%	11%	3%

Note: the sum may not add to 100% due to rounding

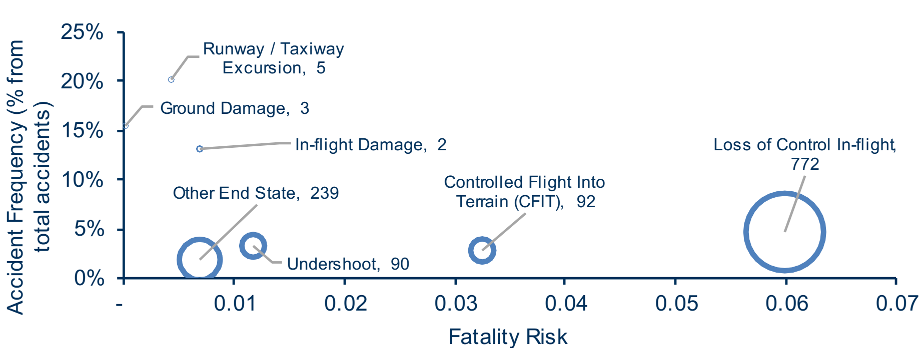
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)
B777 (MH370). Location: unknown

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
26%

Threats

Meteorology:
32%

Flight Crews Errors

Manual Handling / Flight Controls:
29%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
25%

Countermeasure

Overall Crew Performance:
21%

➤ See detailed view

Jet Aircraft Accidents – Accident rate*

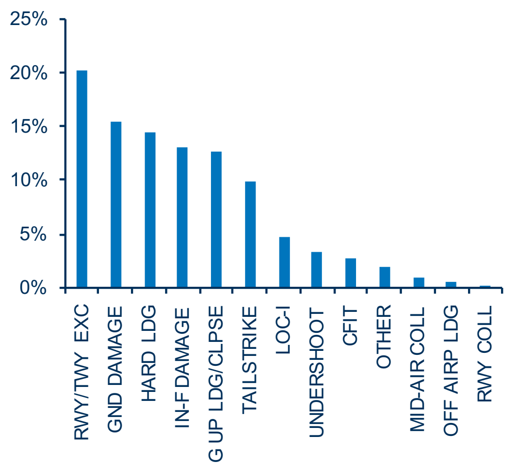
		Accident rate*	2015	'11-'15
2015	Accident rate: 1.46	IATA Member	1.19	1.12
2011-2015	Accident rate: 1.47	Mortality risk**	0.00	0.03
		Fatal	0.00	0.15
		Hull Losses	0.32	0.37

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

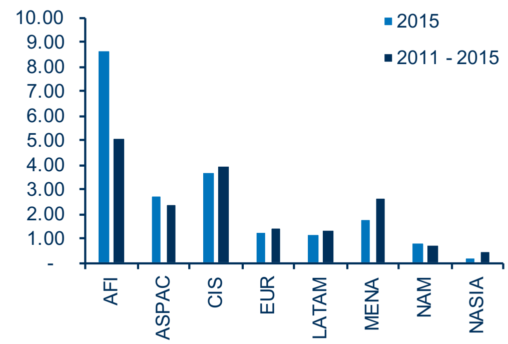
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

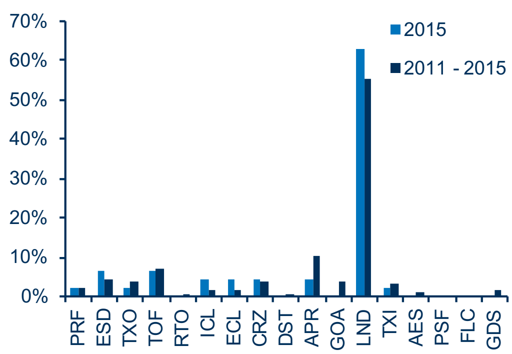
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



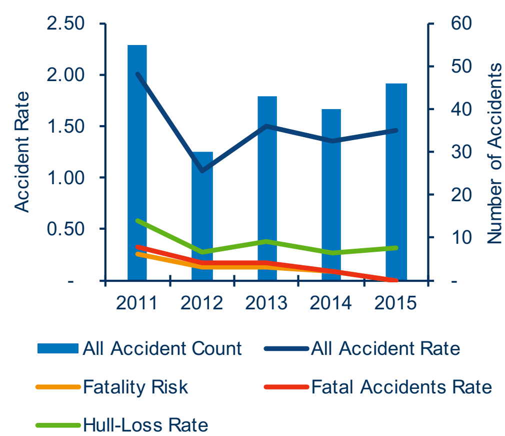
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



Turboprop Aircraft Accidents – Accident count

2015	Number of accidents: 22	Number of fatalities: 136
2011-2015	Number of accidents: 193	Number of fatalities: 655

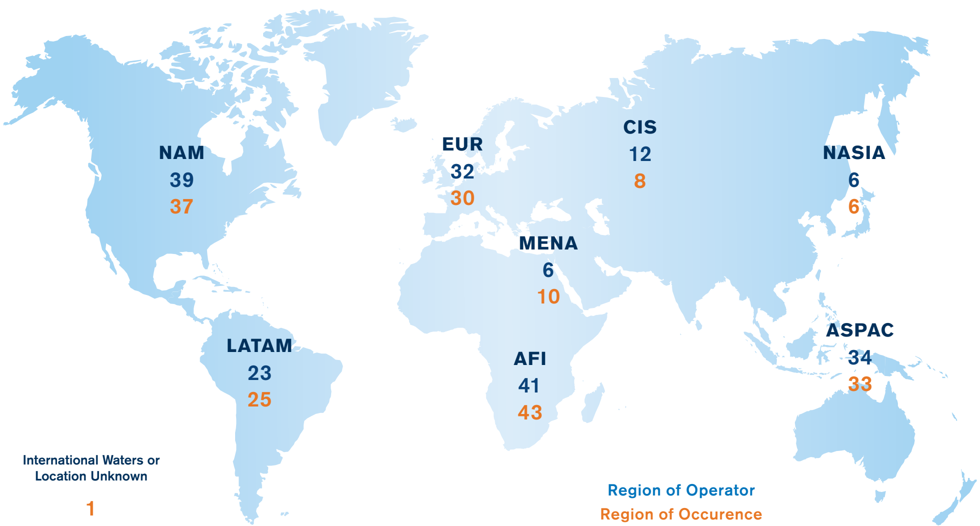
Accident Count % from total	2015	'11-'15
IATA Member	9%	9%
Full-Loss Equivalents	3%	1%
Fatal	18%	24%
Hull Losses	36%	51%

	Passenger	Cargo	Ferry
2015	64%	36%	0%
2011-2015	70%	26%	4%

Note: the sum may not add to 100% due to rounding

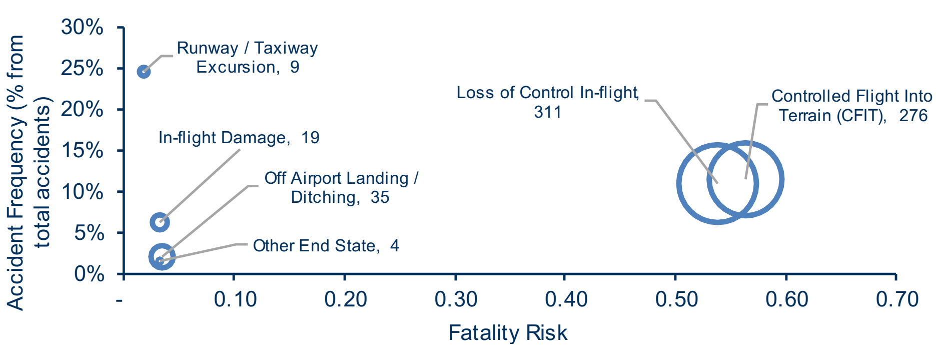
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: B1900, presumingly crashed near Sao Tome and Principe.
wreckage not known to have been found.

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
38%

Threats

Meteorology:
29%

Flight Crews Errors

Manual Handling / Flight Controls:
32%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
17%

Countermeasure

Overall Crew Performance:
27%

➤ See detailed view

Turboprop Aircraft Accidents – Accident rate*

2015 Accident rate: 3.55
2011-2015 Accident rate: 6.31

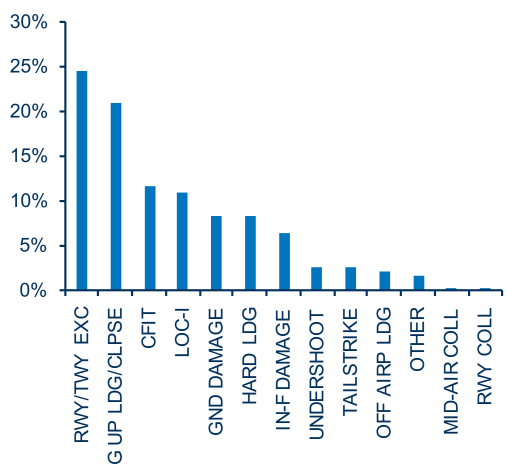
Accident rate*	2015	'11-'15
IATA Member	1.41	3.07
Mortality risk**	0.12	0.07
Fatal	0.65	1.50
Hull Losses	1.29	3.20

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

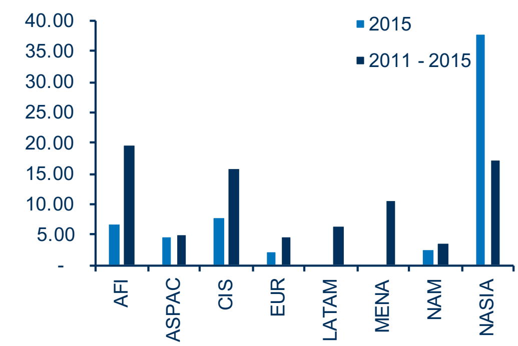
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

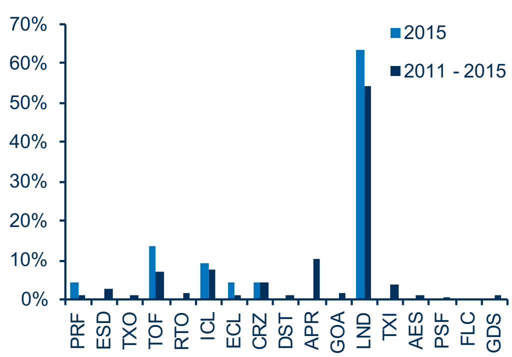
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



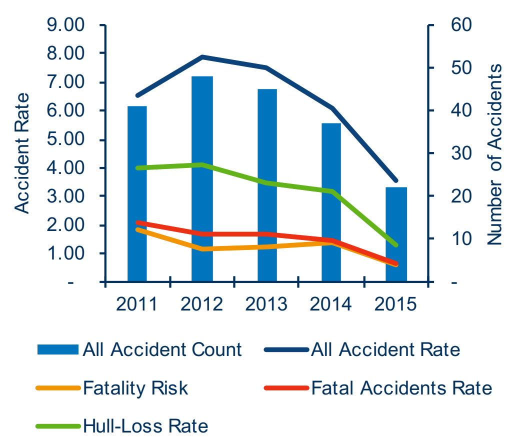
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



5-Year Trend (2011 - 2015)

See Annex 1 for the definitions of different metrics used



5

In-Depth Regional Accident Analysis

INTRODUCTION TO THREAT AND ERROR MANAGEMENT

Following the same model as the in-depth analysis by accident category presented in Section 4, this section presents an overview of occurrences and their contributing factors broken down by the region of the involved operator(s).

The purpose of this section is to identify issues that operators located in the same region may share, in order to develop adequate prevention strategies.

Note: IATA determines the accident region based on the operator's "home" country as specified in the operator's Air Operator Certificate (AOC).

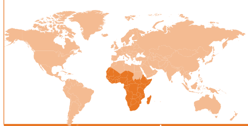
For example, if a Canadian-registered operator has an accident in Europe, this accident is considered a North American accident.

For a complete list of countries assigned per region, please consult Annex 1.

Image courtesy of Embraer

Africa Aircraft Accidents – Accident count

2015	Number of accidents: 8	Number of fatalities: 37
2011-2015	Number of accidents: 54	Number of fatalities: 322



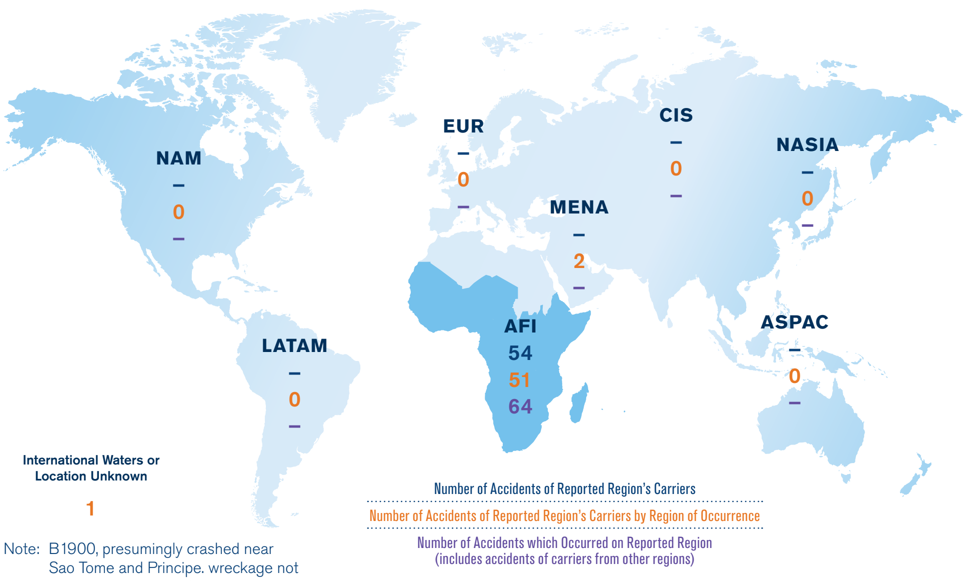
Accident Count % from total	2015	'11-'15
IATA Member	13%	6%
Full-Loss Equivalents	12%	23%
Fatal	13%	28%
Hull Losses	50%	70%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	50%	50%	0%	63%	38%
2011-2015	48%	39%	13%	24%	76%

Note: the sum may not add to 100% due to rounding

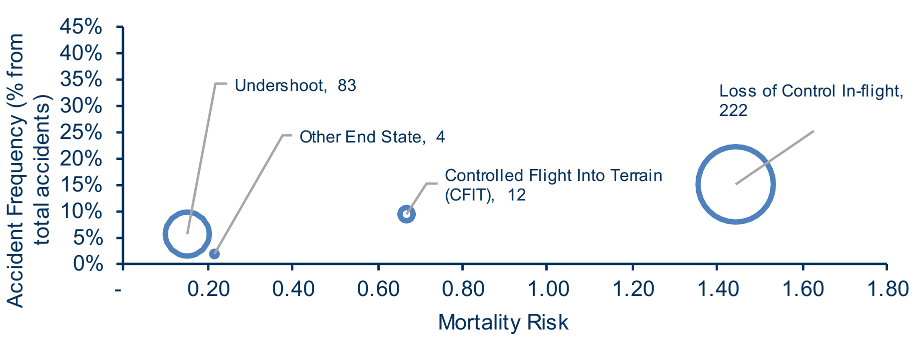
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: B1900, presumingly crashed near Sao Tome and Principe. wreckage not known to have been found.

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
50%

Threats

Airport Facilities:
30%

Flight Crews Errors

Manual Handling / Flight Controls:
23%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
20%

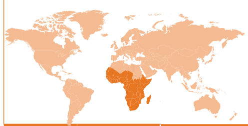
Countermeasure

Overall Crew Performance:
23%

➤ See detailed view

Africa Aircraft Accidents – Accident rate*

2015 Accident rate: 7.88
2011-2015 Accident rate: 11.64



Accident rate*	2015	'11-'15
IATA Member	1.94	1.32
Mortality risk**	0.96	2.69
Fatal	0.99	3.23
Hull Losses	3.94	8.19

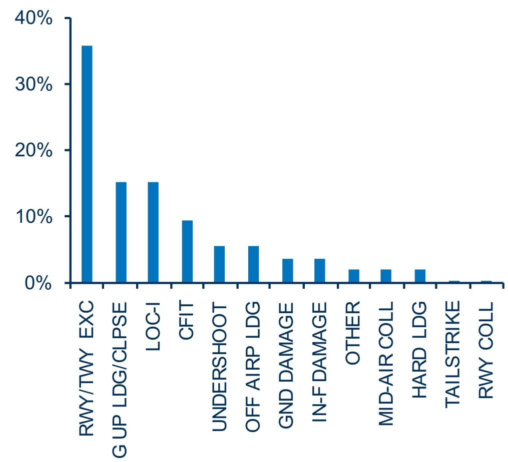
	Jet	Turboprop
2015	8.72	6.80
2011-2015	5.10	19.62

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

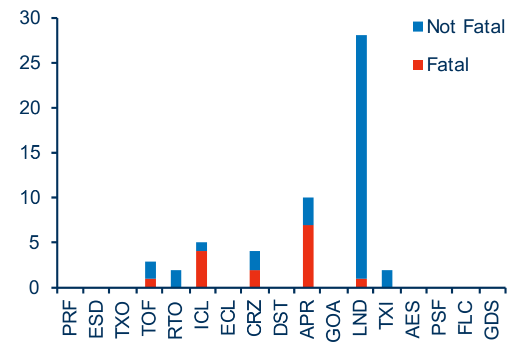
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

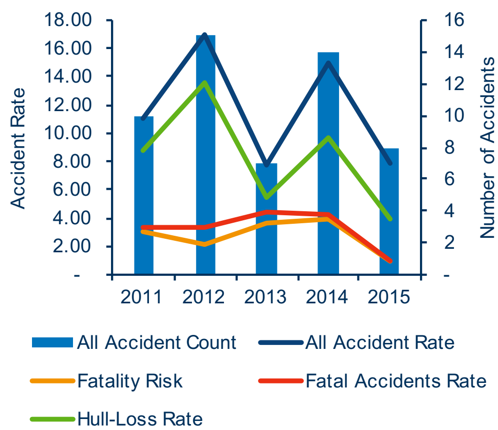
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



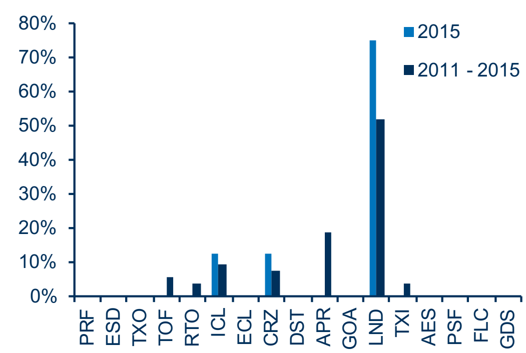
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



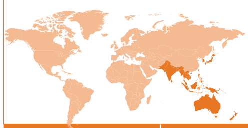
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



Asia/Pacific Aircraft Accidents – Accident count

2015	Number of accidents: 20	Number of fatalities: 54
2011-2015	Number of accidents: 84	Number of fatalities: 761



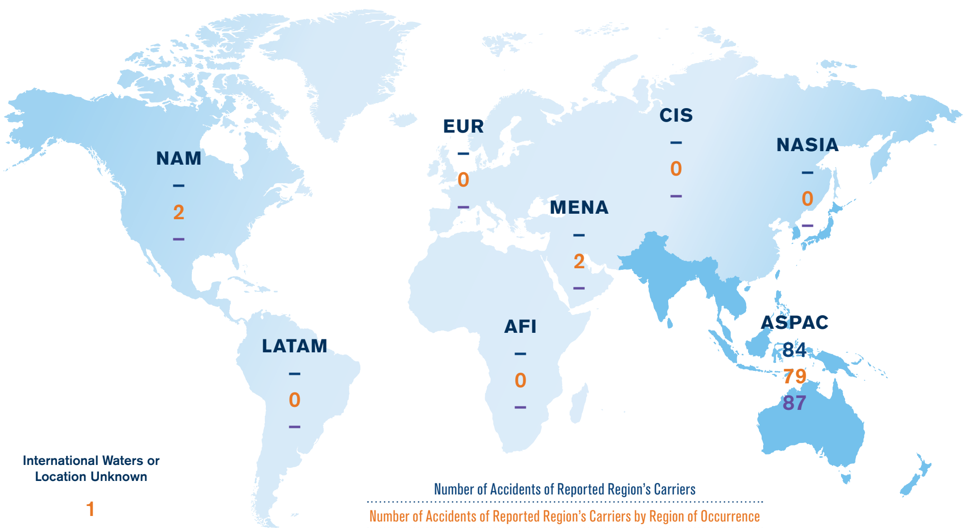
Accident Count % from total	2015	'11-'15
IATA Member	35%	35%
Full-Loss Equivalents	5%	14%
Fatal	5%	17%
Hull Losses	20%	27%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	90%	10%	0%	65%	35%
2011-2015	88%	10%	1%	60%	40%

Note: the sum may not add to 100% due to rounding

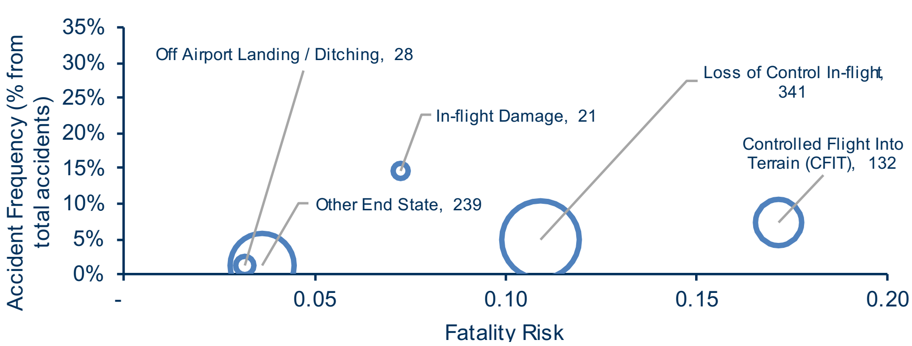
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: B777 (MH370). Location: unknown

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
55%

Threats

Meteorology:
32%

Flight Crews Errors

Manual Handling / Flight Controls:
42%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
30%

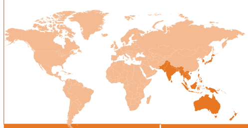
Countermeasure

Overall Crew Performance:
31%

➤ See detailed view

Asia/Pacific Aircraft Accidents – Accident rate*

2015 Accident rate: 3.24
2011-2015 Accident rate: 3.05



Accident rate*	2015	'11-'15
IATA Member	3.00	2.61
Mortality risk**	0.16	0.42
Fatal	0.16	0.51
Hull Losses	0.65	0.83

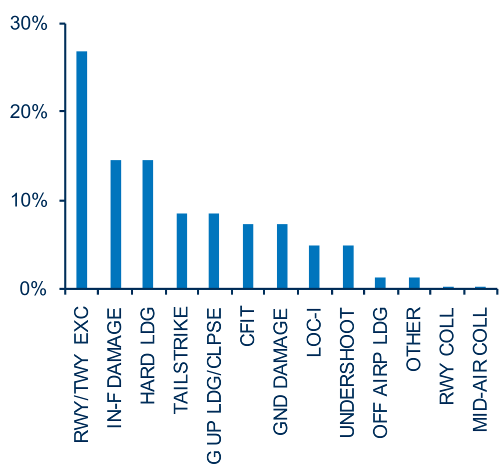
	Jet	Turboprop
2015	2.75	4.82
2011-2015	2.39	5.13

Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

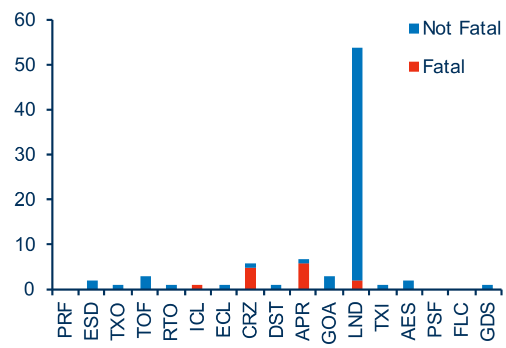
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

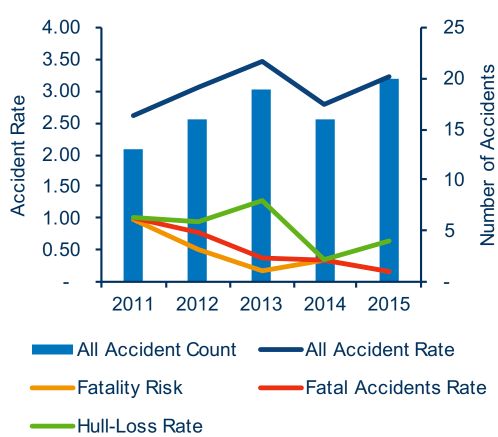
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



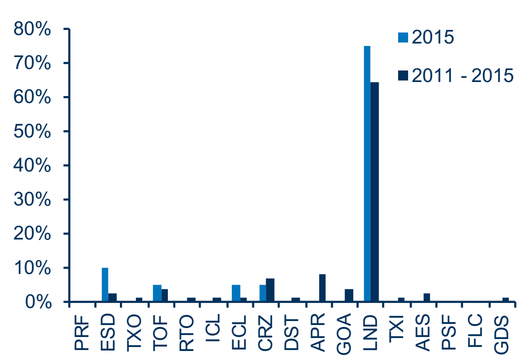
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



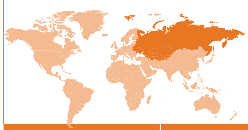
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



Commonwealth of Independent States (CIS) Aircraft Accidents – Accident count

2015 Number of accidents: 5 Number of fatalities: 0
2011-2015 Number of accidents: 32 Number of fatalities: 295



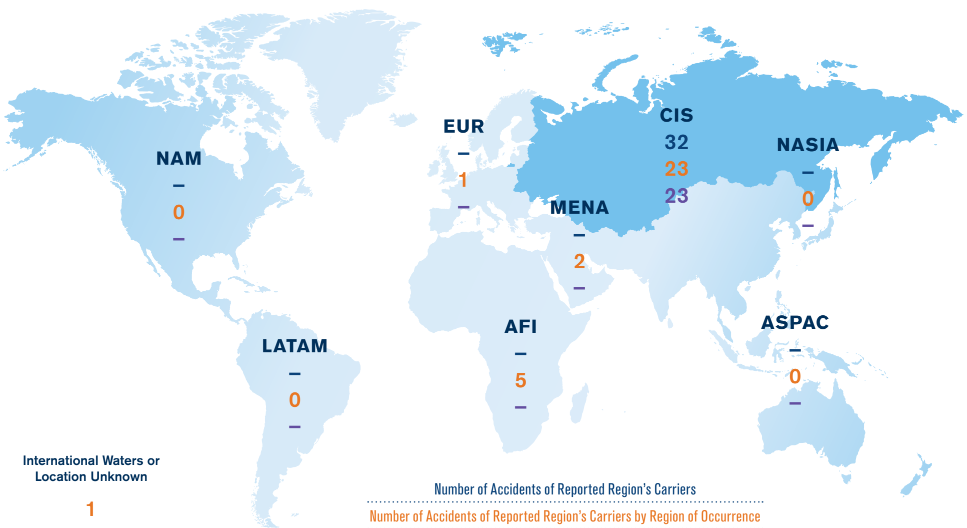
Accident Count % from total	2015	'11-'15
IATA Member	0%	9%
Full-Loss Equivalents	0%	38%
Fatal	0%	50%
Hull Losses	40%	75%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	60%	40%	0%	80%	20%
2011-2015	69%	25%	6%	63%	38%

Note: the sum may not add to 100% due to rounding

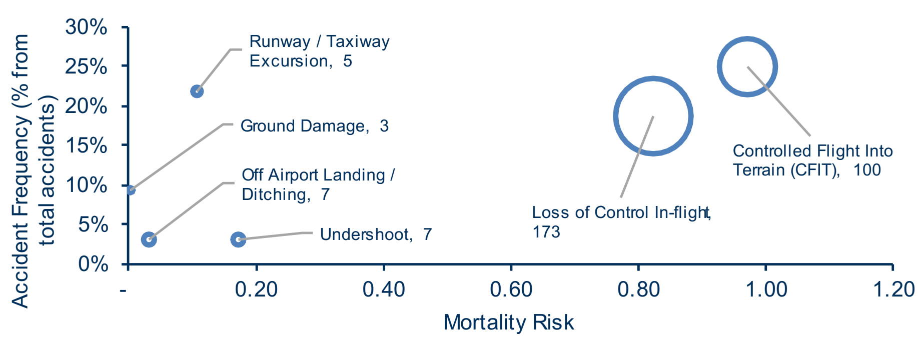
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note. An-74 Hard Landing. Location: Barneo Ice Base (International Waters).

Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
54%

Threats

Meteorology:
54%

Flight Crews Errors

SOP Adherence / SOP Cross-verification:
46%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
50%

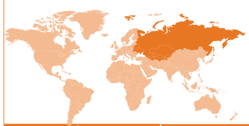
Countermeasure

Overall Crew Performance:
38%

➤ See detailed view

Commonwealth of Independent States (CIS) Aircraft Accidents – Accident rate*

2015 Accident rate: 4.20
2011-2015 Accident rate: 5.54



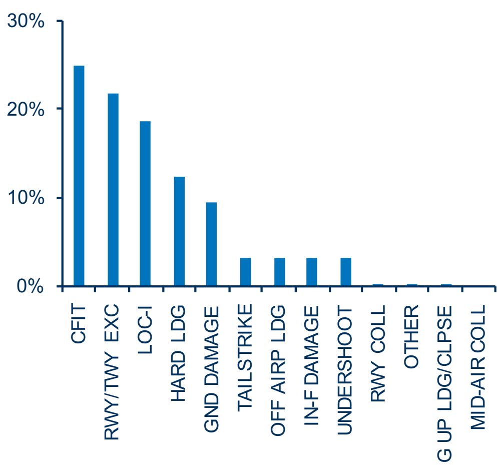
Accident rate*	2015	'11-'15
IATA Member	0.00	0.98
Mortality risk**	0.00	2.11
Fatal	0.00	2.77
Hull Losses	1.68	4.15

	Jet	Turboprop	
2015	3.76	7.87	Accident Rates for Passenger, Cargo and Ferry are not available.
2011-2015	3.97	16.13	

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

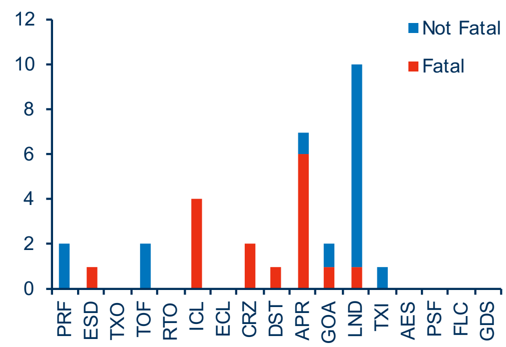
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

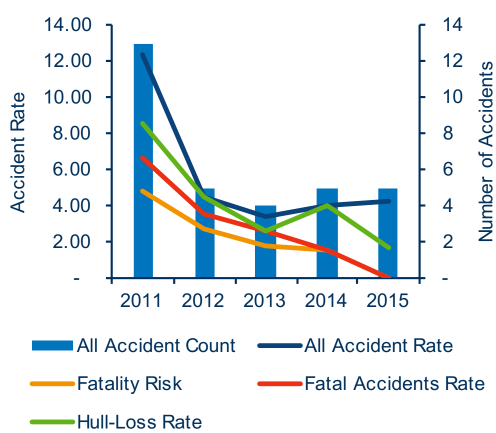
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



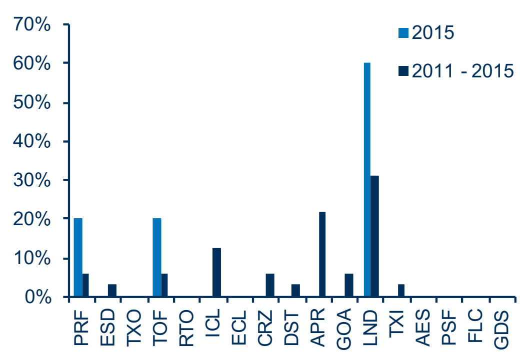
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



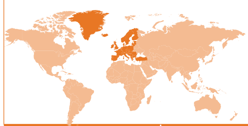
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



Europe Aircraft Accidents – Accident count

2015	Number of accidents: 12	Number of fatalities: 0
2011-2015	Number of accidents: 81	Number of fatalities: 122



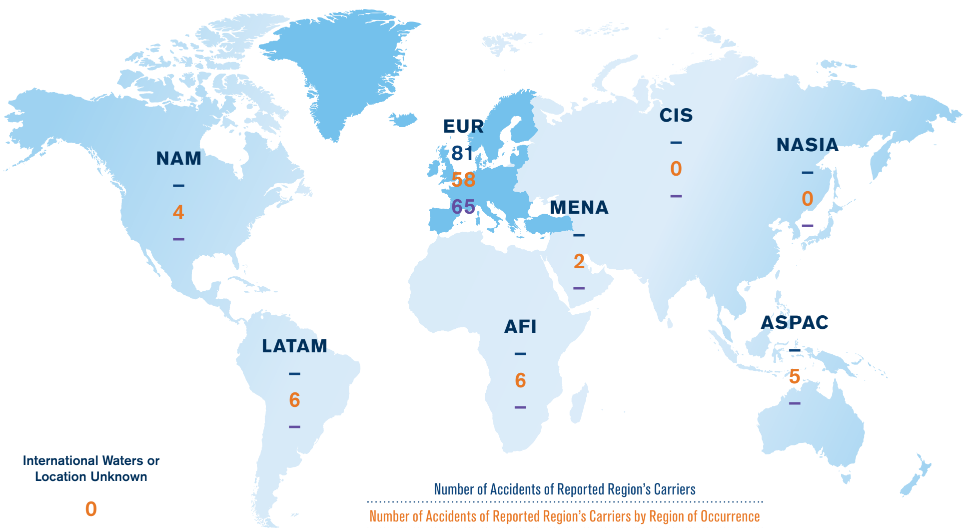
Accident Count % from total	2015	'11-'15
IATA Member	50%	42%
Full-Loss Equivalents	0%	2%
Fatal	0%	2%
Hull Losses	8%	17%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	92%	8%	0%	75%	25%
2011-2015	85%	11%	2%	60%	40%

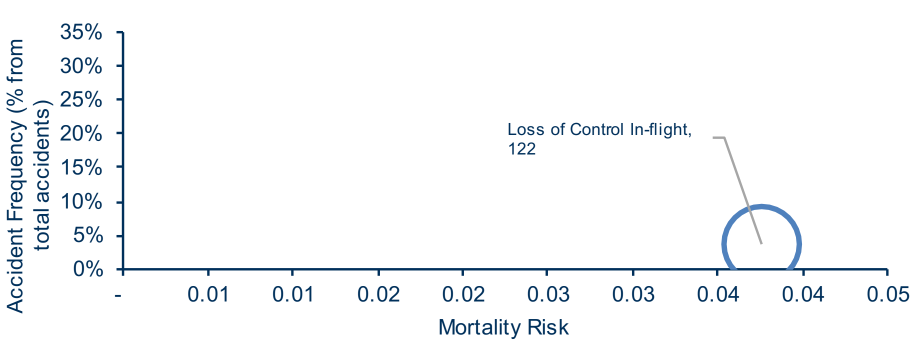
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations.
12%

Threats

Meteorology:
31%

Flight Crews Errors

Manual Handling / Flight Controls:
35%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
23%

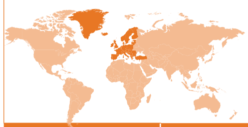
Countermeasure

Overall Crew Performance:
20%

➤ See detailed view

Europe Aircraft Accidents – Accident rate*

2015 Accident rate: 1.46
2011-2015 Accident rate: 2.03



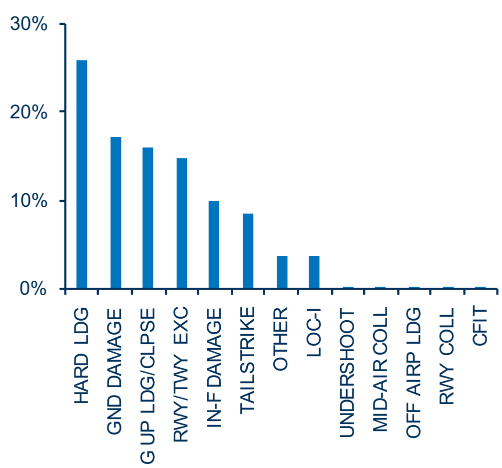
Accident rate*	2015	'11-'15
IATA Member	1.35	1.57
Mortality risk**	0.00	0.04
Fatal	0.00	0.05
Hull Losses	0.12	0.35

	Jet	Turboprop	
2015	1.31	2.26	Accident Rates for Passenger, Cargo and Ferry are not available.
2011-2015	1.47	4.82	

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

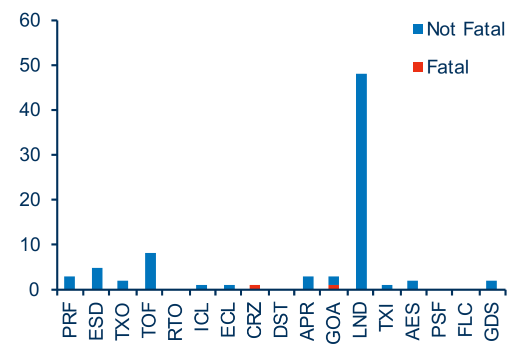
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

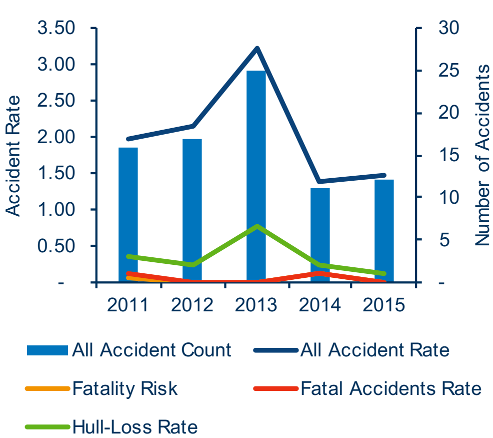
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



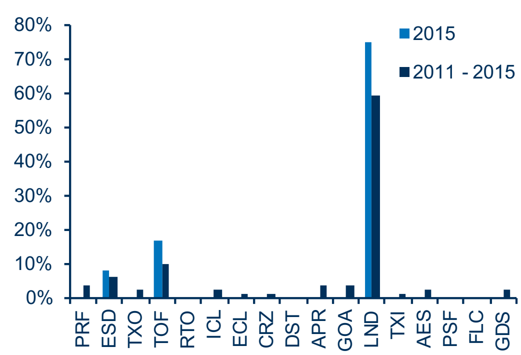
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



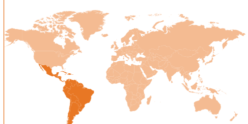
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



Latin America & the Caribbean Aircraft Accidents – Accident count

2015	Number of accidents: 3	Number of fatalities: 0
2011-2015	Number of accidents: 39	Number of fatalities: 74



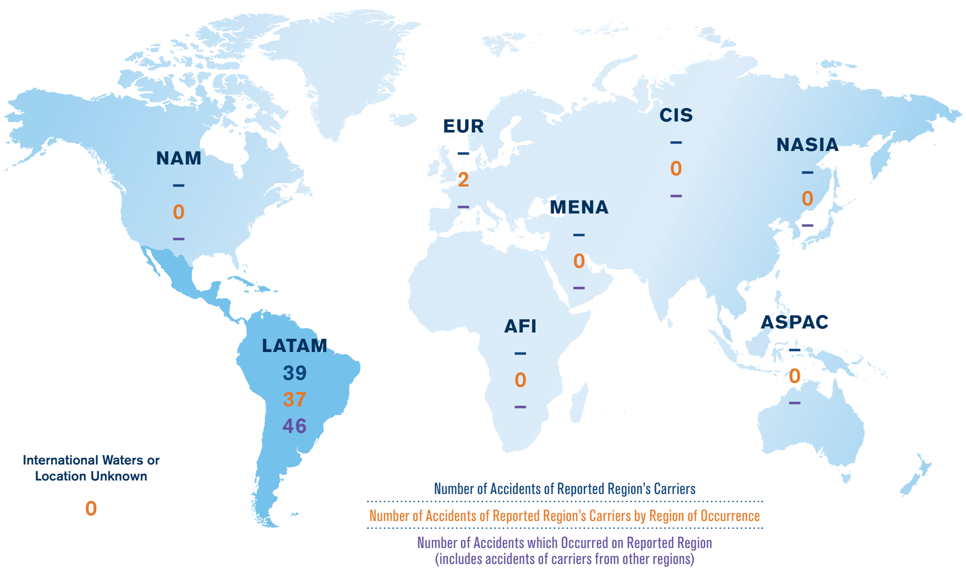
Accident Count % from total	2015	'11-'15
IATA Member	33%	21%
Full-Loss Equivalents	0%	16%
Fatal	0%	18%
Hull Losses	33%	51%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	100%	0%	0%	100%	0%
2011-2015	87%	13%	0%	41%	59%

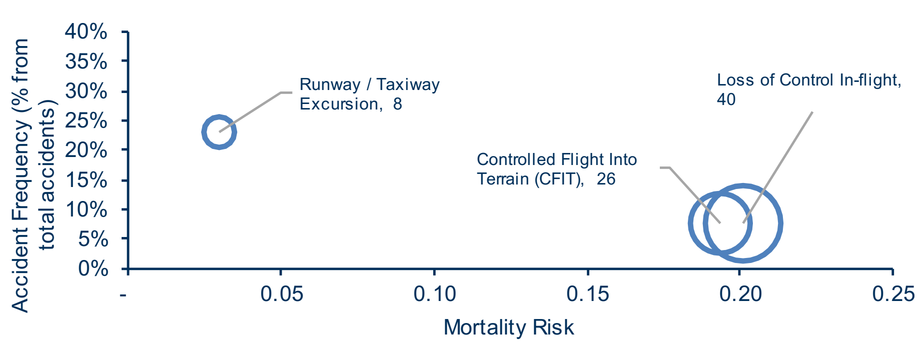
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
26%

Threats

Aircraft Malfunction:
45%

Flight Crews Errors

Manual Handling / Flight Controls:
13%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
16%

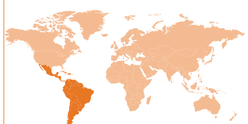
Countermeasure

Overall Crew Performance:
19%

➤ See detailed view

Latin America & the Caribbean Aircraft Accidents – Accident rate*

2015 Accident rate: 0.92
2011-2015 Accident rate: 2.61



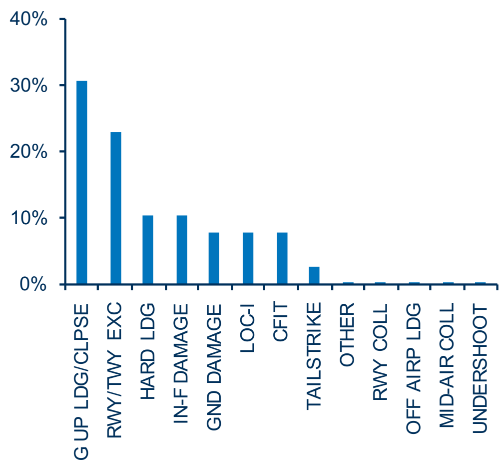
Accident rate*	2015	'11-'15
IATA Member	0.44	0.95
Mortality risk**	0.00	0.42
Fatal	0.00	0.47
Hull Losses	0.31	1.34

	Jet	Turboprop	
2015	1.18	0.00	Accident Rates for Passenger, Cargo and Ferry are not available.
2011-2015	1.40	6.57	

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

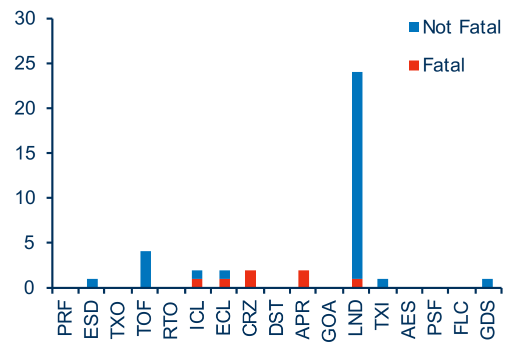
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

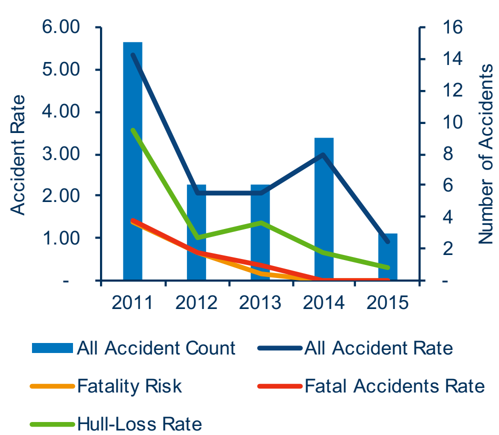
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



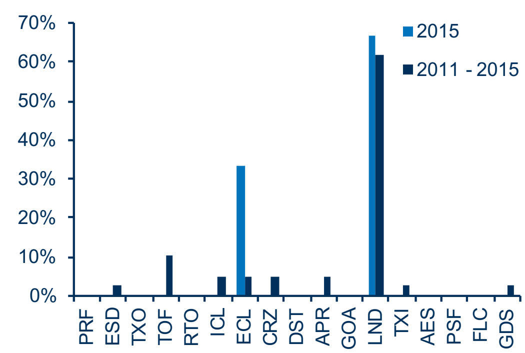
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



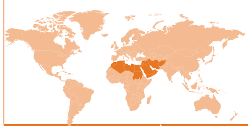
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



Middle East & North Africa Aircraft Accidents – Accident count

2015	Number of accidents: 3	Number of fatalities: 0
2011-2015	Number of accidents: 26	Number of fatalities: 158



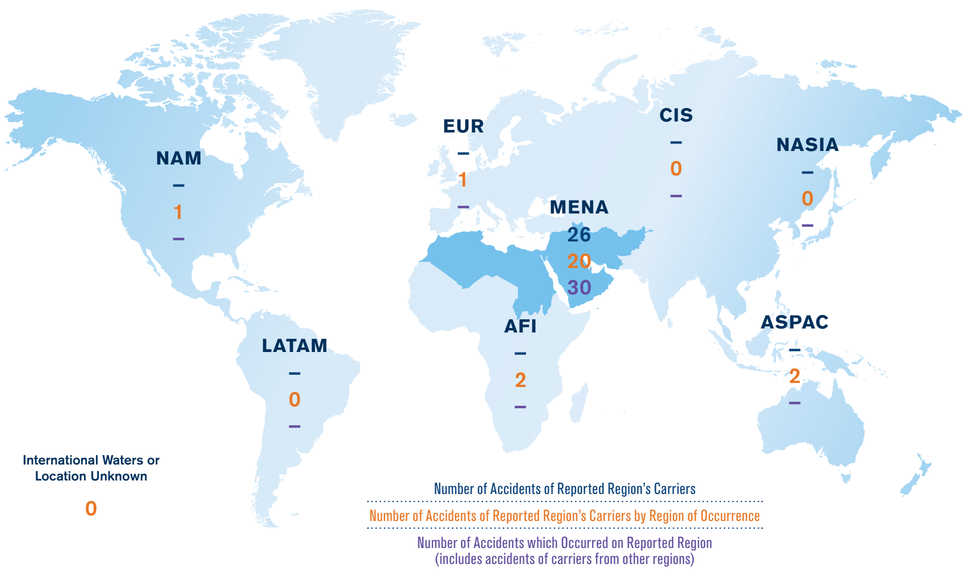
Accident Count % from total	2015	'11-'15
IATA Member	67%	54%
Full-Loss Equivalents	0%	11%
Fatal	0%	12%
Hull Losses	0%	35%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	100%	0%	0%	100%	0%
2011-2015	100%	0%	0%	77%	23%

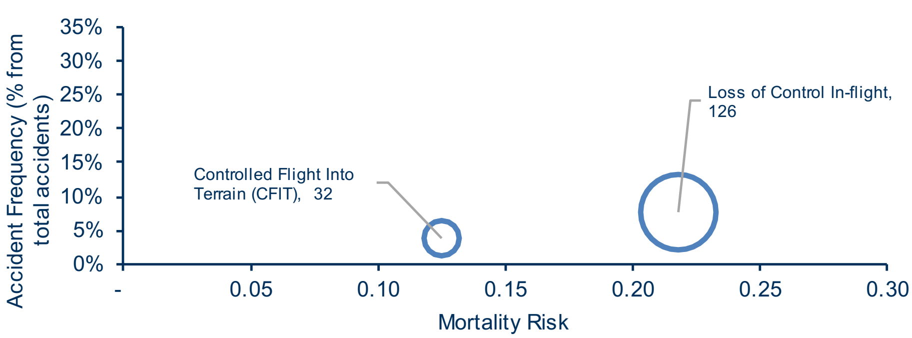
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
21%

Threats

Aircraft Malfunction:
37%

Flight Crews Errors

SOP Adherence / SOP Cross-verification:
26%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
11%

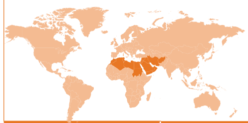
Countermeasure

Overall Crew Performance:
32%

➤ See detailed view

Middle East & North Africa Aircraft Accidents – Accident rate*

2015 Accident rate: 1.67
2011-2015 Accident rate: 3.25



Accident rate*	2015	'11-'15
IATA Member	1.39	2.17
Mortality risk**	0.00	0.34
Fatal	0.00	0.38
Hull Losses	0.00	1.13

	Jet	Turboprop
2015	1.78	0.00
2011-2015	2.69	10.78

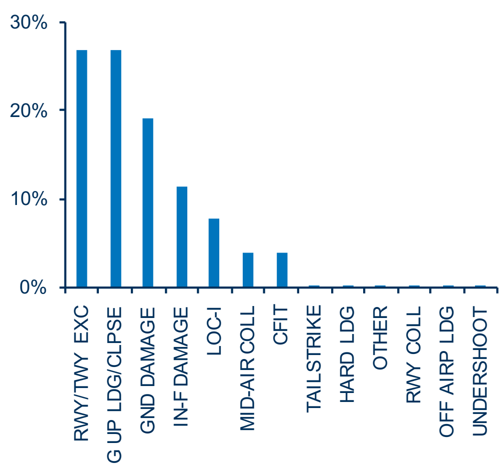
Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown

**Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

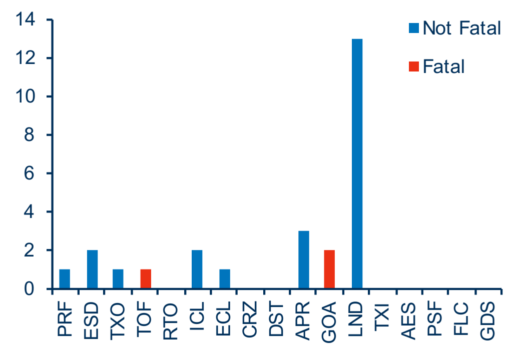
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

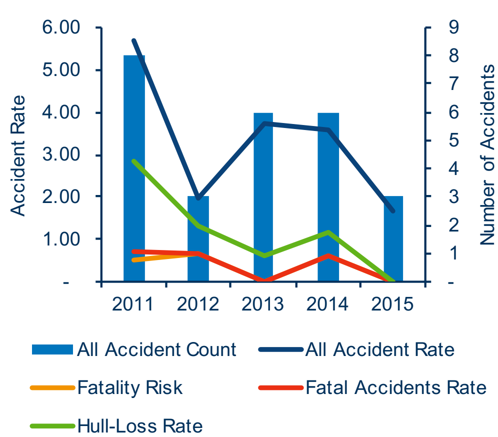
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



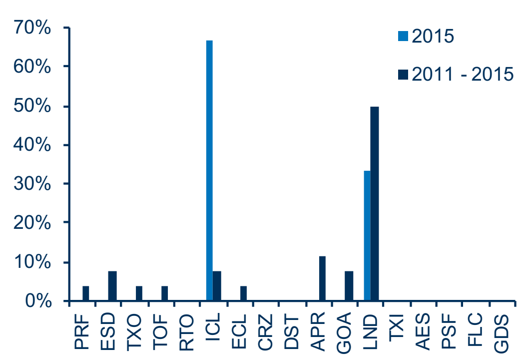
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



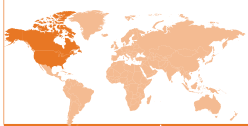
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



North America Aircraft Accidents – Accident count

2015	Number of accidents: 13	Number of fatalities: 2
2011-2015	Number of accidents: 76	Number of fatalities: 35



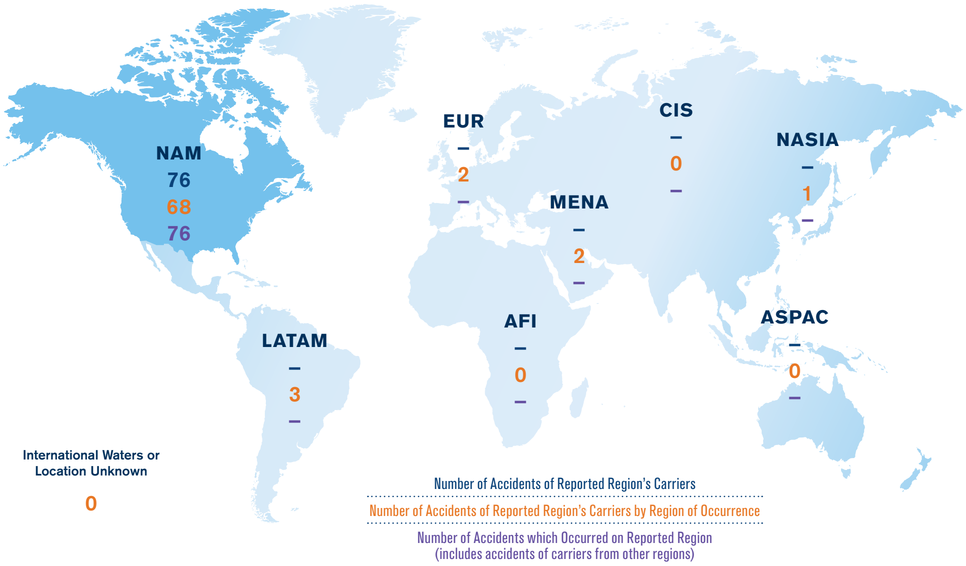
Accident Count % from total	2015	'11-'15
IATA Member	38%	24%
Full-Loss Equivalents	8%	10%
Fatal	8%	12%
Hull Losses	31%	25%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	85%	15%	0%	62%	38%
2011-2015	72%	26%	1%	49%	51%

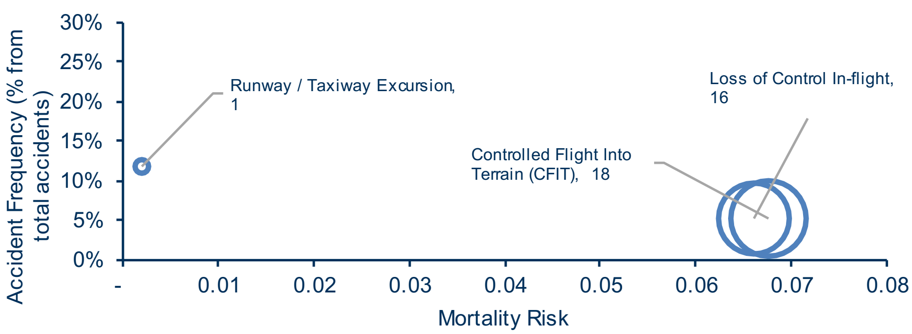
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Regulatory Oversight.
15%

Threats

Meteorology:
28%

Flight Crews Errors

Manual Handling / Flight Controls:
17%

Undesired aircraft state

Vertical / Lateral / Speed Deviation:
13%

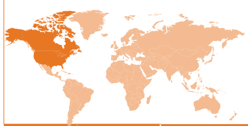
Countermeasure

Overall Crew Performance:
10%

➤ See detailed view

North America Aircraft Accidents – Accident rate*

2015 Accident rate: 1.15
2011-2015 Accident rate: 1.35



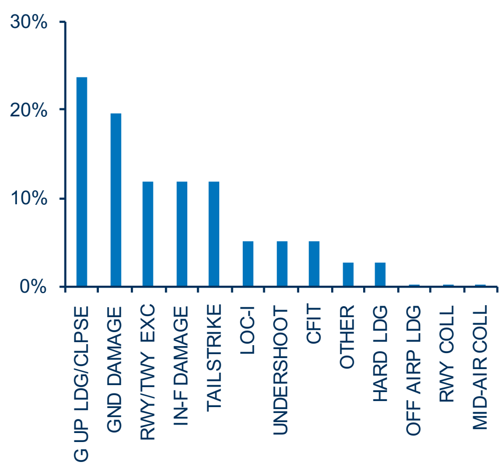
Accident rate*	2015	'11-'15
IATA Member	1.20	0.92
Mortality risk**	0.09	0.14
Fatal	0.09	0.16
Hull Losses	0.35	0.34

	Jet	Turboprop	
2015	0.85	2.56	Accident Rates for Passenger, Cargo and Ferry are not available.
2011-2015	0.80	3.86	

*Number of accidents per million sectors flown **Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

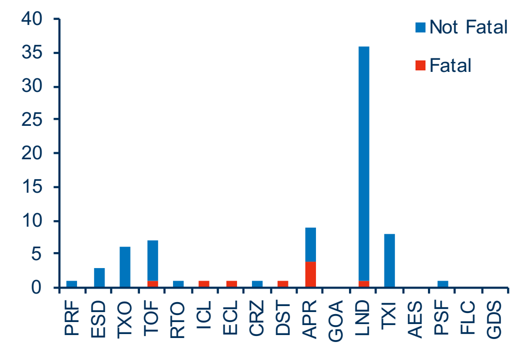
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

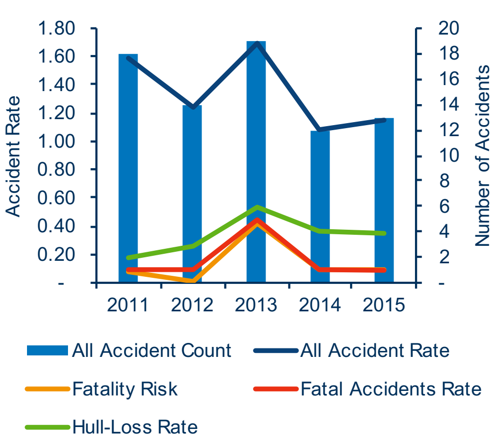
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



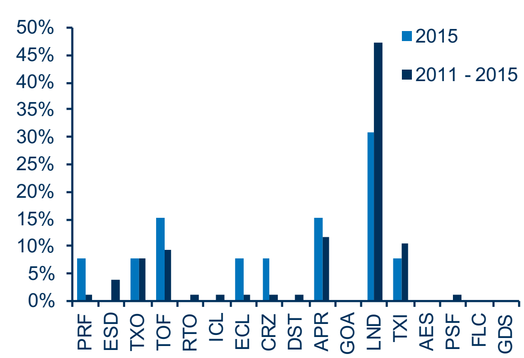
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



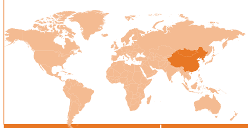
Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



North Asia Aircraft Accidents – Accident count

2015	Number of accidents: 4	Number of fatalities: 43
2011-2015	Number of accidents: 15	Number of fatalities: 91



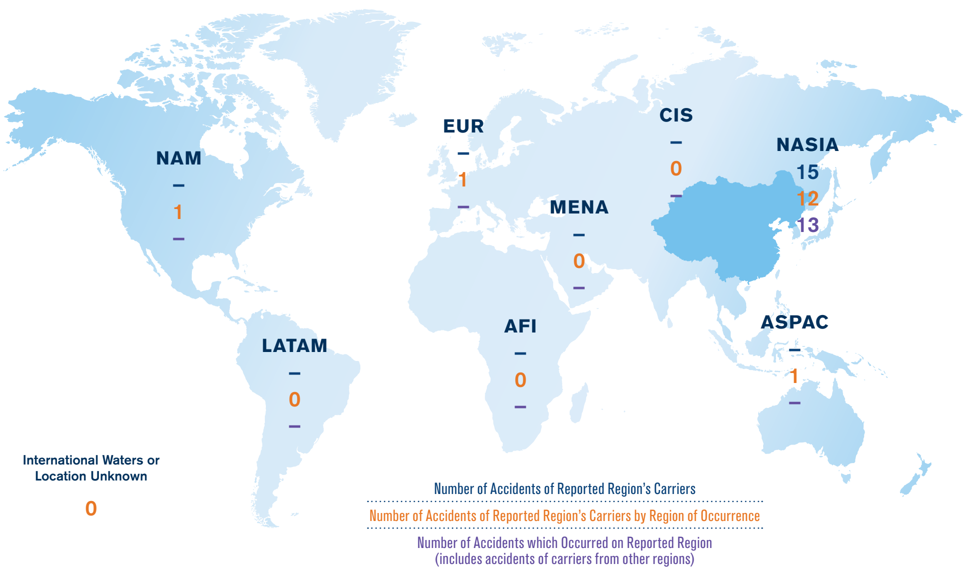
Accident Count % from total	2015	'11-'15
IATA Member	50%	60%
Full-Loss Equivalents	19%	10%
Fatal	25%	13%
Hull Losses	50%	27%

	Passenger	Cargo	Ferry	Jet	Turboprop
2015	75%	25%	0%	25%	75%
2011-2015	73%	27%	0%	60%	40%

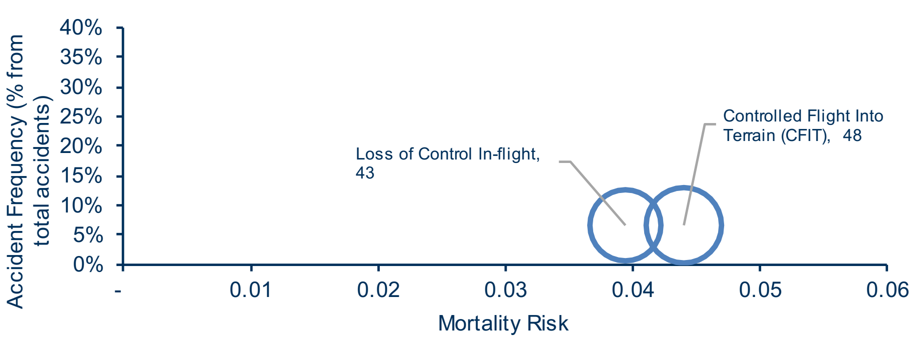
Note: the sum may not add to 100% due to rounding

Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Accident Category Frequency and Mortality Risk (2011-2015)



The graph shows the relationship between the accident category frequency and the mortality risk, measured as the number of full-loss equivalents per 1 million flights. The size of the buble is an indicative of the number of fatalities for each category (value displayed). The graph does not display accidents without fatalities.

Top Contributing Factors

Latent conditions

Flight Operations.
25%

Threats

Meteorology:
50%

Flight Crews Errors

Manual Handling / Flight Controls:
67%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:
42%

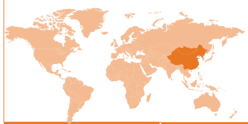
Countermeasure

Monitor / Cross-check:
58%

➤ See detailed view

North Asia Aircraft Accidents – Accident rate*

2015 Accident rate: 0.86
2011-2015 Accident rate: 0.80



Accident rate*	2015	'11-'15
IATA Member	0.49	0.54
Mortality risk**	0.16	0.08
Fatal	0.22	0.11
Hull Losses	0.43	0.21

	Jet	Turboprop
2015	0.22	37.49
2011-2015	0.49	17.23

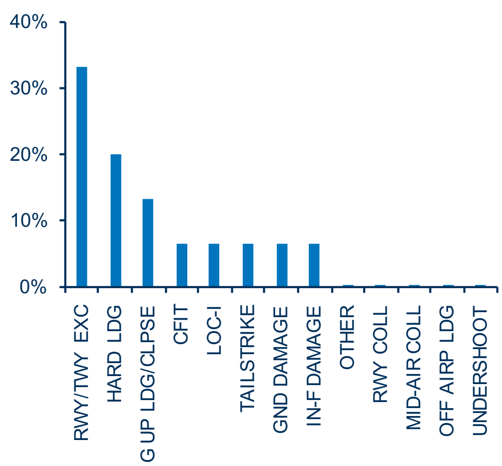
Accident Rates for Passenger, Cargo and Ferry are not available.

*Number of accidents per million sectors flown

**Number of full-loss equivalents per 1 million flights

Accident Category Distribution (2011 - 2015)

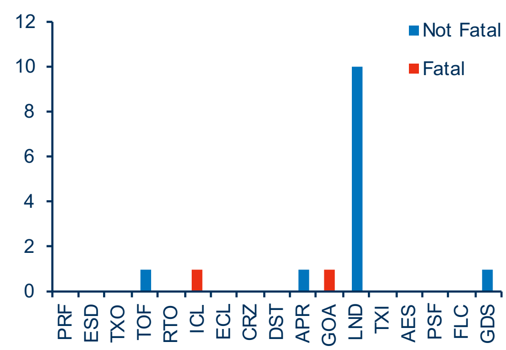
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

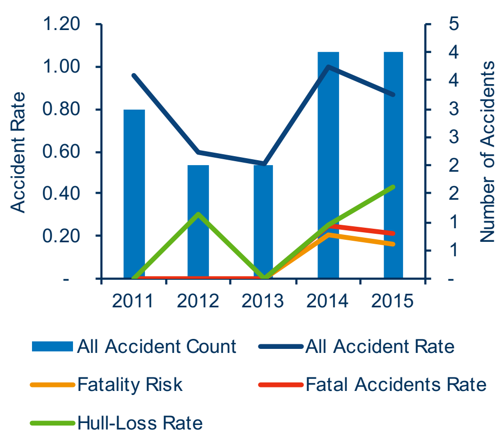
Accidents per Phase of Flight (2011 - 2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



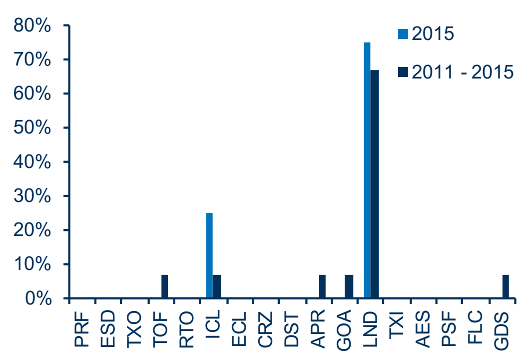
Regional Accident Rate (2011 - 2015)

Accidents per Million Sectors



Accidents per Phase of Flight (2011 - 2015)

Distribution of accidents as percentage of total



6

Analysis of Cargo Aircraft Accidents

2015 CARGO OPERATOR OVERVIEW

CARGO VS. PASSENGER OPERATIONS FOR JET AIRCRAFT

	Fleet Size	HL	HL / 1000 ACTF	SD	SD / 1000 ACTF	Total Acc	Acc / 1000 ACTF
Cargo	2,124	1	0.47	3	1.41	4	1.88
Passenger	22,373	9	0.40	33	1.47	42	1.88
Total	24,487	10	0.41	36	1.47	46	1.88

HL = Hull Loss SD = Substantial Damage

Note: Fleet Size includes both in-service and stored aircraft operated by commercial airlines.
Cargo aircraft are defined as dedicated cargo. mixed passenger/cargo (combi) or quick-change configurations.

CARGO VS. PASSENGER OPERATIONS FOR TURBOPROP AIRCRAFT

	Fleet Size	HL	HL / 1000 ACTF	SD	SD / 1000 ACTF	Total Acc	Acc / 1000 ACTF
Cargo	1,338	3	2.24	5	3.74	8	5.98
Passenger	3,917	5	1.28	9	2.30	14	3.57
Total	5,255	8	1.52	14	2.66	22	4.19

HL = Hull Loss SD = Substantial Damage

Note: Fleet Size includes both in-service and stored aircraft operated by commercial airlines.
Cargo aircraft are defined as dedicated cargo. mixed passenger/cargo (combi) or quick-change configurations.

Cargo Aircraft Accidents – Accident count

2015	Number of accidents: 12	Number of fatalities: 39
2011-2015	Number of accidents: 75	Number of fatalities: 129

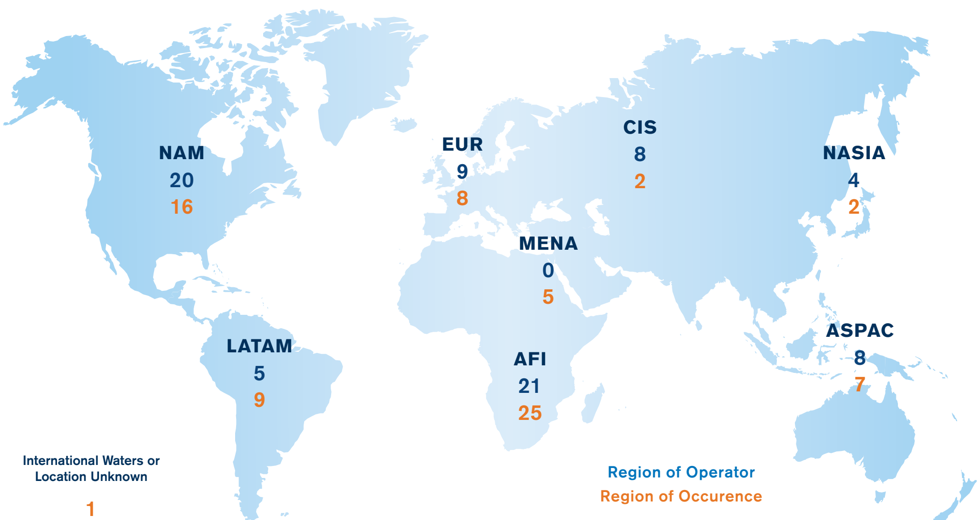
Accident Count % from total	2015	'11-'15
IATA Member	8%	16%
Full-Loss Equivalents	16%	29%
Fatal	17%	31%
Hull Losses	33%	57%

	Jet	Turboprop
2015	33%	67%
2011-2015	32%	68%

Note: the sum may not add to 100% due to rounding

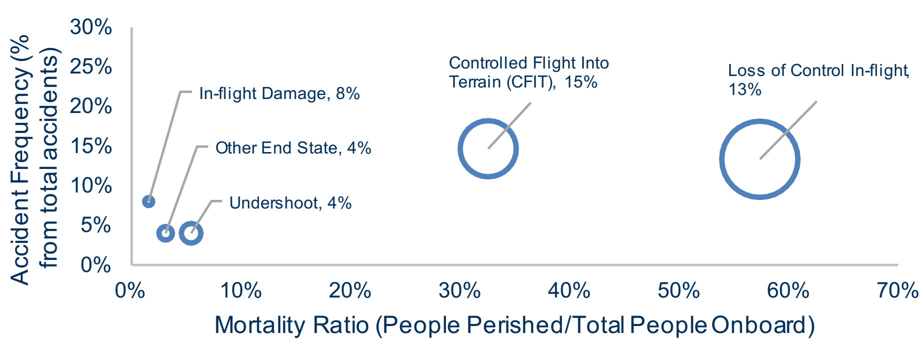
Number of Accidents per Region (2011-2015)

The accident rate based on region of occurrence is not available, therefore the map only displays counts



Note: An-74 Hard Landing. Location: Barneo Ice Base (International Waters)

Accident Category Frequency and Mortality Risk (2011-2015)



Note: Since the sector count broken down by cargo flights is not available, rates cold not be calculated. The 'fatality risk' rate was therefore substituted by a 'mortality ratio' value, which is the total number of fatalities divided by the total number of people carried. Although this removes the effect of the percentage of people who perished in each fatal crash, it can still be used as a reference to determine which accident categories contributed the most to the amount of fatalities in the cargo flights. Accident categories with no fatalities are not displayed.

Top Contributing Factors

Latent conditions

Regulatory Oversight.

37%

Threats

Aircraft Malfunction:

33%

Flight Crews Errors

Manual Handling / Flight Controls:

23%

Undesired aircraft state

Long/floated/bounced/firm/off-center/crabbed land:

19%

Countermeasure

Overall Crew Performance:

19%

➤ See detailed view

Cargo Aircraft Accidents – Accident rate*

Accident rate*: –

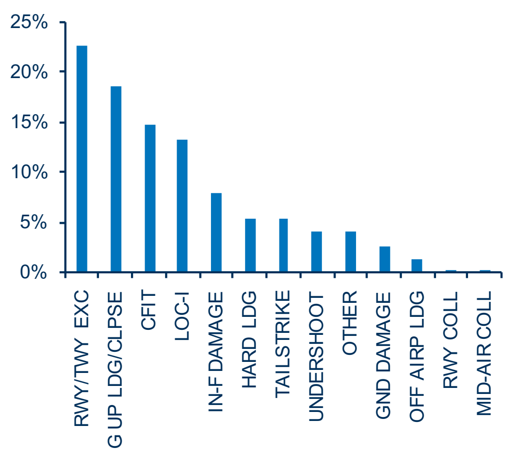
Accident rate*	2015
IATA Member	–
Mortality risk**	–
Fatal	–
Hull Losses	–

Passenger	Cargo	
–	–	Cargo accident rates are not available

Note: the number of sectors for cargo flights is not available and therefore the rate calculation is not being shown

Accident Category Distribution (2011-2015)

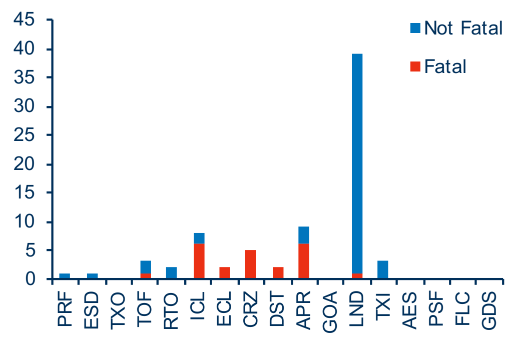
Distribution of accidents as percentage of total



Note: End State names have been abbreviated.
Refer to List of Acronyms/Abbreviations' section for full names.

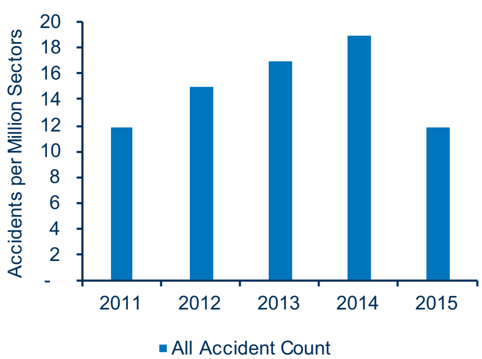
Accidents per Phase of Flight (2011-2015)

Total Number of Accidents (Fatal vs. Non-Fatal)



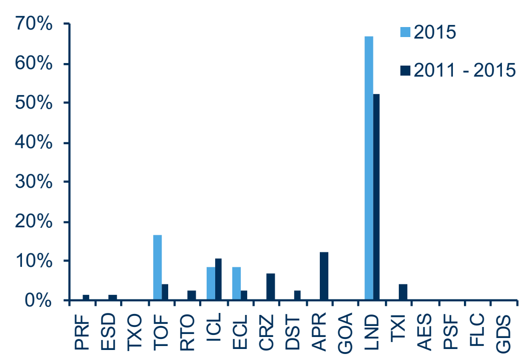
5-Year Trend (2011-2015)

See Annex 1 for the definitions of different metrics used



Accidents per Phase of Flight (2011-2015)

Distribution of accidents as percentage of total



IATA Cabin Operations Safety Conference

10-12 May, 2016 in Miami, USA

May is just around the corner.

Join us for the next flagship Cabin Operations Safety Conference as we lift off on 10-12 May 2016 in the beautiful city of Miami, Florida USA. Always popular, this rapidly growing event will once again guarantee an abundance of networking opportunities. Delegates can look forward to a robust schedule designed to address the most topical issues facing our industry today. Register today so you won't miss this exciting opportunity to collaborate with colleagues and experts from around the world. Download the conference agenda today!

JOIN US FOR THIS EXCITING THREE DAY EVENT

DAY 1 - OPENING PLENARY SESSION

Join us at the Cabin Safety Cafe and an afternoon of "speed networking" on key flight topics.

DAY 2 - INTERACTIVE WORKSHOPS

- Commanding the Evacuation - best practices for safe, efficient aircraft evacuation
- Cabin Safety Investigation - investigating cabin incidents
- Driving Fatigue Risk-Management in SMS from an airline perspective

DAY 3 - A FULL DAY OF DYNAMIC PLENARY SESSIONS

Onboard safety is taken to new heights. Join the conversation and network, network, network with more than 100 airlines and more than 300 global experts.

REGISTER NOW!

Reserve your seat now!

www.iata.org/cabin-conference

IATA

7

Cabin Safety

This section of the Safety Report 2015 highlights the categories of cabin safety end states that resulted from an accident. Only those that were classified as an accident in accordance with the IATA definition (See Annex 1 of this report) are included in this analysis.

The following definitions apply to the end states in this section:

Abnormal Disembarkation: Passengers and/or crew exit the aircraft via boarding doors (normally assisted by internal aircraft or exterior stairs) after a non-life-threatening and non-catastrophic aircraft incident or accident and when away from the boarding gates or aircraft stands (e.g., on a runway or taxiway).

Evacuation (land): Passengers and/or crew evacuate the aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in the fuselage; usually initiated in life-threatening and/or catastrophic events.

Evacuation (water): Passengers and/or crew evacuate the aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in the fuselage and into or onto water.

Hull Loss/Nil Survivors: Aircraft impact resulting in a complete hull loss with no survivors.

Normal Disembarkation: Passengers and/or crew exit the aircraft via boarding doors during normal operations.

Rapid Deplaning: Passengers and/or crew rapidly exit the aircraft via boarding doors and jet bridges or stairs, as a precautionary measure.

CABIN SAFETY

The factors contributing to most of the accidents detailed in the charts and graphs in this section are not attributed to cabin operations or the actions taken inside the cabin by the crew. The statistics do show, however, the end result of an accident and highlight where cabin crew may have had a positive impact on the outcome and survivability of the aircraft occupants.

The role of cabin crew is not solely to evacuate an aircraft in case of emergency, as almost all flights operated do not end in this manner. On every flight, cabin crew carry out numerous duties, both inside and outside the aircraft, which contribute to safe operations and prevent incidents from escalating into accidents.

While performing customer service duties as expected by the airline, a cabin crew member will always have an underlying safety aspect to their work and must remain aware of ever-changing situations inside the cabin (e.g., turbulence, unruly passengers, medical emergencies and the presence of smoke or fumes). Effective management of threats such as these will help minimize the risk of an accident occurring and/or positively influence the cabin end state.

Safety managers at airlines around the world are faced with keeping their cabin crew up-to-date with the latest changes in regulation and policy, all of which are aimed at reducing the safety risk. Furthermore, the hazards themselves evolve and change along with consumer markets and technologies.

IATA's role is to keep airlines informed of regulatory changes, best practices as well as new and emerging issues in the field of cabin safety, and to act as a resource for help.

Image courtesy of Boeing

CABIN SAFETY INITIATIVES

IATA seeks to contribute to the continuous reduction in the number and severity of incidents and accidents, as well as the costs associated with ensuring the safe operation of commercial aircraft. This is achieved through the recognition and analysis of worldwide trends as well as the initiation of corrective actions through the development and promotion of globally applicable recommended practices.

Safety promotion is a major component of Safety Management Systems (SMS) and the sharing of safety information is an important focus for IATA. The organization of global conferences and regional seminars brings together a broad spectrum of experts and stakeholders to exchange cabin safety information. The global Cabin Operations Safety Conference enters its third year in 2016 and has become an established and popular venue for the exchange of ideas and education of Cabin Safety specialists: www.iata.org/cabin-safety-conference.

IATA Cabin Operations Safety Best Practices Guide (2nd Edition)

The IATA Cabin Operations Safety Best Practices Guide was first released in 2014 and updated in 2015. It includes best practice guidance on specific issues of concern to the industry (i.e., effective report writing, fatigue management, portable electronic devices (PEDs), cabin crew checklist, lithium battery fire prevention, and cabin crew seat safety).

The IATA Cabin Operations Safety Best Practices Guide and other guidance materials are available at: www.iata.org/cabin-safety.

Health and Safety Guidelines – Passengers and Crew

IATA creates guidelines regarding the health and safety of passengers and crew, including on suspected communicable disease:

- General guidelines for cabin crew
- Cabin announcement scripts to be read by cabin crew to passengers prior to arrival
- Universal precaution kit.

These guidelines and many others are available at: www.iata.org/health.

IOSA AND CABIN OPERATIONS SAFETY

The IATA Operational Safety Audit (IOSA) standards manual includes Section 5 – Cabin Operations (CAB), which contains key elements of cabin safety, such as the IATA Standards and Recommended Practices (ISARPs) for:

- Management and control
- Training and qualification
- Line operations
- Cabin systems and equipment

For more information on IOSA and to download the latest version of the IOSA Standards Manual (ISM), go to: www.iata.org/iosa.

STEADES™

IATA Global Aviation Data Management (GADM) includes a business intelligence tool called the Safety Trend Evaluation, Analysis and Data Exchange System (STEADES™) that provides access to data, analysis and global safety trends on established key performance indicators in comparison to worldwide benchmarks. STEADES™ enhances safety for IATA member airlines.

Examples of STEADES™ cabin safety analysis include:

- Inadvertent Slide Deployments (ISDs)
- Fire, smoke and fume events
- Passenger and cabin crew injuries
- Turbulence injuries or incidents
- Unruly passenger incidents
- Operational pressure

For more information on STEADES™, please visit www.iata.org/steades.

IATA Cabin Operations Safety Task Force (COSTF)

The work of IATA is supported by our member airlines and delivers great results with their input. The members of the COSTF are representatives from IATA member airlines who are experts in cabin safety, cabin operations, cabin safety training, accident/incident investigation; human factors and quality assurance.

The COSTF meets regularly to discuss ongoing issues or concerns and to support IATA in our objectives. The mandate also includes reviewing the IOSA CAB Section 5 and the classification of cabin safety end states for the Accident Classification Task Force (ACTF).

IATA Cabin Operations Safety Task Force (COSTF) Members (2016-2017)

Stephane Soum AIR FRANCE	Lorena Guardia LAN AIRLINES
Shane Constable AIR NEW ZEALAND	Gisa Todt LUFTHANSA
Gennaro Anastasio ALITALIA	Rosnina Abdullah MALAYSIA AIRLINES BERHAD
Brett Garner AMERICAN AIRLINES	Warren Elias QATAR AIRWAYS
Ruben Inion AUSTRIAN AIRLINES	Johnny Chin SINGAPORE AIRLINES
Nathalie Calenge BOLIVIANA de AVIACION	Lerato Luti SOUTH AFRICAN AIRWAYS
Catherine Chan (Vice Chair) CATHAY PACIFIC	Martin Ruedisueli (Chair) SWISS INTERNATIONAL AIR LINES
Anabel Brough EMIRATES	Carlos Mouzaco Dias TAP PORTUGAL
Jonathan Jasper (Secretary) IATA	Mary Gooding VIRGIN ATLANTIC AIRWAYS

Cabin End States

	2015	2014-2015
Total 'Passenger-only' Accidents	56	111

The total number of accidents in 2015 involving passenger aircraft (i.e., not including cargo-only aircraft) was 56 compared to 55 in 2014.

While the total number of accidents increased by one accident, the total number of sectors increased by 2.03 million. This demonstrates a decrease from 1.54 accidents per million flights in 2014, to 1.49 per million in 2015.

The Cabin End State classification has only been used for accidents recorded since 2014. The following analysis takes into account two years of accidents in order to rationalize the totals.

	2014-2015					
	Normal Disembarkation	Abnormal Disembarkation	Land Evacuation	Water Evacuation	Hull Loss/ Nil survivors	Total
All	42	16	47	1	5	111
IATA Member	18	4	14	1	1	38
IOSA-Registered	26	7	16	1	2	52
Fatal	0	0	1	1	5	7
Hull Loss	1	3	19	1	5	29
Jet	36	10	26	0	3	75
Turboprop	6	6	21	1	2	36

The above table shows the total count of each type of Cabin End State classification and is broken down by operator status and aircraft type.

Of the 111 total accidents, 29 hull losses were recorded; of these five were not survivable. This demonstrates that, in the remaining 83% of hull loss accidents, cabin crew actions likely had an impact on survivability for passengers and crew.

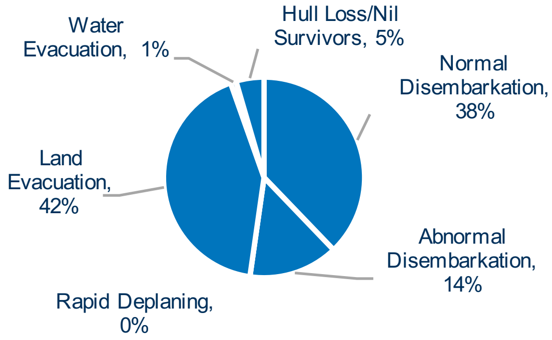
In 99% of survivable accidents, passengers disembarked the aircraft onto land. Furthermore, in 40% of these cases, passengers disembarked normally onto steps or a passenger boarding bridge at an airport. Only 1% of survivable accidents resulted in an evacuation onto water.

There were 72 jet accidents during this time, and 36 turboprop. Taking into account the fleet size difference, this represents a rate of 1.46 jet accidents per million sectors, against a turboprop rate of 3.55 accidents per million sectors.

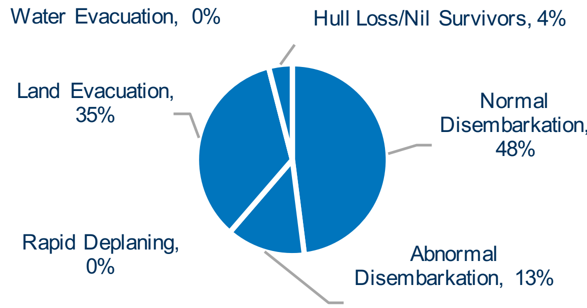
The data shows that cabin end states on turboprop aircraft have different characteristics from jet aircraft. The majority of jet aircraft involved in an accident carried out a normal disembarkation, whereas the majority of turboprops carried out a land evacuation. A review of the accident details shows that this is likely due to the difference in aircraft attitude and size, which makes it easier to leave turboprop aircraft directly to the ground rather than using steps or slides.

Cabin End States (cont'd)

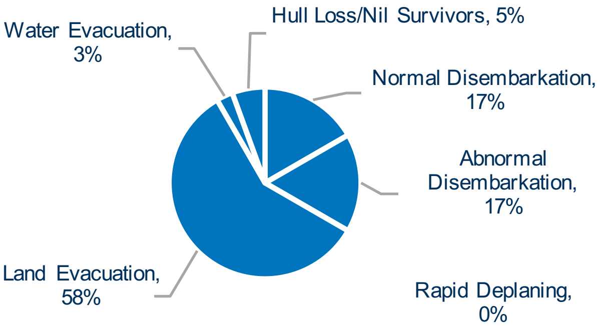
Cabin End States (Jet and Turboprop)



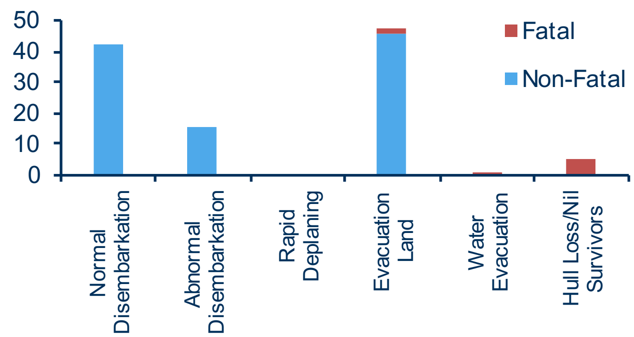
Cabin End States (Jet)



Cabin End States (Turboprop)



Cabin End States of Accidents Involving/Not Involving Fatalities

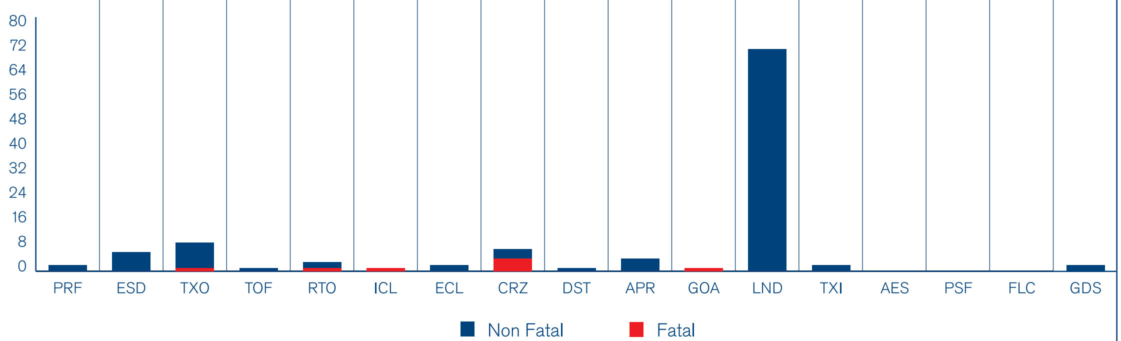


The above graph demonstrates that the vast majority of accidents were survivable and that fatalities occurred in one water evacuation and in one of 46 land evacuations.

Cabin End States (cont'd)

Cabin End States per Phase of Flight

	PRF	ESD	TXO	TOF	RTO	ICL	ECL	CRZ	DST	APR	GOA	LND	TXI	AES	PSF	FLC	GDS
Total Accidents	2	6	1	9	1	3	2	7	1	4	1	70	2	0	0	0	2
Normal Disembarkation	100%	67%	0%	44%	0%	67%	100%	43%	100%	50%	0%	29%	0%	0%	0%	0%	100%
Abnormal Disembarkation	0%	17%	0%	22%	0%	0%	0%	0%	0%	0%	0%	19%	0%	0%	0%	0%	0%
Rapid Deplaning	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Land Evacuation	0%	17%	100%	22%	100%	0%	0%	0%	0%	50%	100%	53%	100%	0%	0%	0%	0%
Water Evacuation	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hull Loss/Nil Survivors	0%	0%	0%	11%	0%	0%	0%	57%	0%	0%	0%	0%	0%	0%	0%	0%	0%



Total Accidents: 111

Note: please refer to Annex 1 for definition of each phase of flight

The above table shows the distribution of cabin end states per phase of flight. The table's first row shows the total number of accidents for 2014-2015, while the table and chart below give some additional contextual information.

Landing is by far the most critical stage for cabin crew to be prepared for an accident. Other important phases are Engine Start and Take-Off.

During engine start, cabin crew have an increased workload – preparing doors for departure, providing a safety briefing for passengers and securing the cabins, galleys and lavatories. All of these processes and procedures may distract them from identifying safety issues and concerns outside of the cabin. Therefore, it is important that cabin crew recognize the importance of communication with flight crew and between each other at times of high workload, so that they can respond quickly to a problem if it arises.

During the take-off and landing phases, cabin crew are secured in their crew seats, normally adjacent to door areas, and are able to monitor situations both inside the cabin and outside. As these are the most critical stages, cabin crew are normally trained in the "silent review" – a period of time where they politely refrain from conversation with passengers to mentally review their emergency evacuation procedures and emergency responses.

It is often reported that situations in the cabin may require cabin crew to make a decision on whether or not to leave the safety of their crew seat to assist. For example, a passenger suffering from cardiac arrest in the cabin during the landing phase will require a thorough and immediate risk assessment on the part of the cabin crew member in charge to determine the best course of action. Not every eventuality can be included in standard operating procedures. Therefore, it is important for operators to include threat management and/or risk assessment training for senior cabin crew members.

Cabin End States (cont'd)

Accident End States and Cabin End States

	Normal Disembarkation	Abnormal Disembarkation	Rapid Deplaning	Land Evacuation	Water Evacuation	Hull Loss/ Nil Survivors	Total
Hard Landing	16	2	0	5	0	0	23
Runway / Taxiway Excursion	1	3	0	18	0	0	22
Gear-up Landing / Gear Collapse	1	2	0	16	0	0	19
In-flight Damage	11	5	0	2	0	0	18
Ground Damage	8	2	0	2	0	0	12
Loss of Control In-flight	0	0	0	0	1	3	4
Undershoot	1	1	0	2	0	0	4
Tailstrike	3	1	0	0	0	0	4
Other End State	0	0	0	1	0	1	2
Controlled Flight Into Terrain (CFIT)	0	0	0	1	0	1	2
Mid-air Collision	1	0	0	0	0	0	1
Runway Collision	0	0	0	0	0	0	0
Off Airport Landing / Ditching	0	0	0	0	0	0	0

The above table compares the cabin end state against the accident classification type.

Hard landings accounted for the highest number of accidents of which the most likely outcome was a normal disembarkation.

During runway/taxiway excursions, the most likely outcome was a land evacuation, most probably due to inaccessibility of steps or servicing vehicles.

During a gear-up landing or gear collapse situation, a land evacuation is most likely, again due to inaccessibility of disembarkation equipment as well as the abnormal attitude of the aircraft.

Where the aircraft is damaged in flight, for example by hail or bird strike, the most likely consequence is a normal disembarkation.

No accidents involving rapid deplaning were recorded during this time period. While there were likely several rapid deplaning incidents during this period, none were the result of an accident. While this could infer that this is not a likely scenario, the classification remains in order to identify where passengers were asked to leave the aircraft with their belongings as quickly as possible, using the passenger boarding bridge or steps as a precautionary measure.

8

Report Findings and IATA Prevention Strategies

TOP FINDINGS, 2011-2015

Of the 407 accidents between '11 and '15:

- 29% involved IATA members
- 17% were fatal
- 78% involved passenger aircraft, 18% involved cargo aircraft and 3% involved ferry flights (note: numbers don't add up to 100% due to rounding).
- 53% involved jet aircraft and 47% involved turboprops
- 37% resulted in a hull loss
- 63% resulted in a substantial damage
- 55% occurred during landing
- 38% of the fatal accidents occurred during approac.

Top 3 Contributing Factors

Latent conditions (deficiencies in…)	1. Regulatory oversight 2. Safety management 3. Flight operations : Training Systems
Threats (Environmental)	1. Meteorology 2. Airport facilities 3. Nav Aids
Threats (Airline)	1. Aircraft malfunction 2. Maintenance events 3. Ground events
Flight crew errors relating to latent conditions (deficiencies in…)	1. Manual handling/ flight controls 2. SOP adherence/ cross-verification 3. Failure to go around after destabilized approach
Undesired aircraft states	1. Long, floated, bounced, firm, off-centerline or crabbed landing 2. Vertical/lateral/speed deviation 3. Unstable approach
End states	1. Runway excursion 2. Gear-up landing/gear collapse 3. Ground damage

PROPOSED COUNTERMEASURES

Every year, the ACTF classifies accidents and, with the benefit of hindsight, determines actions or measures that could have been taken to prevent an accident. These proposed countermeasures can include issues within an organization or a particular country, or involve performance of front line personnel, such as pilots or ground personnel. They are valid for accidents involving both Eastern and Western-built jet and turboprop aircraft.

Based on statistical analysis, this section presents some countermeasures that can help airlines enhance safety, in line with the ACTF analysis of all accidents between 2011 and 2015.

The following tables present the top five counter measures which should be addressed along with a brief description for each.

The last column of each table presents the percentage of accidents where countermeasures could have been effective, according to the analysis conducted by the ACTF.

Countermeasures are aimed at two levels:

- The operator or the state responsible for oversight. These countermeasures are based on activities, processes and systemic issues internal to the airline operation or state's oversight activities
- Flight crew. These countermeasures are to help flight crew manage threats or their own errors during operations

Countermeasures for other areas, such as ATC, ground crew, cabin crew or maintenance staff, are important but are not considered at this time.

COUNTERMEASURES FOR THE OPERATOR AND THE STATE

Subject	Description	% of accidents where counter-measures could have been effective (2011-2015)
Regulatory oversight by the state of the operator	States must be responsible for establishing a safety program, in order to achieve an acceptable level of safety, encompassing the following responsibilities: ▪ Safety regulation ▪ Safety oversight ▪ Accident/incident investigation ▪ Mandatory/voluntary reporting systems ▪ Safety data analysis and exchange ▪ Safety assurance ▪ Safety promotion	**31%**
Safety management system (operator)	The operator should implement a safety management system accepted by the state that, as a minimum: ▪ Identifies safety hazards ▪ Ensures that remedial action necessary to maintain an acceptable level of safety is implemented ▪ Provides for continuous monitoring and regular assessment of the safety level achieved ▪ Aims to make continuous improvements to the overall level of safety	**23%**
Flight operations: 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.	**12%**

COUNTERMEASURES FOR FLIGHT CREWS

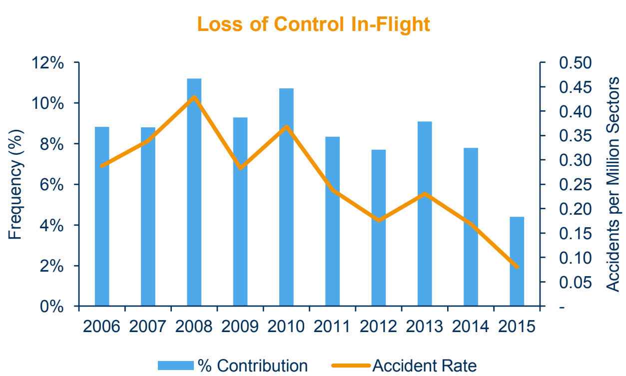
Subject	Description	% of accidents where counter-measures could have been effective (2011-2015)
Overall crew performance	Overall, crew members should perform well as risk managers. Includes flight, cabin, and ground crew as well as their interactions with ATC.	**24%**
Monitor/ cross-check	Crew members should actively monitor and cross-check flight path, aircraft performance, systems and other crew members. Aircraft position, settings and crew actions are verified.	**16%**
Contingency management	Crew members should develop effective strategies to manage threats to safety.	**7%**
Leadership	Captain should show leadership and coordinate flight deck activities. First Officer is assertive when necessary and is able to take over as the leader.	**7%**
Taxiway/Runway Management	Crew members use caution and keep watch outside when navigating taxiways and runways.	**5%**
Captain Should Show Leadership	In command, decisive and encourages crew participation.	**5%**

LOSS OF CONTROL IN-FLIGHT

Background:

The generally high reliability and usefulness of automated systems poses the question of whether the high amount of flight hours spent in fully automated flight is responsible for pilots being increasingly reluctant to revert to manual flying skills when needed. While aircraft are highly automated, the automation is not designed to recover an aircraft from all unusual attitudes. Therefore, flight crews must still be capable of manually operating the aircraft, especially in edge-of-the-envelope situations.

Flight crews are seemingly more apprehensive about manually flying their aircraft or changing the modes of automation when automated systems fail, when aircraft attitudes reach unusual positions, or when airspeeds are not within the appropriate range. This is due in no small part to not fully understanding what level of automation is being used or the crew's need to change that level due to the level of automation being degraded for a given reason. The graph below indicates the percentage of all accidents that were Loss of Control In-flight (LOC-I) over the past ten years. The discussion below focuses on a 5-year period.



Discussion:

The last five years have seen a total of 31 LOC-I accidents (30 involved fatalities), with an average of approximately six LOC-I accidents per year. Turboprop aircraft contributed to 68% of the accidents.

The accident rate for the 5-year period was of 0.18 LOC-I accidents per million sectors. The breakdown is 0.07 for jets and 0.69 for turboprops.

These accidents come from a variety of scenarios and it is difficult to single out the most critical scenario. However, looking at accident data, LOC-I is often linked to an operation of the aircraft well below stall speed. Even with fully protected aircraft, stall awareness and stall recovery training, as well as approach to stall recovery training, needs to be addressed on a regular basis.

Weather is also a key contributing factor to LOC-I accidents, with 32% of loss of control accidents having occurred in degraded meteorological condition, in most of the cases involving thunderstorms and icing.

It is recommended that airline training departments pay attention to the contents of the Upset Recovery Toolkit, which is still valid and which contains very useful information. Upset recovery training - as with any other training - largely depends on the skills and knowledge of the instructor. It is therefore recommended that the industry place a particular emphasis on instructor training.

Upset recovery training, aerobatics and unusual attitude training included as part of an operator's flight crew training syllabus gives crew a chance to experience potentially dangerous situations in a safe and controlled environment, which better prepares them if they should encounter a similar situation while flying on the line. Regrettably, current flight simulator technology is limited in how accurately it can reproduce these scenarios.

Somatogravic illusion (the feeling where the perceived and actual acceleration vectors differ considerably) can create spatial disorientation and lead to catastrophic events such as CFITs. Training is available to assist crews facing spatial disorientation situations. Simulator training may be of limited value for somatogravic illusions. The simulator is an illusion already so may be unrepresentative if we attempt to reproduce such illusions.

In modern aircraft, failure of a relatively simple system (e.g., radio altimeter) may have a cascade effect that can result in a catastrophic outcome. Crew training should emphasize solving complex, cascading failures that originate from a single source.

Automation is a tool that can be helpful to flight crew, however it is never a replacement for the airmanship skills required to operate the aircraft. Training for scenarios that could lead to an upset (e.g.low-energy approaches, engine failures, etc.) must be continuously reinforced to address areas of safety concern, as well as the usual training protocols which achieve a baseline proficiency in aircraft handling.

Recommendations to Operators:

Operators are encouraged to follow up on current research activities, such as the SUPRA-Project (Simulation of Upset Recovery in Aviation) by NLR/TNO in The Netherlands and activity by the International Committee for Aviation Training in Extended Envelopes (ICATEE), established by the Flight Simulation Group of RAeS. ICAO and SkyBrary also have materials dealing with LOC-I.

Airlines should consider the introduction of upset recovery training, aerobatic training or other unusual attitude recovery training into their syllabus to better prepare flight crews for similar events in routine operations. Training should be designed to take pilots to the edge of the operating envelope in a safe environment so that they are better prepared to deal with real-life situations.

Training syllabi should be updated to include abnormal events that flight crew may routinely face (e.g., stalls and icing) as well as conventional training such as engine failure on take-off.

Operators should consider incorporating procedures to allow for manual flying of the airplane in line operations, under some circumstances. Such operations should be encouraged to get flight crews comfortable with manual control and to exercise these skills on a regular basis. The FAA SAFO 13002 Manual Flying Skills outlines recommendations that include all phases of operations: initial, recurrent, initial operation experience, and operator guidance for "Line Operations when appropriate". Efforts to restore and maintain manual flying skills must be comprehensive and ongoing. Periodic simulator training should include unusual attitude exercises that are realistic to include extremes of center of gravity, weight, altitude, and control status.

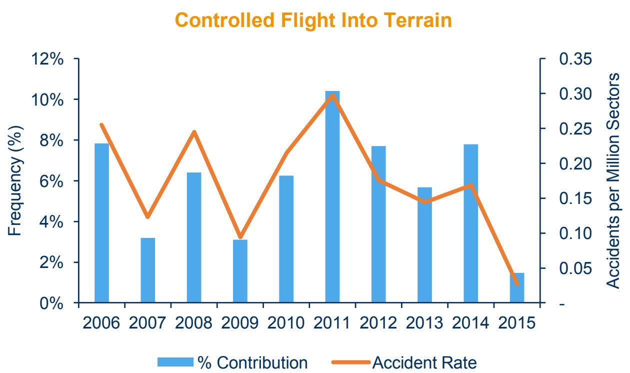
Operators should be aware of limitations of simulators to represent conditions out of the flight envelope as they have not been calibrated against flight data. The simulator response may differ from what is experienced in the aircraft, thus there is a possibility of providing negative training.

Training should also not rely too much on certain aircraft flight control protections. Increased focus on training scenarios under degraded flight control protection should be considered.

CONTROLLED FLIGHT INTO TERRAIN

Background:

2015 saw an all-time low in CFIT accidents, with only one, well below the average for 2010 to 2014 of 6.8. The graph below indicates the percentage of all accidents that were CFIT and its yearly rate over the past ten years.



The vast majority of CFIT accidents between 2011 and 2015 occurred during the approach phase, with 79% of the accidents on turboprops.

The accident rate for the 5-year period was of 0.16 CFIT accidents per million sectors. The breakdown was 0.04 for jets and 0.72 for turboprops.

There is a very strong correlation between the lack of instrument landing systems (ILS) or state-of-the-art approach procedures, such as performance-based navigation (PBN). The malfunction or the lack of ground-based nav-aids was a contributing factor in 60% of the CFIT accidents in the 2011-2015 period.

Discussion:

The lack of precision approaches has been noted as a major contributing factor to CFIT accidents. The implementation of precision approaches or PBN approaches is seen as a method to reduce the risk of CFIT accidents. Where this is impractical, the use of Continuous Angle Non-Precision Approaches (CANPA) can help with the transition from approach to landing by providing a more stable descent profile than traditional "dive and drive" methods used for non-precision approaches.

Some airlines are prohibiting circling approaches in favor of using RNAV or RNP approaches instead. Some airlines discuss the operational impact of circling approaches and perform a risk evaluation. Forward knowledge of terrain through prior experience does not eliminate the need to adhere to EGPWS warnings. It was predicted that at some point a pilot will ignore a valid EGPWS warning, believing to know their actual position relative to the ground, and that this would lead to a CFIT accident.

Most pilots do not appreciate how close the approaching terrain is when the EGPWS alarm is sounded. There is often little or no visual reference available and a very short time to react.

Be mindful of operational pressures and manage them properly. Trust the safety equipment provided in the aircraft. Ensure proper QNH settings on early-generation EGPWS units to avoid false warnings that could lead crews to suppress alarms (e.g., placing the system into "TERRAIN" mode). Modern EGPWS systems use GPS altitude to reduce the rate of these instances.

Recommendations to Operators

Operators should support the concept of CANPA to reduce the risk of approach and landing CFITs, and train their pilots to select CANPA instead of "Dive and Drive".

Airlines should ensure that as many aircraft as possible are equipped with approved GPS so that accurate positioning and altitude data is available. In the case of retrofitted navigation systems through supplemental-type certificates (STC), airlines should pay particular attention to the human-machine interface requirements, so that navigation source switching does not become a hazard. A proper change management process can help identify and mitigate risks that are created by the introduction of the new hardware (e.g., by making the appropriate changes to SOPs).

Crews are encouraged to use Regulator, OEM and Operator-approved navigation equipment only. Unapproved equipment can lead to a false impression of high navigation accuracy. All crewmembers should be aware of the nature and limitations of the safety systems installed. For example, it is important to understand the difference between terrain information derived from a navigation database and that which is derived from a direct reading sensor such as radar altimeter. Effective procedures, and individual discipline, also need to address the issues of which approach procedure and track to choose, what data to follow, and how to handle being off track. Effective CRM training and drills should mitigate errors and fatigue, and enhance the escape from dangerous situations. With modern NAV displays driven by GPS and FMS, it is easy to assume that the desired track line is correct and safe.

Airlines are encouraged to maintain their equipment and ensure that the terrain/obstacle data being used by the system is current. Airlines should develop procedures to ensure that the EGPWS database is kept as up-to-date as possible. In addition, operators are recommended to ensure that the terrain warning system and its sensors are also up to date. Each operator should ensure that the latest modifications are incorporated in their particular 'TAWS' or EGPWS computer and with GPS providing aircraft position data directly to the computer. These provide earlier warning times and minimize unwanted alerts and warnings.

Flight operations departments are encouraged to review their circling approach policies and are encouraged to reduce the number of circling approaches, possibly through increasing the visibility requirements. They are also encouraged to conduct a risk analysis of the various approach options. Operators are advised to use published Global Navigation Satellite System (GNSS) approaches rather than "circle to land" when a certified GPS is installed on board and the crew is trained for the procedures.

Airlines are encouraged to familiarize theirs crews with the proximity of terrain once the EGPWS has triggered an alarm (perhaps use a simulator with a very high fidelity visual system). Many crews falsely believe that there is ample time to react once an EGPWS alert is sounded. While many operators include this as part of their training program, it is essential information that should be included in all training programs.

Remind crews that if an EGPWS alert triggers during an instrument approach, the alert should be respected at all times. Incorrect altimeter settings, incorrect or missing low temperature adjustment, radio altimeter failures, etc. can all lead to cases where the true altitude of the aircraft is not known by the crew.

Recommendations to Industry

The industry is encouraged to further their work on implementing PBN approaches in areas where a precision approach is not practical. Where these are not available, it is recommended to review the adoption of Continuous Angle Non-Precision Approaches (CANPA) for non-precision approaches.

CFIT accidents are occurring mainly in areas of the world where the use of Terrain Awareness Warning Systems (TAWS) is not mandatory. It is recommended that these states mandate the use of TAWS in air transport aircraft as it demonstrates a clear benefit for CFIT reduction. These aircraft will need to be fitted with accurate navigation features (i.e., stand alone or, better, dual GPS for both navigation and terrain surveillance benefit). Most air transport aircraft are fitted or could be fitted with such systems. Without an accurate position it's more difficult to have an appropriate TAWS functioning.

Authorities are recommended to investigate mandating procedures that ensure EGPWS databases are kept accurate and up-to-date. This has to be emphasized in light of two cases in 2011 were the EGPWS database was never updated. These updates are critical as they include terrain and runway ends.

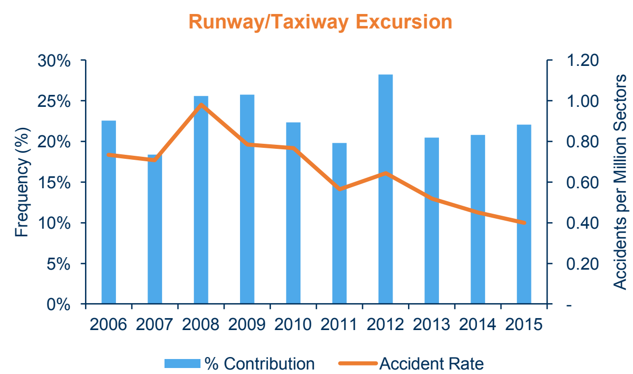
In some countries an EGPWS supplier has to contact the state to get access to terrain data. Governments are encouraged to automatically provide to manufacturers the respective terrain data in cases where a new airport opens.

Authorities are encouraged to comply with ICAO recommendations and guidelines regarding PBN implementation.

RUNWAY EXCURSIONS

Background:

In 2015 Runway Excursions contributed to 22% of the accidents. The following graph indicates the percentage of accidents classified as runway excursion over the previous ten years and its yearly rate. Runway excursions include landing overruns, take-off overruns, landing veer-offs, take-off veer-offs and taxiway excursions meeting the IATA definition of an accident. It is worth noting not all runway excursions meet this definition. Therefore, other studies which include serious incidents may indicate a higher number of events.



Over the five year period from 2011 to 2015, 86 percent of runway excursions occurred in the landing phase of flight. There are many factors noted to have contributed to runway. Long, floated or bounced landings were noted in 46 percent of all runway excursion accidents during this period, while a continued landing after an unstable approach was a factor in 19 percent of the runway excursions.

Poor weather conditions (present in 48 percent of the accidents) and airport facilities (39%) still represent the largest components for environmental factors, while errors in the manual handling of the aircraft were noted to have contributed to 42 percent of runway excursions.

Aircraft malfunctions, such as brake or engine malfunction are also a factor that should be noted, having contributed to 12 percent of all runway excursions.

While the occurrence rates of aircraft flying unstable approaches or landing on contaminated runways are low, the proportion of runway excursions from those precursors remains high.

While there was a correlation between runway excursions and wet or contaminated runways, there is also need for flight crews to be conscious of the risk of excursion even in favorable conditions, with a high percentage of the excursions having occurred in good meteorological conditions. This underscores the need for crews to be vigilant in the landing phase of flight, regardless of the runway conditions.

Discussion:

Airlines can better use Flight Data Analysis (FDA) programs to understand the root causes of unstable approaches:

- FDA can help the airline determine correlations of interest between unstable approaches and specific airports (e.g., ATC restrictions), individual pilots, specific fleets, etc.
- Personal FDA debriefs on the request of a flight crew member should be encouraged

Airlines should address not only unstable approaches but also destabilization after being stabilized, especially at low altitude (below MDA/DH) and consequently go-arounds / rejected landings.

Being stable at 500 feet does not guarantee that the landing will occur -– a go-around may still be necessary.

Auto-land and other automation tools only work within certain limitations which need to be well understood by the crew.

Recommendations to Operators:

These highlights could work as defenses for avoiding runway excursions:

- Landing in the touchdown zone
- Defining the touchdown aiming point as the target
- Parameters of stable approach based on the manufacturer information
- Deviation call outs by the Pilot Monitoring
- Recommend the use of metrics to measure SMS affectivity and ensure continuance improvement.
- Implement a flight data monitoring system.
- Validate the FDM parameters with the flight Ops department based on manufacturer's criteria.

Stable approaches are the first defense against runway excursions. The final, more important, defense is landing in the touchdown zone.

Airlines are recommended to modify their approach procedures to call out "STABILIZED" or "NOT STABILIZED" at a given point on the approach to ensure a timely go-around is carried out when necessary. This type of callout is especially useful in situations where a high crew social gradient (social power distance from a new or unassertive first officer to a domineering or challenging captain) exists, or when cultural conditioning could hinder crew member communication. Note: some companies prefer the use of the callout "GO AROUND" if stabilization criteria are not met at their respective gates. Bear in mind that, even when stabilization criteria are met at certain points, destabilization can require a go-around at any time. In this context, a company backed "no fault" go-around policy would establish crew member confidence about making the decision to go-around when established conditions make a go-around necessary.

Airlines are encouraged to set windows in the approach at specific points (e.g."Plan to be at X feet and Y knots at point Z"). This is especially useful at airports with special approaches. Brief key points in each window and how they are different from the standard approach procedure. Establish a policy specifying that if these parameters are not met a go-around must be executed.

Pilots should make an early decision to use the maximum available braking capability of the aircraft whenever landing performance is compromised, seems to be compromised or doubt exists that the aircraft can be stopped on the runway. Pilots should be mindful of what is called 'procedural memory'. It is recommended that training departments address the issue. Pilots must be aware that late application of reverse thrust is less effective than early application on account of the time required for engines to spool up and produce maximum thrust. The application of reverse thrust (when installed) is paramount on braking action challenged runways – it is much more effective at higher speeds when aircraft braking is not as effective on wet or slippery runways.

Investigate technology to help crews determine the actual touchdown point and estimate the point where the aircraft is expected to stop. Various manufacturers offer or are developing these systems. Work is ongoing to enhance runway remaining displays on both heads-up display (HUD) and primary flight display (PFD) panels. The airline industry should monitor the validity of predicted stopping indicators, especially in situations of contaminated surfaces or less than optimum performance of brakes, spoilers, and thrust reversers. While a display can give a prediction based upon the deceleration rate, it cannot anticipate changes in surface friction which will result in actual performance that is less than predicted.

Operators are advised to conduct a field survey to determine the actual landing and take-off distances in comparison to their predicted (calculated) values. Consideration for runway conditions at the time of the survey should be incorporated. This data may be obtainable from the operator's FDA program.

Operators should encourage flight crews and dispatchers to calculate stopping distances on every landing using charts and tools as recommended by the National Transportation Safety Board (NTSB) and described by the FAA in their Safety Alert for Operators (SAFO) 06012. Crews should understand and build margins into these numbers.

Operators are encouraged to set a safety focus where actual take-off/landing distances are compared with calculated take-off and landing distances to give pilots a feel for how big a bias there is between data from the manufacturer and the average pilot. For example, if the calculation shows a stop margin of "XX" meters at V1, then use FDA data and compare what the actual stop margin at V1 was on this particular flight.

Recommendations to Industry:

1. Encourage implementation of SMS for all commercial airlines and maintenance facilities.
2. Encourage a policy of a rejected landing in the case of long landings.
3. Measure the long landings at the simulators.
4. Require training in bounced landing recovery techniques.
5. Train pilots in crosswind and tailwind landings up to the maximum OEM-certified winds.
6. Encourage airlines to develop campaigns to establish SOPs as culturally normative actions.

Technology to assist in landing during severe weather is available, but is not widely installed. Airports authorities are encouraged to cooperate with other industry and commercial stakeholders to see if a viable safety and business case can be created to install such resources.

Regulators and airports are encouraged to use RESA (Runway End Safety Area), EMAS (Engineered Material Arrestor System), and similar runway excursion prevention technologies and infrastructure to help reduce the severity of runway excursions. Where these systems are in place, their presence should be communicated to crews by indicating them on charts or, possibly, including signage that indicates EMAS ahead. Regulators should also investigate standardizing runway condition reporting in an effort to simplify decisions faced by flight crews when determining required runway length for landing. Standardized reporting must be harmonized with the airplane performance information supplied by airplane manufacturers.

Airports are encouraged to improve awareness of the touch-down zone. Borrowing time-tested military concepts, such as touch-down zone markings every 1000 feet, can greatly improve a flight crew's situational awareness during landing rollout.

Scientific communities are encouraged to evaluate the usefulness of current technologies with regards to accurate and timely measurement of winds and wind shear to determine how this information can be relayed to flight crews to increase situational awareness.

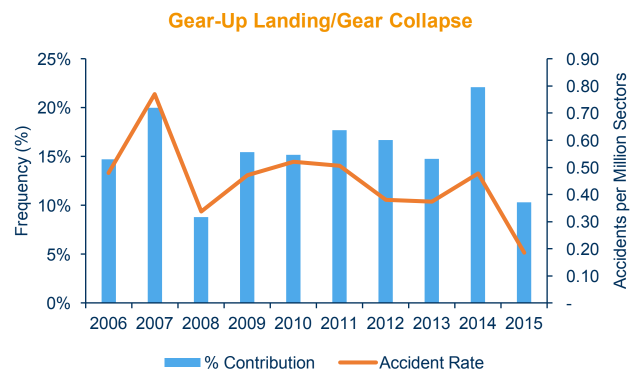
Airports should refrain from publishing requirements limiting the use of reverse thrust due to noise issues because this practice contributes to runway excursions as crews do not utilize the full capability of stopping devices. This is particularly true at airports with high-intensity operations.

AIRCRAFT TECHNICAL FAILURES AND MAINTENANCE SAFETY

Background:

2015 saw a significant decrease in the number (and rate) of accidents involving a gear up landing or a gear collapse. In 81% of the accidents, aircraft malfunction was a contributing factor, while 40% involved a maintenance-related event.

Of the 67 gear up landing/gear collapse accidents in the 2011-2015 period, maintenance operations and non-adherence to SOPs were contributors in 30% of the accidents.



Discussion:

Commercial pressures have forced virtually all airlines to out-source at least a portion of their heavy and/or routine maintenance operations.

The capability of any maintenance and repair organization (MRO) chosen to perform an airline's maintenance must match the airline's size (both number of aircraft and number of flights) and their normal maintenance practices. Very few MROs are capable of completing a large work package (due to deferred maintenance on MEL items) to a high standard under normal airline time pressures. MRO certification is not a guaranty of work quality.

After a heavy maintenance check, many larger airlines will have a "shakedown cruise" to gauge the quality of work performed by the MRO and determine the short-term (e.g., 30 day) reliability of the aircraft. This helps to identify issues before the aircraft goes back into service and ensures a higher degree of reliability and completion factor for the airline.

In many cases, too much effort and legislation is put into oversight of the documentation trail, rather than the repair work being physically performed on the aircraft. For example, whoever certifies an aircraft as airworthy must be certificated, however those who perform maintenance the work do not necessarily have to possess any licensing credentials. There are some anecdotal cases where the primary concern was that the paperwork for a work-package was not done, where the when in reality the work itself had not been completed.

The issue of aircraft parts was also discussed. This aspect ties into both bogus parts and what are termed as "rogue parts". A rogue part is one that is reused without being properly certified or checked for serviceability. For example, a part may be written-up in a crew aircraft maintenance discrepancy report. However, after the part receives a clean bench check, it is placed back on the "serviceable" shelf for re-use at a later date. Another interpretation of a rogue part is an old part (sometimes as much as 30 years old) being inappropriately refurbished and then certified as serviceable. Parts need to be checked for serviceability regardless of age or certification status.

Maintenance configuration control was also discussed. Specifically, are the installed parts in the aircraft supposed to be there according to the actual in-service documentation? This issue is not limited to older aircraft as recent models can also be affected by similar lapses. There are also anecdotes regarding operations replacing parts as a means to extend MEL periods due to financial constraints. This is separate from the rotation of parts for the purpose of troubleshooting.

Maintenance human error continues to be a leading factor in maintenance aircraft incident events. To address these errors the industry needs to identify the root cause of such events. Maintenance departments should adopt similar safety programs and tools as are used during Flight Operations. For example, the principles of Crew Resource Management (CRM) can be applied to Maintenance Resource Management, Line Oriented Safety Audits (LOSA) can be developed for maintenance and ramp operations, and Fatigue Risk Management Systems (FRMS) can be implemented for Maintenance. All of these programs and tools can help proactively identify the root cause of errors so that proper mitigation steps can be taken to prevent these errors from becoming significant events.

Flight crews also have a role in maintenance-related safety. The number and combination of MEL items, combined with other factors (e.g., weather) can lead to degraded safety levels. Also, temporary revisions to procedures are affected depending on the MEL items. Operators are reminded that MELs are meant as a way to legally fly the aircraft to a location where it can be repaired, and not as a maximum time limit on how long the aircraft can remain in service before maintenance must be performed. Ensuring this aspect of maintenance-related activities is well understood within its own flight and maintenance organizations will ensure that aircraft are repaired correctly and on-time. Flight crews should not be forced to make operational decisions and "push" their limits while flying revenue flights.

Recommendations to Operators:

Functional check flights (FCF) or shakedown cruises after heavy aircraft maintenance are recommended to verify that the aircraft is operating normally. This will also increase in-service reliability and enhance the airline's completion factor after heavy maintenance is performed.

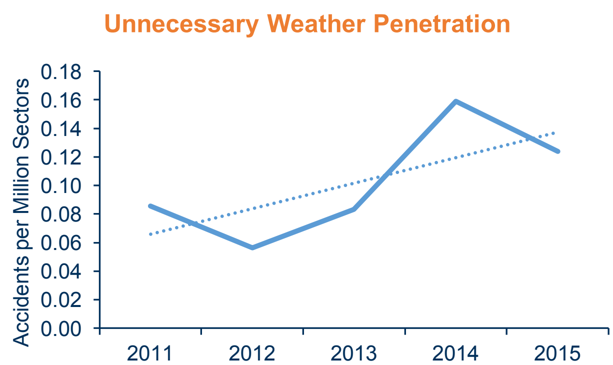
The Flight Safety Foundation (FSF) has published a FCF Compendium document containing information that can be used to reduce risk. The information contained in the guidance document is generic and may need to be adjusted to apply to an airline's specific aircraft. Operators are encouraged to retrieve this material.

Maintenance Repair Operator (MRO)/Airline Maintenance departments should implement a LOSA system for their maintenance activity.

CONTINUATION OF AIRLINE OPERATION DURING SEVERE WEATHER

Background:

Airline operations may be completely suspended by severe weather in some parts of the world. Meteorological threats were identified as factors in 37 percent of accidents in 2015 and 31 percent of accidents during the period of 2011 to 2015. Unnecessary weather penetration was a factor in 8 percent of the accidents in 2015 and it is on the rise. The graph below shows the rate of accidents where this contributing factor was present.



Not only aerodromes are encouraged to provide aviation weather services to Air Traffic Services (ATS) units, airline operators, flight crew members, dispatchers and airport management by supplying the necessary meteorological information in a timely and accurate manner, but crews also need to be able to identify and avoid poor weather conditions whenever possible and applicable. The ACTF believes that there is a need for improved real-time weather information available in the cockpit, improved awareness of weather phenome by all the key personnel involved with the planning and execution of a flight and technology development for advanced forecast and presentation of weather pertinent to a particular flight.

Discussion:

Weather has a large-scale effect on operations. Operators need to be aware of commercial factors relating to weather delays such as public expectations and passenger compensation criteria (where in effect).

Aerodrome's ATS observations and forecasts are to be disseminated to aircraft pilots and flight dispatchers for pre-flight planning.

Auto-land and other automation tools only work within certain limitations. Technology to assist in landing during severe weather is available but is not widely installed.

All aerodromes need to issue alerts for low-level wind shear and turbulence within three nautical miles of the runway thresholds for relay by air traffic controllers to approaching and departing aircraft.

Continuous improvement of various warning services is needed to develop capabilities for real-time downlink of weather data obtained by aircraft and uplink of weather information required in the cockpit.

Recommendations to Operators:

Operators should consider tools that allow dispatch offices to provide crews with the most up-to-date weather information possible.

Ensure that aerodrome's ATS observations and forecasts are disseminated to aircraft pilots and flight dispatchers for pre-flight planning.

Airlines should develop a contingency plan, involving dispatch and crew support, that clearly defines guidance at an organizational level on who is responsible to cease operations.

The applicability of limits for wind and gusts should be clearly defined in the Operations Manual.

All aerodromes need to have a meteorological office that issues alerts of low-level wind shear and turbulence within three nautical miles of the runway thresholds for relay by air traffic controllers to approaching and departing aircraft.

Recommendations to Industry:

Scientific communities are encouraged to evaluate the usefulness of current technologies with regards to accurate and timely measurement of gusty winds and how such information can be quickly relayed to flight crews to increase situational awareness.

Develop capabilities for real-time downlink of weather data obtained by aircraft and uplink of weather information required in the cockpit

CREW RESOURCE MANAGEMENT

Background:

Social and communication skills are a vital part of overall crew performance. Ultimately, an electronic system cannot be designed for every possible threat and efficient crew interaction is critical for the mitigation of potential threats.

Discussion:

Crew Resource Management (CRM) continues to be an important factor in aviation safety, especially in more conservative social environments. While implemented at many operators, CRM is not universally applied and many airlines have ineffective or no formalized CRM training programs in place.

In cultural environments where a high social gradient exists, strict standard operating procedures (SOPs) help establish clear lines of communication and allow for first officers to pass critical situational information to the captain without compromising their position or causing the captain to "lose face".

Effective crew pairing with respect to seniority and experience can promote optimal conditions for crew performance.

Recommendations to Operators:

CRM training should include and emphasize assertiveness and identify specific cases where the social gradient or rank distance between the captain and first officer is high enough to impede effective communications. Focus on specific cultural factors when applicable.

Encourage captains to allow first officers to demonstrate assertiveness and leadership. Communicate that despite rank or position, the captain is still human and is capable of making mistakes. Ensure that captains understand they are not infallible.

Specific call-outs of information or decision requirements at critical points in the flight may help the first officer to overcome the social gradient between the crew members. Properly developed SOPs with clear instructions may empower first officers to take over the flight controls when the situation requires assertiveness.

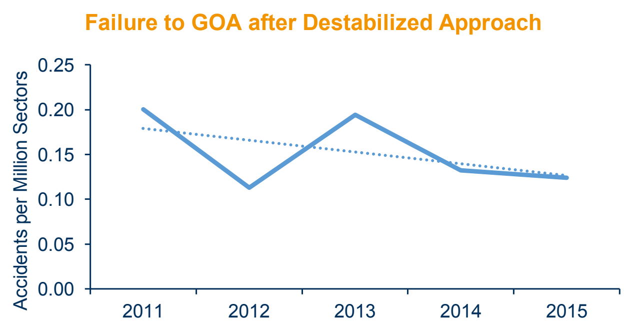
A process for debriefing CRM issues that arose during line operation will give the individual pilot essential feedback on his/her performance.

GO AROUNDS

Background:

Failure to go around after a destabilized approach was a contributing factor in 9 percent of the accidents between 2011 and 2015. While focus on go arounds is of extreme importance, the handling of the aircraft after a go around is initiated needs to be a topic of discussion, especially on circumstances not foreseen during simulator training.

Rate of accidents where 'Failure to go around after destabilized approach' was a contributing factor



Discussion:

The go-around procedure is rarely flown and is a challenging maneuver. Crews must be sufficiently familiar with flying go-arounds through initial and recurrent training.

Somatogravic head-up illusions during the unfamiliar forward acceleration in a go-around can lead to the incorrect perception by the flight crew that the nose of the aircraft is pitching up. This illusion can cause pilots to respond with an inappropriate nose down input on the flight controls during the execution of a go-around. Such responses have led to periodic accidents.

There are also cases when the crew engage the autopilot to reduce the workload, but instead put the aircraft in an undesired situation due to a lack of situational awareness with the automation.

Airlines should not limit training scenarios to the initiation of a go-around at the approach minimum or missed approach point. Training scenarios should focus on current operational threats as well as traditional situations.

Recommendations to Operators

Airlines are recommended to modify their approach procedures to call out “STABILIZED” or “GO-AROUND” at a given point to ensure a timely go-around is carried out. While a STABLE or STABILIZED callout might be required at either 1000 feet or 500 feet above touchdown, the “GO-AROUND” command can and must be made at any time prior to deployment of thrust reversers.

When developing crew training programs, operators are encouraged to create unexpected go-around scenarios at intermediate altitudes with instructions that deviate from the published procedure; this addresses both go-around decision-making and execution. The training should also include go-around execution with all engines operating, including level-off at a low altitude and go-arounds from long flares and bounced landings. Operators should also consider go-arounds not only at heavy weight and one engine inoperative, which are the typical scenarios, but also at light weight with both engines operative in order to experience the higher dynamics. Crews should fly the go-around pitch and Flight Director bars and adapt the thrust to remain within flight parameters.

Training should emphasize the significance of thrust reverser deployment for a go-around decision. From a technical point of view, a go-around may always be initiated before reverser deployment and never after reverser application.

Introduce destabilized approach simulator training scenarios, which emphasize that deviations from the stabilized approach profile at low altitudes (below MDA/ DH) should require execution of a go-around.

It has often been said that failure to execute a go-around is usually associated with a mind set to land. There are very few situations where a go-around is not an option and it is important for crews to have an understanding of when they must land and when to leave themselves an out.

Airlines should incorporate training on somatogravic illusions during the initiation of a go-around. Simulators that combine the possibilities of both the hexapod and the human centrifuge are already available and in use, (e.g., for military training).They can be used to demonstrate the illusions during go-around initiation and train pilots for a correct reaction on the heads-up illusion. As preventive means, crews are recommend to brief the go-around, not delay it, respect minima, monitor the flight parameters and fly the go-around pitch and the Flight Director bars where available.

Airlines should consider the time loss due to go around as necessary for safe operations. Therefore, commercial pressure should not be imposed on flight crews. Pilots may be reluctant to go-around if they feel the fuel state does not support it. A go-around should be considered as potentially occurring on every flight and so the flight must be fueled to allow for a go-around without resulting in a low-fuel situation. A no fault go-around policy should be promoted by the operators. If pilots are fearful of disciplinary action they will be less likely to go around when they should.

Recommendations to Industry

Authorities should examine if initial go-around altitudes may be increased wherever possible to give flight crews additional time to both reconfigure the aircraft and adjust to their new situation.

Industry should support the development of operational feasible simulators which can generate sustained g-forces for generic go-around training with regard to somatogravic illusions.

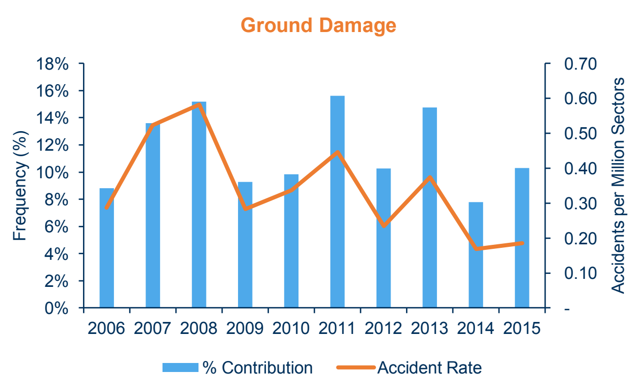
Air traffic controllers should be reminded that any aircraft might execute a balked landing or missed approach. This will involve startle and surprise for the ATC just as it might for the flight crew involved. They should understand that the flight crew will immediately be involved in stabilizing the flight path, changing configuration, and communicating with each other. The flight crew will communicate with ATC as soon as they are able and ATC should be prepared to clear other traffic, provide or approve an altitude and direction of flight. They should also understand that the aircraft might be entering a fuel critical state such that routing and sequencing for diversion or subsequent landing must be without undue delay.

GROUND OPERATIONS & GROUND DAMAGE PREVENTION

Background:

In 2015 there were seven accidents categorized a ground damage. The rate was of 0.19 accidents per million sectors. 86% were in jet aircraft and the accident rate brakes down into 0.19 for jets and 0.16 for turboprops. The rate for the five-year period was of 0.23 and 0.52, respectively.

The graph below indicates the percentage of ground damage accidents over the previous ten years and its rate in accident per million sectors. This downward trend, however, need to be treated carefully because it does not include damage caused by ground operations-related incidents that do not fit the accident criteria. Ground damage continues to be a major cost for operators, and requires a cooperative safety approach with all involved parties including airlines, ground service providers, airport authorities and government.



Discussion:

Actual hands-on experience with a real aircraft is required to accurately gauge the size and position of the wings and airframe when moving on the ramp. This is particularly true as new aircraft with larger wingspans are being added to airline fleets. The risk of ground events is expected to increase as growth in traffic outpaces growth in airport capacity resulting in more aircraft operating in a limited space.

Crews need to exercise increased vigilance during taxi operations in congested airports, near challenging gates or stands in close proximity to obstacles. Operators and crews should note:

- Not to rely solely on ground marshals or wing walkers for obstacle avoidance and/or clearance while taxiing.
- Turboprops can be especially prone to ground damage. Several cases of turboprops taxiing into ground carts were noted.
- ATC clearance to taxi is not an indication that it is safe to begin taxiing - surroundings must be monitored at all times.

Ground staff should be informed to respect lines and other markings depicting protected zones. As surface markings can differ from one airport to another, the ground crew is better positioned to assure the safe positioning of the aircraft when approaching a parking spot or gate. Issues such as ground vehicles failing to give right of way to moving aircraft, movable stands, carts and other equipment being placed incorrectly, not being removed, or blowing into moving aircraft continue to affect safety on the ground.

Ground markings should be clear and well understood by ramp workers. Confusing and/or overlapping lines can contribute to improperly positioned aircraft and result in ground damage. Lines can be difficult to see in wet conditions; this can be helped through the use of contrast painting (i.e., a black border to taxi lines where the surface is concrete).

Damage to composite materials will not necessarily show visible signs of distress or deformation. Engineering and maintenance must remain on constant vigilance when dealing with newer aircraft that contain major composite structures.

Due to hesitation of some ground staff in submitting ground damage reports, the data available is not enough to be more effective in finding accident precursors, identifying hazards and mitigating risks.

All service providers such as aircraft operators, maintenance organizations, air traffic service providers and aerodrome operators need to be compliant with ICAO SMS Doc.9859 to strengthen the concept of a proactive and predictive approach to reducing ground damage events.

IATA Safety Audit for Ground Operations (ISAGO) certifications may benefit all service providers in understanding high risk areas within ground operations in all aerodromes.

Recommendations to Operators

Ensure crews receive taxi training that includes time spent in real aircraft (with wing walkers indicating the actual position of the wings to the pilot) to help accurately judge the size of the aircraft and its handling on the ground.

Ensure crews inform ATC of aircraft position while waiting to enter the ramp area in preparation for a final parking slot to increase situational awareness and indicate that the aircraft may not be fully clear of the taxiway.

Consider the utilization of stop locations for aircraft entering the ramp similar to those used while leaving ramp areas. Stop locations should ensure adequate clearance from movement areas while transitioning from ground control.

Lapses in SOPs such as not setting the parking brake can lead to ground damage and even ramp injuries or fatalities. Crew training with regards to effective communication during the taxi procedure should be applied and reinforced.

Inform crews of the unique nature of composite materials and reinforce that severely damaged composite materials may show no visible signs of distress.

Train crews regarding the handling and responsibilities of taxi instructions. The taxi clearance does not ensure that no obstacles are present for the crew. The crews must be aware of their surroundings and know to request assistance when in doubt; particular attention must be paid to wingtip clearances.

Ensure compliance with ICAO Safety Management System (SMS) Document 9859.

Encourage all ground staff to report all ground damage events, incidents or violations through the Safety Reporting System and/or Aviation Confidential Reporting System (ACRS).

Recommendations to Industry

Lack of information on charts, in particular airport taxi charts, can lead to ground damage. Chart providers are encouraged to include as much information as possible on charts while maintaining legibility.

Additionally, potential hazards and areas of confusion must be identified clearly.

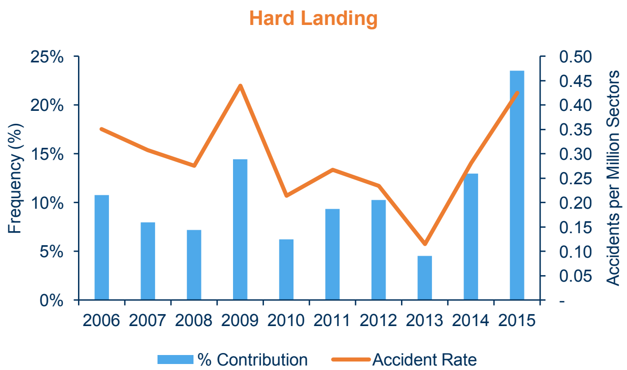
Manufacturers are asked to investigate the use of technology to assist crews in determining the proximity of aircraft to obstacles. Similar technology has been available in automobiles for several years and would be extremely useful in low-visibility situations or when the pilot's view is obstructed.

While a flight crew can be expected to avoid collisions with fixed structures and parked aircraft by maintaining the correct relationship with taxi lane markings, the situation will be improved with enhancements that provide both moving real time ground mapping as well as real time traffic display. Technology exists for every aircraft and ground vehicle to emit position information. It is expected that ADS-B out and in will provide the necessary ground collision prevention in conjunction with well-engineered ramps and taxi lanes.

HARD LANDING

Background:

2015 represents a continuing upward trend in the occurrence of hard landing accidents. The graph below shows that, in terms of accident rates, the industry is back to the high numbers experienced in 2009 and before.



Frequent contributing factors to hard landings in the last five years were:

- Flight Operations (Training Systems): 28%
- Meteorology: 49%
- Errors in the manual handling of the aircraft: 74%
- Long, floated or bounced landing: 63%

Discussion:

Meteorological phenomena and other factors that lead to a (late) destabilization of the final approach have again been identified as typical precursors of hard landings that led to accidents. Additionally, hard landings often either lead to or have been the result of bounced landings. For this reason in particular the importance of flying stabilized approaches all the way to the landing as well as the recovery of bounced landings continue to be critical areas for crew training activities.

At the same time there are still limitations in the ability of simulators to induce occurrences such as bounced landings at a level of fidelity that is sufficiently high to avoid the danger of "negative training".

Recommendations to Operators

Bounced landing recovery remains a challenging maneuver for crews and thus continues to be a critical simulator training issue. At the same time limitations of training devices have to be respected. When designing training programs, operators are encouraged to be mindful of the risk of "negative training" (e.g., by asking the trainee to perform a long or bounced landing to practice the recovery thereof).Focus rather has to be on training for the correct landing parameters (e.g., pitch, power, visual picture) on every landing. This is to develop sufficient awareness and motor-skills to always perform the landing the way the airplane manufacturer recommends and to always land at the correct location on the runway, regardless of how favorable or unfavorable the conditions are. Focus also has to be on the fact that the landing is to be rejected should the aforementioned landing parameters not be met.

In addition to the above, and as discussed in other parts of this publication, airlines are recommended to modify their approach procedures to include a call out such as "STABILIZED" or "GO AROUND" at a certain gate to ensure a timely go-around is carried out. Emphasis should also be put on pilots to understand that a destabilization can occur at any altitude and that the set parameters are to be met at all times after the gate and until landing. To provide training that is consistent with this, it is recommended to include training of go-arounds from low altitudes and rejected landings (as well as due to long flares and bounced landings) in the recurrent training program.

Operators are recommended to set procedures that do not require late disconnection of the Auto Pilot. There are events when the crew has no time to enter into the aircraft loop by disconnecting at low altitudes, such as 200 ft, particularly in adverse conditions such as crosswind or gusts, in which case the approach may destabilize on very short final. Pilots need to get a 'feel' for the aircraft.

Introducing scenarios that are common precursors to hard landings in the training environment remains a challenge. In the short term, the challenge could possibly be overcome by workarounds such as introducing very low altitude wind shear on approach. However, operators are encouraged to work with simulator manufacturers to overcome the challenges more systematically in the long term.

Operators are also encouraged to train pilots on landing in real aircraft whenever possible.

Recommendations to Industry

Aircraft manufacturers are encouraged to provide better guidelines to be used in determining when a hard landing has occurred. These guidelines should be based on measurable factors. As noted above, simulator manufacturers, operators and industry partners are encouraged to work together to develop training devices that are better able to recreate the precursors to a hard landing.

Regulators are encouraged to evaluate landing training requirements.

IN-FLIGHT DECISION MAKING

Background:

With fuel prices increasing, financial pressure to airlines getting higher and airports being more and more congested, the chance of a diversion from the original destination airport will grow.

Discussion:

Many airlines offer strategies to their pilots for decision making in abnormal conditions and failure cases. Often, they are sound concepts based on TEM models and they are demonstrated to crews on a regular basis.

However, very few strategies can be found for normal operations in terms of giving the crews guidelines for desirable conditions and triggers for diversion enroute and at destination.

Standard alternate airports are mainly based on official weather minima. In the case of a real diversion, crews may find themselves in conditions that are the same or even worse than at the original destination, now however with considerably less fuel.

The difference between a legal alternate and a sound and valid new option is often not considered by crews when diverting, nor is this trained.

This may end up in a cul-de-sac situation with minimum fuel or, in the worst case, in a hopeless situation with no fuel.

Often, the airlines` operational control centers do not have all necessary operational information about possible diversion alternates available.

Recommendations to Operators

Create and train a model for inflight decision making in normal daily operations.

These models should be a solid concept that allows crews to have a stringent and timely strategy for diversion airport assessment.

As a minimum, a diversion airport should always have adequate weather conditions which may be different from legal minima. Operational conditions should be such that the traffic situation and system outages present no constraint to a safe landing. The airport layout should allow for more than one possibility to land (e.g., at least a parallel taxiway).

Enable operational control centers or dispatch to have access to enroute alternate airport databases and means to transfer this information to flight crews enroute.

Recommendations to Industry

Develop and maintain databases for hazards enroute or at specific airports and make them available to airline crews and operational control centers.

ACTF DISCUSSION & STRATEGIES

FINAL STATEMENTS

Accidents are reaching all-time-lows, but work must go on! The focus the industry gave on high risk accidents, namely CFIT, LOC-I and Runway Excursion are paying off. The rates for these accidents have been in constant decline.

However, a false sense of security could lead us back into an upward trend. LOC-I and CFIT are still the accidents with the lowest survivability ratio. The constant decline in their yearly rates could mean that the low-handing fruits have been largely removed, which means safety professionals around the world need to work even harder in order to mitigate the occurrence of those factors that, although unlikely to occur, have catastrophic consequences.

In addition to the discussion points above, the ACTF would like to highlight:

Maintenance-related events

The ACTF has recognized some accidents where the aircraft had come out straight out from maintenance done by MRO. The airline still has the final responsibility to audit and supervise the work performed, even though it was performed by a certified MRO.

In the context of landing gear accidents, it was noted that many occurred on older in-service airplanes. Some of those were attributed to gear shimmy. These hazards have been identified and mitigated by the manufacturers through maintenance and operational recommendations.

Safety Culture

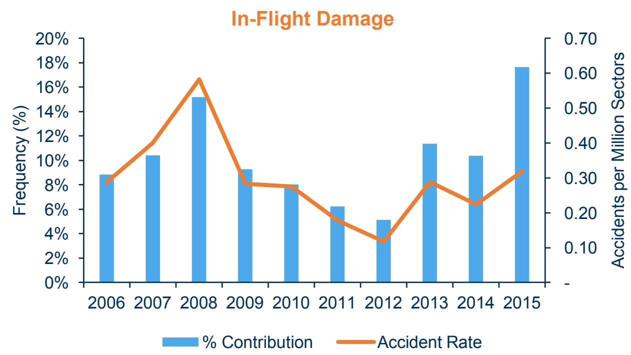
There is still a wide variance in the approach to the overall level of worldwide safety management, while some societies are extremely proactive in making system-safety stronger, there are other cultures where the punitive approach is taken too often. This results in airlines and crews pushing the envelope so as to avoid the punitive culture.

While the vast majority of the globe is extremely proactive in promoting a progressive safety management culture, some notable regions continue to follow a punitive safety agenda, resulting in crews potentially overreaching their ability to safely operate the aircraft.

There is clearly a strong correlation between lack of regulatory oversight and a higher number of accidents in specific parts of the world. This lack of both regulatory oversight and safety management was found to lead to a higher accident occurrence rate, with no notable improvement.

Upward trend in in-flight damage

Particularly in the past three years, the rate of occurrence of In-Flight Damage accidents has significantly increased, as seen from the graph below.



The top causal factors are: Wildlife/Birds/Foreign Object. While bird strikes are predominant, a large number of accidents occurred due to inadequate airport perimeter fencing and/or wildlife control.

Aircraft Malfunction, Maintenance Events: (get some graphs), reference above. In some cases maintenance events are correlated to deficiencies in aircraft design, however, the larger number of events are related to deficiencies in maintenance organizations' safety management systems and oversight.

Upward trend in Hard Landing and Undershoot

From the data available to the group, no definitive conclusions could be drawn on whether or not pilot experience and/or pilot recency are causal.

Accurate, real time meteorological information should be provided to flight crews for them to be able to make accurate operational decisions. Additionally, pilots need to understand and respect the weather-directed operational decisions they face using all means available.

Poor commitment to thorough accident investigation

We continue to see a high number of accidents that (1) are not investigated, (2) when the investigation does occur, results of the investigation are not shared in the international community, nor even the manufacturers (OEMs).

As an estimate, 25% of accidents are not investigated, less than half of all investigations produce a final report and many of them lack credibility and do not lend themselves to improving worldwide aviation safety.

Recommendation:

- The industry must continue to make positive strides to promote the adoption of "just safety culture" globally. A "Just Culture" seeks to promote and reward the person(s) who speak out and identify safety related situations, "Just Cultures" investigate in the name of fixing the cause rather than laying blame. "Just Cultures" also are defined by a high level of leadership commitment.
- The industry should strive to promote the review, via internal and external reviews, of the safety climate within their organizations. Climate differs from culture in that culture is the environment which is stated and desired by an organization whereas climate is the actual truth of the normative behaviors, daily actions and perceptions of the organizations.
- Encourage the adoption of programs such as the "Aviation Safety Action Program" (ASAP) as a non-punitive means for aircrews to self-report hazards and risks in a consequence free environment. The industry needs to ensure the crews on the flightdeck, and in the cabin are given a voice.
- Advise, and aid lesser capable countries on the aviation accident investigation and safety resources available to assist them, or complete accident investigations. Encourage the development of a world-wide pool of approved accident investigators who could help bolster the effort of such governments when needed.

Industry Responsibility

The aviation industry has a responsibility to the flying public and cargo customers to identify areas of safety risk where positive progress can be made. In SMS speak, continuance improvement, as part of safety assurance is what must happen. This report is relevant to this responsibility as it identifies those safety areas where the industry is being challenged and those where it is strong; the latter being more important to ensuring the continued safety of the aviation industry. Those areas where challenges exist are opportunities for the aviation industry to forge a future that strives for continuous improvement. Therefore, the industry should promote SMS and the means to accomplish the task of proactive risk management. The industry has a responsibility to identify the regions who need help, identify the resources that can be matched to their needs to proceed forward to develop SMS, to develop a "Just Safety Culture" and to insist upon through, complete and open investigations of issues and incidents.

9

TAWS Analysis

TERRAIN AWARENESS & WARNING SYSTEM (TAWS) ANALYSIS

1.0 EXECUTIVE SUMMARY

IATA Global Aviation Data Management (GADM) comprises of several safety exchange programs including; Operational Safety reports, Flight Data information, Ground Damage reports and Accident information. Members routinely submit data to IATA where it is processed, de-identified and used for analysis towards improving safety across the aviation industry.

This analysis used data from the following GADM programs; STEADES, a database comprising of more than 1.3 million incident reports from over 190 airlines worldwide. FDX, a database that comprises of more than 2.9 million reports recorded by flight data recorders from over 50 airlines worldwide and the Accident database, which records all commercial aviation accidents worldwide[1].

This study used STEADES, FDX, and Accident data to analyze incidents and accidents related to "Terrain Awareness and Warning System" (TAWS) from January 2010 to June 2015. The purpose of the analysis was to understand the relationships between incidents identified in STEADES and FDX and Controlled Flight into Terrain (CFIT) Accidents from the Accident database. The analysis was broken down into four areas.

1. Global CFIT Accidents

2. Global STEADES Reports

3. LATAM regional analysis

For the overall analysis, there were 34 CFIT accidents and 16,684 STEADES reports relating to TAWS. For the LATAM regional analysis, 8,718 FDX reports and 846 STEADES reports related to TAWS were used.

1 The IATA accident database contains accidents that meet the IATA accident criteria determined by the IATA Accident Classification Taskforce (ACTF).

2.0 INTRODUCTION

The IATA Six-Point Safety Strategy highlights CFIT accidents as one of the top three accident categories. IATA is working on a number of initiatives to help reduce CFIT accidents, this analysis aims to understand the commonalities between the scenarios identified in incidents and accidents related to TAWS and the differences between what is reported by flight crews versus what is recorded by the flight data.

CFIT accidents, whilst on the decline over recent years, still occur far too often and have an 88% fatality rate. From 2010 to Q2 2015 there were a total of 34[2] CFIT accidents, which equates to one CFIT accident every two months. CFIT accidents accounted for 674 fatalities during the period and was the second highest fatal accident end state. From an incident perspective, there were 16,684 TAWS related STEADES reports, from January 2010 to Q2 2015, which equates to 8 reports per day. These 8 reports per day can be further broken down to 1 serious incident and 7 incidents per day, so what does it take for the incidents to become serious incidents and for the serious incidents to become an accident?

The analysis drilled down into the following areas to understand the issues and factors present in TAWS events;

- CFIT Accidents: TAWS was primarily developed to reduce the number of CFIT accidents therefore, the CFIT accidents in the accident database were analyzed to determine common threats, errors, and countermeasures.
- STEADES Reports: The STEADES reports were analyzed to determine the threats, errors, and countermeasures present, allowing for a qualitative global assessment of TAWS related events and comparison to the accident data.
- LATAM Region: A drill down was conducted looking at the LATAM region due to the amount of FDX data available for that region and the similarity of members between FDX and STEADES. This allowed for a comparison to be conducted between the FDX flight data and the STEADES reports.

2 Note: The analysis focused on accidents between Q1 2010 and Q2 2015 - subsequent to the analysis there was 1 CFIT accident in Q3 2015 and is therefore not included in this analysis.

3.0 ANALYSIS

3.1 CFIT Accident Analysis

Accident Database Query Criteria:

- Date range: Q1 2010 to Q2 2015 inclusive
- Phase of flight: All phases
- Category: Controlled Flight Into Terrain (CFIT)

This resulted in 34 reports from the Accident database, which were analysed to determine the relevant threats, errors, and countermeasures.

Accidents Rates and Aircraft Type

Figure 1 below breaks down the accidents by year and provides the rate per 1 million flights. During the period, CFIT accidents have been declining since a high of 10 accidents per year in 2011 to zero in Q1 and Q2 2015.

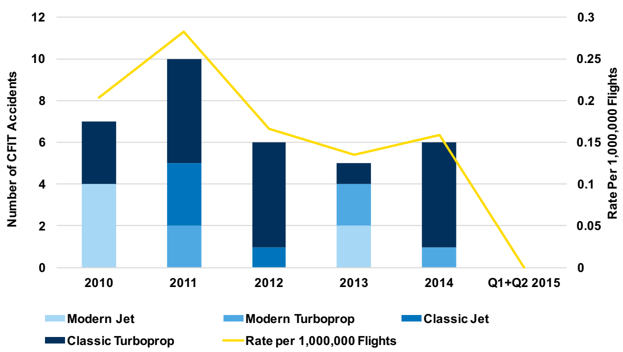


Figure 1 – Accident Rate & Aircraft Type / Era

Accidents were also classified by aircraft type and era: classic and modern[3]. There were 26 different aircraft types involved in the 34 accidents. 71% (24) of accidents involved turboprops. 68% (23) of accidents were on a classic aircraft, of these classic aircraft, 83% (19) of accidents involved classic turboprops. Figure 1 above breaks down the aircraft types per year.

Region of Occurrence

The accidents were then broken down into region of occurrence and region of operator. AFI recorded the highest number of region of occurrence accidents with 8. Of the 8 accidents, 6 involved AFI operators. CIS was the region with the highest number of operator accidents with 9. Of the 9 accidents, 5 occurred in CIS, 2 in MENA and 2 in AFI. Europe was the region with the lowest number of accidents, there was only 1 CFIT accident in EUR which occurred on a foreign registered aircraft.

Figure 2 – Region of Occurrence and Operator

Common Threats and Errors

Each accident was analyzed and assigned threats and errors by the Accident Classification Task Force (ACTF). Of the 34 accidents, 26 accidents had sufficient information for the ACTF to be able to assign threats, errors and countermeasures.

There were 86 threats identified, the most common threat was meteorology, present in 58% (15) of accidents. Followed by navigational aids and ground-based navigational aid malfunction / not available, occurring in 54% (14) of accidents and terrain obstacles in 23% (6) accidents.

THREATS	
Threats	**Percentage of CFIT Accidents**
Meteorology	58%
Ground-based Navigation Aid malfunction or not available	54%
Terrain	23%
Air Traffic Services	19%

Figure 3 – CFIT Accident Threats

There were 37 errors identified, the most common errors were SOP adherence / SOP cross-verification apparent in 50% (13) of accidents. Manual handling / flight controls was present in 19% (5) of accidents and pilot-to-pilot communication in 12% (3) of accidents.

ERRORS	
Errors	**Percentage of CFIT Accidents**
SOP Adherence / SOP Cross-verification	50%
Manual Handling / Flight Controls	19%
Pilot-to-Pilot Communication	12%
Briefings	8%

Figure 4 – CFIT Accident Errors

Countermeasures

The ACTF identified 57 countermeasures that if used in the accident sequence, would have increased the chance of preventing the accident. The most common countermeasure was monitor / cross check, categorised in 50% (13) of accidents followed by overall crew performance with 46% (12) of accidents. Communication environment was categorised in 15% (4) of accidents.

3 Definition: The Modern classification was assigned to aircraft initially certified in the mid-1980s or later with the introduction of glass cockpits and Flight Management Systems (FMS). Classic aircraft were certified before the mid-1980s.

COUNTERMEASURES	
Countermeasures	**Percentage of CFIT Accidents**
Monitor / Cross-check - Proper monitoring and cross checking of flight instruments and flight path	50%
Overall Crew Performance - If the crew had been communicating and working together more cohesively	46%
Communication Environment – The ease of communication within the flight crew	15%
SOP Briefing/Planning - Following the established procedures, checklists, and briefings	12%

Figure 5 – CFIT Accident Countermeasures

CFIT Accident Summary

The rate of CFIT accidents has seen a decrease since a high of 10 in 2011. The region which had the highest number of CFIT Accidents was AFI with a total of 8 accidents. Globally, 56% (19) of accidents involved classic turboprops. The greatest threats present in most CFIT accidents were those relating to weather and navigation aids. The greatest errors present in most CFIT accidents was a failure to adhere to appropriate SOPs and checklists and the countermeasures that could have had the greatest effect in preventing accidents was monitor / cross check.

3.2 STEADES Global Analysis

STEADES database query criteria:

- Date range: Q1 2010 to Q2 2015 inclusive
- Phase of flight: All phases
- Descriptors/categories: All STEADES EGPWS/GPWS descriptors

This resulted in 16,684 relevant reports from the STEADES database for the period. Due to the large number of reports a random data sample was used for further in-depth analysis. The random data sample consisted of 639 reports giving a 99% level of confidence and an error rate of 5%. Of the 639 reports, 13% (80) of reports were not used as they did not contain sufficient information in the report narrative, resulting in 559 reports that were coded according to the TEM framework.

Limitations

The reports analyzed for the in-depth analysis were extracted from the STEADES database from over 190 participating airlines. This analysis cannot confirm if TAWS incidents were equally distributed amongst all participating airlines nor if such events were reported routinely or underreported by flight crews.

Global View

The 16,684 TAWS reports equated to 1 report per 3,128 flights or 8 reports per day. For Q1 to Q2 2015, there were 2,228 reports which represents 1 report per 2,645 flights or 12 reports per day, indicating that incident reporting increased over the period. STEADES currently represents around 30% of world flights, the figures presented here represent the lower measure of the true number of events occurring globally. It is important to remember that reporting is heavily dependent on the reporting cultures of individual airlines, countries and States.

STEADES In-depth Analysis

The 559 reports used for the in-depth analysis were coded using the TEM framework. Coding consists of manually reading the narratives for each of the reports and identifying an UAS, threats, errors and countermeasures. We did not include the definitions in the appendix. Where possible, the definitions were aligned with those used by the ACTF to categorize accidents.

Undesired Aircraft States (UAS)

For the UAS, the main TAWS modes were used. A severity ranking was developed by GADM in conjunction with the IATA Safety Group which was applied to each of the UAS. Figure 6 shows the breakdown of the UAS and includes the severity factor. UAS is mutually exclusive and where reports had multiple alerts or warnings, the most severe warning was used.

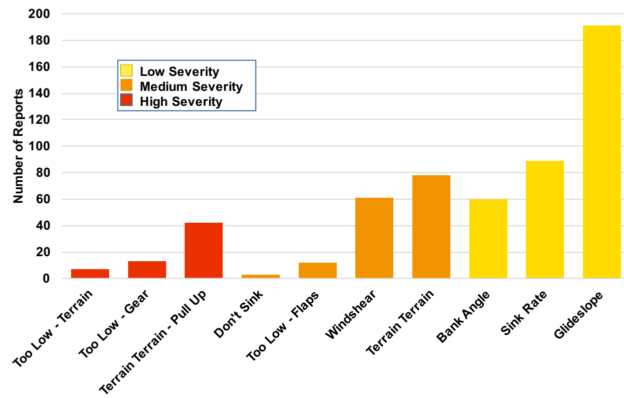


Figure 6 – STEADES Undesired Aircraft State

Glideslope and sink rate accounted for 50% (280) of reports, both of which were classified as low severity. Terrain terrain and windshear ranked 3rd and 4th with 14% and 11% (78 and 61) of reports respectively, both of these categories were classified as medium severity. Terrain terrain – pull up, too low gear and too low terrain accounted for 11% (62) of reports and were classified as high severity reports.

Threats

There were 505 threats identified in the reports falling into 10 threat categories. Threats were not mutually exclusive and 1 report may contain multiple threats. Of the 10 categories identified only two, fatigue and cockpit distractions were threats internal to the flight deck.

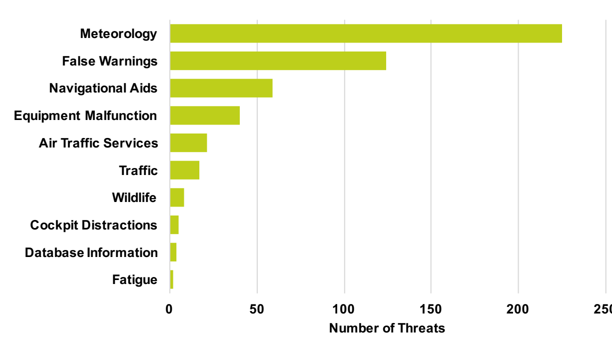


Figure 7 – STEADES Threats

Figure 7 depicts meteorology as the greatest threat with 40% (225) of reports followed by false warnings with 22% (124) of reports and navigational aids in 11% (59) of reports. Excluding false warnings, the threats identified in the STEADES in-depth analysis are very similar to those identified by the ACTF for the CFIT accidents.

Errors

There were 326 errors identified in 51% (286) of reports. The remaining 49% (273) reports did not contain any information about errors prior to the TAWS alert or warning. Of the reports that did mention an error, the two most common errors were approach / climb deviations, present in 26% (143) of reports, and high rate of descent found in 13% (70) of reports. Both of which fall into the top accident category of manual handling / flight controls. When including incorrect configurations, as per the accident classification, manual handling / flight controls errors accounted for 71% (233) of errors identified in the STEADES reports.

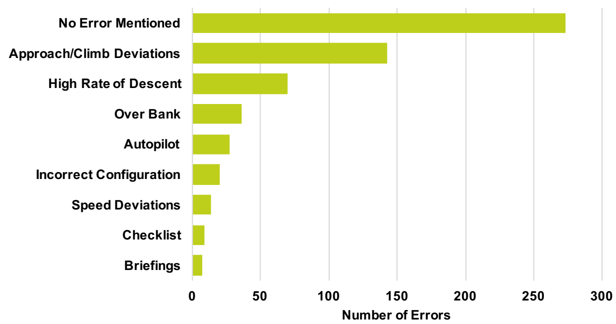


Figure 8 – STEADES Errors

Countermeasures

There were 790 countermeasures identified in 90% (503) of reports. The top three countermeasures were flight path correction 44% (246) of reports, ignored warnings[4] 32% (177) of reports and visual verification 30% (168) of reports.

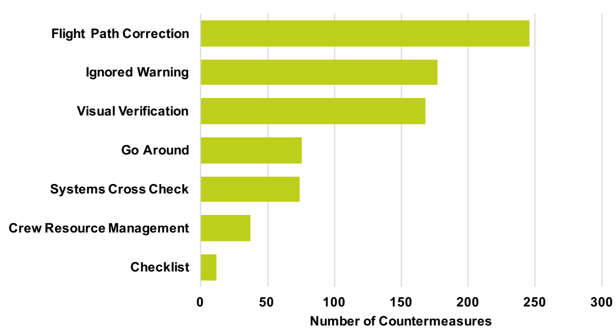


Figure 9 – STEADES Countermeasures

The errors and countermeasures were combined to provide further insight into the incidents. For the reports where there were no errors mentioned there were still one or more countermeasure identified. The most common countermeasure for no error mentioned was a visual verification and ignored warning.

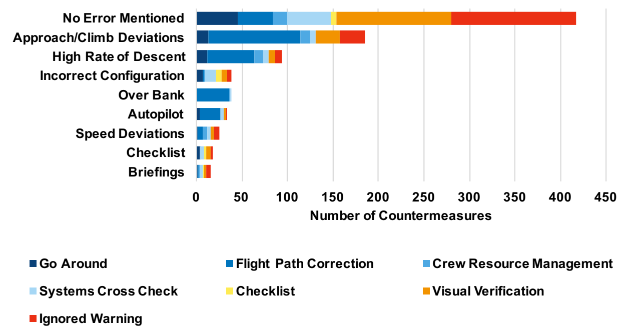


Figure 10 – STEADES Errors versus Countermeasures

UAS versus Errors, Threats and Countermeasures

A comparison of each UAS and related errors, threats and countermeasures was performed to establish if there are any common issues specific to each warning or alert.

Glideslope (Low Severity)

Glideslope alerts and warnings accounted for 34% (191) of the total TAWS reports. The top 3 threats were navigational aids, false warnings and meteorology. The top threats were typically due to the PAPI and or other aircraft instrumentation displaying a correct glideslope, yet the crew still receiving a glideslope alert or warning. The most common countermeasure for glideslope errors was a flight path correction.

Sink Rate (Low Severity)

Sink rate alerts accounted for 16% (89) reports of the total TAWS reports. The most common threat was meteorology and the most common errors leading to sink rate alerts were a high rate of descent and approach and climb deviations. The top countermeasure was flight path correction. A common scenario found in the reports was a tail wind causing the aircraft to be high on approach leading to a high rate of descent and subsequent sink rate alert. There were more go-arounds for sink rate warnings than that of glideslope alerts or warnings.

Bank Angle (Low Severity)

Bank angle alerts accounted for 11% (60) reports of the total TAWS reports. Meteorology was the top threat identified. The top 2 errors for bank angle alerts were over bank and autopilot. Flight path correction was the top countermeasure when receiving a bank angle warning.

Terrain Terrain (Medium Severity)

Terrain terrain alerts accounted for 14% (78) reports of the total TAWS reports. There were 65 threats identified, false warning was the top threat accounting for nearly half of all warnings. False warnings were often combined with equipment malfunctions or database information threats. There were two reports of terrain terrain alerts in the cruise phase of flight, both of the reports indicated that there was another aircraft below. There were 23 errors identified, approach / climb deviations was top followed by a high rate of descent. There were 125 countermeasures identified, ignored warning and visual verification were the two top countermeasures used.

4 Ignored warnings are not usually considered as a countermeasure, rather a flight crew response. They have been included in the analysis in the countermeasures section to highlight the number of reports where flight crews chose to ignore the TAWS warning or alert.

Windshear (Medium Severity)

Windshear alerts accounted for 11% (61) of the total TAWS reports. Meteorology was the top threat. Only 4 errors were identified for windshear indicating that flight crews had very little knowledge of the onset of a windshear event. There were 75 countermeasures mentioned with the top countermeasure being a Go-Around accounting for 52% (39) of countermeasures.

Terrain Terrain – Pull Up (High Severity)

Terrain terrain pull up warnings accounted for 8% (42) of the total TAWS reports. There were 43 threats identified, false warning was the top threat, this was often combined with very few errors. A visual verification and ignored warning were the countermeasures used when the flight crew suspected a false warning.

There were 73 countermeasures identified, ignored warning and visual verification were the top two countermeasures. There were 4 reports that did not mention any countermeasures after receiving a Terrain terrain – pull up, in one report the aircraft was reported to be within 600ft of the terrain.

Too Low Gear – (High Severity)

Too low gear warnings accounted for 2.3% (13) of the total TAWS reports. There were 13 threats identified, false warning was the highest followed by equipment malfunction and aircraft technical defects. There were 38 countermeasures identified, 50% (17) of all of the countermeasures indicated that the warning was ignored after a visual verification or systems cross check.

Too Low Flaps (Medium Severity)

The too low flaps warnings accounted for 2.1% (12) of the total TAWS reports. There were 13 threats identified, false warnings and meteorology were the top 2. There were 75% (9) errors relating to incorrect configurations 4 of which resulted in a go-around.

Don't Sink (Medium Severity)

Don't Sink alerts accounted for 0.5% (3) of the total TAWS reports. All three resulted from manual handling / flight control errors and the countermeasures were flight path corrections.

Too Low Terrain (High Severity)

Too low terrain alerts accounted for 1.3% (7) of the total TAWS reports. 4 reports were false warnings.

TAWS False Warning

For the purpose of this analysis, a false warning was defined as a warning that the flight crew perceived to be false at the time of the incident, this was either stated or derived from the report narratives. False warnings accounted for 22% (124) of reports. Glideslope and terrain terrain warnings had the greatest number of false warning reports. Terrain terrain – pull up, too low gear and too low terrain all had 50% of reports classified as a false warning, all 3 UAS were high severity warnings. There were only 8 errors identified in the 124 reports of false warning. In 90% (112) of reports, the countermeasure was to ignore the warning with 79% (99) of reports performing a visual verification as well.

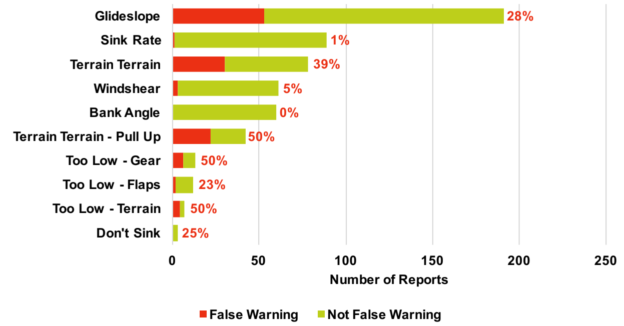


Figure 11 – STEADES False Warnings

TAWS Go-Arounds

A go-around was performed as a countermeasure for 14% (76) of all reports. The 2 most common UAS that preceded a go-around were windshear and sink rate warnings which accounted for 74% (56) of all go-arounds.

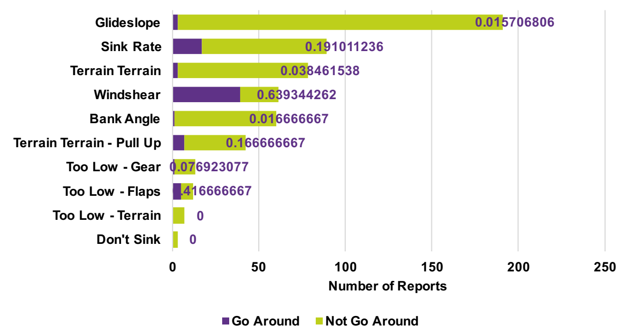


Figure 12 – STEADES Go-Arounds

TAWS Severity Index

In order to understand the overall severity generated by TAWS reports and to understand if there were any severity trends, a severity index was developed. The severities identified in conjunction with the IATA Safety Group were allocated severity points and ranked accordingly. This provided an average report severity per year and a severity rate per 1,000 flights.

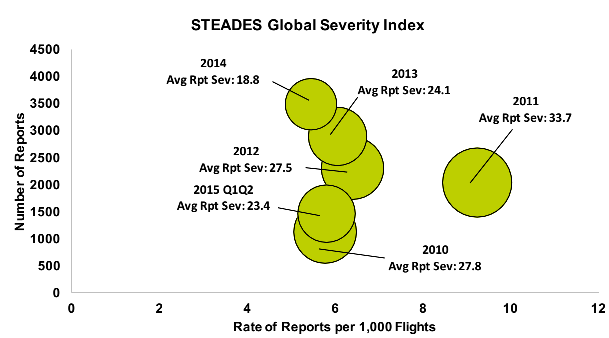


Figure 13 STEADES TAWS Severity Index

Figure 13 shows the highest average report severity was in 2011 with 33.7 and a severity rate of 9.23 per 1,000 flights; 2011 also had the highest number of accidents for the period. The severity index also shows that whilst the number of reports has been increasing since 2011, the severity of the reports has been decreasing.

STEADES Summary

Incident reporting increased during the analysis period whilst the overall severity came down. The greatest threats present were meteorology, false warnings, navigational aids, and equipment malfunction. With the exception of false warning, the most common threats matched with the threats identified in CFIT accidents. The most common error was approach/climb deviations, flight crews often perceived that they were receiving false warnings from the TAWS when following visual navigation aids e.g. PAPI, VASI. The countermeasures most commonly applied were those of correcting the flight path, and visually verifying the aircraft position. 3 out of 174 ignored warning reports involved no other countermeasures, in all 3 reports, the flight crew recognized that they should have responded differently.

3.3 LATAM Regional Analysis

The LATAM region is the most mature in terms of FDX coverage, of the 48 FDX members worldwide 56% (27) of FDX members were located in LATAM. There were also 26 STEADES members in LATAM. 73% (19) of LATAM members contributed to both STEADES and FDX, allowing for an in-depth comparison between both datasets.

The FDX database went live in LATAM in 2013 therefore, the data used for this LATAM analysis from both STEADES and FDX is from Q1 2013 to Q2 2015.

LATAM recorded 3 accidents from Q1 2010 to Q2 2015 but as the last CFIT accident in LATAM was in 2012, they fell outside the date range for this LATAM drill down.

STEADES database query criteria:

- Date range: Q1 2013 to Q2 2015 inclusive
- Phase of flight: All phases
- Descriptors/categories: All STEADES EGPWS/GPWS descriptor
- Region of occurrence: LATAM

This resulted in 846 reports from the STEADES database, a random data sample was taken for further in-depth analysis. The random data sample consisted of 265 reports giving a 95% level of confidence and an error rate of 5%. Of the 265 reports, 3.7% (10) of reports were not used, as they did not contain sufficient information in the report narrative, resulting in 255 reports that were coded according to the TEM framework.

FDX Database query criteria.

- Date range: Q1 2013 to Q2 2015 inclusive
- Phase of flight: All Phases
- Region of occurrence: LATAM
- Descriptors/categories: All EGPWS/GPWS events

This resulted in 8,718 flights containing 11,434 TAWS events. These events were analyzed and the most severe event was used for each flight resulting in 8,718 reports for the analysis.

Reporting Rates

STEADES had 846 reports for the period whilst FDX recorded 10 times more reports with 8,718 reports for the period. STEADES operators recorded 3,381,473 flights giving a rate of 1 report per 3,997 flights whereas FDX operators recorded a total of 1,714,820 flights giving a rate of 1 report per 197 flights. Both STEADES and FDX reports and rates remained fairly steady during the period.

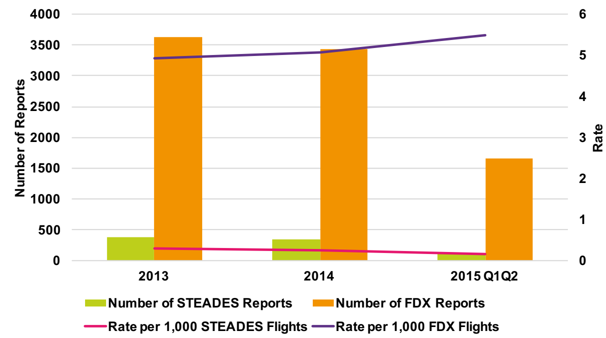


Figure 14 – LATAM STEADES & FDX Reporting Rates

Undesired Aircraft States for STEADES and FDX.

Figure 15 identifies the UAS for both STEADES and FDX. The top 3 for FDX were glideslope 51% (4,433) of reports, sink rate with 25% (2,134) of reports and terrain terrain with 7% (625) of reports. For STEADES, the top 3 UAS were terrain terrain 39% (330) of reports, sink rate 16.2% (137) of reports and terrain terrain – pull up 13% (113) of reports.

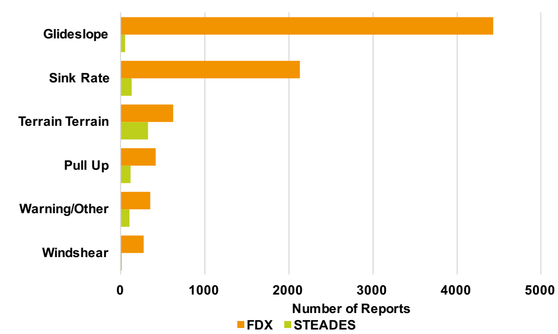


Figure 15 – LATAM UAS STEADES and FD.

The distribution of FDX UAS matches the Global STEADES distribution, whereas the STEADES LATAM UAS distribution does not match the global distribution. The reports in LATAM STEADES had a greater number of higher severity reports, compared to the lower severity reports in the STEADES global dataset, indicating that reporting in LATAM is inconsistent with the reporting levels in other regions. This could be driven by state or country reporting requirements or individual airline requirements, and is an area that is worth exploring further.

STEADES LATAM In-depth Analysis

The in-depth analysis comprised of 255 reports that were coded using the TEM framework.

Threats

There were 182 threats identified in 57% (146) of reports. False warnings was the greatest threat apparent in 33% (84) of reports followed by meteorology with 26% (66) of reports and navigational aids 4% (11) of reports. There was a higher perception of false warnings in LATAM compared to the global STEADES reports.

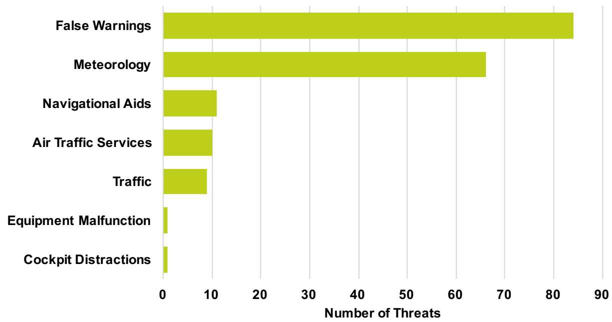


Figure 16 – LATAM STEADES Threats

Errors

There were 130 errors identified in 50% (127) of reports. Approach/climb deviations was the most common error with 25% (63) of reports followed by high rate of descent with 16% (42) of reports. The LATAM distribution of errors is similar to the global distribution of STEADES reports.

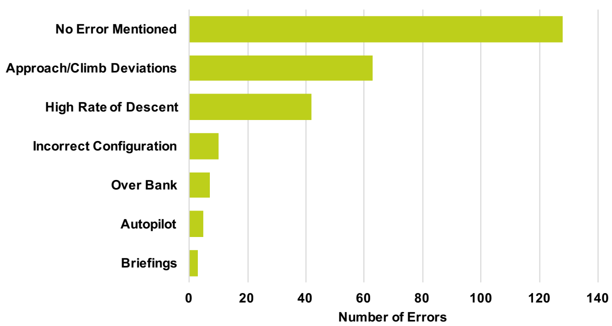


Figure 17 – LATAM STEADES Errors

Countermeasures

There were 342 countermeasures identified in 100% (255) of reports. Ignored warning was identified in 42% (106) of reports followed by visual verification accounting for 40% (103) of reports. Flight path correction was apparent in 33% (83) of reports. The LATAM distribution of countermeasures is similar to that of the global distribution; however, there was a higher proportion of ignored warnings in LATAM compared to the global STEADES data.

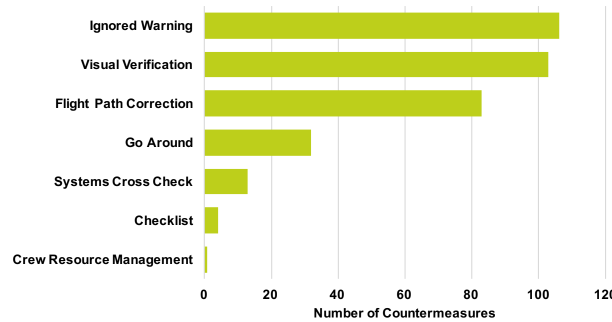


Figure 18 – LATAM STEADES Countermeasures

TAWS Severity Index STEADES and FDX

STEADES and FDX reports for LATAM were classified with a severity rating in the same way as global STEADES analysis. Figure 19 highlights the difference in reporting rate and severity between STEADES and FDX. STEADES reports had double the average severity per report compared to FDX, which follows on from the higher number of more severe reports mentioned previously.

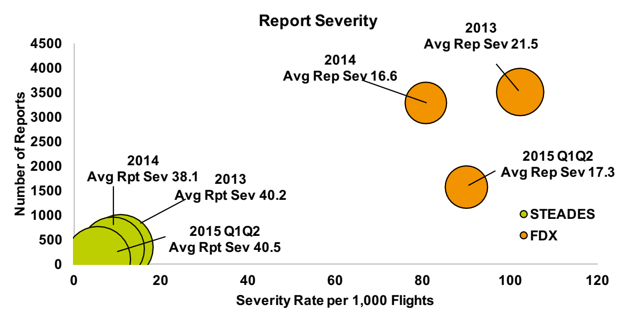


Figure 19– LATAM STEADES & FDX Severity Index

LATAM Summary

There were 10 times more FDX reports than STEADES reports in LATAM. The distribution of FDX reports in LATAM matches the distribution of STEADES reports globally. The distribution of STEADES reports in LATAM indicates that reporting of lower severity events is not reported the same in LATAM as it is for the global reports.

4.0 SUMMARY

It is encouraging to see that CFIT accidents have been decreasing over the years and that 2015 was the safest year yet for CFIT accidents.

CFIT accidents typically still occur on classic aircraft and in particular classic turboprops. However, since 2010 there have been a number of CFIT accidents occurring on modern jets.

This analysis has highlighted the threats and errors present in CFIT accidents, and their similarity to the threats and errors identified in incident reports. Meteorology and navigational aids play a big part in both the accidents and incidents reviewed; when these threats are coupled with either a Manual handling / flight control error and or a failure to follow SOPs the incidents can quickly become much worse.

The analysis showed that flight crew perceived a high number of warnings as false warnings, especially if they are using visual aids. Whilst there was no way to confirm if the warning was false or not, it highlights that flight crews can become de-sensitized and may mistake a real warning for a false warning.

TAWS systems are more mature and GPS databases are providing data that is more accurate. With all the enhancements in technology and accuracy in the data, it is important that this all translates through to the flight deck. Whilst this analysis does not touch on TAWS database updates and GPS feeds to the TAWS systems, it is paramount that flight crews be provided with the best chance that technology has to offer. By keeping the TAWS terrain database up to date and providing a direct GPS feed to the TAWS system, flight crew receive the warnings and alerts earlier, buying more time to react accordingly. Having data that is more accurate also reduces the number of false warnings, which will help the flight crews take the right action when a warning does occur.

From a global reporting perspective, it is positive to see an increase in low severity TAWS reports especially as the severity index is down on previous years. The LATAM in-depth analysis indicates that reporting in LATAM is not in line with the global reporting and that reporting of lower severity events should be explored further.

5.0 FUTURE WORK

IATA Safety is currently surveying airlines regarding the modification status, GPS feed and updates to the TAWS system. Once this survey is completed, the results of this analysis will be reviewed in conjunction with the survey. GADM is also looking at a more specific analysis using both STEADES and FDX to highlight some TAWS hotspots. The IATA regional office for LATAM will work with the LATAM airlines to understand the reporting requirements in the region with a view to increase reporting of lower severity events in line with the global reporting level.

10

GSIE Harmonized Accident Rate

In the spirit of promoting aviation safety, the Department of Transportation of the United States, the Commission of the European Union, the International Air Transport Association (IATA) and ICAO signed a Memorandum of Understanding (MoU) on a Global Safety Information Exchange (GSIE) on 28 September 2010 during the 37th Session of the ICAO Assembly. The objective of the GSIE is to identify information that can be exchanged between the parties to enhance risk reduction activities in the area of aviation safety.

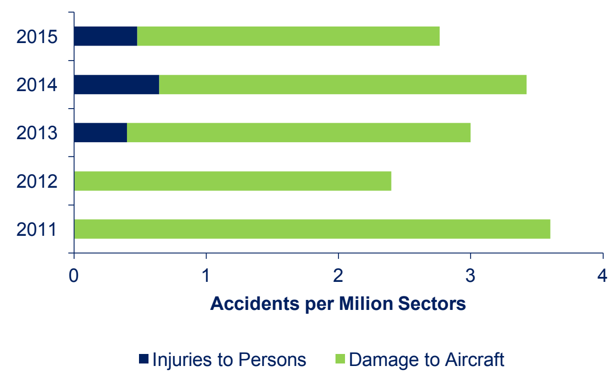
The GSIE developed a harmonized accident rate beginning in 2011. This was accomplished through close co-operation between ICAO and IATA to align accident definitions, criteria and analysis methods used to calculate the harmonized rate, which is considered a key safety indicator for commercial aviation operations worldwide. The joint analysis includes accidents meeting the ICAO Annex 13 criteria for all typical commercial airline operations for scheduled and non-scheduled flights.

Starting in 2013, ICAO and IATA have increasingly harmonized the accident analysis process and have developed a common list of accident categories to facilitate the sharing and integration of safety data between the two organizations.

ANALYSIS OF HARMONIZED ACCIDENTS

A total of 104 accidents were considered as part of the harmonized accident criteria in 2015. These include scheduled and non-scheduled commercial operations, including ferry flights, for aircraft with a maximum certificated take-off weight above 5700kg. The GSIE harmonized accident rate for the period from 2011 (the first year the rate was calculated) to 2015 is shown below. As of 2013, a breakdown of the rate in terms of the operational safety component, covering accidents involving damage to aircraft and the medical/injury component pertaining to accidents with serious or fatal injuries to persons, but little or no damage to the aircraft itself, is also presented.

GSIE HARMONIZED ACCIDENT RATE



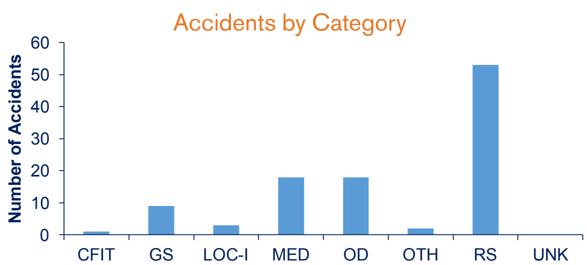
DEFINITIONS AND METHODS

In order to build upon the harmonized accident rate presented in the last two safety reports, ICAO and IATA worked closely to develop a common taxonomy that would allow for a seamless integration of accident data between the two organizations. A detailed explanation of the harmonized accident categories and how the relate to the Commercial Aviation Safety Team/ICAO Common Taxonomy Team (CICTT) occurrence categories can be found at the end of this section.

A common list was developed by ICAO and IATA using the CICTT Phases of Flight.

HARMONIZED ACCIDENT CATEGORIES

The fundamental differences in the approaches of the ICAO (CICTT Occurrence Categories) and IATA (Flight-crew centric Threat and Error Management Model) classification systems required the harmonization of accident criteria being used. The breakdown of accidents by harmonized category can be seen in the figure below.



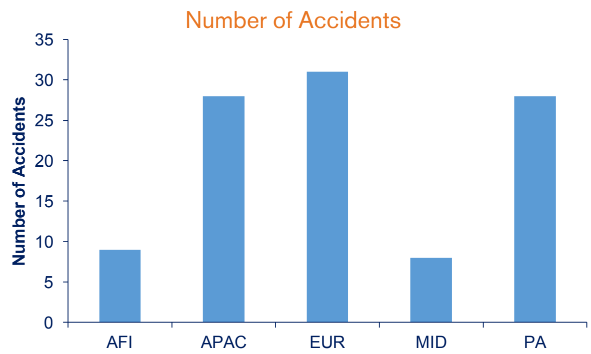
Accident Categories

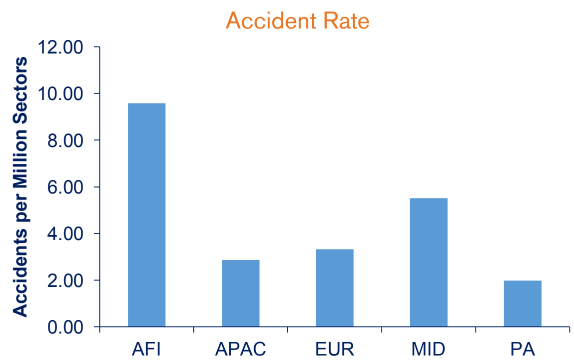
Controlled Flight into Terrain (CFIT)
Loss of Control In-flight (LOC-I)
Runway Safety (RS)
Ground Safety (GS)
Operational Damage (OD)
Injuries to and/or Incapacitation of Persons (MED)
Other (OTH)
Unknown (UNK)

Full details of categories can be found at the end of this section.

ACCIDENTS BY REGION OF OCCURRENCE

A harmonized regional analysis is provided using the ICAO Regional Aviation Safety Group regions. The number of accidents and harmonized accident rate by region are shown in the figure below:





FUTURE DEVELOPMENT

Both ICAO and IATA continue to work closely together and, through their respective expert groups, provide greater alignment in their analysis methods and metrics for the future. This ongoing work will be shared with GSIE participants, States, international organizations and safety stakeholders in the interest of promoting common, harmonized safety reporting at the global level.

GSIE HARMONIZED ACCIDENT CATEGORIES

Category	Description
Controlled Flight into Terrain (CFIT)	Includes all instances where the aircraft was flown into terrain in a controlled manner, regardless of the crew's situational awareness. Does not include undershoots, overshoots or collisions with obstacles on takeoff and landing which are included in Runway Safety .
Loss of Control In-flight (LOC-I)	Loss of control in-flight that is not recoverable. .
Runway Safety (RS)	Includes runway excursions and incursions, undershoot/overshoot, tailstrike and hard landing events. .
Ground Safety (GS)	Includes ramp safety, ground collisions, all ground servicing, pre-flight, engine start/departure and arrival events. Taxi and towing events are also included. .
Operational Damage (OD)	Damage sustained by the aircraft while operating under its own power. This includes in-flight damage, foreign object debris (FOD) and all system or component failures. .
Injuries to and/or Incapacitation of Persons (MED)	All injuries or incapacitations sustained by anyone coming into in direct contact with any part of the aircraft structure. Includes turbulence-related injuries, injuries to ground staff coming into contact with the structure, engines or control surfaces aircraft and on-board injuries or incapacitations and fatalities not related to unlawful external interference.
Other (OTH)	Any event that does not fit into the categories listed above. .
Unknown (UNK)	Any event whereby the exact cause cannot be reasonably determined through information or inference, or when there are insufficient facts to make a conclusive decision regarding classification. .

Category	CICTT Occurrence Catogies	IATA Classification End States
Controlled Flight into Terrain (CFIT)	CFIT, CTOL	CFIT
Loss of Control In-flight (LOC-I)	LOC-I	LOC-I
Runway Safety (RS)	RE, RI, ARC, USOS	Runway Excursion, Runway Collision, Tailstrike, Hard Landing, Undershoot, Gear-up Landing / Gear Collapse
Ground Safety (GS)	G-COL, RAMP, LOC-G	Ground Damage
Operational Damage (OD)	SCF-NP, SCF-PP	In-flight Damage
Injuries to and/or Incapacitation of Persons (MED)	CABIN, MED, TURB	None (excluded from IATA Safety Report)
Other (OTH)	All other CICTT Occurrence Categories	All other IATA End States
Unknown (UNK)	UNK	Insufficient Data

RASG Region	List of Countries
Africa (AFI)	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Côte d'Ívoire, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Île De La Réunion (Fr.), Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mayotte (Fr.), Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe
Asia Pacific (APAC)	Afghanistan, American Samoa (U.S.A.), Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Cook Islands, Democratic People's Republic of Korea, Timor-Leste, Fiji, French Polynesia (Fr.), Guam (U.S.A.), India, Indonesia, Japan, Kiribati, Laos, Malaysia, Maldives, Marshall Islands, Micronesia, Mongolia, Myanmar, Nauru, Nepal, New Caledonia (Fr.), New Zealand, Niue (NZ.), Norfolk Island (Austr.), Northern Mariana Islands (U.S.A.), Pakistan, Palau, Papua New Guinea, Philippines, Republic of Korea, Samoa, Singapore, Solomon Islands, Sri Lanka, Thailand, Tonga, Tuvalu, Vanuatu, Viet Nam, Wallis Is. (Fr.)
Europe (EUR)	Albania, Algeria, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Faroe Islands (Den.), Finland, France, Georgia, Germany, Gibraltar (U.K.), Greece, Greenland (Den.), Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Monaco, Montenegro, Morocco, Netherlands, Norway, Poland, Portugal, Moldova, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Tunisia, Turkey, Turkmenistan, Ukraine, United Kingdom, Uzbekistan
Middle East (MID)	Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Oman, Qatar, Saudi Arabia, Sudan, Syria, United Arab Emirates, Yemen
Pan-America (PA)	Anguilla (U.K.), Antigua and Barbuda, Argentina, Aruba (Neth.), Bahamas, Barbados, Belize, Bermuda (U.K.), Bolivia, "Bonaire. Saint Eustatius and Saba", Brazil, Canada, Cayman Islands (U.K.), Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands (Malvinas), French Guiana (Fr.), Grenada, Guadeloupe (Fr.), Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique (Fr.), Mexico, Montserrat (U.K.), Nicaragua, Panama, Paraguay, Peru, Puerto Rico (U.S.A.), Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sint Maarten (Netherlands), Suriname, Trinidad and Tobago, Turks and Caicos Islands (U.K.), United States, Uruguay, Venezuela, Virgin Islands (U.S.A.)

Addendum A

Top Contributing Factors – Section 4

2015 Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	31%
Safety Management	19%
Flight Operations	15%
Maintenance Operations	11%
Flight Ops: Training Systems	10%
Maintenance Ops: SOPs & Checking	10%
Flight Ops: SOPs & Checking	6%
Technology & Equipment	6%
Design	6%
Ops Planning & Scheduling	3%
Change Management	3%
Management Decisions	3%
Ground Operations	2%
Ground Ops: Training Systems	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	34%
SOP Adherence / SOP Cross-verification	24%
Failure to GOA after Destabilized Approach	8%
Pilot-to-Pilot Communication	6%
Ground Navigation	3%
Automation	3%
Abnormal Checklist	2%
Ground Crew	2%
Crew to External Communication	2%
Callouts	2%
Normal Checklist	2%
Systems / Radios / Instruments	2%

2015 Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	37%
Aircraft Malfunction	21%
Wind/Windshear/Gusty wind	21%
Airport Facilities	18%
Maintenance Events	15%
Gear / Tire	13%
Poor visibility / IMC	13%
Lack of Visual Reference	11%
Thunderstorms	10%
Optical Illusion / visual mis-perception	8%
Operational Pressure	6%
Contaminated runway/taxiway - poor braking action	6%
Nav Aids	6%
Ground-based nav aid malfunction or not available	6%
Poor/faint marking/signs or runway/taxiway closure	6%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Wildlife/Birds/Foreign Object	5%
Ground Events	5%
Extensive / Uncontained Engine Failure	3%
Airport perimeter control/fencing/wildlife control	3%
Fatigue	3%
Crew Incapacitation	3%
Air Traffic Services	3%
Dispatch / Paperwork	2%
Inad overrun area/trench/ditch/prox of structures	2%

2015 Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	31%
Long/floated/bounced/firm/off-center/crabbed land	21%
Unstable Approach	16%
Continued Landing after Unstable Approach	10%
Abrupt Aircraft Control	10%
Unnecessary Weather Penetration	8%
Brakes / Thrust Reversers / Ground Spoilers	5%
Flight Controls / Automation	5%
Wrong taxiway / ramp / gate / hold spot	3%
Ramp movements	3%
Engine	3%
Operation Outside Aircraft Limitations	3%
Unauthorized Airspace Penetration	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	18%
Monitor / Cross-check	11%
Leadership	6%
FO is assertive when necessary	5%
Evaluation of Plans	3%
Communication Environment	3%
Taxiway / Runway Management	3%
Workload Management	3%
Automation Management	2%
Captain should show leadership	2%

Note: 6 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Top Contributing Factors – Section 4

2011-2015 Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	31%
Safety Management	23%
Flight Operations	15%
Flight Ops: Training Systems	12%
Maintenance Operations	7%
Technology & Equipment	7%
Maintenance Ops: SOPs & Checking	7%
Flight Ops: SOPs & Checking	7%
Design	5%
Change Management	3%
Selection Systems	3%
Management Decisions	2%
Maintenance Ops: Training Systems	1%
Dispatch Ops: SOPs & Checking	1%
Ops Planning & Scheduling	1%
Ground Operations	1%
Dispatch	1%
Ground Ops: Training Systems	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	30%
SOP Adherence / SOP Cross-verification	24%
Failure to GOA after Destabilized Approach	9%
Pilot-to-Pilot Communication	5%
Callouts	4%
Systems / Radios / Instruments	2%
Crew to External Communication	2%
Ground Crew	2%
Automation	2%
Normal Checklist	2%
Abnormal Checklist	2%
Ground Navigation	1%
Documentation	1%
Briefings	1%
ATC	1%
Wrong ATIS or Clearance Recorded	1%

2011-2015 Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	31%
Aircraft Malfunction	24%
Wind/Windshear/Gusty wind	17%
Airport Facilities	15%
Gear / Tire	13%
Poor visibility / IMC	11%
Maintenance Events	10%
Nav Aids	10%
Ground-based nav aid malfunction or not available	10%
Air Traffic Services	8%
Contaminated runway/taxiway - poor braking action	8%
Thunderstorms	7%
Lack of Visual Reference	7%
Ground Events	6%
Wildlife/Birds/Foreign Object	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	4%
Optical Illusion / visual mis-perception	4%
Poor/faint marking/signs or runway/taxiway closure	3%
Terrain / Obstacles	3%
Inad overrun area/trench/ditch/prox of structures	3%
Operational Pressure	3%
Fatigue	3%
Airport perimeter control/fencing/wildlife control	2%
Contained Engine Failure/Powerplant Malfunction	2%
Icing Conditions	2%
Extensive / Uncontained Engine Failure	2%
Hydraulic System Failure	1%
Flight Controls	1%
Crew Incapacitation	1%
Secondary Flight Controls	1%
Traffic	1%
Brakes	1%
Dangerous Goods	1%
Dispatch / Paperwork	1%
Spatial Disorientation / somatogravic illusion	1%

2011-2015 Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	22%
Vertical / Lateral / Speed Deviation	19%
Unstable Approach	10%
Continued Landing after Unstable Approach	9%
Operation Outside Aircraft Limitations	7%
Unnecessary Weather Penetration	6%
Abrupt Aircraft Control	6%
Loss of aircraft control while on the ground	5%
Brakes / Thrust Reversers / Ground Spoilers	3%
Controlled Flight Towards Terrain	3%
Ramp movements	2%
Flight Controls / Automation	2%
Engine	2%
Weight & Balance	1%
Landing Gear	1%
Wrong taxiway / ramp / gate / hold spot	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	24%
Monitor / Cross-check	16%
Contingency Management	7%
Leadership	7%
Captain should show leadership	5%
Taxiway / Runway Management	5%
Communication Environment	4%
FO is assertive when necessary	4%
Automation Management	4%
Evaluation of Plans	3%
Workload Management	2%
Plans Stated	2%
SOP Briefing/Planning	1%

Note: 83 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

2011-2015 Fatal Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	56%
Safety Management	46%
Technology & Equipment	30%
Flight Operations	26%
Flight Ops: SOPs & Checking	18%
Flight Ops: Training Systems	18%
Selection Systems	10%
Change Management	4%
Dispatch	4%
Maintenance Ops: SOPs & Checking	4%
Maintenance Operations	4%
Dispatch Ops: SOPs & Checking	4%
Management Decisions	4%
Ops Planning & Scheduling	4%
Design	2%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	40%
Manual Handling / Flight Controls	26%
Pilot-to-Pilot Communication	12%
Callouts	10%
Systems / Radios / Instruments	8%
Failure to GOA after Destabilized Approach	6%
Abnormal Checklist	4%
Documentation	4%
Wrong ATIS or Clearance Recorded	4%
Automation	2%

2011-2015 Fatal Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	44%
Nav Aids	30%
Ground-based nav aid malfunction or not available	30%
Aircraft Malfunction	26%
Poor visibility / IMC	26%
Thunderstorms	14%
Air Traffic Services	14%
Lack of Visual Reference	12%
Contained Engine Failure/Powerplant Malfunction	10%
Terrain / Obstacles	8%
Maintenance Events	8%
Icing Conditions	8%
Wind/Windshear/Gusty wind	8%
Fire / Smoke (Cockpit/Cabin/Cargo)	8%
Operational Pressure	6%
Fatigue	6%
Crew Incapacitation	4%
Optical Illusion / visual mis-perception	4%
Flight Controls	2%
Wildlife/Birds/Foreign Object	2%
Primary Flight Controls	2%
Extensive / Uncontained Engine Failure	2%
Dangerous Goods	2%
Airport Facilities	2%
Spatial Disorientation / somatogravic illusion	2%
Contaminated runway/taxiway - poor braking action	2%
Gear / Tire	2%

2011-2015 Fatal Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	32%
Unnecessary Weather Penetration	18%
Controlled Flight Towards Terrain	16%
Operation Outside Aircraft Limitations	12%
Unstable Approach	10%
Engine	6%
Continued Landing after Unstable Approach	6%
Flight Controls / Automation	4%
Long/floated/bounced/firm/off-center/crabbed land	4%
Abrupt Aircraft Control	4%
Brakes / Thrust Reversers / Ground Spoilers	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	46%
Monitor / Cross-check	30%
Leadership	16%
Captain should show leadership	14%
Contingency Management	14%
Communication Environment	12%
FO is assertive when necessary	8%
Evaluation of Plans	8%
Automation Management	8%
Workload Management	6%
SOP Briefing/Planning	4%
Plans Stated	4%

Note: 18 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

2011-2015 Non-Fatal Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	27%
Safety Management	19%
Flight Operations	12%
Flight Ops: Training Systems	11%
Maintenance Operations	8%
Maintenance Ops: SOPs & Checking	8%
Design	6%
Flight Ops: SOPs & Checking	5%
Change Management	3%
Technology & Equipment	3%
Management Decisions	2%
Selection Systems	2%
Ground Operations	1%
Maintenance Ops: Training Systems	1%
Ground Ops: Training Systems	1%
Dispatch Ops: SOPs & Checking	1%
Ops Planning & Scheduling	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	31%
SOP Adherence / SOP Cross-verification	21%
Failure to GOA after Destabilized Approach	9%
Pilot-to-Pilot Communication	4%
Callouts	3%
Crew to External Communication	2%
Ground Crew	2%
Normal Checklist	2%
Automation	1%
Ground Navigation	1%
Abnormal Checklist	1%
Systems / Radios / Instruments	1%
Briefings	1%
ATC	1%

2011-2015 Non-Fatal Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	28%
Aircraft Malfunction	23%
Wind/Windshear/Gusty wind	18%
Airport Facilities	17%
Gear / Tire	15%
Maintenance Events	11%
Contaminated runway/taxiway - poor braking action	9%
Poor visibility / IMC	8%
Air Traffic Services	7%
Ground Events	7%
Nav Aids	6%
Ground-based nav aid malfunction or not available	6%
Thunderstorms	6%
Lack of Visual Reference	6%
Wildlife/Birds/Foreign Object	6%
Optical Illusion / visual mis-perception	4%
Fire / Smoke (Cockpit/Cabin/Cargo)	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Inad overrun area/trench/ditch/prox of structures	3%
Airport perimeter control/fencing/wildlife control	3%
Operational Pressure	2%
Fatigue	2%
Terrain / Obstacles	2%
Secondary Flight Controls	1%
Traffic	1%
Extensive / Uncontained Engine Failure	1%
Hydraulic System Failure	1%
Flight Controls	1%
Brakes	1%
Icing Conditions	1%
Contained Engine Failure/Powerplant Malfunction	1%
Dispatch / Paperwork	1%
Crew Incapacitation	1%

2011-2015 Non-Fatal Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	25%
Vertical / Lateral / Speed Deviation	17%
Unstable Approach	10%
Continued Landing after Unstable Approach	9%
Operation Outside Aircraft Limitations	6%
Loss of aircraft control while on the ground	6%
Abrupt Aircraft Control	6%
Brakes / Thrust Reversers / Ground Spoilers	4%
Unnecessary Weather Penetration	4%
Ramp movements	3%
Flight Controls / Automation	1%
Weight & Balance	1%
Landing Gear	1%
Engine	1%
Wrong taxiway / ramp / gate / hold spot	1%
Controlled Flight Towards Terrain	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	20%
Monitor / Cross-check	13%
Contingency Management	6%
Leadership	5%
Taxiway / Runway Management	5%
Captain should show leadership	4%
Automation Management	3%
FO is assertive when necessary	3%
Communication Environment	3%
Evaluation of Plans	2%
Plans Stated	2%
Workload Management	2%

Note: 65 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

2011-2015 IOSA Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	17%
Flight Operations	13%
Safety Management	11%
Flight Ops: Training Systems	11%
Maintenance Operations	8%
Maintenance Ops: SOPs & Checking	8%
Design	8%
Change Management	5%
Technology & Equipment	4%
Flight Ops: SOPs & Checking	3%
Ops Planning & Scheduling	2%
Ground Operations	2%
Management Decisions	1%
Selection Systems	1%
Maintenance Ops: Training Systems	1%
Ground Ops: Training Systems	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	28%
SOP Adherence / SOP Cross-verification	20%
Pilot-to-Pilot Communication	7%
Failure to GOA after Destabilized Approach	6%
Callouts	6%
Ground Crew	3%
Crew to External Communication	3%
Automation	3%
Abnormal Checklist	2%
Ground Navigation	2%
Briefings	1%
Systems / Radios / Instruments	1%
ATC	1%
Normal Checklist	1%

2011-2015 IOSA Aircraft Accidents

THREATS

	Percentage Contribution
Aircraft Malfunction	27%
Meteorology	26%
Wind/Windshear/Gusty wind	16%
Gear / Tire	16%
Maintenance Events	12%
Air Traffic Services	12%
Airport Facilities	11%
Ground Events	9%
Poor visibility / IMC	6%
Thunderstorms	6%
Contaminated runway/taxiway - poor braking action	6%
Nav Aids	6%
Ground-based nav aid malfunction or not available	6%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Optical Illusion / visual mis-perception	4%
Wildlife/Birds/Foreign Object	4%
Fatigue	4%
Lack of Visual Reference	4%
Poor/faint marking/signs or runway/taxiway closure	3%
Traffic	3%
Operational Pressure	3%
Inad overrun area/trench/ditch/prox of structures	2%
Secondary Flight Controls	2%
Flight Controls	2%
Icing Conditions	2%
Contained Engine Failure/Powerplant Malfunction	2%
Hydraulic System Failure	1%
Dangerous Goods	1%
Extensive / Uncontained Engine Failure	1%
Terrain / Obstacles	1%
Airport perimeter control/fencing/wildlife control	1%
Spatial Disorientation / somatogravic illusion	1%
Electrical Power Generation Failure	1%

2011-2015 IOSA Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	20%
Vertical / Lateral / Speed Deviation	15%
Unstable Approach	9%
Operation Outside Aircraft Limitations	9%
Abrupt Aircraft Control	7%
Continued Landing after Unstable Approach	6%
Unnecessary Weather Penetration	5%
Loss of aircraft control while on the ground	4%
Ramp movements	4%
Brakes / Thrust Reversers / Ground Spoilers	4%
Engine	2%
Wrong taxiway / ramp / gate / hold spot	1%
Weight & Balance	1%
Flight Controls / Automation	1%
Controlled Flight Towards Terrain	1%
Landing Gear	1%
Proceeding toward wrong taxiway / runway	1%
Rejected Take-off after V1	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	19%
Monitor / Cross-check	13%
Leadership	9%
Contingency Management	8%
Communication Environment	6%
Captain should show leadership	5%
Taxiway / Runway Management	5%
FO is assertive when necessary	4%
Evaluation of Plans	3%
Automation Management	2%
Plans Stated	1%
Workload Management	1%

Note: 19 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

2011-2015 Non-IOSA Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	42%
Safety Management	32%
Flight Operations	16%
Flight Ops: Training Systems	12%
Flight Ops: SOPs & Checking	10%
Technology & Equipment	10%
Maintenance Ops: SOPs & Checking	7%
Maintenance Operations	7%
Selection Systems	4%
Design	3%
Management Decisions	3%
Dispatch Ops: SOPs & Checking	2%
Change Management	2%
Dispatch	2%
Maintenance Ops: Training Systems	1%
Ops Planning & Scheduling	1%
Ground Operations	1%
Ground Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	32%
SOP Adherence / SOP Cross-verification	26%
Failure to GOA after Destabilized Approach	10%
Callouts	3%
Pilot-to-Pilot Communication	3%
Systems / Radios / Instruments	3%
Normal Checklist	2%
Documentation	2%
Crew to External Communication	1%
Wrong ATIS or Clearance Recorded	1%
Abnormal Checklist	1%
Wrong Weight & Balance / Fuel Information	1%
Ground Navigation	1%
Ground Crew	1%
Automation	1%
ATC	1%

2011-2015 Non-IOSA Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	34%
Aircraft Malfunction	22%
Airport Facilities	17%
Wind/Windshear/Gusty wind	17%
Poor visibility / IMC	15%
Nav Aids	13%
Ground-based nav aid malfunction or not available	13%
Gear / Tire	11%
Contaminated runway/taxiway - poor braking action	9%
Maintenance Events	9%
Lack of Visual Reference	9%
Thunderstorms	8%
Wildlife/Birds/Foreign Object	6%
Air Traffic Services	5%
Terrain / Obstacles	4%
Optical Illusion / visual mis-perception	4%
Fire / Smoke (Cockpit/Cabin/Cargo)	4%
Airport perimeter control/fencing/wildlife control	4%
Inad overrun area/trench/ditch/prox of structures	3%
Poor/faint marking/signs or runway/taxiway closure	3%
Ground Events	3%
Operational Pressure	3%
Contained Engine Failure/Powerplant Malfunction	3%
Crew Incapacitation	2%
Fatigue	2%
Icing Conditions	2%
Brakes	2%
Extensive / Uncontained Engine Failure	2%
Dispatch / Paperwork	1%
Hydraulic System Failure	1%
Primary Flight Controls	1%
Secondary Flight Controls	1%
Spatial Disorientation / somatogravic illusion	1%
Manuals / Charts / Checklists	1%
Flight Controls	1%

2011-2015 Non-IOSA Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	23%
Vertical / Lateral / Speed Deviation	22%
Continued Landing after Unstable Approach	11%
Unstable Approach	10%
Unnecessary Weather Penetration	6%
Operation Outside Aircraft Limitations	6%
Loss of aircraft control while on the ground	5%
Abrupt Aircraft Control	4%
Controlled Flight Towards Terrain	4%
Brakes / Thrust Reversers / Ground Spoilers	3%
Flight Controls / Automation	2%
Engine	2%
Landing Gear	2%
Weight & Balance	1%
Ramp movements	1%
Wrong taxiway / ramp / gate / hold spot	1%
Unauthorized Airspace Penetration	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	28%
Monitor / Cross-check	18%
Contingency Management	6%
Leadership	6%
Captain should show leadership	5%
Automation Management	5%
Taxiway / Runway Management	4%
Workload Management	3%
FO is assertive when necessary	3%
Evaluation of Plans	3%
Communication Environment	3%
Plans Stated	3%
SOP Briefing/Planning	2%

Note: 64 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Controlled Flight into Terrain

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	90%
Technology & Equipment	75%
Safety Management	55%
Flight Operations	20%
Flight Ops: SOPs & Checking	15%
Flight Ops: Training Systems	10%
Selection Systems	5%
Management Decisions	5%

THREATS

	Percentage Contribution
Nav Aids	60%
Ground-based nav aid malfunction or not available	60%
Meteorology	50%
Poor visibility / IMC	40%
Air Traffic Services	25%
Terrain / Obstacles	20%
Lack of Visual Reference	15%
Wind/Windshear/Gusty wind	10%
Fatigue	10%
Optical Illusion / visual mis-perception	10%
Thunderstorms	10%
Crew Incapacitation	10%
Spatial Disorientation / somatogravic illusion	5%
Operational Pressure	5%

Controlled Flight into Terrain

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	50%
Callouts	10%
Manual Handling / Flight Controls	10%
Systems / Radios / Instruments	10%
Failure to GOA after Destabilized Approach	5%
Documentation	5%
Wrong ATIS or Clearance Recorded	5%
Pilot-to-Pilot Communication	5%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	50%
Unnecessary Weather Penetration	15%
Unstable Approach	10%
Continued Landing after Unstable Approach	5%
Long/floated/bounced/firm/off-center/crabbed land	5%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	50%
Monitor / Cross-check	50%
Automation Management	10%
SOP Briefing/Planning	10%
FO is assertive when necessary	10%
Plans Stated	10%
Leadership	10%
Communication Environment	10%
Contingency Management	5%
Captain should show leadership	5%
Evaluation of Plans	5%
Workload Management	5%

Note: 8 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Loss of Control In-flight

LATENT CONDITIONS

	Percentage Contribution
Safety Management	38%
Flight Operations	29%
Regulatory Oversight	29%
Flight Ops: Training Systems	21%
Flight Ops: SOPs & Checking	17%
Selection Systems	13%
Change Management	8%
Maintenance Operations	8%
Maintenance Ops: SOPs & Checking	8%
Design	4%
Dispatch Ops: SOPs & Checking	4%
Management Decisions	4%
Technology & Equipment	4%
Dispatch	4%
Ops Planning & Scheduling	4%

THREATS

	Percentage Contribution
Meteorology	42%
Aircraft Malfunction	42%
Contained Engine Failure/Powerplant Malfunction	21%
Icing Conditions	17%
Thunderstorms	17%
Lack of Visual Reference	13%
Poor visibility / IMC	13%
Wind/Windshear/Gusty wind	8%
Nav Aids	8%
Fire / Smoke (Cockpit/Cabin/Cargo)	8%
Ground-based nav aid malfunction or not available	8%
Operational Pressure	8%
Maintenance Events	8%
Air Traffic Services	4%
Gear / Tire	4%
Fatigue	4%

Loss of Control In-flight

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	38%
SOP Adherence / SOP Cross-verification	38%
Pilot-to-Pilot Communication	17%
Callouts	8%
Abnormal Checklist	8%
Failure to GOA after Destabilized Approach	4%
Automation	4%
Systems / Radios / Instruments	4%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	25%
Operation Outside Aircraft Limitations	21%
Unnecessary Weather Penetration	21%
Unstable Approach	13%
Engine	8%
Abrupt Aircraft Control	8%
Flight Controls / Automation	8%
Brakes / Thrust Reversers / Ground Spoilers	4%
Continued Landing after Unstable Approach	4%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	46%
Leadership	21%
Captain should show leadership	21%
Contingency Management	21%
Communication Environment	13%
Monitor / Cross-check	13%
Evaluation of Plans	8%
Automation Management	4%
FO is assertive when necessary	4%

Note: 7 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Mid-air Collision

At least three accidents are required before the accident classification is provided.
This category only contained 2 accidents in the past 5 years.

Addendum A

Top Contributing Factors – Section 4

Runway/Taxiway Excursion

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	43%
Safety Management	35%
Flight Ops: Training Systems	16%
Flight Operations	16%
Flight Ops: SOPs & Checking	9%
Change Management	4%
Ops Planning & Scheduling	3%
Design	3%
Selection Systems	3%
Maintenance Ops: SOPs & Checking	1%
Management Decisions	1%
Maintenance Operations	1%
Technology & Equipment	1%
Dispatch Ops: SOPs & Checking	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	42%
SOP Adherence / SOP Cross-verification	30%
Failure to GOA after Destabilized Approach	19%
Pilot-to-Pilot Communication	6%
Callouts	4%
Normal Checklist	3%
Systems / Radios / Instruments	1%
Ground Navigation	1%
Automation	1%
Briefings	1%
Abnormal Checklist	1%

Runway/Taxiway Excursion

THREATS

	Percentage Contribution
Meteorology	48%
Airport Facilities	39%
Contaminated runway/taxiway - poor braking action	32%
Wind/Windshear/Gusty wind	26%
Poor visibility / IMC	19%
Lack of Visual Reference	14%
Thunderstorms	13%
Ground-based nav aid malfunction or not available	13%
Nav Aids	13%
Aircraft Malfunction	12%
Air Traffic Services	9%
Fatigue	6%
Poor/faint marking/signs or runway/taxiway closure	4%
Inad overrun area/trench/ditch/prox of structures	4%
Contained Engine Failure/Powerplant Malfunction	3%
Optical Illusion / visual mis-perception	3%
Brakes	3%
Terrain / Obstacles	3%
Maintenance Events	1%
Crew Incapacitation	1%
Gear / Tire	1%
Secondary Flight Controls	1%
Flight Controls	1%
Airport perimeter control/fencing/wildlife control	1%
Operational Pressure	1%

Runway/Taxiway Excursion

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	46%
Vertical / Lateral / Speed Deviation	23%
Continued Landing after Unstable Approach	19%
Unstable Approach	15%
Loss of aircraft control while on the ground	13%
Brakes / Thrust Reversers / Ground Spoilers	10%
Unnecessary Weather Penetration	6%
Operation Outside Aircraft Limitations	6%
Abrupt Aircraft Control	4%
Flight Controls / Automation	3%
Engine	1%
Weight & Balance	1%

COUNTERMEASURES

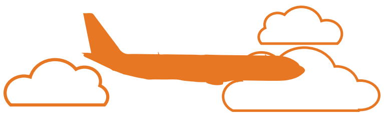
	Percentage Contribution
Overall Crew Performance	33%
Monitor / Cross-check	25%
Taxiway / Runway Management	12%
Leadership	10%
Contingency Management	10%
FO is assertive when necessary	7%
Captain should show leadership	7%
Communication Environment	6%
Plans Stated	4%
Evaluation of Plans	3%
Automation Management	3%
Workload Management	1%
SOP Briefing/Planning	1%

Note: 21 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

In-flight Damage



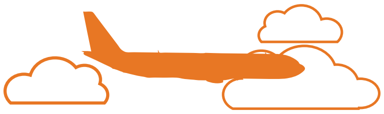
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	23%
Maintenance Operations	13%
Maintenance Ops: SOPs & Checking	13%
Design	10%
Safety Management	8%
Change Management	3%
Technology & Equipment	3%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	13%
Pilot-to-Pilot Communication	5%
Automation	3%
Callouts	3%
Systems / Radios / Instruments	3%
Ground Navigation	3%

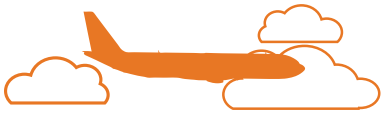
In-flight Damage



THREATS

	Percentage Contribution
Wildlife/Birds/Foreign Object	36%
Aircraft Malfunction	31%
Maintenance Events	15%
Airport Facilities	15%
Meteorology	15%
Airport perimeter control/fencing/wildlife control	13%
Fire / Smoke (Cockpit/Cabin/Cargo)	13%
Extensive / Uncontained Engine Failure	10%
Wind/Windshear/Gusty wind	8%
Thunderstorms	8%
Flight Controls	5%
Optical Illusion / visual mis-perception	5%
Ground-based nav aid malfunction or not available	5%
Nav Aids	5%
Poor visibility / IMC	5%
Contaminated runway/taxiway - poor braking action	5%
Gear / Tire	5%
Dangerous Goods	5%
Secondary Flight Controls	3%
Lack of Visual Reference	3%
Air Traffic Services	3%
Inad overrun area/trench/ditch/prox of structures	3%
Primary Flight Controls	3%
Contained Engine Failure/Powerplant Malfunction	3%
Terrain / Obstacles	3%

In-flight Damage



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	10%
Operation Outside Aircraft Limitations	5%
Long/floated/bounced/firm/off-center/crabbed land	5%
Unstable Approach	3%
Abrupt Aircraft Control	3%
Wrong taxiway / ramp / gate / hold spot	3%
Continued Landing after Unstable Approach	3%

COUNTERMEASURES

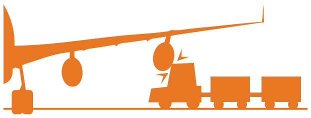
	Percentage Contribution
Leadership	5%
Automation Management	5%
Communication Environment	5%
Contingency Management	3%
FO is assertive when necessary	3%
Overall Crew Performance	3%
Captain should show leadership	3%
Taxiway / Runway Management	3%
Evaluation of Plans	3%

Note: 1 accident was not classified due to insufficient data; this accident was subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Ground Damage



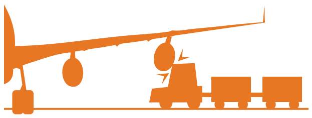
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	22%
Safety Management	15%
Ground Operations	10%
Maintenance Operations	5%
Maintenance Ops: SOPs & Checking	5%
Flight Operations	5%
Ground Ops: Training Systems	5%
Flight Ops: SOPs & Checking	5%
Design	2%
Ground Ops: SOPs & Checking	2%
Change Management	2%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	15%
Ground Crew	12%
Crew to External Communication	12%
Ground Navigation	5%
Abnormal Checklist	2%
Systems / Radios / Instruments	2%
Manual Handling / Flight Controls	2%
ATC	2%
Normal Checklist	2%

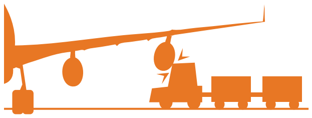
Ground Damage



THREATS

	Percentage Contribution
Ground Events	41%
Aircraft Malfunction	17%
Air Traffic Services	17%
Airport Facilities	17%
Fire / Smoke (Cockpit/Cabin/Cargo)	15%
Maintenance Events	10%
Traffic	7%
Inad overrun area/trench/ditch/prox of structures	7%
Poor/faint marking/signs or runway/taxiway closure	7%
Meteorology	5%
Optical Illusion / visual mis-perception	5%
Hydraulic System Failure	5%
Wildlife/Birds/Foreign Object	2%
Brakes	2%
Secondary Flight Controls	2%
Wind/Windshear/Gusty wind	2%
Airport perimeter control/fencing/wildlife control	2%
Gear / Tire	2%
Manuals / Charts / Checklists	2%
Operational Pressure	2%
Thunderstorms	2%

Ground Damage



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Ramp movements	20%
Loss of aircraft control while on the ground	10%
Brakes / Thrust Reversers / Ground Spoilers	5%
Wrong taxiway / ramp / gate / hold spot	5%
Engine	2%
Proceeding toward wrong taxiway / runway	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	12%
Taxiway / Runway Management	12%
Monitor / Cross-check	7%
Leadership	2%
Plans Stated	2%
Workload Management	2%
FO is assertive when necessary	2%

Note: 8 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Undershoot

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	70%
Safety Management	60%
Flight Operations	40%
Flight Ops: SOPs & Checking	30%
Management Decisions	20%
Flight Ops: Training Systems	20%
Change Management	10%
Selection Systems	10%
Dispatch	10%
Technology & Equipment	10%
Ops Planning & Scheduling	10%
Dispatch Ops: SOPs & Checking	10%

THREATS

	Percentage Contribution
Meteorology	80%
Poor visibility / IMC	50%
Wind/Windshear/Gusty wind	40%
Ground-based nav aid malfunction or not available	30%
Nav Aids	30%
Optical Illusion / visual mis-perception	20%
Airport Facilities	20%
Air Traffic Services	10%
Icing Conditions	10%
Lack of Visual Reference	10%
Thunderstorms	10%
Poor/faint marking/signs or runway/taxiway closure	10%
Contaminated runway/taxiway - poor braking action	10%

Undershoot

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	50%
SOP Adherence / SOP Cross-verification	50%
Failure to GOA after Destabilized Approach	30%
Callouts	20%
Wrong ATIS or Clearance Recorded	10%
Pilot-to-Pilot Communication	10%
Documentation	10%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	80%
Unnecessary Weather Penetration	30%
Continued Landing after Unstable Approach	20%
Loss of aircraft control while on the ground	10%
Unstable Approach	10%

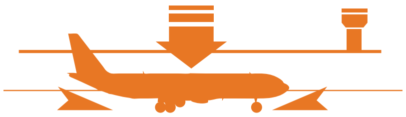
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	40%
Monitor / Cross-check	20%
Leadership	10%
Captain should show leadership	10%
Automation Management	10%
Workload Management	10%

Note: 2 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A
Top Contributing Factors – Section 4

Hard Landing



LATENT CONDITIONS

	Percentage Contribution
Flight Operations	28%
Flight Ops: Training Systems	26%
Safety Management	16%
Regulatory Oversight	16%
Flight Ops: SOPs & Checking	9%
Selection Systems	7%
Management Decisions	5%
Dispatch	2%
Change Management	2%
Dispatch Ops: SOPs & Checking	2%
Technology & Equipment	2%

THREATS

	Percentage Contribution
Meteorology	49%
Wind/Windshear/Gusty wind	37%
Poor visibility / IMC	9%
Lack of Visual Reference	7%
Thunderstorms	7%
Optical Illusion / visual mis-perception	7%
Airport Facilities	7%
Operational Pressure	7%
Nav Aids	5%
Air Traffic Services	5%
Poor/faint marking/signs or runway/taxiway closure	5%
Ground-based nav aid malfunction or not available	5%
Icing Conditions	5%
Terrain / Obstacles	2%
Dispatch / Paperwork	2%
Airport perimeter control/fencing/wildlife control	2%
Gear / Tire	2%
Aircraft Malfunction	2%

Hard Landing

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	74%
SOP Adherence / SOP Cross-verification	23%
Failure to GOA after Destabilized Approach	19%
Callouts	5%
Pilot-to-Pilot Communication	2%
Automation	2%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	63%
Vertical / Lateral / Speed Deviation	33%
Unstable Approach	30%
Abrupt Aircraft Control	23%
Continued Landing after Unstable Approach	19%
Operation Outside Aircraft Limitations	12%
Unnecessary Weather Penetration	7%
Loss of aircraft control while on the ground	2%
Engine	2%
Flight Controls / Automation	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	35%
Monitor / Cross-check	21%
Contingency Management	9%
Evaluation of Plans	5%
Automation Management	5%
Plans Stated	2%
Taxiway / Runway Management	2%
Leadership	2%
FO is assertive when necessary	2%
Workload Management	2%

Note: 2 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Gear-up Landing/Gear Collapse

LATENT CONDITIONS

	Percentage Contribution
Maintenance Ops: SOPs & Checking	30%
Maintenance Operations	30%
Design	15%
Regulatory Oversight	15%
Safety Management	11%
Maintenance Ops: Training Systems	9%
Flight Operations	2%
Flight Ops: Training Systems	2%

THREATS

	Percentage Contribution
Aircraft Malfunction	81%
Gear / Tire	79%
Maintenance Events	40%
Meteorology	4%
Wind/Windshear/Gusty wind	4%
Hydraulic System Failure	4%
Flight Controls	2%
Secondary Flight Controls	2%
Electrical Power Generation Failure	2%
Fatigue	2%
Inad overrun area/trench/ditch/prox of structures	2%
Wildlife/Birds/Foreign Object	2%
Airport Facilities	2%

Gear-up Landing/Gear Collapse

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	4%
Manual Handling / Flight Controls	4%
Crew to External Communication	2%
ATC	2%
Normal Checklist	2%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Landing Gear	6%

COUNTERMEASURES

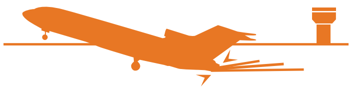
	Percentage Contribution
Contingency Management	2%
Overall Crew Performance	2%
Monitor / Cross-check	2%
Workload Management	2%

Note: 20 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Tailstrike



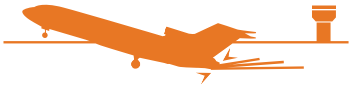
LATENT CONDITIONS

	Percentage Contribution
Flight Ops: Training Systems	18%
Regulatory Oversight	18%
Flight Operations	18%
Technology & Equipment	14%
Change Management	9%
Design	5%
Safety Management	5%

THREATS

	Percentage Contribution
Meteorology	32%
Wind/Windshear/Gusty wind	27%
Nav Aids	9%
Ground-based nav aid malfunction or not available	9%
Fatigue	5%
Terrain / Obstacles	5%
Lack of Visual Reference	5%
Spatial Disorientation / somatogravic illusion	5%
Wildlife/Birds/Foreign Object	5%
Poor visibility / IMC	5%

Tailstrike



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	73%
SOP Adherence / SOP Cross-verification	27%
Pilot-to-Pilot Communication	9%
Failure to GOA after Destabilized Approach	9%
Wrong Weight & Balance / Fuel Information	5%
Documentation	5%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	36%
Operation Outside Aircraft Limitations	27%
Continued Landing after Unstable Approach	14%
Weight & Balance	14%
Vertical / Lateral / Speed Deviation	14%
Unstable Approach	9%
Abrupt Aircraft Control	5%
Brakes / Thrust Reversers / Ground Spoilers	5%
Unnecessary Weather Penetration	5%

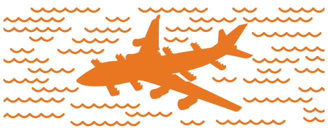
COUNTERMEASURES

	Percentage Contribution
Monitor / Cross-check	18%
Overall Crew Performance	18%
Captain should show leadership	14%
Contingency Management	14%
Leadership	14%
Automation Management	9%

Note: 4 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Top Contributing Factors – Section 4

Off-Airport Landing/Ditching



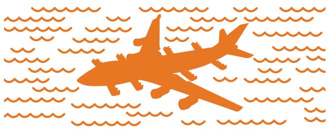
LATENT CONDITIONS

	Percentage Contribution
Flight Ops: Training Systems	67%
Flight Operations	67%
Flight Ops: SOPs & Checking	33%
Regulatory Oversight	33%
Safety Management	33%

THREATS

	Percentage Contribution
Maintenance Events	67%
Aircraft Malfunction	33%
Extensive / Uncontained Engine Failure	33%
Fire / Smoke (Cockpit/Cabin/Cargo)	33%

Off-Airport Landing/Ditching



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	67%
SOP Adherence / SOP Cross-verification	67%
Pilot-to-Pilot Communication	33%
Callouts	33%
Abnormal Checklist	33%
Systems / Radios / Instruments	33%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Landing Gear	33%
Engine	33%
Operation Outside Aircraft Limitations	33%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	67%
Monitor / Cross-check	33%
Communication Environment	33%
FO is assertive when necessary	33%
Captain should show leadership	33%
Leadership	33%
Contingency Management	33%
Evaluation of Plans	33%
Workload Management	33%

Note: 2 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Jet Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	26%
Safety Management	19%
Flight Operations	15%
Flight Ops: Training Systems	12%
Maintenance Ops: SOPs & Checking	9%
Maintenance Operations	9%
Design	6%
Technology & Equipment	6%
Flight Ops: SOPs & Checking	5%
Change Management	5%
Selection Systems	3%
Management Decisions	2%
Ground Operations	2%
Ops Planning & Scheduling	2%
Dispatch Ops: SOPs & Checking	1%
Dispatch	1%
Maintenance Ops: Training Systems	1%
Ground Ops: SOPs & Checking	1%
Ground Ops: Training Systems	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	29%
SOP Adherence / SOP Cross-verification	25%
Failure to GOA after Destabilized Approach	9%
Callouts	5%
Pilot-to-Pilot Communication	5%
Systems / Radios / Instruments	3%
Documentation	2%
Ground Navigation	2%
Automation	2%
Normal Checklist	1%
Ground Crew	1%
Wrong ATIS or Clearance Recorded	1%
Abnormal Checklist	1%
Briefings	1%
Crew to External Communication	1%
ATC	1%
Wrong Weight & Balance / Fuel Information	1%

Jet Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	32%
Aircraft Malfunction	21%
Wind/Windshear/Gusty wind	17%
Airport Facilities	14%
Maintenance Events	14%
Gear / Tire	12%
Air Traffic Services	12%
Poor visibility / IMC	11%
Ground-based nav aid malfunction or not available	9%
Nav Aids	9%
Contaminated runway/taxiway - poor braking action	9%
Thunderstorms	9%
Lack of Visual Reference	6%
Ground Events	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Wildlife/Birds/Foreign Object	5%
Optical Illusion / visual mis-perception	5%
Poor/faint marking/signs or runway/taxiway closure	4%
Fatigue	4%
Operational Pressure	3%
Inad overrun area/trench/ditch/prox of structures	3%
Terrain / Obstacles	3%
Traffic	2%
Secondary Flight Controls	2%
Hydraulic System Failure	2%
Icing Conditions	2%
Flight Controls	2%
Crew Incapacitation	2%
Contained Engine Failure/Powerplant Malfunction	1%
Extensive / Uncontained Engine Failure	1%
Dangerous Goods	1%
Dispatch / Paperwork	1%
Airport perimeter control/fencing/wildlife control	1%
Manuals / Charts / Checklists	1%
Spatial Disorientation / somatogravic illusion	1%
Electrical Power Generation Failure	1%

Jet Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	25%
Vertical / Lateral / Speed Deviation	20%
Unstable Approach	10%
Continued Landing after Unstable Approach	9%
Operation Outside Aircraft Limitations	8%
Unnecessary Weather Penetration	6%
Abrupt Aircraft Control	6%
Brakes / Thrust Reversers / Ground Spoilers	5%
Ramp movements	4%
Loss of aircraft control while on the ground	4%
Weight & Balance	2%
Flight Controls / Automation	2%
Controlled Flight Towards Terrain	2%
Wrong taxiway / ramp / gate / hold spot	1%
Engine	1%
Rejected Take-off after V1	1%
Proceeding toward wrong taxiway / runway	1%
Landing Gear	1%
Unauthorized Airspace Penetration	1%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	21%
Monitor / Cross-check	17%
Leadership	8%
Contingency Management	8%
Taxiway / Runway Management	7%
FO is assertive when necessary	5%
Captain should show leadership	5%
Communication Environment	4%
Automation Management	4%
Plans Stated	2%
Evaluation of Plans	2%
Workload Management	2%
SOP Briefing/Planning	1%

Note: 29 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum A

Top Contributing Factors – Section 4

Turboprop Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	38%
Safety Management	29%
Flight Operations	14%
Flight Ops: Training Systems	11%
Technology & Equipment	9%
Flight Ops: SOPs & Checking	9%
Maintenance Operations	5%
Maintenance Ops: SOPs & Checking	5%
Design	4%
Management Decisions	3%
Selection Systems	3%
Dispatch Ops: SOPs & Checking	2%
Maintenance Ops: Training Systems	2%
Dispatch	1%
Change Management	1%
Ops Planning & Scheduling	1%
Ground Ops: Training Systems	1%
Ground Operations	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	32%
SOP Adherence / SOP Cross-verification	22%
Failure to GOA after Destabilized Approach	8%
Pilot-to-Pilot Communication	5%
Crew to External Communication	3%
Callouts	3%
Normal Checklist	2%
Abnormal Checklist	2%
Ground Crew	2%
Systems / Radios / Instruments	1%
Automation	1%
Ground Navigation	1%
ATC	1%

Turboprop Aircraft Accidents

THREATS

	Percentage Contribution
Meteorology	29%
Aircraft Malfunction	27%
Wind/Windshear/Gusty wind	16%
Airport Facilities	15%
Gear / Tire	14%
Poor visibility / IMC	12%
Ground-based nav aid malfunction or not available	11%
Nav Aids	11%
Lack of Visual Reference	7%
Maintenance Events	6%
Contaminated runway/taxiway - poor braking action	6%
Ground Events	6%
Wildlife/Birds/Foreign Object	6%
Thunderstorms	5%
Contained Engine Failure/Powerplant Malfunction	4%
Airport perimeter control/fencing/wildlife control	4%
Fire / Smoke (Cockpit/Cabin/Cargo)	4%
Air Traffic Services	3%
Icing Conditions	3%
Operational Pressure	3%
Inad overrun area/trench/ditch/prox of structures	3%
Terrain / Obstacles	3%
Optical Illusion / visual mis-perception	3%
Extensive / Uncontained Engine Failure	2%
Poor/faint marking/signs or runway/taxiway closure	2%
Brakes	2%
Fatigue	1%
Flight Controls	1%
Spatial Disorientation / somatogravic illusion	1%
Crew Incapacitation	1%
Primary Flight Controls	1%
Hydraulic System Failure	1%

Turboprop Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	17%
Long/floated/bounced/firm/off-center/crabbed land	17%
Unstable Approach	9%
Continued Landing after Unstable Approach	9%
Operation Outside Aircraft Limitations	6%
Loss of aircraft control while on the ground	6%
Unnecessary Weather Penetration	5%
Controlled Flight Towards Terrain	5%
Abrupt Aircraft Control	5%
Engine	3%
Flight Controls / Automation	2%
Landing Gear	2%
Ramp movements	1%
Wrong taxiway / ramp / gate / hold spot	1%
Brakes / Thrust Reversers / Ground Spoilers	1%
Weight & Balance	1%

COUNTERMEASURES

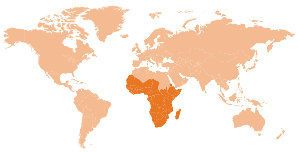
	Percentage Contribution
Overall Crew Performance	27%
Monitor / Cross-check	14%
Contingency Management	6%
Captain should show leadership	6%
Leadership	6%
Evaluation of Plans	4%
Workload Management	4%
Communication Environment	4%
Automation Management	3%
FO is assertive when necessary	2%
Plans Stated	2%
SOP Briefing/Planning	1%
Taxiway / Runway Management	1%

Note: 54 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum B

Top Contributing Factors – Section 5

Africa Aircraft Accidents



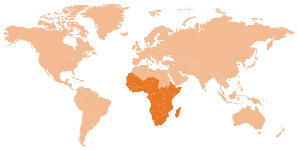
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	50%
Safety Management	40%
Flight Ops: SOPs & Checking	13%
Flight Operations	13%
Technology & Equipment	10%
Flight Ops: Training Systems	10%
Selection Systems	7%
Dispatch Ops: SOPs & Checking	7%
Maintenance Ops: SOPs & Checking	7%
Ops Planning & Scheduling	3%
Maintenance Operations	3%
Management Decisions	3%
Dispatch	3%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	23%
SOP Adherence / SOP Cross-verification	20%
Failure to GOA after Destabilized Approach	17%
Pilot-to-Pilot Communication	10%
Callouts	7%
Documentation	3%
Systems / Radios / Instruments	3%
Wrong ATIS or Clearance Recorded	3%
Ground Navigation	3%
Abnormal Checklist	3%

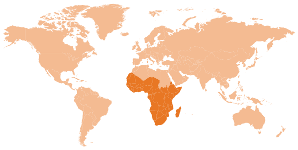
Africa Aircraft Accidents



THREATS

	Percentage Contribution
Airport Facilities	30%
Meteorology	23%
Aircraft Malfunction	23%
Gear / Tire	20%
Thunderstorms	17%
Contaminated runway/taxiway - poor braking action	17%
Poor visibility / IMC	13%
Maintenance Events	13%
Air Traffic Services	10%
Airport perimeter control/fencing/wildlife control	10%
Nav Aids	10%
Ground-based nav aid malfunction or not available	10%
Wildlife/Birds/Foreign Object	7%
Inad overrun area/trench/ditch/prox of structures	7%
Wind/Windshear/Gusty wind	7%
Manuals / Charts / Checklists	3%
Hydraulic System Failure	3%
Secondary Flight Controls	3%
Operational Pressure	3%
Ground Events	3%
Contained Engine Failure/Powerplant Malfunction	3%
Crew Incapacitation	3%
Lack of Visual Reference	3%

Africa Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	20%
Vertical / Lateral / Speed Deviation	17%
Continued Landing after Unstable Approach	10%
Abrupt Aircraft Control	7%
Flight Controls / Automation	3%
Unnecessary Weather Penetration	3%
Brakes / Thrust Reversers / Ground Spoilers	3%
Wrong taxiway / ramp / gate / hold spot	3%
Engine	3%
Landing Gear	3%
Unauthorized Airspace Penetration	3%
Weight & Balance	3%
Unstable Approach	3%
Loss of aircraft control while on the ground	3%
Ramp movements	3%
Operation Outside Aircraft Limitations	3%

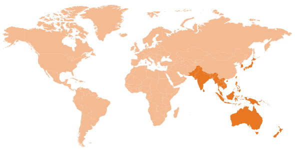
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	23%
Captain should show leadership	10%
Leadership	7%
Plans Stated	7%
Monitor / Cross-check	7%
Automation Management	3%
Communication Environment	3%
FO is assertive when necessary	3%
Contingency Management	3%
Workload Management	3%
Taxiway / Runway Management	3%

Note: 24 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum B
Top Contributing Factors – Section 5

Asia/Pacific Aircraft Accidents



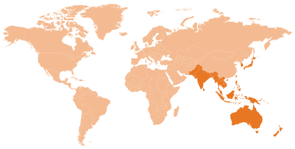
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	55%
Safety Management	39%
Flight Operations	20%
Flight Ops: Training Systems	16%
Flight Ops: SOPs & Checking	9%
Maintenance Ops: SOPs & Checking	5%
Maintenance Operations	5%
Change Management	4%
Technology & Equipment	4%
Management Decisions	3%
Selection Systems	3%
Design	3%
Maintenance Ops: Training Systems	1%
Ground Operations	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	42%
SOP Adherence / SOP Cross-verification	36%
Failure to GOA after Destabilized Approach	11%
Pilot-to-Pilot Communication	9%
Callouts	5%
Crew to External Communication	3%
Automation	3%
Ground Crew	3%
Abnormal Checklist	1%
Systems / Radios / Instruments	1%
ATC	1%

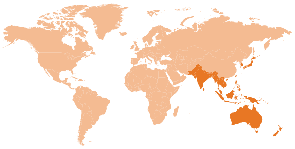
Asia/Pacific Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	32%
Nav Aids	18%
Ground-based nav aid malfunction or not available	18%
Airport Facilities	18%
Wind/Windshear/Gusty wind	16%
Aircraft Malfunction	14%
Poor visibility / IMC	11%
Thunderstorms	9%
Contaminated runway/taxiway - poor braking action	9%
Maintenance Events	8%
Gear / Tire	8%
Lack of Visual Reference	7%
Wildlife/Birds/Foreign Object	7%
Ground Events	5%
Fatigue	4%
Terrain / Obstacles	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Operational Pressure	4%
Optical Illusion / visual mis-perception	3%
Dangerous Goods	3%
Inad overrun area/trench/ditch/prox of structures	3%
Fire / Smoke (Cockpit/Cabin/Cargo)	3%
Airport perimeter control/fencing/wildlife control	3%
Air Traffic Services	1%
Flight Controls	1%
Contained Engine Failure/Powerplant Malfunction	1%
Hydraulic System Failure	1%
Spatial Disorientation / somatogravic illusion	1%
Brakes	1%
Primary Flight Controls	1%
Crew Incapacitation	1%

Asia/Pacific Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	30%
Vertical / Lateral / Speed Deviation	26%
Unstable Approach	18%
Continued Landing after Unstable Approach	18%
Operation Outside Aircraft Limitations	9%
Abrupt Aircraft Control	8%
Unnecessary Weather Penetration	7%
Controlled Flight Towards Terrain	4%
Ramp movements	4%
Loss of aircraft control while on the ground	3%
Flight Controls / Automation	3%
Brakes / Thrust Reversers / Ground Spoilers	3%
Engine	1%

COUNTERMEASURES

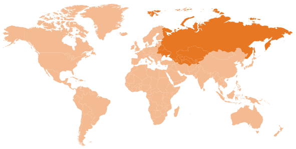
	Percentage Contribution
Overall Crew Performance	31%
Monitor / Cross-check	20%
Contingency Management	11%
Leadership	9%
Captain should show leadership	7%
Automation Management	7%
Communication Environment	5%
FO is assertive when necessary	5%
Evaluation of Plans	4%
Taxiway / Runway Management	3%
Workload Management	1%
SOP Briefing/Planning	1%
Plans Stated	1%

Note: 10 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum B

Top Contributing Factors – Section 5

Commonwealth of Independent States (CIS) Aircraft Accidents



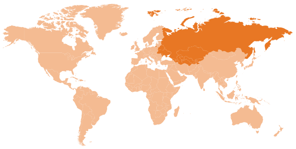
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	54%
Safety Management	50%
Flight Operations	21%
Flight Ops: Training Systems	17%
Technology & Equipment	17%
Flight Ops: SOPs & Checking	13%
Selection Systems	8%
Change Management	8%
Maintenance Operations	8%
Maintenance Ops: SOPs & Checking	4%
Design	4%

FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	46%
Manual Handling / Flight Controls	33%
Callouts	13%
Failure to GOA after Destabilized Approach	13%
Systems / Radios / Instruments	8%
Pilot-to-Pilot Communication	8%
Documentation	4%
Normal Checklist	4%
Wrong ATIS or Clearance Recorded	4%

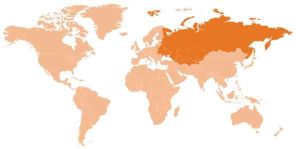
Commonwealth of Independent States (CIS) Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	54%
Poor visibility / IMC	38%
Lack of Visual Reference	21%
Wind/Windshear/Gusty wind	17%
Fire / Smoke (Cockpit/Cabin/Cargo)	17%
Maintenance Events	17%
Aircraft Malfunction	17%
Air Traffic Services	13%
Crew Incapacitation	8%
Nav Aids	8%
Icing Conditions	8%
Operational Pressure	8%
Ground-based nav aid malfunction or not available	8%
Airport Facilities	8%
Poor/faint marking/signs or runway/taxiway closure	4%
Contaminated runway/taxiway - poor braking action	4%
Optical Illusion / visual mis-perception	4%
Dispatch / Paperwork	4%
Extensive / Uncontained Engine Failure	4%
Terrain / Obstacles	4%
Thunderstorms	4%

Commonwealth of Independent States (CIS) Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	50%
Long/floated/bounced/firm/off-center/crabbed land	21%
Unnecessary Weather Penetration	21%
Operation Outside Aircraft Limitations	13%
Unstable Approach	13%
Abrupt Aircraft Control	8%
Brakes / Thrust Reversers / Ground Spoilers	8%
Controlled Flight Towards Terrain	8%
Flight Controls / Automation	4%
Loss of aircraft control while on the ground	4%
Weight & Balance	4%

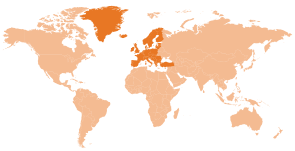
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	38%
Monitor / Cross-check	17%
Contingency Management	13%
Captain should show leadership	8%
Taxiway / Runway Management	8%
Leadership	8%
Automation Management	4%
Plans Stated	4%
Communication Environment	4%

Note: 8 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Top Contributing Factors – Section 5

Europe Aircraft Accidents



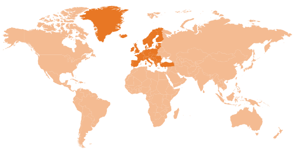
LATENT CONDITIONS

	Percentage Contribution
Flight Operations	12%
Regulatory Oversight	11%
Flight Ops: Training Systems	11%
Safety Management	9%
Design	8%
Technology & Equipment	7%
Maintenance Ops: SOPs & Checking	4%
Ground Operations	4%
Maintenance Operations	4%
Change Management	3%
Flight Ops: SOPs & Checking	3%
Ground Ops: Training Systems	3%
Ground Ops: SOPs & Checking	1%
Dispatch Ops: SOPs & Checking	1%
Selection Systems	1%
Dispatch	1%
Management Decisions	1%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	35%
SOP Adherence / SOP Cross-verification	23%
Failure to GOA after Destabilized Approach	9%
Callouts	3%
Ground Crew	1%
Wrong Weight & Balance / Fuel Information	1%
Documentation	1%
Automation	1%
Crew to External Communication	1%
Abnormal Checklist	1%

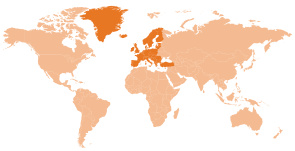
Europe Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	31%
Wind/Windshear/Gusty wind	23%
Aircraft Malfunction	21%
Gear / Tire	12%
Ground Events	11%
Air Traffic Services	9%
Airport Facilities	9%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Thunderstorms	5%
Maintenance Events	5%
Poor visibility / IMC	5%
Contaminated runway/taxiway - poor braking action	4%
Poor/faint marking/signs or runway/taxiway closure	4%
Lack of Visual Reference	3%
Inad overrun area/trench/ditch/prox of structures	3%
Extensive / Uncontained Engine Failure	3%
Icing Conditions	3%
Operational Pressure	3%
Optical Illusion / visual mis-perception	3%
Wildlife/Birds/Foreign Object	3%
Hydraulic System Failure	1%
Ground-based nav aid malfunction or not available	1%
Secondary Flight Controls	1%
Traffic	1%
Contained Engine Failure/Powerplant Malfunction	1%
Nav Aids	1%
Electrical Power Generation Failure	1%
Fatigue	1%
Dispatch / Paperwork	1%
Airport perimeter control/fencing/wildlife control	1%
Flight Controls	1%

Europe Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	23%
Vertical / Lateral / Speed Deviation	12%
Unstable Approach	9%
Operation Outside Aircraft Limitations	9%
Continued Landing after Unstable Approach	8%
Loss of aircraft control while on the ground	7%
Abrupt Aircraft Control	4%
Unnecessary Weather Penetration	4%
Ramp movements	3%
Proceeding toward wrong taxiway / runway	1%
Brakes / Thrust Reversers / Ground Spoilers	1%
Engine	1%
Weight & Balance	1%
Landing Gear	1%

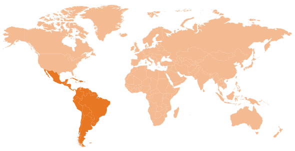
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	20%
Monitor / Cross-check	12%
Contingency Management	9%
Leadership	4%
Taxiway / Runway Management	4%
Captain should show leadership	3%
Automation Management	3%
Evaluation of Plans	3%
Communication Environment	1%
FO is assertive when necessary	1%

Note: 7 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Top Contributing Factors – Section 5

Latin America & the Caribbean Aircraft Accidents



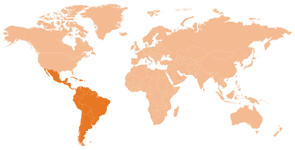
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	26%
Safety Management	23%
Maintenance Operations	19%
Maintenance Ops: SOPs & Checking	19%
Technology & Equipment	6%
Maintenance Ops: Training Systems	6%
Flight Ops: Training Systems	6%
Flight Operations	6%
Flight Ops: SOPs & Checking	6%
Dispatch Ops: SOPs & Checking	3%
Design	3%
Dispatch	3%
Ops Planning & Scheduling	3%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	13%
SOP Adherence / SOP Cross-verification	6%
Pilot-to-Pilot Communication	6%
Failure to GOA after Destabilized Approach	3%
Systems / Radios / Instruments	3%

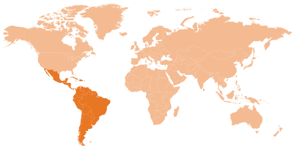
Latin America & the Caribbean Aircraft Accidents



THREATS

	Percentage Contribution
Aircraft Malfunction	45%
Gear / Tire	29%
Maintenance Events	19%
Nav Aids	16%
Ground-based nav aid malfunction or not available	16%
Meteorology	13%
Wildlife/Birds/Foreign Object	10%
Optical Illusion / visual mis-perception	10%
Airport Facilities	10%
Thunderstorms	6%
Brakes	6%
Airport perimeter control/fencing/wildlife control	6%
Contained Engine Failure/Powerplant Malfunction	6%
Contaminated runway/taxiway - poor braking action	6%
Fatigue	6%
Air Traffic Services	3%
Secondary Flight Controls	3%
Traffic	3%
Flight Controls	3%
Wind/Windshear/Gusty wind	3%
Hydraulic System Failure	3%
Icing Conditions	3%
Terrain / Obstacles	3%
Ground Events	3%

Latin America & the Caribbean Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	16%
Vertical / Lateral / Speed Deviation	13%
Continued Landing after Unstable Approach	10%
Unstable Approach	6%
Weight & Balance	3%
Loss of aircraft control while on the ground	3%
Ramp movements	3%
Landing Gear	3%

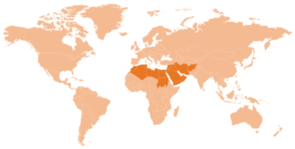
COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	19%
Monitor / Cross-check	16%
Leadership	10%
Communication Environment	10%
Taxiway / Runway Management	6%
FO is assertive when necessary	6%
Captain should show leadership	6%
Workload Management	3%
Automation Management	3%
Plans Stated	3%
Contingency Management	3%
SOP Briefing/Planning	3%
Evaluation of Plans	3%

Note: 8 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Top Contributing Factors – Section 5

Middle East & North Africa Aircraft Accidents



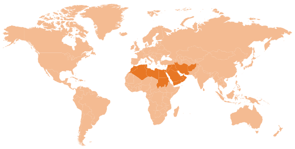
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	21%
Safety Management	16%
Design	16%
Maintenance Ops: SOPs & Checking	11%
Flight Operations	11%
Flight Ops: Training Systems	11%
Maintenance Operations	11%
Flight Ops: SOPs & Checking	5%
Technology & Equipment	5%
Selection Systems	5%

THREATS

	Percentage Contribution
Aircraft Malfunction	37%
Meteorology	26%
Maintenance Events	21%
Gear / Tire	16%
Air Traffic Services	16%
Airport Facilities	16%
Contained Engine Failure/Powerplant Malfunction	16%
Poor visibility / IMC	11%
Lack of Visual Reference	11%
Wind/Windshear/Gusty wind	11%
Poor/faint marking/signs or runway/taxiway closure	11%
Ground-based nav aid malfunction or not available	5%
Nav Aids	5%
Wildlife/Birds/Foreign Object	5%
Traffic	5%
Icing Conditions	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Inad overrun area/trench/ditch/prox of structures	5%

Middle East & North Africa Aircraft Accidents



FLIGHT CREW ERRORS

	Percentage Contribution
SOP Adherence / SOP Cross-verification	26%
Manual Handling / Flight Controls	21%
Normal Checklist	11%
Ground Navigation	11%
Callouts	5%
Crew to External Communication	5%
Systems / Radios / Instruments	5%
Ground Crew	5%
Failure to GOA after Destabilized Approach	5%
Pilot-to-Pilot Communication	5%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Unstable Approach	11%
Long/floated/bounced/firm/off-center/crabbed land	11%
Continued Landing after Unstable Approach	11%
Vertical / Lateral / Speed Deviation	11%
Unnecessary Weather Penetration	11%
Operation Outside Aircraft Limitations	11%
Loss of aircraft control while on the ground	11%
Brakes / Thrust Reversers / Ground Spoilers	11%
Engine	5%
Controlled Flight Towards Terrain	5%
Wrong taxiway / ramp / gate / hold spot	5%

COUNTERMEASURES

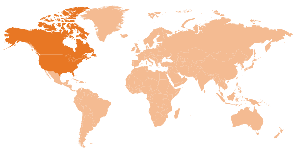
	Percentage Contribution
Overall Crew Performance	32%
Leadership	16%
Taxiway / Runway Management	16%
Monitor / Cross-check	16%
FO is assertive when necessary	16%
Evaluation of Plans	11%
SOP Briefing/Planning	5%
Communication Environment	5%
Captain should show leadership	5%
Plans Stated	5%
Workload Management	5%

Note: 7 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum B

Top Contributing Factors – Section 5

North America Aircraft Accidents



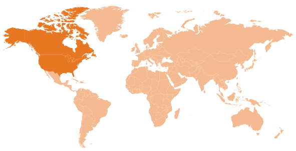
LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	15%
Flight Operations	12%
Technology & Equipment	10%
Maintenance Ops: SOPs & Checking	8%
Maintenance Operations	8%
Design	7%
Flight Ops: Training Systems	7%
Change Management	5%
Management Decisions	5%
Safety Management	3%
Flight Ops: SOPs & Checking	3%
Maintenance Ops: Training Systems	2%
Ops Planning & Scheduling	2%
Selection Systems	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	17%
SOP Adherence / SOP Cross-verification	12%
Normal Checklist	3%
Failure to GOA after Destabilized Approach	3%
Callouts	3%
Crew to External Communication	3%
Ground Crew	2%
Briefings	2%
Ground Navigation	2%
ATC	2%
Systems / Radios / Instruments	2%
Abnormal Checklist	2%
Automation	2%

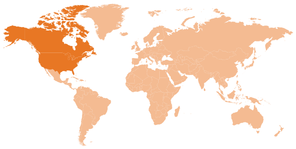
North America Aircraft Accidents



THREATS

	Percentage Contribution
Meteorology	28%
Aircraft Malfunction	27%
Wind/Windshear/Gusty wind	18%
Gear / Tire	15%
Air Traffic Services	13%
Poor visibility / IMC	13%
Airport Facilities	13%
Lack of Visual Reference	12%
Ground-based nav aid malfunction or not available	10%
Nav Aids	10%
Optical Illusion / visual mis-perception	8%
Maintenance Events	8%
Contaminated runway/taxiway - poor braking action	8%
Wildlife/Birds/Foreign Object	7%
Ground Events	7%
Terrain / Obstacles	7%
Fatigue	5%
Fire / Smoke (Cockpit/Cabin/Cargo)	5%
Extensive / Uncontained Engine Failure	3%
Inad overrun area/trench/ditch/prox of structures	3%
Traffic	2%
Spatial Disorientation / somatogravic illusion	2%
Poor/faint marking/signs or runway/taxiway closure	2%
Operational Pressure	2%
Icing Conditions	2%
Thunderstorms	2%

North America Aircraft Accidents



UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Vertical / Lateral / Speed Deviation	13%
Long/floated/bounced/firm/off-center/crabbed land	13%
Controlled Flight Towards Terrain	5%
Loss of aircraft control while on the ground	5%
Abrupt Aircraft Control	3%
Brakes / Thrust Reversers / Ground Spoilers	3%
Unnecessary Weather Penetration	3%
Rejected Take-off after V1	2%
Continued Landing after Unstable Approach	2%
Flight Controls / Automation	2%
Unstable Approach	2%
Landing Gear	2%
Ramp movements	2%
Engine	2%
Wrong taxiway / ramp / gate / hold spot	2%

COUNTERMEASURES

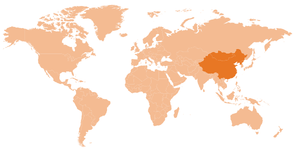
	Percentage Contribution
Monitor / Cross-check	10%
Overall Crew Performance	10%
Contingency Management	3%
Workload Management	3%
Taxiway / Runway Management	3%
Captain should show leadership	2%
Communication Environment	2%
Leadership	2%
Automation Management	2%

Note: 16 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum B

Top Contributing Factors – Section 5

North Asia Aircraft Accidents



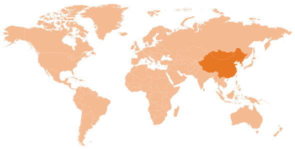
LATENT CONDITIONS

	Percentage Contribution
Safety Management	25%
Flight Ops: Training Systems	25%
Regulatory Oversight	25%
Flight Operations	25%
Flight Ops: SOPs & Checking	17%
Maintenance Ops: SOPs & Checking	8%
Selection Systems	8%
Change Management	8%
Maintenance Operations	8%
Management Decisions	8%
Ops Planning & Scheduling	8%

THREATS

	Percentage Contribution
Meteorology	50%
Wind/Windshear/Gusty wind	42%
Thunderstorms	25%
Aircraft Malfunction	25%
Airport Facilities	17%
Contaminated runway/taxiway - poor braking action	17%
Poor visibility / IMC	8%
Ground-based nav aid malfunction or not available	8%
Nav Aids	8%
Maintenance Events	8%
Secondary Flight Controls	8%
Flight Controls	8%
Gear / Tire	8%

North Asia Aircraft Accidents



FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	67%
SOP Adherence / SOP Cross-verification	17%
Automation	8%
Abnormal Checklist	8%
Briefings	8%
Failure to GOA after Destabilized Approach	8%
Pilot-to-Pilot Communication	8%

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	42%
Operation Outside Aircraft Limitations	25%
Abrupt Aircraft Control	25%
Unstable Approach	25%
Vertical / Lateral / Speed Deviation	25%
Engine	8%
Flight Controls / Automation	8%
Continued Landing after Unstable Approach	8%
Loss of aircraft control while on the ground	8%
Controlled Flight Towards Terrain	8%
Unnecessary Weather Penetration	8%
Brakes / Thrust Reversers / Ground Spoilers	8%

COUNTERMEASURES

	Percentage Contribution
Monitor / Cross-check	58%
Overall Crew Performance	42%
Leadership	17%
Workload Management	17%
Plans Stated	8%
Communication Environment	8%
Evaluation of Plans	8%
FO is assertive when necessary	8%
Contingency Management	8%
Automation Management	8%
Captain should show leadership	8%

Note: 3 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum C

Top Contributing Factors – Section 6

Cargo Aircraft Accidents

LATENT CONDITIONS

	Percentage Contribution
Regulatory Oversight	37%
Safety Management	28%
Maintenance Operations	14%
Maintenance Ops: SOPs & Checking	14%
Technology & Equipment	12%
Flight Operations	7%
Flight Ops: SOPs & Checking	5%
Flight Ops: Training Systems	2%
Dispatch Ops: SOPs & Checking	2%
Design	2%
Maintenance Ops: Training Systems	2%
Management Decisions	2%

FLIGHT CREW ERRORS

	Percentage Contribution
Manual Handling / Flight Controls	23%
SOP Adherence / SOP Cross-verification	9%
Failure to GOA after Destabilized Approach	7%
Normal Checklist	5%
Crew to External Communication	2%
Callouts	2%
ATC	2%

Cargo Aircraft Accidents

THREATS

	Percentage Contribution
Aircraft Malfunction	33%
Meteorology	28%
Airport Facilities	19%
Wind/Windshear/Gusty wind	19%
Gear / Tire	16%
Maintenance Events	12%
Lack of Visual Reference	12%
Poor/faint marking/signs or runway/taxiway closure	9%
Poor visibility / IMC	9%
Contaminated runway/taxiway - poor braking action	9%
Ground-based nav aid malfunction or not available	7%
Fatigue	7%
Optical Illusion / visual mis-perception	7%
Air Traffic Services	7%
Fire / Smoke (Cockpit/Cabin/Cargo)	7%
Nav Aids	7%
Extensive / Uncontained Engine Failure	5%
Thunderstorms	5%
Inad overrun area/trench/ditch/prox of structures	5%
Wildlife/Birds/Foreign Object	5%
Terrain / Obstacles	5%
Flight Controls	2%
Spatial Disorientation / somatogravic illusion	2%
Airport perimeter control/fencing/wildlife control	2%
Contained Engine Failure/Powerplant Malfunction	2%
Secondary Flight Controls	2%
Dangerous Goods	2%
Dispatch / Paperwork	2%
Operational Pressure	2%

Cargo Aircraft Accidents

UNDESIRED AIRCRAFT STATE

	Percentage Contribution
Long/floated/bounced/firm/off-center/crabbed land	19%
Vertical / Lateral / Speed Deviation	16%
Continued Landing after Unstable Approach	12%
Unstable Approach	5%
Controlled Flight Towards Terrain	5%
Abrupt Aircraft Control	5%
Brakes / Thrust Reversers / Ground Spoilers	2%
Flight Controls / Automation	2%
Landing Gear	2%
Unnecessary Weather Penetration	2%
Loss of aircraft control while on the ground	2%

COUNTERMEASURES

	Percentage Contribution
Overall Crew Performance	19%
Monitor / Cross-check	12%
Workload Management	5%
Contingency Management	2%
Captain should show leadership	2%

Note: 32 accidents were not classified due to insufficient data; these accidents were subtracted from the total accident count in the calculation of contributing factor frequency.

Addendum D
Abuja Declaration

The first step was taken by IATA by convening a decision makers' (DGs of CAA and Airline CEOs) summit in Johannesburg in May 2012 to address what then seemed the highest ever accident rate in Africa.

It was this summit's outcomes/report that was politically presented by the Africa Civil Aviation Commission (AFCAC) at the Abuja Ministerial Meeting of July 2012 to deliver the famous Abuja Declaration on improving safety in Africa. The declaration, among numerous other safety targets, recognized IOSA as a very effective safety enhancement tool for use by both airlines and regulators.

The other safety targets besides IOSA under the declaration included the following safety targets:

- Reduce runway-related accidents and serious incidents by 50% by end of 2015

Runway/Taxiway Excursion Accident Rate (accidents per million sectors)	
3-year average in 2012	3-year average in 2015
5.59	3.51
37% reduction	
2012 accident rate	2015 accident rate
6.79	2.96
56% reduction	

- Reduce Controlled Flight Into Terrain (CFIT) related accidents and serious incidents by 50% by end of 2015

CFIT Accident Rate (accidents per million sectors)	
3-year average in 2012	3-year average in 2015
1.12	1.10
2% reduction	
2012 accident rate	2015 accident rate
1.13	0.00
100% reduction	

- Reduce LOC-I related accidents and serious incidents by 50% by the end of 2015

LOC-I Accident Rate (accidents per million sectors)	
3-year average in 2012	3-year average in 2015
2.23	1.77
21% reduction	
2012 accident rate	2015 accident rate
2.26	0.99
56% reduction	

- States to establish and strengthen autonomous Civil Aviation Authorities by end of 2013

Comprehensive data on status of CAAs not available. Although many States have in place, appropriate legal provisions establishing autonomous CAAs, effectiveness is still a challenge.

- Resolve ALL identified Significant Safety Concerns (existing ones by July 2013 and new ones within 12 months)

Six (6) States with SSCs

- Implementation of State specific ICAO Plans of Actions by July 2013

Twenty nine (29) States have accepted ICAO Plans of Action and are at different stages of implementation

- Implement State Safety Programs (SSP) and ensure that all Service Providers implement a Safety Management System (SMS) by end of 2015

Comprehensive data on status of SSP/SMS implementation not available. However, none of the forty eight (48) States has attained level 4 implementation of SSP

- Certify all international aerodromes by end of 2015

Forty five (45) International Aerodromes in twelve (12) States were certified.

- Require all African airlines to obtain an IATA Operational Safety Audit (IOSA) certification by end of 2015

No comprehensive data available on the status of IOSA as a State regulatory requirement. By end of 2014 there were twenty four (24. operators from seventeen (17) States on the IOSA Registry

Immediately thereafter, IATA started an IOSA awareness campaign through workshops organized for both air carriers and regulators. After identifying eligible air carriers, IATA made an undertaking to sponsor most of them through the IOSA Training Initiative (ITI) workshop as a project with a target of adding 10 of them (carriers) to the IOSA Registry by December 31, 2015.

Annex 1 – Definitions

Abnormal Disembarkation: Passengers and/or crew exit the aircraft via boarding doors (normally assisted by internal aircraft or exterior stairs) after an aircraft incident or accident and when away from the boarding gates or aircraft stands (e.g., onto runway or taxiway), only in a non-life-threatening and non-catastrophic event.

Accident: An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

a) A person is fatally or seriously injured as a result of:

- Being in the aircraft, or
- Direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
- Direct exposure to jet blast,

Except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) The aircraft sustains damage or structural failure which:

- Adversely affects the structural strength, performance or flight characteristics of the aircraft, and
- Would normally require major repair or replacement of the affected component,

Except for engine failure or damage, when the damage is limited to a single engine (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome); or

c) The aircraft is missing or is completely inaccessible.

Notes:

1. For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury by ICAO.

2. An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.

For purposes of this Safety Report, only operational accidents (aircraft sustained damage or structural failure) are classified.

The following types of operations are excluded:

- Private aviation
- Business aviation
- Illegal flights (e.g., cargo flights without an airway bill, fire arms or narcotics trafficking)
- Humanitarian relief
- Crop dusting/agricultural flights
- Security-related events (e.g., hijackings)
- Experimental/Test flights

3. Only the following accident categories are considered for this report:

- Controlled Flight Into Terrain (CFIT)
- Gear-up Landing / Gear Collapse
- Ground Damage
- Hard Landing
- In-flight Damage
- Loss of Control In-flight
- Mid-air Collision
- Off Airport Landing / Ditching
- Other End State (generally when unknown)
- Runway / Taxiway Excursion
- Runway Collision
- Tailstrike
- Undershoot

Accident classification: the process by which actions, omissions, events, conditions, or a combination thereof, which led to the accident are identified and categorized.

Aircraft: the involved aircraft, used interchangeably with airplane(s).

Air Traffic Service unit: as defined in applicable ATS, Search and Rescue and overflight regulations.

Cabin Safety-related Event: accident involving cabin operational issues, such as a passenger evacuation, an onboard fire, a decompression or a ditching, which requires actions by the operating cabin crew.

Captain: the involved pilot responsible for operation and safety of the aircraft during flight time.

Commander: the involved pilot, in an augmented crew, responsible for operation and safety of the aircraft during flight time.

Crewmember: anyone on board a flight who has duties connected with the sector of the flight during which the accident happened. It excludes positioning or relief crew, security staff, etc. (see definition of "Passenger" below).

Evacuation (Land): Passengers and/or crew evacuate aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in fuselage, usually initiated in life-threatening and/or catastrophic events.

Evacuation (Water): Passengers and/or crew evacuate aircraft via escape slides/slide rafts, doors, emergency exits, or gaps in fuselage and into or on water.

Fatal accident: An accident where at least one passenger or crewmember is killed or later dies of their injuries as a result of an operational accident

Events such as slips and falls, food poisoning, turbulence or accidents involving on board equipment, which may involve fatalities, but where the aircraft sustains minor or no damage, are excluded.

Fatality: a passenger or crewmember who is killed or later dies of their injuries resulting from an operational accident. Injured persons who die more than 30 days after the accident are excluded.

Fatality Risk: the sum of full-loss equivalents per 1 million sectors.

Full-Loss Equivalent: a number representing the equivalent of a catastrophic accident where all people onboard died. For an individual accident, the full-loss equivalent is a value between 0 and 1 representing the ratio between the number of people who perished and the number of people onboard the aircraft. In a broader context, the full-loss equivalent is the sum of each accident's full-loss equivalent value.

Hazard: condition, object or activity with the potential of causing injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function.

Hull loss: an accident in which the aircraft is destroyed or substantially damaged and is not subsequently repaired for whatever reason including a financial decision of the owner.

Hull Loss/Nil Survivors: Aircraft impact resulted in complete hull loss and no survivors. Used as a Cabin End State.

IATA accident classification system: refer to Annexes 2 and 3 of this report.

IATA regions: IATA determines the accident region based on the operator's home country as specified in the operator's Air Operator Certificate (AOC).

For example, if a Canadian-registered operator has an accident in Europe, this accident is counted as a "North American" accident.

For a complete list of countries assigned per region, please consult the following table:

IATA REGIONS

Region	Country
AFI	Angola
	Benin
	Botswana
	Burkina Faso
	Burundi
	Cameroon
	Cape Verde
	Central African Republic
	Chad
	Comoros
	Congo, Democratic Republic of
	Congo, Republic of
	Côte d'Ivoire
	Djibouti
	Equatorial Guinea
	Eritrea
	Ethiopia
	Gabon
	Gambia
	Ghana
	Guinea
	Guinea-Bissau
	Kenya
	Lesotho
	Liberia
	Madagascar
	Malawi
	Mali
	Mauritania
	Mauritius
	Mozambique
	Namibia
	Niger
	Nigeria
	Rwanda
	São Tomé and Príncipe
	Senegal
	Seychelles
	Sierra Leone
	Somalia
	South Africa

Region	Country
	South Sudan
	Swaziland
	Tanzania
	Togo
	Uganda
	Zambia
	Zimbabwe
ASPAC	Australia[1]
	Bangladesh
	Bhutan
	Brunei Darussalam
	Burma
	Cambodia
	East Timor
	Fiji Islands
	India
	Indonesia
	Japan
	Kiribati
	Laos
	Malaysia
	Maldives
	Marshall Islands
	Micronesia
	Nauru
	Nepal
	New Zealand[2]
	Pakistan
	Palau
	Papua New Guinea
	Philippines
	Samoa
	Singapore
	Solomon Islands
	South Korea
	Sri Lanka
	Thailand
	Tonga
	Tuvalu, Ellice Islands
	Vanuatu
	Vietnam

Region	Country
CIS	Armenia
	Azerbaijan
	Belarus
	Georgia
	Kazakhstan
	Kyrgyzstan
	Moldova
	Russia
	Tajikistan
	Turkmenistan
	Ukraine
	Uzbekistan
EUR	Albania
	Andorra
	Austria
	Belgium
	Bosnia and Herzegovina
	Bulgaria
	Croatia
	Cyprus
	Czech Republic
	Denmark[3]
	Estonia
	Finland
	France[4]
	Germany
	Greece
	Hungary
	Iceland
	Ireland
	Italy
	Israel
	Kosovo
	Latvia
	Liechtenstein
	Lithuania
	Luxembourg
	Macedonia
	Malta
	Monaco
	Montenegro
	Netherlands[5]

Region	Country
	Norway
	Poland
	Portugal
	Romania
	San Marino
	Serbia
	Slovakia
	Slovenia
	Spain
	Sweden
	Switzerland
	Turkey
	United Kingdom[6]
	Vatican City
LATAM	Antigua and Barbuda
	Argentina
	Bahamas
	Barbados
	Belize
	Bolivia
	Brazil
	Chile
	Colombia
	Costa Rica
	Cuba
	Dominica
	Dominican Republic
	Ecuador
	El Salvador
	Grenada
	Guatemala
	Guyana
	Haiti
	Honduras
	Jamaica
	Mexico
	Nicaragua

Region	Country
	Panama
	Paraguay
	Peru
	Saint Kitts and Nevis
	Saint Lucia
	Saint Vincent and the Grenadines
	Suriname
	Trinidad and Tobago
	Uruguay
	Venezuela
MENA	Afghanistan
	Algeria
	Bahrain
	Egypt
	Iran
	Iraq
	Jordan
	Kuwait
	Lebanon
	Libya
	Morocco
	Oman
	Qatar
	Saudi Arabia
	Sudan
	Syria
	Tunisia
	United Arab Emirates
	Yemen
NAM	Canada
	United States of America[7]
NASIA	China[8]
	Mongolia
	North Korea

[1]Australia includes:
Christmas Island Cocos (Keeling) Islands Norfolk Island Ashmore and Cartier Islands Coral Sea Islands Heard Island and McDonald Islands

[2]New Zealand includes:
Cook Islands Niue Tokelau

[3]Denmark includes:
Faroe Islands Greenland

[4]France includes:
French Polynesia New Caledonia Saint-Barthélemy Saint Martin Saint Pierre and Miquelon Wallis and Futuna French Southern and Antarctic Lands

[5]Netherlands include:
Aruba

[6]United Kingdom includes:
England Scotland Wales Northern Ireland Akrotiri and Dhekelia Anguilla Bermuda British Indian Ocean Territory British Virgin Islands Cayman Islands Falkland Islands Gibraltar Montserrat Pitcairn Islands Saint Helena South Georgia and the South Sandwich Islands Turks and Caicos Islands British Antarctic Territory Guernsey Isle of Man Jersey

[7]United States of America include:
American Samoa Guam Northern Mariana Islands Puerto Rico United States Virgin Islands

[8]China includes:
Hong Kong Macau Chinese Taipei

Incident: an occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

In-flight Security Personnel: an individual who is trained, authorized and armed by the state and is carried on board an aircraft and whose intention is to prevent acts of unlawful interference.

Investigation: a process conducted for the purpose of accident prevention, which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of safety recommendations.

Investigator in charge: a person charged, on the basis of his or her qualifications, with the responsibility for the organization, conduct and control of an investigation.

Involved: directly concerned, or designated to be concerned, with an accident or incident.

Level of safety: how far safety is to be pursued in a given context, assessed with reference to an acceptable risk, based on the current values of society.

Major repair: a repair which, if improperly done, might appreciably affect mass, balance, structural strength, performance, powerplant operation, flight characteristics, or other qualities affecting airworthiness.

Non-operational accident: this definition includes acts of deliberate violence (sabotage, war, etc.), and accidents that occur during crew training, demonstration and test flights. Sabotage is believed to be a matter of security rather than flight safety, and crew training, demonstration and test flying are considered to involve special risks inherent to these types of operations.

Also included in this category are:

- Non-airline operated aircraft (e.g., military or government operated, survey, aerial work or parachuting flights)
- Accidents where there has been no intention of flight

Normal Disembarkation: Passengers and/or crew exit the aircraft via boarding doors during normal operations.

Occurrence: any unusual or abnormal event involving an aircraft, including but not limited to, an incident.

Operational accident: an accident which is believed to represent the risks of normal commercial operation, generally accidents which occur during normal revenue operations or positioning flights.

Operator: a person, organization or enterprise engaged in, or offering to engage in, aircraft operations.

Passenger: anyone on board a flight who, as far as may be determined, is not a crewmember. Apart from normal revenue passengers this includes off-duty staff members, positioning and relief flight crew members, etc., who have no duties connected with the sector of the flight during which the accident happened. Security personnel are included as passengers as their duties are not concerned with the operation of the flight.

Person: any involved individual, including airport and ATS personnel.

Phase of flight: the phase of flight definitions developed and applied by IATA are presented in the following table:

PHASE OF FLIGHT DEFINITIONS

Flight Planning (FLP) This phase begins when the flight crew initiates the use of flight planning information facilities and becomes dedicated to a flight based upon a route and an airplane; it ends when the crew arrives at the aircraft for the purpose of the planned flight or the crew initiates a "Flight Close" phase.

Pre-flight (PRF) This phase begins with the arrival of the flight crew at an aircraft for the purpose of flight; it ends when a decision is made to depart the parking position and/or start the engine(s). It may also end by the crew initiating a "Post-flight" phase.

Note: The Pre-flight phase assumes the aircraft is sitting at the point at which the aircraft will be loaded or boarded, with the primary engine(s) not operating. If boarding occurs in this phase, it is done without any engine(s) operating. Boarding with any engine(s) operating is covered under Engine Start/ Depart.

Engine Start/Depart (ESD) This phase begins when the flight crew take action to have the aircraft moved from the parked position and/or take switch action to energize the engine(s); it ends when the aircraft begins to move under its own power or the crew initiates an "Arrival/Engine Shutdown" phase.

Note: The Engine Start/Depart phase includes: the aircraft engine(s) start-up whether assisted or not and whether the aircraft is stationary with more than one engine shutdown prior to Taxi-out, (i.e., boarding of persons or baggage with engines running). It includes all actions of power back for the purpose of positioning the aircraft for Taxi-out.

Taxi-out (TXO) This phase begins when the crew moves the aircraft forward under its own power; it ends when thrust is increased for the purpose of Takeoff or the crew initiates a "Taxi-in" phase.

Note: This phase includes taxi from the point of moving under its own power, up to and including entering the runway and reaching the Takeoff position.

Takeoff (TOF) This phase begins when the crew increases the thrust for the purpose of lift-off; it ends when an Initial Climb is established or the crew initiates a "Rejected Takeoff" phase.

Rejected Takeoff (RTO) This phase begins when the crew reduces thrust for the purpose of stopping the aircraft prior to the end of the Takeoff phase; it ends when the aircraft is taxied off the runway for a "Taxi-in" phase or when the aircraft is stopped and engines shutdown.

Initial Climb (ICL) This phase begins at 35 feet above the runway elevation; it ends after the speed and configuration are established at a defined maneuvering altitude or to continue the climb for the purpose of cruise. It may also end by the crew initiating an "Approach" phase.

Note: Maneuvering altitude is based upon such an altitude to safely maneuver the aircraft after an engine failure occurs, or predefined as an obstacle clearance altitude. Initial Climb includes such procedures applied to meet the requirements of noise abatement climb, or best angle/rate of climb.

En Route Climb (ECL) This phase begins when the crew establishes the aircraft at a defined speed and configuration enabling the aircraft to increase altitude for the purpose of cruising; it ends with the aircraft established at a predetermined constant initial cruise altitude at a defined speed or by the crew initiating a "Descent" phase.

Cruise (CRZ) The cruise phase begins when the crew establishes the aircraft at a defined speed and predetermined constant initial cruise altitude and proceeds in the direction of a destination; it ends with the beginning of Descent for the purpose of an approach or by the crew initiating an "En Route Climb" phase.

Descent (DST) This phase begins when the crew departs the cruise altitude for the purpose of an approach at a particular destination; it ends when the crew initiates changes in aircraft configuration and/or speeds to facilitate a landing on a particular runway. It may also end by the crew initiating an "En Route Climb" or "Cruise" phase.

Approach (APR) This phase begins when the crew initiates changes in aircraft configuration and /or speeds enabling the aircraft to maneuver for the purpose of landing on a particular runway; it ends when the aircraft is in the landing configuration and the crew is dedicated to land on a specific runway. It may also end by the crew initiating a "Go-around" phase.

Go-around (GOA) This phase begins when the crew aborts the descent to the planned landing runway during the Approach phase, it ends after speed and configuration are established at a defined maneuvering altitude or to continue the climb for the purpose of cruise (same as end of "Initial Climb").

Landing (LND) This phase begins when the aircraft is in the landing configuration and the crew is dedicated to touch down on a specific runway; it ends when the speed permits the aircraft to be maneuvered by means of taxiing for the purpose of arriving at a parking area. It may also end by the crew initiating a "Go-around" phase.

Taxi-in (TXI) This phase begins when the crew begins to maneuver the aircraft under its own power to an arrival area for the purpose of parking; it ends when the aircraft ceases moving under its own power with a commitment to shut down the engine(s). It may also end by the crew initiating a "Taxi-out" phase.

Arrival/Engine Shutdown (AES) This phase begins when the crew ceases to move the aircraft under its own power and a commitment is made to shutdown the engine(s); it ends with a decision to shut down ancillary systems for the purpose of securing the aircraft. It may also end by the crew initiating an "Engine Start/Depart" phase.

Note: The Arrival/Engine Shutdown phase includes actions required during a time when the aircraft is stationary with one or more engines operating while ground servicing may be taking place (i.e., deplaning persons or baggage with engine(s) running, and/refueling with engine(s) running).

Post-flight (PSF) This phase begins when the crew commences the shutdown of ancillary systems of the aircraft for the purpose of leaving the flight deck; it ends when the flight and cabin crew leaves the aircraft. It may also end by the crew initiating a "Pre-flight" phase.

Flight Close (FLC) This phase begins when the crew initiates a message to the flight-following authorities that the aircraft is secure and the crew is finished with the duties of the past flight; it ends when the crew has completed these duties or begins to plan for another flight by initiating a "Flight Planning" phase.

Ground Servicing (GDS) This phase begins when the aircraft is stopped and available to be safely approached by ground personnel for the purpose of securing the aircraft and performing the duties applicable to the arrival of the aircraft (i.e. aircraft maintenance, etc.); it ends with completion of the duties applicable to the departure of the aircraft or when the aircraft is no longer safe to approach for the purpose of ground servicing e.g., prior to crew initiating the "Taxi-out" phase.

Note: The GDS phase was identified by the need for information that may not directly require the input of flight or cabin crew. It is acknowledged as an entity to allow placement of the tasks required of personnel assigned to service the aircraft.

Rapid Deplaning: passengers and/or crew rapidly exit aircraft via boarding doors and jet bridge or stairs, as precautionary measures.

Risk: the assessment, expressed in terms of predicted probability and severity, of the consequence(s) of a hazard, taking as reference the worst foreseeable situation.

Safety: the state in which the risk of harm to persons or property is reduced to, and maintained at or be-low, an acceptable level through a continuing process of hazard identification and risk management.

Sector: the operation of an aircraft between takeoff at one location and landing at another (other than a diversion).

Serious Injury: an injury sustained by a person in an accident and which:

- Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or
- Results in a fracture of any bone (except simple fractures of fingers, toes or nose); or
- Involves lacerations which cause severe hemorrhage, or nerve, muscle or tendon damage;
- Involves injury to any internal organ; or
- Involves second or third-degree burns, or any burns affecting more than 5% of the surface of the body; or
- Involves verified exposure to infectious substances or injurious radiation.

Serious Incident: an incident involving circumstances indicating that an accident nearly occurred (note the difference between an accident and a serious incident lies only in the result).

Sky Marshal: see In-flight Security Personnel.

Substantial Damage: damage or structural failure, which adversely affects the structural strength, performance or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component.

Notes:

1. Bent fairing or cowling, dented skin, small punctured holes in the skin or fabric, minor damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wing tips are not considered "substantial damage" for the purpose of this Safety Report.

2. The ICAO Annex 13 definition is unrelated to cost and includes many incidents in which the financial consequences are minimal.

Unstable Approach: approach where the ACTF has knowledge about vertical, lateral or speed deviations in the portion of the flight close to landing.

Note: This definition includes the portion immediately prior to touchdown and in this respect the definition might differ from other organizations. However, accident analysis gives evidence that a destabilization just prior to touchdown has contributed to accidents in the past.

A2

Annex 2
Accident Classification Taxonomy Flight Crew

1. LATENT CONDITIONS

Definition: Conditions present in the system before the accident and triggered by various possible factors.

Latent Conditions (deficiencies in…)	Examples
Design	↗ Design shortcomings ↗ Manufacturing defects
Regulatory Oversight	↗ Deficient regulatory oversight by the State or lack thereof
Management Decisions	↗ Cost cutting ↗ Stringent fuel policy ↗ Outsourcing and other decisions, which can impact operational safety
Safety Management	Absent or deficient: ↗ Safety policy and objectives ↗ Safety risk management (including hazard identification process) ↗ Safety assurance (including Quality Management) ↗ Safety promotion
Change Management	↗ Deficiencies in monitoring 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
Operations Planning and Scheduling	↗ Deficiencies in crew rostering and staffing practices ↗ Issues with flight and duty time limitations ↗ Health and welfare issues

1. LATENT CONDITIONS (CONT'D)

Technology and Equipment	↗ Available safety equipment not installed (EGPWS, predictive wind-shear, TCAS/ACAS, etc.)
Flight Operations	See the following breakdown
Flight Operations: Standard Operating Procedures and 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 Operations: 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
Cabin Operations	See the following breakdown
Cabin Operations: Standard Operating Procedures and 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
Cabin Operations: 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
Ground Operations	See the following breakdown
Ground Operations: SOPs and 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
Ground Operations: 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

1. LATENT CONDITIONS (CONT'D)

Maintenance Operations	See the following breakdown
Maintenance Operations: SOPs and 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 ↗ Includes deficiencies in technical documentation, unrecorded maintenance and the use of bogus parts/unapproved modifications
Maintenance Operations: Training Systems	↗ Omitted training, language skills deficiencies, qualifications and experience of maintenance crews, operational needs leading to training reductions, deficiencies in assessment of training or training resources such as manuals or CBT devices
Dispatch	See the following breakdown
Dispatch: Standard Operating Procedures and 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
Dispatch: Training Systems	↗ Omitted training, language skills deficiencies, qualifications and experience of dispatchers, operational needs leading to training reductions, deficiencies in assessment of training or training resources such as manuals or CBT devices
Other	↗ Not clearly falling within the other latent conditions

Note: All areas such as Training, Ground Operations or Maintenance include outsourced functions for which the operator has oversight responsibility.

2. THREATS

Definition: 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.

Mismanaged threat: A threat that is linked to or induces a flight crew error.

Environmental Threats	Examples
Meteorology	See the following breakdown
	↗ Thunderstorms
	↗ Poor visibility/IMC
	↗ Wind/wind shear/gusty wind
	↗ Icing conditions
Lack of Visual Reference	↗ Darkness/black hole effect ↗ 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/ground)
Wildlife/ Birds/Foreign Objects	↗ Self-explanatory
Airport Facilities	See the following breakdown
	↗ Poor signage, faint markings ↗ Runway/taxiway closures
	↗ Contaminated runways/taxiways ↗ Poor braking action
	↗ Trenches/ditches ↗ Inadequate overrun area ↗ Structures in close proximity to runway/taxiway
	↗ Inadequate airport perimeter control/fencing ↗ Inadequate wildlife control

2. THREATS (CONT'D)

Navigational Aids	See the following breakdown
	↗ Ground navigation aid malfunction ↗ Lack or unavailability (e.g., ILS)
	↗ NAV aids not calibrated – unknown to flight crew
Terrain/Obstacles	↗ Self-explanatory
Traffic	↗ Self-explanatory
Other	↗ Not clearly falling within the other environmental threats
Airline Threats	Examples
Aircraft Malfunction	↗ Technical anomalies/failures See breakdown (on the next page)
MEL Item	↗ MEL items with operational implications
Operational Pressure	↗ Operational time pressure ↗ Missed approach/diversion ↗ Other non-normal operations
Cabin Events	↗ Cabin events (e.g., unruly passenger) ↗ Cabin crew errors ↗ Distractions/interruptions
Ground Events	↗ Aircraft loading events ↗ Fueling errors ↗ Agent interruptions ↗ Improper ground support ↗ Improper deicing/anti-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 ↗ Checklist layout/design issues
Other	↗ Not clearly falling within the other airline threats

2. THREATS (CONT'D)

Aircraft Malfunction Breakdown (Technical Threats)	Examples
Extensive/Uncontained Engine Failure	↗ Damage due to non-containment
Contained Engine Failure / Power plant Malfunction	↗ Engine overheat ↗ Propeller failure ↗ Failure affecting power plant components
Gear/Tire	↗ Failure affecting parking, taxi, takeoff or landing
Brakes	↗ Failure affecting parking, taxi, takeoff or landing
Flight Controls	See the following breakdown
Primary Flight Controls	↗ Failure affecting aircraft controllability
Secondary Flight Controls	↗ Failure affecting flaps, spoilers
Structural Failure	↗ Failure due to flutter, overload ↗ Corrosion/fatigue ↗ Engine separation
Fire/Smoke in 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

3. FLIGHT CREW ERRORS

Definition: An observed flight crew deviation from organizational expectations or crew intentions.
Mismanaged error: An error that is linked to or induces additional error or an undesired aircraft state.

Aircraft Handling Errors	Examples
Manual Handling/Flight Controls	↗ Hand flying vertical, lateral, or speed deviations ↗ Approach deviations by choice (e.g., flying below the glide slope) ↗ 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/ Radios/Instruments	↗ Incorrect packs, altimeter, fuel switch settings, or radio frequency dialed
Other	↗ Not clearly falling within the other errors

Procedural Errors	Examples
Standard Operating Procedures Adherence / Standard Operating Procedures Cross-verification	↗ Intentional or unintentional failure to cross-verify (automation) inputs ↗ Intentional or unintentional failure to follow SOPs ↗ PF makes own automation changes ↗ Sterile cockpit violations
Checklist	See the following breakdown
Normal Checklist	↗ Checklist performed from memory or omitted ↗ Wrong challenge and response ↗ Checklist performed late or at wrong time ↗ Checklist items missed
Abnormal Checklist	↗ Checklist performed from memory or omitted ↗ Wrong challenge and response ↗ Checklist performed late or at wrong time ↗ Checklist 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

3. FLIGHT CREW ERRORS (CONT'D)

Documentation	See the following breakdown
	↗ 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 Destabilisation during Approach	↗ Flight crew does not execute a go-around after stabilization requirements are not met
Other Procedural	↗ Administrative duties performed after top of descent or before leaving active runway ↗ Incorrect application of MEL
Communication Errors	Examples
Crew to External Communication	See breakdown
With Air Traffic Control	↗ Flight crew to ATC – missed calls, misinterpretation of instructions, or incorrect read-backs ↗ Wrong clearance, taxiway, gate or runway communicated
With Cabin Crew	↗ Errors in Flight to Cabin Crew communication ↗ Lack of communication
With Ground Crew	↗ Errors in Flight to Ground Crew communication ↗ Lack of communication
With Dispatch	↗ Errors in Flight Crew to Dispatch communication ↗ Lack of communication
With Maintenance	↗ Errors in Flight to Maintenance Crew communication ↗ Lack of communication
Pilot-to-Pilot Communication	↗ Within flight crew miscommunication ↗ Misinterpretation ↗ Lack of communication

4. UNDESIRED AIRCRAFT STATES (UAS)

Definition: A flight-crew-induced aircraft state that clearly reduces safety margins; a safety-compromising situation that results from ineffective error management. An undesired aircraft state is **recoverable**.

Mismanaged UAS: A UAS that is linked to or induces additional flight crew errors.

Undesired Aircraft States	Breakdown
Aircraft Handling	↗ Abrupt aircraft control
	↗ Vertical, lateral or speed deviations
	↗ Unnecessary weather penetration
	↗ Unauthorized airspace penetration
	↗ Operation outside aircraft limitations
	↗ Unstable approach
	↗ Continued landing after unstable approach
	↗ Long, floated, bounced, firm, porpoised, off-centerline landing ↗ Landing with excessive crab angle
	↗ Rejected takeoff after V1
	↗ Controlled flight towards terrain
	↗ Other
Ground Navigation	↗ Proceeding towards wrong taxiway/runway
	↗ Wrong taxiway, ramp, gate or hold spot
	↗ Runway/taxiway incursion
	↗ Ramp movements, including when under marshalling
	↗ Loss of aircraft control while on the ground
	↗ Other

4. UNDESIRED AIRCRAFT STATES (UAS) (CONT'D)

Incorrect Aircraft Configurations	↗ Brakes, thrust reversers, ground spoilers
	↗ Systems (fuel, electrical, hydraulics, pneumatics, air conditioning, pressurization/ instrumentation
	↗ Landing gear
	↗ Flight controls/automation
	↗ Engine
	↗ Weight & balance
	↗ Other

5. END STATES

Definition: An end state is a reportable event. It is **unrecoverable**.

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 Collision	↗ Any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, person or wildlife on the protected area of a surface designated for the landing and takeoff of aircraft and resulting in a collision
Mid-air Collision	↗ Collision between aircraft in flight
Runway Excursion	↗ A veer off or overrun off the runway or taxiway surface
In-flight Damage	Damage occurring while airborne, including: ↗ Weather-related events, technical failures, bird strikes and fire/smoke/fumes
Ground Damage	Damage occurring while on the ground, including: ↗ Occurrences during (or as a result of) ground handling operations ↗ Collision while taxiing to or from a runway in use (excluding a runway collision) ↗ Foreign object damage ↗ Fire/smoke/fumes

5. END STATES (CONT'D)

Undershoot	↗ A touchdown off 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)
Tailstrike	↗ Tailstrike resulting in substantial damage
Off-Airport Landing/ Ditching	↗ Any controlled landing outside of the airport area

6. FLIGHT CREW COUNTERMEASURES

The following list includes countermeasures that the flight crew can take. Countermeasures from other areas, such as ATC, ground operations personnel and maintenance staff, are not considered at this time.

Team Climate		
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 disharmonies. Right amount of hierarchy gradient Flight Crew member reacts to assertive callout of other crew member(s)
Leadership	See the following breakdown	
	Captain should show leadership and coordinate flight deck activities	In command, decisive, and encourages crew participation
	First Officer (FO) is assertive when necessary and is able to take over as the leader	FO 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	Not clearly falling within the other categories	

6. FLIGHT CREW COUNTERMEASURES (CONT'D)

Planning		
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	Not clearly falling within the other categories	
Execution		
Monitor/ Cross-check	Crew members should actively monitor and cross-check flight path, aircraft performance, systems and other crew members	Aircraft position, settings, and crew actions are verified
Workload Management	Operational tasks should be prioritized and properly managed to handle primary flight duties	↗ Avoid task fixation. ↗ Do not allow work overload
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 or aircraft cockpit moving map displays are used when needed
Other	Not clearly falling within the other categories	
Review/Modify		
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	Not clearly falling within the other categories	

7. ADDITIONAL CLASSIFICATIONS

Additional Classification	Breakdown
Insufficient Data	Accident does not contain sufficient data to be classified
Incapacitation	Crew member unable to perform duties due to physical or psychological impairment
Fatigue	Crew member unable to perform duties due to fatigue
Spatial Disorientation and Spatial/ Somatogravic Illusion (SGI)	SGI is a form of spatial disorientation that occurs when a shift in the resultant gravitoinertial force vector created by a sustained linear acceleration is misinterpreted as a change in pitch or bank attitude

"2015 saw the lowest number of fatalities in the past 10 years, at 136"

A3

Annex 3 – Accidents Summary

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	OPERATOR REGION	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
24-12-15	Airbus	A310-300	9Q-CVH	Services Air	AFI	Mbuji Mayi, DR Congo	LND	Cargo	Jet	Substantial Damage	The aircraft overran the runway on landing
24-12-15	Airbus	A310-300	EP-MNP	Mahan Air	MENA	Istanbul - Ataturk/ Yesilkov Int'l, Turkey	LND	Passenger	Jet	Substantial Damage	The aircraft overshot its stand while parking and collided with a guard rail and a low wall
21-12-15	Embraer	E195	PK-KDC	Kalstar Aviation	ASPAC	Kupang - Eltari, Indonesia	LND	Passenger	Jet	Substantial Damage	The aircraft overran the runway on landing
16-12-15	Airbus	A319	VT-SCQ	Air India	ASPAC	Mumbai, India	ESD	Passenger	Jet	Substantial Damage	An engineer was sucked by the engine during push-back
15-12-15	Boeing	B737-300	N649SW	Southwest Airlines	NAM	Nashville, USA	TXI	Passenger	Jet	Substantial Damage	The aircraft went off the taxiway when taxiing in
06-12-15	Boeing	B737-800	9V-MGM	SilkAir	ASPAC	Changi - International, Singapore	ESD	Passenger	Jet	Substantial Damage	The tug collided with the aircraft during push-back
04-12-15	Bombardier	Dash 8-400	VT-SUC	Spicejet	ASPAC	Jabalpur, India	LND	Passenger	Turboprop	Substantial Damage	The arcraft went off the runaway after a heard of wild boar strayed onto the runway
26-11-15	Boeing	B737-300	XA-UNM	Magnicharters	LATAM	Mexico City - Benito Juarez, Mexico	LND	Passenger	Jet	Hull Loss	The aircraft's left main undercarriage failed and collapsed during the landing
22-11-15	Boeing	B737-300	EX-37005	Avia Traffic Company	CIS	Osh, Kyrgyzstan	LND	Passenger	Jet	Hull Loss	The aircraft suffered a hard landing
06-11-15	Airbus	A330-300	TC-JOA	Turkish Airlines (THY)	EUR	Colombo - Katunayake Intl, Sri Lanka	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
06-11-15	Boeing	B737-900	PK-LBO	Batik Air	ASPAC	Yogyakarta, Indonesia	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a runway excursion on landing
04-11-15	Antonov	An-12	EY-406	Allied Services Limited	AFI	(near) Juba International Airport,Juba,,South Sudan	ICL	Cargo	Turboprop	Hull Loss	The aircraft impacted a hill on a shallow climb after take-off
03-11-15	Boeing	B737-400	AP-BJO	Shaheen Air International	ASPAC	Lahore, Pakistan	LND	Passenger	Jet	Hull Loss	The aircraft touched down left of the runway, crossed a taxiway causing both gear struts to collapse
01-11-15	Grumman	Gulfstream I	9Q-CNP	Malu Aviation	AFI	Kinshasa - N`Djili Int'l, DR Congo	LND	Passenger	Turboprop	Hull Loss	The aircraft had a belly landing. The crew reported problems with the left undercarriage after take-off
31-10-15	Bombardier	CRJ1000	EC-LPG	Air Nostrum	EUR	Toulouse, France	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
29-10-15	Boeing	767-200	N251MY	Dynamic International Airways	NAM	Fort Lauderdale - Hollywood International, FL, USA	TXO	Passenger	Jet	Hull Loss	The aircraft suffered an engine fire during taxi

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	OPERATOR REGION	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
26-10-15	Boeing	B737-400	ZS-OAA	Comair (South Africa)	AFI	Johannesburg - O R Tambo Int'l, South Africa	LND	Passenger	Jet	Hull Loss	The aircraft's left main undercarriage failed and collapsed during the landing roll
23-10-15	Boeing	B737-300	OB-2040-P	Peruvian Airlines	LATAM	Cuzco - Velazco Astete, Peru	LND	Passenger	Jet	Substantial Damage	The aircraft's right main undercarriage failed and collapsed towards the end of the landing rol
16-10-15	Airbus	A321	9V-TRH	Tigerair	ASPAC	Singapore, Singapore	TOF	Passenger	Jet	Substantial Damage	The cowlings from the aircraft's left engine were torn off as it climbed after take-off
06-10-15	BAE Systems	BAE146-300	9G-SBB	Starbow	AFI	Tamale, Ghana	LND	Passenger	Jet	Substantial Damage	The aircraft overran the end of the runway on landing
19-09-15	Airbus	A321	D-ABCK	Air Berlin	EUR	Dussldorf, Germany	TOF	Passenger	Jet	Substantial Damage	Tyre debris damaged the aircraft's wing on take-off
16-09-15	Airbus	A330-300	B-HLK	Dragonair	NASIA	Penang	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
15-09-15	Boeing	B777-300	A7-BAC	Qatar Airways	MENA	Miami, United States	ICL	Passenger	Jet	Substantial Damage	The aircraft struck approach lights during take-off
08-09-15	Boeing	B777-200	G-VIIO	British Airways	EUR	Las Vegas - McCarran International, NV, USA	TOF	Passenger	Jet	Substantial Damage	The aircraft's left engine suffered a 'catastrophic failure' at the start of the take-off run
05-09-15	Boeing	B737-800	3C-LLY	Ceiba Intercontinental	AFI	En-route	CRZ	Passenger	Jet	Substantial Damage	The aircraft collided with a HS-125 during flight. The B737 suffered damage while the other aircraft crashed into the ocean
28-08-15	Boeing	B737-300	PK-BBY	Cardig Air	ASPAC	Wamena, Indonesia	LND	Cargo	Jet	Substantial Damage	The aircraft landed short of the runway
16-08-15	ATR	ATR 42	PK-YRN	Trigana Air Service	ASPAC	near Oksibil, Indonesia, at the side of the Pegunungan Bintang Regency at coordinates S4.8215 E140.4992	CRZ	Passenger	Turboprop	Hull Loss	The aircraft crashed the side of a mountain
15-08-15	Airbus	A321	N564UW	American Airlines	NAM	Charlotte, United States	APR	Passenger	Jet	Substantial Damage	The aircraft hit runway lights during a go-around following a hard landing.
24-07-15	ATR	ATR 72	XY-AIH	Air Bagan	ASPAC	Yangon - International, Myanmar	LND	Passenger	Turboprop	Substantial Damage	The aircraft ran off the left side of the runway on landing
01-07-15	Airbus	A321	F-GYAP	Air Mediterranee	EUR	Lourdes/Tarbes - Osun, France	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
23-06-15	Bombardier	CRJ200	VP-BVC	Rusline	CIS	Voronezh, Russia	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a bounced hard Landing
17-06-15	Boeing	B747-400	N664US	Delta Air Lines	NAM	En-route over China	CRZ	Passenger	Jet	Substantial Damage	The aircraft sustained damage after hail strike
16-06-15	Boeing	B737-300	LY-FLB	Scat	CIS	Aktau, Kazakhstan	PRF	Passenger	Jet	Hull Loss	The aircraft burned while on ground as it was being serviced
10-05-15	Xian	MA60	B-3476	Joy Air	NASIA	Fuzhou - Changle, China	LND	Passenger	Turboprop	Hull Loss	The aircraft suffered a hard Landing
05-05-15	Airbus	A330	9M-XXW	AirAsia X	ASPAC	Kathmandu - Tribhuvan International, Nepal	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
04-05-15	Bombardier	CRJ900		Mesa Airlines	NAM	Pheonix	PRF	Passenger	Turboprop	Substantial Damage	The aircraft's horizontal stabilizer was damanged by another aircraft
25-04-15	Airbus	A320	TC-JPE	Turkish Airlines (THY)	EUR	Istanbul, Turkey	LND	Passenger	Jet	Hull Loss	The aircraft suffered a hard landing

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	OPERATOR REGION	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
20-04-15	ATR	ATR 72	PK-WGS	Wings Air	ASPAC	Sumbawa Besar, Indonesia	LND	Passenger	Turboprop	Substantial Damage	The aircraft suffered a hard Landing
16-04-15	Fairchild (Swearingen)	Metro III	N2691W	Key Lime Air	NAM	Rifle, Garfield County, CO, USA	TOF	Cargo	Turboprop	Substantial Damage	The aircraft was substantially damaged after an uncontained engine failure during climb
14-04-15	Airbus	A320	HL7762	Asiana Airlines	ASPAC	Hiroshima, Japan	LND	Passenger	Jet	Substantial Damage	The aircraft landed short of runway
13-04-15	Boeing	B737-800	VT-JGA	Jet Airways	ASPAC	Khajuraho, India	LND	Passenger	Jet	Substantial Damage	The aircraft's left main undercarriage collapsed during landing
13-04-15	Fairchild (Swearingen)	Metro III	C-GSKC	Carson Air Ltd	NAM	Approximately 15NM north of Vancouver Intl airport	ECL	Cargo	Turboprop	Hull Loss	The aircraft collided with wooded terrain
03-04-15	Antonov	An-74	RA-74056	Shar ink	CIS	Barneo Ice Base,Arctic Circle,International waters	LND	Cargo	Jet	Substantial Damage	The aircraft suffered a hard landing. The damage to the main gear caused the aircraft to settle on its tail
29-03-15	Airbus	A320	C-FTJP	Air Canada	NAM	Halifax International, Nova Scotia, Canada	LND	Passenger	Jet	Hull Loss	The aircraft landed short of runway
19-03-15	Embraer	E145	N625AE	Envoy Air	NAM	(near) Springfield, United States	APR	Passenger	Jet	Substantial Damage	The aircraft suffered a bird strike on approach
14-03-15	Airbus	A330	9M-MTA	Malaysia Airlines	ASPAC	Melbourne, Australia	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing
08-03-15	Bombardier	Dash 8-400	VT-SUA	Spicejet	ASPAC	Hubli, India	LND	Passenger	Turboprop	Hull Loss	The aircraft veered off the runway on landing
05-03-15	Let	L-410 Turbolet	E7-WDT	Icar Air	EUR	Ancona - Falconara, Italy	LND	Cargo	Turboprop	Substantial Damage	The aircraft suffered a nose wheel collpase on landing
05-03-15	Boeing	MD-80	N909DL	Delta Air Lines	NAM	New York - La Guardia, NY, USA	LND	Passenger	Jet	Hull Loss	The aircraft ran off the left side of the runway on landing
04-03-15	Airbus	A330	TC-JOC	Turkish Airlines (THY)	EUR	Kathmandu - Tribhuvan International, Nepal	LND	Passenger	Jet	Substantial Damage	The aircraft's nose undercarriage failed and collapsed after it ran off the left side of the runway
04-03-15	BAE Systems	ATP	PK-DGB	Deraya Air Taxi	ASPAC	Wamena, Indonesia	LND	Cargo	Turboprop	Hull Loss	The aircraft skidded during landing, losing directional control and suffering a runway excursion
03-03-15	Fokker	F100	VH-NHK	Network Aviation Australia	ASPAC	Near Paraburdoo	ECL	Passenger	Jet	Substantial Damage	The aircraft suffered a bird strike
24-02-15	Bombardier	Dash 8-100	C-GTAI	Jazz	NAM	Sault Ste Marie, Canada	LND	Passenger	Turboprop	Substantial Damage	The aircraft touched down short of runway
23-02-15	BAE Systems	BAE146-200	G-RAJJ	Cello Aviation	EUR	Guernsey, Channel Islands, United Kingdom	LND	Passenger	Jet	Substantial Damage	The aircraft's undercarriage developed a fault on departure. During landing at destination the left gear partially collapsed
15-02-15	Airbus	A321	VT-PPD	Air India	ASPAC	Mumbai - Chhatrapati Shivaji International, India	LND	Passenger	Jet	Substantial Damage	The aircraft suffered a hard landing and tailstrike
10-02-15	Embraer	E190	N953UW	US Airways	NAM	Houston - Intercontinental, USA	LND	Passenger	Jet	Substantial Damage	The aircraft had problems with lowering the nose undercarriage. A landing was performed with its nose gear retracted
08-02-15	Airbus	A321	PT-XPB	TAM Linhas Aereas	LATAM	climb out of Rio de Janeiro	ECL	Passenger	Jet	Substantial Damage	Hail strike damaged windshield and nose cone

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	OPERATOR REGION	LOCATION	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
05-02-15	Dornier	Do-228-200	B-55563	Daily Air	NASIA	Orchid Island, Taiwan	LND	Cargo	Turboprop	Substantial Damage	The aircraft veered to the right during the landing roll
04-02-15	ATR	ATR 72	B-22816	TransAsia Airways	NASIA	2.9NM from Taipei, Taiwan	ICL	Passenger	Turboprop	Hull Loss	The aircraft crashed during initial climb after a right-engine flame out warning and a left engine shut-down
03-02-15	ATR	ATR 72	PK-GAG	Garuda Indonesia	ASPAC	Praya, Indonesia	LND	Passenger	Turboprop	Substantial Damage	The aircraft ran off the side of the runway during landing
02-02-15	BAE Systems	Jetstream 41	SX-DIA	Sky Express	EUR	Rhodes, Greece	LND	Passenger	Turboprop	Substantial Damage	The aircraft sustained damage when it suffered a hard landing
26-01-15	Airbus	A320	VP-CXJ	Flynas	MENA	Jeddah - King Abdul Aziz Int'l, Saudi Arabia	ICL	Passenger	Jet	Substantial Damage	The core cowls on the aircraft's left engine came open and were torn away shortly after take-off
23-01-15	Bombardier	Dash 8-300	C-FYAI	Air Inuit	NAM	Umiujaq, Quebec, Canada	TOF	Passenger	Turboprop	Substantial Damage	The aircraft suffered a tailstrike on take-off
20-01-15	Fokker	F100	HB-JVE	Helvetic Airlines	EUR	Nuremberg, Germany	ESD	Passenger	Jet	Substantial Damage	The aircraft suffered an APU uncontained failure as de-icing fluid (highly flamable) was sucked into the APU
10-01-15	Boeing	B737-400	ET-AQV	Ethiopian Airlines	AFI	Accra - Kotoka International, Ghana	LND	Cargo	Jet	Hull Loss	The aircraft ran off the side of runway during landing
04-01-15	Fokker	F50	5Y-SIB	Skyward International Aviation	AFI	Nairobi - Jomo Kenyatta, Kenya	LND	Cargo	Turboprop	Substantial Damage	The aircraft belly landed. During the take-off the aircraft had suffered two bird strikes.
03-01-15	Antonov	AN-26	RA-26082	KAPO Avia - Gorbunova	CIS	Magadan, Russia	TOF	Cargo	Turboprop	Substantial Damage	The aircraft ran off the side of the runway after aborting the takeoff when the pilot attempted to rotate without success
02-01-15	Saab	Saab 340	G-LGNL	Loganair	EUR	Stornoway, Western Isles, United Kingdom	TOF	Passenger	Turboprop	Substantial Damage	The aircraft ran off the side of the runway after directional control was lost during take-off

A4

Annex 4 – Table of Sectors

This table provides a breakdown of the sectors used in the production of rates for this report by aircraft type and year. It is up-to-date as at the time of report production.

MANUFACTURER	MODEL	2011	2012	2013	2014	2015
Aerospatiale	262	1,340	1,340	1,340	1,340	1,340
Airbus	A300	234,929	222,797	197,772	180,349	168,959
Airbus	A310	81,705	74,752	58,117	53,635	46,796
Airbus	A318	105,574	116,010	110,564	114,190	109,675
Airbus	A319	2,170,670	2,201,349	2,242,075	2,300,993	2,344,504
Airbus	A320	4,159,456	4,613,657	5,094,788	5,537,100	6,032,906
Airbus	A321	967,745	1,049,905	1,175,381	1,346,655	1,523,144
Airbus	A330	691,920	759,481	835,224	917,489	1,008,592
Airbus	A340	197,552	188,313	169,911	150,911	137,656
Airbus	A350	-	-	-	49	5,051
Airbus	A380	28,110	42,399	57,167	72,289	92,013
Aircraft Industries (LET)	410	111,417	103,317	101,670	105,625	109,068
Antonov	An-12	11,473	8,196	6,695	5,915	5,731
Antonov	An-22	-	-	-	-	4
Antonov	An-24	71,216	52,824	45,616	41,496	42,378
Antonov	An-26	25,778	24,973	23,403	23,055	23,681
Antonov	An-28	4,604	3,841	3,967	3,918	4,084
Antonov	An-30	585	245	257	357	355
Antonov	An-32	3,094	2,891	2,967	3,056	3,003
Antonov	An-38	3,040	3,055	3,041	3,040	2,827
Antonov	An-72 / An-74	343	384	466	582	561
Antonov	An-124	5,673	5,799	5,840	5,530	5,503
Antonov	An-140	4,035	5,036	4,553	2,531	1,592
Antonov	An-148	12,843	13,518	22,338	22,730	21,121
Antonov	An-158	-	-	2,065	6,151	8,396

MANUFACTURER	MODEL	2011	2012	2013	2014	2015
Antonov	An-225	48	48	47	30	48
ATR	ATR 42	444,545	400,359	352,995	365,329	386,779
ATR	ATR 72	930,132	958,502	997,431	1,191,535	1,398,885
Avro	RJ	182,411	144,563	133,207	143,724	142,690
BAE Systems	ATP	26,308	23,722	25,710	30,263	27,805
BAE Systems	Jetstream	191,512	182,817	193,830	190,240	185,858
BAE Systems	Jetstream 41	94,950	100,537	98,744	99,569	97,309
BAE Systems	146	73,883	72,860	70,782	68,141	68,628
BAE Systems (BAC)	One-Eleven	20	14	-	-	-
BAE Systems (Hawker Siddeley)	748	14,922	13,557	12,248	11,875	10,735
Boeing	707	237	252	68	-	-
Boeing	717	267,888	280,684	276,351	272,553	264,965
Boeing	727	119,691	100,451	61,227	43,867	41,542
Boeing	737	8,307,913	8,560,901	8,644,716	9,026,736	9,928,142
Boeing	747	421,423	398,234	369,255	342,898	337,751
Boeing	757	840,242	802,681	752,893	702,247	682,323
Boeing	767	670,965	686,483	675,672	646,435	673,611
Boeing	777	681,309	739,641	814,595	872,617	962,564
Boeing	787	392	13,460	41,350	119,395	218,208
Boeing (Douglas)	DC-8	12,411	5,560	2,185	895	651
Boeing (Douglas)	DC-9	99,766	79,600	68,835	29,456	28,420
Boeing (Douglas)	DC-10	62,613	56,315	49,445	44,843	39,441
Boeing (Douglas)	MD-11	115,950	112,053	104,898	96,691	87,296
Boeing (Douglas)	MD-80	823,469	733,430	690,535	603,330	592,750
Boeing (Douglas)	MD-90	106,285	95,364	106,345	108,547	107,924
Canadair (Bombardier)	CRJ	2,702,512	2,587,857	2,500,479	2,416,484	2,428,967
CASA / IAe	212	43,678	41,695	41,311	34,704	31,189
CASA / IAe	235	4,376	5,434	5,457	6,046	6,570
Comac	ARJ21	-	-	-	-	168
Convair	580	37,312	38,291	37,419	38,283	38,328
De Havilland (Bombardier)	DHC-7	53,115	51,320	47,689	44,507	41,882
De Havilland (Bombardier)	DHC-8	1,686,695	1,723,986	1,759,600	1,741,699	1,775,284
Embraer	120 Brasilia	224,729	218,135	212,038	203,917	130,782
Embraer	135 / 140 / 145	1,544,368	1,567,002	1,586,888	1,436,275	1,303,058
Embraer	170 / 175	587,925	605,154	650,970	721,703	851,148
Embraer	190 / 195	765,828	950,255	1,076,499	1,173,871	1,218,177

MANUFACTURER	MODEL	2011	2012	2013	2014	2015
Fairchild (Swearingen)	Metro	826,649	816,468	802,456	762,020	729,415
Fairchild Dornier	328JET	14,202	12,388	11,413	12,184	12,657
Fairchild Dornier	228	123,067	119,795	105,658	103,935	102,675
Fairchild Dornier	328	92,118	75,237	62,073	56,070	50,955
Fokker	F27	7,674	8,067	7,965	5,036	4,320
Fokker	F28	12,978	7,241	3,158	3,018	3,017
Fokker	50	150,868	146,542	125,971	97,731	102,596
Fokker	70	79,271	81,048	70,421	56,980	54,633
Fokker	100	247,467	219,349	197,660	180,495	168,396
Grumman	G73 Turbo Mallard	4,955	4,972	4,955	4,955	4,955
Gulfstream Aerospace (Grumman)	Gulfstream	5,886	5,150	4,310	4,130	3,702
Harbin	Y12	13,871	14,399	14,517	14,121	15,467
Hawker Beechcraft	1900	946,551	941,258	932,332	942,092	923,845
Ilyushin	Il-18	2,766	2,813	2,679	2,708	2,707
Ilyushin	Il-62	4,262	3,548	3,116	2,405	1,956
Ilyushin	Il-76	22,653	21,246	21,782	21,880	22,265
Ilyushin	Il-86	121	-	-	-	-
Ilyushin	Il-96	6,046	6,523	6,458	3,950	3,908
Ilyushin	Il-114	987	1,112	1,216	1,293	1,292
Lockheed Martin	L-182 / L-282 / L-382 (L-100) Hercules	35,629	32,861	31,189	26,332	25,381
Lockheed Martin	L-188	1,846	1,420	337	1,184	1,461
Lockheed Martin	L-1011 Tristar	1,330	1,446	790	-	-
NAMC	YS-11	4,519	2,802	2,867	1,867	2,883
Saab	340	402,471	350,862	336,705	308,525	315,841
Saab	2000	53,419	51,443	50,969	53,744	52,406
Shaanxi	Y-8	32	16	-	-	-
Shorts	330	15,737	15,766	13,875	12,797	13,151
Shorts	360	63,891	55,564	53,868	51,850	50,633
Sukhoi	Superjet 100	1,790	7,651	13,227	32,226	65,687
Tupolev	Tu-134	38,531	25,308	22,163	18,915	15,433
Tupolev	Tu-154	47,064	34,235	32,287	23,875	18,108
Tupolev	Tu-204 / Tu-214	15,879	16,973	15,248	14,966	14,952
Xian	MA-60	4,613	4,791	4,251	4,703	5,754
Yakovlev	Yak-40	45,867	36,134	29,907	26,554	23,532
Yakovlev	Yak-42 / Yak-142	39,433	35,879	33,598	33,696	30,417

Source: Ascend - A Flightglobal Advisory Service

LIST OF ACRONYMS/ABBREVIATIONS

Accident Category Abbreviation

Abbreviation	Full Name
RWY/TWY EXC	Runway/Taxiway Excursion
G UP LDG/CLPSE	Gear Up Landing/Gear Collapse
GND DAMAGE	Ground Damage
HARD LDG	Hard Landing
IN-F DAMAGE	In-Flight Damage
LOC-I	Loss of Control In Flight
CFIT	Controlled Flight Into Terrain
TAILSTRIKE	Tailstrike
UNDERSHOOT	Undershoot
OTHER	Other End State
OFF AIRP LDG	Off Airport Landing
MID-AIR COLL	Mid-Air Collision
RWY COLL	Runway Collision

List of Acronyms

Acronym	Meaning
ACAS	Airborne Collision Avoidance System
ACRS	Aviation Confidential Reporting System
ACTF	Accident Classification Task Force
ADS-B	Automatic Dependent Surveillance-Broadcast
AES	Arrival/Engine Shutdown (ATA Phase of Flight)
AFI	Africa (IATA Region)
ALPA	Airline Pilots Association
AOC	Air Operator Certificate
APR	Approach (ATA Phase of Flight)
ARC	Abnormal Runway Contact
ASAP	Aviation Safety Action Plan
ASPAC	Asia/Pacific (IATA Region)
ATC	Air Traffic Control
ATO	Authorized Training Organizations

List of Acronyms (Cont'd)

Acronym	Meaning
ATS	Air Traffic Service
CA	Captain
CAA	Civil Aviation Autority
CAB	Cabin Operations
CABIN	Cabin Safety Events
CANPA	Continuous Angle Non-Precision Approaches
CAST	Commercial Aviation Safety Team
CBT	Computer-based Training
CEO	Chief Operating Officer
CFIT	Controlled Flight into Terrain
CICTT	CAST/ICAO Common Taxonomy Team
CIS	Commonwealth of Independent States (IATA Region)
COSTF	Cabin Operations Safety Task Force
CRM	Crew Resource Management
CRZ	Cruise (IATA Phase of Flight)
CTOL	Collision with obstacle(s) during takeoff and landing
DG	Director General
DH	Decision Height
DST	Descent (IATA Phase of Flight)
ECL	En Route Climb (IATA Phase of Flight)
EGPWS	Enhanced Ground Proximity Warning System
E-GPWS	Enhanced Ground Proximity Warning System
EMAS	Engineered Material Arrestor System
ESD	Engine Start/Depart (IATA Phase of Flight)
EUR	Europe (IATA Region)
FAA	Federal Aviation Administration (of the USA)
FCF	Functional Check Flight
FDA	Flight Data Analysis
FDX	Flight Data eXchange
FLC	Flight Close (IATA Phase of Flight)
FLE	Full-Loss Equivalent
FLP	Flight Planning (IATA Phase of Flight)
FMS	Flight Management System
FO	First Officer
FRMS	Fatigue Risk Management System
FSF	Flight Safety Foundation
GADM	Global Aviation Data Management

List of Acronyms (Cont'd)

Acronym	Meaning
G-COL	Ground Collision
GDS	Ground Servicing (IATA Phase of Flight)
GOA	Go-around (IATA Phase of Flight)
GPS	Global Positioning System
GPWS	Global Positioning System
HL	Hull Loss
HUD	Heads-Up Display
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICATEE	International Committee for Aviation Training in Extended Envelopes
ICL	Initial Climb (IATA Phase of Flight)
IFALPA	International Federation of Air Line Pilots' Associations
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IOSA	IATA Operational Safety Audit
ISAGO	IATA Safety Audit for Ground Operations
ISARP	IATA Standards & Recommended Practices
ISD	Inadvertent Slide Deployment
ISM	IOSA Standards Manual
ISSA	IATA Standard Safety Assessment
LATAM	Latin America and the Caribbean (IATA Region)
LND	Landing (IATA Phase of Flight)
LOC-G	Loss of Control - Ground
LOC-I	Loss of Control - In Flight
LOSA	Line Oriented Safety Audit
MDA	Minimum Descent Altitude
MED	Injuries to and/or Incapacitation of Persons
MEL	Minimum Equipment List
MENA	Middle East and North Africa (IATA Region)
MRO	Maintenance Repair Organization
NAM	North America (IATA Region)
NASIA	North Asia (IATA Region)
NavAids	Navigational Aids
NLR/TMO	National aerospace Laboratory/Organization for Applied Scientific Research
NTSB	National Transportation Safety Board (of the USA)
OEM	Original Equipment Manufacturer
OPC	(IATA) Operations Committee

List of Acronyms (Cont'd)

Acronym	Meaning
PBN	Performance-Based Navigation
PED	Portable Electronic Device
PFD	Primary Flight Display
PRF	Pre-Flight (IATA Phase of Flight)
PSF	Post-Flight (IATA Phase of Flight)
RA	Resolution Advisory
RAeS	Royal Aeronautical Society
RAMP	Ground Handling
RE	Runway Excursion
RESA	Runway End Safety Area
RI	Runway Incursion
RNAV	Area Navigation
RNP	Required Navigation Performance
RTO	Rejected Takeoff (ATA Phase of Flight)
SAFO	Safety Alert for Operators
SARP	Standard and Recommended Practices
SCF-NP	System/Component Failure or Malfunction (Non-Powerplant)
SCG-PP	System/Component Failure or Malfunction (Powerplant)
SD	Substantial Damage
SG	(IATA) Safety Group
SMS	Safety Management System
SOP	Standard Operating Procedures
STC	Suplementary Type Certificate
STEADES	Safety Trend Evaluation, Analysis and Data Exchange System
SUPRA	Simulation of Upset Recovery in Aviation
TAWS	Terrain Awareness Warning System
TCAS	Traffic Alert and Collision Avoidance System
TCAS RA	Traffic Alert and Collision Avoidance System Resolution Advisory
TEM	Threat and Error Management
TOF	Takeoff (IATA Phase of Flight)
TP	Turboprop
TURB	Turbulence Encounter
TXI	Taxi-in (IATA Phase of Flight)
TXO	Taxi-out (IATA Phase of Flight)
UAS	Undesired Aircraft State
USOS	Undershoot/Overshoot

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